Supplementary Dossier

Nomination Document for Inscription on the UNESCO World Heritage List

State of Qatar

January 2013
Al Zubarah
Archaeological Site

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Qatar Museums Authority

*Her Excellency*
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Chairperson
Qatar Museums Authority

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i. Preface
Foreword

In the two years since the submission by the State of Qatar of the Nomination File for inscription of Al Zubarah Archaeological Site on the UNESCO World Heritage List, the Qatar Museums Authority is pleased to report that an expanded program of heritage management, site preservation, and archaeological research has resulted in many noteworthy advances in our understanding of the site. The work has greatly broadened our understanding of the proven cultural significance of the Nominated Property and in the context of its extensive hinterland, the historical impact of which can now be more precisely evaluated within the context of local, regional and, more broadly, global perspectives. The greater insights thereby produced have provided us with an invaluable opportunity to disseminate widely by various media the more substantial knowledge gained to both Qatari and international audiences.

The eighteenth and earlier nineteenth centuries of the Common Era, which marked the zenith of Al Zubarah’s notable influence and prosperity, saw the dramatic self-definition of a cultural, political, and economic framework that came to define many of the social norms prevalent in the Arabian Gulf today. The last two years of extensive work in northwest Qatar under the auspices of the Qatar Museums Authority’s bold heritage initiatives have highlighted the complexity of cultural, political, and economic structures that developed in this unquestionably crucial period of transition; developments that found a clear social expression in the tangible remains of the then newly constructed town of Al Zubarah. The influence of the society they created in a physically challenging environment, documented recently in detailed specialist studies, transcended the immediate world of the peninsula of Qatar to reach deep into Arabia, east and west along the Gulf, and far beyond: to India, China, Iran, Iraq, east Africa, Turkey and all the way to Europe.

The new discoveries at Al Zubarah Archaeological Site validate beyond doubt the crucial importance of inscribing the Nominated Property on the UNESCO World Heritage List. Al Zubarah Archaeological Site offers an extraordinary insight into Qatar’s past and, without question, into the whole Gulf region. The Nominated Property stands as the only extensive, intact, and coherent representative of pre-modern Islamic urbanism in the Gulf region that reveals traditional practices of social interconnection and
economic activity, including pearl fishing, that are remembered and reminisced in the region, but have completely disappeared. Hence *Al Zubarah Archaeological Site* is an outstanding, and possibly the only, candidate to adequately represent the plethora of social, political and economic activities that merged to create it, but also testifies to the many complex threads that were woven into a rich tapestry of life in eighteenth- and nineteenth-century Gulf society.

In addition to acknowledging the important role of *Al Zubarah Archaeological Site* in the formation of modern Qatar and the Gulf, its listing will greatly advance a wider recognition of Qatar’s expressed commitment to preserving and building respect for the precious values and heritage that rest at the heart of the Nation. The State of Qatar sees cultural heritage as a crucial component in achieving the Qatar National Vision 2030 goal of conserving, enhancing, and broadcasting – nationally and internationally alike – Qatar’s deep-rooted Arab and Islamic identity; a greatly prized heritage open to visitor appreciation at *Al Zubarah Archaeological Site* and through multi-media gallery displays in the highly anticipated National Museum of Qatar, designed by the celebrated architect Jean Nouvel.

We are most pleased that this Supplementary Dossier to the detailed Nomination File for inscription of *Al Zubarah Archaeological Site* on the UNESCO World Heritage List, previously submitted by the State Party in January 2011, offers a convincing account of the high-quality and internationally respected research undertaken since the submission of the primary Nomination documentation. It demonstrates, unequivocally, the fundamental social values and cultural immediacy preserved, as an unparalleled historical testament, at *Al Zubarah Archaeological Site*; a testament to the ingenuity, community aspirations, and commercial acumen of Gulf society as it moved – decisively – to forge a new and locally sourced identity.

H.E. Sheikh Hassan Bin Mohammed Bin Ali Al Thani
Vice Chairman
Qatar Museums Authority, State of Qatar
The World Heritage Committee’s Decision

The World Heritage Committee,

Having examined Documents WHC-12/36.COM/8B and WHC-12/36.COM/INF.8B1,

Refers the nomination of Al Zubarah Archaeological Site, Qatar, back to the State Party, in order to allow it to:

1. Further develop its understanding of how the fabric of Al Zubarah and its desert hinterland were an exceptional testimony to a specific interaction between nomadic herders, pearl divers, fishermen and traders that once characterised the way of life in the Gulf (as opposed to connection to the pearling industry) by:

   • Presenting the results of surveys and excavations carried out in the property and its wider setting, including underwater archaeology, that have already permitted the understanding of the origins of the town, the basis for its prosperity, its layout and how it related to the coast, its desert landscape and small satellite settlements and

   • Completing the archival and oral history research developed within the project

   • Formalize the official approval of the buffer zone limits and the Madinat Al Shamal urban plan

   • Complete and implement the Conservation Strategy, identifying the interventions desirable to stabilise the urban remains

   • Follow up the development of the Site Management Unit, operational on site since 2011

   • Monitor the effectiveness of the Management Plan

2. Recommends that Heritage Impact Assessments be renewed in case major infrastructural projects in the vicinity of the property should become active again, in order to ensure that these do not impact adversely on the town and its wider desert setting.
State Party’s response

The State of Qatar has prepared the present Supplementary Dossier to address the recommendations concerning the Nomination of Al Zubarah Archaeological Site (Documents WHC-12/36.COM/8B and WHC-12/36.COM/INF.8B1) made to the State Party by the World Heritage Committee during its meeting in St Petersburg between 24 June and 6 July 2012, as contained in the Revised Draft Decision 36 COM 8B.19 (Document WHC-12/36.COM/19, p. 177).

In order to fully address the recommendations made by ICOMOS and UNESCO, the State Party has brought together in this document a detailed summary of the results of two years of research on Al Zubarah Archaeological Site and its hinterland undertaken by an international and renowned team of experts. This has included archaeological excavations, regional survey, archival and oral history research, conservation and heritage management. This comprehensive program of archaeological and historical investigations, material culture analysis, and the implementation of both an advanced Conservation Strategy for the physical remains of the Nominated Property and heritage management activities in the region, marks the QIAH Project’s work on Al Zubarah Archaeological Site as one of the largest and most holistic archaeology and heritage projects in the world.

The results of the program have provided much new and illuminating information with which to expand the understanding of the cultural and historical importance of northwest Qatar, and especially the role of Al Zubarah in the development of the region’s modern identity. The appeal of these developments is of great regional and international relevance, as the peoples of the Gulf and the wider world seek to understand the emergent global importance of the Arab World. The exponential growth in documentation and its relevance, as revealed in full in the Annexes to the Supplementary Dossier, argues convincingly for the validity of the inscription of Al Zubarah Archaeological Site in the UNESCO World Heritage List, as well as for the stable continuation of this ground-breaking investigative work for the future.

This Supplementary Dossier has been structured to address the recommendations made by UNESCO in their Revised Draft Decision, and to reflect the structure of the original Nomination File, Volume I. Each chapter is created to provide an update of the information originally presented in the Nomination File, therefore Chapter 1 proposes a new Executive Summary reproducing the revised statement of Outstanding Universal Value and the criteria for inscription of Al Zubarah Archaeological Site in the World Heritage List, which are presented in Chapter 3.
Chapter 2 of the Dossier updates the archaeological and historical information contained in Chapter 2 of the Nomination File, summarising the results of the excavations, survey, archival, and oral history research undertaken in the State of Qatar since 2010, as requested by the World Heritage Committee's Revised Draft Decision document. Annexes 1 to 5 reproduce the complete End of Season Reports for Archaeology (2010-2011, 2011-2012, and Excavations at Ruwaidah) and Community Archaeology (including Oral History, 2011-2012), as well as a report containing supplementary results of the archival research undertaken on Al Zubarah in 2011-2012.

Chapter 3 proposes revised versions of the Statement of Outstanding Universal Value, the Criteria for Inscription of Al Zubarah Archaeological Site in the World Heritage List, and the Statement of Integrity and Authenticity of the Site. Furthermore, an improved discussion of the comparative analysis of sites undertaken in the Nomination File is also included here.

Chapter 4 presents a summary of results of the Conservation Strategy for Al Zubarah Archaeological Site, which has been greatly and successfully developed in the last two years of work and research. The chapter also includes updated information concerning the state of conservation of the major structures of Al Zubarah Archaeological Site, as well as an overview of the legacy of the conservation program to the State of Qatar. Annex 6 reproduces the complete first edition of the QIAH Conservation Handbook: Al Zubarah Archaeological Site.

Chapter 5 provides supplementary information on the Protection and Management of the Nominated Property, as specifically requested in the World Heritage Committee's Decision document.

Notably, the applicable issues raised in the ICOMOS Evaluation Report, part of which have been later adopted by the World Heritage Committee at its meeting in St Petersburg and are contained in the Revised Draft Decision document, have been accurately addressed in the content of the Dossier. These are included in the text in the form of italicised quotes with reference to the page numbers of the original Evaluation document transmitted by ICOMOS to the State of Qatar in spring 2012.

Furthermore, references to the accompanying Annexes are presented throughout the Dossier in order to highlight those discoveries of the last two years that confirm and reinforce the exceptional status and universal importance of the Nominated Property on the world cultural stage.
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1. Revised Executive Summary
State Party
State of Qatar

State, Province or Region
Madinat Ash Shamal Municipality

Name of Property/Site
Al Zubarah Archaeological Site

Geographical coordinates to the nearest second
The geographical coordinates of the centre of the Nominated Property (corresponding to Al Zubarah tower number 13 in the town wall) are:

Latitude: 25° 58’ 41” N
Longitude: 51° 01’ 47” E

Al Zubarah Archaeological Site covers an area of 415.66 ha.

The limits of the Nominated Property are identified by the following coordinates:

North limit: 51°01'32” E 26°03’17” N
South limit: 51°03'29” E 25°56’37” N
East limit: 51°04'57” E 25°57’47” N
West limit: 50°57’05” E 25°59’15” N

The Buffer Zone (not including the Nominated Property) covers an area of 7196.4 ha.

The limits of the Buffer Zone are identified by the following coordinates:

North limit: 51°01’32” E 26°03’17” N
South limit: 51°03’29” E 25°56’37” N
East limit: 51°04’57” E 25°57’47” N
West limit: 50°57’05” E 25°59’15” N
Textual description of the boundaries of the Nominated Site

*Al Zubarah Archaeological Site* lies approximately 92km north-west of Doha, on the north-western coast of Qatar, in the Madinat ash Shamal municipality.

The Nominated Property consists of two parcels owned by the Qatar Museums Authority (QMA). The larger area of land contains the coastal town of Al Zubarah and its immediate hinterland, including features related to the defence and supply of the town, as well as the early 20th century Al Zubarah Fort. Separated by a modern road, the second parcel includes the fort and settlement of Qal‘at Murair, including wells for the water supply of Al Zubarah.

In the north, the Nominated Property is defined as a straight line between the coast and the existing fence around Al Zubarah Fort. The eastern extent encompasses the remains at Qal‘at Murair, while the current road from Al Zubarah Fort to the Ras Ushairiq peninsula defines the southern limit. The intersection between the beach and the sabkha formation south-west of Al Zubarah town forms the western boundary of the Nominated Property.

A vast Buffer Zone, incorporating both the wider hinterland and the extensive coral reef system off the shore of Al Zubarah, surrounds the Nominated Property. On the hinterland, the Buffer Zone follows administrative and physical limits to the East, South and North of the site, and includes the archaeological sites of Qal‘at Shuwail, Helwan, and the abandoned village of Ain Mohammad. In the sea, it draws a north-west quadrant at 6.2km from the north point of the Nominated Property.

MAP OF THE NOMINATED SITE

[see p.8]
Al Zubarah Archaeological Site is of outstanding universal value as the Gulf’s most complete and well-preserved town of the 18th-19th centuries connected to the practice of pearl trading and fishing. Until the introduction of the cultured pearl, and before the exploitation of oil and gas, the trade in pearls constituted the Gulf’s most important industry, employing up to a third of the male population in the region. It created large economic surplus and wealth at a time when the Persian Safavid Empire had lost political influence and importance. Pearling was the foundation on which incipient city-states were formed and gained wider regional influence and importance, laying down the crucial geopolitical, social, and cultural trajectories of recent Gulf history, which shape the region to this day.

Al Zubarah played a pivotal role in this historic phase of development, as it represented one of the most prolific and crucial international trading ports in the region. As a traditional settlement located in Arabia in which trade, commerce and hence social and cultural interaction and exchange were the underlying tenets, the Nominated Property relates to a number of socially and culturally relevant themes. The site reflects the history of tribal migration in the Gulf, as it was founded by merchants arriving from Kuwait and Basra in search of pearls. Al Zubarah also represents a unique mode of occupying a fragile desert ecosystem, which includes a particular system of water management. Moreover, during the mid to late 18th century, Al Zubarah was the Gulf’s most important trading hub, connecting the Indian Ocean with Arabia and western Asia, and highlighting how trade and exchange connected people from East and West economically, socially and culturally. Collectively, these themes highlight Al Zubarah as a non-European, traditional form of settlement, which encapsulates anthropological and social historical themes.

Al Zubarah Archaeological Site’s Outstanding Universal Value also pertains to the unique preservation of a complete urban town plan of an 18th-19th century pearling and trading settlement in the Gulf. Surrounded and protected by a 2.5km long wall, the town extended over an area of 61 hectares. Due to the abandonment of the site in the beginning of the 20th century, the entire layout of the settlement is preserved in great detail, providing key archaeological and anthropological data on economic, social and cultural relations between the inhabitants of the town, as well as traditional pearling practices. This exceptional state of preservation is strengthened by the integrity and authenticity of the site, and it provides crucial information on human interactions with the land and sea, trade links, and social and economic relationships, which are engrained and materialised in this exceptional assemblage of urban, historic fabric.

The site is today largely preserved in the form of low mounds, which mask the buried traces of traditional vernacular and religious architecture. The urban fabric of the Nominated Property includes courtyard
houses, palaces, mosques, suqs, defensive walls and palm-leaf fishermen’s huts and tents. This represents a unique mix and assemblage of building types, the spatial organisation of which is preserved in outstanding detail across the entire townscape. The Nominated Property includes the entire town, harbour, canal, screening walls, cemeteries, Qal’at Murair and Al Zubarah Fort. Qal’at Murair, which was destroyed in the latter part of the 20th century, survives largely as sub-surface archaeology, but is an important, interconnected feature of the Nominated Property. The fort showcases how the desert’s most precious resource – water – was managed and protected, and how Al Zubarah’s rulers strategically protected access to it.

The integrity of Al Zubarah Archaeological Site is guaranteed, as it was abandoned in the early 20th century and being located far from any modern settlement, it has remained untouched by modern development. Only a small proportion of the site has been excavated and restored, and scientific reports have been – or are in preparation to be – published. The archaeological phases at the site are intact and showcase the development and evolution of the town. Al Zubarah Archaeological Site is under development to ensure the preservation and presentation of the site for future generations.

The Nominated Property is proposed for inscription under criteria (iii) and (v), as it is an outstanding example of a mid-18th to late 19th century pearl fishing and trading settlement, representing a traditional form of land- and sea-use, settlement and water management. Moreover, Al Zubarah is one of the last remaining localities that embodies the historical trajectories that shaped the economic, social and geopolitical landscape of the early-modern and modern Gulf. Al Zubarah Archaeological Site encapsulates the traditions and lifestyle of 18th-19th century urban populations in the Gulf, and reflects the relationship that existed between the people of the Arabian Peninsula and their natural environment.

The property is owned by the QMA, a distinct governmental organisation under direct control of the Amir’s Office. The large Buffer Zone around Al Zubarah Archaeological Site protects it from the impact of any development plan being considered for the region, guaranteeing the preservation of not only the archaeological remains, but also of their setting and the surrounding landscape. The Nominated Property includes the 1938 Al Zubarah Fort, itself an important visitor attraction and a source of national pride, while Qal’at Shuwail is inside the limits of the Buffer Zone. Given the strong existing governmental planning and development control, in which the QMA has direct input for the protection of archaeological and historic building assets, the Buffer Zone will guarantee the highest level of protection for this outstanding site.
Criteria for Nomination

The nomination of Al Zubarah Archaeological Site for inscription on the World Heritage List is based on criteria (iii) and (v) of UNESCO’s Operational Guidelines for the Implementation of the World Heritage Convention.

Criterion (iii) requires that Al Zubarah should:

“…bear a unique or at least exceptional testimony to a cultural tradition or to a civilisation which is living or which has disappeared”

The abandoned settlement of Al Zubarah is a unique testimony to the merchant and pearl trading tradition of the Arabian Gulf during the 18th and 19th centuries. The settlement was founded by Utub merchants emigrating from other towns and seeking a safe haven for trading during a time of great upheaval in the Gulf region. Over a very short period of time, Al Zubarah quickly rose to become the foremost centre for pearl-based trade and commerce in the region, and Qatar’s largest and most important town.

Al Zubarah Archaeological Site represents the only complete urban plan of an Arabian town strongly connected to the traditional practice of pearl fishing. Its unique combination of neighbourhoods, mosques, palaces, markets, defensive systems and a canal is in itself a unique testament to the achievements of Al Zubarah’s inhabitants. The town plan encapsulates and preserves key ideas about urbanism and town planning during the 18th-19th centuries, and it is the best-preserved record of its type. The individual neighbourhood plots, plazas, mosques and markets that are discernible from the town plan also reflect a significant degree of urban planning and control.

The different components of Al Zubarah’s urban plan show that the settlement was conceived and implemented from the outset. The fabric of the city shows both the sophistication of the planning principles, and the capacity of Al Zubarah’s rulers to control and direct the social and economic forces driving the creation of the town. Trade, commerce and pearling are ever-present in the archaeology of the town. Ceramics attest to trade links along the so-called maritime silk route connecting Al Zubarah with the Indian Ocean, eastern Africa, eastern and western Asia, and Europe. Its geographic location in the Arabian Gulf, between the Indian Ocean and western Asia, facilitated its rapid rise as a key commercial centre. The economic surplus and wealth created by this trade provided the financial and political basis on which the early modern, incipient city-states of the Gulf were created.

The abandonment of Al Zubarah at the beginning of the 20th century has helped to preserve the most detailed urban layout of an 18th-19th century pearl fishing and trading town anywhere in the region. The Nominated Property reflects the heyday of the pearl trade, during which the key trajectories of the Gulf’s early modern history were established, before the introduction of the cultured pearl brought this centuries-old tradition to an
end. It can therefore be said that Al Zubarah stands today as the most complete and intact material representation of the role that the Arab world played in the formation of both modern trade systems, and an important precursor to the creation of independent Arab states.

Criterion (v) requires that Al Zubarah should:

“be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change”

Al Zubarah Archaeological Site bears unique testimony to the human interaction with both the sea and the harsh, desert environment of the region. Pearl divers’ weights, depictions of dhows, and imported ceramics show how the town’s development was driven by trade and commerce to a great extent, and that many of the town’s inhabitants felt a close connection with the sea. Al Zubarah’s natural harbour provided ample protection against piracy or bad weather, and it supported a sizeable pearling fleet, which travelled twice annually to the oyster banks along the north-eastern coast of Qatar.

A canal to the south of the settlement connected Qalat Murair to the sea, allowing freshwater to be transported to supply ships, and goods to be ferried between the harbour and the fort. Intra-tidal traps built of low walls utilised the natural tides to catch fish in a complex, dense trapping system that can be found in association with numerous settlements up and down the coast, including Al Zubarah.

These reflect an intensive exploitation of marine resources. Date presses (madbassas) found in the settlement, and traces of field systems found in Qalat Murair show that the exploitation of the seas was complemented by an equally intensive use of Al Zubarah’s hinterland. Palm groves provided a food source for the settlement, while wells in and near Murair were the principal source of freshwater. Remains of enclosures provide evidence for the keeping of livestock, helping to feed the town’s population.

The town of Al Zubarah and the fort at Murair therefore formed a symbiotic, economic and social relationship. Qalat Murair protected the town’s crucial freshwater resource and two screening walls allowed people to safely transport water from Qalat Murair to Al Zubarah. The local geology and geography shaped the traditional settlement system in the area, with freshwater wells only existing on the higher ground to the east. These ecological conditions led to the establishment of small-scale settlements in Al Zubarah’s hinterland in support of the town. With Al Zubarah at its centre, the site and region represent an outstanding example of traditional human settlement, land-use and sea-use.
1. Revised Executive Summary

- Supplementary Dossier

Al Zubarah Archaeological Site
“Further develop its understanding of how the fabric of Al Zubarah and its desert hinterland were an exceptional testimony to a specific interaction between nomadic herders, pearl divers, fishermen and traders that once characterised the way of life in the Gulf (as opposed to connection to the pearling industry) by:

1. Presenting the results of surveys and excavations carried out in the property and its wider setting, including underwater archaeology, that have already permitted the understanding of the origins of the town, the basis for its prosperity, its layout and how it related to the coast, its desert landscape and small satellite settlements

2. Completing the archival and oral history research developed within the project”

(From the World Heritage Committee’s Revised Draft Decision 36 COM 8B.19)
2.A. Summary of results of Archaeological Investigations; two years of achievement: the 2010-2011 and 2011-2012 seasons

The relevant principal data from the last two years of archaeological research is presented below in summary form. The following areas of work are covered:

i. Strategically planned excavations following strict scientific and site management principles located within the Nominated Property [see Fig 1], specifically: changing settlement profiles in an area straddling the Inner Town Wall (Zubarah Excavation Point 01 – ZUEP01); extensive structures of types commonly associated with commercial activities (ZUEP02); the investigation of a large walled building complex on the southern extremity of the site (ZUEP04); sampling urban rubbish heaps, or middens (ZUEP05); and urban defensive regimes (ZUEP10 and other locations).

ii. Exploration of Al Zubarah’s extensive hinterland in order to locate, record, describe and categorise settlements and activities within their environmental settings, paying particular attention to the supply of water, agriculture, and the acquisition of other resources. Significant here is evaluating the extent to which these resources were managed by – or denied to – the inhabitants of the town, many of whom were new (but not completely unknown) arrivals; and evidence for settlement in time periods other than during Al Zubarah’s heyday (18th and 19th centuries CE).

iii. The classification, documentation (description, image generation), and study of the rich and diverse material culture recovered from the excavations, which offers unparalleled insights into cultural and economic life in the town along with its region, while documenting the widespread connections generated by community ties and trade within the Gulf and far beyond. These objects, endowed with meaning by their contextualised story-lines, will constitute the core of a major gallery display in the new and inspired, Jean Nouvel designed, National Museum of Qatar in Doha.
Fig 1: Plan of Al Zubarah showing excavation areas
2.A.i. Al Zubarah Archaeological Investigations

Zubarah Excavation Point 01
Excavations in ZUEP01, completed in the 2011-2012 season, have garnered many fascinating details on urban planning in Al Zubarah, including defensive strategies (19th century) and stratified lifestyles in different parts of a household (18th century). Recent research has recreated lines of movement and different zones of activity within the household, as briefly described below. The last two seasons of work have also brought to the fore the nature of the earliest occupation in this area of Al Zubarah, either some time (although not long) before the construction of the permanent settlement, or actually with the arrival of settlers.

The analysis of a typical courtyard residence of moderate size (ca. 21 m. N-S by 22.5 m. E-W) undertaken by the QIAH Project is especially revealing about cultural and social life in Al Zubarah [see Fig 2 p.13]. Belonging to the period ca. 1770-1811, the formal entry was from a street to the north, which gave access to an enclosed hallway separated from the courtyard beyond by curtain walls – a common strategy to maintain privacy. To the west, a doorway with an archway decorated in a ‘dogtooth’ pattern lead into a single room, most likely meant to receive visitors, to which access was also possible from the courtyard. Facing out onto the central courtyard were a number of rooms and a porticoed space or iwan, also once arched. The iwan, positioned on the cooler south side of the courtyard, overlooked the main habitation area of the compound, consisting of three large rooms (Spaces 102, 105, 119), each with closable doorways and internal washing facilities of rectangular and square type. The north wall of Space 102 featured a scale image of a large dhow, expertly etched into the wall’s plaster surface. South of the iwan was another living room (Space 100), also with a corner washroom (Space 101). The southwest quadrant of the compound was the work area of the household, with Space 110 containing over 20 cooking ovens and Spaces 111 and 112 seemingly devoted to fish preparation. These rooms were rich in animal remains. Other rooms were for storage. Space 116, with cooking and washing activities, was likely a service room for the reception room Space 108. Among the many interesting finds from this compound was a wooden pearl-merchant’s chest [see Photo 16], a solid testimony to one of the mainstays of Al Zubarah’s economy.

Other structures across a street north of this compound have turned up evidence of a specialised date-syrup production facility. Throughout the site, the common occurrence of large, high-capacity date presses demonstrates the crucial role of syrup production in the economy of Al Zubarah, as at neighbouring localities also [see below]. Work in this area has also uncovered evidence on the primary layout and continuous maintenance of streets, revealing an ongoing desire to maintain established levels of urban organisation within a flexible system of space usage.
Below the 18th century architectural phase, a densely acculturated layer of sand and mixed cultural material was uncovered in both years of work, but especially during the 2011-2012 season. The excavations have shown categorically that this pre-architectural occupational phase was dominated by tents and/or palm frond structures (*barasti*). The numerous postholes and the intercutting rubbish pits, tannurs, and hearths reveal that these structures were subjected to numerous rebuilds and repairs. Spatial patterning suggests that structures were orientated in a northeast to southwest alignment, with rubbish pits to their northwest. Burning seems to have occurred towards the end of the occupation period, probably to clear the area. Analysis of the pottery from some of the rubbish pits indicates that some earlier ceramic forms are present but, as these are intermingled with types from the subsequent architectural phase, the dating of the original transient structures cannot be that much earlier.

*For further information see:*
*End of Season Report 2010-11, pp. 1-2, 6-18;*  
*End of Season Report 2011-12, pp. 7-16*

**Zubarah Excavation Point 02**

While ZUEP01 has given a clear insight into household management and activities in the 18th century town including pecuniary matters, work closer to the coast in ZUEP02 has revealed much more detail about the central role of commerce and trade.

Previous excavations had exposed a series of rooms suggestive of a *suq* (market), and given the seaside location next to a reef-free beach, this seemed very
likely. Given that suq served a primary role in towns, evidence for a wide range of primary activities – commerce, politics, and social interaction – could be expected. The results have not disappointed. Excavations to date have uncovered two enclosed courtyard warehouses separated by parallel access streets, each of which led down to the broad sandy beach of the bay – perfect for drawing up dhows [see Photo 2]. One of the warehouses featured a central courtyard with a second access courtyard to the west, all enclosed on three sides with deep rooms including three large date presses side-by-side as well as storage rooms. A doorway gave direct access from the west. Elsewhere a wide range of activities have been identified, including the redistribution of commodities and artisanal enterprises, especially iron working. The floors of some shops were littered with potsherds in their hundreds, these being remnants of containers for goods sold in the market. Local wares were identified, as well as ceramics brought in from across the Gulf, such as pots from Khunj in Iran. A large windlass stone weight, used to secure the beached dhows, was also recovered.

After a period of demolition (perhaps resulting from the attack of 1811), the suq was rebuilt, although on a reduced scale. The two phases of the suq were separated by a period of dense occupation represented by tannurs [see Photo 3], fire pits, post and driven stake holes, but no stone-built structures. One of the expansive surfaces excavated in the 2011-2012 season was noteworthy, it being particularly rich in finds: numerous ceramics and iron objects, shell, animal bone, and ash, and occasional glass and copper alloy objects. Finds of note included two coins; a blue porcelain Buddhist dragon dog
(temple guardian) figurine, two stone sling shots or musket balls; a copper alloy ring; a glass bead; an iron and copper alloy locking mechanism; and a porcelain kohl bottle. So while newly built architecture might be absent, activity is evident everywhere.

This sequence – suq/perishable structures/suq once more – offers compelling evidence for considerable social resilience in the geographical heart of Al Zubarah, in which calamity was followed by a new period of high activity. In one room of the second architectural phase, ten intact and six fragmentary haematite marine diving weights in the shape of a tear-drop and sourced outside of Al Zubarah were uncovered, further evidence of the enduring role of pearl fishing at Al Zubarah. This room, as well as many others in the area, were destroyed in another conflagration, and although it may be dangerous to attribute every burning event to conflict, and to one event in particular, the sack of 1878 by Shaykh Jassim bin Muhammad Al Thani may have been the cause.

For further information see:
End of Season Report 2010-11, pp. 2, 19-38;
End of Season Report 2011-12, pp. 17-27

Zubarah Excavation Point 04
During the original full-site planning exercise of early 2009, an archaeological zone that, at first, presented as jumbled banks of rubble and wind-blown sand, quickly took on a clearer and more obviously planned aspect than first realised. Between the outer circuit wall and the white-sanded beachfront of the bay, a network of streets had been systematically placed that linked beach and wall, thereby creating building blocks further subdivided by cross-streets to produce an ordered town plan. While obscured on the west by the 19th century settlement, areas to the south, east and northeast preserve the grid setup until today. Typically the grid delimited rectangular blocks filled with courtyard units, often set two deep and up to seven long. Yet the urban landscape was dominated by fortress-like compounds replete with robust corner towers and enclosure walls, notably in the south of the site. Each would have served as the palace of a prominent shaykh, within which the cultural, political, and economic activities of the community would have been concentrated.

Since 2010, work at the largest of these, measuring 100 by 110 metres (ZUEP04), has focused on the south-westernmost of the nine large internal courtyard units. Although part of a grand complex, features were quickly taken on a clearer and more obviously planned aspect than first realised. Between the outer circuit wall and the white-sanded beachfront of the bay, a network of streets had been systematically placed that linked beach and wall, thereby creating building.
similar to those found elsewhere at Al Zubarah: a concealed entrance, an iwan for shade (although here it faces out on a private courtyard), a date press, kitchen and storage areas, and washrooms. The walls and doorways of rooms on the southern and eastern sides – the living areas of the building – were originally decorated with intricate plaster stucco, complemented by recess niches in the walls for lamps or other objects. Staircases leading from the courtyard suggest that the building once carried a second floor, at least in part.

The excavation of the south-western circular tower of the compound revealed new information on construction methods and potential use. The tower turned out to be of solid construction with bracing cross walls, with access to the top of the tower via a staircase. The rise of steps on the staircase indicated a tower height of over four metres, and with a parapet the height would have topped six metres. Given the solid, shock-proof nature of the tower, most likely the intent was to install one or two small-gauge cannon on its high point – an indication of the defining role of regional power plays and conflict in the 19th century history of Al Zubarah.

While the absolute size and fortress-like appearance of the palace at ZUEP04 clearly proclaims the presence of an influential family at Al Zubarah, confirmation came from an ashy midden deposited outside the south wall of the building. The midden produced numerous finds expected of a rubbish dump: broken pottery, fine porcelains, metal fittings, broken coloured glass bracelets, and sheep, goat, birds, and fish bones; but it also revealed the extraordinary: evidence for the hunting of game in particular gazelle, often seen as an activity of ruling elites.

In 2011-2012, new architectural features were discovered when the excavation was extended approximately five metres to the north. Investigation revealed the presence of an east-west running corridor, which linked the compound to the exterior via a doorway in the west wall. Intriguing was the uncovering of twelve plaster niches set into the north face of the south perimeter wall of the neighbouring compound, and with the elongated rooms of this compound may suggest a commercial role for the building.

For further information see:
End of Season Report 2010-11, pp. 2, 39-55;
End of Season Report 2011-12, pp. 28-37
**Zubarah Excavation Point 05**
Located next to the Outer Town Wall, ZUEP05 was positioned on a large midden with the idea that the careful excavation of an urban rubbish heap would significantly expand knowledge of everyday objects in use during the heyday of Al Zubarah. Maximum recovery techniques were used (sieving, water flotation) to extract the greatest amount of information from the excavated deposits.

Eighty-three field objects were registered from ZUEP05, including 27 coins. Other field objects included worked bone, beads, wood and several metal objects such as iron nails, and a bronze rosette, pendants, buckles and rings. The main bulk finds were ceramics and animal bones, both of which represent substantial collections. Sheep, goat, camel, and fish predominate. Preliminary results from the ceramics analysis indicate that the midden collection includes a very wide and varied assemblage, thus covering a wide range of activities. Aside from the extremely rich finds of ceramics, bones and other objects, the midden also produced substantial amount of easily perishable organic material such as botanical remains, human and animal hair, wood, rope and various fragments of textile. Fascinating was the identification of stone fruits and grains, all imports from India and Iran. The excavated soil also included high amounts of organic material; soil samples were, therefore, regularly taken during excavation for flotation. In all, a rich insight into the material culture, diet, and economy of 18th and early 19th century Al Zubarah was recovered from the midden finds. The results are on a scale and with reliability that surpasses the information from more scattered finds from building contexts.

**For further information see:**
*End of Season Report 2010-11, pp. 2, 56-63*

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**Zubarah Excavation Point 10**
ZUEP10 was begun to investigate possible surviving archaeology against the inside face of the Outer Town Wall in preparation for scheduled conservation work, as procedures require. The work revealed an especially dense sequence of archaeological deposits indicative of ongoing activity during the main phase of Al Zubarah’s occupation. The earliest activity, represented by a number of postholes, pits and patchy surfaces, seems to be directly associated with the construction of the main city wall, with little or no evidence of any prior occupation. Once the wall was in place, the immediate vicinity appears to have been used mainly as a thoroughfare with trampled surfaces forming across the area. Soon after, the construction of a banquette, or walkway, on the inner side of the city wall, turned the higher part of the wall into a defendable parapet suitable for rifle fire. This refortification, probably coinciding with increased tribal tensions around the turn of the 19th century, begins a period of greater activity in the area. A number of laid surfaces cut by postholes suggest the possibility of barasti dwellings built against the lower wall, complete with a nearby tannur installation set into the wall itself, and other evidence of cooking and domestic activity.
The work at ZUEP10 has raised the question of the function and date of Al Zubarah’s Outer Town Wall (OTW). Early work (in 2009-2010) had already demonstrated categorically that the Inner Town Wall (ITW) was of later date than the OTW, as the ITW was constructed over and around substantial buildings belonging to the main settlement period of the later 18th and early 19th century. However, the positioning of the earlier OTW also suggests very strongly that it was built sometime after the primary layout, if not construction, of the late 18th century town. A clear demonstration of this reality can be seen in the southern part of ZUEP04, where the town wall skirts the enclosure wall of the palace, and the wall tower is deliberately placed midway between the two southern corner towers of the palace. Coincidentally, it also seems very likely that the southern flanking wall connecting Al Zubarah to the fortress at Murair was erected over the filled-in eastern part of the sea canal that joined the fort to Al Zubarah’s harbour.

For further information see:  
End of Season Report 2011-12, pp. 38-43
2.A.ii. Hinterland Researches

In keeping with modern advances in Landscape Studies, with an emphasis on land use and human impact on the natural environment, Decision 36 COM 8B.19 of the World Heritage Committee in 2012 stressed the need to present the results of survey work in the desert hinterland of Al Zubarah, so as to document how the town was connected with its natural and cultural surroundings. The program of work scheduled for the 2010-2011 and 2011-2012 seasons had already foreseen the importance of these questions, and the remarkable results produced by two professional teams of dedicated landscape experts and research groups are here presented in brief. The work focused on two main branches of endeavour: hinterland reconnaissance surveys and mapping to locate, document, and classify sites, especially in the Al Zubarah Archaeological Site Buffer Zone; and strategic excavations to gain an insight into the character and function at a select number of archaeological sites.

The landscape survey work was, in itself, divided into two further parts: the ground verification and basic recording of cultural places principally identified by remote sensing and entered on the Qatar National Historic Environment Record (QNHER) as likely archaeological sites; and detailed mapping with a total station and photography of selected sites deemed significant and/or threatened within the survey zone. In addition, a detailed systematic survey of a number of transects was undertaken to identify what, if anything, was being missed through the two-pronged strategy outlined above. This

![Fig 4: The densely-populated landscape of Al Zubarah hinterland; Zone A is directly relevant to understanding the Al Zubaran hinterland](image_url)
vigorous scrutiny of methods revealed that, apart from a number of recent or near-recent Bedouin encampments, little has been missed.

A Geodesic Survey of Sites in the Al Zubarah Buffer Zone Area

During the 2010-2011 and 2011-2012 seasons, mapping teams undertook topographic surveys of sites within the hinterland of Al Zubarah. Surveys were completed at the following sites of importance: Shuwail, Ain Mohammad, Musaikah, Helwan, and Muhayriqat [see Fig 4 p.19].

Shuwail, a water-rich location especially noted for its potable supply (QNG 184076/469378), Helwan (QNHER 3; QNG 184578.350E/466078.276N), and Ain Mohammad (QNHER 10192; QNG 183897E/472065N), have been described in the original Nomination File. These sites have undergone further survey and mapping during the last two years of work.

At Musaikah, some seven kilometres southeast of Al Zubarah, the remains of a fort and some footings still survive on the eastern edge of a farm that presently occupies the site. In addition, three sites located outside the boundary of the present farm (Musaikah A, B, and C) were planned. These sites were characterised by a distinctive linear arrangement of small rectangular structures set to an east-west or northeast-southwest alignment. Associated ceramics, especially turquoise-glazed wares, link these places with the earlier historical period often termed ‘Abbasid’ in Qatar (ca. 8th to 11th centuries CE), although the influence of the Abbasid caliphate on the peninsula is a moot point. Elsewhere
on the northwest peninsula, survey work has located a number of other sites of the same date, thereby enlarging our comprehension of land and water management in Islamic times [see further below].

The Regional Survey

The powerful contribution of landscape archaeology in comprehending and explaining the role of population dynamics in the formation of social and economic structures has found wide acceptance in contemporary research. Beginning with the 2009-2010 season, and expanded in the 2010-2011 and 2011-2012 seasons, survey and mapping teams have delved deep into the countryside north and east of Al Zubarah in the quest to discover, document, and classify the villages, hamlets, and encampments in the hinterland of the town, with a view to evaluate the nature of cultural, political, and economic interactions between them. Of special interest was the impact made by the sudden arrival of a large and comparatively wealthy group to Al Zubarah in an existing network of coastal villages and inland pastoral-agricultural settlements, and what distortions that arrival may have produced, and of recovery strategies of regional sites with the 19th century decline of the town. Such developments on the northwest coast are instrumental in understanding the emergence and formation of modern Qatar.

The map [see Fig 4 p.19] shows the fertile results of the comprehensive assessment of the cultural landscape of northern Qatar. In a number of ways, the quantity, range, and significance of the results from original geomorphological fieldwork went far to identify a resource-driven landscape revolving around water resources, compact yet valuable agricultural fields, and extensive pastoral opportunities.

Spread across the entire north of the Qatar peninsula is a peppering of sites with, understandably, the most significant profile clustered around the main water sources. Sites closer to Al Zubarah have wide evidence for occupation during the heyday of the town, with water management often enforced by the construction of forts at the wells – the ‘secure and deny’ principle. Field systems, probably from the same period, have also been recorded associated with the main water sources, and where the desert rawdah soils were present.

A major advance in 2010-2011 and 2011-2012 seasons was the identification and categorisation of a dozen or so agricultural
and pastoral sites from earlier Islamic times [see Fig 4, larger green dots], datable preliminarily by surface ceramics to sometime around the 9th or 10th to 11th centuries CE, and therefore roughly contemporary with the renowned and larger site of Murwab, located south of Al Zubarah. The northern sites are smaller in dimension, and are characterised by a line – usually singular – of rectangular structures sometimes accompanied by a mosque, stretching in an open-spaced pattern for often hundreds of metres along a rocky rise or ridge above flatlands of silty clay rawdah soils, such as at Umm al-Kilab (QIAH40-191). Trees, commonly acacias, typically adorn these areas, indicating the presence of reasonably fresh water at a shallow depth. Similar alignments of structures were recorded at Makin (QIAH40-184) and (QIAH40-242), Umm al-Suf (QIAH40-188), Qa’at Rakayat (QIAH40-427), and other sites, while at Al Nahy (QIAH40-144) a large rectangular multi-celled structure, potentially represents a warehouse and market.

For further information see:
End of Season Report 2010-11, pp. 2-3, 80-145 (sections covering geomorphology, mapping, and survey);

Strategic Excavations
While rescue and exploratory excavations were undertaken at a variety of sites, such as Ruwais/ Khasumah (2010-2011) and Fuwairit (2011-2012), two important sites have been the subject of ongoing research over the last two seasons. Archaeological work at Freiha, located on the coast just north of Al Zubarah [see Fig 4], has investigated a large mosque and domestic areas, while the field work of Dr Andrew Petersen (University of Wales collaborative partner) at Ruwaidah has focused on a stout fortress, a mosque, and the workshops and storerooms of a warehouse.

At Freiha, a site closely pre-dating Al Zubarah, detailed insights into revolving settlement profiles were identified, in which a repeating pattern of abandonment and rebuilding was discerned. The pattern follows a complex palimpsest typified by phases of expanding settlement at the site, interspersed by periods of total or near-total abandonment. This is something that can be seen most clearly
in the remains of the mosque (FREP01). Here, five periods of construction, several on quite a significant scale, took place throughout the life of the building. Each of these phases of use was followed by a period of abandonment, during which thick layers of windblown silt would accumulate along with debris from wall and roof collapse. The Phase 3 rebuilding represents a considerable investment of resources, with the prayer hall being rebuilt on a different alignment. Later, major architectural changes to the layout of the mosque occurred. The sequence indicates that the returning population had enough resources to rebuild in the same location each time.

Investigations in residential areas of Freiha turned up a long and complex settlement history, with ceramics confirming settlement at this location before Al Zubarah’s heyday. In Freiha Excavation Point 4 (FREP04), excavations have uncovered a complex and dense occupation sequence. This began with post-built structures, followed by pisé and mud-brick dwellings which were replaced, after a structural hiatus, by stone structures. The most extensive activity was most commonly found in external areas, with internal spaces only containing a few features. This pattern may imply that the rooms tended to be used for storage, resting, or sleeping, but not domestic activity.

Ruwaidah is a large site stretching along the coast for two and a half kilometres. Although it was identified as an important archaeological site in the early 1970s, no excavations were carried out there until the University of Wales work began in 2009. The site is not mentioned in historical sources of the 19th century and appears to have been abandoned sometime
in the late 1700s or early 1800s. Archaeological excavations at Ruwaidah have concentrated on the area of the fortress and its immediate surroundings. During the first season of trial excavations it was demonstrated that the fortress was built in several phases with a variety of construction methods. Excavations were resumed in 2011, when a large residential compound in the north-east corner of the fortress was uncovered, as well as a gateway to the main courtyard of the fortress. During the 2011 season of work a mound locally identified as a mosque was excavated and proved to be the courtyard of a small mosque next to the sea. Two construction phases were identified in both the residential compound and the mosque, suggesting a period of abandonment followed by reconstruction at a later date. During the 2011 season an enigmatic feature on the beach, located about 800 metres to the west of the fortress, appears to have been a tomb or mausoleum. The burial is extremely unusual because there are no other burials in the immediate vicinity and due to its location on a small platform at high water mark.

The 2011-12 season continued to focus on the fortress and the area immediately in front of it. The prayer hall of the mosque was excavated and proved to be a six bay structure supported by the external walls and four piers (2 central piers and 2 engaged piers). A mihrab in the west wall was modified twice; firstly by a change in the orientation of the qiblah and secondly by the addition of a minbar recess. In addition to the mosque a warehouse complex of eight rooms was uncovered directly in front of the gateway to the fortress. A small building between the warehouses was also excavated and tentatively identified as a workshop for boat repairs.

The dating evidence from Ruwaidah in the form of imported ceramics indicates that the settlement was abandoned by the early 19th century. An area at the west end of the site also contained 13th-14th century Chinese ceramics, indicating that Ruwaidah may be one of the few sites to have substantial remains which date before the 18th century.

For further information see:
End of Season Report 2010-11, pp. 2, 66-79;
2. A.iii. Finds and Object Conservation

Finds Processing and Storage System
Beginning with preliminary sorting in the field of all recovered material, and following its arrival at Al Zubarah Field Station on a daily basis, the finds are divided into the following three categories:

1. Bulk Finds: These can be of any material, but mainly comprise bagged assortments of ceramic shards, bone, shell, indistinct metals, glass fragments, charcoal, and bitumen. In 2011-2012, a total of 3599 bags were processed.

2. Samples: These fall into three main categories, as follows.
   a. Soil samples (for flotation and specialist examination of resultant residue)
   b. Samples for specialist analyses (e.g. stone varieties, wood pieces)
   c. Miscellaneous other material samples

   In 2011-2012, a total of 1335 bagged samples were collected, of which 985 were soil samples for flotation by the QIAH Project’s archaeobotanist.

3. Field Objects: These are commonly worked single objects deemed by the excavator to be of special significance, such as for object collections or museum specimens, and confirmed in the finds lab following preliminary cleaning and identification. Each object receives an individual registration number to commence to recording process, as outlined below. In 2011-2012, a total of 920 objects were registered.

The registration process, devised by the finds team and built on many years of collective experience, seeks to allocate the available resources of conservation, description, visual recording, and interpretation appropriate to the significance and condition of each finds category. The process is built upon five clear stages of identification and treatment, as follows.

Stage One in the registration process, which applies to all categories of finds, involves an Initial Registration (IR) of the incoming material. The finds are first assessed and logged in separate site-specific databases, thus providing a complete record and quick overview of all physical finds. This classificatory stage determines the subsequent processing of finds, although with flexibility. The IR record is constantly updated with new information produced during the Stage Two activities of cleaning, conservation, sorting, and study of the finds, as these processes often require reassessments of them. For example, if a Field Object is labelled as possibly a glass bead by the excavator and, on cleaning in the
Stage Three of the registration process leads to the appropriate storage of finds in an accessible system compatible with whether the material is at the before- or after-study stage. Each box/crate is allocated a Unique Number; this number is entered on a database table thereby providing a searchable list. Each box has an easy-read front label with the Site, Area, Finds Category, Material and Object Type listed. At this point the allocated box is not a final, fixed storage location. The aim is, rather, to facilitate specialist studies by ensuring that the stored material is easily retrievable, currently in most cases at Al Zubarah Research Station.

The finds are boxed/crated by finds category and, within this, by material and then by object type, if applicable.

Finds Category Examples of main materials

<table>
<thead>
<tr>
<th>Finds Category</th>
<th>Examples of main materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Finds</td>
<td>Ceramic, bone, shell, glass</td>
</tr>
<tr>
<td>Samples for Analysis</td>
<td>C14, petrography</td>
</tr>
<tr>
<td>Material Samples</td>
<td>Plaster, charcoal</td>
</tr>
<tr>
<td>Catalogued Field Objects</td>
<td>Glass, stone, ceramic, metal</td>
</tr>
<tr>
<td>Un-Catalogued Field Objects</td>
<td>Glass, stone, ceramic, metal</td>
</tr>
<tr>
<td>Finds from processed soil samples</td>
<td>Seeds, charcoal, ceramic, bone, shell</td>
</tr>
</tbody>
</table>
Further sub-divisions are necessary for some categories of finds, for example the field objects. Examples are given below:

**Fig 7: Example of field object material sub-divisions**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Object classes (examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass</td>
<td>Vessels, bracelets, beads</td>
</tr>
<tr>
<td>Stone</td>
<td>Tools (grinders, whetstones), weights (diving), architectural fragments</td>
</tr>
<tr>
<td>Metal</td>
<td>Coins, jewellery, nails and fittings</td>
</tr>
</tbody>
</table>

**Stage Four** focuses on facilitating the study of the finds, work which is undertaken by leading specialists in the field. While most specialists are material specific – ceramics, animal bone, shell etc – others undertake comparative studies into a range of materials and/or object types. All specialists produce interim and final reports and have the option to publish their results. They also identify material for inclusion in final publications and select representative pieces for addition to reference collections in Qatar, including outstanding objects for display in the galleries of the highly anticipated National Museum of Qatar.

**Stage Five** involves the final storage of the material, which constitutes part of the Long-Term Storage Plan. The studied material is re-boxed according to the archaeological phase within each site and subcategorised according to area/building. In this way the storage system will reflect the final written publication. Each box will be allocated a Unique Box Number, and the following information is written on the box front or label: site, area, phase, historical date, locus, material and, importantly, publication reference. The box number and publication reference is also added to any record catalogue sheet and the database. In addition, the specific storage location will be added to the database and paper record, for example Al Zubarah Research Station, The National Museum of Qatar, or The Qatar Museums Authority Store. This system facilitates the further study and consultation of the material and allows for easy retrieval of the finds.

Work is advanced by a specialist **Finds Team** comprising a Finds Manager, a Supervising Registrar and assistants, a Ceramicist, two to three experienced object conservators (drawn from Moesgård Museum, Aarhus, as well as The Royal Danish Academy of Fine Arts, Schools of Architecture, Design and Conservation), an Illustrator, and a Photographer and assistant. In total the finds lab is staffed by some ten professionals and advanced trainees. The finds team has two substantial work rooms and a dedicated conservation lab at their disposal in Al Zubarah Research Station.

For further information see:
*End of Season Report 2010-11, pp. 146-49;*
*End of Season Report 2011-12, pp. 94-97*
1. **Registration**
   Registration of all finds recovered from site in database

2. **Processing**

   **Bulk Finds**
   - (ceramic, bone, shell, glass, bitumen)
   - cleaning
   - sorting
   - extraction of whole objects (e.g. coins)

   **Samples**
   - (soil sample, sample for analysis etc)
   - sample dependent (e.g. flotation)

   **Field Objects**
   - (coins, beads, worked bone/shell, metal artefacts, stone tools etc)
   - photographed
   - cleaning/conservation
   - catalogued
   - illustrated
   - re-photographed

3. **Boxed For Study**
   Finds stored by category in catalogued boxes for access by specialists

4. **Study by specialists**
   Study of artefacts by specialists and selection of objects for museums

5. **Archival Storage**
   Finds stored in appropriate packaging and organised by archaeological phase, category and material type
Finds Conservation Policies and Procedures: with a focus on objects selected for the new National Museum of Qatar

In each of the 2010-2011 and 2011-2012 seasons, a team of conservators, including staff from Denmark’s Moesgaard Museum, have systematically treated major objects that have been recovered during the course of excavation. As most of the archaeological work has occurred on coastal sites, the primary challenges are salination and corrosion. In addition to the general treatment of registered finds, special attention was paid to selected objects slated for display in the new National Museum of Qatar. Objects were selected not simply for their aesthetic, visual impact, but according to various display themes that could be used to tell different heritage stories. By the end of the season 156 objects had been chosen from the different sites covering the topics of architecture, household, industry, diet, food storage, fresh water, commerce, trade, pearling, fishing, personal items, decorated objects and children. In total, 202 objects have now been designated for the new National Museum of Qatar. Below are presented examples of objects selected for the National Museum of Qatar and conserved.

One interesting object listed for the National Museum of Qatar is a copper alloy Jeton (counter) from Al Zubarah. Careful conservation has revealed a sun, seven stars, crescent moon and the letters E. L. S. LAUER and RECHE R/N_FEN on the reverse and on the obverse a ship with the letters PLUS UL_ and I.L.S.L. The Lauer family were the last makers of jetons in Nuremberg, Bavaria, in the late 18th – early 19th century. Our jeton bears the initials of Ernst Ludwig
Sigmund Lauer whilst the other word on the reverse is probably ‘Rechenpfen(ning)’ being German for jeton. On the obverse, Plus Ul(tra) is probably the family motto.

The 2011-2012 season also saw the full conservation of the pearl merchant’s chest recovered from Al Zubarah, which is the subject of a detailed conservation report. Datable to the later 18th century, the lid and internal details are missing, but many other features were identified. Of particular note is the unusual use of red cloth to clad the outside surface, red being the preferred colour for accentuating the natural beauty of pearls.

Another important class of objects exhibiting a commercial role is a collection of haematite stone marine weights recovered from ZUEP02. Along with the merchant’s chest and a number of boat anchors, such finds can serve as focal points for interactive, multi-media displays on the leading role of the sea and its resources in the economy and culture of Qatar before oil and gas. These finds, along with other story-laden objects from the excavations, will feature in many galleries of the new National Museum of Qatar, revealing a diversity of cultural material that gives a deep insight into trade (porcelains and glazed wares from China, Iran, and other places), commerce (pearler’s box, coinage, weights for scales), the resources of the sea (divers’ weights, dhow anchors), personal adornment (glass bracelets, beads, stone pendants), food acquisition and preparation (mortars and querns, including rotary querns, cooking vessels), household furnishings and lighting, recreational activities, especially coffee and tobacco consumption (hookah heads, pipe bowls, and snuff bottles), aesthetic consciousness (architectural mouldings and geometric stuccos from doorways and walls), and conflict (e.g. a cannon ball).

For further information see:
End of Season Report 2010-11, pp. 63;
End of Season Report 2011-12, pp. 94-102
2.A.iv. Digital Data Storage and Archive: Excavations and Finds Lab

All data recorded during excavation, survey, finds processing, and finds conservation are documented initially on paper recording sheets and registers, which are regularly digitised for backup and storage. Spatial and object data are then entered and maintained in a relational database management system (DBMS) linked to a Geographic Information System (GIS), from which area and phase plans, finds distribution maps, and the foundation of all interpretive illustrations and reconstructions can be extracted.

The main archaeological database for Al Zubarah and the other sites under investigation by the QIAH Project is based on a SQL table structure with a Microsoft Access frontend that allows shared and concurrent access via a local and, eventually, an online network. All data is organised primarily by locus as the smallest spatial unit of stratigraphy, but information can be queried freely by type of deposit or feature, by chronological phase, type or density of finds, type or relative date of ceramics, and other variables, although some of these features are in the process of being implemented. The database also gives access to any photos and illustrations of a locus or catalogued find, as well as to scans of original paperwork. By the 2013-2014 field season, it is envisioned that remote access to the database by researchers not affiliated directly with the QIAH Project will be possible, given the granting of approval by the QMA. Read-only access can then be approved also to the general public, once data proofing is completed.

Digital data generated by the QIAH Project include scanned excavation and survey recording sheets, scanned locus plans, sections and wall elevations, native digital photographs of each locus or survey site, field object and ceramic typologies, scans of illustrations of catalogued objects and pots, as well as progress and specialist reports throughout any field season. Photos are labelled following an internal chronological system and tagged by locus, field object catalogue number or other identifying
2.A.v. Presentation of Archaeological Discoveries in Museums and in Publications, 2010-2012

The compilation and dissemination of the outstanding results produced by the recent archaeological work in northwest Qatar seeks to raise a heightened awareness of Qatar’s rich heritage both locally and abroad through multilingual and age-appropriate outreach programs (further described in Section 5B, below). From the outset, the QIAH Project has placed great importance on making available to the general public and the academic community alike, the rapid pace of discoveries at Al Zubarah Archaeological Site and satellite sites in its hinterland, and how these discoveries are initiating a re-evaluation of Qatar’s Islamic heritage. Writing history anew with the inclusion of archaeological evidence, which encourages an elevated level of public engagement and excitement, is a challenging yet rewarding exercise as it offers, for instance, a deeper appreciation of the past at all social levels, not just that of elites. It is precisely these details that modern audiences crave, as the 2011 installation of photographs and info-panels at Al Zubarah Fort plainly illustrated.

Archaeological objects from the recent excavations continue to form a core element in the dissemination program. In 2012, members of the finds and data management teams along with senior project management...
have been actively involved with curatorial staff from the National Museum of Qatar in the selection, allocation, and story-line writing of objects from the excavations for presentation in the display galleries of the new and stunningly innovative National Museum building in Doha. One full gallery will be devoted to the legacy of Al Zubarah, with interactive experiences of life in the 18th and 19th century town linked to object displays. Other galleries with thematic topics, such as the sea and pearling, will also incorporate finds drawn from the QIAH Project collections, including the Pearl Merchant’s Chest described previously. A total of 202 objects, each remarkable for its representative individuality and heritage importance, have been transferred to the National Museum of Qatar, offering a deeper understanding of traditional practices in architecture, the decorative arts, household arrangements, industry, diet, food storage, fresh water acquisition, commerce, trade, pearling, fishing, personal life and children. Together, these cultural objects create an absorbing insight, notable for its immediacy, into the variety of social customs gathered at Al Zubarah and in hinterland settlements.

It is expected that the museum experience created by the display of finds from Al Zubarah and other sites will convince visitors, both local and international, to make the journey of discovery to the northwest coast, where a well thought out sight-seeing experience catering for adults and children will await [see below, Section 5.B.i].

Complementing the museum program is an active commitment to publishing results aimed at public and academic audiences in newspapers, cultural magazines, scholarly journals, and on the web. In addition, the appearance of preliminary reports
in print and on the web – so-called ‘grey literature’ – has been prolific and speedy. Appendix 3 of the 2011-2012 End of Season Report lists a full publication profile. In the two years 2010-2011 and 2011-2012, QIAH staff members have authored seven major international, peer-reviewed journal and magazine publications. In addition, they have made a number of major contributions to newspaper features, other magazine articles, radio interviews, and video presentations on the work at Al Zubarah and in its hinterland (representative links can be found at www.miri.ku.dk/projekts/qiahp/). As the project work consolidates and prepares to build on the gains already made, the publication focus of the upcoming years is on developing a major international scholarly series of research volumes (most likely through Bloomsbury Qatar Foundation Publishing) supported by interactive web content housed on QMA servers. First volumes, already in the pipeline, will deal with the geomorphology of Qatar and the archaeozoology (especially fish) of the northwest peninsula.

In the last two years, presentation and dissemination initiatives have been set in place as core components in the archaeology programs of the QIAH Project. The impact has been immediate, with formidable gains being made in fostering a deeper appreciation of Qatar’s extensive Arab and Islamic heritage. The results, in museums and the media, promise to inform an international audience as Qatar looks forward to the nationally important hosting of the 2022 FIFA World CupTM. Furthermore, the contribution of an informed stream of heritage knowledge will serve to promote, to a new level, a national understanding of the country’s history and culture in pursuit of the legitimate aspirations and strategic goals of the Qatari people as set down in the Qatar National Vision 2030 document.

For further information see:
End of Season Report 2011-12, Appendix 3 (List of Publications)
2.B. Supplementary historical details

2.B.i. Origins of Al Zubarah

While the conventional historical accounts attribute the foundation of Al Zubarah to tribal leagues of Arabia and the Gulf, the archaeological work of the 2010-2011 and 2011-2012 seasons have given significant insights into the nature of that event, revealing a ‘roll-out’ approach to the foundation of the town.

In ZUEP01 [above, p.12], a densely acculturated deposit of sand and mixed cultural material was uncovered directly under the main 18th century architectural phase. This important occupational phase, not associated with any stone architecture, was characterised by more transient structures notably tents and/or palm leaf huts (*barasti*). Nonetheless, the occupational time-span was considerable as indicated by the numerous postholes and the intercutting rubbish pits, tannurs, and hearths, evidence that these structures underwent numerous rebuilds and repairs. Most significantly, a degree of settlement planning was already in place, as these structures were orientated in a northeast to southwest alignment, with rubbish pits to their northwest. The pottery associated with this settlement indicates that, while some earlier ceramic forms are present, they are intermingled with types from the architectural phase which suggests that foundation transient structures cannot be much earlier in date.

ZUEP01 also revealed the progressive occupation and utilisation of space that occurred in this area, a process most likely to be more widespread in the settlement of intramural Al Zubarah. Compounds were delimitated by the main arterial routes that were carefully and systematically laid out to transverse the town from coast to circuit wall (generally west to east), as the architectural phase progressed. Evidence from ZUEP01 shows that, as settlement expanded, once vacant areas adjacent to established compounds were developed to support production and domestic activities, indicative of population and economic growth. In
some instances, the function of buildings and open areas alike saw change, such as the conversion of a date syrup production area into domestic use [see especially End of Season Report 2011-12, pp. 7-16].

Overall, there is scant archaeological evidence to date of any significant settlement at Al Zubarah before the establishment of the town in the 18th century CE. This is not particularly surprising given the lack of decent water supplies. The first phase of tents and huts in ZUEP01 would seem to predate the main architectural phase by a few decades only; however, continued work in the coastal location of ZUEP02 may challenge this conclusion given its proximity to a most suitable landing spot for dhows. Work on the outer areas of the town, specifically the large compound at ZUEP04 [above, pp.15-16], has failed to identify any pre-architectural phase, as the pits and postholes found cut into the natural substrata were, in all likelihood, an outcome of primary building activities. Nonetheless, it is unlikely that an earlier settlement – if any – was of any great size or importance, demonstrating the arrival of tribal settlers with their social, political, and economic ambitions was the inspiration and force behind the site’s rapid development. The coastal knoll of rock on which the town of Al Zubarah was constructed both defined and limited the layout of the settlement. On one side (the west) lay a broad, sheltered bay suitable as a harbour with extensive sandy beaches, while to the south, east, and north sabkha mudflats of differing ages served as a barrier to the easy movement of people and animals, with both positive and negative outcomes [see Fig 1 p.11].

Building upon the detailed planning of the site in 2009-2010, archaeological research during the 2010-2011 and 2011-2012 seasons has actively sought to explain the motivations behind the urban plan of Al Zubarah, and especially the crucial physical and, by implication, defining socio-economic linkages forged by the settlement with the sea and the scarp lands to the east. As noted earlier, work in ZUEP01 has documented the primary role of providing open access from the wall gates to the sea in the planning of the town, and how the paths so created set limits to the compounds – both large and small – that characterised the urban landscape of Al Zubarah. Here and elsewhere, such as ZUEP02, the evidence has shown that streets were continuously maintained with the primary objective of protecting the crucial lines of community connectivity well into the 19th century.

Within this town-wide framework, the compounds served by the street system had their own rules controlling access and circulation [above, p.12]. Space inside the residential units focused on a central courtyard, and each was separated into a reception and hospitality area, shielded from the living areas for privacy reasons, an area devoted to domestic activities such as cooking, and rooms for day-to-day living in a third area. This arrangement existed regardless of the size of the compound. While much of intramural Al Zubarah was given over to residential units (which, nonetheless,
did not preclude significant production and craft activities within these compounds), a picture of major functional stratification within the urban landscape is emerging rapidly from the archaeological work – the sort of detail that only a well preserved and intact site with an outstanding cultural integrity can produce. That Al Zubarah is an archaeological site virtually ‘frozen in time’ and available to detailed scientific examination, an undertaking fully supported by the Qatar Museums Authority, is an added and exceptional advantage in revealing and explaining details of the site layout.

Providing an important insight are the excavations in ZUEP02, where a commercial complex replete with warehouses supporting light and heavy crafts, foodstuff production, and commodity exchange were associated with a shopping precinct, located right on the beach in an area suitable for drawing up dhows on the shore. Significant is the unambiguous continuity of functionality in settlement of this area, characterised by a rebuilding of the commercial area, albeit on a reduced scale. Most likely this reconstruction followed the historically attested 1811 sack of Al Zubarah. Just to the north, perched on a ledge of bedrock jutting out into the bay, the substantial remains of a coastal fort can be seen, with two major phases of construction evident as with the markets. Even further in the same direction, the architectural features belonging to a large mosque can be seen stretching over a sizable area, associated with rooms and features suggestive of a major religious and educational centre.
Notable in the layout of Al Zubarah are the two levels of circuit walls. Earlier research in ZUEP01 had categorically shown that the Inner Town Wall post-dates significantly the Outer Town Wall (OTW), in that the inner wall was constructed directly over residential units dating to the main settlement of the later 18th century. Completion of work in ZUEP01 during the last two years has confirmed the accuracy of that conclusion, and shows that after the 1811 sack the less compact settlement covered a little under one-fifth of the original 61 hectares within the OTW. New, however, is the revelation of the deeply symbiotic relationship between the planned layout of the 18th century urban centre and the OTW. Given the difficulty of defending the ca. 2.5 kilometre length of the OTW, a service passageway was left open inside the wall, thereby facilitating a rapid response to any external threat. The evidence from ZUEP04 suggests that the OTW was erected sometime after the primary layout, if not construction, of the late 18th century town. Here the OTW accommodates the existing southern enclosure wall of the palace, with the wall tower being intentionally located midway between the two southern corner towers of the palace to produce a formidable defensive profile to the south [above, pp. 17-18].

While the last two years have gone a long way in achieving an understanding of the site layout and its social implications, and confirms the seaward aspect of the urban landscape, many new avenues of research have been identified as a result of this work, each worthy of detailed scientific study in the years ahead.

**Al Zubarah: Interaction with its surroundings**

The most recent seasons of archaeological research in northwest Qatar (in 2010-2011 and 2011-2012) have dramatically increased our knowledge of the relationships between Al Zubarah and its hinterland – both marine and terrestrial. The exceptionally well preserved core archaeological site corresponds with the pristine nature of its hinterland. Ground-breaking geomorphological research has revealed the extent to which the overarching importance of water acquisition was reflected in settlement profiles, the outcome of which has resulted in the identification by aerial and ground survey of a multitude of important villages, hamlets and encampments inland and on the coast [above, pp. 19-22, and the relevant sections in the referenced End of Season reports for the last two years].

![Harbour fort (green shading) and mosque (blue shading) north of the commercial area (ZUEP02)](image)

**Photo 21:** The Harbour Fort (foreground centre-right)
The region of northwest Qatar, focusing on Al Zubarah, is a special case, in that a purposely engineered town was rapidly inserted within the midst of a populated landscape in the later 18th century, gaining immediate benefits from this existing social and economic structure while impacting on subsequent developments. As research stemming from the archaeological survey program has already shown, northwest Qatar offers an unparalleled case study into urban-rural dynamics in the 18th and 19th centuries and the role of these agents in the emergence of the modern states in the Gulf. The largely uncharted connection between, at times, the circuitous formation of modern Qatar and its recent past is no better documented than in the sometimes fraught relations between the competing settlements in northern Qatar – Al Zubarah, Freiha, Ruwaidah, and Fuwairit to name some of the most obvious candidates. The most apparent manifestation of these rivalries was the widespread fortification of water resources near to and far from Al Zubarah – the ‘secure and deny’ principle [above, p. 21]. Not only was the impact felt on Qatar’s neighbours, but also more widely throughout the Gulf region and the Arabian Peninsula; in some ways, the resulting cultural and political upheavals were not resolved until the 2001 judgement passed down by the International Court of Justice in The Hague. In this context, the exceptional contribution of Al Zubarah and its hinterland of northwest Qatar in fathoming the complex matrix of cultural, political, and economic ties throughout the whole Gulf region during the formative 18th, 19th, and early twentieth centuries stands without parallel, with unbroken relevance down to modern times.

A Basis for Prosperity

The final issue requiring review is the contribution of recent archaeological work on identifying and explaining the underpinnings of Al Zubarah’s very apparent prosperity in the 18th and 19th centuries. The long involvement of Arab communities in the harvesting, marketing, and transport of pearls in the Gulf stands as a testament to their commercial acumen, but undue emphasis on one commodity runs the risk of underestimating the cultural and economic complexity of trading societies. So while the pearling narrative still rings loudly in the composition of an economic history for the Gulf, the new archaeological investigations in and around Al Zubarah have and will continue to offer a more nuanced explanation for the foundation, expansion, contraction, and abandonment of permanent settlement at the town site and developments in corresponding settlements of the hinterland.

The primary placement of a large area of warehouses and markets in a central coastal location (ZUEP02, pp. 13-15), evidence for the production of and trade in commodities, and the diversity and richness of finds uncovered during the excavations [above, pp. 29-30] reveal that Al Zubarah served as a trading emporium on the mid-south coast of the Gulf, in which pearls (blatantly seen in the numerous marine weights recovered in ZUEP02 and a pearl merchant’s chest) played a crucial, but not solitary, part in Al Zubarah’s prosperity. In addition to the tangible objects
listed earlier in this document, many less visible and intangible commodities (tobacco, sugar, coffee, and foodstuffs, for instance) would have been supplied on active trade routes. A recent study of organic remains from a midden at Al Zubarah has identified a range of grains, nuts, and fruits (including peaches, plums and grapes) necessarily brought in from Oman, India and Iran.

While commerce and trade, including pearling, were core activities in the maintenance of the town, cultural and religious life were equally significant in building a successful society at Al Zubarah. Most notably the mosque, prominently represented by a large example with auxiliary buildings north of the commercial zone of ZUEP02, created a focal point for scholarship and education in addition to its role as a place of community prayer. Encouraged by changing geopolitical conditions in the 18th century and the growing confidence and effectiveness of tribal leaders, the archaeological discoveries of the 2010-2011 and 2011-2012 seasons at Al Zubarah and in its hinterland have decisively demonstrated that for some fifty years this town thrived as a major regional centre with extensive cultural, economic, and political links throughout the Gulf and beyond. While Al Zubarah's heyday may have been relatively short, its powerful historical legacy lasts until today as an outstanding and exceptionally well-preserved example of a nascent Arab tribal community increasingly eager to exercise cultural, political and economic independence that had been long absent in the empire-dominated Gulf prior to the crucial 18th century.

In the last two years of research it has been possible to see, as has been demonstrated, not just a general broadening of our understanding of Al Zubarah Archaeological Site and its hinterland, but also a more nuanced and compatible conception of Gulf society in the decisive 18th and 19th centuries CE. Understanding this crucial age of transition into the modern world must rely, not solely but in a significant way, upon the recovery of new and almost unlimited information that can emanate from well-conducted and problem-oriented archaeological research. The last two years of work in northwest Qatar, summarised in this document and spelt out in full in the two accompanying and comprehensive End of Season Reports for 2010-2011 and 2011-2012, have highlighted the essential role of the peoples of Al Zubarah in these fundamentally important changes.
2.C. Archival Research, Oral History, and Underwater Archaeology

“ICOMOS considers that the results of the current QIAH project, based on survey and key targeted excavations, perhaps combined with more archival and underwater archaeology, and with more detailed surveys of the satellite settlements, are needed before a clear understanding of the development and phasing of the town, of precisely how it functioned in relation to the sea and to its desert hinterland, and of whether its urban plan is unique or typical, is forthcoming.” [p.103]

“Such work could usefully be augmented with archival and oral history research, and perhaps underwater archaeology around the harbour.” [p.107]

In 2011 an extensive program of archival research began, confirming that the phasing of the settlement currently known in its broad outline matches the phases of development known from historical sources. The development of a detailed understanding of the relationship between Al Zubarah, its hinterland and its maritime seascape is ongoing and further results are forthcoming, but the overall tenets and historical trajectories of the town’s relationship with the wider world, as well as its internal urban organisation and functioning, are at this point known and reasonably well understood. Since the Nomination File was submitted in January 2011, knowledge of the old town has deepened considerably.

Alongside archival research, an intensive collection of oral histories was initiated in 2011/2012, widening our knowledge of local history, customs and traditions, as well as deepening our understanding of specific features of the archaeological sites.

An overview of the results of both research programs will be presented below, followed by information on past results and future plans for underwater archaeological investigations in the Al Zubarah area.
2.C.i. Archival research

There is no single historical source that explains why or how Al Zubarah was established. Rather, the history of Al Zubarah requires an analysis of a broad range of historical and archival sources in order to understand the context in which the town was conceived, grew and ultimately collapsed. Potentially relevant archives, repositories and manuscripts have therefore been collated, and have revealed a limited and uneven, but nonetheless complex body of sources for the history of Al Zubarah and the Gulf in the second half of the 18th century.

The section below provides a short overview of the work undertaken, organised according to the main language of the source.

Ottoman sources

The Başbakanlık Osmanlı Arşivleri in Istanbul is one of the largest archival holdings in the world, with nearly 100 million documents. Material from here should, in theory, provide an Ottoman perspective on developments in the Gulf, which were previously much influenced by British Gulf historiography and the idea of European hegemony (Fuccaro 1999; Valenti 2011). Regrettably, the Ottoman administrative archives from Nejd and Hasa, kept in Baghdad and Basra, have been destroyed, and very few documents related to the Gulf in the 18th century are thought to have survived. Ottoman influence on the area of Eastern Arabia in the second half of the 18th century was negligent, although they kept a theoretical claim to it until 1870.

Arabic sources

Only a few primary Arabic sources have been identified, owing to the fact that much of the Gulf’s locally written sources are currently still hidden in private libraries or are simply lost (Hakima 1965:14; Onley 2005:62; Slot 1993:386; Segal 2008:709). The forthcoming season of QIAH work will focus on an analysis of the works of contemporaneous Wahhabi chroniclers, with the intention of shedding light on the political milieu of East Arabia during the late 17th to 19th centuries. Among the sources included in this geo-political assessment of the region are Ibn Ghannam’s Rawdhat al-Afkar wal-Afham, which ends in the year 1797; Ibn Bishr’s Unwan al-Majd fi Tarikh Najd from 1854; and the anonymous Lam’ al-Shihab from 1817, which was most likely collected at the behest of a British officer Robert Taylor (Davies 1997:132). These sources contain numerous references to Al Zubarah and northwestern Qatar, which have not yet been taken into consideration in modern research on the Gulf. Along the same lines, a comprehensive analysis will be done on Sirhan ibn Sa’id ibn Sirhan’s Kashf al-Ghummah al-Jami’ li Akbar al-Umma, The Hijaz portfolios kept at the National Archives of Egypt is a rarely used source on the development of the first Saudi state, as seen from an Ottoman perspective, and could offer an insight into the expansionist politics that involved Al Zubarah from the 1790s.
generally referred to as the Annals of Oman. The book ends with the events of 1728, but it contains a wealth of information on the political and economic development of the Gulf region up until that year. This text will supply important information to understand the dynamics of local politics.

Several sources relating directly to Al Zubarah have also been identified. Of particular interest is ‘Uthman Ibn Sanad’s Saba’ik al-‘Asjad fi Akhbar Ahmad Najl Rizq al-‘As’ad. This book, written in the early 19th century, is a biography on one of the wealthy pearl merchants that partook in the founding of Al Zubarah. Notably, the text includes references to religious and scholarly life in Al Zubarah and to the patronage of wealthy merchants. The author himself was the supreme judge in Al Zubarah.

Another source comes from al-Tabataba’i, a merchant and scholar who settled in Al Zubarah in 1766, where he wrote the poetic diary Rawdh al-khill wa-al-khaliil diwân al-sayyid, published in Beirut in 1964. In this volume he commented on local historical events and on the scholarly community established in the town.

One further scholar, Saleh al-Atiqi, who was responsible for the ‘writing office’ of Ahmad b. Rizq, has left behind so-called acquisition contracts dealing with buying and borrowing of books among the religious and scholarly community. The contracts are now kept in the family archive of the descendants in Kuwait. This information has kindly been shared with us by Dr. Imad al-Atiqi.
In the 1780s Al Zubarah merchants began to supply the inner Arabian tribes with commodities, especially coffee (Manesty and Jones 1791), thereby crossing trajectories with the Saudi expansionist politics. Another potential source is Kitab tarikh kayf kana dhuhur Shaik al-Islam Muhammed Ibn Abdul-Wahhab. Most likely written around 1803 by a Nadji merchant, this manuscript offers information on inland trade in Eastern Arabia (Fattah 1997:68).

The Zanzibar National Archives (ZNA) hold a rich collection of documents from the era of Omani rule (1800-1890) that until now has been overlooked by Arabian Gulf researcher (Bang 2008:349). These archives contain essential details on Arab trading diasporas in the Indian Ocean and their role and relations to mercantile dynamics in the Gulf region. Despite fluctuations in their political relationship, Omani Muscat was an important trading partner. The archives may also provide more information on the Omani dynasty’s shifting attitude to the Khalifa Utub, as well as the attack on Al Zubarah in 1811.

For various reasons there is a dearth of Qatari documents (Anon. 1998:6), particularly concerning the years before 1820 (Tuson 1991).

Dutch sources
When the Dutch East India Company went bankrupt in 1795, the Dutch state inherited their archives, leaving a large coherent body of material, a large portion of which is kept at the National Archives of the Netherlands. The material is particularly informative on the conditions in the Gulf prior to the establishment of Al Zubarah, but less so after 1766, when the company left the Gulf. The reports by Tiddo von Kniphausen from the 1750s are particularly informative about the history of the Utub (Floor 2007). This material is presently being digitised.

The largest archive by far on Dutch interaction with the Indian Ocean world is the central administrative archive in Jakarta. In contrast to other company archives, the collection was not discontinued in 1795. The archive is not digitised and has not yet been consulted in connection with Gulf research.

Indian sources
After the conquest of Bahrain, the Khalifah Utub had direct commercial ties with Surat, in Gujarat. Further research into archival material from this area seems therefore relevant. However, present research on Indian traders tends to rely on European sources (Nadri 2008), which could be seen as indicative of a lack of local sources. The only text identified so far is the Waqai-i Manazil-i Rum: Diary of a Journey to Constantinople (Hasan 1968). In 1786, Tipu Sultan, the Muslim ruler of Mysore, in southern India, made attempts to expand his diplomatic and commercial network into the Gulf and sent there a group of diplomats. One of these, Abdul Qadir, kept a diary which has survived in the Waqai-i Manazil-i Rum. The text is only available in Farsi, with an English summary that does not always follow the structure of the Persian text (Brittlebank 2005:211), and it
provides valuable information on customs and local conditions, although information on the Eastern Arabian area is not of high quality.

**British sources**

The primary sources of textual information for the Gulf and Qatar are the archives of the East India Company (EIC). Although a private company, the EIC often acted as a state institution, assuming diplomatic and military functions; the material contained in its archives therefore presents a variety of information. There are two main repositories of EIC material relating to the factories (trading stations) of Gombroon (Bandar Abbas), Bushire and Bussora (Basra): the India Office Records (IOR) in London and the Maharashtra State Archives (MSA) in Bombay.

The IOR are administered by the British Library in London, and deposited at the Asia Pacific & Africa Collections. The series is made up of various texts relating to Persia and the Gulf (Tuson 1979). The central groups of IOR records relevant for Al Zubarah are the so-called Gombroon Diaries (reference numbers G/29/1, G/29/4, G/29/6-14) and the archive of the British Residency at Bushire (R/15/1/1 - 13) which covers the period 1763-1813. Of particular interest is G/29/25 (Report on the British Trade with Persia and Arabia, 1791) which contains two short sections dedicated to trade at Al Zubarah. All the historical material held at the India Office and concerning the Gulf is currently in the process of being digitised, courtesy of the British Library and sponsored by the Qatar foundation. A fully searchable website, available from 2015, will greatly assist and facilitate research.

The MSA contains records from EIC Bombay administration, including several papers relating to political history. Of particular interest are the Bussora (Basra) and Gombroon Factory diaries. A closer look at this archive is of interest, as it apparently contains material not systematically used in modern research. A selection of very central records on Eastern Arabia was compiled and edited by Hughes Thomas, 1856, and reprinted by Oleander Press in 1985. It contains information that Lorimer only partially included in his *Gazetteers*. The latter has, since its declassification in 1970, been the most used secondary source for the 19th century history of the Gulf, but it contains very little material on the 18th century. The MSA is housed in the Elphinstone College Building, Mumbai, an open-air structure built in 1888. As a result, the archive is not in optimal conditions and should therefore be a priority research focus in the near future.

Approximately 11,000 photocopied pages selected from the Bombay Secret and Political Department Diaries for the years 1778–1820 are kept at the University of Exeter.

In 2009 Sotheby’s auctioned off a collection of private papers belonging to Harford Jones (later Sir Harford Jones-Brydges), who served the EIC in Basra and Baghdad before becoming ambassador to Persia. The archive covers the period from 1783 to 1811 and therefore relates to the last 27-28 years of Al Zubarah’s history. The over 3100
items which formed the collection would document diplomatic and military events of the period and could offer invaluable insight into language, customs and trade. Sold for £217,000, its present location is unfortunately unknown.

Research into the local and regional history of Eastern Arabia and the Gulf in the second half of the 18th century is hindered by a dearth of primary sources. The difficulty in accessing some of the texts is a further limitation. As few events are covered or confirmed by other contemporary records, judging the validity of the sources is difficult.

Overall, there are at present only a few in-depth studies of the complex social and economic dynamics that facilitated the regional development and trans-regional trade in the Gulf during the 18th and early 19th centuries (Fattah 1997, Abdullah 2001 and Onley 2007 are noticeable exceptions). Even the most recent and thorough publication on pearling in the Gulf only utilised primarily QF material, much to the author’s own regret (Carter 2012).

Owing to the nature of the data currently accessible, the written material uncovered so far clearly favours economic history [See Annex 4]. However, any informed discussion on trade should not just focus on merchants, trading networks and marketing statistics. Of equal importance is information on goods traded, reasons for trading and on the people involved in the exchange. Patterns of regional and international trade are closely linked with domestic consumer culture. Food and cloth belong to the category of human necessities and express social identities that are subject to change under external influences. A future research trajectory for the QIAH Project is therefore an examination of the published textual evidence with regard to what foodstuffs were traded and how they were consumed at Al Zubarah. This will be analytically juxtaposed with the environmental and archaeological components of the QIAH Project.

An international workshop held in collaboration with Qatar University is currently being planned for late 2013. The present ambition of the workshop is to further identify relevant textual material in Arabic, Persian, Turkish, Indian, Dutch, Portuguese and English, and to make an assessment of the appropriate methodological approach to the sources.
Archival Research Short Bibliography


Valenti, P. C. 2011 Creating a New Historiography of the Persian Gulf: The Case of Qatar, New Middle Eastern Studies 1, 1-23

Zahlan, R. S. 1979. The Creation of Qatar. London: Croom Helm
2.C.ii. Oral History Research

During 2012 the QMA and University of Copenhagen’s jointly run QIAH Project’s Community Archaeology component focused its fieldwork on gathering oral histories and traditions. The collection of oral histories, folklore, stories and local traditions of the northwestern region enriched our knowledge of Al Zubarah and the surrounding sites, and of Qatar as a whole. This work also improved the level of acceptance and trust for the Project within the local communities, especially among the tribes of Al Shamal and their respected elders.

The process of interviewing started after researching details about the northern tribes of Qatar, as well as the basic history of the northern villages - including Al Zubarah - at the Qatar Foundation Library of Arab and Islamic Heritage for Education, Science and Community Development in Doha. A list of all the Al Shamal tribes, their internal divisions and their village affiliations was created. Interviewees were selected on the basis of their knowledge of specific topics, their tribal affiliations and village of residence before moving to Doha or Al Shamal, and their willingness to be interviewed. Many interviews with the elders of a tribe were conducted in the tribes’ majlis, an exclusively male gathering house or place of assembly. Women were interviewed in their homes or in the farms, a place of gathering during the weekends and on holidays. As for the interviews themselves they focused on various aspects, such as the history of the tribes of Al Shamal, their tribal affiliations their social, economic, and cultural traditions, as well as distribution and access to their water sources. Interviews also focused on

**Fig 12: Interviewees**

<table>
<thead>
<tr>
<th>Person name</th>
<th>Date</th>
<th>Location</th>
<th>Topic “in brief”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women folk of Mubarak Fadalah</td>
<td>Feb 12</td>
<td>The women’s majles</td>
<td>Information on women’s daily lives and activities. Included a field visit to collect the Kama (truffle)</td>
</tr>
<tr>
<td>Seif Al Fadalah</td>
<td>Feb 13</td>
<td>Field visit to Majtar</td>
<td>The layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants. Water sources.</td>
</tr>
<tr>
<td>Hussein Al Fadalah</td>
<td>Feb 13</td>
<td>Municipality of el Shamal</td>
<td>Follow up after June workshop. Asked about abandonment of villages, cleaning of sites, maps...etc</td>
</tr>
<tr>
<td>Khaled Al Kubasi</td>
<td>Feb 15</td>
<td>Al Kubasi Majles in al shamal</td>
<td>Discussed the details of al kubasi tribe including the list of their branches, Their villages and information about al arish.</td>
</tr>
<tr>
<td>Khaltifa Al Kubasi</td>
<td>Feb 16</td>
<td>On site in al Arish</td>
<td>The layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali al Kubasi and his father</td>
<td>Feb 21</td>
<td>Um Qabrain</td>
<td>The water source and earlier town before the move to al Arish</td>
</tr>
<tr>
<td>Khaltifa Al Kubasi</td>
<td>Feb 21</td>
<td>His farm house in alshamal</td>
<td>Life in al arish, food sources and education</td>
</tr>
<tr>
<td>Grandfather Isad bin Selham</td>
<td>Feb 25</td>
<td>In his majles</td>
<td>An 80 year old gentleman. Meet with me even while using an oxygen tank to breath!! ...met for 4 hours. Main topic – fish traps and the sea</td>
</tr>
<tr>
<td>Mohammed bin Issa bin sloum Al-Kabasi</td>
<td>March 7</td>
<td>Al Jamil -Al Shamal</td>
<td>Review the layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali al Kubasi and his father Kahlifa</td>
<td>March 10</td>
<td>Fish traps of al shamal NW coast</td>
<td>A detailed tour of all fish traps designation of owners, use, construction...etc.</td>
</tr>
<tr>
<td>Mohamed Saleh Ali al Fadalah</td>
<td>March 11</td>
<td>In his Doha Majlis</td>
<td>His life and war stories</td>
</tr>
<tr>
<td>Seif al Fadalah</td>
<td>March 13</td>
<td>Ruways port- in al shamal</td>
<td>Fishing</td>
</tr>
<tr>
<td>Khaled Ali al Kubasi</td>
<td>March 13</td>
<td>Um Qabrain- al shamal</td>
<td>Review the layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Mohammed bin Issa bin Mohamed bin sloum al Kubasi</td>
<td>March 19</td>
<td>In his Doha Majlis</td>
<td>Poetry and his life in alshamal</td>
</tr>
<tr>
<td>Mohammed bin omr aldasim Al Kubasi</td>
<td>March 28</td>
<td>Site visit to Khwair</td>
<td>Village tour. description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali Shebib Manani</td>
<td>April 1</td>
<td>His Majlis in Abu Thalouf</td>
<td>Discussed his writings and the inhabitants of Abu thalouf wa al yusefiyah</td>
</tr>
<tr>
<td>Najla the wife of Mohammed bin omr aldasim al kubasi</td>
<td>April 2</td>
<td>Visit her in her home</td>
<td>Discuss women’s life, work, traditional food and games</td>
</tr>
</tbody>
</table>

Dr. Saca
the interviewees’ recollections of their daily life in the now completely abandoned coastal villages of northwestern Qatar. An aspect that was discussed at length during the field visits were the fish traps (masaker) that dotted the coast of Qatar. Maps and aerial photographs were used for the interviews and a number of specific questions were prepared before the field trips were planned.

All of the abandoned villages dotted along the northwestern coast of Qatar were visited, and a number of them were explored in detail. Among the villages surveyed and researched are: Arish, Al Jumail, Al Mafjar, Al Khweir, and Umm Qabrain.

The results of the first season of research indicated that about 11-12 tribes used to live in the Al Shamal area and these tribes are further divided into fakhd and badidah (branch and family). These divisions create a framework to organise life and social relations, including water access, marriage, land ownership and village of residence. Each of the family groups lived in specific villages and the identification of tribal affiliation with villages was part of the results of the fieldwork season (See Annex 5 for a detailed report of results).

During the village visits the informants identified water sources for their village, and the patterns of distribution of water to the residences after it arrived at the village (by donkey or later by truck). Even though these days most of the structures are entirely or partially destroyed, it was possible to identify buildings and houses in the villages, as well as names of the owners and residents of the houses. Public buildings such as mosques, forts and schools were also identified, and in many cases it was possible to gather the names of students who attended the village school and the teachers who taught them. Walking through the houses the Community Archaeology team was able to better understand the layout of the villages and the internal division within each household, and how such divisions reflected the role of certain members within that society, as well as the role of men and women in the villages.

Fish traps were discussed by all the informants. They were the main means of obtaining readily available food and income for many of the villagers, so the structures were well maintained for years. It became apparent from the preliminary research carried out on these fish traps, that in the past they could be owned and used by both men and women. Each trap was owned by a family and often named after its name or
that of a particular member of the family. The tribes who lived in these villages were familiar with traps’ names and their ownership and they did not trespass on the other people’s fish traps. Ownership could be transferred between families or individuals by means of purchase. During fieldwork it was possible to identify the fish traps associates with the towns and villages of Al Zubarah, Freiha, Al Arish, Al Khweir and Al Khidaj. These structures are proving to be a great source of information on the social and economic life of the abandoned villages and further research is needed on these barely preserved structures.

Future community archaeology work will focus on continuing the field work and interviews with both Qatari men and women from the Al Shamal tribes, in an effort to build on the cultural survey started in 2012. It will aim to achieve a better understanding of life in the abandoned villages of the northwestern coast of Qatar. The history of Al Zubarah and its hinterland, as well as other aspects of culture and history of Qatar will be investigated whenever possible. Oral histories will be gathered on pearl fishing, trading, tribal movements, fish traps, land use, and water use; these issues proved to be key elements in these tribes’ past and present lives. The women of Al Shamal, who are considered by Qatari people to be “Tradition Keepers”, will become important contributors and information will be gathered on contemporary Qatari writers focusing on local history.

It became clear during the fieldwork undertaken that the tribes of Al Shamal are keen on seeing their villages preserved and infused with new life. Through general town hall meetings and workshops and through their leaders or elders, these tribes should be involved in the decision making process regarding the future of the abandoned villages.
2.C.iii. Underwater Archaeology

Since 2010 the State of Qatar has been engaged in a program of marine-archaeological surveys in cooperation with the University of Birmingham and the Hampshire Wight Trust for Maritime Archaeology. Recent maritime research close to Al Zubarah has focused on an area between Qatar and Bahrain, within Qatar territorial waters. As a part of this a large tract of sidescan sonar data was subject to analysis for sea bed anomalies and gound-truthing through diver inspections. Further work has involved sea bed characterisation and the recording of extensive - and mostly late Islamic period - pottery scatters on the sea bed.

The potential for the discovery of shipwrecks related to Zubarah is significant. Wooden vessels sunk in 1895 would have been close enough to the coast to have been salvaged for cargo and, where not destroyed by fire, for wood. However, investigations have, to date, not produced any significant finds of wrecks or other submerged features that can be directly linked to Al Zubarah. Given the shallow water any remains not covered by sedimentation would have decayed fairly rapidly with the most likely evidence for wrecks being the remains of exposed ballast. However, the examination of aerial photographs from 1958 and 1969 would suggest that extensive sedimentation has taken place, and any remains within the bay of Zubarah are probably buried below marine sedimentation. The discovery of any remains is likely to require significant programme of marine geophysics close to the coast. These investigations include analyses of the submarine landscapes associated with Al Zubarah, but to date have not produced any significant finds of wrecks or other submerged features that can be directly linked to Al Zubarah. The scientific results of this work have been preliminarily published in the Proceedings of the Seminar of Arabian Studies (2011 & 2012) and broadly disseminated through the independent portal www.qatararchaeology.com. Additionally, seasonal reports have been submitted to the QMA, and the outcomes of this work will gradually be incorporated into Al Zubarah Archaeological Site and its management plan.

Moreover, in 2013 the QIAH Project will begin a collaborative initiative with Marburg Universität, Germany, under the direction of Prof. Ralph Petersen. This initiative will aim at undertaking further investigations to scan the seabed of the Al Zubarah region, in order to clearly ascertain the need for possible underwater excavations.

2.D. QIAH Project Organisation

The QIAH Project was created in 2009 as an initiative by the Qatar Museums Authority, and is run in collaboration with the University of Copenhagen. In general terms, the Project aims to investigate, preserve and present to the public the Islamic archaeology and the cultural and natural heritage of northern Qatar, with a focus on the important UNESCO nominated settlement of Al Zubarah. It is one of the largest heritage projects in the Gulf region and involves more than one hundred specialists in archaeology, history, conservation, architecture, natural history, material science, geomatics, geology, heritage, oral history, dissemination and museum studies. In addition, the team is assisted by a labour force of about ninety persons. The QIAH Project also engages expertise from leading laboratories and companies in order to develop and perform best praxis.

The multi-disciplinary and holistic approach of the QIAH Project requires an efficient and comprehensive organisation to reach the goals defined by the QMA. A matrix structure has been designed to align all involved disciplines and secure the optimal coordination of specialists working within the wide range of sub-projects that single out Al Zubarah Archaeological Site as an outstanding international heritage site. This organisational structure will be functional throughout the capacity building phase defined in the Management Plan (2012-2019).

The matrix structure is organised according to three main levels: the management level (executive director and board of directors), administration and logistics, and the sub-projects level [see Fig 14 p.55].
The executive director is responsible for contracts between involved partners and between the QIAH Project and the QMA, as well as for legal and budget matters. The board of directors is composed of four directors representing each main disciplinary field:

- heritage, site conservation and community archaeology
- archaeology and object conservation
- history
- natural history and environment

Each director has responsibility for designing, staffing and running her/his component of the sub-projects.

The administration and logistics division is a shared capacity for all disciplines and sub-projects, necessary for an optimal and efficiently functioning fieldwork. Its main areas of operation are procurement, contracts, transportation, data management, finds management, photography and films, camp management, translation and editing, media and design, and coordination.

The sub-projects are those activities that the QMA and the QIAH Project jointly decide to carry out in a season of fieldwork normally taking place during the winter, when outdoor working conditions are optimal. Sub-projects are regularly described in Scope of Work documents agreed between the QIAH Project and the QMA, which also present work targets and estimations of required resources. An example of a sub-project is the work on the Palatial Compound (EP04). A number of specialist and general work force is allocated to such a project, and together they form the sub-project team. The EP04 sub-project includes excavation, conservation of architecture and presentation to visitors. For each main discipline a coordinator is assigned who is responsible for reaching milestones defined in work process diagrams. In the case of the EP04 sub-project three coordinators - one for excavations, one for building conservation and one for presentation activities - manage the workload for the team. Together, the three coordinators are responsible for the best possible workflow of the sub-project and they refer directly to the board of directors.

The interdisciplinary, holistic approach of the work undertaken at Al Zubarah Archaeological Site is a unique collaborative effort that has produced extremely valuable results, which have gone a long way to create a better picture of the past, as well as a sustainable heritage asset for Qatar and the world.
The image contains a table titled "QIAH Project Matrix Structure UNESCO Phase One, Year Two (2013)". The table is divided into categories such as Executive Direction, Board of Directors, Heritage Management, Conservation and Community Archaeology, Archaeology and Object Conservation, Natural History and Environment, and History.

**Administration & Logistics**

- Logistics: Procurement, Accounts, Travel & Salaries, Data Mgmt, Finds Mgmt, Photo & Data Mgmt, Camp Management
- Editorial: Editing, Translation
- Media & Design: Media, Design
- Coordination: General Coordination, Project Structure

**Projects**

- **Al Zubarah Archaeological Site**
  - Site Management
  - Fort Conservation: Al Zubarah Fort Conservation, The Palace ZUEP04 Excavation Conservation, The Fortified Compound QMA4 Conservation

- **Al Ruwaidah Archaeological Site**
  - Excavation and Conservation: Al Zubarah Hinterland Survey
  - Minarets, Al Shamal Municipality Conservation Area Conservation Plan and Structural Recommendations

**Fig 14: QIAH Project Structure**
3. Revised Justification of Outstanding Universal Value, Integrity and Authenticity
3. Revised Justification of Outstanding Universal Value

3.A. Criteria under which inscription is proposed (and justification for inscription under these criteria)

The nomination of Al Zubarah Archaeological Site for inscription on the World Heritage List is based on criteria (iii) and (v) of UNESCO’s Operational Guidelines for the Implementation of the World Heritage Convention.

Criterion (iii) requires that Al Zubarah should:

“...bear a unique or at least exceptional testimony to a cultural tradition or to a civilisation which is living or which has disappeared”

The abandoned settlement of Al Zubarah is a unique testimony to the merchant and pearl trading tradition of the Arabian Gulf during the 18th and 19th centuries. The settlement was founded by Utub merchants emigrating from other towns and seeking a safe haven for trading during a time of great upheaval in the Gulf region. Over a very short period of time, Al Zubarah quickly rose to become the foremost centre for pearl-based trade and commerce in the region, and Qatar’s largest and most important town.

Al Zubarah Archaeological Site represents the only complete urban plan of an Arabian town strongly connected to the traditional practice of pearl fishing. Its unique combination of neighbourhoods, mosques, palaces, markets, defensive systems and a canal is in itself a unique testament to the achievements of Al Zubarah’s inhabitants. The town plan encapsulates and preserves key ideas about urbanism and town planning during the 18th-19th centuries, and it is the best-preserved record of its type. The individual neighbourhood plots, plazas, mosques and markets that are discernible from the town plan also reflect a significant degree of urban planning and control.

The different components of Al Zubarah’s urban plan show that the settlement was conceived and implemented from the outset. The fabric of the city shows both the sophistication of the planning principles, and the capacity of Al Zubarah’s rulers to control and direct the social and economic forces...
Al Zubarah Archaeological Site bears unique testimony to the human interaction with both the sea and the harsh, desert environment of the region. Pearl divers’ weights, depictions of dhows, and imported ceramics show how the town’s development was driven by trade and commerce to a great extent, and that many of the town’s inhabitants felt a close connection with the sea. Al Zubarah’s natural harbour provided ample protection against piracy or bad weather, and it supported a sizeable pearling fleet, which travelled twice annually to the oyster banks along the northeastern coast of Qatar.

A canal to the south of the settlement connected Qalat Murair to the sea, allowing freshwater to be transported to supply ships, and goods to be ferried between the harbour and the fort. Intra-tidal traps built of low walls utilised the natural tides to catch fish in a complex, dense trapping system that can be found in association with numerous settlements up and down the coast, including Al Zubarah. These reflect an intensive exploitation of marine resources. Date presses (madbassas) found in the settlement, and traces of field systems found in Qalat Murair show that the exploitation of the seas was complemented by an equally intensive use of Al Zubarah’s hinterland. Palm groves provided a food source for the settlement, while wells in and near Murair were the...
principal source of freshwater. Remains of enclosures provide evidence for the keeping of livestock, helping to feed the town’s population.

The town of Al Zubarah and the fort at Murair therefore formed a symbiotic, economic and social relationship. Qa‘at Murair protected the town’s crucial freshwater resource and two screening walls allowed people to safely transport water from Qa‘at Murair to Al Zubarah. The local geology and geography shaped the traditional settlement system in the area, with freshwater wells only existing on the higher ground to the east. These ecological conditions led to the establishment of small-scale settlements in Al Zubarah’s hinterland in support of the town. With Al Zubarah at its centre, the site and region represent an outstanding example of traditional human settlement, land-use and sea-use.
3.B. Proposed Statement of Outstanding Universal Value

*Al Zubarah Archaeological Site* is of outstanding universal value as the Gulf’s most complete and well-preserved town of the 18th-19th centuries connected to the practice of pearl trading and fishing. Until the introduction of the cultured pearl, and before the exploitation of oil and gas, the trade in pearls constituted the Gulf’s most important industry, employing up to a third of the male population in the region. It created large economic surplus and wealth at a time when the Persian Safavid Empire had lost political influence and importance. Pearling was the foundation on which incipient city-states were formed and gained wider regional influence and importance, laying down the crucial geopolitical, social, and cultural trajectories of recent Gulf history, which shape the region to this day.

*Al Zubarah Archaeological Site* played a pivotal role in this historic phase of development, as it represented one of the most prolific and crucial international trading ports in the region. As a traditional settlement located in Arabia in which trade, commerce and hence social and cultural interaction and exchange were the underlying tenets, the Nominated Property relates to a number of socially and culturally relevant themes. The site reflects the history of tribal migration in the Gulf, as it was founded by merchants arriving from Kuwait and Basra in search of pearls. *Al Zubarah* also represents a unique mode of occupying a fragile desert ecosystem, which includes a particular system of water management. Moreover, during the mid to late 18th century, *Al Zubarah* was the Gulf’s most important trading hub, connecting the Indian Ocean with Arabia and western Asia, and highlighting how trade and exchange connected people from East and West economically, socially and culturally. Collectively, these themes highlight *Al Zubarah* as a non-European, traditional form of settlement, which encapsulates anthropological and social historical themes.

*Al Zubarah Archaeological Site*’s Outstanding Universal Value also pertains to the unique preservation of a complete urban town plan of an 18th-19th century pearling and trading settlement in the Gulf. Surrounded and
protected by a 2.5km long wall, the town extended over an area of 61 hectares. Due to the abandonment of the site in the beginning of the 20th century, the entire layout of the settlement is preserved in great detail, providing key archaeological and anthropological data on economic, social and cultural relations between the inhabitants of the town, as well as traditional pearling practices. This exceptional state of preservation is strengthened by the integrity and authenticity of the site, and it provides crucial information on human interactions with the land and sea, trade links, and social and economic relationships, which are engraved and materialised in this exceptional assemblage of urban, historic fabric.

The site is today largely preserved in the form of low mounds, which mask the buried traces of traditional vernacular and religious architecture. The urban fabric of the Nominated Property includes courtyard houses, palaces, mosques, suqs, defensive walls and palm-leaf fishermen’s huts and tents. This represents a unique mix and assemblage of building types, the spatial organisation of which is preserved in outstanding detail across the entire townscape. The Nominated Property includes the entire town, harbour, canal, screening walls, cemeteries, Qal’at Murair and Al Zubarah Fort. Qal’at Murair, which was destroyed in the latter part of the 20th century, survives largely as sub-surface archaeology, but is an important, interconnected feature of the Nominated Property. The fort showcases how the desert’s most precious resource – water – was managed and protected, and how Al Zubarah’s rulers strategically protected access to it.

The integrity of Al Zubarah Archaeological Site is guaranteed, as it was abandoned in the early 20th century and being located far from any modern settlement, it has remained untouched by modern development. Only a small proportion of the site has been excavated and restored, and scientific reports have been – or are in preparation to be – published. The archaeological phases at the site are intact and showcase the development and evolution of the town. Al Zubarah Archaeological Site is under development to ensure the preservation and presentation of the site for future generations.

The Nominated Property is proposed for inscription under criteria (iii) and (v), as it is an outstanding example of a mid-18th to late 19th century pearl fishing and trading settlement, representing a traditional form of land– and sea-use, settlement and water management. Moreover, Al Zubarah is one of the last remaining localities that embodies the historical trajectories that shaped the economic, social and geopolitical landscape of the early-modern and modern Gulf. Al Zubarah Archaeological Site encapsulates the traditions and lifestyle of 18th-19th century urban populations in the Gulf, and reflects the relationship that existed between the people of the Arabian Peninsula and their natural environment.

The property is owned by the QMA, a distinct governmental organisation under direct control of the Amir’s Office. The large
Buffer Zone around Al Zubarah Archaeological Site protects it from the impact of any development plan being considered for the region, guaranteeing the preservation of not only the archaeological remains, but also of their setting and the surrounding landscape. The Nominated Property includes the 1938 Al Zubarah Fort, itself an important visitor attraction and a source of national pride, while Qalat Shuwaill is inside the limits of the Buffer Zone. Given the strong existing governmental planning and development control, in which the QMA has direct input for the protection of archaeological and historic building assets, the Buffer Zone will guarantee the highest level of protection for this outstanding site.
3.C. Comparative Analysis

The Nomination File that was submitted to the UNESCO World Heritage Committee for the inscription of Al Zubarah Archaeological Site in 2011 contained a substantial catalogue of comparative sites. Among them are localities that have been inscribed in the UNESCO World Heritage List, as well as sites that for various reasons have not. As many of the sites directly comparable to the Nominated Property only are known historically, and their physical remains have either been lost or severely reduced as a result of natural disasters and/or modern development, Al Zubarah Archaeological Site may validly be considered of Outstanding Universal Value.

On page 92 of Volume I of the Nomination File, Al Zubarah is described as representing "...a unique and fleeting moment..." in the history of Gulf trade and its connection to more global mercantile networks. The last two seasons of excavation, combined with the augmented program of historical research, have nevertheless demonstrated that the substantial period represented by Al Zubarah is of crucial relevance to the development of early modern trading systems, and to the way in which these were gradually transformed into the coherent systems of the 20th century. Furthermore, Al Zubarah stands as the most complete and intact material representation of the role that the Arab world played in the formation of both modern trade systems and independent Arab states.

A range of other settlements in Qatar (Huweila, Fuwairit and Al Bida) are historically attested to have played similar roles as mercantile nodes sustained largely by the control and exploitation of local resources (i.e. salt-water pearls). The trade in these resources facilitated the interaction with the environment, as well as with local and regional communities. Over the last two seasons, significant work has been done on mapping other sites in north-western Qatar, and investigating the nature of their relationship with Al Zubarah. Al Zubarah Archaeological Site is thus placed within a significant cultural framework, but stands out clearly as the largest, most successful, and most intact manifestation of these trends.
In regard to positioning Al Zubarah within a more regional framework, Volume I of the Nomination File describes a number of sites in the Gulf, in which similar dynamics as those associated with the Nominated Property can be detected either historically or archaeologically (i.e. Nakhlul, Bandar Lingeh, Bandar Abbas and Bushire on the Persian coast; Kuwait City, Qatif, Awal/Manama and Muharraq in the Upper Gulf; and Muscat, Jazirat al Hamra, Dubai and Abu Dhabi in the Lower Gulf). This comparative analysis remains valid and clearly shows that Al Zubarah is part of a wide-spread trend in the Gulf region that combines the harnessing of natural resources, the cohesion of the littoral as a cultural entity, and the building of links to inland communities.

There can be little doubt that all of the Gulf sites mentioned in the Nomination File are comparable in their existential trajectory. However, following the last two seasons of work, the distinction between Al Zubarah Archaeological Site and its Gulf counterparts is more apparent than ever before. The vast majority of physical remains from this period have disappeared under the massive urban development of the 20th century. The taphonomic processes related to the Gulf sites have damaged most traces of any material culture pre-dating the 1970s, and it is solely due to the abandonment of Al Zubarah in favour of Doha that we are fortunate enough to have the intact and authentic example that this settlement constitutes. Its unique survival, combined with the ambitious and extensive program of research associated with Al Zubarah Archaeological Site, make it the only viable candidate to satisfactorily represent the many complex threads that make up the tapestry of 18th and 19th century Gulf societies.

While the State Party increasingly views Al Zubarah Archaeological Site in a much broader framework than was initially expressed in the Nomination File, its affiliation to, and major role in the extraction and trade of pearls remains evident. In this regard, it should be recalled that the activities and culture associated with pre-modern pearling in the Gulf have been recognised as being of Outstanding Universal Value to humanity by the UNESCO World Heritage Committee in 2012, when a number of both cultural and natural sites within Bahrain were inscribed as individual representations of one composite whole: Pearling: Testimony of an Island Economy. While the State Party considers the innovative nature of this combined thematic inscription commendable and appropriate, there can be little doubt that as a testimony of this specific cultural tradition Al Zubarah Archaeological Site is unsurpassed in both integrity and holistic authenticity.

A similar argument can be made for pearling communities outside the Gulf region. Some of the most prominent of these (e.g. Tutucorin, India; Jolo, Phillipines; and Nueva Cadiz, Venezuela) have been described in Volume I of the Nomination File [pp. 106-10], but it is apparent that as pre-modern settlements, the original and authentic nature of these sites has succumbed to modern development. Again the historical trajectories of Al Zubarah cause it to be uniquely representative of a trend that can be anchored at a local, regional and even global level. From the perspective
of intactness, *Al Zubarah Archaeological Site* stands as the most intact singular representation of a pre-modern cultural and economic activity that helped shape communities all over the world.

Comparative analysis in Volume I of the Nomination File considers a number of merchant settlements that have been inscribed in the UNESCO World Heritage List. The list includes the multi-period site of Qal'at Al Bahrain, which, in spite of its age and long lifespan, is of little direct relevance to the socio-economic and cultural dynamics represented by *Al Zubarah Archaeological Site*. Qal'at Al Bahrain represents, in fact, a much more sporadic and undocumented range of mercantile activities, which have in turn transpired over a much longer period of time than at Al Zubarah. The discrepancy between the two sites thus pertains to their nature as representations of World Heritage, and as our understanding of Al Zubarah grows, it is becoming increasingly clear that their comparison holds little scientific validity.

The *Land of Frankincense* (Oman) is the second UNESCO World Heritage Site to be considered in this regard. This is of considerable relevance, in that it reflects the important trinity of pre-modern economic development: valued resource(s), nodal site(s) and associated trade patterns. Like Bahrain's *Pearling: Testimony of an Island Economy*, the inscription of the *Land of Frankincense* in the UNESCO World Heritage List in 2000 was based on the combination of a range of different cultural and natural sites, which illustrated the complex diachronic relationships between natural resources, landscape creation, patterns of mobility and trade, and mercantile settlements. Even though it represents similar dynamics, Al Zubarah's intactness and its extensive social, cultural, and economic links to its surroundings, reminds us that although the cultural trends associated with profitable and important natural resources are part of our heritage, such trends are often only sporadically represented in the archaeological record. This paucity of intact sites is the primary motivation behind composite inscriptions, and opportunities to scientifically investigate and professionally manage an intact and authentic site are extremely rare.

Both the rarity of such sites and the source of information that surviving intact sites constitute, is reflected in other UNESCO World Heritage Site inscriptions. The parallels provided in the Nomination File suggest how important and rare such sites are on the World Heritage List. No other site within the region in question constitutes a valid
comparison, and one is forced to move far beyond the geographic boundaries of the Gulf in order to identify appropriate parallels that have achieved inscription. In Burkina Faso, the ruins of the once great trading metropolis of Loropeni are one such parallel. Here, it was primarily gold that was the natural resource driving mercantile initiatives, but, as at Al Zubarah, the extraction and trade in gold saw a plethora of mercantile initiatives, commodities and sites developing in its wake. As such, it has provided scholarship, and indeed the world, with a substantiated glimpse into the great urban and mercantile traditions of continental Africa, and how these impacted everything from the creation of coastal emporia and the harnessing of resources, to the price of commodities in Europe and elsewhere.

A final comparison is offered in the *Iwami Ginzan Silver Mine* complex in southwest Japan. While this site’s comparative relevance to Al Zubarah was initially considered somewhat tenuous, the dramatic increase in empirical evidence over the last two archaeological campaigns has caused us to reconsider the relevance of this site in legitimising Al Zubarah’s claim to inscription. Again the similarity can be seen in the comprehensive societal impact that sought-after resources can have, and the material manifestations of human endeavours to control, profit, and grow from such resources. While the Nomination File sufficiently underlines the comparative relevance of the *Iwami Ginzan Silver Mine* to *Al Zubarah Archaeological Site*, the State Party finds it pertinent to emphasise that it was within the context of its ‘cultural landscape’ that the UNESCO World Heritage Committee found Iwami Ginzan worthy of inscription. Similarly, it is the broad programme of scientific investigations associated with *Al Zubarah Archaeological Site*, and the massive amount of relevant empirical evidence generated by these efforts, which more than suggest Al Zubarah’s cultural worth as an intact, authentic and indeed highly informative testimony to an important natural resource, and all of the human endeavours associated with it.
3. D. Integrity and Authenticity of the site

3. D. i. Integrity

The 18th century urban layout of Al Zubarah has been almost entirely preserved in situ. It is an outstanding example of a newly established, planned Islamic town during the 18th century. Not only do the town plan and monuments within the town maintain their original aspect, but the surrounding environment and related infrastructures – canal and field systems at Qal’at Murair – have also been preserved. The Nominated Property therefore shows an extraordinary degree of integrity and authenticity, with no modern incongruous additions to the architectural remains or any substantial modification of the original town’s street network.

Considering that other comparable towns such as Kuwait City, Abu Dhabi, or Manama have been completely modified in modern times, with the subsequent loss of their original layout, Al Zubarah offers a unique and invaluable example of 18th century urban layout and design, as well as town life, during the heyday of the pearling economy. Although Al Zubarah is the most extraordinary settlement of the region, aerial pictures show that it was part of a larger complex settlement and fortification system – still partially unknown – running along the northern Qatar coastline in the Al Zubarah area. The inscription of the Nominated Property in the UNESCO World Heritage List will boost research on this region and catalyse the scientific attention on the area, playing a positive role for its preservation and study.

Integrity is considered in the UNESCO Operational Guidelines as a measure of the: “wholeness and intactness of the cultural and/or natural heritage and its attributes”. The physical fabric of the property and/or its significant features should be in good condition, and the impact of deterioration processes controlled. Al Zubarah has kept its integrity as an abandoned town, since the site has lain in ruins following its destruction in 1811. Only a small part of the original area was resettled during the late 19th century.
Al Zubarah Archaeological Site  Supplementary Dossier

3. Revised Justification of Outstanding Universal Value

The town plan has been largely preserved in the archaeological record and shows all the vestiges of an Islamic town.

The site has been protected since 1980 under the first antiquity law of the State of Qatar [see 5.8 Protective Designation], and was listed as a heritage site by the National Council for Culture Arts and Heritage (now part of the QMA). The first archaeological excavations were carried out during the mid-1980s and throughout the 1990s. In 2009, a larger-scale comprehensive project, the Qatar Islamic Archaeology and Heritage Project (QIAH Project) was launched. The new project was initiated by the QMA, with the University of Copenhagen in charge of the scientific direction of the project, in order to investigate, preserve and present to the public the important remains of Islamic heritage in the northern part of Qatar. The Nominated Property consists of a large archaeological site currently under excavation and until now 2.5% of the entire town has been excavated. The QIAH Project aims to uncover and to present approximately 10% of the town in the coming years.

Parts of the Nominated Property were in the past fenced by the Ministry of Environment and the National Council for Culture Arts and Heritage, but a new, solid, long-lasting structure encircling the archaeological site has now been built. This fence, planned since 2005, guarantees the preservation of the integrity of the property. Now that the fence is completed, an additional guarding system strengthens the initial protective measures. The Nominated Property and the Buffer Zone are not inhabited and therefore no developmental pressure will endanger the site’s integrity. Furthermore, the conservation, monitoring and management mechanisms [in Volume 2 of the Nomination File and in the updated Management Plan submitted in December 2011] will ensure the medium and long-term conservation and maintenance of the site.
3.D.ii. Authenticity

Al Zubarah owes its high degree of authenticity as an 18th-19th century trading centre to the fact that it retains a high proportion of its original historic substance. Its authenticity is further guaranteed by the preservation of the totality of the former urban area and by its surrounding hinterland and related infrastructures.

The restoration work carried out during the 1980s focused on the then-excavated buildings and sections of the outer urban enceinte. To prevent further structural decay, old wall stones were re-used to complete or to rebuild parts of the wall structures. Other walls were more extensively reconstructed. In some cases, cement was used in these restoration measures, and walls were capped with a cement coat. The methods used in the 1980s are no longer acceptable today, but their actual impact is minor and does not alter the overall authenticity of the architectural and archaeological remains of the Nominated Property. Lack of maintenance during the past twenty-five years has resulted in substantial decay of the exposed walls.

To avoid further collapse of endangered wall structures, the initial phase of the QIAH Project included the backfilling of older excavation areas. In addition, the new excavation areas opened by the QIAH Project since 2009 are partly backfilled at the end of each field season [see Fig 15]. This is the best available, short-term method to avoid further collapse of fragile architectural remains, but can only act as a temporary measure as it does not facilitate a
positive visitor experience. New conservation efforts begun in 2011 will protect the site in the medium- and longer-terms.

The QIAH Project respects the recommendations of international charters and follows the internationally-agreed principles for the protection and management of archaeological heritage. It notably respects the provisions of the Nara Document on Authenticity and of the ICOMOS Charter for the Protection and Management of Archaeological Heritage, in that reconstruction will not take place within the Nominated Property. The QIAH Project keeps an inventory of all archaeological structures and sites within the Buffer Zone of the Nominated Property. They are documented through Geographical Information Systems (GIS), providing the basis for the understanding of the settlement’s system and its history. In addition, GIS serves as the platform for the understanding of the settlement’s development. It will also serve as an essential tool for the continuous monitoring of the site, as foreseen by the Management Plan.

Ultimately, Al Zubarah Archaeological Site reflects the transition to modern systems of resource exploitation, processing, and trade on a global level. When considering this in combination with the site’s Outstanding Universal Value, its intactness and authenticity, as well as the comprehensive programme of research, conservation and management instigated by the State Party, Al Zubarah Archaeological Site should be considered worthy of the highest international acknowledgement in the form of inscription in the UNESCO World Heritage List.
4. Summary of Results of Conservation Strategy

“Complete and implement the Conservation Strategy, identifying the interventions desirable to stabilise the urban remains”

(From the World Heritage Committee’s Revised Draft Decision 36 COM 8B.19)
In 2009, the QIAH Project began studying and documenting the state of preservation of the architectural remains of Al Zubarah town. The goal was to define an appropriate conservation strategy for the exposed remains, which could ensure and protect the site’s unique integrity and authenticity. The conservation strategy had to fulfil a number of requirements:

1. It had to both protect and strengthen the structures in order for them to be preserved for future generations.

2. It had to take a certain amount of annual visitors into consideration.

3. It had to be a sustainable strategy that in addition to protecting archaeological remains, made them an understandable medium for explaining the town’s history.

The initial conservation strategy was based on a premise of stone architecture. However, studying the deterioration patterns and decay processes on site soon made it clear that, even though the architecture included stone as a primary building material, the structures as a whole have more in common with traditional Arabian adobe architecture than they do with the deterioration processes normally associated with stone architecture. In particular, the study of the decay processes of the building structures consolidated in the 1980s provided a basis to discuss different possible approaches to protect and preserve the fragile vestiges. As a consequence of the documentation of decay processes, and in consideration of the need to present this unique example of 18th century town planning in the Gulf to a wide audience, a revised strategy was formulated for the 2011-2012 QIAH fieldwork season, which has set the standards for future investigations.

**Conservation strategy (2009 to 2011): Preserving and protecting only**

In the initial approach, the QIAH Project set out to maintain the preservation of the town architecture in the exact state in which it was left after the completion of archaeological excavations. The primary objective was therefore to brace the beach rock wall stones with lime slurry. While similar in concept to the material originally applied, the new lime slurry differed in colour and composition from the historic plaster surfaces. There was no differentiation between wall faces and wall tops (with regards to materials and treatment) and no structural or aesthetic additions were made to the exposed architecture. The conservation efforts also refrained from levelling uneven wall surfaces. In general, the strategy appeared to have been best suited to traditional stone architecture.

**Conservation strategy (since 2011/2012): Preserving remains and making the architecture understandable**

Following in-field observations from 2010-2011, a revised strategy of conservation was formulated which implemented a more
multifaceted approach to the technical and aesthetic challenges of architecture at Al Zubarah. The revised strategy includes the re-plastering/re-surfacing of wall faces to protect the actual building stones from erosion. Furthermore, there is a much clearer differentiation between wall faces and wall tops with a ‘double lined’ plaster ledge separating the wall plaster and the rough surface of the wall top. Both the treatment of surfaces and the visual characteristics of the new, currently lime-based plaster approximate the historic construction processes, in order to create a homogeneous appearance between original and conserved surfaces.

The revised strategy also entails a degree of structural rebuilding, including the restitution of architectural elements such as wall faces, niches, ledges and doorways. The consolidation of historic plasters includes the stabilisation of exposed surfaces, cementing cracks and border lines, filling voids and fixing loose components. In sum, the revised conservation strategy is specifically tailored to the characteristics of earthen architecture.

Although the aim of the consolidation of plaster remains and wall structures is to stabilise them and to reduce the impact of weathering, deterioration processes cannot be stopped or interrupted completely. Preventive measures, e.g. structural rebuilding, temporary propping and backfill will therefore help to minimise potential damages. It follows that, owing to the environmental conditions and the composition of the historic building materials, a regular maintenance and monitoring programme is required. Even so, because of the harsh environmental conditions and the weak
Composition of the historic building materials, the conservation strategy will require a regular program of maintenance and monitoring of the architecture.

Protection and conservation measures undertaken in 2012 also involved the implementation of solutions to mitigate the impact of pedestrian and vehicular traffic approaching the site and within it. A first track (Track 1) leading visitors to the main points of interest was prepared in March 2012 in the southern part of Al Zubarah town and a raised walkway is being planned to improve its accessibility and minimise threats to the site caused by tourism pressure [see p.92]. The addition of walkways to the proposed three visitor tracks at Al Zubarah will give limited access to the site and protect the fragile vestiges from increased footfall by keeping visitors outside unexcavated areas of the town. Since March 2012 a marked vehicle track guiding visitors to an area designated for interim parking has limited the impact of vehicular traffic approaching the old town [see Fig 16 p.74]. Regulating access to the site can improve maintenance of the facilities and remains, as well as increase the protection of the natural environment within the borders of Al Zubarah Archaeological Site. Moreover, a service track running around the outer perimeter of the site and used by archaeologists to carry on working in the areas to be opened for tourism in the near future was established in November 2011. This service track will help to reduce the impact of the archaeological fieldwork on site.

conservation and consolidation work. Each work step is accompanied by images and text [see Fig 17]. Relevant reports and documents are compiled in the appendices to the Conservation Handbook.

Implementation and Monitoring
Since 2009 the exposed building remains of Al Zubarah have been systematically documented and recorded within an inventory database. A priority list is then prepared on the basis of the inventory record. The analysis of priorities forms the basis for the preparation of the QIAH Project’s scope of work proposed annually to the QMA. Recorded damages and deterioration patterns are assessed by a group of experts (the Heritage Conservation Strategy Group) — including conservation architects, conservators, building archaeologists and archaeometrists — set up by the QIAH Project to define and revise chosen methods, materials and approaches. The Heritage Conservation Strategy Group meets at least three times per year to follow up on the conservation activities and optimise the conservation strategy. Every two years an international workshop gathers experts in the field of heritage conservation of archaeological sites to discuss the executed and planned conservation and consolidation work at Al Zubarah. The first workshop was held in December 2011 and the second and third ones are planned for March 2013 and 2015. The intense on site discussions during the meetings help to develop and update the conservation methods.

The state of conservation of Al Zubarah Archaeological Site has been carefully monitored and recorded since 2009 and details regarding the main features of the site in 2012 are summarised in this section of the Supplementary Dossier.

Town walls
Tower 8 of the Outer Town Wall was consolidated in spring 2011 as an initial consolidation work sample. Parts of the collapsed walls were rebuilt and the wall structure strengthened. Joints were re-pointed and wall stones on the wall base were exchanged to stabilise the structure. In the autumn of 2011 and spring of 2012 the town wall segment between Towers 8 and 9, including Tower 9, underwent a process of consolidation. The cement capping from the 1980s was removed as part of the work, and the wall tops were re-shaped with some stone material that will serve as a sacrificial layer. The inner wall face behind Tower 8 was excavated during the 2011-2012 season and consolidated afterwards. Here the exposed walkway was rebuilt to preserve the integrity of the town wall; the initially stabilised and consolidated wall will be re-plastered to protect the fragile stones and slow down the decay process.

The sand and soil deposits along the wall segments between Towers 7 and 10 were removed, to make the segments previously exposed in the 1980s visible again.

Palatial compounds
The initial 2009 inventory record of the smaller of the two excavated palatial compounds (QMA4) was completed in 2012 with a 3D-laserscan record as a basis for the initial consolidation work, which is planned for spring 2013.

The larger compound (EP04) saw the first conservation tests on wall 4010 in spring 2011. During the 2011-2012 work season the vast majority of structures in the courtyard were consolidated. The walls were re-pointed and re-plastered to protect the fragile stones with a sacrificial layer. Partial rebuilding took place to stabilise the wall structure, to make the architecture more understandable, as well as to reduce the visual impact of the plaster coating. Historic plaster remains were consolidated and re-attached to the wall whenever possible. Floors were protected with a breathable membrane and covered...
with salt-free quartz sand, to reduce the impact of salts on the materials. Most of the now exposed walls are stabilised and ready for re-plastering.

**Urban patterns: Mosques, Streets, Quarters, Courtyard houses, and Fishermen’s huts**

The remains of two further mosques were identified in the town of Al Zubarah, bringing the total of identified mosques to four. Two are situated in the northern part of the town, respectively next to an industrial area (QMA3) and the so-called North House (QMA2); one further structure is located in the central part of the settlement and the fourth one is in the south-eastern quadrant, between the palatial compounds. No excavations or systematic documentation of the mosques have yet been carried out. All buildings are today in ruins, although photographic evidence attests to the fact that large parts of the south-eastern mosque were still standing in the late 1950s. During the 1960s the building seems to have collapsed completely.

In four excavation areas (ZUEP01, ZUEP02, QMA2, and QMA3) parts of the urban patterns have been uncovered, revealing courtyard houses as the predominant building type. The state of conservation of the courtyard houses in the different excavation areas varies significantly. While the architectural remains of the North House (QMA2), situated in the northern area of the town and restored in the 1980s, are in poor condition, the unconsolidated industrial area (QMA3) is better preserved, owing to the use of higher quality stone as building material. All of the earlier excavation areas are considerably affected by blown-in sand deposits. Although in general the industrial area is in a better state of preservation than the North House, it also needs intense conservation activities to preserve the building structures and some well-preserved plaster surfaces. In some cases the entire wall mortar has been blown out by the strong winds and only a dry stone structure has survived. As a first step, parts of the excavated structures were backfilled or stabilised with sand bags to avoid further collapse. At present the North House serves as a reference area to test conservation materials and concepts. The most recent record of the area (QMA2) was undertaken in April 2012 and three climate data loggers have been permanently installed to monitor on-site conditions.

In addition to the 2010 silicon mould copy of the well-preserved etching of a dhow found in the wall plaster of one room of the courtyard houses (ZUEP01, Space 102, wall 615), a high resolution scan was taken in spring 2011. The area is fully backfilled and a replica of the dhow etching is being commissioned for display in the area, to keep the original covered and protected as long as possible. Moving the etching from the site to the National Museum has been discussed, but until adequate facilities are available and a secure transport can be guaranteed, the etching will stay in place.
4. Summary of Results of Conservation Strategy

**Detailed record of defects, such as cracks and voids, and materials of the exterior facades was begun in spring 2012.**

**Phase One of the restoration was completed between November 2011 and June 2012.** The aims of this phase were the replacement of damaged timber elements, strengthening the fort structure, and preparing the fort for its future as a visitor centre. The walkways built with concrete in the 1980s were replaced by a reinforced limecrete structure and cement plasters were replaced by a lime coating. Timber elements not infected or damaged were kept in place. Damaged structural timbers were replaced by termite-resistant hard wood [see Photo 31]. Alongside this work, tests were carried out to define ways to repair historic plaster surfaces, as well as structural cracks.

**Suq (ZUEP02/QMA1)**

In the suq area (QMA1) two different building phases were preserved, which resulted in very complex and difficult to read structures. Their 2009 state of conservation record was updated in 2012 with 3D-laser scanning. This record will be the basis for coming consolidation work. The newly exposed plaster remains (ZUEP02) were stabilised in 2012 and consolidated in situ during the excavation, before a systematic backfill took place.

**Qalat Murair**

Regular security patrols based at Al Zubarah Research Station and at the Fort since summer 2011 have minimised illegal waste disposal. A proposed fence around the site has not yet been implemented.

**Al Zubarah Fort**

As previously noted in the Nomination File [see Volume I, p.138], the survey of the state of preservation and the structural integrity of the Fort, which included a comprehensive timber survey, was carried out between December 2010 and March 2011 by the QIAH Project in cooperation with Alan Baxter Engineering. Although in the mid-2000s the Fort was equipped with floodlights and electricity, during the survey they all were found to be malfunctioning.

Before the restoration began, ample documentation of the state of conservation was undertaken using photogrammetry and 3D-laser scanning in cooperation with Hafen City University, Hamburg, Germany. On the basis of this documentation, a detailed record of defects, such as cracks and voids, and materials of the exterior facades was begun in spring 2012.
Since October 2011 conservation work has been carried out on a large scale in three main areas: the outer town wall (segments 8 to 9, including towers 8 and 9); the exposed parts of the palatial compound (ZUEP04); and the consolidation of in situ plaster remains at the suq area (ZUEP02). A series of tests to define mortar materials and surface treatment in the context of the harsh environmental conditions were carried out in the area of the courtyard complex referred to as the North House (QMA2), located to the northeast of the suq area. Conservation materials for the consolidation of historic plaster surfaces were also tested in the same area. Data loggers were installed on-site and near Al Zubarah Research Station to record and monitor temperature and humidity data, leading to a better understanding of the climatic factors influencing the deterioration of building materials.

Conservation work is carried out by skilled European craftsmen and conservators, who supervise trained QMA staff and an untrained local workforce. The ongoing training of conservation teams by the QIAH Project is accompanied by an intensive research and study program aimed at developing and defining a revised conservation strategy, as stated above.

To ensure that the architectural remains exposed so far will be conserved to a standard appropriate to the level of protection required by the unique urban fabric of Al Zubarah – mainly composed of town walls, house remains and the street grid system - a program of initial consolidation work and repairs is proposed for the period between 2013 and 2015. Ongoing monitoring will be undertaken in the future to ensure the implementation and adjustment of the conservation concept.

Data from the conservation work is recorded at different levels. The state of conservation is documented with images, notes and sketches organised in an inventory database (Microsoft Access-based) linked to the main GIS-database of the QIAH Project through excavation point indicators and the use of the
same locus numbering. Photos are stored with Meta
data within the main Project database. In addition to
images, 3D-laserscans are also performed. 3D-data
provides the main basis for documenting applied
conservation measures with overlays and comparison
of scan data. Conservation work is recorded in
the inventory, as well as in separate reports. Daily
work processes are recorded in a site journal [see
templates in Appendix 9.3 and 9.4 to the Conservation
Handbook] and summarised in monthly reports to
the QMA. Reports are stored with unique document
numbers on the Project server/hard drive.

Architectural elements and finds - especially from
Al Zubarah Fort – are currently kept at Al Zubarah
Research Station. Replaced timbers from the Fort
are stored under the Research Station in a shaded
area with good air circulation, to prevent greying
effects and further damage by humidity. The timbers
are numbered and labelled to record their original
positions, which are mapped on the plans attached
to the timber survey report. All reports are included
in the End of the Season reports, as well as stored on
the main QiAH Project server.

Some of the timber elements are likely to be removed
at a later point to one of the storage units of the
Restoration Department of the QMA in Doha or to
a storage facility related to a future visitor centre.
Although whole timber parts are currently kept,
the Restoration Department of the QMA indicated
that only samples of the damaged timbers will be
preserved for the future. These samples will be
eventually displayed to show the damage sustained
by Al Zubarah Fort. Object conservation measures
are planned only for these samples. Other finds are
recorded as archaeological finds and follow
the procedures explained in section 2.A.iii on
page 25.
**Action Plan for program of initial conservation and maintenance of Al Zubarah Archaeological Site**

**2012/2013**

**Town wall (segment 8 to 9):**
Re-rendering (including towers)

**Town wall (segments 17 to 18):**
Removal of soil deposits, documentation, consolidation of wall structure and foundations, removal of cement capping and re-shaping of wall tops, re-plastering

**Palace (EP04):**
Continued conservation following archaeological work

**Suq (ZUEP02):**
Consolidation of in situ plasters and initial consolidation of walls according to archaeology

**Fortified compound (QMA4):**
Beginning of consolidation work
Action Plan for program of initial conservation and maintenance of Al Zubarah Archaeological Site

2013/2014
Town wall (segments 16 to 17, including towers 16 to 18):
Removal of soil deposits, documentation, consolidation of wall structure and foundations, removal of cement capping and re-shaping of wall tops, re-plastering

Palace (EP04):
Continued conservation following archaeological work

Suq (ZUEP02 + QMA1):
Consolidation in situ plasters and initial consolidation of walls in QMA1 according to archaeology

Courtyard house (ZUEP01):
Start of conservation and consolidation work

Fortified compound (QMA4):
Continuation of consolidation work

2014/2015
Town wall (segments 6 to 8):
Removal of soil deposits, documentation, consolidation of wall structure and foundations, removal of cement capping and re-shaping of wall tops, re-plastering

Palace (EP04):
Continued conservation following archaeological work

Suq (ZUEP02 & QMA1):
Consolidation of architectural remains according to archaeology

Repairs according to state of conservation

Record of State of Conservation to prepare ICOMOS report

2015/2016
Town wall:
Maintenance according to state of conservation

Palace (ZUEP04):
Continued conservation following state of archaeological work and maintenance

Suq (ZUEP02 & QMA1):
Continued consolidation of architectural remains according to archaeology

North house (QMA 2):
Start of initial conservation work

Repairs according to state of conservation

Industrial area (QMA3):
Initial conservation (optional)
Action Plan for program of initial conservation and maintenance of Al Zubarah Archaeological Site

2016/2017

Town wall:
Maintenance

Palace (ZUEP04):
Maintenance and conservation according to archaeological investigations

Suq (ZUEP02 & QMA1):
Maintenance

North house (QMA2):
Continued conservation

Industrial area (QMA3):
Continued conservation/consolidation

General repairs according to state of conservation and Conservation Handbook
4.C. Legacy

The program of conservation and protection of Al Zubarah Archaeological Site undertaken by the QIAH Project in collaboration with the QMA focuses primarily on the technical activities necessary to protect and preserve the remains of the old town and fort carried out by international specialists. However, a second and equally important component of the program concentrates on building local capacity in the field of conservation techniques among professionals, and creating a skilled workforce to undertake the delicate aspects of restoration that will be crucial in the future to the maintenance of archaeological structures throughout the country.

The legacy being created by the QIAH Project for the State of Qatar builds on several different aspects of training and capacity building. At the most basic level training sessions for a local workforce are being held at Al Zubarah on a yearly basis throughout the QIAH work season. The first training program for conservation techniques has taken place in January to March 2012 and a second and more intensive season of training, building on previously acquired skills, will be undertaken in the spring of 2013.

Capacity building for QMA staff takes the form of training courses offered in collaboration with the newly opened Qatar branch of University College London (UCL) [see Fig 20 p.85], as well as opportunities for networking and knowledge building offered by an already established cooperation among a pool of foreign experts in the field of restoration, who biannually convene in Qatar to discuss the conservation of Al Zubarah Archaeological Site during the QIAH organised workshop: Conserving Al Zubarah.

A further part of the conservation program focuses on dissemination of information in the form of production of two conservation manuals dedicated to Al Zubarah town and Al Zubarah Fort. In January 2013 the first edition of the Conservation Handbook: Al Zubarah Archaeological Site [see Annex 6] was completed; the volume will be regularly updated in the future according to the results of the implementation of the Conservation Concept. The production of a second manual, Conservation Handbook: Al Zubarah Fort, in collaboration with London-based Alan Baxter Engineering, is foreseen for 2014.
<table>
<thead>
<tr>
<th>SN</th>
<th>Course Title</th>
<th>Course Brief</th>
<th>Eligibility</th>
<th>Training Provider</th>
<th>Days</th>
<th>Time</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>Venue</th>
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<tr>
<td>1</td>
<td>Introduction to Cultural Technology</td>
<td>This course investigates the tools, techniques and implications of digital media in a museum environment. Topics will include social media, mobile interpretation, working with structured data and website design.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>4</td>
<td>9am - 2.30pm</td>
<td>13-16</td>
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<td>2</td>
<td>An Overview of Museums</td>
<td>This course will give an overview of museums from multiple perspectives: their image, history, types, exhibition styles and techniques, education and visitor analysis.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>2,5</td>
<td>9am -2pm &amp; 9am-11am</td>
<td>27-29</td>
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<td>3</td>
<td>Introduction to Oral History</td>
<td>This course will examine using oral history as evidence and look at all the aspects of an interview such as how to ask questions effectively and how to bring out the various forms of narrative. The course will also briefly touch upon sound editing, transcribing, summarizing and archiving.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>4</td>
<td>9am -3.30pm</td>
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<td>3-4</td>
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<td>4</td>
<td>Archiving Oral History: After the Interview</td>
<td>This course considers all of those activities of oral history that take place once the interview has been completed, and it acts as an introduction to the expertise which the archivist of oral history needs to acquire.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>1</td>
<td>9am -3.30pm</td>
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<td>7</td>
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<td>MIA</td>
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<td>5</td>
<td>An Introduction to Aerial Archaeology</td>
<td>This course will cover the history, techniques and basic principles of aerial archaeology as well as its relevance to modern-day cultural resource management in the region. Aerial archaeology combines aerial photography, the interpretation of aerial photographs, creating maps and records.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>5</td>
<td>9am-2.30pm</td>
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<td>10-14</td>
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<td>6</td>
<td>Glass Conservation- Missing Links- what can we do?</td>
<td>This course will look at resins and colours used in the conservation of historical glass. There will also be practical exercises in the technique of gap filling and the use of resins and pigments.</td>
<td>QMA Employees with good understanding of conservation techniques</td>
<td>UCL</td>
<td>5</td>
<td>9am - 2.30pm</td>
<td></td>
<td>17-21</td>
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<td>TBC</td>
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5. Supplementary material on Management and Protection of the Nominated Property

“Formalize the official approval of the Buffer Zone limits and the Madinat Al Shamal urban plan”

“Follow up the development of the Site Management Unit, operational on site since 2011”

“Monitor the effectiveness of the Management Plan”

“The World Heritage Committee recommends that Heritage Impact Assessments be renewed in case major infrastructural projects in the vicinity of the property should become active again, in order to ensure that these do not impact adversely on the town and its wider desert setting.”

(From the World Heritage Committee’s Revised Draft Decision 36 COM 8B.19)
5.A. Supplementary information on Protection of the Nominated Property

“ICOMOS considers that the protective measures for the property will be adequate when the Buffer Zone limits and the Madinat Al Shamal Structure Plan have been officially approved.” [p.104]

The Buffer Zone around Al Zubarah Archaeological Site, as defined in Volume I of the Nomination File, has been approved by the Ministry of Municipality and Urban Planning of Qatar. The borders of the old town of Al Zubarah are marked and protected by a fence erected by the QMA in 2011, while the borders of the Buffer Zone are not protected by a physical boundary, but by the laws of the State of Qatar.

The State of Qatar is legally responsible for ensuring the highest possible protection of the Nominated Property in relation to the development of the nearby municipality of Al Shamal. The Madinat Al Shamal Structure Plan is currently being processed for approval in accordance with the established procedures of state. Formal approval is foreseen for 2013.

In addition to the detailed protection and conservation strategy outlined in the Madinat Al Shamal Structure Plan, the Qatar National Master Plan (QNMP) clearly states that the protection of cultural heritage sites, of which Al Zubarah Archaeological Site is the country’s largest, is of crucial importance throughout Qatar (Policy BE 16). ‘Conservation Areas’ are established and maintained in order to ensure this protection and the policy actions expressly state that this includes Qatar’s northern coastline (Coastal Zone Protection Area) and the area between Al Zubarah and Al Shamal (Al Shamal Conservation Area).

Furthermore, the Master Plan, which outlines Strategic Planning Objectives for Al Shamal Municipality, highlights the primary objective as: “Protecting and preserving the natural environment and historical resources, and promoting sustainable tourism and uses based on these resources”.

It goes on to stipulate that development restrictions in the protected areas will be enforced [QNMP 4.9.6]. Two additional sections make it clear that growth will be constrained by the protected areas [QNMP 4.9.8; 4.9.14]. With regards to infrastructure, the QNMP currently shows the positioning of planned road networks, which clearly avoid the defined Buffer Zone of Al Zubarah Archaeological Site [Figures 4.8 and 7.1 of the QNMP].
5.B. Supplementary information on Management of the Nominated Property

“ICOMOS considers that proposed management system for the property will be adequate when the management unit has been in place and the Management Plan has been further developed.” [p.106]

The Management Unit for *Al Zubarah Archaeological Site* has been fully operational since 2010-2011. As stated in the *Al Zubarah Archaeological Site* Management Plan [pp.18 and 25], until 2015 the Site Management Unit will be run jointly by the QIAH Project and the QMA. A QIAH-appointed Site Manager runs the activities at the Nominated Property in collaboration with a QMA-appointed Deputy Site Manager (position established in 2011). A QMA Facilities Management unit for *Al Zubarah Archaeological Site* was in 2011, following the appointment of a QMA Facilities Manager.

As discussed in the Management Plan [p.18], a QIAH-QMA mentoring system aimed at capacity building in the field of heritage in Qatar has already started in 2012. In 2011/2012 an Education and Outreach division of the Department of archaeology of QMA, headed by a QIAH Associate Director and staffed entirely by QMA personnel, has been set up on a permanent basis and is dedicated to developing and implementing educational programs in local schools, in collaboration with the Supreme Council for Education of Qatar.

At this time a Visitor Centre Coordination division is run by QIAH in collaboration with the QMA team from the National Museum of Qatar. As soon as plans for the new Visitor Centre for *Al Zubarah Archaeological Site* have taken shape, the scope and staffing allocation of this unit of the Site Management Team will be expanded. The Research, Conservation and Monitoring divisions of the Site Management team are currently entirely run by the QIAH Project, as until 2015 all research, survey, excavation and conservation activities at *Al Zubarah Archaeological Site* will be undertaken by the QIAH Project. By 2015 a state of conservation report for *Al Zubarah Archaeological Site* will be produced. In 2011-2012 a program of training in conservation techniques for selected workforce was started. Over the course of the next three years the program will aim to create a skilled workforce specifically trained to undertake all restoration activities at the old town of Al Zubarah.
5.B.i. Management Plan Effectiveness

“ICOMOS considers that proposed management system for the property will be adequate when the management unit has been in place and the Management Plan has been further developed.” [p.106]

The current Management Plan for Al Zubarah Archaeological Site introduces an efficient administrative system for the Nominated Property, which has already been in place since 2010. Further updates to the Management Plan are already planned for 2015 and 2019, as mentioned in the document [pp.39, 66], and will take into consideration the requirements of the Nominated Property at the end of Phases One and Two of the Al Zubarah Archaeological Site management process.

Aside from the previously discussed Site Management Unit, which is already in place, a system of regular cleaning and maintenance of the facilities at Al Zubarah Archaeological Site has been established, as well as permanent guards on duty at the Fort and at the entrance to the old town. Stations for two further guards, located within the fenced area at the entrance to the outer walls of Al Zubarah, have been provided in 2012, in preparation for the future opening of the site to tourism.

Besides the immediate concerns for the protection and preservation of Al Zubarah Archaeological Site, its natural environment and its historical structures, the Management Plan also outlines a program of technical and professional training of QMA staff and capacity building in the field of heritage management that characterises Phase One (2011-2015) of the Management Plan of Al Zubarah Archaeological Site [pp.18, 25, 36]. This program aims at creating a qualified workforce to operate with confidence in the field of heritage management and protection, which can eventually take over all aspects of administration relating to Al Zubarah Archaeological Site. During 2012 training of QMA employees has focused on participation to academic level courses offered in Qatar for the first time in 2012 by the prestigious UCL Q University. Approximately one quarter of the 29 full time students enrolled in MA courses on Archaeology of the Arab and Islamic World and Museum and Gallery Practice, or in the MSc in Conservation Studies are QMA employees, while approximately 180 members of QMA staff in total have attended short term courses offered by UCLQ [see Fig 21 p.90]. With the gradual increase in knowledge and more familiarity with current themes and issues arising in the field of heritage for QMA employees, the State of Qatar is actively focused on building a qualified workforce capable of undertaking the management of all heritage related activities in the country. As this process develops over the course of the next few years, members of the QIAH Project will run many of the daily administrative and research tasks pertaining Al Zubarah Archaeological Site in collaboration and consultation with QMA, while properly trained local staff will be gradually integrated into the national heritage management process.
### Numbers of employees of the restoration department

<table>
<thead>
<tr>
<th>SN</th>
<th>Course Title</th>
<th>Course Brief</th>
<th>Training Provider</th>
<th>Days</th>
<th>Time</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>employees</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cultural Heritage Protection from Pilage and Black Trafficking</td>
<td>This course will provide an acute awareness of the legality of handling of archaeological sites and monuments to supply methods for the trade in antiquities and an understanding of workings of the market.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>5</td>
<td>9-13</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>MIA</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Introduction to Contemporary Conservation</td>
<td>This course discusses conservation of material heritage and the various contexts where conservation works. Focuses on cross-disciplinary aspects of the discipline and challenges conservationists may confront.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>5</td>
<td>13-13</td>
<td>5</td>
<td>5</td>
<td>MIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Conservation Photography</td>
<td>The course will look at the ways one can use digital photography to document and record museum objects. By the end of the course one will be able to take competent photographs of small objects.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>1</td>
<td>16</td>
<td>5</td>
<td>5</td>
<td>MIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Art and Archaeology of Ancient Nubia</td>
<td>The course will present an overview of the Nubian cultures from the end of the Stone Age until the Medieval period.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>5</td>
<td>5-5</td>
<td>5</td>
<td>5</td>
<td>MIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Mapping Living Heritage Demo</td>
<td>Mapping living heritage is about looking at the city in search of facts and inspiration. The course takes the form of three bi-weekly sessions. Each week involves a presentation, in dialogue with students, plus interactive working sessions, with feedback and input.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>4</td>
<td>TBC</td>
<td>7</td>
<td>3</td>
<td>MIA</td>
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</tr>
<tr>
<td>6</td>
<td>Dealing with the Public</td>
<td>This course will look at how staff involved in customer care deal with the public.</td>
<td>QMA Employees</td>
<td>UCL</td>
<td>2</td>
<td>28-20</td>
<td>5</td>
<td>5</td>
<td>MIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Identification of Irritant Materials</td>
<td>The course looks at different substances metals, glass, stone, wall paintings and decorated surfaces and their types of biological attack that effect them.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>2</td>
<td>10-10</td>
<td>2</td>
<td>2</td>
<td>MIA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Risk Management

“Risk management is a subject that needs to be addressed as part of the further development of the Management Plan.” [p.106]

A Risk Management Strategy undertaken in collaboration with the Municipality of Al Shamal, the Ministry of Municipality and Urban Planning, and the Ministry of Environment, in accordance with Policies ENV2 and ENV4 of the Qatar National Development Framework (QNDF) for Al Shamal Municipality, will be part of any update to the current Management Plan, starting with the first update, which is foreseen for 2015. Policy ENV 2 deals, in fact, with management of cultural and environmental resources and risk assessment related to infrastructure development, climate change and rising sea levels, while Policy ENV 4 focuses on Coastal Zone protection and risk management. As Al Zubarah Archaeological Site lies within the core area of the UNESCO Al Reem Biosphere Reserve, which is officially designated as an environmentally protected area, the same legal protection enjoyed by Al Reem is applicable to the Nominated Property. Moreover, Al Zubarah Archaeological Site also forms an integral part of the Al Shamal Conservation Area [See QNDF 4.9.8], a part of Northwestern Qatar characterised by numerous sites of historic and natural importance, which are protected by law from spatial development [See QNDF 4.9.4; 4.9.8; Figures 4.8; 7.1 and Box 9]. The legally protected status which Al Zubarah Archaeological Site enjoys in the national legal system by virtue of its historical importance to the nation derives additional strength from the location of the Nominated Property, which lies in the Coastal Zone Area, in the Al Shamal Conservation Area, as well as within the borders of the Al Reem Biosphere Reserve.

Tourism Strategy

“ICOMOS considers that these concerns [tourism pressure] will need to be addressed by a discrete Tourism Strategy, as envisaged in the Management Plan.” [p.103]

“…the archaeological site itself has no visitors’ interpretive or instructive plaques. The ICOMOS mission was informed that a number of temporary informative panels are planned to be installed at the main excavation areas of the site. This is a subject that the Management Plan plans to address through a Tourism Strategy.” [p.106]

The QIAH Project has already undertaken the first steps to develop a discrete tourism strategy for Al Zubarah Archaeological Site, as outlined in the Management Plan.

Since 2011 the QIAH Project has started the process of gradually developing Al Zubarah Archaeological Site for visitors and particularly for purposes of school education. Promotional and educational booklets and brochures on the site were distributed in 2012 and temporary interpretive panels have been produced and placed on site [Photo 34 and Fig 26 p.93], while the first of three visitor tracks has been identified and marked out.
Future work is intended to enhance the visitor experience along the already existing southern tourist track (Track 1). As the terrain at Al Zubarah is not suitable for disabled access and the soft sands can make walking difficult for able bodied visitors, the addition of raised boardwalks made of entirely recycled and eco-friendly material would improve accessibility for children, disabled visitors and the general public, while also greatly reducing the impact of visitor traffic on the site, protecting the archaeology and the environment [See Fig 22 and Fig 23]. The creation of the recycled plastic boardwalks would not only improve the quality of tourism at Al Zubarah Archaeological Site, but it would also contribute to raising awareness about and promote the use of eco-friendly and sustainable materials in the field of heritage, while improving the sustainability of the site itself.

Each of the three planned independent visitor tracks will develop along raised walkways, each measuring 1-2km in length, and will provide a general overview of the site to all visitors [see p.93], but will also focus on specific elements of the town, telling a different part of the town’s history.

To further enhance the visitor experience at Al Zubarah Archaeological Site four series of new interpretive panels are planned. Panels will be developed over the course of the next few years and will be located along Track 1, to replace existing ones, along Track 2 and Track 3 as they are progressively developed. An additional series of interpretive panels targeted mainly at schools’ education will be placed at the info pavilion near Al Zubarah Fort to replace
5. Management and Protection of the Nominated Property

Fig 24: Walking Tracks at Al Zubarah

Fig 25: Bilingual information flyer

Fig 26: Information booklet

Photo 33: Information pavilion

Photo 34: Information board
existing panels. Information panels will require review after three years and renewal within five. Additional digital media may be produced on a running basis.

Moreover, already tested educational and presentation material created through the use of cutting edge technology in the form of Augmented Reality applications for telephones will be produced to further enhance the visitor experience and entice people to enjoy heritage in alternative and modern ways [see Fig 27].

The opening of one visitors’ track on site at Al Zubarah town, complete with low impact interpretive material and infrastructure already in place, is planned for autumn 2013. This will be the first step in a gradual and low key tourism development strategy based on the progress of the conservation and research at the site.

While the Fort and town are closed to the public for conservation reasons information is available to tourists in proximity of the site in the form of interpretive panels. Information and promotional material about Al Zubarah Archaeological Site, such as brochures, booklets, postcards and a dedicated website, are also available [see p.93].
Feasibility Study

“...the ICOMOS mission was informed that a feasibility study is being conducted to examine potential locations. This will be completed in May or June 2012.” [p.106]

A feasibility study to assess the potential impact of a Visitor Centre at potential locations has not yet been completed, due to ongoing uncertainty concerning the future existence and potential location of a Visitor Centre dedicated to the whole northwestern Qatar region, the requirements of which will need to be negotiated in collaboration with UNESCO. Al Zubarah Fort will be developed into a modern visitor centre dedicated to presenting the cultural and natural heritage of Al Zubarah Archaeological Site and northwest Qatar. The presentations will be centred on three main themes:

1. The history and importance of the Fort and the restoration of a national monument
2. Al Zubarah and the excavation work undertaken at the site by the QIAH Project
3. The fragility of the natural environment of the area and the importance of protecting it

In late 2013 the interior of the Fort will feature rooms repurposed to function as a bookshop, a projection room and as exhibition spaces, while static presentations to be shown in the open galleries and towers of the Fort will be developed [see p.94].

Monitoring

“ICOMOS considers that there is a need to further develop the monitoring indicators to allow them to provide a much more specific and technical record of the state of conservation.” [p.106]

The inventory database set up by the QIAH Project for the architectural remains of Al Zubarah contains several tools for a systematic record of their state of preservation [see Conservation Handbook fiche 6.1 and Annexes 9 & 10]. Permanent data loggers for temperature and humidity measurements were installed in the field and used as reference points at the Research Station workshop, in order to control the environmental conditions on site [see Fig 30 p.96 and Conservation Handbook, p.26 -31; fiche 6.2 & Annex 8]. In addition to visual, haptic, and photographic control,
lab-analyses of building materials and record 3D-laser scans are regularly performed within the framework of QIAH fieldwork, so as to achieve a better understanding of the context and to optimise protection measures. The combination of these monitoring procedures allows specialists to access and evaluate the executed work, and to record decay processes. Evaluation of the data will lead to context-specific methods and materials, which, in turn, will result in improved maintenance processes. All monitoring indicators will be regularly updated and improved on the basis of the results of the monitoring process and evaluations of the ongoing conservation [see Fig 32 p.97].

The Al Zubarah Archaeological Site Manager is responsible for the monitoring of the Nominated Property. Recording of visitor numbers is carried out by site guards and reported to the Site Management through monthly reports [see Conservation Handbook Annex 9.1]; damages to archaeological remains, as well as infrastructure such as walkways, panels, etc., caused by visitors should be reported immediately to the Site Manager by the site guards or by QIAH staff. Guards should check the state of visitor infrastructure (e.g. vehicle track, track fence, parking, walkway, and information panels) on a daily or at least weekly basis. If damages occur, a record sheet [see Conservation Handbook Annex 9.2] should be sent to the Site Management Unit to start the repair/maintenance process.

All records are kept by the Site Manager and a double copy is sent on a regular basis to the QMA Headquarters in Doha. Record sheets and templates for different areas of monitoring have been developed and presented in detail in the Conservation Handbook [see Fig 31 p.97 and Conservation Handbook Fiche 6 and Annex 9 & 10].
Fig 31: Excerpt from conservation manual

**FICHE No.6.3**

**MONITORING**

Site journal - How to record your work?

1. Keep a record of your work.
2. Weather conditions: Note temperature, wind intensity, and general conditions; cloudy, sunny, dusty, humid etc.
3. Who is working? Names of Colleagues and workmen (numbers)
5. “Events”: visits, injuries, etc.
6. Photo documentation of work: at least one image in the morning (before the work starts), one before the main breaks and one at the end of the workday.
7. Saving of images to the database with description (Meta data).
8. Typing in the site journal data and save the report as a pdf (see templates in Appendix 9, especially 9.3 and 9.4).

Fig 32: Ref: Conservation Handbook Fiche 6.4

**MONITORING**

KEY INDICATORS and their recording (revised version after A2AS Management Plan, December 2011)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Periodicity</th>
<th>Location of Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental parameters in Al Zubarah (Temperature, humidity, rain, wind)</td>
<td>Once or twice a week</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Natural changes in north-western Qatar especially within the Buffer Zone (satellite pictures - landscape scale)</td>
<td>Once a year</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Infrastructure changes in north-western Qatar (Zubarah heritage) especially within the Buffer Zone</td>
<td>Once a year</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>No. of visitors (all the Visitors Centre)</td>
<td>Daily record by Guards at the site entrance and/or at Al Zubarah Fort</td>
<td>Hand in monthly in double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Visitor experience (quality assessment of a visit to Al Zubarah)</td>
<td>Once or twice a year</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>State of conservation in earlier QMA excavation areas (Photos, drawings, reports, 3D-scanning, etc.)</td>
<td>Once a year or every third year (according to internal recommendation in last monitoring)</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA), Digital Inventory database</td>
</tr>
<tr>
<td>State of conservation in new QMA excavation areas (Photos, drawings, reports, 3D-scanning, etc.)</td>
<td>Once a year or every third year (according to internal recommendation in last monitoring)</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA), Digital Inventory database</td>
</tr>
<tr>
<td>State of conservation of not excavated structures (Photos, drawings, reports, 3D-scanning, etc.)</td>
<td>General report every third year (according to internal recommendation in last monitoring)</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA), Digital Inventory database</td>
</tr>
<tr>
<td>Damages caused by visitors</td>
<td>Daily, weekly or monthly report (check particularly after the weekend) see Template Appendix 9.3</td>
<td>Double copy to be kept at the QMA, Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Damages caused by high tides</td>
<td>After observed high tides and each third year</td>
<td>Double copy to be kept at the QMA, Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Damages caused by heavy rain</td>
<td>After observed heavy rainfall</td>
<td>Double copy to be kept at the QMA, Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Damages to infrastructure (walkways, panels, etc.)</td>
<td>Daily, weekly and monthly reports (by Guards and on-site personnel); Check daily by guards. Report only when damages appear! For Report use Template in Conservation Handbook Appendix 9.2</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
</tbody>
</table>
5.B.ii. Heritage Impact Assessment

An archaeological assessment of the impact of the Qatar-Bahrain Friendship Bridge and causeway has already been undertaken in 2008-2009. As the Qatar-Bahrain Friendship Bridge Project at present has been halted and there is no planned date for its construction, a new Heritage Impact Assessment will be commissioned if and when the project should become active again [see Fig 33].

Rubaiqah salvage excavations 2010 - 2011

Following the request of the QMA, the University of Wales investigated six areas within the site of Rubaiqah (A to F), a settlement located in the construction line of the Qatar-Bahrain Friendship Bridge and causeway and therefore in need of urgent protective measures.

The main features investigated are a large courtyard house (Area D), a multi-phased mosque (Area B) and a fort (Area A). Harbour facilities could not be identified. In contrast with that of Ruwaidah, the ceramic assemblage from Rubaiqah dates the site to the 19th and earlier 20th centuries, while Ruwaidah dates principally from the earlier 18th century. It therefore reflects the assemblages found in the late occupational phase of Al Zubarah.
6. Supplementary Documentation
<table>
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<th>Photographer/Credit</th>
<th>Copyright Owner</th>
<th>Contact Details</th>
<th>Non exclusive cession rights</th>
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<td>1</td>
<td>Digital Photo-tiff</td>
<td>Al Zubarah Fort</td>
<td>03/10</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<tr>
<td>2</td>
<td>Digital Photo-tiff</td>
<td>Courtyard of Al Zubarah Fort under restoration</td>
<td>11/11</td>
<td>M. Kinzel</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<tr>
<td>3</td>
<td>Digital Photo-tiff</td>
<td>Restoration of Al Zubarah Fort roofing with traditional materials</td>
<td>04/12</td>
<td>M. Kinzel</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<tr>
<td>4</td>
<td>Digital Photo-tiff</td>
<td>Restoration of Al Zubarah Fort roofing</td>
<td>04/11</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<tr>
<td>5</td>
<td>Digital Photo-tiff</td>
<td>Visitor group being shown restoration of Al Zubarah Fort</td>
<td>12/11</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
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<td>6</td>
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<td>Qatari Scout group visit</td>
<td>01/10</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
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<tr>
<td>7</td>
<td>Digital Photo-tiff</td>
<td>School group with Project t-shirt</td>
<td>12/11</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<tr>
<td>8</td>
<td>Digital Photo-tiff</td>
<td>Demonstration of finds to school group</td>
<td>12/11</td>
<td>I. Saca</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<td>9</td>
<td>Digital Photo-tiff</td>
<td>Teacher group introduction at information pavilion</td>
<td>03/12</td>
<td>I. Saca</td>
<td>QMA/QIAH</td>
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<td>School pottery workshop</td>
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<td>Oral history interview</td>
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<td>02/12</td>
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<td>YES</td>
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<td>04/12</td>
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<td>QMA/QIAH</td>
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<td>YES</td>
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<td>Tower of ZUEP04 and Outer Town wall</td>
<td>02/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<td>QMA</td>
<td>YES</td>
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<td>20</td>
<td>Digital Photo-tiff</td>
<td>Aerial view of 18th century <em>suq</em> in ZUEP02</td>
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<td>21</td>
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<td>01/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
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<td>Plastered room (foreground) and <em>shell carpeted</em> room (rear) in ZUEP04</td>
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<td>A. Pantos</td>
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*QMA: Qatar Museums Authority.*

P.O. Box 2777, Doha, State of Qatar

Tel: +974 4452 8770 Fax: +974 4402 8252 Email: smuhesen@qma.org.qa
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Al Zubarah Archaeological Site
Al Zubarah Archaeological Site

Supplementary Dossier

Nomination Document for Inscription on the UNESCO World Heritage List

State of Qatar

January 2013
Qatar Museums Authority

Her Excellency
Sheikha Al Mayassa Bint Hamad Bin Khalifa Al Thani
Chairperson
Qatar Museums Authority

His Excellency
Sheikh Hassan Bin Mohammed Bin Ali Al Thani
Vice Chairman
Qatar Museums Authority
i. Preface
Foreword

In the two years since the submission by the State of Qatar of the Nomination File for inscription of *Al Zubarah Archaeological Site* on the UNESCO World Heritage List, the Qatar Museums Authority is pleased to report that an expanded program of heritage management, site preservation, and archaeological research has resulted in many noteworthy advances in our understanding of the site. The work has greatly broadened our understanding of the proven cultural significance of the Nominated Property and in the context of its extensive hinterland, the historical impact of which can now be more precisely evaluated within the context of local, regional and, more broadly, global perspectives. The greater insights thereby produced have provided us with an invaluable opportunity to disseminate widely by various media the more substantial knowledge gained to both Qatari and international audiences.

The eighteenth and earlier nineteenth centuries of the Common Era, which marked the zenith of Al Zubarah’s notable influence and prosperity, saw the dramatic self-definition of a cultural, political, and economic framework that came to define many of the social norms prevalent in the Arabian Gulf today. The last two years of extensive work in northwest Qatar under the auspices of the Qatar Museums Authority’s bold heritage initiatives have highlighted the complexity of cultural, political, and economic structures that developed in this unquestionably crucial period of transition; developments that found a clear social expression in the tangible remains of the then newly constructed town of Al Zubarah. The influence of the society they created in a physically challenging environment, documented recently in detailed specialist studies, transcended the immediate world of the peninsula of Qatar to reach deep into Arabia, east and west along the Gulf, and far beyond: to India, China, Iran, Iraq, east Africa, Turkey and all the way to Europe.

The new discoveries at *Al Zubarah Archaeological Site* validate beyond doubt the crucial importance of inscribing the Nominated Property on the UNESCO World Heritage List. *Al Zubarah Archaeological Site* offers an extraordinary insight into Qatar’s past and, without question, into the whole Gulf region. The Nominated Property stands as the only extensive, intact, and coherent representative of pre-modern Islamic urbanism in the Gulf region that reveals traditional practices of social interconnection and
economic activity, including pearl fishing, that are remembered and reminisced in the region, but have completely disappeared. Hence *Al Zubarah Archaeological Site* is an outstanding, and possibly the only, candidate to adequately represent the plethora of social, political and economic activities that merged to create it, but also testifies to the many complex threads that were woven into a rich tapestry of life in eighteenth- and nineteenth-century Gulf society.

In addition to acknowledging the important role of *Al Zubarah Archaeological Site* in the formation of modern Qatar and the Gulf, its listing will greatly advance a wider recognition of Qatar’s expressed commitment to preserving and building respect for the precious values and heritage that rest at the heart of the Nation. The State of Qatar sees cultural heritage as a crucial component in achieving the Qatar National Vision 2030 goal of conserving, enhancing, and broadcasting – nationally and internationally alike – Qatar’s deep-rooted Arab and Islamic identity; a greatly prized heritage open to visitor appreciation at *Al Zubarah Archaeological Site* and through multi-media gallery displays in the highly anticipated National Museum of Qatar, designed by the celebrated architect Jean Nouvel.

We are most pleased that this Supplementary Dossier to the detailed Nomination File for inscription of *Al Zubarah Archaeological Site* on the UNESCO World Heritage List, previously submitted by the State Party in January 2011, offers a convincing account of the high-quality and internationally respected research undertaken since the submission of the primary Nomination documentation. It demonstrates, unequivocally, the fundamental social values and cultural immediacy preserved, as an unparalleled historical testament, at *Al Zubarah Archaeological Site*; a testament to the ingenuity, community aspirations, and commercial acumen of Gulf society as it moved – decisively – to forge a new and locally sourced identity.

H.E. Sheikh Hassan Bin Mohammed Bin Ali Al Thani  
Vice Chairman  
Qatar Museums Authority, State of Qatar
The World Heritage Committee’s Decision

The World Heritage Committee,

Having examined Documents WHC-12/36.COM/8B and WHC-12/36.COM/INF.8B1,

Refers the nomination of Al Zubarah Archaeological Site, Qatar, back to the State Party, in order to allow it to:

1. Further develop its understanding of how the fabric of Al Zubarah and its desert hinterland were an exceptional testimony to a specific interaction between nomadic herders, pearl divers, fishermen and traders that once characterised the way of life in the Gulf (as opposed to connection to the pearling industry) by:

   • Presenting the results of surveys and excavations carried out in the property and its wider setting, including underwater archaeology, that have already permitted the understanding of the origins of the town, the basis for its prosperity, its layout and how it related to the coast, its desert landscape and small satellite settlements and

   • Completing the archival and oral history research developed within the project

   • Formalize the official approval of the buffer zone limits and the Madinat Al Shamal urban plan

   • Complete and implement the Conservation Strategy, identifying the interventions desirable to stabilise the urban remains

   • Follow up the development of the Site Management Unit, operational on site since 2011

   • Monitor the effectiveness of the Management Plan

2. Recommends that Heritage Impact Assessments be renewed in case major infrastructural projects in the vicinity of the property should become active again, in order to ensure that these do not impact adversely on the town and its wider desert setting.
State Party’s response

The State of Qatar has prepared the present Supplementary Dossier to address the recommendations concerning the Nomination of Al Zubarah Archaeological Site (Documents WHC-12/36.COM/8B and WHC-12/36.COM/INF.8B1) made to the State Party by the World Heritage Committee during its meeting in St Petersburg between 24 June and 6 July 2012, as contained in the Revised Draft Decision 36 COM 8B.19 (Document WHC-12/36.COM/19, p. 177).

In order to fully address the recommendations made by ICOMOS and UNESCO, the State Party has brought together in this document a detailed summary of the results of two years of research on Al Zubarah Archaeological Site and its hinterland undertaken by an international and renowned team of experts. This has included archaeological excavations, regional survey, archival and oral history research, conservation and heritage management. This comprehensive program of archaeological and historical investigations, material culture analysis, and the implementation of both an advanced Conservation Strategy for the physical remains of the Nominated Property and heritage management activities in the region, marks the QIAH Project’s work on Al Zubarah Archaeological Site as one of the largest and most holistic archaeology and heritage projects in the world.

The results of the program have provided much new and illuminating information with which to expand the understanding of the cultural and historical importance of northwest Qatar, and especially the role of Al Zubarah in the development of the region’s modern identity. The appeal of these developments is of great regional and international relevance, as the peoples of the Gulf and the wider world seek to understand the emergent global importance of the Arab World. The exponential growth in documentation and its relevance, as revealed in full in the Annexes to the Supplementary Dossier, argues convincingly for the validity of the inscription of Al Zubarah Archaeological Site in the UNESCO World Heritage List, as well as for the stable continuation of this ground-breaking investigative work for the future.

This Supplementary Dossier has been structured to address the recommendations made by UNESCO in their Revised Draft Decision, and to reflect the structure of the original Nomination File, Volume I. Each chapter is created to provide an update of the information originally presented in the Nomination File, therefore Chapter 1 proposes a new Executive Summary reproducing the revised statement of Outstanding Universal Value and the criteria for inscription of Al Zubarah Archaeological Site in the World Heritage List, which are presented in Chapter 3.
Chapter 2 of the Dossier updates the archaeological and historical information contained in Chapter 2 of the Nomination File, summarising the results of the excavations, survey, archival, and oral history research undertaken in the State of Qatar since 2010, as requested by the World Heritage Committee’s Revised Draft Decision document. Annexes 1 to 5 reproduce the complete End of Season Reports for Archaeology (2010-2011, 2011-2012, and Excavations at Ruwaidah) and Community Archaeology (including Oral History, 2011-2012), as well as a report containing supplementary results of the archival research undertaken on Al Zubarah in 2011-2012.

Chapter 3 proposes revised versions of the Statement of Outstanding Universal Value, the Criteria for Inscription of "Al Zubarah Archaeological Site" in the World Heritage List, and the Statement of Integrity and Authenticity of the Site. Furthermore, an improved discussion of the comparative analysis of sites undertaken in the Nomination File is also included here.

Chapter 4 presents a summary of results of the Conservation Strategy for "Al Zubarah Archaeological Site", which has been greatly and successfully developed in the last two years of work and research. The chapter also includes updated information concerning the state of conservation of the major structures of "Al Zubarah Archaeological Site", as well as an overview of the legacy of the conservation program to the State of Qatar. Annex 6 reproduces the complete first edition of the QIAH Conservation Handbook: "Al Zubarah Archaeological Site".

Chapter 5 provides supplementary information on the Protection and Management of the Nominated Property, as specifically requested in the World Heritage Committee’s Decision document.

Notably, the applicable issues raised in the ICOMOS Evaluation Report, part of which have been later adopted by the World Heritage Committee at its meeting in St Petersburg and are contained in the Revised Draft Decision document, have been accurately addressed in the content of the Dossier. These are included in the text in the form of italicised quotes with reference to the page numbers of the original Evaluation document transmitted by ICOMOS to the State of Qatar in spring 2012.

Furthermore, references to the accompanying Annexes are presented throughout the Dossier in order to highlight those discoveries of the last two years that confirm and reinforce the exceptional status and universal importance of the Nominated Property on the world cultural stage.
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1. Revised Executive Summary
State Party
State of Qatar

State, Province or Region
Madinat Ash Shamal Municipality

Name of Property/Site
Al Zubarah Archaeological Site

Geographical coordinates to the nearest second
The geographical coordinates of the centre of the Nominated Property (corresponding to Al Zubarah tower number 13 in the town wall) are:

Latitude: 25° 58' 41" N
Longitude: 51° 01' 47" E

Al Zubarah Archaeological Site covers an area of 415.66 ha.

The limits of the Nominated Property are identified by the following coordinates:

North limit: 51°01'32" E 25°03'17" N
South limit: 51°03'29" E 25°56'37" N
East limit: 51°04'57" E 25°57'47" N
West limit: 50°57'05" E 25°59'15" N

The Buffer Zone (not including the Nominated Property) covers an area of 7196.4 ha.

The limits of the Buffer Zone are identified by the following coordinates:

North limit: 51°01'32" E 26°03'17" N
South limit: 51°03'29" E 25°56'37" N
East limit: 51°04'57" E 25°57'47" N
West limit: 50°57'05" E 25°59'15" N
**Textual description of the boundaries of the Nominated Site**

*Al Zubarah Archaeological Site* lies approximately 92km north-west of Doha, on the north-western coast of Qatar, in the Madinat ash Shamal municipality.

The Nominated Property consists of two parcels owned by the Qatar Museums Authority (QMA). The larger area of land contains the coastal town of Al Zubarah and its immediate hinterland, including features related to the defence and supply of the town, as well as the early 20th century Al Zubarah Fort. Separated by a modern road, the second parcel includes the fort and settlement of Qal‘at Murair, including wells for the water supply of Al Zubarah.

In the north, the Nominated Property is defined as a straight line between the coast and the existing fence around Al Zubarah Fort. The eastern extent encompasses the remains at Qal‘at Murair, while the current road from Al Zubarah Fort to the Ras Ushairiq peninsula defines the southern limit. The intersection between the beach and the sabkha formation south-west of Al Zubarah town forms the western boundary of the Nominated Property.

A vast Buffer Zone, incorporating both the wider hinterland and the extensive coral reef system off the shore of Al Zubarah, surrounds the Nominated Property. On the hinterland, the Buffer Zone follows administrative and physical limits to the East, South and North of the site, and includes the archaeological sites of Qal‘at Shuwail, Helwan, and the abandoned village of Ain Mohammad. In the sea, it draws a north-west quadrant at 6.2km from the north point of the Nominated Property.
Statement of Outstanding Universal Value

Al Zubarah Archaeological Site is of outstanding universal value as the Gulf's most complete and well-preserved town of the 18th-19th centuries connected to the practice of pearl trading and fishing. Until the introduction of the cultured pearl, and before the exploitation of oil and gas, the trade in pearls constituted the Gulf’s most important industry, employing up to a third of the male population in the region. It created large economic surplus and wealth at a time when the Persian Safavid Empire had lost political influence and importance. Pearling was the foundation on which incipient city-states were formed and gained wider regional influence and importance, laying down the crucial geopolitical, social, and cultural trajectories of recent Gulf history, which shape the region to this day.

Al Zubarah played a pivotal role in this historic phase of development, as it represented one of the most prolific and crucial international trading ports in the region. As a traditional settlement located in Arabia in which trade, commerce and hence social and cultural interaction and exchange were the underlying tenets, the Nominated Property relates to a number of socially and culturally relevant themes. The site reflects the history of tribal migration in the Gulf, as it was founded by merchants arriving from Kuwait and Basra in search of pearls. Al Zubarah also represents a unique mode of occupying a fragile desert ecosystem, which includes a particular system of water management. Moreover, during the mid to late 18th century, Al Zubarah was the Gulf’s most important trading hub, connecting the Indian Ocean with Arabia and western Asia, and highlighting how trade and exchange connected people from East and West economically, socially and culturally. Collectively, these themes highlight Al Zubarah as a non-European, traditional form of settlement, which encapsulates anthropological and social historical themes.

Al Zubarah Archaeological Site’s Outstanding Universal Value also pertains to the unique preservation of a complete urban town plan of an 18th-19th century pearling and trading settlement in the Gulf. Surrounded and protected by a 2.5km long wall, the town extended over an area of 61 hectares. Due to the abandonment of the site in the beginning of the 20th century, the entire layout of the settlement is preserved in great detail, providing key archaeological and anthropological data on economic, social and cultural relations between the inhabitants of the town, as well as traditional pearling practices. This exceptional state of preservation is strengthened by the integrity and authenticity of the site, and it provides crucial information on human interactions with the land and sea, trade links, and social and economic relationships, which are engrafted and materialised in this exceptional assemblage of urban, historic fabric.

The site is today largely preserved in the form of low mounds, which mask the buried traces of traditional vernacular and religious architecture. The urban fabric of the Nominated Property includes courtyard
houses, palaces, mosques, suqs, defensive walls and palm-leaf fishermen’s huts and tents. This represents a unique mix and assemblage of building types, the spatial organisation of which is preserved in outstanding detail across the entire townscape. The Nominated Property includes the entire town, harbour, canal, screening walls, cemeteries, Qal‘at Murair and Al Zubarah Fort. Qal‘at Murair, which was destroyed in the latter part of the 20th century, survives largely as sub-surface archaeology, but is an important, interconnected feature of the Nominated Property. The fort showcases how the desert’s most precious resource – water – was managed and protected, and how Al Zubarah’s rulers strategically protected access to it.

The integrity of *Al Zubarah Archaeological Site* is guaranteed, as it was abandoned in the early 20th century and being located far from any modern settlement, it has remained untouched by modern development. Only a small proportion of the site has been excavated and restored, and scientific reports have been – or are in preparation to be – published. The archaeological phases at the site are intact and showcase the development and evolution of the town. *Al Zubarah Archaeological Site* is under development to ensure the preservation and presentation of the site for future generations.

The Nominated Property is proposed for inscription under criteria (iii) and (v), as it is an outstanding example of a mid-18th to late 19th century pearl fishing and trading settlement, representing a traditional form of land- and sea-use, settlement and water management. Moreover, Al Zubarah is one of the last remaining localities that embodies the historical trajectories that shaped the economic, social and geopolitical landscape of the early-modern and modern Gulf. *Al Zubarah Archaeological Site* encapsulates the traditions and lifestyle of 18th-19th century urban populations in the Gulf, and reflects the relationship that existed between the people of the Arabian Peninsula and their natural environment.

The property is owned by the QMA, a distinct governmental organisation under direct control of the Amir’s Office. The large Buffer Zone around *Al Zubarah Archaeological Site* protects it from the impact of any development plan being considered for the region, guaranteeing the preservation of not only the archaeological remains, but also of their setting and the surrounding landscape. The Nominated Property includes the 1938 Al Zubarah Fort, itself an important visitor attraction and a source of national pride, while Qal‘at Shuwail is inside the limits of the Buffer Zone. Given the strong existing governmental planning and development control, in which the QMA has direct input for the protection of archaeological and historic building assets, the Buffer Zone will guarantee the highest level of protection for this outstanding site.
Criteria for Nomination

The nomination of Al Zubarah Archaeological Site for inscription on the World Heritage List is based on criteria (iii) and (v) of UNESCO’s Operational Guidelines for the Implementation of the World Heritage Convention.

Criterion (iii) requires that Al Zubarah should:

“...bear a unique or at least exceptional testimony to a cultural tradition or to a civilisation which is living or which has disappeared”

The abandoned settlement of Al Zubarah is a unique testimony to the merchant and pearl trading tradition of the Arabian Gulf during the 18th and 19th centuries. The settlement was founded by Utub merchants emigrating from other towns and seeking a safe haven for trading during a time of great upheaval in the Gulf region. Over a very short period of time, Al Zubarah quickly rose to become the foremost centre for pearl-based trade and commerce in the region, and Qatar’s largest and most important town.

Al Zubarah Archaeological Site represents the only complete urban plan of an Arabian town strongly connected to the traditional practice of pearl fishing. Its unique combination of neighbourhoods, mosques, palaces, markets, defensive systems and a canal is in itself a unique testament to the achievements of Al Zubarah’s inhabitants. The town plan encapsulates and preserves key ideas about urbanism and town planning during the 18th-19th centuries, and it is the best-preserved record of its type. The individual neighbourhood plots, plazas, mosques and markets that are discernible from the town plan also reflect a significant degree of urban planning and control.

The different components of Al Zubarah’s urban plan show that the settlement was conceived and implemented from the outset. The fabric of the city shows both the sophistication of the planning principles, and the capacity of Al Zubarah’s rulers to control and direct the social and economic forces driving the creation of the town. Trade, commerce and pearling are ever-present in the archaeology of the town. Ceramics attest to trade links along the so-called maritime silk route connecting Al Zubarah with the Indian Ocean, eastern Africa, eastern and western Asia, and Europe. Its geographic location in the Arabian Gulf, between the Indian Ocean and western Asia, facilitated its rapid rise as a key commercial centre. The economic surplus and wealth created by this trade provided the financial and political basis on which the early modern, incipient city-states of the Gulf were created.

The abandonment of Al Zubarah at the beginning of the 20th century has helped to preserve the most detailed urban layout of an 18th-19th century pearl fishing and trading town anywhere in the region. The Nominated Property reflects the heyday of the pearl trade, during which the key trajectories of the Gulf’s early modern history were established, before the introduction of the cultured pearl brought this centuries-old tradition to an
end. It can therefore be said that Al Zubarah stands today as the most complete and intact material representation of the role that the Arab world played in the formation of both modern trade systems, and an important precursor to the creation of independent Arab states.

Criterion (v) requires that Al Zubarah should:

“be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change”

Al Zubarah Archaeological Site bears unique testimony to the human interaction with both the sea and the harsh, desert environment of the region. Pearl divers’ weights, depictions of dhows, and imported ceramics show how the town’s development was driven by trade and commerce to a great extent, and that many of the town’s inhabitants felt a close connection with the sea. Al Zubarah’s natural harbour provided ample protection against piracy or bad weather, and it supported a sizeable pearling fleet, which travelled twice annually to the oyster banks along the north-eastern coast of Qatar.

A canal to the south of the settlement connected Qalat Murair to the sea, allowing freshwater to be transported to supply ships, and goods to be ferried between the harbour and the fort. Intra-tidal traps built of low walls utilised the natural tides to catch fish in a complex, dense trapping system that can be found in association with numerous settlements up and down the coast, including Al Zubarah.

These reflect an intensive exploitation of marine resources. Date presses (madbassas) found in the settlement, and traces of field systems found in Qalat Murair show that the exploitation of the seas was complemented by an equally intensive use of Al Zubarah’s hinterland. Palm groves provided a food source for the settlement, while wells in and near Murair were the principal source of freshwater. Remains of enclosures provide evidence for the keeping of livestock, helping to feed the town’s population.

The town of Al Zubarah and the fort at Murair therefore formed a symbiotic, economic and social relationship. Qalat Murair protected the town’s crucial freshwater resource and two screening walls allowed people to safely transport water from Qalat Murair to Al Zubarah. The local geology and geography shaped the traditional settlement system in the area, with freshwater wells only existing on the higher ground to the east. These ecological conditions led to the establishment of small-scale settlements in Al Zubarah’s hinterland in support of the town. With Al Zubarah at its centre, the site and region represent an outstanding example of traditional human settlement, land-use and sea-use.
Central Coordinate
51°01′32″ E 25°59′17″ N

Buffer Zone
Nominated Property

1. Revised Executive Summary

Al Zubarah Archaeological Site
Supplementary Dossier
1. Revised Executive Summary
2. Supplementary Description

“Further develop its understanding of how the fabric of Al Zubarah and its desert hinterland were an exceptional testimony to a specific interaction between nomadic herders, pearl divers, fishermen and traders that once characterised the way of life in the Gulf (as opposed to connection to the pearling industry) by:

1. Presenting the results of surveys and excavations carried out in the property and its wider setting, including underwater archaeology, that have already permitted the understanding of the origins of the town, the basis for its prosperity, its layout and how it related to the coast, its desert landscape and small satellite settlements

2. Completing the archival and oral history research developed within the project”

(From the World Heritage Committee’s Revised Draft Decision 36 COM 8B.19)
2.A. Summary of results of Archaeological Investigations; two years of achievement: the 2010-2011 and 2011-2012 seasons

The relevant principal data from the last two years of archaeological research is presented below in summary form. The following areas of work are covered:

i. Strategically planned excavations following strict scientific and site management principles located within the Nominated Property [see Fig 1], specifically: changing settlement profiles in an area straddling the Inner Town Wall (Zubarah Excavation Point 01 – ZUEP01); extensive structures of types commonly associated with commercial activities (ZUEP02); the investigation of a large walled building complex on the southern extremity of the site (ZUEP04); sampling urban rubbish heaps, or middens (ZUEP05); and urban defensive regimes (ZUEP10 and other locations).

ii. Exploration of Al Zubarah’s extensive hinterland in order to locate, record, describe and categorise settlements and activities within their environmental settings, paying particular attention to the supply of water, agriculture, and the acquisition of other resources. Significant here is evaluating the extent to which these resources were managed by – or denied to – the inhabitants of the town, many of whom were new (but not completely unknown) arrivals; and evidence for settlement in time periods other than during Al Zubarah’s heyday (18th and 19th centuries CE).

iii. The classification, documentation (description, image generation), and study of the rich and diverse material culture recovered from the excavations, which offers unparalleled insights into cultural and economic life in the town along with its region, while documenting the widespread connections generated by community ties and trade within the Gulf and far beyond. These objects, endowed with meaning by their contextualised story-lines, will constitute the core of a major gallery display in the new and inspired, Jean Nouvel designed, National Museum of Qatar in Doha.
Fig 1: Plan of Al Zubarah showing excavation areas
2.A.i. Al Zubarah Archaeological Investigations

Zubarah Excavation Point 01
Excavations in ZUEP01, completed in the 2011-2012 season, have garnered many fascinating details on urban planning in Al Zubarah, including defensive strategies (19th century) and stratified lifestyles in different parts of a household (18th century). Recent research has recreated lines of movement and different zones of activity within the household, as briefly described below. The last two seasons of work have also brought to the fore the nature of the earliest occupation in this area of Al Zubarah, either some time (although not long) before the construction of the permanent settlement, or actually with the arrival of settlers.

The analysis of a typical courtyard residence of moderate size (ca. 21 m. N-S by 22.5 m. E-W) undertaken by the QIAH Project is especially revealing about cultural and social life in Al Zubarah [see Fig 2 p.13]. Belonging to the period ca. 1770-1811, the formal entry was from a street to the north, which gave access to an enclosed hallway separated from the courtyard beyond by curtain walls – a common strategy to maintain privacy. To the west, a doorway with an archway decorated in a ‘dogtooth’ pattern lead into a single room, most likely meant to receive visitors, to which access was also possible from the courtyard. Facing out onto the central courtyard were a number of rooms and a porticoed space or iwan, also once arched. The iwan, positioned on the cooler south side of the courtyard, overlooked the main habitation area of the compound, consisting of three large rooms (Spaces 102, 105, 119), each with closable doorways and internal washing facilities of rectangular and square type. The north wall of Space 102 featured a scale image of a large dhow, expertly etched into the wall’s plaster surface. South of the iwan was another living room (Space 100), also with a corner washroom (Space 101). The southwest quadrant of the compound was the work area of the household, with Space 110 containing over 20 cooking ovens and Spaces 111 and 112 seemingly devoted to fish preparation. These rooms were rich in animal remains. Other rooms were for storage. Space 116, with cooking and washing activities, was likely a service room for the reception room Space 108. Among the many interesting finds from this compound was a wooden pearl-merchant’s chest [see Photo 16], a solid testimony to one of the mainstays of Al Zubarah’s economy.

Other structures across a street north of this compound have turned up evidence of a specialised date-syrup production facility. Throughout the site, the common occurrence of large, high-capacity date presses demonstrates the crucial role of syrup production in the economy of Al Zubarah, as at neighbouring localities also [see below]. Work in this area has also uncovered evidence on the primary layout and continuous maintenance of streets, revealing an ongoing desire to maintain established levels of urban organisation within a flexible system of space usage.
Below the 18th century architectural phase, a densely acculturated layer of sand and mixed cultural material was uncovered in both years of work, but especially during the 2011-2012 season. The excavations have shown categorically that this pre-architectural occupational phase was dominated by tents and/or palm frond structures (barasti). The numerous postholes and the intercutting rubbish pits, tannurs, and hearths reveal that these structures were subjected to numerous rebuilds and repairs. Spatial patterning suggests that structures were orientated in a northeast to southwest alignment, with rubbish pits to their northwest. Burning seems to have occurred towards the end of the occupation period, probably to clear the area. Analysis of the pottery from some of the rubbish pits indicates that some earlier ceramic forms are present but, as these are intermingled with types from the subsequent architectural phase, the dating of the original transient structures cannot be that much earlier.

For further information see:
End of Season Report 2010-11, pp. 1-2, 6-18;
End of Season Report 2011-12, pp. 7-16

**Zubarah Excavation Point 02**

While ZUEP01 has given a clear insight into household management and activities in the 18th century town including pecuniary matters, work closer to the coast in ZUEP02 has revealed much more detail about the central role of commerce and trade.

Previous excavations had exposed a series of rooms suggestive of a *suq* (market), and given the seaside location next to a reef-free beach, this seemed very
likely. Given that suq served a primary role in towns, evidence for a wide range of primary activities – commerce, politics, and social interaction – could be expected. The results have not disappointed. Excavations to date have uncovered two enclosed courtyard warehouses separated by parallel access streets, each of which led down to the broad sandy beach of the bay – perfect for drawing up dhows [see Photo 2]. One of the warehouses featured a central courtyard with a second access courtyard to the west, all enclosed on three sides with deep rooms including three large date presses side-by-side as well as storage rooms. A doorway gave direct access from the west. Elsewhere a wide range of activities have been identified, including the redistribution of commodities and artisanal enterprises, especially iron working. The floors of some shops were littered with potsherds in their hundreds, these being remnants of containers for goods sold in the market. Local wares were identified, as well as ceramics brought in from across the Gulf, such as pots from Khunj in Iran. A large windlass stone weight, used to secure the beached dhows, was also recovered.

After a period of demolition (perhaps resulting from the attack of 1811), the suq was rebuilt, although on a reduced scale. The two phases of the suq were separated by a period of dense occupation represented by tannurs [see Photo 3], fire pits, post and driven stake holes, but no stone-built structures. One of the expansive surfaces excavated in the 2011-2012 season was noteworthy, it being particularly rich in finds: numerous ceramics and iron objects, shell, animal bone, and ash, and occasional glass and copper alloy objects. Finds of note included two coins; a blue porcelain Buddhist dragon dog
(temple guardian) figurine, two stone sling shots or musket balls; a copper alloy ring; a glass bead; an iron and copper alloy locking mechanism; and a porcelain kohl bottle. So while newly built architecture might be absent, activity is evident everywhere.

This sequence – suq/perishable structures/suq once more – offers compelling evidence for considerable social resilience in the geographical heart of Al Zubarah, in which calamity was followed by a new period of high activity. In one room of the second architectural phase, ten intact and six fragmentary haematite marine diving weights in the shape of a tear-drop and sourced outside of Al Zubarah were uncovered, further evidence of the enduring role of pearl fishing at Al Zubarah. This room, as well as many others in the area, were destroyed in another conflagration, and although it may be dangerous to attribute every burning event to conflict, and to one event in particular, the sack of 1878 by Shaykh Jassim bin Muhammad Al Thani may have been the cause.

For further information see:
End of Season Report 2010-11, pp. 2, 19-38;
End of Season Report 2011-12, pp. 17-27

Zubarah Excavation Point 04
During the original full-site planning exercise of early 2009, an archaeological zone that, at first, presented as jumbled banks of rubble and wind-blown sand, quickly took on a clearer and more obviously planned aspect than first realised. Between the outer circuit wall and the white-sanded beachfront of the bay, a network of streets had been systematically placed that linked beach and wall, thereby creating building blocks further subdivided by cross-streets to produce an ordered town plan. While obscured on the west by the 19th century settlement, areas to the south, east and northeast preserve the grid setup until today. Typically the grid delimited rectangular blocks filled with courtyard units, often set two deep and up to seven long. Yet the urban landscape was dominated by fortress-like compounds replete with robust corner towers and enclosure walls, notably in the south of the site. Each would have served as the palace of a prominent shaykh, within which the cultural, political, and economic activities of the community would have been concentrated.

Since 2010, work at the largest of these, measuring 100 by 110 metres (ZUEP04), has focused on the south-westernmost of the nine large internal courtyard units. Although part of a grand complex, features were
similar to those found elsewhere at Al Zubarah: a concealed entrance, an iwan for shade (although here it faces out on a private courtyard), a date press, kitchen and storage areas, and washrooms. The walls and doorways of rooms on the southern and eastern sides – the living areas of the building – were originally decorated with intricate plaster stucco, complemented by recess niches in the walls for lamps or other objects. Staircases leading from the courtyard suggest that the building once carried a second floor, at least in part.

The excavation of the south-western circular tower of the compound revealed new information on construction methods and potential use. The tower turned out to be of solid construction with bracing cross walls, with access to the top of the tower via a staircase. The rise of steps on the staircase indicated a tower height of over four metres, and with a parapet the height would have topped six metres. Given the solid, shock-proof nature of the tower, most likely the intent was to install one or two small-gauge cannon on its high point – an indication of the defining role of regional power plays and conflict in the 19th century history of Al Zubarah.

While the absolute size and fortress-like appearance of the palace at ZUEP04 clearly proclaims the presence of an influential family at Al Zubarah, confirmation came from an ashy midden deposited outside the south wall of the building. The midden produced numerous finds expected of a rubbish dump: broken pottery, fine porcelains, metal fittings, broken coloured glass bracelets, and sheep, goat, birds, and fish bones; but it also revealed the extraordinary: evidence for the hunting of game in particular gazelle, often seen as an activity of ruling elites.

In 2011-2012, new architectural features were discovered when the excavation was extended approximately five metres to the north. Investigation revealed the presence of an east-west running corridor, which linked the compound to the exterior via a doorway in the west wall. Intriguing was the uncovering of twelve plaster niches set into the north face of the south perimeter wall of the neighbouring compound, and with the elongated rooms of this compound may suggest a commercial role for the building.

For further information see:
End of Season Report 2010-11, pp. 2, 39-55;
End of Season Report 2011-12, pp. 28-37
Zubarah Excavation Point 05
Located next to the Outer Town Wall, ZUEP05 was positioned on a large midden with the idea that the careful excavation of an urban rubbish heap would significantly expand knowledge of everyday objects in use during the heyday of Al Zubarah. Maximum recovery techniques were used (sieving, water flotation) to extract the greatest amount of information from the excavated deposits.

Eighty-three field objects were registered from ZUEP05, including 27 coins. Other field objects included worked bone, beads, wood and several metal objects such as iron nails, and a bronze rosette, pendants, buckles and rings. The main bulk finds were ceramics and animal bones, both of which represent substantial collections. Sheep, goat, camel, and fish predominate. Preliminary results from the ceramics analysis indicate that the midden collection includes a very wide and varied assemblage, thus covering a wide range of activities. Aside from the extremely rich finds of ceramics, bones and other objects, the midden also produced substantial amount of easily perishable organic material such as botanical remains, human and animal hair, wood, rope and various fragments of textile. Fascinating was the identification of stone fruits and grains, all imports from India and Iran. The excavated soil also included high amounts of organic material; soil samples were, therefore, regularly taken during excavation for flotation. In all, a rich insight into the material culture, diet, and economy of 18th and early 19th century Al Zubarah was recovered from the midden finds. The results are on a scale and with reliability that surpasses the information from more scattered finds from building contexts.

For further information see:
End of Season Report 2010-11, pp. 2, 56-63

Zubarah Excavation Point 10
ZUEP10 was begun to investigate possible surviving archaeology against the inside face of the Outer Town Wall in preparation for scheduled conservation work, as procedures require. The work revealed an especially dense sequence of archaeological deposits indicative of ongoing activity during the main phase of Al Zubarah’s occupation. The earliest activity, represented by a number of postholes, pits and patchy surfaces, seems to be directly associated with the construction of the main city wall, with little or no evidence of any prior occupation. Once the wall was in place, the immediate vicinity appears to have been used mainly as a thoroughfare with trampled surfaces forming across the area. Soon after, the construction of a banquette, or walkway, on the inner side of the city wall, turned the higher part of the wall into a defendable parapet suitable for rifle fire. This refortification, probably coinciding with increased tribal tensions around the turn of the 19th century, begins a period of greater activity in the area. A number of laid surfaces cut by postholes suggest the possibility of barasti dwellings built against the lower wall, complete with a nearby tannur installation set into the wall itself, and other evidence of cooking and domestic activity.
The work at ZUEP10 has raised the question of the function and date of Al Zubarah’s Outer Town Wall (OTW). Early work (in 2009-2010) had already demonstrated categorically that the Inner Town Wall (ITW) was of later date than the OTW, as the ITW was constructed over and around substantial buildings belonging to the main settlement period of the later 18th and early 19th century. However, the positioning of the earlier OTW also suggests very strongly that it was built sometime after the primary layout, if not construction, of the late 18th century town. A clear demonstration of this reality can be seen in the southern part of ZUEP04, where the town wall skirts the enclosure wall of the palace, and the wall tower is deliberately placed midway between the two southern corner towers of the palace. Coincidentally, it also seems very likely that the southern flanking wall connecting Al Zubarah to the fortress at Murair was erected over the filled-in eastern part of the sea canal that joined the fort to Al Zubarah’s harbour.

For further information see: 
*End of Season Report 2011-12, pp. 38-43*
2.5 200000 190000 490000 B 5 km 220000 210000 480000

2.A.ii. Hinterland Researches

In keeping with modern advances in Landscape Studies, with an emphasis on land use and human impact on the natural environment, Decision 36 COM 88.19 of the World Heritage Committee in 2012 stressed the need to present the results of survey work in the desert hinterland of Al Zubarah, so as to document how the town was connected with its natural and cultural surroundings. The program of work scheduled for the 2010-2011 and 2011-2012 seasons had already foreseen the importance of these questions, and the remarkable results produced by two professional teams of dedicated landscape experts and research groups are here presented in brief. The work focused on two main branches of endeavour: hinterland reconnaissance surveys and mapping to locate, document, and classify sites, especially in the Al Zubarah Archaeological Site Buffer Zone; and strategic excavations to gain an insight into the character and function at a select number of archaeological sites.

The landscape survey work was, in itself, divided into two further parts: the ground verification and basic recording of cultural places principally identified by remote sensing and entered on the Qatar National Historic Environment Record (QNHER) as likely archaeological sites; and detailed mapping with a total station and photography of selected sites deemed significant and/or threatened within the survey zone. In addition, a detailed systematic survey of a number of transects was undertaken to identify what, if anything, was being missed through the two-pronged strategy outlined above. This
vigorous scrutiny of methods revealed that, apart from a number of recent or near-recent Bedouin encampments, little has been missed.

A Geodesic Survey of Sites in the Al Zubarah Buffer Zone Area

During the 2010-2011 and 2011-2012 seasons, mapping teams undertook topographic surveys of sites within the hinterland of Al Zubarah. Surveys were completed at the following sites of importance: Shuwail, Ain Mohammad, Musaikah, Helwan, and Muhayriqat [see Fig 4 p.19].

Shuwail, a water-rich location especially noted for its potable supply (QNG 184076/469378), Helwan (QNHER 3; QNG 184578.350E/466078.276N), and Ain Mohammad (QNHER 10192; QNG 183897E/472065N), have been described in the original Nomination File. These sites have undergone further survey and mapping during the last two years of work.

At Musaikah, some seven kilometres southeast of Al Zubarah, the remains of a fort and some footings still survive on the eastern edge of a farm that presently occupies the site. In addition, three sites located outside the boundary of the present farm (Musaikah A, B, and C) were planned. These sites were characterised by a distinctive linear arrangement of small rectangular structures set to an east-west or northeast-southwest alignment. Associated ceramics, especially turquoise-glazed wares, link these places with the earlier historical period often termed ‘Abbasid’ in Qatar (ca. 8th to 11th centuries CE), although the influence of the Abbasid caliphate on the peninsula is a moot point. Elsewhere
on the northwest peninsula, survey work has located a number of other sites of the same date, thereby enlarging our comprehension of land and water management in Islamic times [see further below].

**The Regional Survey**

The powerful contribution of landscape archaeology in comprehending and explaining the role of population dynamics in the formation of social and economic structures has found wide acceptance in contemporary research. Beginning with the 2009-2010 season, and expanded in the 2010-2011 and 2011-2012 seasons, survey and mapping teams have delved deep into the countryside north and east of Al Zubarah in the quest to discover, document, and classify the villages, hamlets, and encampments in the hinterland of the town, with a view to evaluate the nature of cultural, political, and economic interactions between them. Of special interest was the impact made by the sudden arrival of a large and comparatively wealthy group to Al Zubarah in an existing network of coastal villages and inland pastoral-agricultural settlements, and what distortions that arrival may have produced, and of recovery strategies of regional sites with the 19th century decline of the town. Such developments on the northwest coast are instrumental in understanding the emergence and formation of modern Qatar.

The map [see Fig 4 p.19] shows the fertile results of the comprehensive assessment of the cultural landscape of northern Qatar. In a number of ways, the quantity, range, and significance of the results from original geomorphological fieldwork went far to identify a resource-driven landscape revolving around water resources, compact yet valuable agricultural fields, and extensive pastoral opportunities.

Spread across the entire north of the Qatar peninsula is a peppering of sites with, understandably, the most significant profile clustered around the main water sources. Sites closer to Al Zubarah have wide evidence for occupation during the heyday of the town, with water management often enforced by the construction of forts at the wells – the ‘secure and deny’ principle. Field systems, probably from the same period, have also been recorded associated with the main water sources, and where the desert rawdah soils were present.

A major advance in 2010-2011 and 2011-2012 seasons was the identification and categorisation of a dozen or so agricultural
and pastoral sites from earlier Islamic times [see Fig 4, larger green dots], datable preliminarily by surface ceramics to sometime around the 9th or 10th to 11th centuries CE, and therefore roughly contemporary with the renowned and larger site of Murwab, located south of Al Zubarah. The northern sites are smaller in dimension, and are characterised by a line – usually singular – of rectangular structures sometimes accompanied by a mosque, stretching in an open-spaced pattern for often hundreds of metres along a rocky rise or ridge above flatlands of silty clay rawdah soils, such as at Umm al-Kilab (QIAH40-191). Trees, commonly acacias, typically adorn these areas, indicating the presence of reasonably fresh water at a shallow depth. Similar alignments of structures were recorded at Makin (QIAH40-184) and (QIAH40-242), Umm al-Suf (QIAH40-188), Qa’at Rakayat (QIAH40-427), and other sites, while at Al Nahy (QIAH40-144) a large rectangular multi-celled structure, potentially represents a warehouse and market.

For further information see:
End of Season Report 2010-11, pp. 2-3, 80-145 (sections covering geomorphology, mapping, and survey);

Strategic Excavations
While rescue and exploratory excavations were undertaken at a variety of sites, such as Ruwais/Khasumah (2010-2011) and Fuwairit (2011-2012), two important sites have been the subject of ongoing research over the last two seasons. Archaeological work at Freiha, located on the coast just north of Al Zubarah [see Fig 4], has investigated a large mosque and domestic areas, while the field work of Dr Andrew Petersen (University of Wales collaborative partner) at Ruwaidah has focused on a stout fortress, a mosque, and the workshops and storerooms of a warehouse.

At Freiha, a site closely pre-dating Al Zubarah, detailed insights into revolving settlement profiles were identified, in which a repeating pattern of abandonment and rebuilding was discerned. The pattern follows a complex palimpsest typified by phases of expanding settlement at the site, interspersed by periods of total or near-total abandonment. This is something that can be seen most clearly
in the remains of the mosque (FREP01). Here, five periods of construction, several on quite a significant scale, took place throughout the life of the building. Each of these phases of use was followed by a period of abandonment, during which thick layers of windblown silt would accumulate along with debris from wall and roof collapse. The Phase 3 rebuilding represents a considerable investment of resources, with the prayer hall being rebuilt on a different alignment. Later, major architectural changes to the layout of the mosque occurred. The sequence indicates that the returning population had enough resources to rebuild in the same location each time.

Investigations in residential areas of Freiha turned up a long and complex settlement history, with ceramics confirming settlement at this location before Al Zubarah’s heyday. In Freiha Excavation Point 4 (FREP04), excavations have uncovered a complex and dense occupation sequence. This began with post-built structures, followed by pisé and mud-brick dwellings which were replaced, after a structural hiatus, by stone structures. The most extensive activity was most commonly found in external areas, with internal spaces only containing a few features. This pattern may imply that the rooms tended to be used for storage, resting, or sleeping, but not domestic activity.

Ruwaidah is a large site stretching along the coast for two and a half kilometres. Although it was identified as an important archaeological site in the early 1970s, no excavations were carried out there until the University of Wales work began in 2009. The site is not mentioned in historical sources of the 19th century and appears to have been abandoned sometime...
in the late 1700s or early 1800s. Archaeological excavations at Ruwaidah have concentrated on the area of the fortress and its immediate surroundings. During the first season of trial excavations it was demonstrated that the fortress was built in several phases with a variety of construction methods. Excavations were resumed in 2011, when a large residential compound in the north-east corner of the fortress was uncovered, as well as a gateway to the main courtyard of the fortress. During the 2011 season of work a mound locally identified as a mosque was excavated and proved to be the courtyard of a small mosque next to the sea. Two construction phases were identified in both the residential compound and the mosque, suggesting a period of abandonment followed by reconstruction at a later date. During the 2011 season an enigmatic feature on the beach, located about 800 metres to the west of the fortress, appears to have been a tomb or mausoleum. The burial is extremely unusual because there are no other burials in the immediate vicinity and due to its location on a small platform at high water mark.

The 2011-12 season continued to focus on the fortress and the area immediately in front of it. The prayer hall of the mosque was excavated and proved to be a six bay structure supported by the external walls and four piers (2 central piers and 2 engaged piers). A mihrab in the west wall was modified twice; firstly by a change in the orientation of the qiblah and secondly by the addition of a minbar recess. In addition to the mosque a warehouse complex of eight rooms was uncovered directly in front of the gateway to the fortress. A small building between the warehouses was also excavated and tentatively identified as a workshop for boat repairs.

The dating evidence from Ruwaidah in the form of imported ceramics indicates that the settlement was abandoned by the early 19th century. An area at the west end of the site also contained 13th-14th century Chinese ceramics, indicating that Ruwaidah may be one of the few sites to have substantial remains which date before the 18th century.

For further information see:
End of Season Report 2010-11, pp. 2, 66-79;
2.A.iii. Finds and Object Conservation

Finds Processing and Storage System
Beginning with preliminary sorting in the field of all recovered material, and following its arrival at Al Zubarah Field Station on a daily basis, the finds are divided into the following three categories:

1. Bulk Finds: These can be of any material, but mainly comprise bagged assortments of ceramic shards, bone, shell, indistinct metals, glass fragments, charcoal, and bitumen. In 2011-2012, a total of 3599 bags were processed.

2. Samples: These fall into three main categories, as follows.
   a. Soil samples (for flotation and specialist examination of resultant residue)
   b. Samples for specialist analyses (e.g. stone varieties, wood pieces)
   c. Miscellaneous other material samples

In 2011-2012, a total of 1335 bagged samples were collected, of which 985 were soil samples for flotation by the QIAH Project’s archaeobotanist.

3. Field Objects: These are commonly worked single objects deemed by the excavator to be of special significance, such as for object collections or museum specimens, and confirmed in the finds lab following preliminary cleaning and identification. Each object receives an individual registration number to commence to recording process, as outlined below. In 2011-2012, a total of 920 objects were registered.

The registration process, devised by the finds team and built on many years of collective experience, seeks to allocate the available resources of conservation, description, visual recording, and interpretation appropriate to the significance and condition of each finds category. The process is built upon five clear stages of identification and treatment, as follows.

Stage One in the registration process, which applies to all categories of finds, involves an Initial Registration (IR) of the incoming material. The finds are first assessed and logged in separate site-specific databases, thus providing a complete record and quick overview of all physical finds. This classificatory stage determines the subsequent processing of finds, although with flexibility. The IR record is constantly updated with new information produced during the Stage Two activities of cleaning, conservation, sorting, and study of the finds, as these processes often require reassessments of them. For example, if a Field Object is labelled as possibly a glass bead by the excavator and, on cleaning in the
Stage Three of the registration process leads to the appropriate storage of finds in an accessible system compatible with whether the material is at the before- or after-study stage. Each box/crate is allocated a Unique Number; this number is entered on a database table thereby providing a searchable list. Each box has an easy-read front label with the Site, Area, Finds Category, Material and Object Type listed. At this point the allocated box is not a final, fixed storage location. The aim is, rather, to facilitate specialist studies by insuring that the stored material is easily retrievable, currently in most cases at Al Zubarah Research Station.

The finds are boxed/crated by finds category and, within this, by material and then by object type, if applicable.

<table>
<thead>
<tr>
<th>Finds Category</th>
<th>Examples of main materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Finds</td>
<td>Ceramic, bone, shell, glass</td>
</tr>
<tr>
<td>Samples for Analysis</td>
<td>C14, petrography</td>
</tr>
<tr>
<td>Material Samples</td>
<td>Plaster, charcoal</td>
</tr>
<tr>
<td>Catalogued Field Objects</td>
<td>Glass, stone, ceramic, metal</td>
</tr>
<tr>
<td>Un-Catalogued Field Objects</td>
<td>Glass, stone, ceramic, metal</td>
</tr>
<tr>
<td>Finds from processed soil samples</td>
<td>Seeds, charcoal, ceramic, bone, shell</td>
</tr>
</tbody>
</table>
Further sub-divisions are necessary for some categories of finds, for example the field objects. Examples are given below:

<table>
<thead>
<tr>
<th>Materials</th>
<th>Object classes (examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass</td>
<td>Vessels, bracelets, beads</td>
</tr>
<tr>
<td>Stone</td>
<td>Tools (grinders, whetstones), weights (diving), architectural fragments</td>
</tr>
<tr>
<td>Metal</td>
<td>Coins, jewellery, nails and fittings</td>
</tr>
</tbody>
</table>

**Stage Four** focuses on facilitating the study of the finds, work which is undertaken by leading specialists in the field. While most specialists are material specific – ceramics, animal bone, shell etc – others undertake comparative studies into a range of materials and/or object types. All specialists produce interim and final reports and have the option to publish their results. They also identify material for inclusion in final publications and select representative pieces for addition to reference collections in Qatar, including outstanding objects for display in the galleries of the highly anticipated National Museum of Qatar.

**Stage Five** involves the final storage of the material, which constitutes part of the Long-Term Storage Plan. The studied material is re-boxed according to the archaeological phase within each site and subcategorised according to area/building. In this way the storage system will reflect the final written publication. Each box will be allocated a Unique Box Number, and the following information is written on the box front or label: site, area, phase, historical date, locus, material and, importantly, publication reference. The box number and publication reference is also added to any record catalogue sheet and the database. In addition, the specific storage location will be added to the database and paper record, for example Al Zubarah Research Station, The National Museum of Qatar, or The Qatar Museums Authority Store. This system facilitates the further study and consultation of the material and allows for easy retrieval of the finds.

Work is advanced by a specialist **Finds Team** comprising a Finds Manager, a Supervising Registrar and assistants, a Ceramicist, two to three experienced object conservators (drawn from Moesgård Museum, Aarhus, as well as The Royal Danish Academy of Fine Arts, Schools of Architecture, Design and Conservation), an Illustrator, and a Photographer and assistant. In total the finds lab is staffed by some ten professionals and advanced trainees. The finds team has two substantial work rooms and a dedicated conservation lab at their disposal in Al Zubarah Research Station.

*For further information see:*  
*End of Season Report 2010-11, pp. 146-49;*  
*End of Season Report 2011-12, pp. 94-97*
## 1. Registration
Registration of all finds recovered from site in database

update of catalogue where necessary

## 2. Processing

<table>
<thead>
<tr>
<th>Bulk Finds</th>
<th>Samples</th>
<th>Field Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ceramic, bone, shell, glass, bitumen)</td>
<td>(soil sample, sample for analysis etc)</td>
<td>(coins, beads, worked bone/shell, metal artefacts, stone tools etc)</td>
</tr>
<tr>
<td>cleaning</td>
<td>sample dependent (e.g. flotation)</td>
<td>photographed</td>
</tr>
<tr>
<td>sorting</td>
<td></td>
<td>cleaning/conservation</td>
</tr>
<tr>
<td>extraction of whole objects (e.g. coins)</td>
<td></td>
<td>catalogued</td>
</tr>
<tr>
<td></td>
<td></td>
<td>illustrated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>re-photographed</td>
</tr>
</tbody>
</table>

## 3. Boxed For Study
Finds stored by category in catalogued boxes for access by specialists

## 4. Study by specialists
Study of artefacts by specialists and selection of objects for museums

## 5. Archival Storage
Finds stored in appropriate packaging and organised by archaeological phase, category and material type
Finds Conservation Policies and Procedures: with a focus on objects selected for the new National Museum of Qatar

In each of the 2010-2011 and 2011-2012 seasons, a team of conservators, including staff from Denmark’s Moesgård Museum, have systematically treated major objects that have been recovered during the course of excavation. As most of the archaeological work has occurred on coastal sites, the primary challenges are salination and corrosion. In addition to the general treatment of registered finds, special attention was paid to selected objects slated for display in the new National Museum of Qatar. Objects were selected not simply for their aesthetic, visual impact, but according to various display themes that could be used to tell different heritage stories. By the end of the season 156 objects had been chosen from the different sites covering the topics of architecture, household, industry, diet, food storage, fresh water, commerce, trade, pearling, fishing, personal items, decorated objects and children. In total, 202 objects have now been designated for the new National Museum of Qatar. Below are presented examples of objects selected for the National Museum of Qatar and conserved.

One interesting object listed for the National Museum of Qatar is a copper alloy Jeton (counter) from Al Zubarah. Careful conservation has revealed a sun, seven stars, crescent moon and the letters E. L. S. LAUER and RECHE R/N_FEN on the reverse and on the obverse a ship with the letters PLUS UL_ and I.L.S.L. The Lauer family were the last makers of jetons in Nuremberg, Bavaria, in the late 18th – early 19th century. Our jeton bears the initials of Ernst Ludwig
Sigmund Lauer whilst the other word on the reverse is probably ‘Rechenpfen(ning)’ being German for jeton. On the obverse, Plus Ul(tra) is probably the family motto.

The 2011-2012 season also saw the full conservation of the pearl merchant’s chest recovered from Al Zubarah, which is the subject of a detailed conservation report. Datable to the later 18th century, the lid and internal details are missing, but many other features were identified. Of particular note is the unusual use of red cloth to clad the outside surface, red being the preferred colour for accentuating the natural beauty of pearls.

Another important class of objects exhibiting a commercial role is a collection of haematite stone marine weights recovered from ZUEP02. Along with the merchant’s chest and a number of boat anchors, such finds can serve as focal points for interactive, multi-media displays on the leading role of the sea and its resources in the economy and culture of Qatar before oil and gas. These finds, along with other story-laden objects from the excavations, will feature in many galleries of the new National Museum of Qatar, revealing a diversity of cultural material that gives a deep insight into trade (porcelains and glazed wares from China, Iran, and other places), commerce (pearler’s box, coinage, weights for scales), the resources of the sea (divers’ weights, dhow anchors), personal adornment (glass bracelets, beads, stone pendants), food acquisition and preparation (mortars and querns, including rotary querns, cooking vessels), household furnishings and lighting, recreational activities, especially coffee and tobacco consumption (hookah heads, pipe bowls, and snuff bottles), aesthetic consciousness (architectural mouldings and geometric stuccos from doorways and walls), and conflict (e.g. a cannon ball).

For further information see:
End of Season Report 2010-11, pp. 63;
End of Season Report 2011-12, pp. 94-102
2.A.iv. Digital Data Storage and Archive: Excavations and Finds Lab

All data recorded during excavation, survey, finds processing, and finds conservation are documented initially on paper recording sheets and registers, which are regularly digitised for backup and storage. Spatial and object data are then entered and maintained in a relational database management system (DBMS) linked to a Geographic Information System (GIS), from which area and phase plans, finds distribution maps, and the foundation of all interpretive illustrations and reconstructions can be extracted.

The main archaeological database for Al Zubarah and the other sites under investigation by the QIAH Project is based on a SQL table structure with a Microsoft Access frontend that allows shared and concurrent access via a local and, eventually, an online network. All data is organised primarily by locus as the smallest spatial unit of stratigraphy, but information can be queried freely by type of deposit or feature, by chronological phase, type or density of finds, type or relative date of ceramics, and other variables, although some of these features are in the process of being implemented. The database also gives access to any photos and illustrations of a locus or catalogued find, as well as to scans of original paperwork. By the 2013-2014 field season, it is envisioned that remote access to the database by researchers not affiliated directly with the QIAH Project will be possible, given the granting of approval by the QMA. Read-only access can then be approved also to the general public, once data proofing is completed.

Digital data generated by the QIAH Project include scanned excavation and survey recording sheets, scanned locus plans, sections and wall elevations, native digital photographs of each locus or survey site, field object and ceramic typologies, scans of illustrations of catalogued objects and pots, as well as progress and specialist reports throughout any field season. Photos are labelled following an internal chronological system and tagged by locus, field object catalogue number or other identifying
2.A.v. Presentation of Archaeological Discoveries in Museums and in Publications, 2010-2012

The compilation and dissemination of the outstanding results produced by the recent archaeological work in northwest Qatar seeks to raise a heightened awareness of Qatar's rich heritage both locally and abroad through multilingual and age-appropriate outreach programs (further described in Section 5B, below). From the outset, the QIAH Project has placed great importance on making available to the general public and the academic community alike, the rapid pace of discoveries at Al Zubarah Archaeological Site and satellite sites in its hinterland, and how these discoveries are initiating a re-evaluation of Qatar's Islamic heritage. Writing history anew with the inclusion of archaeological evidence, which encourages an elevated level of public engagement and excitement, is a challenging yet rewarding exercise as it offers, for instance, a deeper appreciation of the past at all social levels, not just that of elites. It is precisely these details that modern audiences crave, as the 2011 installation of photographs and info-panels at Al Zubarah Fort plainly illustrated.

Archaeological objects from the recent excavations continue to form a core element in the dissemination program. In 2012, members of the finds and data management teams along with senior project management
have been actively involved with curatorial staff from the National Museum of Qatar in the selection, allocation, and story-line writing of objects from the excavations for presentation in the display galleries of the new and stunningly innovative National Museum building in Doha. One full gallery will be devoted to the legacy of Al Zubarah, with interactive experiences of life in the 18th and 19th century town linked to object displays. Other galleries with thematic topics, such as the sea and pearling, will also incorporate finds drawn from the QIAH Project collections, including the Pearl Merchant’s Chest described previously. A total of 202 objects, each remarkable for its representative individuality and heritage importance, have been transferred to the National Museum of Qatar, offering a deeper understanding of traditional practices in architecture, the decorative arts, household arrangements, industry, diet, food storage, fresh water acquisition, commerce, trade, pearling, fishing, personal life and children. Together, these cultural objects create an absorbing insight, notable for its immediacy, into the variety of social customs gathered at Al Zubarah and in hinterland settlements. It is expected that the museum experience created by the display of finds from Al Zubarah and other sites will convince visitors, both local and international, to make the journey of discovery to the northwest coast, where a well thought out sight-seeing experience catering for adults and children will await [see below, Section 5.B.i].

Complementing the museum program is an active commitment to publishing results aimed at public and academic audiences in newspapers, cultural magazines, scholarly journals, and on the web. In addition, the appearance of preliminary reports
in print and on the web – so-called ‘grey literature’ – has been prolific and speedy. Appendix 3 of the 2011-2012 End of Season Report lists a full publication profile. In the two years 2010-2011 and 2011-2012, QIAH staff members have authored seven major international, peer-reviewed journal and magazine publications. In addition, they have made a number of major contributions to newspaper features, other magazine articles, radio interviews, and video presentations on the work at Al Zubarah and in its hinterland (representative links can be found at www.miri.ku.dk/projekts/qiahp/). As the project work consolidates and prepares to build on the gains already made, the publication focus of the upcoming years is on developing a major international scholarly series of research volumes (most likely through Bloomsbury Qatar Foundation Publishing) supported by interactive web content housed on QMA servers. First volumes, already in the pipeline, will deal with the geomorphology of Qatar and the archaeozoology (especially fish) of the northwest peninsula.

In the last two years, presentation and dissemination initiatives have been set in place as core components in the archaeology programs of the QIAH Project. The impact has been immediate, with formidable gains being made in fostering a deeper appreciation of Qatar’s extensive Arab and Islamic heritage. The results, in museums and the media, promise to inform an international audience as Qatar looks forward to the nationally important hosting of the 2022 FIFA World CupTM. Furthermore, the contribution of an informed stream of heritage knowledge will serve to promote, to a new level, a national understanding of the country’s history and culture in pursuit of the legitimate aspirations and strategic goals of the Qatari people as set down in the Qatar National Vision 2030 document.

For further information see:
End of Season Report 2011-12, Appendix 3 (List of Publications)
2.B. Supplementary historical details

2.B.i. Origins of Al Zubarah

While the conventional historical accounts attribute the foundation of Al Zubarah to tribal leagues of Arabia and the Gulf, the archaeological work of the 2010-2011 and 2011-2012 seasons have given significant insights into the nature of that event, revealing a ‘roll-out’ approach to the foundation of the town.

In ZUEP01 [above, p.12], a densely acculturated deposit of sand and mixed cultural material was uncovered directly under the main 18th century architectural phase. This important occupational phase, not associated with any stone architecture, was characterised by more transient structures notably tents and/or palm leaf huts (barasti). Nonetheless, the occupational time-span was considerable as indicated by the numerous postholes and the intercutting rubbish pits, tannurs, and hearths, evidence that these structures underwent numerous rebuilds and repairs. Most significantly, a degree of settlement planning was already in place, as these structures were orientated in a northeast to southwest alignment, with rubbish pits to their northwest. The pottery associated with this settlement indicates that, while some earlier ceramic forms are present, they are intermingled with types from the architectural phase which suggests that foundation transient structures cannot be much earlier in date.

ZUEP01 also revealed the progressive occupation and utilisation of space that occurred in this area, a process most likely to be more widespread in the settlement of intramural Al Zubarah. Compounds were delimitated by the main arterial routes that were carefully and systematically laid out to transverse the town from coast to circuit wall (generally west to east), as the architectural phase progressed. Evidence from ZUEP01 shows that, as settlement expanded, once vacant areas adjacent to established compounds were developed to support production and domestic activities, indicative of population and economic growth. In
some instances, the function of buildings and open areas alike saw change, such as the conversion of a date syrup production area into domestic use [see especially End of Season Report 2011-12, pp. 7-16].

Overall, there is scant archaeological evidence to date of any significant settlement at Al Zubarah before the establishment of the town in the 18th century CE. This is not particularly surprising given the lack of decent water supplies. The first phase of tents and huts in ZUEP01 would seem to predate the main architectural phase by a few decades only; however, continued work in the coastal location of ZUEP02 may challenge this conclusion given its proximity to a most suitable landing spot for dhows. Work on the outer areas of the town, specifically the large compound at ZUEP04 [above, pp.15-16], has failed to identify any pre-architectural phase, as the pits and postholes found cut into the natural substrata were, in all likelihood, an outcome of primary building activities. Nonetheless, it is unlikely that an earlier settlement – if any – was of any great size or importance, demonstrating the arrival of tribal settlers with their social, political, and economic ambitions was the inspiration and force behind the site’s rapid development. The coastal knoll of rock on which the town of Al Zubarah was constructed both defined and limited the layout of the settlement. On one side (the west) lay a broad, sheltered bay suitable as a harbour with extensive sandy beaches, while to the south, east, and north sabkha mudflats of differing ages served as a barrier to the easy movement of people and animals, with both positive and negative outcomes [see Fig 1 p.11].

Building upon the detailed planning of the site in 2009-2010, archaeological research during the 2010-2011 and 2011-2012 seasons has actively sought to explain the motivations behind the urban plan of Al Zubarah, and especially the crucial physical and, by implication, defining socio-economic linkages forged by the settlement with the sea and the scarp lands to the east. As noted earlier, work in ZUEP01 has documented the primary role of providing open access from the wall gates to the sea in the planning of the town, and how the paths so created set limits to the compounds – both large and small – that characterised the urban landscape of Al Zubarah. Here and elsewhere, such as ZUEP02, the evidence has shown that streets were continuously maintained with the primary objective of protecting the crucial lines of community connectivity well into the 19th century.

Within this town-wide framework, the compounds served by the street system had their own rules controlling access and circulation [above, p.12]. Space inside the residential units focused on a central courtyard, and each was separated into a reception and hospitality area, shielded from the living areas for privacy reasons, an area devoted to domestic activities such as cooking, and rooms for day-to-day living in a third area. This arrangement existed regardless of the size of the compound. While much of intramural Al Zubarah was given over to residential units (which, nonetheless,
did not preclude significant production and craft activities within these compounds), a picture of major functional stratification within the urban landscape is emerging rapidly from the archaeological work – the sort of detail that only a well preserved and intact site with an outstanding cultural integrity can produce. That Al Zubarah is an archaeological site virtually ‘frozen in time’ and available to detailed scientific examination, an undertaking fully supported by the Qatar Museums Authority, is an added and exceptional advantage in revealing and explaining details of the site layout.

Providing an important insight are the excavations in ZUEP02, where a commercial complex replete with warehouses supporting light and heavy crafts, foodstuff production, and commodity exchange were associated with a shopping precinct, located right on the beach in an area suitable for drawing up dhows on the shore. Significant is the unambiguous continuity of functionality in settlement of this area, characterised by a rebuilding of the commercial area, albeit on a reduced scale. Most likely this reconstruction followed the historically attested 1811 sack of Al Zubarah. Just to the north, perched on a ledge of bedrock jutting out into the bay, the substantial remains of a coastal fort can be seen, with two major phases of construction evident as with the markets. Even further in the same direction, the architectural features belonging to a large mosque can be seen stretching over a sizable area, associated with rooms and features suggestive of a major religious and educational centre.
Notable in the layout of Al Zubarah are the two levels of circuit walls. Earlier research in ZUEP01 had categorically shown that the Inner Town Wall post-dates significantly the Outer Town Wall (OTW), in that the inner wall was constructed directly over residential units dating to the main settlement of the later 18th century. Completion of work in ZUEP01 during the last two years has confirmed the accuracy of that conclusion, and shows that after the 1811 sack the less compact settlement covered a little under one-fifth of the original 61 hectares within the OTW. New, however, is the revelation of the deeply symbiotic relationship between the planned layout of the 18th century urban centre and the OTW. Given the difficulty of defending the ca. 2.5 kilometre length of the OTW, a service passageway was left open inside the wall, thereby facilitating a rapid response to any external threat. The evidence from ZUEP04 suggests that the OTW was erected sometime after the primary layout, if not construction, of the late 18th century town. Here the OTW accommodates the existing southern enclosure wall of the palace, with the wall tower being intentionally located midway between the two southern corner towers of the palace to produce a formidable defensive profile to the south [above, pp. 17-18].

While the last two years have gone a long way in achieving an understanding of the site layout and its social implications, and confirms the seaward aspect of the urban landscape, many new avenues of research have been identified as a result of this work, each worthy of detailed scientific study in the years ahead.

**Al Zubarah: Interaction with its surroundings**

The most recent seasons of archaeological research in northwest Qatar (in 2010-2011 and 2011-2012) have dramatically increased our knowledge of the relationships between Al Zubarah and its hinterland – both marine and terrestrial. The exceptionally well preserved core archaeological site corresponds with the pristine nature of its hinterland. Ground-breaking geomorphological research has revealed the extent to which the overarching importance of water acquisition was reflected in settlement profiles, the outcome of which has resulted in the identification by aerial and ground survey of a multitude of important villages, hamlets and encampments inland and on the coast [above, pp. 19-22, and the relevant sections in the referenced End of Season reports for the last two years].
The region of northwest Qatar, focusing on Al Zubarah, is a special case, in that a purposely engineered town was rapidly inserted within the midst of a populated landscape in the later 18th century, gaining immediate benefits from this existing social and economic structure while impacting on subsequent developments. As research stemming from the archaeological survey program has already shown, northwest Qatar offers an unparalleled case study into urban-rural dynamics in the 18th and 19th centuries and the role of these agents in the emergence of the modern states in the Gulf. The largely uncharted connection between, at times, the circuitous formation of modern Qatar and its recent past is no better documented than in the sometimes fraught relations between the competing settlements in northern Qatar – Al Zubarah, Freiha, Ruwaidah, and Fuwairit to name some of the most obvious candidates. The most apparent manifestation of these rivalries was the widespread fortification of water resources near to and far from Al Zubarah – the ‘secure and deny’ principle [above, p. 21]. Not only was the impact felt on Qatar’s neighbours, but also more widely throughout the Gulf region and the Arabian Peninsula; in some ways, the resulting cultural and political upheavals were not resolved until the 2001 judgement passed down by the International Court of Justice in The Hague. In this context, the exceptional contribution of Al Zubarah and its hinterland of northwest Qatar in fathoming the complex matrix of cultural, political, and economic ties throughout the whole Gulf region during the formative 18th, 19th, and early twentieth centuries stands without parallel, with unbroken relevance down to modern times.

A Basis for Prosperity

The final issue requiring review is the contribution of recent archaeological work on identifying and explaining the underpinnings of Al Zubarah’s very apparent prosperity in the 18th and 19th centuries. The long involvement of Arab communities in the harvesting, marketing, and transport of pearls in the Gulf stands as a testament to their commercial acumen, but undue emphasis on one commodity runs the risk of underestimating the cultural and economic complexity of trading societies. So while the pearling narrative still rings loudly in the composition of an economic history for the Gulf, the new archaeological investigations in and around Al Zubarah have and will continue to offer a more nuanced explanation for the foundation, expansion, contraction, and abandonment of permanent settlement at the town site and developments in corresponding settlements of the hinterland.

The primary placement of a large area of warehouses and markets in a central coastal location (ZUEP02, pp. 13-15), evidence for the production of and trade in commodities, and the diversity and richness of finds uncovered during the excavations [above, pp. 29-30] reveal that Al Zubarah served as a trading emporium on the mid-south coast of the Gulf, in which pearls (blatantly seen in the numerous marine weights recovered in ZUEP02 and a pearl merchant’s chest) played a crucial, but not solitary, part in Al Zubarah’s prosperity. In addition to the tangible objects...
listed earlier in this document, many less visible and intangible commodities (tobacco, sugar, coffee, and foodstuffs, for instance) would have been supplied on active trade routes. A recent study of organic remains from a midden at Al Zubarah has identified a range of grains, nuts, and fruits (including peaches, plums and grapes) necessarily brought in from Oman, India and Iran.

While commerce and trade, including pearling, were core activities in the maintenance of the town, cultural and religious life were equally significant in building a successful society at Al Zubarah. Most notably the mosque, prominently represented by a large example with auxiliary buildings north of the commercial zone of ZUEP02, created a focal point for scholarship and education in addition to its role as a place of community prayer. Encouraged by changing geopolitical conditions in the 18th century and the growing confidence and effectiveness of tribal leaders, the archaeological discoveries of the 2010-2011 and 2011-2012 seasons at Al Zubarah and in its hinterland have decisively demonstrated that for some fifty years this town throve as a major regional centre with extensive cultural, economic, and political links throughout the Gulf and beyond. While Al Zubarah’s heyday may have been relatively short, its powerful historical legacy lasts until today as an outstanding and exceptionally well-preserved example of a nascent Arab tribal community increasingly eager to exercise cultural, political and economic independence that had been long absent in the empire-dominated Gulf prior to the crucial 18th century.

In the last two years of research it has been possible to see, as has been demonstrated, not just a general broadening of our understanding of Al Zubarah Archaeological Site and its hinterland, but also a more nuanced and compatible conception of Gulf society in the decisive 18th and 19th centuries CE. Understanding this crucial age of transition into the modern world must rely, not solely but in a significant way, upon the recovery of new and almost unlimited information that can emanate from well-conducted and problem-oriented archaeological research. The last two years of work in northwest Qatar, summarised in this document and spelt out in full in the two accompanying and comprehensive End of Season Reports for 2010-2011 and 2011-2012, have highlighted the essential role of the peoples of Al Zubarah in these fundamentally important changes.
2.C. Archival Research, Oral History, and Underwater Archaeology

“ICOMOS considers that the results of the current QIAH project, based on survey and key targeted excavations, perhaps combined with more archival and underwater archaeology, and with more detailed surveys of the satellite settlements, are needed before a clear understanding of the development and phasing of the town, of precisely how it functioned in relation to the sea and to its desert hinterland, and of whether its urban plan is unique or typical, is forthcoming.” [p.103]

“Such work could usefully be augmented with archival and oral history research, and perhaps underwater archaeology around the harbour.” [p.107]

In 2011 an extensive program of archival research began, confirming that the phasing of the settlement currently known in its broad outline matches the phases of development known from historical sources. The development of a detailed understanding of the relationship between Al Zubarah, its hinterland and its maritime seascape is ongoing and further results are forthcoming, but the overall tenets and historical trajectories of the town’s relationship with the wider world, as well as its internal urban organisation and functioning, are at this point known and reasonably well understood. Since the Nomination File was submitted in January 2011, knowledge of the old town has deepened considerably.

Alongside archival research, an intensive collection of oral histories was initiated in 2011/2012, widening our knowledge of local history, customs and traditions, as well as deepening our understanding of specific features of the archaeological sites.

An overview of the results of both research programs will be presented below, followed by information on past results and future plans for underwater archaeological investigations in the Al Zubarah area.
2.C.i. Archival research

There is no single historical source that explains why or how Al Zubarah was established. Rather, the history of Al Zubarah requires an analysis of a broad range of historical and archival sources in order to understand the context in which the town was conceived, grew and ultimately collapsed. Potentially relevant archives, repositories and manuscripts have therefore been collated, and have revealed a limited and uneven, but nonetheless complex body of sources for the history of Al Zubarah and the Gulf in the second half of the 18th century.

The section below provides a short overview of the work undertaken, organised according to the main language of the source.

Ottoman sources

The başbakanlık Osmanlı arşivleri in Istanbul is one of the largest archival holdings in the world, with nearly 100 million documents. Material from here should, in theory, provide an Ottoman perspective on developments in the Gulf, which were previously much influenced by British Gulf historiography and the idea of European hegemony (Fuccaro 1999; Valenti 2011). Regrettably, the Ottoman administrative archives from Nejd and Hasa, kept in Baghdad and Basra, have been destroyed, and very few documents related to the Gulf in the 18th century are thought to have survived. Ottoman influence on the area of Eastern Arabia in the second half of the 18th century was negligent, although they kept a theoretical claim to it until 1870.

The Hijaz portfolios kept at the National Archives of Egypt is a rarely used source on the development of the first Saudi state, as seen from an Ottoman perspective, and could offer an insight into the expansionist politics that involved Al Zubarah from the 1790s.

Arabic sources

Only a few primary Arabic sources have been identified, owing to the fact that much of the Gulf’s locally written sources are currently still hidden in private libraries or are simply lost (Hakima 1965:14; Onley 2005:62; Slot 1993:386; Segal 2008:709). The forthcoming season of QIAH work will focus on an analysis of the works of contemporaneous Wahhabi chroniclers, with the intention of shedding light on the political milieu of East Arabia during the late 17th to 19th centuries. Among the sources included in this geo-political assessment of the region are Ibn Ghannam’s Rawdat al-Afkar wal-Afham, which ends in the year 1797; Ibn Bishr’s Unwan al-Majd fi Tarikh Najd from 1854; and the anonymous Lam’ al-Shihab from 1817, which was most likely collected at the behest of a British officer Robert Taylor (Davies 1997:132). These sources contain numerous references to Al Zubarah and northwestern Qatar, which have not yet been taken into consideration in modern research on the Gulf. Along the same lines, a comprehensive analysis will be done on Sirhan Ibn Sa’id Ibn Sirhan’s Kashf al-Ghummah al-Jami’ li Akbar al-Umma.
generally referred to as the Annals of Oman. The book ends with the events of 1728, but it contains a wealth of information on the political and economic development of the Gulf region up until that year. This text will supply important information to understand the dynamics of local politics.

Several sources relating directly to Al Zubarah have also been identified. Of particular interest is ‘Uthman Ibn Sanad’s Saba’ik al-Asjad fi Akhbar Ahmad Najl Rizq al-As’ad. This book, written in the early 19th century, is a biography on one of the wealthy pearl merchants that partook in the founding of Al Zubarah. Notably, the text includes references to religious and scholarly life in Al Zubarah and to the patronage of wealthy merchants. The author himself was the supreme judge in Al Zubarah.

Another source comes from al-Tabataba’i, a merchant and scholar who settled in Al Zubarah in 1766, where he wrote the poetic diary Rawd al-khill wa-al-khalil diwan al-sayyid, published in Beirut in 1964. In this volume he commented on local historical events and on the scholarly community established in the town.

One further scholar, Saleh al-Atiqi, who was responsible for the ‘writing office’ of Ahmad b. Rizq, has left behind so-called acquisition contracts dealing with buying and borrowing of books among the religious and scholarly community. The contracts are now kept in the family archive of the descendants in Kuwait. This information has kindly been shared with us by Dr. Imad al-Atiqi.
In the 1780s Al Zubarah merchants began to supply the inner Arabian tribes with commodities, especially coffee (Manesty and Jones 1791), thereby crossing trajectories with the Saudi expansionist politics. Another potential source is Kitab tarikh kayf kana dhuhur Shaik al-Islam Muhammed Ibn Abdul-Wahhab. Most likely written around 1803 by a Nadji merchant, this manuscript offers information on inland trade in Eastern Arabia (Fattah 1997:68).

The Zanzibar National Archives (ZNA) hold a rich collection of documents from the era of Omani rule (1800-1890) that until now has been overlooked by Arabian Gulf researcher (Bang 2008:349). These archives contain essential details on Arab trading diasporas in the Indian Ocean and their role and relations to mercantile dynamics in the Gulf region. Despite fluctuations in their political relationship, Omani Muscat was an important trading partner. The archives may also provide more information on the Omani dynasty’s shifting attitude to the Khalifa Utub, as well as the attack on Al Zubarah in 1811.

For various reasons there is a dearth of Qatari documents (Anon. 1998:6), particularly concerning the years before 1820 (Tuson 1991).

**Dutch sources**

When the Dutch East India Company went bankrupt in 1795, the Dutch state inherited their archives, leaving a large coherent body of material, a large portion of which is kept at the National Archives of the Netherlands. The material is particularly informative on the conditions in the Gulf prior to the establishment of Al Zubarah, but less so after 1766, when the company left the Gulf. The reports by Tiddo von Kniphausen from the 1750s are particularly informative about the history of the Utub (Floor 2007). This material is presently being digitised.

The largest archive by far on Dutch interaction with the Indian Ocean world is the central administrative archive in Jakarta. In contrast to other company archives, the collection was not discontinued in 1795. The archive is not digitised and has not yet been consulted in connection with Gulf research.

**Indian sources**

After the conquest of Bahrain, the Khalifah Utub had direct commercial ties with Surat, in Gujarat. Further research into archival material from this area seems therefore relevant. However, present research on Indian traders tends to rely on European sources (Nadri 2008), which could be seen as indicative of a lack of local sources. The only text identified so far is the Waqai-i Manazil-i Rum: Diary of a Journey to Constantinople (Hasan 1968). In 1786, Tipu Sultan, the Muslim ruler of Mysore, in southern India, made attempts to expand his diplomatic and commercial network into the Gulf and sent there a group of diplomats. One of these, Abdul Qadir, kept a diary which has survived in the Waqai-i Manazil-i Rum. The text is only available in Farsi, with an English summary that does not always follow the structure of the Persian text (Brittlebank 2005:211), and it
provides valuable information on customs and local conditions, although information on the Eastern Arabian area is not of high quality.

**British sources**

The primary sources of textual information for the Gulf and Qatar are the archives of the East India Company (EIC). Although a private company, the EIC often acted as a state institution, assuming diplomatic and military functions; the material contained in its archives therefore presents a variety of information. There are two main repositories of EIC material relating to the factories (trading stations) of Gombroon (Bandar Abbas), Bushire and Bussora (Basra): the India Office Records (IOR) in London and the Maharashtra State Archives (MSA) in Bombay.

The IOR are administered by the British Library in London, and deposited at the Asia Pacific & Africa Collections. The series is made up of various texts relating to Persia and the Gulf (Tuson 1979). The central groups of IOR records relevant for Al Zubarah are the so-called Gombroon Diaries (reference numbers G/29/1, G/29/4, G/29/6-14) and the archive of the British Residency at Bushire (R/15/1/1 - 13) which covers the period 1763-1813. Of particular interest is G/29/25 (Report on the British Trade with Persia and Arabia, 1791) which contains two short sections dedicated to trade at Al Zubarah. All the historical material held at the India Office and concerning the Gulf is currently in the process of being digitised, courtesy of the British Library and sponsored by the Qatar foundation. A fully searchable website, available from 2015, will greatly assist and facilitate research.

The MSA contains records from EIC Bombay administration, including several papers relating to political history. Of particular interest are the Bussora (Basra) and Gombroon Factory diaries. A closer look at this archive is of interest, as it apparently contains material not systematically used in modern research. A selection of very central records on Eastern Arabia was compiled and edited by Hughes Thomas, 1856, and reprinted by Oleander Press in 1985. It contains information that Lorimer only partially included in his *Gazetteers*. The latter has, since its declassification in 1970, been the most used secondary source for the 19th century history of the Gulf, but it contains very little material on the 18th century. The MSA is housed in the Elphinstone College Building, Mumbai, an open-air structure built in 1888. As a result, the archive is not in optimal conditions and should therefore be a priority research focus in the near future.

Approximately 11,000 photocopied pages selected from the Bombay Secret and Political Department Diaries for the years 1778–1820 are kept at the University of Exeter.

In 2009 Sotheby’s auctioned off a collection of private papers belonging to Harford Jones (later Sir Harford Jones-Brydges), who served the EIC in Basra and Baghdad before becoming ambassador to Persia. The archive covers the period from 1783 to 1811 and therefore relates to the last 27-28 years of Al Zubarah’s history. The over 3100
items which formed the collection would document diplomatic and military events of the period and could offer invaluable insight into language, customs and trade. Sold for £217,000, its present location is unfortunately unknown.

Research into the local and regional history of Eastern Arabia and the Gulf in the second half of the 18th century is hindered by a dearth of primary sources. The difficulty in accessing some of the texts is a further limitation. As few events are covered or confirmed by other contemporary records, judging the validity of the sources is difficult.

Overall, there are at present only a few in-depth studies of the complex social and economic dynamics that facilitated the regional development and trans-regional trade in the Gulf during the 18th and early 19th centuries (Fattah 1997, Abdullah 2001 and Onley 2007 are noticeable exceptions). Even the most recent and thorough publication on pearling in the Gulf only utilised primarily IOR material, much to the author’s own regret (Carter 2012).

Owing to the nature of the data currently accessible, the written material uncovered so far clearly favours economic history [See Annex 4]. However, any informed discussion on trade should not just focus on merchants, trading networks and marketing statistics. Of equal importance is information on goods traded, reasons for trading and on the people involved in the exchange. Patterns of regional and international trade are closely linked with domestic consumer culture. Food and cloth belong to the category of human necessities and express social identities that are subject to change under external influences. A future research trajectory for the QIAH Project is therefore an examination of the published textual evidence with regard to what foodstuffs were traded and how these were consumed at Al Zubarah. This will be analytically juxtaposed with the data provided by the environmental and archaeological components of the QIAH Project.

An international workshop held in collaboration with Qatar University is currently being planned for late 2013. The present ambition of this workshop is to further identify relevant textual material in Arabic, Persian, Turkish, Indian, Dutch, Portuguese and English, and to make an assessment of the appropriate methodological approach to the sources.
Archival Research Short Bibliography


Valenti, P. C. 2011 Creating a New Historiography of the Persian Gulf: The Case of Qatar, New Middle Eastern Studies 1, 1-23

Zahlan, R. S. 1979. The Creation of Qatar. London: Croom Helm
2.C.ii. Oral History Research

During 2012 the QMA and University of Copenhagen’s jointly run QIAH Project’s Community Archaeology component focused its fieldwork on gathering oral histories and traditions. The collection of oral histories, folklore, stories and local traditions of the northwestern region enriched our knowledge of Al Zubarah and the surrounding sites, and of Qatar as a whole. This work also improved the level of acceptance and trust for the Project within the local communities, especially among the tribes of Al Shamal and their respected elders.

The process of interviewing started after researching details about the northern tribes of Qatar, as well as the basic history of the northern villages - including Al Zubarah - at the Qatar Foundation Library of Arab and Islamic Heritage for Education, Science and Community Development in Doha. A list of all the Al Shamal tribes, their internal divisions and their village affiliations was created. Interviewees were selected on the basis of their knowledge of specific topics, their tribal affiliations and village of residence before moving to Doha or Al Shamal, and their willingness to be interviewed. Many interviews with the elders of a tribe were conducted in the tribes’ majlis, an exclusively male gathering house or place of assembly. Women were interviewed in their homes or in the farms, a place of gathering during the weekends and on holidays. As for the interviews themselves they focused on various aspects, such as the history of the tribes of Al Shamal, their tribal affiliations their social, economic, and cultural traditions, as well as distribution and access to their water sources. Interviews also focused on

<table>
<thead>
<tr>
<th>Person name</th>
<th>Date</th>
<th>Location</th>
<th>Topic “in brief”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women folk of Mubarak Fadalah</td>
<td>Feb 12</td>
<td>The women’s majles</td>
<td>Information on women’s daily lives and activities. Included a field visit to collect the Kama[truffle]</td>
</tr>
<tr>
<td>Seif Al-Fadalah</td>
<td>Feb 13</td>
<td>Field visit to Majjar</td>
<td>The layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants. Water sources.</td>
</tr>
<tr>
<td>Husain al-Fadalah</td>
<td>Feb 13</td>
<td>Municipality of el Shamal</td>
<td>Follow up after June workshop. Asked about abandonment of villages, cleaning of sites, maps...etc.</td>
</tr>
<tr>
<td>Khaled Al-Kabasi</td>
<td>Feb 15</td>
<td>Al Kabasi Majles in al shamal</td>
<td>Discussed the details of al kabasi tribe including the list of their branches, Their villages and information about al arish.</td>
</tr>
<tr>
<td>Khalifa al-Kubasi</td>
<td>Feb 16</td>
<td>On site in al Arish</td>
<td>The layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali al Kubasi and his father</td>
<td>Feb 21</td>
<td>Um Qabrain</td>
<td>The water source and earlier town before the move to al Arish.</td>
</tr>
<tr>
<td>Khalifa al Kubasi</td>
<td>Feb 21</td>
<td>His farm house in alshamal</td>
<td>Life in al arish, food sources and education</td>
</tr>
<tr>
<td>Grandfather Eid bin Selham</td>
<td>Feb 25</td>
<td>In his majles</td>
<td>An 80 year old gentleman. Meet with me even while using an oxygen tank to breath!!...met for 4 hours. Main topic – fish traps and the sea</td>
</tr>
<tr>
<td>Mohammed bin Issa bin sloum Al-Kabasi</td>
<td>March 7</td>
<td>Al Jamal - Al Shamal</td>
<td>Review the layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali al Kubasi and his father Kahlifa</td>
<td>March 10</td>
<td>Fish traps of al shamil NW coast</td>
<td>A detailed tour of all fishtraps designation of owners, use, construction…etc.</td>
</tr>
<tr>
<td>Mohammed Saleh Ali al Fadalah</td>
<td>March 11</td>
<td>In his Doha Majlis</td>
<td>His life and war stories</td>
</tr>
<tr>
<td>Seif al Fadalah</td>
<td>March 13</td>
<td>Ruways port- in at shamil</td>
<td>Fishing</td>
</tr>
<tr>
<td>Khaled Ali al Kubasi</td>
<td>March 13</td>
<td>farmhouse- al shamil</td>
<td>Review the layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Mohammed bin Issa bin Mohammed bin sloum al Kubasi</td>
<td>March 19</td>
<td>In his Doha Majlis</td>
<td>Poetry and his life in alshamal</td>
</tr>
<tr>
<td>Mohammed bin onur aldasim al Kubasi</td>
<td>March 28</td>
<td>Site visit to Khwair</td>
<td>Village tour. description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali Shebib Manan’s</td>
<td>April 1</td>
<td>His Majlis in Abu Tholouf</td>
<td>Discussed his writings and the inhabitants of Abu tholouf wa al yasefyyah</td>
</tr>
<tr>
<td>Najla the wife of Mohammed bin onur aldasim al Kubasi</td>
<td>April 2</td>
<td>Visit her in her home</td>
<td>Discuss women’s life, work, traditional food and games</td>
</tr>
</tbody>
</table>

Dr. Saca
the interviewees’ recollections of their daily life in the now completely abandoned coastal villages of northwestern Qatar. An aspect that was discussed at length during the field visits were the fish traps (masaker) that dotted the coast of Qatar. Maps and aerial photographs were used for the interviews and a number of specific questions were prepared before the field trips were planned.

All of the abandoned villages dotted along the northwestern coast of Qatar were visited, and a number of them were explored in detail. Among the villages surveyed and researched are: Arish, Al Jumail, Al Mafjar, Al Khweir, and Umm Qabrain.

The results of the first season of research indicated that about 11-12 tribes used to live in the Al Shamal area and these tribes are further divided into fakhd and badidah (branch and family). These divisions create a framework to organise life and social relations, including water access, marriage, land ownership and village of residence. Each of the family groups lived in specific villages and the identification of tribal affiliation with villages was part of the results of the fieldwork season [See Annex 5 for a detailed report of results].

During the village visits the informants identified water sources for their village, and the patterns of distribution of water to the residences after it arrived at the village (by donkey or later by truck). Even though these days most of the structures are entirely or partially destroyed, it was possible to identify buildings and houses in the villages, as well as names of the owners and residents of the houses. Public buildings such as mosques, forts and schools were also identified, and in many cases it was possible to gather the names of students who attended the village school and the teachers who taught them. Walking through the houses the Community Archaeology team was able to better understand the layout of the villages and the internal division within each household, and how such divisions reflected the role of certain members within that society, as well as the role of men and women in the villages.

Fish traps were discussed by all the informants. They were the main means of obtaining readily available food and income for many of the villagers, so the structures were well maintained for years. It became apparent from the preliminary research carried out on these fish traps, that in the past they could be owned and used by both men and women. Each trap was owned by a family and often named after its name or...
that of a particular member of the family. The tribes who lived in these villages were familiar with traps’ names and their ownership and they did not trespass on the other people's fish traps. Ownership could be transferred between families or individuals by means of purchase. During fieldwork it was possible to identify the fish traps associates with the towns and villages of Al Zubarah, Freiha, Al Arish, Al Khweir and Al Khidaj. These structures are proving to be a great source of information on the social and economic life of the abandoned villages and further research is needed on these barely preserved structures.

Future community archaeology work will focus on continuing the field work and interviews with both Qatari men and women from the Al Shamal tribes, in an effort to build on the cultural survey started in 2012. It will aim to achieve a better understanding of life in the abandoned villages of the northwestern coast of Qatar. The history of Al Zubarah and its hinterland, as well as other aspects of culture and history of Qatar will be investigated whenever possible. Oral histories will be gathered on pearl fishing, trading, tribal movements, fish traps, land use, and water use; these issues proved to be key elements in these tribes’ past and present lives. The women of Al Shamal, who are considered by Qatari people to be “Tradition Keepers”, will become important contributors and information will be gathered on contemporary Qatari writers focusing on local history.

It became clear during the fieldwork undertaken that the tribes of Al Shamal are keen on seeing their villages preserved and infused with new life. Through general town hall meetings and workshops and through their leaders or elders, these tribes should be involved in the decision making process regarding the future of the abandoned villages.
2.C.iii. Underwater Archaeology

Since 2010 the State of Qatar has been engaged in a program of marine-archaeological surveys in cooperation with the University of Birmingham and the Hampshire Wight Trust for Maritime Archaeology. Recent maritime research close to Al Zubarah has focused on an area between Qatar and Bahrain, within Qatar territorial waters. As a part of this a large tract of sidescan sonar data was subject to analysis for sea bed anomalies and ground-truthing through diver inspections. Further work has involved sea bed characterisation and the recording of extensive - and mostly late Islamic period - pottery scatters on the sea bed.

The potential for the discovery of shipwrecks related to Zubarah is significant. Wooden vessels sunk in 1895 would have been close enough to the coast to have been salvaged for cargo and, where not destroyed by fire, for wood. However, investigations have, to date, not produced any significant finds of wrecks or other submerged features that can be directly linked to Al Zubarah. Given the shallow water any remains not covered by sedimentation would have decayed fairly rapidly with the most likely evidence for wrecks being the remains of exposed ballast. However, the examination of aerial photographs from 1958 and 1969 would suggest that extensive sedimentation has taken place, and any remains within the bay of Zubarah are probably buried below marine sedimentation. The discovery of any remains is likely to require significant programme of marine geophysics close to the coast. These investigations include analyses of the submarine landscapes associated with Al Zubarah, but to date have not produced any significant finds of wrecks or other submerged features that can be directly linked to Al Zubarah. The scientific results of this work have been preliminarily published in the Proceedings of the Seminar of Arabian Studies (2011 & 2012) and broadly disseminated through the independent portal www.qatararchaeology.com. Additionally, seasonal reports have been submitted to the QMA, and the outcomes of this work will gradually be incorporated into Al Zubarah Archaeological Site and its management plan.

Moreover, in 2013 the QIAH Project will begin a collaborative initiative with Marburg Universität, Germany, under the direction of Prof. Ralph Petersen. This initiative will aim at undertaking further investigations to scan the seabed of the Al Zubarah region, in order to clearly ascertain the need for possible underwater excavations.

2.D. QIAH Project Organisation

The QIAH Project was created in 2009 as an initiative by the Qatar Museums Authority, and is run in collaboration with the University of Copenhagen. In general terms, the Project aims to investigate, preserve and present to the public the Islamic archaeology and the cultural and natural heritage of northern Qatar, with a focus on the important UNESCO nominated settlement of Al Zubarah. It is one of the largest heritage projects in the Gulf region and involves more than one hundred specialists in archaeology, history, conservation, architecture, natural history, material science, geomatics, geology, heritage, oral history, dissemination and museum studies. In addition, the team is assisted by a labour force of about ninety persons. The QIAH Project also engages expertise from leading laboratories and companies in order to develop and perform best praxis.

The multi-disciplinary and holistic approach of the QIAH Project requires an efficient and comprehensive organisation to reach the goals defined by the QMA. A matrix structure has been designed to align all involved disciplines and secure the optimal coordination of specialists working within the wide range of sub-projects that single out Al Zubarah Archaeological Site as an outstanding international heritage site. This organisational structure will be functional throughout the capacity building phase defined in the Management Plan (2012-2019).

The matrix structure is organised according to three main levels: the management level (executive director and board of directors), administration and logistics, and the sub-projects level [see Fig 14 p.55].
The executive director is responsible for contracts between involved partners and between the QIAH Project and the QMA, as well as for legal and budget matters. The board of directors is composed of four directors representing each main disciplinary field:

- heritage, site conservation and community archaeology
- archaeology and object conservation
- history
- natural history and environment

Each director has responsibility for designing, staffing and running her/his component of the sub-projects.

The administration and logistics division is a shared capacity for all disciplines and sub-projects, necessary for an optimal and efficiently functioning fieldwork. Its main areas of operation are procurement, contracts, transportation, data management, finds management, photography and films, camp management, translation and editing, media and design, and coordination.

The sub-projects are those activities that the QMA and the QIAH Project jointly decide to carry out in a season of fieldwork normally taking place during the winter, when outdoor working conditions are optimal. Sub-projects are regularly described in Scope of Work documents agreed between the QIAH Project and the QMA, which also present work targets and estimations of required resources. An example of a sub-project is the work on the Palatial Compound (EP04). A number of specialist and general work force is allocated to such a project, and together they form the sub-project team. The EP04 sub-project includes excavation, conservation of architecture and presentation to visitors. For each main discipline a coordinator is assigned who is responsible for reaching milestones defined in work process diagrams. In the case of the EP04 sub-project three coordinators - one for excavations, one for building conservation and one for presentation activities - manage the workload for the team. Together, the three coordinators are responsible for the best possible workflow of the sub-project and they refer directly to the board of directors.

The interdisciplinary, holistic approach of the work undertaken at Al Zubarah Archaeological Site is a unique collaborative effort that has produced extremely valuable results, which have gone a long way to create a better picture of the past, as well as a sustainable heritage asset for Qatar and the world.
### QIAH Project Matrix Structure UNESCO Phase One, Year Two (2013)

**Executive Direction**

**Board of Directors**

<table>
<thead>
<tr>
<th>Heritage Management, Conservation and Community Archaeology</th>
<th>Archaeology and Object Conservation</th>
<th>Natural History and Environment</th>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Administration &amp; Logistics</strong></td>
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<td></td>
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<tr>
<td><strong>Logistics</strong></td>
<td><strong>Accounts</strong></td>
<td><strong>Travel &amp; Salaries</strong></td>
<td></td>
</tr>
<tr>
<td>Procurement</td>
<td>Contracts</td>
<td>Hotels &amp; Flights</td>
<td></td>
</tr>
<tr>
<td>Logistics</td>
<td>Data Mgmt</td>
<td>Digital data &amp; Maps</td>
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<tr>
<td>Travel &amp; Salaries</td>
<td>Finds Mgmt</td>
<td>Materials &amp; Objects</td>
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<tr>
<td>Travel</td>
<td>Photo &amp; Data Mgmt</td>
<td>Accommodation &amp; Admin</td>
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<tr>
<td>Photo</td>
<td>Camp Management</td>
<td>Cars &amp; Workmen</td>
<td></td>
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<tr>
<td>&amp; Data Mgmt</td>
<td>Editorial</td>
<td>Food and storage</td>
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</tr>
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<td>Data Mgmt</td>
<td>Media &amp; Design</td>
<td>Editing</td>
<td></td>
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<td>Mgmt</td>
<td>Coordination</td>
<td>Translation</td>
<td></td>
</tr>
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<td><img src="image" alt="Fig 14: QIAH Project Structure" /></td>
<td></td>
<td>Media</td>
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<tr>
<td></td>
<td></td>
<td>Design</td>
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<td>General Coordination</td>
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<tr>
<td></td>
<td></td>
<td>Project Structure</td>
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**Projects**

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</thead>
<tbody>
<tr>
<td>Al Zubarah Archaeological Site Excavation and conservation</td>
<td>Al Zubarah Hinterland Survey</td>
<td>Freiha Mosque Conservation; Fort Concept for Conservation; Site Presentation</td>
<td>Minarets, Al Shamal Municipality Conservation Area Conservation Plan and Structural Recommendations</td>
<td>Al Zubarah Hinterland Heritage and Tourism Management</td>
<td>Natural History and Environment Studies</td>
<td>Underwater Archaeology Survey</td>
<td>History Research on written sources</td>
<td>Data Handling Interpretation and Output</td>
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3. Revised Justification of Outstanding Universal Value, Integrity and Authenticity
3.A. Criteria under which inscription is proposed (and justification for inscription under these criteria)

The nomination of Al Zubarah Archaeological Site for inscription on the World Heritage List is based on criteria (iii) and (v) of UNESCO’s Operational Guidelines for the Implementation of the World Heritage Convention.

Criterion (iii) requires that Al Zubarah should:

“...bear a unique or at least exceptional testimony to a cultural tradition or to a civilisation which is living or which has disappeared”

The abandoned settlement of Al Zubarah is a unique testimony to the merchant and pearl trading tradition of the Arabian Gulf during the 18th and 19th centuries. The settlement was founded by Utub merchants emigrating from other towns and seeking a safe haven for trading during a time of great upheaval in the Gulf region. Over a very short period of time, Al Zubarah quickly rose to become the foremost centre for pearl-based trade and commerce in the region, and Qatar’s largest and most important town.

Al Zubarah Archaeological Site represents the only complete urban plan of an Arabian town strongly connected to the traditional practice of pearl fishing. Its unique combination of neighbourhoods, mosques, palaces, markets, defensive systems and a canal is in itself a unique testament to the achievements of Al Zubarah’s inhabitants. The town plan encapsulates and preserves key ideas about urbanism and town planning during the 18th-19th centuries, and it is the best-preserved record of its type. The individual neighbourhood plots, plazas, mosques and markets that are discernible from the town plan also reflect a significant degree of urban planning and control.

The different components of Al Zubarah’s urban plan show that the settlement was conceived and implemented from the outset. The fabric of the city shows both the sophistication of the planning principles, and the capacity of Al Zubarah’s rulers to control and direct the social and economic forces...
An Al Zubarah Archaeological Site bears unique testimony to the human interaction with both the sea and the harsh, desert environment of the region. Pearl divers’ weights, depictions of dhows, and imported ceramics show how the town’s development was driven by trade and commerce to a great extent, and that many of the town’s inhabitants felt a close connection with the sea. Al Zubarah’s natural harbour provided ample protection against piracy or bad weather, and it supported a sizeable pearling fleet, which travelled twice annually to the oyster banks along the north-eastern coast of Qatar.

A canal to the south of the settlement connected Qal’at Murair to the sea, allowing freshwater to be transported to supply ships, and goods to be ferried between the harbour and the fort. Intra-tidal traps built of low walls utilised the natural tides to catch fish in a complex, dense trapping system that can be found in association with numerous settlements up and down the coast, including Al Zubarah. These reflect an intensive exploitation of marine resources. Date presses (madbassas) found in the settlement, and traces of field systems found in Qal’at Murair show that the exploitation of the seas was complemented by an equally intensive use of Al Zubarah’s hinterland. Palm groves provided a food source for the settlement, while wells in and near Murair were the driving the creation of the town. Trade, commerce and pearling are ever-present in the archaeology of the town. Ceramics attest to trade links along the so-called maritime silk route connecting Al Zubarah with the Indian Ocean, eastern Africa, eastern and western Asia, and Europe. Its geographic location in the Arabian Gulf, between the Indian Ocean and western Asia, facilitated its rapid rise as a key commercial centre. The economic surplus and wealth created by this trade provided the financial and political basis on which the early modern, incipient city-states of the Gulf were created.

The abandonment of Al Zubarah at the beginning of the 20th century has helped to preserve the most detailed urban layout of an 18th-19th century pearl fishing and trading town anywhere in the region. The Nominated Property reflects the heyday of the pearling trade, during which the key trajectories of the Gulf’s early modern history were established, before the introduction of the cultured pearl brought this centuries-old tradition to an end. It can therefore be said that Al Zubarah stands today as the most complete and intact material representation of the role that the Arab world played in the formation of both modern trade systems, and an important precursor to the creation of independent Arab states.

Criterion (v) requires that Al Zubarah should:

“...be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change”
principal source of freshwater. Remains of enclosures provide evidence for the keeping of livestock, helping to feed the town’s population.

The town of Al Zubarah and the fort at Murair therefore formed a symbiotic, economic and social relationship. Qa‘at Murair protected the town’s crucial freshwater resource and two screening walls allowed people to safely transport water from Qa‘at Murair to Al Zubarah. The local geology and geography shaped the traditional settlement system in the area, with freshwater wells only existing on the higher ground to the east. These ecological conditions led to the establishment of small-scale settlements in Al Zubarah’s hinterland in support of the town. With Al Zubarah at its centre, the site and region represent an outstanding example of traditional human settlement, land-use and sea-use.
3.8. Proposed Statement of Outstanding Universal Value

*Al Zubarah Archaeological Site* is of outstanding universal value as the Gulf’s most complete and well-preserved town of the 18th-19th centuries connected to the practice of pearl trading and fishing. Until the introduction of the cultured pearl, and before the exploitation of oil and gas, the trade in pearls constituted the Gulf’s most important industry, employing up to a third of the male population in the region. It created large economic surplus and wealth at a time when the Persian Safavid Empire had lost political influence and importance. Pearling was the foundation on which incipient city-states were formed and gained wider regional influence and importance, laying down the crucial geopolitical, social, and cultural trajectories of recent Gulf history, which shape the region to this day.

Al Zubarah played a pivotal role in this historic phase of development, as it represented one of the most prolific and crucial international trading ports in the region. As a traditional settlement located in Arabia in which trade, commerce and hence social and cultural interaction and exchange were the underlying tenets, the Nominated Property relates to a number of socially and culturally relevant themes. The site reflects the history of tribal migration in the Gulf, as it was founded by merchants arriving from Kuwait and Basra in search of pearls. Al Zubarah also represents a unique mode of occupying a fragile desert ecosystem, which includes a particular system of water management. Moreover, during the mid to late 18th century, Al Zubarah was the Gulf’s most important trading hub, connecting the Indian Ocean with Arabia and western Asia, and highlighting how trade and exchange connected people from East and West economically, socially and culturally. Collectively, these themes highlight Al Zubarah as a non-European, traditional form of settlement, which encapsulates anthropological and social historical themes.

*Al Zubarah Archaeological Site*’s Outstanding Universal Value also pertains to the unique preservation of a complete urban town plan of an 18th-19th century pearling and trading settlement in the Gulf. Surrounded and
protected by a 2.5km long wall, the town extended over an area of 61 hectares. Due to the abandonment of the site in the beginning of the 20th century, the entire layout of the settlement is preserved in great detail, providing key archaeological and anthropological data on economic, social and cultural relations between the inhabitants of the town, as well as traditional pearling practices. This exceptional state of preservation is strengthened by the integrity and authenticity of the site, and it provides crucial information on human interactions with the land and sea, trade links, and social and economic relationships, which are engrafted and materialised in this exceptional assemblage of urban, historic fabric.

The site is today largely preserved in the form of low mounds, which mask the buried traces of traditional vernacular and religious architecture. The urban fabric of the Nominated Property includes courtyard houses, palaces, mosques, suqs, defensive walls and palm-leaf fishermen’s huts and tents. This represents a unique mix and assemblage of building types, the spatial organisation of which is preserved in outstanding detail across the entire townscape. The Nominated Property includes the entire town, harbour, canal, screening walls, cemeteries, Qal`at Murair and Al Zubarah Fort. Qal`at Murair, which was destroyed in the latter part of the 20th century, survives largely as sub-surface archaeology, but is an important, interconnected feature of the Nominated Property. The fort showcases how the desert’s most precious resource – water – was managed and protected, and how Al Zubarah’s rulers strategically protected access to it.

The integrity of Al Zubarah Archaeological Site is guaranteed, as it was abandoned in the early 20th century and being located far from any modern settlement, it has remained untouched by modern development. Only a small proportion of the site has been excavated and restored, and scientific reports have been – or are in preparation to be – published. The archaeological phases at the site are intact and showcase the development and evolution of the town. Al Zubarah Archaeological Site is under development to ensure the preservation and presentation of the site for future generations.

The Nominated Property is proposed for inscription under criteria (iii) and (v), as it is an outstanding example of a mid-18th to late 19th century pearl fishing and trading settlement, representing a traditional form of land– and sea-use, settlement and water management. Moreover, Al Zubarah is one of the last remaining localities that embodies the historical trajectories that shaped the economic, social and geopolitical landscape of the early-modern and modern Gulf. Al Zubarah Archaeological Site encapsulates the traditions and lifestyle of 18th–19th century urban populations in the Gulf, and reflects the relationship that existed between the people of the Arabian Peninsula and their natural environment.

The property is owned by the QMA, a distinct governmental organisation under direct control of the Amir’s Office. The large
Buffer Zone around Al Zubarah Archaeological Site protects it from the impact of any development plan being considered for the region, guaranteeing the preservation of not only the archaeological remains, but also of their setting and the surrounding landscape. The Nominated Property includes the 1938 Al Zubarah Fort, itself an important visitor attraction and a source of national pride, while Qalat Shuwail is inside the limits of the Buffer Zone. Given the strong existing governmental planning and development control, in which the QMA has direct input for the protection of archaeological and historic building assets, the Buffer Zone will guarantee the highest level of protection for this outstanding site.
3.C. Comparative Analysis

The Nomination File that was submitted to the UNESCO World Heritage Committee for the inscription of Al Zubarah Archaeological Site in 2011 contained a substantial catalogue of comparative sites. Among them are localities that have been inscribed in the UNESCO World Heritage List, as well as sites that for various reasons have not. As many of the sites directly comparable to the Nominated Property only are known historically, and their physical remains have either been lost or severely reduced as a result of natural disasters and/or modern development, Al Zubarah Archaeological Site may validly be considered of Outstanding Universal Value.

On page 92 of Volume I of the Nomination File, Al Zubarah is described as representing "...a unique and fleeting moment..." in the history of Gulf trade and its connection to more global mercantile networks. The last two seasons of excavation, combined with the augmented program of historical research, have nevertheless demonstrated that the substantial period represented by Al Zubarah is of crucial relevance to the development of early modern trading systems, and to the way in which these were gradually transformed into the coherent systems of the 20th century. Furthermore, Al Zubarah stands as the most complete and intact material representation of the role that the Arab world played in the formation of both modern trade systems and independent Arab states.

A range of other settlements in Qatar (Huweila, Fuwairit and Al Bida) are historically attested to have played similar roles as mercantile nodes sustained largely by the control and exploitation of local resources (i.e. salt-water pearls). The trade in these resources facilitated the interaction with the environment, as well as with local and regional communities. Over the last two seasons, significant work has been done on mapping other sites in north-western Qatar, and investigating the nature of their relationship with Al Zubarah. Al Zubarah Archaeological Site is thus placed within a significant cultural framework, but stands out clearly as the largest, most successful, and most intact manifestation of these trends.
In regard to positioning Al Zubarah within a more regional framework, Volume I of the Nomination File describes a number of sites in the Gulf, in which similar dynamics as those associated with the Nominated Property can be detected either historically or archaeologically (i.e. Nakhilu, Bandar Lingeh, Bandar Abbas and Bushire on the Persian coast; Kuwait City, Qatif, Awal/Manama and Muharraq in the Upper Gulf; and Muscat, Jazirat al Hamra, Dubai and Abu Dhabi in the Lower Gulf). This comparative analysis remains valid and clearly shows that Al Zubarah is part of a wide-spread trend in the Gulf region that combines the harnessing of natural resources, the cohesion of the littoral as a cultural entity, and the building of links to inland communities.

There can be little doubt that all of the Gulf sites mentioned in the Nomination File are comparable in their existential trajectory. However, following the last two seasons of work, the distinction between Al Zubarah Archaeological Site and its Gulf counterparts is more apparent than ever before. The vast majority of physical remains from this period have disappeared under the massive urban development of the 20th century. The taphonomic processes related to the Gulf sites have damaged most traces of any material culture pre-dating the 1970s, and it is solely due to the abandonment of Al Zubarah in favour of Doha that we are fortunate enough to have the intact and authentic example that this settlement constitutes. Its unique survival, combined with the ambitious and extensive program of research associated with Al Zubarah Archaeological Site, make it the only viable candidate to satisfactorily represent the many complex threads that make out the tapestry of 18th and 19th century Gulf societies.

While the State Party increasingly views Al Zubarah Archaeological Site in a much broader framework than was initially expressed in the Nomination File, its affiliation to, and major role in the extraction and trade of pearls remains evident. In this regard, it should be recalled that the activities and culture associated with pre-modern pearling in the Gulf have been recognised as being of Outstanding Universal Value to humanity by the UNESCO World Heritage Committee in 2012, when a number of both cultural and natural sites within Bahrain were inscribed as individual representations of one composite whole: Pearling: Testimony of an Island Economy. While the State Party considers the innovative nature of this combined thematic inscription commendable and appropriate, there can be little doubt that as a testimony of this specific cultural tradition Al Zubarah Archaeological Site is unsurpassed in both integrity and holistic authenticity.

A similar argument can be made for pearling communities outside the Gulf region. Some of the most prominent of these (e.g. Tutucorin, India; Jolo, Phillipines; and Nueva Cadiz, Venezuela) have been described in Volume I of the Nomination File [pp. 106-10], but it is apparent that as pre-modern settlements, the original and authentic nature of these sites has succumbed to modern development. Again the historical trajectories of Al Zubarah cause it to be uniquely representative of a trend that can be anchored at a local, regional and even global level. From the perspective
of intactness, *Al Zubarah Archaeological Site* stands as the most intact singular representation of a pre-modern cultural and economic activity that helped shape communities all over the world.

Comparative analysis in Volume I of the Nomination File considers a number of merchant settlements that have been inscribed in the UNESCO World Heritage List. The list includes the multi-period site of Qal'at Al Bahrain, which, in spite of its age and long lifespan, is of little direct relevance to the socio-economic and cultural dynamics represented by *Al Zubarah Archaeological Site*. Qal'at Al Bahrain represents, in fact, a much more sporadic and undocumented range of mercantile activities, which have in turn transpired over a much longer period of time than at Al Zubarah. The discrepancy between the two sites thus pertains to their nature as representations of World Heritage, and as our understanding of Al Zubarah grows, it is becoming increasingly clear that their comparison holds little scientific validity.

The *Land of Frankincense* (Oman) is the second UNESCO World Heritage Site to be considered in this regard. This is of considerable relevance, in that it reflects the important trinity of pre-modern economic development: valued resource(s), nodal site(s) and associated trade patterns. Like Bahrain's *Pearling: Testimony of an Island Economy*, the inscription of the *Land of Frankincense* in the UNESCO World Heritage List in 2000 was based on the combination of a range of different cultural and natural sites, which illustrated the complex diachronic relationships between natural resources, landscape creation, patterns of mobility and trade, and mercantile settlements. Even though it represents similar dynamics, Al Zubarah’s intactness and its extensive social, cultural, and economic links to its surroundings, reminds us that although the cultural trends associated with profitable and important natural resources are part of our heritage, such trends are often only sporadically represented in the archaeological record. This paucity of intact sites is the primary motivation behind composite inscriptions, and opportunities to scientifically investigate and professionally manage an intact and authentic site are extremely rare.

Both the rarity of such sites and the source of information that surviving intact sites constitute, is reflected in other UNESCO World Heritage Site inscriptions. The parallels provided in the Nomination File suggest how important and rare such sites are on the World Heritage List. No other site within the region in question constitutes a valid
comparison, and one is forced to move far beyond the geographic boundaries of the Gulf in order to identify appropriate parallels that have achieved inscription. In Burkina Faso, the ruins of the once great trading metropolis of Loropeni are one such parallel. Here, it was primarily gold that was the natural resource driving mercantile initiatives, but, as at Al Zubarah, the extraction and trade in gold saw a plethora of mercantile initiatives, commodities and sites developing in its wake. As such, it has provided scholarship, and indeed the world, with a substantiated glimpse into the great urban and mercantile traditions of continental Africa, and how these impacted everything from the creation of coastal emporia and the harnessing of resources, to the price of commodities in Europe and elsewhere.

A final comparison is offered in the Iwami Ginzan Silver Mine complex in southwest Japan. While this site’s comparative relevance to Al Zubarah was initially considered somewhat tenuous, the dramatic increase in empirical evidence over the last two archaeological campaigns has caused us to reconsider the relevance of this site in legitimising Al Zubarah’s claim to inscription. Again the similarity can be seen in the comprehensive societal impact that sought-after resources can have, and the material manifestations of human endeavours to control, profit, and grow from such resources. While the Nomination File sufficiently underlines the comparative relevance of the Iwami Ginzan Silver Mine to Al Zubarah Archaeological Site, the State Party finds it pertinent to emphasise that it was within the context of its ‘cultural landscape’ that the UNESCO World Heritage Committee found Iwami Ginzan worthy of inscription. Similarly, it is the broad programme of scientific investigations associated with Al Zubarah Archaeological Site, and the massive amount of relevant empirical evidence generated by these efforts, which more than suggest Al Zubarah’s cultural worth as an intact, authentic and indeed highly informative testimony to an important natural resource, and all of the human endeavours associated with it.
3.D. Integrity and Authenticity of the site

3.D.i. Integrity

The 18th century urban layout of Al Zubarah has been almost entirely preserved in situ. It is an outstanding example of a newly established, planned Islamic town during the 18th century. Not only do the town plan and monuments within the town maintain their original aspect, but the surrounding environment and related infrastructures – canal and field systems at Qal'at Murair – have also been preserved. The Nominated Property therefore shows an extraordinary degree of integrity and authenticity, with no modern incongruous additions to the architectural remains or any substantial modification of the original town’s street network.

Considering that other comparable towns such as Kuwait City, Abu Dhabi, or Manama have been completely modified in modern times, with the subsequent loss of their original layout, Al Zubarah offers a unique and invaluable example of 18th century urban layout and design, as well as town life, during the heyday of the pearling economy. Although Al Zubarah is the most extraordinary settlement of the region, aerial pictures show that it was part of a larger complex settlement and fortification system – still partially unknown – running along the northern Qatar coastline in the Al Zubarah area. The inscription of the Nominated Property in the UNESCO World Heritage List will boost research on this region and catalyse the scientific attention on the area, playing a positive role for its preservation and study.

Integrity is considered in the UNESCO Operational Guidelines as a measure of the: “wholeness and intactness of the cultural and/or natural heritage and its attributes”. The physical fabric of the property and/or its significant features should be in good condition, and the impact of deterioration processes controlled. Al Zubarah has kept its integrity as an abandoned town, since the site has lain in ruins following its destruction in 1811. Only a small part of the original area was resettled during the late 19th century.
The town plan has been largely preserved in the archaeological record and shows all the vestiges of an Islamic town.

The site has been protected since 1980 under the first antiquity law of the State of Qatar [see 5.B Protective Designation], and was listed as a heritage site by the National Council for Culture Arts and Heritage (now part of the QMA). The first archaeological excavations were carried out during the mid-1980s and throughout the 1990s. In 2009, a larger-scale comprehensive project, the Qatar Islamic Archaeology and Heritage Project (QIAH Project) was launched. The new project was initiated by the QMA, with the University of Copenhagen in charge of the scientific direction of the project, in order to investigate, preserve and present to the public the important remains of Islamic heritage in the northern part of Qatar. The Nominated Property consists of a large archaeological site currently under excavation and until now 2.5% of the entire town has been excavated. The QIAH Project aims to uncover and to present approximately 10% of the town in the coming years.

Parts of the Nominated Property were in the past fenced by the Ministry of Environment and the National Council for Culture Arts and Heritage, but a new, solid, long-lasting structure encircling the archaeological site has now been built. This fence, planned since 2005, guarantees the preservation of the integrity of the property. Now that the fence is completed, an additional guarding system strengthens the initial protective measures. The Nominated Property and the Buffer Zone are not inhabited and therefore no developmental pressure will endanger the site’s integrity. Furthermore, the conservation, monitoring and management mechanisms [in Volume 2 of the Nomination File and in the updated Management Plan submitted in December 2011] will ensure the medium and long-term conservation and maintenance of the site.
3.D.ii. Authenticity

Al Zubarah owes its high degree of authenticity as an 18th-19th century trading centre to the fact that it retains a high proportion of its original historic substance. Its authenticity is further guaranteed by the preservation of the totality of the former urban area and by its surrounding hinterland and related infrastructures.

The restoration work carried out during the 1980s focused on the then-excavated buildings and sections of the outer urban enceinte. To prevent further structural decay, old wall stones were re-used to complete or to rebuild parts of the wall structures. Other walls were more extensively reconstructed. In some cases, cement was used in these restoration measures, and walls were capped with a cement coat. The methods used in the 1980s are no longer acceptable today, but their actual impact is minor and does not alter the overall authenticity of the architectural and archaeological remains of the Nominated Property. Lack of maintenance during the past twenty-five years has resulted in substantial decay of the exposed walls.

To avoid further collapse of endangered wall structures, the initial phase of the QIAH Project included the backfilling of older excavation areas. In addition, the new excavation areas opened by the QIAH Project since 2009 are partly backfilled at the end of each field season [see Fig 15]. This is the best available, short-term method to avoid further collapse of fragile architectural remains, but can only act as a temporary measure as it does not facilitate a...
positive visitor experience. New conservation efforts begun in 2011 will protect the site in the medium- and longer-terms.

The QIAH Project respects the recommendations of international charters and follows the internationally-agreed principles for the protection and management of archaeological heritage. It notably respects the provisions of the Nara Document on Authenticity and of the ICOMOS Charter for the Protection and Management of Archaeological Heritage, in that reconstruction will not take place within the Nominated Property. The QIAH Project keeps an inventory of all archaeological structures and sites within the Buffer Zone of the Nominated Property. They are documented through Geographical Information Systems (GIS), providing the basis for the understanding of the settlement’s system and its history. In addition, GIS serves as the platform for the understanding of the settlement’s development. It will also serve as an essential tool for the continuous monitoring of the site, as foreseen by the Management Plan.

Ultimately, Al Zubarah Archaeological Site reflects the transition to modern systems of resource exploitation, processing, and trade on a global level. When considering this in combination with the site’s Outstanding Universal Value, its intactness and authenticity, as well as the comprehensive programme of research, conservation and management instigated by the State Party, Al Zubarah Archaeological Site should be considered worthy of the highest international acknowledgement in the form of inscription in the UNESCO World Heritage List.
4. Summary of Results of Conservation Strategy

“Complete and implement the Conservation Strategy, identifying the interventions desirable to stabilise the urban remains”

(From the World Heritage Committee’s Revised Draft Decision 36 COM 8B.19)
In 2009, the QIAH Project began studying and documenting the state of preservation of the architectural remains of Al Zubarah town. The goal was to define an appropriate conservation strategy for the exposed remains, which could ensure and protect the site’s unique integrity and authenticity. The conservation strategy had to fulfil a number of requirements:

1. It had to both protect and strengthen the structures in order for them to be preserved for future generations.

2. It had to take a certain amount of annual visitors into consideration.

3. It had to be a sustainable strategy that in addition to protecting archaeological remains, made them an understandable medium for explaining the town’s history.

The initial conservation strategy was based on a premise of stone architecture. However, studying the deterioration patterns and decay processes on site soon made it clear that, even though the architecture included stone as a primary building material, the structures as a whole have more in common with traditional Arabian adobe architecture than they do with the deterioration processes normally associated with stone architecture. In particular, the study of the decay processes of the building structures consolidated in the 1980s provided a basis to discuss different possible approaches to protect and preserve the fragile vestiges. As a consequence of the documentation of decay processes, and in consideration of the need to present this unique example of 18th century town planning in the Gulf to a wide audience, a revised strategy was formulated for the 2011-2012 QIAH fieldwork season, which has set the standards for future investigations.

**Conservation strategy (2009 to 2011): Preserving and protecting only**

In the initial approach, the QIAH Project set out to maintain the preservation of the town architecture in the exact state in which it was left after the completion of archaeological excavations. The primary objective was therefore to brace the beach rock wall stones with lime slurry. While similar in concept to the material originally applied, the new lime slurry differed in colour and composition from the historic plaster surfaces. There was no differentiation between wall faces and wall tops (with regards to materials and treatment) and no structural or aesthetic additions were made to the exposed architecture. The conservation efforts also refrained from levelling uneven wall surfaces. In general, the strategy appeared to have been best suited to traditional stone architecture.

**Conservation strategy (since 2011/2012): Preserving remains and making the architecture understandable**

Following in-field observations from 2010-2011, a revised strategy of conservation was formulated which implemented a more...
multifaceted approach to the technical and aesthetic challenges of architecture at Al Zubarah. The revised strategy includes the re-plastering/re-surfacing of wall faces to protect the actual building stones from erosion. Furthermore, there is a much clearer differentiation between wall faces and wall tops with a ‘double lined’ plaster ledge separating the wall plaster and the rough surface of the wall top. Both the treatment of surfaces and the visual characteristics of the new, currently lime-based plaster approximate the historic construction processes, in order to create a homogeneous appearance between original and conserved surfaces.

The revised strategy also entails a degree of structural rebuilding, including the restitution of architectural elements such as wall faces, niches, ledges and doorways. The consolidation of historic plasters includes the stabilisation of exposed surfaces, cementing cracks and border lines, filling voids and fixing loose components. In sum, the revised conservation strategy is specifically tailored to the characteristics of earthen architecture.

Although the aim of the consolidation of plaster remains and wall structures is to stabilise them and to reduce the impact of weathering, deterioration processes cannot be stopped or interrupted completely. Preventive measures, e.g. structural rebuilding, temporary propping and backfill will therefore help to minimise potential damages. It follows that, owing to the environmental conditions and the composition of the historic building materials, a regular maintenance and monitoring programme is required. Even so, because of the harsh environmental conditions and the weak
The first part contains basic information on Al Zubarah’s history and archaeology, environmental/climatic conditions, information on building materials and general deterioration patterns attested at Al Zubarah. General information on Gulf architecture and a glossary of architectural terms are included. The second part focuses on the Conservation Concept, its development and improvement. It contains the examination and assessment of previously executed consolidation work. Examples of characteristic architectural features are given to provide a basis for best practice. The third part of the Handbook, Conservation Manual, is built on technical instructions, organised according to a ‘fiche method’, where each fiche summarises a specific aspect of the conservation work. Starting with general topics covering Health and Safety regulations on site and how to deal with specific materials, the manual presents a step by step description of the conservation concept and methods are compiled by the QIAH Project in a Conservation Handbook organised in three main sections: 1. Basics; 2. Conservation Concept; and 3. Conservation Manual.

The composition of the historic building materials, the conservation strategy will require a regular program of maintenance and monitoring of the architecture.

Protection and conservation measures undertaken in 2012 also involved the implementation of solutions to mitigate the impact of pedestrian and vehicular traffic approaching the site and within it. A first track (Track 1) leading visitors to the main points of interest was prepared in March 2012 in the southern part of Al Zubarah town and a raised walkway is being planned to improve its accessibility and minimise threats to the site caused by tourism pressure [see p.92]. The addition of walkways to the proposed three visitor tracks at Al Zubarah will give limited access to the site and protect the fragile vestiges from increased footfall by keeping visitors outside unexcavated areas of the town. Since March 2012 a marked vehicle track guiding visitors to an area designated for interim parking has limited the impact of vehicular traffic approaching the old town [see Fig 16 p.74]. Regulating access to the site can improve maintenance of the facilities and remains, as well as increase the protection of the natural environment within the borders of Al Zubarah Archaeological Site. Moreover, a service track running around the outer perimeter of the site and used by archaeologists to carry on working in the areas to be opened for tourism in the near future was established in November 2011. This service track will help to reduce the impact of the archaeological fieldwork on site.
conservation and consolidation work. Each work step is accompanied by images and text (see Fig 17). Relevant reports and documents are compiled in the appendices to the Conservation Handbook.

Implementation and Monitoring
Since 2009 the exposed building remains of Al Zubarah have been systematically documented and recorded within an inventory database. A priority list is then prepared on the basis of the inventory record. The analysis of priorities forms the basis for the preparation of the QIAH Project’s scope of work proposed annually to the QMA. Recorded damages and deterioration patterns are assessed by a group of experts (the Heritage Conservation Strategy Group) — including conservation architects, conservators, building archaeologists and archaeometrists — set up by the QIAH Project to define and revise chosen methods, materials and approaches. The Heritage Conservation Strategy Group meets at least three times per year to follow up on the conservation activities and optimise the conservation strategy. Every two years an international workshop gathers experts in the field of heritage conservation of archaeological sites to discuss the executed and planned conservation and consolidation work at Al Zubarah. The first workshop was held in December 2011 and the second and third ones are planned for March 2013 and 2015. The intense on site discussions during the meetings help to develop and update the conservation methods.

The state of conservation of *Al Zubarah Archaeological Site* has been carefully monitored and recorded since 2009 and details regarding the main features of the site in 2012 are summarised in this section of the Supplementary Dossier.

**Town walls**

Tower 8 of the Outer Town Wall was consolidated in spring 2011 as an initial consolidation work sample. Parts of the collapsed walls were rebuilt and the wall structure strengthened. Joints were re-pointed and wall stones on the wall base were exchanged to stabilise the structure. In the autumn of 2011 and spring of 2012 the town wall segment between Towers 8 and 9, including Tower 9, underwent a process of consolidation. The cement capping from the 1980s was removed as part of the work, and the wall tops were re-shaped with some stone material that will serve as a sacrificial layer. The inner wall face behind Tower 8 was excavated during the 2011-2012 season and consolidated afterwards. Here the exposed walkway was rebuilt to preserve the integrity of the town wall; the initially stabilised and consolidated wall will be re-plastered to protect the fragile stones and slow down the decay process.

**Palatial compounds**

The initial 2009 inventory record of the smaller of the two excavated palatial compounds (QMA4) was completed in 2012 with a 3D-laserscan record as a basis for the initial consolidation work, which is planned for spring 2013.

The larger compound (EP04) saw the first conservation tests on wall 4010 in spring 2011. During the 2011-2012 work season the vast majority of structures in the courtyard were consolidated. The walls were re-pointed and re-plastered to protect the fragile stones with a sacrificial layer. Partial rebuilding took place to stabilise the wall structure, to make the architecture more understandable, as well as to reduce the visual impact of the plaster coating. Historic plaster remains were consolidated and re-attached to the wall whenever possible. Floors were protected with a breathable membrane and covered
with salt-free quartz sand, to reduce the impact of salts on the materials. Most of the now exposed walls are stabilised and ready for re-plastering.

**Urban patterns:**
**Mosques, Streets, Quarters, Courtyard houses, and Fishermen’s huts**
The remains of two further mosques were identified in the town of Al Zubarah, bringing the total of identified mosques to four. Two are situated in the northern part of the town, respectively next to an industrial area (QMA3) and the so-called North House (QMA2); one further structure is located in the central part of the settlement and the fourth one is in the south-eastern quadrant, between the palatial compounds. No excavations or systematic documentation of the mosques have yet been carried out. All buildings are today in ruins, although photographic evidence attests to the fact that large parts of the south-eastern mosque were still standing in the late 1950s. During the 1960s the building seems to have collapsed completely.

In four excavation areas (ZUEP01, ZUEP02, QMA2, and QMA3) parts of the urban patterns have been uncovered, revealing courtyard houses as the predominant building type. The state of conservation of the courtyard houses in the different excavation areas varies significantly. While the architectural remains of the North House (QMA2), situated in the northern area of the town and restored in the 1980s, are in poor condition, the unconsolidated industrial area (QMA3) is better preserved, owing to the use of higher quality stone as building material. All of the earlier excavation areas are considerably affected by blown-in sand deposits. Although in general the industrial area is in a better state of preservation than the North House, it also needs intense conservation activities to preserve the building structures and some well-preserved plaster surfaces. In some cases the entire wall mortar has been blown out by the strong winds and only a dry stone structure has survived. As a first step, parts of the excavated structures were backfilled or stabilised with sand bags to avoid further collapse. At present the North House serves as a reference area to test conservation materials and concepts. The most recent record of the area (QMA2) was undertaken in April 2012 and three climate data loggers have been permanently installed to monitor on-site conditions.

In addition to the 2010 silicon mould copy of the well-preserved etching of a *dhow* found in the wall plaster of one room of the courtyard houses (ZUEP01, Space 102, wall 615), a high resolution scan was taken in spring 2011. The area is fully backfilled and a replica of the *dhow* etching is being commissioned for display in the area, to keep the original covered and protected as long as possible. Moving the etching from the site to the National Museum has been discussed, but until adequate facilities are available and a secure transport can be guaranteed, the etching will stay in place.
**Suq (ZUEP02/QMA1)**

In the *suq* area (QMA1) two different building phases were preserved, which resulted in very complex and difficult to read structures. Their 2009 state of conservation record was updated in 2012 with 3D-laser scanning. This record will be the basis for coming consolidation work. The newly exposed plaster remains (ZUEP02) were stabilised in 2012 and consolidated in situ during the excavation, before a systematic backfill took place.

**Qalat Murair**

Regular security patrols based at Al Zubarah Research Station and at the Fort since summer 2011 have minimised illegal waste disposal. A proposed fence around the site has not yet been implemented.

**Al Zubarah Fort**

As previously noted in the Nomination File [see Volume I, p.138], the survey of the state of preservation and the structural integrity of the Fort, which included a comprehensive timber survey, was carried out between December 2010 and March 2011 by the QIAH Project in cooperation with Alan Baxter Engineering. Although in the mid-2000s the Fort was equipped with floodlights and electricity, during the survey they all were found to be malfunctioning.

Before the restoration began, ample documentation of the state of conservation was undertaken using photogrammetry and 3D-laser scanning in cooperation with Hafen City University, Hamburg, Germany. On the basis of this documentation, a detailed record of defects, such as cracks and voids, and materials of the exterior facades was begun in spring 2012.

Phase One of the restoration was completed between November 2011 and June 2012. The aims of this phase were the replacement of damaged timber elements, strengthening the fort structure, and preparing the fort for its future as a visitor centre. The walkways built with concrete in the 1980s were replaced by a reinforced limecrete structure and cement plasters were replaced by a lime coating. Timber elements not infected or damaged were kept in place. Damaged structural timbers were replaced by termite-resistant hard wood [see Photo 31]. Alongside this work, tests were carried out to define ways to repair historic plaster surfaces, as well as structural cracks.
4.B. Ongoing conservation measures

Since October 2011 conservation work has been carried out on a large scale in three main areas: the outer town wall (segments 8 to 9, including towers 8 and 9); the exposed parts of the palatial compound (ZUEP04); and the consolidation of in situ plaster remains at the suq area (ZUEP02). A series of tests to define mortar materials and surface treatment in the context of the harsh environmental conditions were carried out in the area of the courtyard complex referred to as the North House (QMA2), located to the northeast of the suq area. Conservation materials for the consolidation of historic plaster surfaces were also tested in the same area. Data loggers were installed on-site and near Al Zubarah Research Station to record and monitor temperature and humidity data, leading to a better understanding of the climatic factors influencing the deterioration of building materials.

Conservation work is carried out by skilled European craftsmen and conservators, who supervise trained QMA staff and an untrained local workforce. The ongoing training of conservation teams by the QIAH Project is accompanied by an intensive research and study program aimed at developing and defining a revised conservation strategy, as stated above.

To ensure that the architectural remains exposed so far will be conserved to a standard appropriate to the level of protection required by the unique urban fabric of Al Zubarah – mainly composed of town walls, house remains and the street grid system - a program of initial consolidation work and repairs is proposed for the period between 2013 and 2015. Ongoing monitoring will be undertaken in the future to ensure the implementation and adjustment of the conservation concept.

Data from the conservation work is recorded at different levels. The state of conservation is documented with images, notes and sketches organised in an inventory database (Microsoft Access-based) linked to the main GIS-database of the QIAH Project through excavation point indicators and the use of the
same locus numbering. Photos are stored with Meta
data within the main Project database. In addition to
images, 3D-laserscans are also performed. 3D-data
provides the main basis for documenting applied
conservation measures with overlays and comparison
of scan data. Conservation work is recorded in
the inventory, as well as in separate reports. Daily
work processes are recorded in a site journal [see
templates in Appendix 9.3 and 9.4 to the Conservation
Handbook] and summarised in monthly reports to
the QMA. Reports are stored with unique document
numbers on the Project server/hard drive.

Architectural elements and finds - especially from
Al Zubarah Fort – are currently kept at Al Zubarah
Research Station. Replaced timbers from the Fort
are stored under the Research Station in a shaded
area with good air circulation, to prevent greying
effects and further damage by humidity. The timbers
are numbered and labelled to record their original
positions, which are mapped on the plans attached
to the timber survey report. All reports are included
in the End of the Season reports, as well as stored on
the main QIAH Project server.

Some of the timber elements are likely to be removed
at a later point to one of the storage units of the
Restoration Department of the QMA in Doha or to
a storage facility related to a future visitor centre.
Although whole timber parts are currently kept,
the Restoration Department of the QMA indicated
that only samples of the damaged timbers will be
preserved for the future. These samples will be
eventually displayed to show the damage sustained
by Al Zubarah Fort. Object conservation measures
are planned only for these samples. Other finds are
recorded as archaeological finds and follow
the procedures explained in section 2.A.iii on
page 25.
Action Plan for program of initial conservation and maintenance of Al Zubarah Archaeological Site

2012/2013

**Town wall (segment 8 to 9):**
Re-rendering (including towers)

**Town wall (segments 17 to 18):**
Removal of soil deposits, documentation, consolidation of wall structure and foundations, removal of cement capping and re-shaping of wall tops, re-plastering

**Palace (EP04):**
Continued conservation following archaeological work

**Suq (ZUEP02):**
Consolidation of in situ plasters and initial consolidation of walls according to archaeology

**Fortified compound (QMA4):**
Beginning of consolidation work
Action Plan for program of initial conservation and maintenance of Al Zubarah Archaeological Site

2013/2014
Town wall (segments 16 to 17, including towers 16 to 18):
Removal of soil deposits, documentation, consolidation of wall structure and foundations, removal of cement capping and re-shaping of wall tops, re-plastering

Palace (EP04):
Continued conservation following archaeological work

Suq (ZUEP02 + QMA1):
Consolidation in situ plasters and initial consolidation of walls in QMA1 according to archaeology

Courtyard house (ZUEP01):
Start of conservation and consolidation work

Fortified compound (QMA4):
Continuation of consolidation work

2014/2015
Town wall (segments 6 to 8):
Removal of soil deposits, documentation, consolidation of wall structure and foundations, removal of cement capping and re-shaping of wall tops, re-plastering

Palace (EP04):
Continued conservation following archaeological work

Suq (ZUEP02 & QMA1):
Consolidation of architectural remains according to archaeology

Repairs according to state of conservation

Record of State of Conservation to prepare ICOMOS report

2015/2016
Town wall:
Maintenance according to state of conservation

Palace (ZUEP04):
Continued conservation following state of archaeological work and maintenance

Suq (ZUEP02 & QMA1):
Continued consolidation of architectural remains according to archaeology

North house (QMA 2):
Start of initial conservation work

Repairs according to state of conservation

Industrial area (QMA3):
Initial conservation (optional)
Action Plan for program of initial conservation and maintenance of Al Zubarah Archaeological Site

2016/2017

Town wall:
Maintenance

Palace (ZUEP04):
Maintenance and conservation according to archaeological investigations

Suq (ZUEP02 & QMA1):
Maintenance

North house (QMA2):
Continued conservation

Industrial area (QMA3):
Continued conservation/consolidation

General repairs according to state of conservation and Conservation Handbook
The program of conservation and protection of *Al Zubarah Archaeological Site* undertaken by the QIAH Project in collaboration with the QMA focuses primarily on the technical activities necessary to protect and preserve the remains of the old town and fort carried out by international specialists. However, a second and equally important component of the program concentrates on building local capacity in the field of conservation techniques among professionals, and creating a skilled workforce to undertake the delicate aspects of restoration that will be crucial in the future to the maintenance of archaeological structures throughout the country.

The legacy being created by the QIAH Project for the State of Qatar builds on several different aspects of training and capacity building. At the most basic level training sessions for a local workforce are being held at Al Zubarah on a yearly basis throughout the QIAH work season. The first training program for conservation techniques has taken place in January to March 2012 and a second and more intensive season of training, building on previously acquired skills, will be undertaken in the spring of 2013.

Capacity building for QMA staff takes the form of training courses offered in collaboration with the newly opened Qatar branch of University College London (UCL) [see Fig 20 p.85], as well as opportunities for networking and knowledge building offered by an already established cooperation among a pool of foreign experts in the field of restoration, who biannually convene in Qatar to discuss the conservation of *Al Zubarah Archaeological Site* during the QIAH organised workshop: *Conserving Al Zubarah*.

A further part of the conservation program focuses on dissemination of information in the form of production of two conservation manuals dedicated to Al Zubarah town and Al Zubarah Fort. In January 2013 the first edition of the *Conservation Handbook: Al Zubarah Archaeological Site* [see Annex 6] was completed; the volume will be regularly updated in the future according to the results of the implementation of the Conservation Concept. The production of a second manual, *Conservation Handbook: Al Zubarah Fort*, in collaboration with London-based Alan Baxter Engineering, is foreseen for 2014.
<table>
<thead>
<tr>
<th>SN</th>
<th>Course Title</th>
<th>Course Brief</th>
<th>Eligibility</th>
<th>Training Provider</th>
<th>Days</th>
<th>Time</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Cultural Technology</td>
<td>This course investigates the tools, techniques and implications of digital media in a museum environment. Topics will include social media, mobile interpretation, working with structured data and website design.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>4</td>
<td>9am - 2.30pm</td>
<td>13-16</td>
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<td></td>
<td>MIA</td>
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<td>2</td>
<td>An Overview of Museums</td>
<td>This course will give an overview of museums from multiple perspectives: their image, history, types, exhibition styles and techniques, education and visitor analysis.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>2.5</td>
<td>9am - 2pm &amp; 9am-11am</td>
<td>27-29</td>
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<td></td>
<td>MIA</td>
</tr>
<tr>
<td>3</td>
<td>Introduction to Oral History</td>
<td>This course will examine using oral history as evidence and will look at all the aspects of an interview such as how to ask questions effectively and how to bring out the various forms of narrative. The course will also briefly touch upon sound editing, transcribing, summarizing and archiving.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>4</td>
<td>9am - 3.30pm</td>
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<td>MIA</td>
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<tr>
<td>4</td>
<td>Archiving Oral History: After the Interview</td>
<td>This course considers all of those activities of oral history that take place once the interview has been completed, and it acts as an introduction to the expertise which the archivist of oral history needs to acquire.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>1</td>
<td>9am - 3.30pm</td>
<td></td>
<td></td>
<td></td>
<td>MIA</td>
</tr>
<tr>
<td>5</td>
<td>An Introduction to Aerial Archaeology</td>
<td>This course will cover the history, techniques and basic principles of aerial archaeology as well as its relevance to modern-day cultural resource management in the region. Aerial archaeology combines aerial photography, the interpretation of aerial photographs, creating maps and records.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>5</td>
<td>9am - 2.30pm</td>
<td>10-14</td>
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<td></td>
<td>TBC</td>
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<tr>
<td>6</td>
<td>Glass Conservation: Missing Links: what can we do?</td>
<td>This course will look at resins and colours used in the conservation of historical glass. There will also be practical exercises in the technique of gap filling and the use of resins and pigments.</td>
<td>QMA Employees with good understanding of conservation techniques</td>
<td>UCL</td>
<td>5</td>
<td>9am - 2.30pm</td>
<td>17-21</td>
<td></td>
<td></td>
<td>TBC</td>
</tr>
</tbody>
</table>
5. Supplementary material on Management and Protection of the Nominated Property

“Formalize the official approval of the Buffer Zone limits and the Madinat Al Shamal urban plan”

“Follow up the development of the Site Management Unit, operational on site since 2011”

“Monitor the effectiveness of the Management Plan”

“The World Heritage Committee recommends that Heritage Impact Assessments be renewed in case major infrastructural projects in the vicinity of the property should become active again, in order to ensure that these do not impact adversely on the town and its wider desert setting.”

(From the World Heritage Committee’s Revised Draft Decision 36 COM 8B.19)
5.A. Supplementary information on Protection of the Nominated Property

"ICOMOS considers that the protective measures for the property will be adequate when the Buffer Zone limits and the Madinat Al Shamal Structure Plan have been officially approved." [p.104]

The Buffer Zone around Al Zubarah Archaeological Site, as defined in Volume I of the Nomination File, has been approved by the Ministry of Municipality and Urban Planning of Qatar. The borders of the old town of Al Zubarah are marked and protected by a fence erected by the QMA in 2011, while the borders of the Buffer Zone are not protected by a physical boundary, but by the laws of the State of Qatar.

The State of Qatar is legally responsible for ensuring the highest possible protection of the Nominated Property in relation to the development of the nearby municipality of Al Shamal. The Madinat Al Shamal Structure Plan is currently being processed for approval in accordance with the established procedures of state. Formal approval is foreseen for 2013.

Furthermore, the Master Plan, which outlines Strategic Planning Objectives for Al Shamal Municipality, highlights the primary objective as: “Protecting and preserving the natural environment and historical resources, and promoting sustainable tourism and uses based on these resources”.

It goes on to stipulate that development restrictions in the protected areas will be enforced [QNP 4.9.6]. Two additional sections make it clear that growth will be constrained by the protected areas [QNP 4.9.8; 4.9.14]. With regards to infrastructure, the QNMP currently shows the positioning of planned road networks, which clearly avoid the defined Buffer Zone of Al Zubarah Archaeological Site [Figures 4.8 and 7.1 of the QNMP].
5.B. Supplementary information on Management of the Nominated Property

“ICOMOS considers that proposed management system for the property will be adequate when the management unit has been in place and the Management Plan has been further developed.” [p.106]

The Management Unit for Al Zubarah Archaeological Site has been fully operational since 2010-2011. As stated in the Al Zubarah Archaeological Site Management Plan [pp.18 and 25], until 2015 the Site Management Unit will be run jointly by the QIAH Project and the QMA. A QIAH-appointed Site Manager runs the activities at the Nominated Property in collaboration with a QMA-appointed Deputy Site Manager (position established in 2011). A QMA Facilities Management unit for Al Zubarah Archaeological Site was in 2011, following the appointment of a QMA Facilities Manager.

As discussed in the Management Plan [p.18], a QIAH-QMA mentoring system aimed at capacity building in the field of heritage in Qatar has already started in 2012. In 2011/2012 an Education and Outreach division of the Department of archaeology of QMA, headed by a QIAH Associate Director and staffed entirely by QMA personnel, has been set up on a permanent basis and is dedicated to developing and implementing educational programs in local schools, in collaboration with the Supreme Council for Education of Qatar.

At this time a Visitor Centre Coordination division is run by QIAH in collaboration with the QMA team from the National Museum of Qatar. As soon as plans for the new Visitor Centre for Al Zubarah Archaeological Site have taken shape, the scope and staffing allocation of this unit of the Site Management Team will be expanded. The Research, Conservation and Monitoring divisions of the Site Management team are currently entirely run by the QIAH Project, as until 2015 all research, survey, excavation and conservation activities at Al Zubarah Archaeological Site will be undertaken by the QIAH Project. By 2015 a state of conservation report for Al Zubarah Archaeological Site will be produced. In 2011-2012 a program of training in conservation techniques for selected workforce was started. Over the course of the next three years the program will aim to create a skilled workforce specifically trained to undertake all restoration activities at the old town of Al Zubarah.
5. B.i. Management Plan Effectiveness

“ICOMOS considers that proposed management system for the property will be adequate when the management unit has been in place and the Management Plan has been further developed.” [p.106]

The current Management Plan for Al Zubarah Archaeological Site introduces an efficient administrative system for the Nominated Property, which has already been in place since 2010. Further updates to the Management Plan are already planned for 2015 and 2019, as mentioned in the document [pp.39, 66], and will take into consideration the requirements of the Nominated Property at the end of Phases One and Two of the Al Zubarah Archaeological Site management process.

Aside from the previously discussed Site Management Unit, which is already in place, a system of regular cleaning and maintenance of the facilities at Al Zubarah Archaeological Site has been established, as well as permanent guards on duty at the Fort and at the entrance to the old town. Stations for two further guards, located within the fenced area at the entrance to the outer walls of Al Zubarah, have been provided in 2012, in preparation for the future opening of the site to tourism.

Besides the immediate concerns for the protection and preservation of Al Zubarah Archaeological Site, its natural environment and its historical structures, the Management Plan also outlines a program of technical and professional training of QMA staff and capacity building in the field of heritage management that characterises Phase One (2011-2015) of the Management Plan of Al Zubarah Archaeological Site [pp.18, 25, 36]. This program aims at creating a qualified workforce to operate with confidence in the field of heritage management and protection, which can eventually take over all aspects of administration relating to Al Zubarah Archaeological Site. During 2012 training of QMA employees has focused on participation to academic level courses offered in Qatar for the first time in 2012 by the prestigious UCL Q University. Approximately one quarter of the 29 full time students enrolled in MA courses on Archaeology of the Arab and Islamic World and Museum and Gallery Practice, or in the MSc in Conservation Studies are QMA employees, while approximately 180 members of QMA staff in total have attended short term courses offered by UCLQ [see Fig 21 p.90]. With the gradual increase in knowledge and more familiarity with current themes and issues arising in the field of heritage for QMA employees, the State of Qatar is actively focused on building a qualified workforce capable of undertaking the management of all heritage related activities in the country. As this process develops over the course of the next few years, members of the QIAH Project will run many of the daily administrative and research tasks pertaining Al Zubarah Archaeological Site in collaboration and consultation with QMA, while properly trained local staff will be gradually integrated into the national heritage management process.
### Numbers of employees of the restoration department

<table>
<thead>
<tr>
<th>SN</th>
<th>Course Title</th>
<th>Course Brief</th>
<th>Employees Working in Museums and Archaeology</th>
<th>Training Provider</th>
<th>Days</th>
<th>Time</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>employees</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cultural Heritage Protection and Research Training</td>
<td>This course will provide an incisive awareness of the role of historical sites and museums and the various contexts where conservation efforts are focused.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>5</td>
<td>9am-7pm</td>
<td>9-13</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>MA</td>
</tr>
<tr>
<td>2</td>
<td>Introduction to Contemporary Conservation</td>
<td>This course will provide an incisive awareness of the role of historical sites and museums and the various contexts where conservation efforts are focused.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>3</td>
<td>9am-11pm</td>
<td>10-13</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>MA</td>
</tr>
<tr>
<td>3</td>
<td>Conservation and Heritage Protection</td>
<td>The course will look at the ways one can use digital photography as an object in the museum. The course will provide an incisive awareness of the role of historical sites and museums and the various contexts where conservation efforts are focused.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>1</td>
<td>9am-11pm</td>
<td>10-13</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>MA</td>
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<tr>
<td>4</td>
<td>Art and Archaeology of Ancient Nabataea</td>
<td>The course will present an overview of the Nabataean cultures from the end of the Stone Age until the Medieval period.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>2</td>
<td>9am-11pm</td>
<td>5-6</td>
<td></td>
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<td></td>
<td>5</td>
<td>MA</td>
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<td>5</td>
<td>Mapping Living Heritage and Heritage Protection</td>
<td>The course will look at the ways one can use digital photography as an object in the museum.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>4</td>
<td>9am-11pm</td>
<td>10-13</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>MA</td>
</tr>
<tr>
<td>6</td>
<td>Dealing with the Public</td>
<td>This course will look at how staff should be prepared to deal with the public.</td>
<td>QMA Employees</td>
<td>UCL</td>
<td>2</td>
<td>9am-11pm</td>
<td>10-13</td>
<td></td>
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<td></td>
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<td>MA</td>
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<tr>
<td>7</td>
<td>Biodeterioration of Inorganic Materials</td>
<td>The course will look at the ways one can use digital photography as an object in the museum.</td>
<td>Employees Working in Museums and Archaeology</td>
<td>UCL</td>
<td>2</td>
<td>9am-11pm</td>
<td>10-13</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
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</tbody>
</table>
Risk Management

“Risk management is a subject that needs to be addressed as part of the further development of the Management Plan.” [p.106]

A Risk Management Strategy undertaken in collaboration with the Municipality of Al Shamal, the Ministry of Municipality and Urban Planning, and the Ministry of Environment, in accordance with Policies ENV2 and ENV4 of the Qatar National Development Framework (QNDF) for Al Shamal Municipality, will be part of any update to the current Management Plan, starting with the first update, which is foreseen for 2015. Policy ENV 2 deals, in fact, with management of cultural and environmental resources and risk assessment related to infrastructure development, climate change and rising sea levels, while Policy ENV 4 focuses on Coastal Zone protection and risk management. As Al Zubarah Archaeological Site lies within the core area of the UNESCO Al Reem Biosphere Reserve, which is officially designated as an environmentally protected area, the same legal protection enjoyed by Al Reem is applicable to the Nominated Property. Moreover, Al Zubarah Archaeological Site also forms an integral part of the Al Shamal Conservation Area [See QNDF 4.9.8], a part of Northwestern Qatar characterised by numerous sites of historic and natural importance, which are protected by law from spatial development [See QNDF 4.9.4; 4.9.8; Figures 4.8; 7.1 and Box 9]. The legally protected status which Al Zubarah Archaeological Site enjoys in the national legal system by virtue of its historical importance to the nation derives additional strength from the location of the Nominated Property, which lies in the Coastal Zone Area, in the Al Shamal Conservation Area, as well as within the borders of the Al Reem Biosphere Reserve.

Tourism Strategy

“ICOMOS considers that these concerns [tourism pressure] will need to be addressed by a discrete Tourism Strategy, as envisaged in the Management Plan.” [p.103]

“…the archaeological site itself has no visitors’ interpretive or instructive plaques. The ICOMOS mission was informed that a number of temporary informative panels are planned to be installed at the main excavation areas of the site. This is a subject that the Management Plan plans to address through a Tourism Strategy.” [p.106]

The QIAH Project has already undertaken the first steps to develop a discrete tourism strategy for Al Zubarah Archaeological Site, as outlined in the Management Plan.

Since 2011 the QIAH Project has started the process of gradually developing Al Zubarah Archaeological Site for visitors and particularly for purposes of school education. Promotional and educational booklets and brochures on the site were distributed in 2012 and temporary interpretive panels have been produced and placed on site [Photo 34 and Fig 26 p.93], while the first of three visitor tracks has been identified and marked out.
Future work is intended to enhance the visitor experience along the already existing southern tourist track (Track 1). As the terrain at Al Zubarah is not suitable for disabled access and the soft sands can make walking difficult for able bodied visitors, the addition of raised boardwalks made of entirely recycled and eco-friendly material would improve accessibility for children, disabled visitors and the general public, while also greatly reducing the impact of visitor traffic on the site, protecting the archaeology and the environment [See Fig 22 and Fig 23]. The creation of the recycled plastic boardwalks would not only improve the quality of tourism at Al Zubarah Archaeological Site, but it would also contribute to raising awareness about and promote the use of eco-friendly and sustainable materials in the field of heritage, while improving the sustainability of the site itself.

Each of the three planned independent visitor tracks will develop along raised walkways, each measuring 1-2km in length, and will provide a general overview of the site to all visitors [see p.93], but will also focus on specific elements of the town, telling a different part of the town’s history.

To further enhance the visitor experience at Al Zubarah Archaeological Site four series of new interpretive panels are planned. Panels will be developed over the course of the next few years and will be located along Track 1, to replace existing ones, along Track 2 and Track 3 as they are progressively developed. An additional series of interpretive panels targeted mainly at schools’ education will be placed at the info pavilion near Al Zubarah Fort to replace
5. Management and Protection of the Nominated Property

- Fig 24: Walking Tracks at Al Zubarah
- Fig 25: Bilingual information flyer
- Fig 26: Information booklet
- Photo 33: Information pavilion
- Photo 34: Information board
existing panels. Information panels will require review after three years and renewal within five. Additional digital media may be produced on a running basis.

Moreover, already tested educational and presentation material created through the use of cutting edge technology in the form of Augmented Reality applications for telephones will be produced to further enhance the visitor experience and entice people to enjoy heritage in alternative and modern ways [see Fig 27].

The opening of one visitors’ track on site at Al Zubarah town, complete with low impact interpretive material and infrastructure already in place, is planned for autumn 2013. This will be the first step in a gradual and low key tourism development strategy based on the progress of the conservation and research at the site.

While the Fort and town are closed to the public for conservation reasons information is available to tourists in proximity of the site in the form of interpretive panels. Information and promotional material about Al Zubarah Archaeological Site, such as brochures, booklets, postcards and a dedicated website, are also available [see p.93].
Feasibility Study

“…the ICOMOS mission was informed that a feasibility study is being conducted to examine potential locations. This will be completed in May or June 2012.” [p.106]

A feasibility study to assess the potential impact of a Visitor Centre at potential locations has not yet been completed, due to ongoing uncertainty concerning the future existence and potential location of a Visitor Centre dedicated to the whole northwestern Qatar region, the requirements of which will need to be negotiated in collaboration with UNESCO. Al Zubarah Fort will be developed into a modern visitor centre dedicated to presenting the cultural and natural heritage of Al Zubarah Archaeological Site and northwest Qatar. The presentations will be centred on three main themes:

1 The history and importance of the Fort and the restoration of a national monument
2 Al Zubarah and the excavation work undertaken at the site by the QIAH Project
3 The fragility of the natural environment of the area and the importance of protecting it

In late 2013 the interior of the Fort will feature rooms repurposed to function as a bookshop, a projection room and as exhibition spaces, while static presentations to be shown in the open galleries and towers of the Fort will be developed [see p.94].

The re-designation of Al Zubarah Fort as the first point of introduction to Al Zubarah Archaeological Site will ensure that visitors to Al Zubarah are not deprived of a modern receptive structure for tourism and will ensure that the development of any future construction of a larger scale Visitor Centre can proceed within the needed timeframe. At the same time it will give the iconic monument a new and important role that will see the historic structure continue its cherished existence into the future.

Monitoring

“ICOMOS considers that there is a need to further develop the monitoring indicators to allow them to provide a much more specific and technical record of the state of conservation.” [p.106]

The inventory database set up by the QIAH Project for the architectural remains of Al Zubarah contains several tools for a systematic record of their state of preservation [see Conservation Handbook fiche 6.1 and Annexes 9 & 10]. Permanent data loggers for temperature and humidity measurements were installed in the field and used as reference points at the Research Station workshop, in order to control the environmental conditions on site [see Fig 30 p.96 and Conservation Handbook, p.26 -31; fiche 6.2 & Annex 8]. In addition to visual, haptic, and photographic control,
lab-analyses of building materials and record 3D-laser scans are regularly performed within the framework of QIAH fieldwork, so as to achieve a better understanding of the context and to optimise protection measures. The combination of these monitoring procedures allows specialists to access and evaluate the executed work, and to record decay processes. Evaluation of the data will lead to context-specific methods and materials, which, in turn, will result in improved maintenance processes. All monitoring indicators will be regularly updated and improved on the basis of the results of the monitoring process and evaluations of the ongoing conservation [see Fig 31 p.97].

The *Al Zubarah Archaeological Site* Manager is responsible for the monitoring of the Nominated Property. Recording of visitor numbers is carried out by site guards and reported to the Site Management through monthly reports [see *Conservation Handbook* Annex 9.1]; damages to archaeological remains, as well as infrastructure such as walkways, panels, etc., caused by visitors should be reported immediately to the Site Manager by the site guards or by QIAH staff. Guards should check the state of visitor infrastructure (e.g. vehicle track, track fence, parking, walkway, and information panels) on a daily or at least weekly basis. If damages occur, a record sheet [see *Conservation Handbook* Annex 9.2] should be sent to the Site Management Unit to start the repair/maintenance process.

All records are kept by the Site Manager and a double copy is sent on a regular basis to the QMA Headquarters in Doha. Record sheets and templates for different areas of monitoring have been developed and presented in detail in the *Conservation Handbook* [see Fig 31 p.97 and *Conservation Handbook* Fiche 6 and Annex 9 & 10].
MONITORING Site journal - How to record your work?

1. Keep a record of your work.
2. Weather conditions: Note temperature, wind intensity, and general conditions; cloudy, sunny, dry, humid etc.
3. Who is working: Names of colleagues and workmen (numbers)
4. What Activities and programme.
5. "Events": visits, injuries, etc.
6. Photo documentation of work: at least one image in the morning (before the work starts), one before the main breaks and one at the end of the workday.
8. Typing in the site journal data and save the report as a pdf (see templates in Appendix 9; especially 9.3 and 9.4).

### Table: Monitoring

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Frequency</th>
<th>Location of Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental parameters in Al Zubarah (temperature, humidity, rain, wind)</td>
<td>Daily record (Site Loggers) Record should be downloaded regularly</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Natural changes in earth-western Qatar especially within the Buffer Zone (satellite pictures - landscape scale)</td>
<td>Once a year (every second year or by notice)</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Infrastructure changes in earth-western Qatar (Zubarah Interface) especially within the Buffer Zone</td>
<td>Once a year (every second year or by notice)</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>No. of visitors to the Visitor Centre</td>
<td>Daily record (by Guard at the site entrance and/or at Al Zubarah Fort, for template see Conservation Handbook Appendix 6.1)</td>
<td>Hand written in duplicate copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Visitor experience (quality assessment of a visit to Al Zubarah)</td>
<td>Once or twice a year</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>State of conservation in earlier QMA excavation areas (Photos, drawings, reports, 3D scanning, etc.)</td>
<td>Once a year or every third year (according to internal recommendation in last monitoring). For Inventory categories and record sheets see Conservation Handbook Fiche 6.4 to 6.9 and Appendices 9.3 &amp; 10.</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA), Digital Inventory database</td>
</tr>
<tr>
<td>State of conservation in new QMA excavation areas (Photos, drawings, reports, 3D scanning, etc.)</td>
<td>Once a year or every third year (according to internal recommendation in last monitoring). For Inventory categories and record sheets see Conservation Handbook Fiche 6.4 to 6.9 and Appendices 9.3 &amp; 10.</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA), Digital Inventory database</td>
</tr>
<tr>
<td>State of conservation of non-excaeted structures (Photos, drawings, reports, 3D scanning, etc.)</td>
<td>General report every third year (according to internal recommendation in last monitoring). For Inventory categories and record sheets see Conservation Handbook Fiche 6.4 to 6.9 and Appendices 9.3 &amp; 10.</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA), Digital Inventory database</td>
</tr>
<tr>
<td>Damages caused by visitors</td>
<td>Daily, weekly or monthly report (check particularly after the weekend) see Template Appendix 9.3</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Damages caused by high tides</td>
<td>after observed high tides and each third year</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Damages caused by heavy rain</td>
<td>after observed heavy rainfalls</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
<tr>
<td>Damage to infrastructure (walls, panels, etc.)</td>
<td>Daily, weekly and monthly reports (by Guards and on-site personnel). Check daily by guards. Report only when damages against Far Guard use Template in Conservation Handbook Appendix 9.2</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QMA)</td>
</tr>
</tbody>
</table>
5. B. ii. Heritage Impact Assessment

An archaeological assessment of the impact of the Qatar-Bahrain Friendship Bridge and causeway has already been undertaken in 2008-2009. As the Qatar-Bahrain Friendship Bridge Project at present has been halted and there is no planned date for its construction, a new Heritage Impact Assessment will be commissioned if and when the project should become active again [see Fig 33].

Rubaiqah salvage excavations 2010 - 2011

Following the request of the QMA, the University of Wales investigated six areas within the site of Rubaiqah (A to F), a settlement located in the construction line of the Qatar-Bahrain Friendship Bridge and causeway and therefore in need of urgent protective measures.

The main features investigated are a large courtyard house (Area D), a multi-phased mosque (Area B) and a fort (Area A). Harbour facilities could not be identified. In contrast with that of Ruwaidah, the ceramic assemblage from Rubaiqah dates the site to the 19th and earlier 20th centuries, while Ruwaidah dates principally from the earlier 18th century. It therefore reflects the assemblages found in the late occupational phase of Al Zubarah.
6. Supplementary Documentation
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<td>Al Zubarah Fort</td>
<td>03/10</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
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<td>2</td>
<td>Digital Photo-tiff</td>
<td>Courtyard of Al Zubarah Fort under restoration</td>
<td>11/11</td>
<td>M. Kinzel</td>
<td>QMA/QIAH</td>
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<tr>
<td>3</td>
<td>Digital Photo-tiff</td>
<td>Restoration of Al Zubarah Fort roofing with traditional materials</td>
<td>04/12</td>
<td>M. Kinzel</td>
<td>QMA/QIAH</td>
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<tr>
<td>4</td>
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<td>Restoration of Al Zubarah Fort roofing</td>
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<td>D. Britton</td>
<td>QMA/QIAH</td>
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<td>5</td>
<td>Digital Photo-tiff</td>
<td>Visitor group being shown restoration of Al Zubarah Fort</td>
<td>12/11</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
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<td>6</td>
<td>Digital Photo-tiff</td>
<td>Qatari Scout group visit</td>
<td>01/10</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
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<tr>
<td>7</td>
<td>Digital Photo-tiff</td>
<td>School group with Project t-shirt</td>
<td>12/11</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
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<tr>
<td>8</td>
<td>Digital Photo-tiff</td>
<td>Demonstration of finds to school group</td>
<td>12/11</td>
<td>I. Saca</td>
<td>QMA/QIAH</td>
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<td>9</td>
<td>Digital Photo-tiff</td>
<td>Teacher group introduction at information pavilion</td>
<td>03/12</td>
<td>I. Saca</td>
<td>QMA/QIAH</td>
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<td>School pottery workshop</td>
<td>02/12</td>
<td>I. Saca</td>
<td>QMA/QIAH</td>
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<td>03/12</td>
<td>I. Saca</td>
<td>QMA/QIAH</td>
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<td>12</td>
<td>Digital Photo-tiff</td>
<td>Field visit to Umm Qabrain</td>
<td>02/12</td>
<td>I. Saca</td>
<td>QMA/QIAH</td>
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<td>YES</td>
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<td>13</td>
<td>Digital Photo-tiff</td>
<td>Fish traps with <em>sarouj</em> at Freiha</td>
<td>03/11</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<td>14</td>
<td>Digital Photo-tiff</td>
<td>School group visiting Al Zubarah Town</td>
<td>03/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
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<td>YES</td>
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<td>15</td>
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<td>Conservation of ZUEP04</td>
<td>03/12</td>
<td>M. Kinzel</td>
<td>QMA/QIAH</td>
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<td>Conservation of ZUEP04</td>
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<td>QMA/QIAH</td>
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<td>Courtyard of ZUEP04</td>
<td>04/12</td>
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<td>QMA/QIAH</td>
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<td>YES</td>
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<td>18</td>
<td>Digital Photo-tiff</td>
<td>Tower of ZUEP04 and Outer Town wall</td>
<td>02/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
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<td>YES</td>
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<td>Digital Photo-tiff</td>
<td>Aerial view of town houses in ZUEP01</td>
<td>03/11</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
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<td>YES</td>
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<td>Digital Photo-tiff</td>
<td>Aerial view of 18th century <em>suq</em> in ZUEP02</td>
<td>03/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<tr>
<td>21</td>
<td>Digital Photo-tiff</td>
<td>Aerial view of excavation of ZUEP04</td>
<td>01/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<td>22</td>
<td>Digital Photo-tiff</td>
<td>Plastered room (foreground) and ‘shell carpeted’ room (rear) in ZUEP04</td>
<td>03/12</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
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<td>23</td>
<td>Digital Photo-tiff</td>
<td>Midden deposits against the wall of ZUEP04 wall and tower</td>
<td>03/10</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
<td>QMA</td>
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<td>24</td>
<td>Digital Photo-tiff</td>
<td>‘Blind’ entrance to courtyard excavated in ZUEP04. Doorway blocked with rubble</td>
<td>12/10</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
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<td>25</td>
<td>Digital Photo-tiff</td>
<td>Plastered <em>hammam</em> in ZUEP04</td>
<td>03/11</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
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<td>26</td>
<td>Digital Photo-tiff</td>
<td>Stairs leading to upper story in ZUEP04</td>
<td>03/11</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
<td>QMA</td>
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<td>27</td>
<td>Digital Photo-tiff</td>
<td>Diving weights in situ in room in the later phase settlement in ZUEP02</td>
<td>12/09</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
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<td>28</td>
<td>Digital Photo-tiff</td>
<td>In situ ceramics on the floor of an earlier phase building in ZUEP02</td>
<td>01/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<tr>
<td>29</td>
<td>Digital Photo-tiff</td>
<td>Storage rooms and <em>mabdassas</em> in 18th century <em>suq</em> area, ZUEP02</td>
<td>03/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<tr>
<td>30</td>
<td>Digital Photo-tiff</td>
<td>Aerial view of Al Zubarah shoreline</td>
<td>11/11</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<td>31</td>
<td>Digital Photo-tiff</td>
<td>Spiral tower of Inner Town Wall overlaying earlier settlement</td>
<td>03/10</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
<td>QMA</td>
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<tr>
<td>32</td>
<td>Digital Photo-tiff</td>
<td>Section showing multiple levels of occupation and posthole-cuts below the Inner Town Wall</td>
<td>01/10</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
<td>QMA</td>
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<td>33</td>
<td>Digital Photo-tiff</td>
<td>Excavation of an 18th century street</td>
<td>01/11</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
<td>QMA</td>
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<tr>
<td>34</td>
<td>Digital Photo-tiff</td>
<td>Trench through midden mound against the Outer Town Wall</td>
<td>12/10</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<td>35</td>
<td>Digital Photo-tiff</td>
<td>Glazed and unglazed imported ceramics</td>
<td>01/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
</tr>
<tr>
<td>36</td>
<td>Digital Photo-tiff</td>
<td>Conserved pearl merchant’s box</td>
<td>03/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
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<td>YES</td>
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<td>37</td>
<td>Digital Photo-tiff</td>
<td>Conservator working on small finds</td>
<td>01/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
<td>QMA</td>
<td>YES</td>
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<td>38</td>
<td>Digital Photo-tiff</td>
<td>Conservation of pearl bead (from Freiha)</td>
<td>02/12</td>
<td>D. Britton</td>
<td>QMA/QIAH</td>
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<td>YES</td>
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<tr>
<td>39</td>
<td>Digital Photo-tiff</td>
<td>Aerial view of Al Jumail and Al Jumail mosque (from shore)</td>
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<td>D. Britton</td>
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<td>Aerial view of Shuwaik Fort</td>
<td>03/11</td>
<td>A. Pantos</td>
<td>QMA/QIAH</td>
<td>QMA</td>
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</tbody>
</table>

*QMA: Qatar Museums Authority.

P.O. Box 2777, Doha, State of Qatar

Tel: +974 4452 8770 Fax: +974 4402 8252 Email: smuhesen@qma.org.qa
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End of Season Report

2010-2011
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The QIAH 2010-2011 Crew Members:
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1. **INTRODUCTION**

1.1 **PREAMBLE**

The second season of archaeological fieldwork in Stage 2 of the Qatar Islamic Archaeology and Heritage Project (QIAH) in northern Qatar was carried out between November 1st 2010 and March 29th 2011.

The fieldwork was undertaken by the Department of Cross-Cultural and Regional Studies, University of Copenhagen in partnership with, and funded by, the Qatar Museums Authority. This report provides summaries of the main elements of the archaeological fieldwork carried out in 2010-2011, including substantial excavations in Al Zubarah and Freiha, rescue excavations in Ruwais/Khasuma, and extensive survey work at Islamic sites in various locations across the northern half of the peninsula of Qatar.

1.2 **PROJECT BACKGROUND**

Centring on the major political, cultural, and commercial settlement of Al Zubarah, which prospered in the later 18th and early 19th century CE, the University of Copenhagen was charged with investigating the Islamic era archaeology and heritage of northern Qatar in 2009. Since then the project has carried out three successful seasons of archaeological fieldwork.

Northern Qatar represents a remarkable region in which to study the emergence of economically, culturally and politically specialised settlements and communities during the early modern era in the Gulf. Al Zubarah is one of the most complete preserved cultural and commercial towns in the region, and holds key insights into the nature of urban societies in the Gulf, as seen through trade and economy, social life and status, and human lifeways. The site is embedded within a distinctive interrelated seascape and landscape, which consists of multiple coastal and inland settlements, wells, agricultural areas and temporary camps. Understanding the relationship between this rich historic landscape and urban settlement of Al Zubarah is a key aim of QIAH.

As part of this season, QIAH team members carried out excavations in five areas at Al Zubarah (see Section 2) and three areas in Freiha (see Section 3). In addition, the sites of Fuwairit, Qal‘at Shuwail, Ain Mohammad and Ruwais/Khasuma were mapped. A survey along the coastline between Fuwairit and Ras Laffan was carried out, while Philip Macumber’s detailed geomorphological survey of northern Qatar was continued (see Section 4).

1.3 **AIMS AND OBJECTIVES**

The purpose of this section is to briefly outline the beginning of season objectives for each of the main areas of study in the 2010-2011 season. These are listed as bullet points for brevity and convenience.

1.3.1 **Al Zubarah Excavation Point 1 (ZUEP01)**

- To clarify the nature of Compound 2 by revealing its full extent and to gain a better understanding of its phasing and the function of its rooms
- To understand the chronology of Compound 2 in relation to other compounds in the excavation area and other earlier and later features
- To expose more of the Phase 6 occupation in ZUEP01, excavating a deep probe in the higher ground to the north where the best survival of a long stratigraphic sequence is most likely, in order to better understand the early occupation at Al Zubarah
• Determine whether there is a further alley or street to the north of Compound 2 to enable the further study of Al Zubarah’s street plan

1.3.2 Al Zubarah Excavation Point 2 (ZUEP02)

• To continue to expose the Phase 5 architecture across the site, bringing the entire area into phase with the east-west running roads in the north and south

• To expand the excavations northward to link ZUEP02 with the QMA ‘souq excavation area’ to establish stratigraphic continuity between the two

• To determine the size and function of the important courtyard building beneath the current Phase 3 and Phase 4 architecture in the main area of excavation

1.3.3 Al Zubarah Excavation Point 4 (ZUEP04)

• To continue the excavations in the fortified, palatial compound by exposing all of the southeastern courtyard area and adjacent rooms

• To obtain further data on the date and function of the compound and the individual rooms in the courtyard area

• To excavate a further sounding into the midden between the compound and the outer city wall to obtain additional evidence for dating, diet and lifeways, as well as trace further the character of the outer city wall

1.3.4 Al Zubarah Excavation Point 5 (ZUEP05)

• This new excavation area targeted the sizeable midden mound number 7 in the northern part of the site in order to sample and obtain material culture and other finds for the reconstruction of the inhabitants’ diet, trade links, patterns of consumption, lifestyle choices, and cultural traditions

1.3.5 Al Zubarah Excavation Point 6 (ZUEP06)

• ZUEP06 was a small sondage excavated through the stratigraphic deposits to the north of ZUEP01 to examine the deposits in an area of higher ground through the whole sequence of occupation.

1.3.6 Excavations in Freiha

• To complete excavations of the mosque (FREP01) launched last year and to detail its history of construction and use

• To open a large area in the core of the settlement west of the fort to understand the site’s occupation in terms of chronology, economy, cultural traditions and trade (FREP04)

• To test excavate a series of areas to the north and northeast of the core of the settlement to better understand the phasing of the site and the earlier occupations suspected to be present here

1.3.7 Regional Survey

• To complete the town plan of Al Zubarah following on from the 2009 work, in particular the 1980s and earlier 2000s excavation areas

• To map a series of sites in the surrounding hinterland of Al Zubarah including, but not limited
to, Qal’at Shuwail, Musaykah, Ain Mohammed, Al Khuwair, Qal’at Thaqab, Qal’at Rakayat, Khidaj, Al Nabaah, Jumayl, Qal’at Yusufiah, Shadiraya, Ghariya, and Ruwais. This will enable a more detailed understanding of the development of Al Zubarah’s hinterland

- To conduct test excavations – where necessary – at selected sites to obtain securely stratified samples of material culture and associated finds to enable a dating profile for the surveyed sites
- To carry out a detailed geomorphological assessment of the landscape surrounding Fuwairit to better understand the site’s ecological and environmental setting and history
- To create the first ever map of Fuwairit by carrying out an intensive ground survey of the site
- To collect surface samples of ceramic and other finds
- To make a detailed assessment of the site’s preservation conditions

1.4 Methodology

1.4.1 Excavation

The project utilised the widely used single-context recording system (used in the previous season), which was adapted to the project’s specific needs. The system proved particularly useful for excavations in Al Zubarah, where complex urban stratigraphy was exposed across large open areas. At times, however, the system was adapted to allow for excavation in somewhat more arbitrary levels, wherever sondages had to be excavated (e.g. ZUEP05 and Ruwais/Khasuma). In addition to using loci/contexts to distinguish particular features, architectural units or sediments, so-called “space sheets” were used to group related contexts together coherently. A common site grid aligned on the Qatar National Grid (QNG) was used, which was sub-divided into 5x5 metre squares. All single context and multi-context plans were drawn at 1:20 on Permatrace, which facilitated the subsequent scanning and digitization of site plans.

Samples were taken following a pre-designed scheme, on which basis deposits were sieved differentially according to their perceived interpretative importance. Botanical samples were likewise taken from significant sediment loci (midden deposits, floors, certain fills), and a minimum of 30 litres was taken per sample.

A more detailed overview of the methodology is provided in Richter (2011).

1.4.2 Survey

The project’s regional survey utilised a variety of techniques, from remote sensing using satellite photographs, historic aerial images, kite photography and current aerial photographs, to fieldwalking and site mapping using a Total Station and Global Positioning Systems.

These techniques were employed differently at various sites. Total Station surveys were carried out at a number of key sites in the region, including Fuwairit, to create complete maps of these sites. Fieldwalking was carried out to collect representative samples of material culture for dating purposes. A further fieldwalking survey was carried out along the east coast of Qatar between Fuwairit and Ras Laffan.

Aerial imagery analysis was used to detect sites, characterise them, map their extent and understand their change in preservation over time. For this a combination of aerial imagery and historic map regression was used. Finally, kite photography was used to create overview images of sites to enhance documentation.
1.5 SUMMARY

On the following pages we discuss the excavations in Al Zubarah and Freiha, the regional survey work at Fuwairit, Ruwais and other sites, as well as the rescue excavations carried out at Ruwais/Khasuma. The report also provides a summary of the important finds analysis and conservation work carried out during the field season.
Figure 1.1: Map of Al Zubarah showing the principal excavation areas
2. **Excavations in Al Zubarah**

2.1 **Al Zubarah Excavation Point 1 (ZUEP01)**

Lisa Yeomans

2.1.1 Introduction

Excavations in ZUEP01 during the 2010-2011 season focused on understanding four features: two compounds, a street providing access to one of these compounds, and an external area to the north of this street (Figure 2.1). These were all built during the expansion of the town and are thought to represent architecture from Phase 5 of the settlement’s occupation. During this phase the town was at its largest with blocks of courtyard houses organised around a street grid enclosed by the outer city wall. The main phase of settlement ends with the sacking of the town in 1811, and further archaeological evidence for this was found in ZUEP01. Rebuilding of the town and the construction of the inner city wall enclosing the smaller Phase 3 settlement took place thereafter, and some residual walls belonging to buildings that may date to this time frame were recorded and removed during the 2009-2010 season. In addition to the archaeological sequence dating from Phase 5, numerous features were excavated that suggest extensive earlier occupation either prior to the 1760s expansion or representing the initial occupation associated with their arrival. Here, we highlight some of the discoveries from the 2010-2011 season and provide an overview of the occupation sequence in ZUEP01.

Figure 2.1: North-facing, overhead photo showing Compound 2 (centre), Compound 4 (centre-left), the street to the north that provide access into Compound 4, and the external space beyond north of the street
2.1.2 Phase 6 Occupation

The Phase 5 architecture was built on a layer of mixed sand and cultural material. So far this has only been exposed below the southern end of Compound 4 and below the northern half of the courtyard of Compound 2 as well as below Sp.147 and Sp.166, where the Phase 5 occupation sequence was fully excavated (Figure 2.3). The sand itself has not yet been excavated, but it seals a number of earlier, as yet unexposed, features, which were visible in the sections of several pits excavated here. A number of cut features truncate the sand layer, although only a small number of these features have been excavated so far. These were rubbish pits, fire-pits and tānnūrs (Figure 2.2) indicating the extensive occupation that predates the Phase 5 architecture. Spatially there is no particular distribution of these features, which may suggest that they were part of, or arranged with, temporary, ephemeral structures (e.g. tents or barāštī). Exposure and excavation of a larger area of features dating to Phase 6 is necessary before a fuller interpretation of the nature and date of the occupation can be made.

![Figure 2.2: Pot (7372) reused as a tānnūr pre-dating the construction of Phase 5 architecture](image)

2.1.3 Phase 5 Settlement in ZUEP01

The expansion of Al Zubarah in Phase 5 is characterised by the construction of large compounds accessed from a network of streets. Many of the compounds excavated so far are typical courtyard houses representing the domestic structures of the wealthier segments of the town’s population. Compound 2 is an example of one of these structures with an internal open courtyard surrounded by domestic rooms of various functions, from latrines and washing areas, to cooking and sleeping areas. Access into the compound was from an east-west aligned laneway to the south, which also provided access into a larger courtyard house (Compound 1 excavated in the previous season). Compound 2 underwent minimal modification during its use with the occupation deposits accumulating from use in a recurrent and consistent manner. This differs from Compound 4 which was altered in its layout and function throughout.

Although only part of Compound 4 has been exposed, its original function focused, at least partially, on the production of dried dates and date syrup with two date presses or madbasat constructed during the original layout of the compound. Compound 4, perhaps significantly, was accessed from a different street to Compound 2. Access was from another east-west orien-
tated street north of the two compounds, with the street also providing access into an open area (Sp.190) where numerous temporary structures were erected over time. The urban layout, as demarcated by the access from streets, appears to be divided into zones with the excavations at ZUEP01 covering wealthier courtyard houses accessed from the southern street and production orientated and temporary structures accessed from the north. Although Compound 4 was initially associated with production activities, by its final occupation it had developed into a domestic courtyard house.

The external area to the north of the street also developed during Phase 5 with a curvilinear structure constructed in the northeast corner of the excavation area. This structure (Sp.191) would probably have been a small domestic arrangement providing a space to cook and sleep for an individual or small group of people. Eventually a more substantial roof requiring a large post was constructed in the structure and a stone-paved floor was laid. At the end of the Phase 5 occupation of Zubarah Sp.191 was terminated by fire.

Figure 2.3: Plan of Compound 2 showing Space numbers designated to rooms within the courtyard house
Compound 2 is trapezoidal in shape and contained within the area of two streets converging to the east (Figure 2.3). Although the overall shape of the compound is trapezoidal, the individual main rooms, built along the inside of the external walls, are rectangular allowing them to be easily roofed. On the west side of the compound this resulted in the overall curvature of the external wall with a change of angle where the internal wall dividing Sp.147 and Sp.142 is built into the external western wall. The layout of the courtyard house utilised an irregular plot of land whilst maintaining the regular shape of the main rooms. Walls were generally constructed from beach rock and gypsum stones with those needing to offer more structural stability constructed from aeolianite. The internal sides of the walls were all plastered and several rooms had a plaster surface laid over a stone paved make-up layer.

The main rooms of the compound consisted of a rectangular entrance passage (Sp.132) with bench features built into this eastern and northern ends. This entrance passage would have blocked the view into the compound from the street and provided an area for visitors to wait. To the east of this room, on the south side of the courtyard, was a long rectangular space (185) with a plastered surface. The north side of this space was open with the roof supported by a central column. This room would have provided a communal sitting area (liwān), a common feature of traditional Gulf architecture. Along the western side of the compound was a hammām (Sp.151). The north side of the compound was occupied by a large room (Sp.150) which could be accessed from both the courtyard and Sp.147. This room had to be traversed to reach the smaller plastered room (Sp.142) in the northwest corner of the compound which may have functioned as sleeping quarters. It seems probable that Sp.147 was not covered allowing the breeze to cool down the plastered room Sp.155 through a wide, arched opening. A collapsed arch was recovered from here during the 2009-2010 season. The main cooking room in the compound was Sp.166 which is a small irregular-shaped room formed by the construction of the surrounding rectangular rooms. In the corner of the room a small area of the original floor surface impressed with a relief of matting survived (Figure 2.5). To the north of this was Sp.165 which was a very small room plastered on the inside with no means of access at ground level. There is evidence of a small second storey.
accessed by steps built into the internal wall just outside the kitchen (Figure 2.6). This upper storey would have been supported by three pedestals of masonry found in the southwest corner of Sp.166 and in the northeast and northwest corners of Sp.151. It is possible that the upper storey consisted of a wooden superstructure or may have been a flat, open roof space. It is unlikely that there was a full range of second storey rooms, however.

Occupation within Compound 2 resulted in the accumulation of debris in the small cooking room

Figure 2.5: Matting impressions on the plaster surface (7004) in the southern corner of Sp. 166

Figure 2.6: Steps providing access to a probable small second storey or tower
(Sp.166) as well as in the courtyard. A series of tannurs, fire-pits and hearths were excavated in this room although some cooking also took place in Sp.147 and the courtyard. A rubbish pit in Sp.166 produced an oil lamp discarded amongst the other rubbish (Figure 2.7). Towards the end of the occupation sequence in Compound 2 a large pit lined with stones, possibly used for bitumen processing, was dug into the courtyard. Modifications to the architecture of the courtyard house were limited to those used to reinforce its structural stability.

Figure 2.7: Oil lamp found in a rubbish pit in Sp. 166 from the occupation of Compound 2

Compound 4

As already mentioned, Compound 4 was initially constructed with two date-pressure or madbasat for the production of date syrup (Figure 2.8, Figure 2.9). Aside from the two date-presses, a small room (Sp.195) provided a wash basin as well as cooking facilities. The rest of the exposed part of the compound was left open but a number of hearths, stake- and postholes represent several temporary shelters or lean-tos erected to provide shade whilst working in the outside space.

The first major change in Compound 4 marked a considerable shift in use of the area and involved the dismantling of the upper parts of the walls of Sp.195 to form a large open space, which was re-surfaced. The nature of the occupation in this phase was characterised by numerous post-holes, hearths, one tannur and large rubbish pits. The surfaces themselves are the result of finely laminated occupation spreads, trample and patches of laid-down surfaces that built-up during the use of the area. The postholes represent temporary structures that would not all have been in use at the same time. There was also evidence of bitumen processing and other skilled activities (Figure 2.10).

After the enclosed area of Compound 4 had been used for successive temporary structures, similar in nature to the occupation north of the street, the compound was transformed into a typical courtyard house. Numerous walls were built forming new rooms (Figure 2.11) and another wall was knocked down and rebuilt to align perpendicularly with the new walls. The view into the courtyard was blocked with the construction of a partial wall along the line of sight through the entrance into the compound. Thresholds in doorways were plastered and had sockets for wooden doors and one of the old date-presses was converted into a latrine. A room specifically designed for cooking was built (Figure 2.12) with a wide open entrance from the courtyard.
Figure 2.8: View into Compound 4 from the street showing the two date-presses in use during the early occupation of Compound 4.

Figure 2.9: End of season plan of Compound 4, the street and Sp. 190 showing the date-presses Sp. 192 and Sp. 187 from the initial use of Compound 4.
Figure 2.10: Circular hearth and flue [7218] before excavation showing the scorched edges along the entire feature which cuts an earlier wall.

Figure 2.11: Newly created Sp. 181 forming one of the suite of rooms when Compound 4 was modified into a courtyard house.
Presumably as the family occupying the courtyard house expanded or gained additional wealth, further rooms were added and at times subdivided into small rooms (Figure 2.13). There was no evidence of destruction by burning the end of the occupation of Compound 4. However, two large storage jars appear to have been abandoned and these were subsequently smashed in situ by the collapsing walls of the abandoned structure.

The street

Throughout Phase 5 the street (Sp.189) to the north of Compound 4 was re-surfaced repeatedly with the earliest surfaces still to be excavated. Occupation debris had been trampled into the surface of the street forming numerous thin laminations of debris. All deposits from the excavation of the street were 100% sieved recovering large assemblages of pottery and bone, along with numerous coins and other artefacts. The amount of waste that accumulated in the street is highlighted by the presence of articulated fish bones. A series of plastered gullies (Figure 2.14) built onto the external sides of the walls facing onto the street would have managed the flow of water running off the building after heavy rain.
Figure 2.13: The eastern series of rooms during the final occupation phase of Compound 4 showing Sp.146 in the foreground and Sp. 161 and Sp. 163 in the background.

Figure 2.14: Drain capping stones <1816> sealing drain in the street fed from a plastered gully.
Open area to the north of the street

The occupation sequence to the north of the street remains to be fully excavated. The area is divided from the street by a low wall with a threshold close to the northern limit of excavation where the street navigates around Compound 4 (Figure 2.15). Numerous postholes cut the lowest surface reached during excavation, which would have resulted from a sequence of temporary structures. Following resurfacing, a number of tannurs were constructed perhaps indicating a slight shift in the temporary structures with the area exposed used as an external cooking space (Figure 2.16). In the north east of the area a curvilinear, un-plastered stone wall (enclosing Sp.191) was constructed. This is only partially visible within the limit of excavation and continues to the north and east beyond the excavation area. The western wall of the structure was robbed out, probably in Phase 3 when stones were needed for the construction of the Inner City Wall. Eventually a stone surface was laid and a large roof-support post was erected and held in place by a number of broken grind-stone fragments (Figure 2.17). Sp.191 remained in use for a while resulting in a number of surfaces and occupation debris spreads as well as hearths and a tannur within the room. Eventually, the occupation of Sp.191 ended when fire destroyed the structure. This fire resulted in the accumulation of a burnt deposit which was probably the remains of the roof that fell into the space when still alight as it also scorched the underlying surface. In section this burnt layer could be seen extending slightly beyond the wall of the structure, where it clearly sealed the final layer of street surface, indicating that the occupation of Sp.191 continued until the time when the street was abandoned. It seems possible, therefore, that the fire which destroyed structure Sp.191 was a result of the attack on the town in 1811, which terminated the occupation of the compounds and other structures built in Phase 5.

Figure 2.15: Access into the open area to the north of the street with the numerous post-holes and cuts for tannurs visible in Sp. 190
Figure 2.16: Tannurs (1822), (1825) and (1829) in Sp. 190

Figure 2.17: Structure Sp.191 showing the western wall removed by later robbing, and area of stone paving <1916>
2.1.4 Conclusions and potential for further work

The excavation of ZUEP01 in the 2010 to 2011 season has provided evidence from the occupation of the town during its main occupation phase (Phase 5). Large assemblages of pottery and bone, as well as numerous coins and other artefacts, provide dating evidence and information about the diet and status of these different groups, which will be analysed in due course. As most of the occupation sequence from Phase 5 of the settlement has been excavated at ZUEP01, the area now provides potential to examine the Phase 6 archaeological sequence over a much larger area. This will provide essential evidence allowing us to understand the earliest occupation of the site.
2.2 Al Zubarah Excavation Point 2 (ZUEP02)

Michael House

2.2.1 Introduction

Al Zubarah Excavation Point 2 (ZUEP02) is located inside the inner town wall of Al Zubarah slightly to the north of centre overlooking the beach about 50 m southeast of the QMA’s excavations of the area identified as the ‘suq’ (Figure 1.1 p. 5). Together with ZUEP01, this area has been the longest running excavation area in Al Zubarah and continues on from the previous season of work (see House 2011). As a result, most of the research aims remained the same with the overarching goal to try to gain a better understanding of the area and its function (either static or changing) throughout the development of Al Zubarah.

Last year’s discovery of a number of rooms with significant densities of broken ceramics strewn across their floors, suggested that they functioned as shop fronts (House 2011). This highlighted the possibility that at least some of the structures identified in ZUEP02 form part of the suq previously excavated by QMA. One additional aim this season was to verify this idea by extending the excavation area northward by 35 metre, linking it to the previous QMA suq excavation area.

Similar to ZUEP01, ZUEP02 preserves evidence for the most complete archaeological sequences of phases in Al Zubarah (Phase 1-5), showcasing the site’s development from the late 18th century to its abandonment in the early to mid 20th century. Apart from a few features in the newly opened northern extension, Phase 1 and Phase 2 were already completely excavated, recorded and removed during the previous season of excavation across ZUEP02.

The potential for exposing more of the suq area in ZUEP02 is of crucial importance for our understanding of Al Zubarah’s urban structure. Sughs and their attendant buildings and features were important hubs and centres of the urban life in many Gulf and Arab towns and cities. Given Al Zubarah’s history as a merchants and fishing port, excavations in the suq provide crucial pieces of information on the economic and social life of the settlement’s inhabitants. Understanding the relationship between ZUEP02 and the former suq excavation area to the north is, therefore, of prime importance. Below, the principal phases in ZUEP02 will be discussed in turn.

2.2.2 Phase 5

This Phase has been only partially exposed or excavated in the southern and central part of the excavation area. Excavations in the new northern extension and in the southwest of the excavation area have not reached this point (Figure 2.18).

The tops of walls, which appear to belong to Phase 5, have been partially exposed in the western part of the northern extension. These walls are largely north-south aligned and tacit observations suggest that they are in line with Phase 5 architecture exposed elsewhere in ZUEP02. Exposure and excavation of these structures in the northern extension will be a focus of future fieldwork.

Other than in the previously excavated parts of ZUEP02, as reported in House (2011), Phase 5 architecture and features were exposed in the north-eastern area. Here six rooms (Spaces 014, 015, 016, 024, 030 & 031) were revealed north of an east-west running alleyway (Space 003). Three of these rooms were already excavated during the previous season. To the south of this area there began to emerge a second large courtyard compound bounded to the north and south by roads. Four rooms and a corridor were excavated this season (Spaces 034, 035, 043 and 058), along with part of a fourth room located below the retained Phase 4 date press (Space 011). Three of the rooms were accessed only from a large central courtyard to the north. Prior to its blocking, the corridor (Space 035) linked three other spaces excavated last season (Spaces 025, 027, and 028) to a room as yet unexcavated to the north. Further excavations are necessary to fully expose this structure in plan, but the rooms thus far excavated provide an initial insight into the nature
Figure 2.18: Phase 5 Architecture
of this building. As is common across the site, and typical of the Phase 5 architecture, walls are rendered in gypsum or mud. The rooms appear to be partially dug into the natural, as gypsum plastered steps lead up from them into the courtyard to the north.

A large room (Space 045) was also excavated to the west, which was separated from the rooms to the east by the corridor (Space 035; Figure 2.19). Excavations in this room revealed a collapsed arched lying in the centre, the outside of which had been clad in plaster (Figure 2.20). Excavations down to the floor level produced a scattering of finds, which consisted of ceramics and the occasional coin. Particularly noteworthy was an oyster shell with a not fully developed pearl fused onto the shell. (Figures 2.21, 2.22). A discrete fire place was also found in Space 058.

Collapse in all of the rooms appears to reflect natural decaying processes, suggesting that the buildings were left open and fell down gradually. A large spread of broken ceramics in Space 045 suggests the in situ destruction of one or two large (water) storage vessels, which suggests that the room may have been used as a storage room towards the end of its use-life (Figure 2.23). During the beginning of the abandonment Space 035, the north-south corridor was blocked at the southern end, making it in effect an additional, narrow room. Numerous fish bones discovered here suggest it may have been used for processing fish.

As parts of this building decayed, Space 034 was used as a dumping area for residue from a presumably not as yet further clarified manufacturing process (Figure 2.24). A vivid orange brown deposit was found in-filling this room. This deposit was previously determined to have a high iron content, when it was found to the north of Space 003 (see last year’s report). These related processes of decay, abandonment and dumping of material represent the last stage of Phase 05 excavated during this season in ZUEP02.
Figure 2.20: Space 45 showing the collapsed spanning archway.

Figure 2.21: Oyster shell with fused pearl – found on the surface of Space 58
Figure 2.22: Oyster shell in-situ in the NE corner of Space 58

Figure 2.23: Crushed in-situ water storage jar on the floor of Space 45
Phase 4 was previously characterised as an ‘intermediate stage’ in the occupation of Al Zubarah. It follows on from the seeming abandonment and decay of Phase 5, which probably corresponds to the devastating effects of the 1811 attack on the town (Figure 2.25). This phase consists almost entirely of minute traces of settlement: postholes, stakeholes, tannurs and other fire places, single-course flimsy walls and patchy occupation floors. These mark what remains of ephemeral structures, such as tents or barāštī in the settlement, which sometimes utilised parts of old, abandoned buildings. This picture was reinforced by the findings from this season’s excavations.

The earliest of these features were cut into the orange-brown industrial waste discussed above, but these were quite shallow and are likely truncated. The next group of features were contained beneath a widespread levelling deposit and occupation horizon. This levelling deposit was brought in immediately prior to the construction of the Phase 3 architecture. Cut features appear in distinct clusters throughout the excavation area, but they are difficult to define as individual structures. Many postholes and stakeholes appear to have a quite random spatial orientation; although windbreaks built using stone and stake/post-holes were identified. It is very difficult, if not impossible, to clearly delineate contiguous arrangements, as many of these features may relate to multiple episodes of tents or other ephemeral buildings being situated in this area (Figure 2.26).

Although Phase 4 does not represent a complete hiatus in the settlement sequence of ZUEP02, it shows that the effects of the 1811 attack were likely quite dramatic, with much of the earlier stone architecture being abandoned, left open, or being replaced by tents and windbreaks.
Figure 2.25: Phase 4 open area plan showing the numerous cut features, two temporary structures and the date processing room Space 11

Figure 2.26: Phase 4 - SE view of temporary structure marked by low-lying stone surrounds
2.2.4 Phase 3

The majority of the archaeology excavated during 2010-2011 in ZUEP02 was linked to Phase 3. Some architectural elements of this phase had already been removed during the 2009-2010 season, while new elements were added in the northern extension where additional Phase 3 architecture was found (Figure 2.27).

In the south-western part of the excavation area only one room (Space 029) was excavated, leaving the date storage room (Space 011) behind (Figure 2.28). The date storage room will be excavated and removed in the forthcoming season. Space 029 was constructed in much the same fashion as almost all the Phase 3 architecture. Walls were rubble-built, with a stone core faced with larger selected beach stones bound by a loose mid grey or yellowish brown sand-and-lime mortar. Floors all consisted of shell layers, which appeared burnt in places. A small sub-dividing wall was built following the initial use of the room, splitting the room into two small square-shaped rooms. The building’s main entrance was located to the west.

A large proportion of the Phase 3 architecture is located in the western part of ZUEP02 and most structures had already been recorded in the 2009-2010 season, only requiring removal to pursue the stratigraphy beneath. This included spaces 007, 008, 009, 010, 033, 022 and 023. The trend is again one of ‘piece meal’ architecture, which is characterised by the use of poorer building materials and less carefully applied construction techniques when compared to Phase 5. This is an impression that is concurrent across the excavations in Al Zubarah. The first rooms to be built in the western area were Space 007 and 009 to the north, adjacent to the east-west running road Space 003. An enclosure wall linking these two spaces and enclosing a more or less square shaped courtyard was then built. The enclosure wall does not survive in its entirety having been partially demolished in the south as the compound was expanded. This was likely coupled with the construction of the large enclosed Space 005 to the south.

This latest extension of the enclosure was directly linked to the construction of the additional Space 008 to the north. When the compound was extended eastwards, Space 002 became part of a ‘north wing’ of this enclosed area. This was followed by the construction of two small rooms (Spaces 010 and 033) located south and north of Space 007 respectively. To the west of Space 007 a further room was constructed (Space 023), which was then connected to Space 007 by the construction of a further small room (Space 022). Both were associated with internal and external shell surfaces that served as floors. Space 022 was constructed in a much more flimsy fashion than either Space 022 or Space 007 to the east. A hard metalled surface was removed in this space during the last season, which may reflect a regular, heavy-duty use of the room.

The area to the east of this compound outside Space 022 and 023 saw a considerable amount of activity. This is attested by two tannurs that were built in the open, but sheltered from the winds by existing walls. Additional fire pits and a dumping area consisting of ash, fauna and some ceramics were located around the larger of the two tannurs

Returning to the compound itself, Space 009 saw a considerable amount of activity over its use-life. A southern doorway provided access to and from the enclosed yard (Figure 2.29), and it contains multiple floor levels which were cut by multiple, discreet pits, postholes and door socket/pivot holes. The constructional quality of this room can be considered as somewhat better than most of the other Phase 3 architecture, with more high-quality building material being used and more carefully applied wall rendering. Twenty cut features truncated the vast majority of the earliest floor level, which only survives at the eastern end of the room. Notable amongst the cut features were a row of three post holes that probably represent an internal sub-division of the room by a beam and palm frond construction. Several fire/hearth pits were found in the north and eastern parts of the room, in addition to one hearth-pit in the south-eastern corner.

These twenty features were sealed by a shell floor laid across the room. One dumping pit was cut
Figure 2.27: Phase 3 architectural plan
Figure 2.28: Eastern view of Space 29

Figure 2.29: Threshold in the southern wall of Space 09 allowing access to the courtyard
through the floor containing copious amounts of ash. One post hole near the southern doorway suggests that a new doorway may have been installed at this point. Two successive floors were then laid in the room, but only the latest of the two covered the whole extent of the room. Following the laying down of the first of these two later surfaces, another group of features that included post- and stakeholes were excavated, which may represent yet further subdivisions of this room. The last floor to be laid in this room produced evidence of only a single tannur.

Space 008 was a late addition to this compound in Phase 3 (Figure 2.30). It was built atop a levelling deposit covered by a mortar render. These were sealed beneath a floor, on top of which this room was built. Prior to construction three postholes, a larger pit and tannur indicate that this area saw some activity. A series of features – excavated in the last season – cut the remnants of the earlier floors in this room. Situated between Space 009 to the north and 007 to the south was the small room Space 033. This was a very ephemeral structure, which appears to have been heavily ‘robbed out’ with only a single course of stone remaining in place.

Space 010 was created in a similar process of construction as its counterpart to the north (Space 033) (Figure 2.31), with the insertion of a northeast-southwest running wall between the existing outer compound wall in the south and the southern wall of Space 007 to the north. Two small rectangular openings (vents?) were opened up above ground level in the western wall (Figure 2.32). A pit and an occupation floor were excavated inside this room, with access from the courtyard to the east. There is little understanding of the function of the two openings in the wall, but is likely that they provided some kind of ventilation for this area, as they are somewhat too small and too low above ground to act as windows.

Apart from the construction and activities attested in these rooms, investigations also targeted the courtyard area, where several Phase 3 features were excavated this season. These consist of series of pits, post- and stakeholes and tannurs. Many of the pits and fireplaces appear to be associated with domestic food preparation. Some of the stake- and postholes mark the locations of windbreaks and shelters. These features reflect considerable activity in the courtyard area, and were sealed beneath further occupation levels.

In the northern extension, further architecture belonging to Phase 3 was revealed and recorded, but not yet removed by the end of the season. While the Phase 5 architecture in this northern part appears to relate more closely to the suq previously excavated by QMA, the Phase 3 architecture here has a more random, domestic function. Like the predecessor buildings in this area, this architectural phase is also aligned north-south, although there appears to be somewhat greater deviation to this alignment. Eight rooms (Spaces 036, 037, 038, 039, 040, 041, 044, and 046) were revealed and documented. They form a single complex which is enclosed by a boundary wall around a courtyard. While the western limit falls within the excavation area, the eastern part is beyond the limit of excavation (Figure 2.33).

Three of the rooms (Spaces 037, 038 & 039) were constructed as part of one development, while Spaces 041 and 040 were built somewhat later. Space 044 was constructed even later than that. Space 037 appears to have been used as a storage room (Figure 2.34), as reflected by a wide range of ceramic sherds broken in situ and strewn across the floor of the room. Space 038 is a rectangular room which, on the other hand, appears to have functioned as a cooking area (Figure 2.35). A shell floor covered the entire internal surface of the room, while a wide range of domestic waste and material culture was strewn across the floor. A small fire pit/hearth was located against the eastern wall, which was backfilled and re-cut by a tannur pit. Two further pits and a posthole also cut this earliest floor. The room was then resurfaced with a compacted sand-silt floor, which reflects trampling. Two pits were cut into this floor, including one fire-pit and one proper tannur.
Figure 2.30: Western view of Space 08

Figure 2.31: Eastern enclosing wall forming Space 10
Figure 2.32: Western wall of Space 10, showing the two inserted vents

Figure 2.33: Aerial overview of the Phase 3 architecture in the northern extension area
Figure 2.34: Space 37 storage room (Phase 3), in the northern extension

Figure 2.35: Space 38 cooking area, Phase 3 room in the northern extension
Space 039 was only partly exposed in plan, as it continues eastwards beyond the limit of excavation (Figure 2.36). The western part of the floor, which slopes down towards the centre of the room, was burnt. Two firepits and a single posthole were cut into this floor, filled by ashy deposits with inclusions of animal bone. This appears to be yet another instance of a food preparation/cooking space. However, the peculiar appearance of the floor suggests that the function may have been slightly different. It is possible that this may have been a fish curing or smoking room.

In the southwest corner of the compound Space 036 is a sub-rectangular room (Figure 2.37). The primary floor consists of a thick shell and sand floor, which produced a rich assemblage of material culture and associated finds. This appears to reflect a slow accumulation of occupational detritus combined with trampling. Three cut features (a firepit, tannur, and a posthole) truncated this floor. Once again, it appears that these rooms served broadly domestic functions.

The small room labelled Space 046 is located to the northeast of Space 036 and appears to have served as an entrance corridor or portico leading into Space 036. The internal space of this small room was covered by a trampled occupation surface, which contains a mixed assemblage of material culture, associated finds and charcoal inclusions. A single posthole and a firepit were cut in the southeast corner of the room. The latter was cut by a tannur, which re-used sherds from a storage vessel (Figure 2.38).

North and northwest of Space 039, two further rooms were constructed (Spaces 040 and 041) (Figure 2.39 [includes relationship with Space 044 and 039]). Neither could be fully exposed in plan. Due to the incomplete lateral exposure it is not fully ascertained that Space 040 is indeed a room – it may equally be a courtyard. Again, a sand and shell surface represents the floor surface, which was cut by two features (a pit and firepit – both of which are as yet unexcavated). A sand and shell surface was laid over this floor thereafter, although this was discontinuously spread across the area. Space 041 is a rectangular room in the northeast corner of the northern extension. Access from a space to the north (beyond the limit of excavation) exists, with a second possible entrance in the southern wall. This entrance appears to have been blocked up later on. Due to the construction of Space 044 to the south it is unlikely that this entrance was in use for very long. Space 044 is a small rectangular-shaped room which was one of the last additions to the building. The interior floor surface was virtually indistinguishable from the courtyard floor layers, and the function of this late addition room is as yet unclear.

The courtyard which is surrounded by this group of rooms (Space 042) is an irregularly shaped open space (Figure 2.40), which is characterised by the stepwise development of this compound. Survival of surfaces and floors in the courtyard is patchy and these patches are difficult to link across the entire space. Only one tannur so far is associated with the open courtyard, which was excavated to the west of Space 038.

The area between the compound of the northern extension and the rest of the previously excavated area of ZUEP02 to the south contains a surface deposit, which appears to have developed over a protracted period of time. It contains several burnt lenses, dumping areas, as well as copious amounts of fragmented material culture. Cutting this surface were several features, including a firepit and postholes, which may represent the remnants of a windbreak (Figure 2.41).

Following construction and occupation, Phase 3 architecture across ZUEP02 experiences a gradual decline. Material is dumped in what appears to now be disused buildings. Buildings were left open and decayed gradually, with little robbing of walls or reuse in evidence.
Figure 2.36: Space 39 small cooking room with ash floor and vents in the northern and eastern walls. Insert shows the vents in the west wall.

Figure 2.37: Space 36 – a later domestic addition to the compound - and Space 46 - a small entrance portico to the north allowing access to Space 36 - form the central courtyard.
Figure 2.38: Tannur located in the SE corner of Space 46 (entrance portico)

Figure 2.39: Architectural group including; Spaces 39, 40, 41 & 44 located in the NE corner of the Northern extension area.
Figure 2.40: SE view of the Courtyard Space 42 in the northern extension

Figure 2.41: Firepit and postholes forming a wind break located in an open area to the south of the compound.
Figure 2.42: Phase 2 architecture.
2.2.5 Phases 2 & 1

Evidence for these phases is ephemeral and was only encountered in the northern extension (having been excavated and removed in the southern main area during the previous season of excavation). It consists of some Phase 02 pitting into the rubble infill, as well as Phase 01 accumulation of aeolian silts and sands and some localised trampling (Figure 2.42).

2.2.6 Conclusion

Work in ZUEP02 made significant progress over the course of the 2010-2011 season, with much of the Phase 03 architecture removed in the southern part of the excavation area, and a link being created with the suq in the northern extension. Phase 5 architecture continued to be exposed and we are gaining a better understanding of the kind of structures that can be expected to be fully revealed in the future.

ZUEP02 continues to produce evidence for the most crucial phases of Al Zubarah’s occupation and, together with ZUEP01, is one of the few areas in which excavations have produced a full stratigraphic sequence detailing the history and development of the site. Nevertheless, excavations are at an intermediate stage in ZUEP02 and further work is required to complete the full exposure of Phase 5. Further progress on this will be made during the next season of excavation.

The emergent picture of the Phase 5 architecture appears to confirm that we are looking at a broadly commercially orientated group of spaces and buildings here. It seems that further excavations will reveal more of the suq, allowing us to link the present excavations with the previous QMA excavations stratigraphically. This will provide a fuller understanding of Al Zubarah’s economic and trade activities within a socio-political context. On the surface a look at some of the Phase 5 walls in ZUEP02, particularly in the southern area, suggest that we may be dealing with the footprint of a commercial warehouse in this area, which would work well with the idea of a larger market district. However, further excavations in the main area and in the northern extension have to be undertaken to clarify these issues.
2.3 Al Zubarah Excavation Point 4 (ZUEP04)

Tom Collie

2.3.1 Introduction

The site at Excavation Point 4 (hereafter ZUEP04) is located at the southern end of Al Zubarah (Figure 1.1, p. 5) and focused on a large compound enclosing rooms and courtyards surrounded by perimeter walls with corner towers. This was divided into eight separate areas around a centralised courtyard, which appears to have been circumnavigated by streets and passageways (Figure 2.43). The excavations from this season examined the entirety of one of the eight compound areas (hereafter named Precinct-Section 8), to determine its layout and function within the compound as a whole (Figure 2.44).

The archaeology revealed has been organised into the four phases previously established for ZUEP04 in season 2009-10. The oldest phase pertains to pre-construction activities and the natural geology. The following phase represents the construction of the building. The next phase relates to the occupation of the building including architectural renovations, dumped midden deposits and occupation deposits and features found within the internal rooms. The final phase includes materials from architectural dilapidation and degradation along with modern overburden deposits.

Figure 2.43: Plan of the Precinct Area
Figure 2.44: Post-excavation plan of excavated Precinct-Section 8
2.3.2 Phase 4: Pre-Construction and Natural Geology

Phase 4 details features and deposits that existed before the construction of the compound. Little evidence was found from this phase, purely because most remaining architecture was left in situ, which prevented any observations of the stratigraphy below. This differed from season 2009-10 where archaeological features, believed to pre-date the building construction, were discovered. Floor surfaces and walls were not excavated and therefore any features beneath were simply not seen. Natural geological deposits were evident in the sides of pits from the courtyards and in Space 3019. However glimpses through intrusive archaeological features were inadequate to make large scale conclusions about the nature of the geology prior to building construction. Further work would be needed here to gain greater insight regarding pre-construction activity.

2.3.3 Phases 3 & 2: Construction and Occupation

Descriptions of these important phases are combined in the present report. Ideas on general construction order and planning are described below followed by an account of architectural features and occupation deposits, categorised by architectural location (cardinal sides) and also by space number.

Precinct-Section 8 general parameters

Previous excavation revealed that both the corner tower and the westernmost north-south running precinct wall are contemporary features (Figure 2.44). Subsequently, the southernmost east-west running parameter wall joins the tower at foundation level. Two long, internal constructions further complement the external compound walls, forming a regular, square-shaped area. Together these four walls formed the architectural limits of Precinct-Section 8. The main northern and eastern walls measured 25 metre and 31.6 metre respectively. The outer precinct walls were longer and continued past the limit of excavation. The contiguous architectural units indicate that the compound in its entirety may originally have been organised into these set sections as opposed to being allowed to develop organically within the main walls. This clearly shows that the fortified compound was constructed as part of one overall event and was a carefully planned and organised structure.

Internal Wall Construction Order

Some observations of the architectural plan of Precinct-Section 8 can be made relating to the order of space construction. It seems that wall <4488>, partially uncovered in the excavation from 2009-10, forms part of an internal architectural line that stretches from southernmost outer precinct wall to join the northernmost perimeter wall (Figure 2.24). This internal line runs perpendicular to Precinct-Section 8’s southern and northern-most perimeter walls and is parallel to its eastern and western sides. It is instrumental in forming the basis for the precinct’s internal spaces and indeed governs the layout of the main courtyard Space 3012.

Both the northern and southern extents of this courtyard (Space 3012) are formed by lines of walls that run perpendicular to, and indeed butt against, the previously built western line. These southern and northern walls delineate rooms which skirt the edge of this part of the fortified compound. Most of the rooms on the southern side were excavated during the 2009-10 season (Richter 2011). Two more were revealed during this season. The northern side revealed merely three. After these sides were built the eastern rooms were constructed, which produced an additional entrance space. The eastern side holds another three rooms which includes a small space dominated by a large hammam. The western side is also subdivided into two smaller courtyard areas along with four room spaces.
The Western Side

In total, the western side included Spaces 3001, 3002, 3007, 3008, 3009 and 3020. Spaces 3001 and 3002 were excavated in season 2009-10 and work in these areas was continued. Two mini-courtyard areas (spaces 3002 and 3020) dominate the interior space of the western side. They appear in both the northern and southern areas and are separated by rooms 3007, 3008, and 3009. With the exception of Space 3009, all interior walls and floors hold no signs of rendered plaster. All walls were constructed using unevenly coursed roughly hewn beachstone (AG1-3 & BJ3, Hoffmann et al. 2011) and bound with a grey sandy mortar. Indeed, the northern mini-courtyard was covered in shell and sand, similar to the main courtyard space, suggesting that it was a similar outside space. Conversely, the southern mini-courtyard had a hard compact sandy silt surface. Space 3008 shared the same type of floor and indeed had no threshold step leading into the main area of 3002. It seems it was designed to be left open and maybe ventilated.

Space 3001

Architecture from Space 3001 was fully revealed in excavations from season 2009-10. Work this season focused only on the discrete features found lying at the base of the room. Excavation of these features, suspected to be tannurs, showed they were firepits. The intense ashy and charcoal fills suggest the presence of great heat and prolonged burning, especially since the archaeological strata below had changed in consistency and colour. Since they all truncated the same surface and were situated in one neat line, it is possible that they were operated simultaneously. If this was the case, it would indicate a serious demand for heat and for whatever was being heated (water/food). This supports the idea puported in the 2009-10 season that Space 3001 was some kind of kitchen, left open due to the intense heat, which was utilised by the rest of the precinct-section. Moreover, a view of the sides and base of these pits revealed that more burning activity had occurred in the layers stratigraphically beneath the floor surface. Further excavation will be needed here to discover the nature of these earlier burnt deposits.

Space 3002

Space 3002 was partially excavated in season 2009-10 and work continued here this season to reveal the room’s full extent. This space was revealed to have been truncated by multiple pits and postholes. The larger pits were believed to have been dug to gain access to the natural deposits to provide new material for interior floor surfaces. The purpose of postholes in the far north-western corner is unclear, but they bear resemblance to postholes in Space 3008 in both shape and extent. What is certain is that these pits scarred the floor surface of Space 3002 indiscriminately.

Two masonry features were revealed within this space. The first was a masonry plinth feature <4086> uncovered already in the 2009-10 season. The second feature was a block of beachstone, which butted the major staircase to the south and also main western wall. It was believed to be a small staircase leading to the wall’s top surface, although this seems strange when considering the presence of the larger staircase directly to the south. Further excavation will be needed here to fully determine this feature’s purpose.

The structural repair apparent in the eastern wall was re-examined and consequently redefined as a window cavity effectively linking spaces 3002 and 3004 (Figure 2.45). This was made from a grey plaster render laid into the beachstone wall. It was very similar to a feature in Space 3009. These windows were similar to those observed in another fort in the vicinity of Al Zubarah, namely Qal’at Al Thaqab. Although this fort has been restored, domestic living spaces near the front gate had both one door and one window looking out into a courtyard area. Examination of the plaster work in the far southern corner uncovered the remains of wood, possibly from the window frame.
Space 3007

Excavation herein produced three sequences of deposits. The latest sequence contained thin layers of sand and shell, which formed a floor surface containing the extant remains of a small black vial (Figure 2.46). Beneath this lay a second sequence of similar deposits forming a floor surface which was truncated by four small fire pits possibly created for some minor cooking activity.

The earliest sequence contains the original surface of the room along with a gypsum plastered waterbasin in the north-western corner. Its base is tilted slightly towards the northern wall and has a 0.2m hole cut in the corner which presumably provided drainage. Indeed, on the other side of the wall in Space 3020, there is evidence of a hollow in the ground surface hinting at the presence of a soak-away similar to that found outside space 3013.

The original room surface is unusual since, remarkably, it still held the presence and indentations of footprints and reed-matting from its initial use (Figure 2.47). The basin and the matted-floor resembled a poor mimic of the other, longer rooms, which contain plastered floors and hammams. Indeed, this space shares another similarity with Spaces 3018 and 3014, since it too displays evidence of sandy shell surfaces cut by fire pits. This small room therefore introduces the argument that the rougher undecorated rooms of the western and northern sides fulfilled a more utilitarian, less representational, function.

Space 3008

As mentioned previously, Space 3008 shares the same floor surface with mini courtyard Space 3002 and has no threshold, suggesting that it was an open space. The features associated with the floor surface include eight postholes and a beachstone structure situated in the south-eastern corner (Figure 2.44). The postholes were curious since they were situated along the western and
Figure 2.46: Black glass vial found in Space 3007

Figure 2.47: Footprint found in floor surface (4141) in Space 3007
northern interior sides of the room. Their form suggests that substantial posts were set inside but what they physically supported is uncertain. Their position in relation to the walls suggest that they may have had a structural purpose – possibly as supports for a canopy to provide shade. The beachstone feature in the south-eastern corner was interpreted as a low stone seat. However more investigation within this small room is needed to fully determine its function.

Space 3009

Room 3009 was very similar to Spaces 3003 and 3011 since it was completely devoid of occupation deposits. It differs from the surrounding spaces since its internal walls were plastered along with the floor. All decorative plaster features including the window in the north wall and the threshold, suggests that this big room may have fulfilled some important function on the western side. The window in the northern wall indicates that the room would have been filled with light in contrast to its neighbouring rooms 3007 and 3008, which were only illuminated through the doorways. The collapsed pillar lying inside (discussed in Phase 4) also pointed to a place of relative splendour.

Space 3009 is therefore an anomaly amongst a group of somewhat ‘bare’ rooms. It may have provided a focal point for those occupants functioning within the less luxurious spaces of the western side. This again introduces two levels in the condition of the interior rooms.

Space 3020

Excavations within the mini-courtyard space revealed a series of shell surfaces interwoven with occupation deposits and truncated by small pits. There were three sequences of deposits lying in the southern end of the courtyard, which became gradually more fragmentary and diffuse towards the north. The second sequence of hardened shell was notable in that it was truncated by a large pit filled with redeposited hearth material and contained two small coins. The first sequence consisted of a hardened silt surface, which was truncated by two small post holes. The earliest surface was left *in situ* and stretched from the southern end of Space 3020 through to the middle, whereupon it was covered by deposits from the northern end of the courtyard. These were patchy make-up layers for a courtyard surface and were interpreted as contemporary with the second sequence mentioned above. This hardened floor surface was an excellent archaeological horizon on which to stop work in 2010-2011 and resume work in the future, since it was distinct and well preserved.

The Southern Side

In total, the southern side included spaces 3003, 3004, 3005, 3010 and 3011. Only spaces 3010 and 3011 were excavated since the rest had been examined in season 2009-10 (see QIAH End of Season Report Stage 2, Season 1; 2011).

Spaces 3010 and 3011 displayed signs of high status domestic occupancy. Both rooms have plaster on their interior walls. Space 3011 has a plastered floor and two badly damaged niches set into both the eastern and western walls. The two rooms were separated by a plastered threshold step. They represent dignified internal domestic spaces, especially Space 3011, which was consciously separated from its northern neighbour by the well-constructed doorway.

Both spaces were bounded in the west by a large staircase. This has eight steps, which were built from beachstone, over-rendered with a hard brown sandy mortar, which is badly degraded. The staircase was cleverly constructed since it is supported by two buttresses, tied into the structure itself. This is combined with walls to the east to provide entranceways into Spaces 3011 and 3010 respectively (Figures 2.44, 2.48). The staircase provided access to an upper level, which explains the large quantities of collapsed rock and plaster-vaulting found from Phase 4. It also may explain the presence of the midden in Space 3021, which contains dumped deposits that ac-
cumulated at a point directly outside the precinct wall, as if they had been thrown from a space situated above 3010 and 3011.

Space 3010

Space 3010 was completely covered by a hard sandy shell surface, which then spread 10m north into the main courtyard. Since all major courtyard deposits were retained for future excavation, this shell layer was not fully uncovered. However, a few observations can be raised. Primarily, it bears striking resemblance to the shell deposits found in space 3004, which were revealed to run into the main courtyard. Like space 3004, these deposits indicate that space 3010 was a transitional room between an exterior to an interior area. Secondly, the entrance to this space showed no sign of thresholds or door frames. It was open to the exterior and was as wide as the entrance to space 3004. Moreover, collapsed archway material found at this access point (discussed in Phase 4) again indicates that this room was open to the elements. Space 3010 was therefore interpreted as a passageway through to clearly-defined interior spaces.
Space 3011

This room shares a distinct similarity with Space 3003, since it displays no signs of occupation. Clearly this room was used for functions that did not damage the floor surface and perhaps indicates that this room was used differently than others. The niches in the eastern and western walls, plus the fine plaster walls and the deliberate attempt at separating this space with a threshold step from the neighbouring room to the north, all point to the fact that this room was reserved for a specific purpose.

The Eastern Side

The eastern side includes Spaces 3013, 3014 and 3015. Their interiors were rendered with plaster and separated from the outside by plastered thresholds. They all formed neat interior rooms. The plaster floors from Spaces 3014 and 3015 seem badly damaged and degraded revealing the flag stone foundations beneath. Conversely, Space 3013 seemed well-preserved.

Space 3013

This room was unusual and differed from the other rooms in the precinct. Its western wall was not constructed from the typical roughly hewn beachstone that is so common elsewhere. Instead, it was constructed from aeolianite, a porous limestone (stone type FR1, see Hoffman et al, 2011) (Figure 2.49). The wall formed the western part of a gypsum-plastered hammam. It was the only wall in the entire excavation area where a distinctly different building material was used. It was
probable that the wall was made deliberately thin simply because it aided the function of the washing facility itself. Drainage from the *hammam* into the nearby sinkhole would have been quicker and easier if material did not have to travel a long distance – the *hammam* therefore would have been built as near to the drain as possible. The feature spanned the entire western end of the small room. The *hammam* in the neighbouring room also drained into this and then fluid from both rooms ran under the thin limestone wall and into the nearby soak-away.

Other features within this space were therefore geared to the prime function of this room. A raised line of stone across the doorway effectively formed a recess and was believed to help keep water within the confines of Space 3013. No occupation deposits were found here. Only dilapidation material from Phase 1 was discovered crushed firmly onto the plaster floor surface. The contents of the *hammam*-drainage channels were excavated but no organic materials were found. This space seemed spotlessly clean, which either indicated its immaculate state while in use or the possibility that it was a wash-room. In view of the small size of the soak-away outside the wall to the west, it would seem likely that only liquids were channelled through the drainage system. Having a small sewage system within the confines of a finely decorated high-status domestic space seems impractical and unlikely.

**Space 3014**

There were plastered wall niches in this room’s eastern wall similar to those found in Space 3011. Additionally it contained a *hammam* in the far south-western corner, which drained through to Space 3013. Excavation revealed that it was repaired or at least re-plastered sometime after its original construction. This *hammam* appears to have been for washing, due to its size and location. The drainage channel was filled with a grey brown silty deposit mixed with demolition rubble from Phase 4. This was sampled for organic material.

There were two distinct occupation events in Space 3014. The first covered the entire room and lay beneath the dilapidation deposits from Phase 4. It consisted of loose coarse shelly sand that would have formed a fresh and clean interior floor space. The second event consisted of a previous shell layer with associated occupation deposits. This was interpreted as a floor surface which had laid down to provide a usable platform covering a previously dirtier surface below. However, unlike the shell from the first sequence, it was patchy and badly damaged. The re-plastering of the *hammam* seems contemporary with this layer, since there was evidence of shell mixed into the plaster render at the very base.

Underneath these occupation events was a plaster floor on which an event of small *in situ* burning was revealed. Scars, cracks and fissures in the plaster at the northern end of this room were blackened demarcating a fireplace. It is likely then that the constant use of the room created a demand to renew and replace the floor surface culminating in the shell surface events found above.

**Space 3015**

There were few signs of occupation within this room. Space 3015 had a scarred, degraded plaster floor with evidence of ingrained charcoal staining. Small, dark grey patches of sandy shell and charcoal lay in the southern part of this room, possibly hinting at the last remnants of a previous shell floor layer. However, as the layer is only 0.02m thick, this idea is tenuous. It is more likely that the occupation sat directly on the plaster floor. Indeed, the presence of a small *tannur* truncating the floor supports this theory. The *tannur* was filled with two ash deposits, which contained charcoal and fishbone. Another two small ashy deposits were found lying on top of the floor nearby. All deposits and features within this space pointed to direct use of the plaster floor, perhaps explaining its poor condition at the northern end.
The Northern Side

The northern side included Spaces 3017, 3018 and 3019. It was different since only one of its three rooms displays the high-quality plaster decoration that is common in both the eastern and southern wings.

Space 3017 and Space 3019 were two very small rooms that were not internally plastered. Space 3017 had an occupation surface of coarse gritty sand. There seemed to be no floor surface within the far western Space 3019 and features appeared to truncate natural geological sand and shell. Both rooms had large plastered thresholds and seemed entirely functional. They are markedly different to the lavish domestic settings of the other eastern and southern spaces. Their size and lack of decoration point to areas of storage or production, as opposed to domestic dwelling.

Space 3018 was more akin in size and function to those rooms revealed on the eastern side, specifically Space 3014. It had a deep threshold step which was constructed from beachstone and then covered in a plaster render. The plaster render clearly overlapped original plaster on the interior walls (especially evident on the eastern side) and also sat upon a lower layer of shell. It was clear then that this step was added to the precinct during occupancy, much like the plastered door posts in space 3017. It contains a large hammam, well-preserved plastered walls and a slightly scarred plaster floor. The inclusion of the these smaller rooms to the northern side introduces the idea that it fulfilled more functional roles than the south and the east. Like Space 3009 on the western side, Space 3018 seems to be the only northern room designated to some form of high-status living.

Space 3017

The stratigraphy found herein was distinctly different from the other interior spaces and consisted of three sequences of archaeological features and deposits. The first sequence lay directly beneath the dilapidation deposits of Phase 4 and contained large dumps of shelly sand containing large sherds of smashed black pot. Pottery from these deposits was also seen outside room 3017 in the central courtyard (see discussion for Space 3012) in a large shattered spread. Collectively, these deposits contained sherds from massive vessels that were believed to have sat in storage pits. They had been left lying shattered both inside and outside of Space 3017.

The second middle sequence contained two large pits that truncated an occupation surface. The two pits were very large and were both backfilled with material containing large sherds of black pot identical to those in the stratigraphy above. These pits had contained large vessels which were robbed out and then smashed.

The pits truncated an occupation surface comprised of trampled shell and rare small charcoal flecks. This was contemporary with a renovated doorway consisting of plastered doorpost settings and a plastered threshold, suggesting architectural repairs during occupancy. Similar activity was exemplified by threshold features in Space 3018. A further two surfaces were revealed below the threshold renovations. The earliest floor surface consisted of coarse compact sandy silt and was left preserved in situ. It had been truncated by an oval shaped pit containing a charcoal rich fill.

Space 3018

Space 3018 contained two sequences of clean shell with associated occupation debris. The first lay beneath the dilapidation deposits from Phase 1 and is contemporary with building additions made to the threshold step. The lowest sequence contained a layer of shell which covered the entire room and is believed to renew and replace the plaster floor below. It was truncated by two small fire pits. Below the shell, evidence of similar pits were seen scarring the plaster floor. The fires cut into the shell layer were placed in almost exactly the same positions as the original three, which scarred the plaster floor. It seemed these features had an established place in this room and
were repositioned almost exactly even after a fresh layer of shell obscured their original positions.

Space 3018 shared many similarities with Space 3014. Both have hammams. Both have two series of shell floor surfaces. Both have evidence of interior small fireplaces. The main difference was that the plaster floor in Space 3018 was in a far better condition than that within Space 3014. These similarities may indicate that both spaces had similar functions where light was required and cleanliness was a necessity – perhaps this evidence points to a place of a reception room.

Space 3019

Features and deposits within this small room indicated the occurrence of intense cooking and burning activities. Excavation revealed three sequences of events dominated essentially by the presence of tannurs. The first sequence contained detritus from the dilapidation deposits of Phase 4 mixed with burnt, charcoal-filled deposits. This sequence effectively formed an interface layer between the occupation of Phase 2 and abandonment of Phase 1. Beneath this lay a second major occupation deposit which was truncated by four tannurs and covered in black, ashy deposits. The third sequence consisted of more pits and tannurs which directly truncated the natural geology.

The four tannurs all contained multiple fills of ash mixed with silty sand and charcoal (Figure 2.50). One tannur had particularly damp fill deposits suggesting that this feature extended down to the water table. Additionally, two further dumps of blackened ash and silt were found lying near the tops of these tannurs. They were interpreted as more clean-out from the ovens. These tannurs differed in depth, the largest measuring 0.51m and the smallest 0.24m deep. They were wider at the base than at the top, presumably to withhold heat within the vessel itself. Indeed, the fabric of the tannurs looked extremely robust and in some cases very thick. They truncated a deposit that was interpreted more as an occupation deposit, as opposed to a formal floor surface due to its consistency, compactness and finds content. It may have been formed by material cast-out from the tannurs and then compacted into the ground by constant use of the room.

Figure 2.50: Tannurs cutting into occupation deposit (4208) in Space 3019
The earliest sequence of deposits and features were revealed to directly truncate the natural geology below. They included another series of tannurs, fire pits and dumps of blackened ash (Figure 2.51). These were interpreted as the original cooking facilities that preceded those found in the second sequence. One pit was noticeable because it was the only feature within the room containing animal bone, including those from fish, sheep and goat along with the remains of egg shell.

Unsurprisingly the features from the first sequence all occurred in the western half of Space 3019 whereas the tannurs from the following stratigraphic sequence were housed on the opposite side. Clearly this room went through two phases of use. The first phase utilised the western and middle of the room, using both firepits and tannurs to cook food. The second phase utilised the eastern half of Space 3019, which had not been disturbed by previous activity.

The space appears to have been a central cooking zone which may have complemented the fire pits in Space 3001. The burning episodes in Space 3019 seem far more intense and untidy than those in Space 3001. This space provides more evidence for the use of the west and north-west zones of the structure as dedicated service-duties areas, as opposed to activities that involved non-domestic activities. The walls from this space were undecorated and the narrow threshold step implied that the room itself would have been very smoky and dark if all tannurs were in operation at once.

Entrances Space 3016 and the Main Courtyard Space 3012

Space 3016 represents the main entrance to this part of the fortified compound (Figure 2.44). This L-shaped space in the northeast led directly into the central courtyard. Facing an opposite wall upon entry, and reinforced by a short segment of wall that protruded slightly into the room from the south, direct view into the courtyard was effectively blocked. The actual doorway was formed in a gap between the north-south running architecture and was complemented by a plas-
tered threshold flanked either side by two plastered steps (Figure 2.52). Both these features have two obvious round hollows worn into the stone, which can be interpreted as door sockets. The remains of an arch were observed in section in the as yet unexcavated deposits filling the doorway and alley, suggesting that this was an arched entrance.

The main courtyard, Space 3012, dominated this part of the fortified compound, measuring 17m x 17m. The majority of the deposits within the main courtyard were left in situ for future excavation work. From the surface it appears that the courtyard’s ground surface was comprised of a number of spreads of fine grey yellow sand and minute shell. The extent of these deposits was difficult to determine since the distinction between them was very slight. However, there were differences suggesting that the surface was often renewed, with patches regularly added and old floors re-laid.

A square plastered basin/trough was revealed in the north-western corner of the main courtyard. It remained an enigma since its true function within the courtyard could not be fully determined. It appeared to be some form of drain or water-feature. It was filled with smashed pottery, very reminiscent in fabric to the tannūṣ in Space 3019 and also to the shattered ceramic spread lying outside Space 3017. It was also covered by compact ashy deposits. The feature’s close vicinity to Space 3019 and the ash trample covering suggests that the two are somehow associated. More excavation of this feature and the surrounding deposits is needed to fully determine its purpose. Its presence may indicate further features existing within the courtyard below the current limit of excavation.

Almost adjacent to the plastered basin was a large pit. Its steep sides and flat base, which sank below the present-day water-table, suggested at first this was some form of storage pit. Indeed, large sherds of a storage vessel were discovered in both upper and lower fills. However, since the pit was very close to the plaster basin, it may have been associated with it, perhaps to function
as some form of soakaway. Indeed, excavation of the pit revealed the northern extent of another pit feature, this time lower down in the stratigraphic sequence and buried beneath the higher courtyard deposits. This suggests major excavations occurred in the courtyard area and may indicate the presence of large drainage sumps. The true function of all these pits will need further investigation in the future.

**Exterior Spaces 3021, 3022 and 3023**

Excavation outside the outer precinct walls was kept to minimum due to time constraints and resources. Space 3021 is located outside the southern precinct wall directly to the south of Space 3011 (Figure 2.44). Excavations here aimed to reveal and document the extent of midden deposits that had clearly accumulated against the outer wall, either from an outside influence or indeed from the process of casting out of materials from the precinct’s first floor. Since excavations from season 2009-10 had already focused on the midden near the main tower, excavations was swiftly abandoned. However, the deposits that were apparent bore a striking similarity to those found in Spaces 3000 and 3006 from season 2009-10. These were packed with shell and charcoal and were interpreted as surfaces from within the compound that had been discarded.

Spaces 3022 and 3023 were small exterior areas lying directly outside the outer western compound wall. These spaces were merely planned and not excavated. Two patches of charcoal and ash were noted in Space 3023 indicating that large fires had occurred.

![Figure 2.53: Ceiling fragments bearing indentations of reed and plant material from Space 3011](image-url)
2.3.4 Phase 1: Dilapidation

The final phase pertained to the dilapidation and collapse of the precinct building. Those layers interpreted as direct interfaces with the surviving occupation deposits were usually of mid grey sandy silt containing small fragments of plaster and pieces of beachstone from damaged walls. These deposits differed considerably from the layers of fallen rubble stratigraphically above, since they contained less massive stone and plasterwork. They were more compact and were interpreted as material that had naturally filtered down through the larger material over the last two to three hundred years.

In some spaces, the presence of small organic deposits bearing the indentations of reeds and other vegetation suggested the collapse of ceiling material (Figure 2.53). Spaces 3011, 3016 and 3018 all contained evidence of fallen organic ceiling material.

Collapsed arches and ceiling vaulting were also found in demolition deposits. The excavation of Space 3009 displayed the remains of a large rectangular pillar which had collapsed and fallen onto the plaster floor. Its presence strengthens the idea that Space 3009 was an important space within the western wing.

The remnants of two very large arches were revealed in Spaces 3010 and 3011. A collapsed arch was positioned fairly close to the entrance of Space 3010 and its massive curving structure may indicate the remnants of ceiling vaulting. Its huge size and position near the entrance of the main courtyard was reminiscent of the other archway found at the entrance of Space 3004 in season 2009-10. This served as more evidence to suggest that there was a permanently open entrance-way to Space 3010.

Other collapsed doorway features were found at the entrance between Space 3010 and 3011. The entrance to the courtyard had two arches: one was revealed to have fallen immediately above the threshold of the entrance. The other fallen architectural piece residing within Space 3016 was a fallen lintel comprised of moulded plaster. This lay in the area where Space 3016 joined the central courtyard. The presence of these fallen arches marking the transition between interior and exterior spaces indicate the differences in decoration between these zones.

The dilapidation of the fortified compound seen across in the excavation area did not occur at one specific point in time. Instead, the collapse occurred gradually over a period of some decades. Deposits within the main courtyard, Spaces 3002, 3012 and 3020 all displayed the accumulation of windblown sand that was deposited naturally and intermixed with general architectural detritus. It appears that the building, or at least this part of the fortified compound, was abandoned and left to decay naturally.

2.3.5 Conclusions

The excavations in ZUEP04 achieved their main objectives and revealed some fantastic archaeology, uncovering fourteen new interior and three new exterior spaces to complement the six already uncovered in the 2009-10 season. The excavations in this part of the fortified compound showed that it was orientated towards providing a more independent domestic facility rather than a purely fortified, military structure. The complex was likely a high-status domestic residence, enclosed within a large precinct wall separated from the remainder of Al Zubarah’s population.

The interior spaces were divided into two elements. The first are decorated, well-maintained rooms, which were residences, reception/dining rooms and hammams. The second were more utilitarian rooms, including kitchens, storage rooms, a madbasa room and other work areas.

This division is readily apparent in the architecture, where the rooms of both the southern and eastern sides were revealed to be lavishly decorated. Intricate moulded plaster adorned the walls, complemented by plaster niches for lamps or other objects. There were dedicated washing spaces with associated soakaways, entrances were adorned with decorative arches, and the floors were plastered, flat, and separated from the outside with obvious threshold steps. Conversely, the
spaces on the western side and to the north were geared towards fulfilling more functional roles, including cooking and storage. Floor surfaces were blackened by soot, badly covered by shell, gouged by pitting, while the walls remained deliberately unplastered.

The architectural construction of the precinct seems to have begun with the building of the outer walls and then the construction of the interior areas. The inside was divided by an architectural line running north/south, effectively forming the western side and also a base line onto which the northern and southern sides could be built. The eastern side was then completed, which also formed the entranceway. Beachstone was used for construction and exterior walls were made from a far better quality stone than those in the interior, being prominently constructed with beachstone-type AG3. This stone was an amalgamation of bivalves and gastropods embedded in a fine sandy matrix which is easily fragmented given significant force. This stone was used to build interior partitions where harder stone types such as beachstone-type AG1 and BJ3 were used to dress the exterior. Mudbrick or wood may have been used for coursing the higher level architecture which may explain the vast quantities of disintegrating rubble prevalent in Phase 4. The only difference seen in construction material was in the west wall of washroom 3013 and in the decorative arches placed over the entrances to Spaces 3004 and 3010.

Examination of the occupation surfaces within the rooms displayed there may have been at least two phases of occupation or at least two occasions where the residing occupants renewed the surfaces of their living spaces. Spaces 3018 and 3014 both had multiple layers of shell-renewal surfaces. This too was apparent in Space 3007 as well as 3004. They may have coincided with the surface deposits within room 3019. Renovations were also seen in the hammam of room 3014 and in the additions of threshold steps in Spaces 3017 and 3018. They may have even been coincidental with renovations made to the tower seen in Space 3000. Regardless of the number of times the spaces were renovated, the evidence suggests that the complex was occupied for a period of time long enough to warrant revitalization.

The excavations also clearly recovered signs of the precinct’s decline. There were tantalising glimpses of possible destruction and vandalism shown by the smashed ceramic spread outside of Space 3017 and by the burnt timber and collapsed ceiling material in Space 3011. Indeed the pitting of relatively late surfaces in the western wing displayed a possible disregard to the areas general upkeep and appearance. However, this evidence could just be representative of unlinked separate events. There is not a massive phase of deliberate destruction seen in the archaeology; rather, a deterioration, abandonment and then dilapidation.

Future work in this area will undoubtedly need to focus on the main courtyard area 3012 and the two side-courtyard Spaces 3002 and 3020. Excavation in these three spaces revealed underlying archaeological stratigraphy that will hopefully not only reveal the extent of buried architecture and features but also the function of those already uncovered. Tantalising evidence was also revealed at the northern extent of the site, where remnants of a possible entrance in the main western compound wall were discovered. It would be exciting to gauge the extent of the passageways that were believed to run parallel to the north and east walls and gain an understanding of how these and Precinct-Section 8 related physically to the other divisions of the compound. Whatever the scope for future work, the continued excavations at ZUEP04 will undoubtedly yield more engaging, monumental and exciting archaeology.
2.4 ZUBARAH EXCAVATION POINT 5 (ZUEP05)

Pernille Bangsgaard

2.4.1 Introduction

This report describes the results of the archaeological fieldwork carried out at ZUEP05 during the season from November to the end of December 2010. ZUEP05 is a new excavation area and is located immediately next to the main city wall of Zubarah (Phase 5), in the section between Outer Wall towers 9 and 10 (Figures 1.1 p. 5, 2.54).

The excavation investigated part of a large midden at Al Zubarah thought to belong to the main occupation Phase 5. The aim was to expand our knowledge of the everyday-use objects of Al Zubarah as the houses currently under excavation inside the settlement largely provide materials derived from secondary contexts. The houses generally appear to have been cleaned regularly, and at the time of abandonment, so few of these everyday objects have been found there. Evidence recovered from ZUEP05 adds to material excavated from another midden at ZUEP04 during the 2009-2010 season.

2.4.2 Background

The specific choice of midden was based on the aim of finding Phase 5 remains. This Phase is the time where Al Zubarah reached its maximum extent, and included the construction of the main outer town wall. It was therefore assumed that a location outside this city wall would ensure targeting deposits dating from the correct time frame. Middens belonging to one of the later occupation phases, where the extent of the city was significantly smaller, appear to be located closer to the occupation itself and thus lay within the area of the main town wall and not immediately outside of it. A final dating of the midden will, however, only be ascertained once datable finds from the midden have been analysed.

To sample the midden, a 12m x 2m trench was excavated into the mound. The trench extends in the west into the city proper, crosses the town wall (5005) and extends well into the centre of the midden. Because the town wall is included in the area, 2 metres to the west was not excavated as this would require the removal of the wall, thus leaving an actual area of excavation of approximately 2m x10m.

The midden as a whole is roughly oval in shape with an approximate diameter of 20 metres east-west and approximately 35 metres north-south. The central part of the midden rises approximately 2 metres above the surrounding landscape. The midden is also distinct from the surrounding yellow sand by its more brownish colour, and the ceramics and bone fragments visible on the surface. Part of the mound appears significantly compressed, probably due to the cars driving across the midden in an approximately north-south direction next to and parallel with the town wall. These tracks also cross the excavation area and the effect of such compression is clear. The deposits layers are here hard to distinguish from each other and the amount of finds in this area is significantly lower to what was found further to the east in the central area of the midden.

2.4.3 Excavation and stratigraphy

The midden is characterised by a fairly straightforward stratigraphy (Figures 2.55 to 2.57), but it includes multiple thin layers of deposits typically one to five cm thick. Some of these have a limited extent or simply merge with adjoining layers. A single deposit layer does not always extend across the entire east-west extent of the excavation area and it was therefore necessary to excavate these deposits in groups, as it proved difficult, and too time-consuming, to excavate each layer individually.
From the extent and morphology of these thin deposits it may be suggested that each represent a separate layer of detritus, possibly from a single event of dumping or from a very limited time period. If this is in fact the case then each locus in the main midden levels (two to four) represent a very limited time span that most likely cannot be separated chronologically, by the finds and ceramics analysis.

During excavation all removed soil was sieved in 3 mm sieves. It was possible to divide the 20 loci of ZUEP05 into six stratigraphic levels of use, described below.
Figure 2.56: Excavated northern profile through the midden

Figure 2.57: ZUEP05 - end of excavation
2.4.4 Level 6 (Loci 5019, 5005)

Layer 5019 is unexcavated at this time and as such represents the bottom of the ZUEP05 excavation area. The locus is visible as a hard and compacted surface to the east of the city wall. It butts against the wall and gradual slopes away to the west. The excavators could observe no finds or objects on the surface apart from charcoal flakes and weathered limestone fragments. This combination could suggest that we are dealing with the original surface of the area and as such the possibly top of an underlying natural deposits where the charcoal and limestone may represent remains from the construction of the city wall.

![Figure 2.58: The city wall (east), with the later blocking visible](image)

2.4.5 Blocking of the city wall (5020)

Two metres of the east side of the main city-wall were exposed. This small stretch of wall includes a later blocking made of random courses of beach stones held together by a gritty plaster (Figure 2.58). The blocking is located at the southern end of the excavation area and extends beyond the limit of excavation. It is likely that this later alteration to the city wall blocks an earlier passageway into the city. It is, however, not clear whether the opening represents a larger “proper” town gate or a small, and perhaps less permanent, access point. The location of this opening right in front of a large midden, which was deposited both before and after the blockade does perhaps indicate that a limited amount of traffic would have passed here. Only further excavation to the south of the present ZUEP05 excavation area can establish this with any certainty. The blocking event of a possible entrance into the city represents a convenient division of the midden refuse layers into Phases 4 and 5, but the general appearance of the layer do not deviate significantly from each other.

Based on the evidence outlined above, this phase of the midden deposits belongs to the main occupation of Zubarah, Phase 5, although probably the later part of this.
2.4.7 Level 4 (Loci 5004, 5009-10)

This is the first of two main use levels of the ZUEP05 area as a midden (Figures 2.59, 2.60). In Level 4 the refuse layers extend across the entire excavation area from the city wall in east and into the centre of the midden. Judging by the number of layers and amount of deposits excavated here, the level also spans a longer time period than Level 3. There is no indication of any prolonged break of refuse disposal inside this level, which could potentially have been identified by thick layers of sterile sand.

The deposit layers vary in colour from a brownish-yellow to dark grey and black but generally consist of fine sand. All the midden loci have some inclusions and these include varying amounts...
of white cone-shaped mollusc shells used for pavement inside the courtyards of the houses. The exact amount of inclusions appears to vary between individual loci, but this variation is significantly more pronounced in each locus due to the concentration of finds and objects in the eastern end of the excavation area.

The top layer (5004) is located immediately below the top-soil in the eastern half of the trench, and there is therefore some later contamination, evidenced by the occasional find of plastic. The remainder of this phase appears without any obvious traces of contamination. Included in Level 4 is an unmistakable floor surface located immediately next to the city-wall on the outer eastern side. The surface is clearly detectable for approximately 1 metre and then fades away into the surrounding softer midden layers.

This level of midden deposit likely belongs to the end of the main occupation of Al Zubarah (Phase 5).

2.4.8 Level 3 (Loci 5007-8)

Level 3 represents the latest use of the ZUEP05 area as a midden. The refuse layers are confined to the western half of the excavation, immediately east of the main city wall (5020) and they extend approximately four metres to the east, thus filling the area between the city-wall and the earlier midden deposits. The upper half must be assumed to include some later material as both loci contain the occasional find of plastic. Included among these refuse layers is also a hardened surface located at the top of (5008), likely the result of trampling or repeated use as a walkway.

Figure 2.61: (5003) showing ceramics scatter
2.4.9 Level 2 (Locus 5003)

Level 2 is located in the western half of the excavation area. To the west it is defined by the outside of the town wall and is visible approximately 3 metres further to the east. There are rare finds of ceramics (Figure 2.61) and bones in this locus, but also several fragments of worn plastic, suggesting that the layer is either contaminated or of a fairly modern date. The soil excavated here consists of multiple layers, which are different in character including colour, compactness, grain size and composition.

Locus (5003) does not represent a typical midden deposit. Instead this level includes multiple episodes of use. The brown layers of use include many flecks of charcoal and do in two cases include a hardened walking surface of a slightly lighter colour. These layers are separated by thin intervening yellow sand layers and also a few mixed refuse layers. In the lowest sub-levels of (5003) and in the actual transition from (5003) to (5008), a large concentration of at least three ceramic vessels was found. These vessels appear to have been broken here and sherds were found across an area of about 1.5m x 1m.

2.4.10 Level 1 – (Loci 5002, 5006)

Level 1 is the very latest use level of the area, and apart from the topsoil from across the excavation it consists of the modern rubble-wall (5006) located in the west end of the area (Figure 2.62). The wall cuts across the excavation area from the north at a slight angle (north-northwest to south-southeast) and extends for about 2.5 metres. It is visible on the surface outside the excavation area and it continues further to the north for approximately 2.2 metres. The wall is flimsy and poorly constructed with only two layers of uncut stone of varied size, lain haphazardly on top of each other without any traces of mortar. The wall is clearly datable as a recent construction based on the discovery of half a Styrofoam cup and a piece of plastic sheet found underneath the wall and between the two layers of stone respectively. Based on the Styrofoam cup this phase can be included in the latest sporadic use of the area, Phase 1. The reasoning for dating the wall to this phase (post 1950s) is based on the Styrofoam as this material was only invented in 1954 by Ray McIntire for Dow Chemicals.
2.4.11 Bulk finds and field objects

The amount of finds in the excavation area is as extensive and varied, as had originally been hoped for. This was partly facilitated by sieving all soil in 3 mm sieves, resulting in a very high rate of finds recovery.

Eighty-three field objects have been registered from ZUEP05 and these include 27 coins, which derive from various loci, representing levels 4 to 2. Other field objects include worked bone, various beads, worked wood and several metal objects such as iron nails, and bronze rosette, pendants, buckles and rings.

The main bulk finds are the ceramics and the animal bones both of which represents substantial collections. The faunal remains have not been analysed to date, but the preliminary results from the ceramics analysis indicate that the midden collection includes a very wide and varied assemblage, thus covering a wide range of activities.

Aside from the extremely rich finds of ceramics, bones and other objects the midden also produced substantial amount of easily perishable organic material such as botanical remains, human and animal hair, wood, rope and various fragments of textile. Apart from the macro finds, the excavated soil also included high amounts of organic material particularly in the eastern end of the trench, the central part of the midden. Soil samples were therefore regularly taken during excavation and these samples represent each of the midden levels from context and all loci from 5004 to 5018.

2.4.12 Conclusion and Recommendation

The ZUEP05 excavation represents a substantial addition to our knowledge of Al Zubarah’s occupation. The initial analysis indicates that the aim of expanding our knowledge of the everyday use-objects of al Zubarah has been achieved. The majority of the results from this season are still pending, as these are based not on easily accessible architectural remains, but on the large collections of bulk finds and field objects, most of which require further analysis. These analyses should also be able to establish whether the dating of the midden deposit to Phase 5 is correct, but is already suggested by the stratigraphic relationship between midden and wall. Based on the promising results achieved this season at ZUEP05 it is recommended that further excavation should be carried out at an additional two or three middens at Al Zubarah. At the present only ZUEP05 and a medium size midden deposit next to the palatial compound in ZUEP04 have been excavated. The additional results could greatly enhance our knowledge of the refuse pattern of the town of Al Zubarah and would also facilitate an analysis of the variation in access to resources across the town and potentially also across the main phases of use.
2.5 Zubarah Excavation Point 6 (ZUEP06)

Kirk Roberts

A sondage (ZUEP06) measuring 5.2 x 5.2m was excavated through the stratigraphic sequence located on higher ground approximately 60m to the north of ZUEP01 (Figure 2.63). This demonstrated that the topography of the underlying geology, rather than longer occupation sequence, was the reason for a higher ground level in this part of the site. The earliest feature excavated was a stone-lined hearth sealed under a layer of windblown sand (Figure 2.64). Above the windblown sand were the remains of a probable metal-working area. This included a number of surfaces and post-holes with frequent remains of metalworking in the deposits. As this phase of the use of the area was destroyed by fire, it is a possibility that this occupation relates to the Phase 5 occupation of the city. The architecture was re-built and a sequence of surfaces (Figure 2.65), rubbish pits and occupation layers reflect the built-up of deposits through the use of the area in this phase. Again there was substantial evidence for an industrial use of the area and the surfaces may relate to the beach-stone walls visible on the ground surface in close proximity to the trench. It is therefore possible that this phase of use may date to Phase 3 of the settlement although further work would be needed to test this assumption. The evidence from ZUEP06 fits with the evidence from ZUEP01 of an area to the north of the wealthy courtyard houses (Compound 1 and Compound 2) which is a zone of industrial activity and temporary occupation, located in an area close to the souq to the west.
Figure 2.64: Hearth [7051] underlying clean windblown sand. As hearth was so close to the section it was excavated in reverse stratigraphic order.

Figure 2.65: Surface (1915) truncated by pits.
3. **EXCAVATIONS AT FREIHA**

*Gareth Rees*

### 3.1 INTRODUCTION

Four excavation points were investigated at the settlement of Freiha during the 2010-2011 season. The locations of these excavation areas were based on a total station survey and terrain modelling of the settlement, as well as trial excavations, carried out in the previous season of fieldwork (Figure 3.1). Excavations continued in FREP01 with the aim of understanding the methods of construction and phases of use of the beach front mosque. There was no further excavation in FREP02 or FREP03 this season, the deposits in these parts of the settlement having already been characterised. Instead, three new excavation areas were opened. FREP04 was located in an area highlighted by the survey as containing relatively well preserved structures surviving to a height of 0.5m or more. It was postulated that this area may have been the last to be occupied and so excavations aimed to characterise the architecture of the later buildings as well as investigate the possibility of early phases of structures below, providing a continuous stratigraphic sequence. An additional aim of this season was to investigate the ‘linear midden’ feature which appears to separate the zone of well preserved buildings to the south from those to the north and east; FREP05 was located in this area in order to evaluate the character and date of these deposits. Based on finds recovered from the walk-over survey and excavations in FREP03 in January 2010, both recovering pottery of a relatively early date, FREP06 was opened over a large deflated midden to the east. This aimed to recover datable material and artefacts that would provide information about the character and period of use of this, less well preserved, part of the settlement.

### 3.2 FREIHA EXCAVATION POINT 1 (FREP01)

#### 3.2.1 Introduction

Excavations continued in FREP01 this season, the upper deposits having been removed previously. The excavations encompassed an area 30m<sup>2</sup> centred on a structure with several phases of stone walls aligned west-southwest – east-northeast (SW corner 182425 473280 QNG). Limited excavations were carried out outside of the building in order to investigate building techniques and to verify the existence of any external features. The previous season of fieldwork had uncovered three rows of column bases to the west and a courtyard that measured 18m (NNE\SSW) by 13m (WSW\ENE). The orientation and architectural layout of this building strongly suggested that it was a mosque, and excavations during the current phase of work have shown this to be correct. Only a small number of the architectural features were removed to preserve as much of the building structure as possible. Therefore, the earliest phases (5 and 4) were uncovered in sondages and not fully revealed in plan. However, it was evident that Phase 5 walls and surfaces directly overlay natural deposits. In the later phases the mosque was separated architecturally into three areas: the courtyard, the open iwan, and a prayer hall (Figure 3.2). The prayer hall was divided into two, presumably covered, iwans in Phase 5 which for clarity are referred to in the text as the eastern and western prayer hall; the western prayer hall being the iwan of the qibla.

#### 3.2.2 Phase 5

The first phase of construction (walls 302, 522, 764, 727, 717) formed a building measuring 22m WSW – ENE and 17m NNW–SSE with a central mihrab in the qibla wall to the west-southwest (Figure 3.3). A mortar surface was laid in the courtyard whilst a fine plaster surface was laid in the prayer hall. Evidence of plaster in the mihrab and on the base of the exterior of the western and southern walls indicates that the building may have been plastered inside and out at this time.
Figure 3.1: Plan of surveyed features at Freiha showing excavated areas
Figure 3.2: FREP01 - aerial view
It was not possible to differentiate any internal dividing walls in this phase. A well was dug in the south east corner of the courtyard.

The mosque then appears to have been abandoned for a long period of time, in which the northern wall (522) collapsed and was robbed out, before 0.3m of silt accumulated over its foundation. This abandonment of the mosque does not appear to have been associated with a complete abandonment of the settlement since a large pit was dug during this period.

3.2.3 Phase 4

The northern wall was rebuilt (751 and 753), 2.25m to the north of the previous wall and on the same alignment forming a structure that measured 22m west-southwest - east-northeast x 18.6m NNW - SSE. No evidence for a divide between the prayer hall and the courtyard was uncovered in this phase. Two resurfacing episodes occurred in the western half of the building and externally to the north and south.

Another period of abandonment then occurred with surfaces in the Prayer hall and the courtyard covered by windblown sand and rubble and a thick rubble deposit accumulating in the centre of the building (later the open iwan). The Phase 4 northern wall may have collapsed once again at the end of this phase.

3.2.4 Phase 3

The entire extent of the prayer hall wall (712, 728–41, 48) and the northern courtyard wall (227) were rebuilt during this phase, each of these walls being founded on or over the remains of an earlier wall. Two surfaces were documented in the courtyard: the first appears to be the result of trampling, represented by a compacted sand surface; the second, later, surface was a hard mortar floor. The eastern prayer hall walls from this phase were built in foundation trenches dug into the rubble layer. The mosque may have been realigned at this time, with walls <227> and <712>

Figure 3.3: Phase 5 miḥrāb filled by accumulation of silt overlain by mud-rubble (bottom), overlain by Phase 3 qibla wall
built on an orientation 5 degrees to the north of the Phase 1 and 2 walls (522, 764, 751, 753) and a new mihrab was constructed in the centre of the new qibla wall. The dimensions of the building remained relativity unchanged but three internal walls divided the space. Wall <797> separated the Courtyard from the prayer hall and ran, at ground level, between walls 48 and 49 forming a 12m wide courtyard. Walls 48, 49 and 797 may have formed a colonnaded open iwan, 2.60m wide, but no evidence of columns bonded into these walls survived. A compacted shell and grit mortar surface was constructed in the eastern prayer hall before a levelling layer was deposited for the construction of a new plaster surface. Another plaster surface was also laid in the open iwan.

The open iwan was divided from the main prayer hall by walls 757 and 767. These walls, built in a foundation trench dug into rubble (293), formed a wall across the entire width of the prayer hall with a door in the centre aligned with the qibla wall. To the north of the door in wall 757 a separate, internal, mihrab and minbar were constructed as part of this divide. The prayer hall was then divided again, into an eastern and western iwan. This divide was most likely spanned by arches with the central arch aligned on the axis of the rear mihrab. Postholes and stakeholes dug into the prayer hall surfaces may have held posts that were part of scaffolding for maintenance and alteration of the roof, lintels and columns.

The building then fell out of use for a third time with laminated windblown silts and mud-rubble deposits building up in the courtyard, in the prayer hall and outside the building. There was little evidence of roof collapse in the build up of these layers, but the central columns on bases 791 and 792 may have fallen completely, whilst 793 may have been badly eroded before the next period of use.

3.2.5 Phase 2

The external walls do not appear to have collapsed during the period of abandonment with only internal column bases being replaced. Column bases 56, 57, 58 and 59 were constructed on the courtyard-iwan dividing wall whilst the rear prayer hall column bases were replaced with smaller column bases. Some column bases were completely reconstructed, built in foundation pits dug through the remains of the preceding bases. This new location allowed a complete view of the mihrab and the newly built minbar. Remains of an arch, which would have spanned the qibla area at a height of c.1.96m above the surface, were also found (Figure 3.4).

Plaster surfaces were laid in the prayer hall and the open iwan and a thick beach shell surface was laid in the courtyard. Mortar surfaces were built to the north and south outside of the building. Postholes were dug in all areas of the mosque after the main period of use which may have been provided supports for temporary scaffolds and roof. It is also possible that these posts reflect the use of the abandoned mosque for temporary shelters (e.g. tents), for a short period of time.

There followed a period of major structural collapse with roofing material spread over the prayer hall. Silt and rubble accumulated in all parts of the building and over the external surfaces. The courtyard may have collapsed completely with rubble overlying it in places. The northern prayer hall and the northern segment of the qibla wall may have collapsed along with dividing wall 757/767.

3.2.6 Phase 1

Reconstruction in this phase reused a large amount of rubble, presumably from the previous phase of collapse. The northern prayer hall wall (42=49) and qibla wall 43 were built first, with two windows being added in to the north of the open iwan. The northern pier of the rear prayer hall divide was also built at this time. The eastern prayer hall wall was reconstructed with wall 757/767 (internal mihrab and minbar) being replaced by a more open arrangement of square windows, and flat lintels. Wall 47 was bonded into the northern prayer hall wall whilst 46 had been built in a ‘plug’ knocked through wall 728. This ‘plug’ was then covered externally by a red-
brown silt and cobble facing. Based on the rubble recovered from the upper layers, the mosque at this time may have consisted of arched colonnades at the front and rear with a colonnade with flat lintels between the open iwan and the prayer hall. The prayer hall was then resurfaced with a thick concreted plaster, which may have continued into the iwan. The resurfacing was closely associated with the plastering of all of the internal walls of the structure.

The courtyard wall (38, 39, 40) was constructed in a shallow mortar-filled foundation trench. An entrance was located in the centre of the wall, directly in line with the rear mihrab. Thick mortar surfaces were laid in the courtyard and externally on all sides of the mosque.

3.2.7 Discussion

The mosque in Freiha appears to have been used over an extended period of time with several episodes of abandonment leading to the collapse of the roof and many of the walls and columns. This regular abandonment of the building may indicate that the settlement was of reduced size or depopulated on several occasions. If there was a minaret, it is most likely to have been located to the north-east of the courtyard. The sections of a modern (post-1977) cut feature in this area show that the walls of the building in all phases were deeper in this area, indicating that they may have been supporting the weight of a tall structure. The rubble from the minaret may have been removed and used for building material elsewhere.

The northern walls of the building collapsed more than those to the south and this may be due to the prevailing north-westerly wind eroding mud-brick and plaster faster on the northern side of the structure. The mosque was extended by 2.25m to the north in Phase 4; this event may relate to an increase in the settlement’s population. A major reconstruction event occurred in Phase 3, when the entire prayer hall and northern courtyard wall were rebuilt on a different alignment from that of the previous phases, with a new mihrab being added. It is assumed that the previous southern and eastern courtyard walls were still in use at this time. The mosque in this phase was 18.6m wide and 22m in length and consisted of a courtyard, an open (probably colonnaded) iwan, and a covered prayer hall divided

Figure 3.4: Archway (161) collapsed over mihrab associated with column bases 51 ad 52
into two iwans each 2.60m wide by a row of four columns. The divide between the open iwan and the covered prayer hall was formed by a wall, including a mihrab and minbar. Access to the prayer hall was through an opening in this wall aligned with the rear mihrab. Adjustments to the alignment may have been made following improved measurements of the correct direction of the qibla wall.

The number of postholes located in and around the prayer hall may represent attempts to support the building’s roof during periods of disuse. It is not clear how long the disuse episodes lasted but laminations of windblown silt and eroded red-brown construction material (representing differing erosive processes during different seasons) imply that it was probably years rather than months. The people of Freiha appear to have been constantly battling the erosive forces of the wind, and possibly the sea, to keep their mosque standing.

Reconstruction in Phase 2 consisted primarily of columns, which may indicate a shorter period of abandonment with only minor internal collapse. The two rear central columns were completely rebuilt and a minbar was constructed to the north-northwest of the rear mihrab. These two columns may have supported much of the weight of the roof making them more susceptible to collapse during periods of abandonment. The columns in the prayer hall were spanned by arches (in excess of 1.96m high), although it is possible that a mismatching arch still existed to the south where the Phase 3 column and pier had not collapsed. New columns built at the front of the open iwan were also spanned by plastered arches (in excess of 2.10m high).

A piece of carbonised roofing material was recovered from the collapsed mud-rubble accumulated after this phase. This carbonised material is likely to represent the remains of palm matting laid over wooden beams in the roof. This would then have been covered by the mid-red silt construction material which was found in much of the collapse.

The southern and eastern courtyard walls had been covered with silt and rubble prior to the final use of the building. A thick silt build up covered by roof collapse in the prayer hall also attests to the extent of disrepair by this time. In the final phase of use very little new stone appears to have been sourced with much of the walls consisting of rubble blocks. As was the case during the previous extended periods of abandonment, the northern wall had also collapsed along with the prayer hall/iwan dividing wall. No minbar structures were found associated with this phase and those of previous phases were covered over by new plaster surfaces. The construction technique in this period appeared to be less careful than those of previous phases, however plastering of the entire internal space of the prayer hall and the open iwan along with high quality plaster surfaces may be an indication that the wealth of this later population was no less than previously.

3.3 Freiha Excavation Point 4 (FREP04)

3.3.1 Introduction

Excavations in FREP04, located 65m to the north of the mosque, aimed to investigate the character and date of some of the domestic structures in Freiha. This excavation area targeted buildings identified during the survey in January 2010 in an area, to the south of the linear midden, thought to have had the longest period of occupation. Many of the buildings identified during the survey appear to have consisted of several small rooms surrounding a courtyard measuring about 12m by 12m; the buildings located in FREP04 appeared to be particularly well preserved examples of these typical structures. This trench measured 25m north to south and 40m east to west (SW corner 182255 473370 QNG) and included the remains of four separate stone-built structures along with half of a midden mound c.20m in diameter in the NE corner. Removal of the windblown sand overburden revealed a complex series of rooms with multiple abutting walls. Excavations focused on two buildings in the centre of the area and the midden (Figure 3.5). A minimum of four phases of architecture were uncovered with a final phase of deposits representing midden dumping in the disused rooms.
3.3.2 Phase 5

Few features uncovered this season date to this period. Wall 516, surrounding an uninvestigated room, was the earliest wall uncovered but was built on top of midden material indicating that earlier occupation was present below. Several postholes, identified by a sondage in Space 14, pre-date wall 517 and may relate to occupation associated with wall 516.

3.3.3 Phase 4

Rectangular rooms Space 7 and Space 14 were constructed on different alignments in this phase. Both were constructed from a single wall and contained plastered features. The madbasa in Space 7 indicates that this room was used as a store room at one point in its history whilst the sump pits located in both rooms suggest that they may have been used as domestic kitchens (Figure 3.6). Quern stones and a large amount of pottery recovered from Space 7 support this idea.

A robber trench [699] identified to the south suggests that this period was a time of great investment in the settlement with large and substantial buildings being constructed. The construction of wall 514 may indicate that more rooms were present in this Phase, which were later dismantled.

3.3.4 Phase 3

Several walls survive from this phase that may once have been part of larger, complete rooms. Wall 332, 705, and 511 may have been partially dismantled in a later period, but their fragmentary presence gives an indication of the density of occupation at this time. Space 8 and Space 12 survived intact from this period. Space 8 was formed by a single wall abutting wall 705 and may have been contemporary with the primary use associated with wall 705. Later blocking of the doorway between these two rooms may be an indication that the room formed by 705 was in use.
after Space 8 had been abandoned. Space 8 contained a shell-filled sump pit in the south-west corner (similar to Space 7), as well the remains of several storage vessels and bitumen coated pots.

Space 12 was a courtyard built on to the southern side of Space 14 (suggesting that Space 14 was still in use in this phase). A shell surface was laid and a tānnur dug into it. Tānnurs were also dug to the west of wall 705 at this time. Surfaces located to the east of Space 14 indicate that occupation continued to the east and that perhaps all of the material from these walls was also robbed out.

3.3.5 Phase 2

Spaces 9, 10, 13, 15 and 18 were all constructed in this phase. All of these rooms included parts of earlier phases of walls in their boundaries. Space 9 was constructed over robber trench [699], indicating that the building that may have stood here was removed (Figure 3.7). No features were located in Spaces 10 or 15 indicating that they may have been disused store rooms or domestic spaces. The quern stone located in Space 13 may indicate that processing was taking place in this area. Surfaces, a tānnur and middens in the area south of Space 10 indicate that this area was also used for occupation and that its eastern wall may have been removed.

3.3.6 Phase 1

Activity at this time consisted primarily of the dumping of midden material in the abandoned buildings in this area. This suggests that settlement was still present nearby but had moved away from the buildings of FREP04.
3.3.7 Discussion

The sequence of occupation uncovered in FREP04 is indicative of recurrent occupations of these buildings characterised by periods of dilapidation and abandonment, as suggested by the lack of maintenance of walls (and probably roofs). Only Spaces 7, 14 and that to the south of Space 10 contained more than one period of use. These spaces appear to have been maintained more so than other buildings; a number of postholes associated with Spaces 7 and 14 may represent attempts to support the roofs during periods of absence. Occupation may have been based around these structures, which may have been used for domestic kitchen tasks and storage, with new rooms replacing those around them during each period of occupation. If this was the case then it would have been easiest to reuse fragments of older walls that were still standing and then use the fallen rubble to construct new walls. Midden deposits between some resurfacing and building phases are indicative of abandonment of this local area but not others around, whilst windblown sand build-up between some wall phases tends to indicate a more widespread depopulation.

A large amount of pottery and animal bone (both fish and mammal) was recovered from all of the spaces indicating that this area broadly speaking served had a domestic function. Fishing is likely to have been one of the main subsistence practices in the settlement and several diving weights were recovered. Several fragmentary and complete quern stones indicate that processing of grains or pulses may have taken place, and it is possible that these goods were imported in to the settlement; a large number of coins recovered, particularly from Space 14, is indicative of a population with trading contacts (this is supported by the findings of excavations in Qal‘at Freiha in 2005).

It is not clear whether Freiha was abandoned for long periods, if domestic architecture was deliberately not maintained or if the population had constantly changing needs; but evidence from FREP04 indicates a sporadically thriving population with the means to build and rebuild regularly in the same place.
3.4 FREP05

During the survey of Freiha in early 2010, a difference in building preservation was noted, with buildings to the south generally surviving in a more complete state than most buildings to the north of the site, whilst those to the east survived only in the form of deflated pisé or mud brick footings. The buildings to the south were bounded by a bank of midden material, 250m north of the mosque, running northwest to southeast from the coast for 170m. This bank measured up to 20m wide and survived up to 0.8m above the ground surface, and was a likely location for the boundary of the later activity in the settlement. This bank was reused in the 1960s as a boundary and bulldozing along the course of the feature can be seen on aerial photographs from 1971 (QMA archive). No evidence of this boundary survives at present but the effects of bulldozing can be seen to the south-east of the bank, which continues as a track out to the modern road to the east.

Excavation point 5 (FREP05) targeted this midden bank to ascertain the presence or absence of a boundary wall for the settlement and to understand how these deposits accumulated. The excavation area measured 22m in length and 2m wide and was positioned perpendicular to the line of the mound (Figure 3.8). No boundary wall was found, but the remains of three structures were uncovered with associated tannūrs and refuse pits. These were covered by a thick layer of rubble and midden material when they had fallen out of use. This area may have been on the edge of the later, southern, occupation of the settlement, but the appearance of the boundary-like mound today may have been exacerbated by modern boundary construction in the 1960s.

The architecture uncovered in this trench appears to be closer in character to that uncovered in FREP03 (eastern area) than that in FREP04 (southern area). This may be due to the amount of stone refuse from the foundations that has left only partial evidence for these walls, but it may also be an indication that these buildings were part of an earlier phase of occupation at Freiha from which building material was removed to build new structures to the south.

Figure 3.8: FREP05 - facing south-west
3.5 FREP06

A sondage measuring 2m x 2m was excavated in a large, deflated, sub-circular midden mound to the east of the settlement. This mound, located 85m to the south-west of FREP03, measured 26m in diameter, and was associated with an area containing house platforms with robbed out walls. The deposits in this midden, the largest surviving feature of its kind in the settlement, were eroded by wind, suggesting that it was in use for a long period of time, but also that it was also not used for longer than many of the other middens in the settlement. Excavations aimed to ascertain whether this feature was in fact of an early date and if it was associated with the buildings located nearby.

The character of the deposits in FREP06 is indicative of regular phases of refuse deposition. Like many other middens in the settlement, this mound originated from dumping refuse in a disused building, which demonstrates that there are earlier phases of settlement before the midden deposition began. The dark ashy deposits, similar to those found in other midden deposits at the site, tended to be rich in artefacts especially ceramic and animal bone, and suggest domestic refuse dumping during a period of occupation (Figure 3.9). A friable red silt, composed of a material found in some wall bonding material and renders elsewhere at Freiha, found interlaced with these layers may have derived from render, mud walls or material from roof collapse in the surrounding buildings. If this was the case if would suggest that the red silt layers may be the result of cleaning after a period of abandonment, and partial structural collapse. This pattern of occupation is one also illustrated in the architecture of FREP04 and in the multiple abandonment layers uncovered in the mosque.

Figure 3.9: West-facing section of FREP06
3.6 Discussion

Several themes relating to the occupation of Freiha have become apparent through the excavations carried out in 2010 and 2011. The most dominant of these is a repeated pattern of abandonment and rebuilding. All of the trenches investigated thus far have demonstrated that the settlement is a complex palimpsest of occupation phases interspersed by periods of abandonment. This is something that can be seen most clearly in the remains of the mosque in FREP01. Here, five periods of construction, several on quite a significant scale, took place throughout the life of the building. Each of these phases of use was followed by a period of abandonment, whereby thick layers of windblown silt would accumulate along with debris from wall and roof collapse. The Phase 3 rebuild appears to represent a considerable investment of resources with the entire prayer hall being rebuilt on a different alignment, whilst Phases 2 and 1 represent significant architectural changes to the layout of the mosque; the returning population clearly had enough resources to rebuild this major structure in the same location each time.

The buildings in FREP04, originally thought to be cellular rooms laid out around a courtyard, in fact appear to have been a series of short lived stone-built room based around and abutting two older rectangular rooms. As in the mosque, it was these older rooms in which postholes were found indicating either an attempt to hold up the roof or the use of that area for temporary shelters or lean-tos, perhaps reusing the walls of abandoned buildings. The older rooms, Space 7 and Space 14, had multiple functions with madbasat, a sump pit, quern stones, kitchen waste in Space 7 and a sump pit, a plastered basin and multiple coins uncovered in Space 14.

Both in the mosque and in FREP04 the location remains constant and buildings are rebuilt, probably with rubble, in the same place, rather than moving elsewhere. It is possible that in both these areas some periods of occupation have gone undetected due to the tendency to build directly on to underlying deposits rather than in foundation trenches. The deposits uncovered in the midden (FREP06) to the east of the settlement also clearly illustrate a regular pattern of use with occupational midden deposits interspersed by structural material, possibly cleaned out from partially collapsed buildings. Structural evidence uncovered in FREP03, FREP05 and FREP06 tend to support a model of dynamic, organic occupation in Freiha with walls, rooms and courtyards added when necessary rather than on a set plan, but they also point towards a gradual migration of the settlement from north to south. This migration is illustrated by the large amount of stone masonry that survives to the south in contrast to the fragmentary walls seen to the east and north, and its final stages may be shown by the dumping of midden waste into the rooms in FREP04. It may be suggested that migration of building materials indicates a shrinking population, with people not returning to their houses, and the collapsed masonry eventually being reused in the core further south.

Inspite of these absences the economy of the settlement appears to have been relatively stable and may have involved import of unprocessed foods. Quern stones found in Spaces 7 and 15 may have been used to process grains or pulses, the provenance of which is not known. However, it is highly unlikely that they came from Freiha itself due to the lack of wells in the area (only one was identified by the survey). Coins were found in Space 14 and Space 17. Fishing weights as well as a large number of fish bones reveal the primary diet of people in the settlement, although this appears to have been supplemented by mammals as well as dates. This food appears to have been cooked in several different ways, with clay lined tanmurs uncovered in several areas (FREP04, FREP05 and FREP03), hearth-like installations in Space 17 and a large number of small shallow firepits in all areas that may represent only short term use.

The sequence of occupation in FREP04 is only just becoming clear and it appears that older structures lie to the east and south-east that may be associated with a robbed out foundation trench. Further excavations in this area would lead to a better understanding of the foundation of the settlement. The deep, wide foundation trench may indicate that there was an initial phase of architecture that was not as organic as the later buildings. Continued excavation down to this foundation phase may help to understand why the population first left and why the character and location of buildings changed so readily. One reason for a change in behaviour may have been...
a change in economy, and further, more extensive excavations in FREP03 and FREP05 (which have already produced ceramics dated to the early 17th century) will not only elucidate on the morphology of the early settlement, but will provide data on diet and economy with which to contrast that which has been retrieved from later buildings in FREP04.
4. Regional Survey

4.1 Introduction

The QIAH regional survey continued the project’s successful program of assessing and recording the archaeological heritage of northern Qatar begun the 2009-2010 season. The work consisted of multiple components:

- Geomorphological, geoarchaeological and palaeohydrological survey of northern Qatar with a focus around the area of Fuwairit carried out by Dr Philip Macumber
- Mapping/topographic survey of key Islamic era sites in northern Qatar with a particular focus on Fuwairit
- Pedestrian survey along the coastline between Fuwairit and Ras Laffan
- Rescue excavations at Khasuma (Al Ruwais)

The aim of this survey work is to provide a wide ranging characterisation of the Al Zubarah hinterland, which played a pivotal role in the development of the settlement. Although it is generally acknowledged that hinterlands played an important role in the formation of towns and larger urban settlements, the exact economic and social relations between the town and the hinterland require detailed archaeological assessment by studying both the settlement and surrounding historic landscape in concert, rather than each in isolation. The survey accomplishes that by mapping key Islamic sites to understand their size, character and function, by surface collections of artefacts for dating and functional analysis, by conducting pedestrian survey to discover new sites, visiting known sites for record updating, and carrying out - where necessary - rescue excavations at threatened archaeological localities.

Previous work as part of this survey component of the Project has demonstrated that there was a close relationship between the town of Al Zubarah and its immediate and wider hinterland. Data suggests that there may have been a spike in site densities during the 18th century, which appears to be related to the emergence of Al Zubarah as a key regional centre. Many of these sites consist of small forts or fortified compounds that protect artisan wells and are often accompanied by additional buildings and settlements. Whether these sites appeared in the landscape as a reaction to Al Zubarah’s emergence (protecting existing water and land-use rights?) or whether they were built by Al Zubarah’s inhabitants to strategically take advantage of and protect key locales in the landscape is an as yet unresolved question and a key issue for the ongoing survey work and historical analysis.

The survey also acts as a wider heritage management tool by cross-checking sites listed on the Qatar National Historic Environment Record (QNHER) and evaluating their preservation status. As part of this work the survey naturally records sites belonging to all time periods and phases, not just those dating to the Islamic period.

A key part of the survey work has been the geoarchaeological, palaeoenvironmental and palaeohydrological study of Dr Phillip Macumber, whose studies over the course of the last three years has significantly changed our understanding of the hydrological characteristics and historic settlement patterns of northern Qatar. The link between the scarce water resources of northern Qatar and historic settlement continues to be a key concern, as the availability of consumable fresh water was a key constraint on the distribution of farms, camps, villages and towns.

This multi-faceted, multi-disciplinary approach to the understanding the historic landscape of northern Qatar has already produced, and continues to provide, an in-depth insight into the human-environmental relationships, the interaction between rural areas and urban sites, as well as the social, cultural and economic relations between differently constituted communities in northern Qatar in the Islamic period.
4.2 Geomorphology, Hydrology and Occupation across North-Eastern Qatar

Phillip G. Macumber

4.2.1 Introduction

Central to any holistic archaeological study is the relationship between occupation and the natural environment – why people live where they do. This is especially the case in Qatar where low rainfall coupled with low relief results in the absence of fresh surface water. The only natural water source is from groundwater occurring in the Tertiary marine limestone aquifers, the Umm er-Rhaduma, the Rus, and closer to the coast the Dammam Formation which outcrops across much of Qatar. The deeper part of the aquifer system is brackish to saline, and freshwater in northern Qatar is limited to the upper parts of the aquifer, occurring as a freshwater lens. The freshwater is recharged locally, mostly during storm rainfall events during which run off and silt is concentrated in the many depressions scattered across the landscape. The depressions initially formed in response to solution of gypsum, leading to the development of collapse features in the limestone aquifers. The surface expression of the collapse structures are the rawdha which contain the better soils. With no surface water, the only alternative water source for occupation and settlement was groundwater, obtained from the many wells scattered across the country which are commonly associated with the rawdha. Without the groundwater there could be no settlement, and the history of settlement in Qatar is therefore reflected in the history and distribution of its wells.

In Season 1 (2009), the main emphasis of the hydrology and geomorphology study was placed on the landscape around Al Zubarah, which was strongly influenced by the mid-Holocene high sea level from 7,000 to 4,000 years ago during the Flandrian transgression. The sea transgressed as far inland as the eastern limits of the sabkha near Murayr (Macumber, 2009), depositing sediments at levels reaching 1-3 m above that of the present sea level. Sampling of the inner beach ridge was undertaken to provide a basis for better understanding the evolution of the landscape around Al-Zubarah.

The emphasis during Season 2 (2010) was to gain a broader understanding of the general relationship between occupation and the regional geomorphological/hydrological setting across northern Qatar. Attention was focused on the impact on the landscape by the earlier of the two high sea level phases at Qatar, coinciding with the penultimate interglacial period (Eemian – marine isotope sub stage 5e commencing about 140-130,000) and lasting to perhaps 115,000 years ago. During this period conditions were similar to today but perhaps warmer and certainly wetter. The Eemian finished about 115,000 years ago with rapid cooling.

Season 3 (2011) examines the relationship between landscape and occupation in north eastern Qatar from al-Jumayl to Fuwairit and its hinterland, with an emphasis on:

1. Geomorphology and geology of the Fuwairit-al-Ghariyah coastal area
2. The water supply for Fuwairit and al-Ghariyah and inland areas
3. The association of rawdha-playettes-trees-wells and occupation, exemplified by the ruins near Umm al-Kilab
4. Landscape and water along the NE coast of Qatar between Al Ruwais and al-Ghariyah
5. The inland area of northern Qatar was further investigated.
4.2.2 Geomorphology and geology of the Fuwairit - al-Ghariyah coastal area

The ruins of the towns of Fuwairit and al-Ghariyah are located on the north-eastern coast of Qatar about 50 km north of Doha and about 20 km east of Al Zubarah (Figure 4.1). They are two of a number of small coastal towns located across northern Qatar. Al-Ghariyah is located 6.5 km to the north of Fuwairit. Fuwairit lies in a gap between late Pleistocene aeolianite ridges fronting the coast, whereas al-Ghariyah is located between the more northerly of the two ridges and the sea.

Figure 4.1: Location of Fuwairit, N.E. Qatar

Geomorphology

Fuwairit was established on a narrow north-south trending spit-like promontory, attached to the mainland in the north (Figure 4.2). On its coastward side is a further sand spit, forming a barrier to the sea. The two are separated by a narrow tidal inlet, host to mangroves. A second narrow inlet occurs to the west of the town, where it is abuts higher ground formed from a combination of late Pleistocene shallow marine sediments and Eocene Dammam Formation dolomitic limestone (Figure 4.2). The town appears as a very low bumpy ridge of silty sand which partially masks the individual buildings (Figure 4.7), although they are readily distinguished on the satellite imagery (Figure 4.2).

Inland of Fuwairit there is a narrow sabkha developed at the bottom end of a small drainage line commencing on higher ground to the northwest, where it is associated with broad grassy rawdha flats (Figure 4.3, 4.4). The northern end of the town terminates against a small shallow stream channel emanating from the sabkha and separating the town from higher ground to the north, there formed across planated Eemian suite of marine sediments and the overlying aeolianites which form the Jabal Fuwairit. The base of the channel lies close to the water table and it only contains water in small saline pools where the groundwater outcrops. The sabkha is developed on Eemian marine sediments and is actively expanding by under-sapping its sides creating small scarps cut into the limestone and the marine sediments. The edges of the sabkha are commonly moist showing groundwater outflow mostly by capillarity.
Figure 4.2: Landscape in the immediate vicinity of Fuwairit

Figure 4.3: Locality map. The larger area around Fuwairit with that covered by Figure 4.2 and shown by the inset. Location of geological section lines ‘A-A’ and ‘B-B’ for figures 4.9 and 4.10
Figure 4.4: Relief and drainage pattern formed across the Dammam Formation with stream traces which broaden to form both rawda further inland, and sabkha closer to Fuwairit.

Figure 4.5: Fuwairit sand spit 1958

Figure 4.6: Fuwairit and sand spit 2010
There have been landscape changes at Fuwairit since the 1950s, with the enlargement of the sand spit lying to the east of the town, mostly during the 1970s and 1980s (Figures 4.5, 4.6). In the 1950s and 1960s, the spit was relatively narrow, but with a broad shallow sand bank developed offshore. The spit and sand bank gradually merged with the further development of small offshore bars. The mangroves were not present in 1958, when the area was a sandy tidal inlet. The present distinct tidal channel formed following establishment of the mangroves (Figures 4.7, 4.8).

Geology in the Fuwairit - al-Ghariyah region

A geological and topographic section showing the water table (line A-A -Figure 4.9) is shown passing from the coast at Fuwairit inland to a farm at Feleeha where there are a number of wells, which probably provided water for Fuwairit.

A second B-B section line (Figure 4.10) passes inland through Jabal Fuwairit, showing the more elevated hinterland against which the aeolianite accumulated. The aeolianites are underlain by beach and shallow marine sediments, from which they are derived by deflation. The underlying marine/beach sequences are best observed between Fuwairit and the Jabal, and to the south nearer al-Ghariyah. (see below).
Figure 4.9: SE-NW Geological (diagrammatic) and topographical section ‘A-A’ through Fuwairit

Legend:
- Fuwairit ruins
- Sand spit (recent)
- Shallow marine and beach sediments (Dabb’iya and Futaisi Members of the Fuwairit Formation (Eemian - Late Pleistocene)
- Dammam Formation (Eocene)
- Water table with groundwater salinity show at bottom of figure

Figure 4.10: SE-NW Geological section line ‘B-B’ through Jabal Fuwairit

Legend:
- Aeolianite (Wusayl Member of the Fuwairit Formation –Eemian – Late Pleistocene)
- Shallow marine and beach sediments (Dabb’iya and Futaisi Members of the Fuwairit Formation - Eemian - Late Pleistocene)
- Dammam Formation (Eocene)
- Water table
Dammam Formation and the al-Ghariyah Fault

The Eocene cryptocrystalline marine dolomitic limestone of the Dammam Formation, which forms the surface across much of northern and central Qatar, comes close to the coast in the vicinity of Jabal Fuwairit. It seems likely that the position of the aeolianite ridge forming the jabal was determined by the higher ground of outcropping Dammam Formation limestone, which rises to about 18 m above sea level further inland from the coast.

The Dammam Formation forms a coastward sloping plain, which close to the coast is overlain by the Fuwairit Formation consisting of shallow marine and beach sediments and aeolianites forming the jabal. The limestone has a steeper slope to the southeast, which has generated a number of small drainage lines associated with which are areas of rawdha in the upper areas and sabkha at the lowermost ends (Figure 4.11). The position of the high ground is in turn related to the al-Ghariyah Fault (Macumber, 2009), which crosses the coast between Fuwairit and Jabal Fuwairit (Figures 4.12, 4.13).

Figure 4.11: Geological map in the vicinity of Fuwairit. (Hunting 1980 courtesy of Neil Munro), note small drainage lines passing eastwards towards the sabkha and associated rawdha.
Figure 4.12: Location of the Ghariyah Fault between Fuwairit and al-Ghariyah and its representation to the south. The Eemian coastal terrace lies between the 0 and 6m contours.

Figure 4.13: Relief map of northern and central Qatar showing Al-Ghariyah Fault.
**Shallow marine Fuwairit Formation**

Littoral shallow marine and beach sequences were deposited around the Qatari coastline some 120-130,000 years ago during the last interglacial (oxygen isotope substage 5e - Eemian) when the sea reached levels about 6 m above that at present. As is the case elsewhere they are richly fossiliferous, the most common marine shells being small cerithid gastropods. This event was the earlier of the two most recent marine transgressions, corresponding to interglacial high sea levels, which inundated and sculptured the Qatari coastline.

At the height of the intervening glacial period, sea levels fell to be ca 120-130 m below the present between 18,000 and 15,000 yr BP. The following mid-Holocene (Flandrian) transgression saw sea levels peaking at 2.5 m to 3 m above present from between 7,000 and 4,000 years BP, with the regression commencing soon after, and continuing to about 1,000 yr BP. The period of the regression is based on radiocarbon dates from the excavated channel at al-Zubarah (Macumber, 2010, 2011).

The earlier Eemian marine transgression dates to about 117,000 to 130,000 years BP. At Fuwairit, Eemian littoral marine sediments outcrop in a narrow belt extending northwards beyond Jabal Fuwairit; they underlie the town. The extent of the Eemian transgression into NE Qatar is shown on the geological map by the darker orange unit (Figure 4.14). Overlying the shallow marine sediments are a thick sequence of aeolianites which reach a height of 20 m above sea level and form a 2.5 km long ridge parallel to the coast (Figures 4.16, 4.17). The aeolianite is the Al Wusayl Member of the Fuwairit Formation (Figure 4.16) which consists of a suite of shallow marine sediments and derived aeolianites (Williams and Walkden, 2001; 2002).

On the basis of the bedding within the aeolianites, it was determined that the wind direction of the Shamal at the time of deposition was from the north east, and therefore different from that of today where it comes from the north west. The initial transgression led to deposition of shallow marine deposits of the Futaisi and Dubb’iya Members and an aeolian Al Wusayl Member, each separated by a period of sub-aerial erosion (Figure 4.15). The Futaisi and Dubb’iya Members represent sea levels reaching 1.5-2 m and ca 6 m respectively above present sea level. These sediments are the source of the overlying aeolianite.

The shallow marine beach members of the Fuwairit Formation emerge from beneath the aeolianites to the south of Fuwairit and form the structural base on which the town has been built. Although deemed to be up to 6 m thick (Figure 4.15), the shallow-marine/beach sequence has been strongly wind deflated to form a flat surface whose elevation was dictated by the level of the underlying saline water table. This process, referred to as water table bevelling, is perhaps best seen at Ain Mohammad nearer al-Zubarah on the northwest coast of Qatar, where 3m high pedestals of Eemian beach and shallow marine sediments are preserved above the surrounding sabkha, the top of which is itself formed of marine sediments (Figure 4.18). Similarly, remnants of shallow marine sequences occur between Fuwairit and al-Ghariyah both as discrete pedestals and also forming a low ridge between the coast and sabkha/rawdha further inland (Figure 4.19).

Although somewhat obscured beneath the town of Fuwairit, the marine/beach members of the Fuwairit Formation show clearly in areas immediately to the west, where the sabkha impinges on a planated marine surface into which it has eroded small scarps (Figure 4.18, Figure 4.22). The micro-scarps appear to form from under-sapping by groundwater discharge, as the sabkha edge adjacent to the scarps may be quite moist, and small reeds may be present. The thin layer of Eemian sediments overlie a planated Dammam Formation surface (Figure 4.21), formed initially as a wave cut rock platform during the Eemian transgression (see Macumber 2009, 2010). Therefore while the micro-scap may be cut entirely into the cemented marine/beach sediment, elsewhere the edges consist of a thin layer of marine sediment overlying planated Dammam Formation.
Figure 4.14: Geological map of the Fuwairit area (Hunting, 1980)

Legend
- Sabkha (saline coastal flats)
- Rawdha (colluvial and alluvial flats)
- Beach and shallow marine deposits (Eemian and Holocene)
- Al Wusayl Member of the Fuwayrit Formation – Eemian phase aeolianite
- Upper Dammam Formation dolomitic limestone – Middle Eocene
- Location of wells recorded on the geological map
Figure 4.15: Stratigraphy of the late Pleistocene Fuwairit Formation (from Macumber 2010, modified from Williams and Walken, 2002)

Figure 4.16: Aeolianite at Jabal Fuwairit
Figure 4.17: Aeolian cross-bedding at Jabal Fuwairit

Figure 4.18: Pleistocene shallow marine and beach sediments of the Dabb’iya Member with red-brown palaeo sabkha in the background, indicating the extent of deflation

Figure 4.19: One metre high remnant of pedestal of marine Fuwayrit Formation occurring to the east of al-Ghariyah
Figure 4.20: Dabb’iyya Member of the Fuwairit Formation marking the edge of the sabkha (background) at Fuwairit

Figure 4.21: Shelly marine Fuwairit Formation overlying Damman Formation near Fuwairit

Figure 4.22: Eroded edges of the Fuwairit Formation at Fuwairit, at its junction with the sabkha
4.2.3 Water Supply for Fuwairit and al-Ghariyah

Like all northern Qatari towns, Fuwairit was entirely dependent on groundwater for its water supply. The town is one of a number scattered across northern Qatar between Al Zubarah and Fuwairit for which the groundwater derived from the calcareous (carbonate) facies of the Rus and Umm a’Rhaduma Formations limestone aquifer is the freshest in Qatar. (Figure 4.23). Elsewhere the aquifers are gypseous and the groundwater quality is poorer.

A number of wells appear on the geological map of Qatar (Hunting, 1980), and, although only a guide, the map shows them to be set back from the coast away from the influence of seawater intrusion. In addition three sites (marked as crosses) have been added to the map – two to the west of Fuwairit and one to the west of al-Ghariyah. One well located in an area of grassy rawdha close to an abandoned airstrip, appears to have been more recent (Figure 4.24), the other two are traditional sites and provided water to the respective nearby towns. In the case of both Fuwairit and al-Ghariyah the nearest wells appear to be located about 1.6 to 3.0 km inland of the towns. To the west of Fuwairit, wells are located at Feleeha where they are now associated with a modern day farm (Figure 4.26), those to the west of al-Gharriyah are associated with ruins representing a number of buildings, a small cemetery and perhaps a small fort. In the latter case such features are a common characteristic associated with town supply bores occurring whereby the well field is some distance from the coastal town.

Figure 4.23: Relationship between freshwater and town distribution across northern Qatar
Figure 4.24: Well in rawdha with water within 2m of the surface - at airstrip 2.9km west of Fuwairit

Figure 4.25: Well distribution in the Fuwairit - al-Ghariyah area, inland of the sabkha
Figure 4.26: More recent and older infilled wells located at Feleeha about 1.6km west of Fuwairit

Figure 4.27: Hand-dug wells at ruins west of al-Ghariyah - ruins in background

Figure 4.28: Grassed rawdha with ruins near wells west of al-Ghariyah
More generally, a number of wells are marked on the geological map as occurring closer to the highway, often associated with towns such as al-Adhbar west of al-Ghariyah and Ain Sinan west of Fuwairit (Figure 4.25). It seems likely that these towns, as was the case with Murayr and Al Zubarah, existed as ‘twin-towns’ - one coastal and one inland – each providing different resources with fish from the coastal towns and water and perhaps agricultural produce from the corresponding non-coastal settlement.

The freshwater wells providing for the coastal towns are set well back from the coast away from the influence of modern saline seawater intrusion and that occurring beneath nearby sabkha, which are also underlain by saline water due to coastal groundwater discharge (Macumber, 2009, 2010). The supply wells are most commonly found in areas of rawdha where the freshwater lens may be recharged during heavier rainfall events (Figures 4.27, 4.28). Water tables are shallow (Figure 4.24). This is a common characteristic of wells located on the near coastal plain whether located on the Eemian terrace, or on the Dammam Formation.

Apart from permanent wells, in the Freehah - al-Ghariyah area, modern ‘water harvesting’ is/was carried out from scoop or dragline depressions excavated on the base of the rawdha where water collects during wetter events (Figure 4.29). Unlike the groundwater fed wells, they are essentially opportunistic, being filled only during and after major rainfall events.

A further method of water harvesting/storage was observed in the vicinity of several wells located near al-Adhbah, coastward of the highway adjacent to al-Ghariyah were small ponds/plots were located close to the larger well (Figure 4.30).

Figure 4.29: “Dragline” depressions in rawdha west of Fuwairit

Figure 4.30: Shallow wells shown on Geological Map east of al-Adhbah - the highway is in the background
This technique was also a feature in the area lying between al-Sidriyah and Umm al-Kilab (see below), where a number of roundish ponds were established on the bare rawdha, and the ponds filled during storm events. Across Qatar, interconnected rawdha provide the basis of a poorly connected drainage system, with shallow fluves. The system has considerable antiquity which reflects processes probably commencing in the late Tertiary period and especially active during the last interglacial period from 130,000-113,000 yr BP, when the climate was significantly wetter. However, because of the low relief and low rainfall, there is mostly only a small upper catchment to support the fluves, and internal drainage is the norm. The collection of water on the surface of some rawdha is enabled by the relatively low permeability of the varying thick silty clay deposits washed in from the surrounding higher ground, which commonly form the base of the rawdha, (Figure 4.32).

While the freshwater lens may largely represent sub-fossil water which infiltrated during the period between 9,000 to 6,000 yr BP, when the Inter-Tropical Convergence Zone migrated west across Arabia and northern Africa, modern day recharge to the freshwater lens also occurs from storm events. This is shown by the significant amounts of tritium recorded in the groundwater (Lloyd et al., 1981). The rawdha commonly show the deep wheel ruts of vehicles indicating wet conditions, during which the rawdha may be flooded to form very shallow lakes, as recorded by Dr Tobias Richter during the winter of 2011 from areas close to the ruins of Umm al-Qubur, situated about 5 km east of Furayhah (Figure 4.31).

While the rawdha may be cut virtually across the Dammam Limestone, elsewhere there is a significant deposit of reddish-brown silty clay derived from the surrounding limestone areas (Figure 4.32). Commonly, the silty clay floor has a finely developed pattern of anastomosing channels covering an area of a few hundred metres square, similar to that described from al-Sidriyah (Macumber, 2011). The individual channels may be deeply eroded to form an internally draining channel system across the rawdha floor (Figure 4.33).

The area is one of ‘patterned ground’, with the shallow water table exposed in a nearby dam/well. The drainage pattern formed by numerous small anastomosing channels referred to as playettes (Macumber, 1969; 2011) forms at the lowest parts of the landscape and is at times associated with medium to large trees (Figure 4.34, Figure 4.35). The trees indicate the presence of locally recharged shallow fresher water. The landscape of rawdha, trees and playettes is often one where hand dug wells occur, showing occupation (Figure 4.36).

The origins of the anastomosing pattern have been related to shallow water tables (Macumber (1969; 2011) arising in this instance from the occasional flooding of the rawdha, during which period the water tables rise rapidly towards the surface (cf Macumber, 1991). Conversely, as the temporary lake dries in response to evaporation and infiltration, inbank storage from the slightly higher areas of the rawdha floor and perhaps the adjacent limestone weep out, resulting in peripheral sourced drainage network flowing towards the lowest points in the rawdha, reinforcing any small channels developed across the lowermost rawdha floor. The infiltration process may be reinforced by the karstic nature of the limestone aquifer.

While the rawdha may be grassed or even treed, in other instances it is mostly bare other than scattered small bushes. In the vicinity of Umm al-Kilab, a number of oval to round ‘ponds’ or ‘plots’ have been established, which are deemed to be part of a modern water harvesting system which collects water during storm events. In such cases, the bare ground has been divided by small check banks into plots to pond water. In one instance a flume was observed on a short channel joining the plots (Figure 4.37 to Figure 4.39).

The relationship between bare rawdha, trees, wells and plots may be seen in Figure 4.40, 4.41 and in Figure 4.47 and its relationship with early occupation at Umm al-Kilab is discussed in Section 4.2.4.
Figure 4.31: Flooding of the rawdha in the vicinity of Umm al-Qubur (photo courtesy of Dr Tobias Richter)

Figure 4.32: Silty clay forming the floor of an area channelled rawdha at a well site to the west of al-Mafjar
Figure 4.33: Channels having a playette drainage pattern on the floor of a rawdha near Umm al-Kilab

Figure 4.34: Typical channelled playette drainage pattern (foreground) formed on the lowermost parts of the rawdha floor where the channels are commonly associated with trees - locality, al-Sidriyah
Figure 4.35: Light scattering of trees in rawdha near Umm al-Kilab indicating groundwater availability. The area surrounding the trees has a typical playette pattern.

Figure 4.36: Well near Umm al-Kilab
Figure 4.37: Plots on bare rawdha in the vicinity of Umm al-Kilab

Figure 4.38: Plots on bare rawdha in the vicinity of Umm al-Kilab

Figure 4.39: Plots on bare rawdha in the vicinity of Umm al-Kilab
Figure 4.40: The landscape association of rawdha, wells, channels, trees and occasionally plots in the vicinity of Umm al-Kilab

Figure 4.41: Bare rawdha floor with trees in the background indicating freshwater at a shallow depth
4.2.4 Early occupation and the rawdha landscape association

The rawdha landscape association described above is a setting highly favourable to occupation. The rawdha are extensive across Qatar (Figures 4.42; 4.43); however, there are limitations to settlement determined by groundwater salinity.

The presence of large trees and tree coppices provide a guide to both water presence and quality of the groundwater. Examples of inland settlements include the ruins at Umm al-Qubur (Figure 4.44, Figure 4.45) where occasional flooding guarantees the development and replenishment of the freshwater lens, Ghaf Makin (Figure 4.46), al-Sidiyyah, and the earlier site at Umm al-Kilab. These settlements are located on the Dammam Limestone in contrast to the irrigation settlements closer to the coast at Qal‘at al-Thaqa’ab and al-Jiffarah which are situated on the upper parts of the Eemian terrace (Macumber, 2011).
Figure 4.44: Ruins at Umm al-Qubur with trees and well in background

Figure 4.45: Well at Umm al-Qubur

Figure 4.46: Ruins at Ghaf Makin overlooking extensive rawdha
In a similar setting near Umm al-Kilab overlooking a nearby rawdha are linear ruins stretching along a distance of 400 m (Figure 4.47 to Figure 4.52). At the south western end, the ruins contain an elongated 30 m long rectangular structure with a number of rooms. Two further single detached structures were present at either end, and a number of others extending in a line for 400 m to the north east flanking the rawdha. Although over 6 km from the coast, gastropod shells dominated by conus sp. were scattered throughout the village with a large number of shells forming part of a small mound at the north-eastern end (Figure 4.50). Included in the pottery from the village were a number of turquoise coloured sherds. Conus shells are known to be variously poisonous to humans and their toxin has no known antivenine. One species Conus magus has recently shown promise as a non-addictive pain reliever, more than 1000 times as powerful as morphine.

The ruins lies alongside a rawdha/wadi system which is eroded into an area of plateau lying between the 15 and 16 m contours. The wadi passes westward towards the village of al-Sadriyah lying about 6 km away at an elevation about 10 m above sea level. There are several modern wells in the rawdha close to the village, these include a government observation well and a relatively new farm well. While the latter may have been in use for some short time, the sites of earlier wells in the rawdha present at the time of occupation of the village have been lost due to the silting of the rawdha under storm flood conditions. It is assumed that they would have been in the nearby rawdha, in the vicinity of the present wells, and perhaps in the playette area to the southwest (Figure 4.47).

Note the low areas to the south of the village where the hand-dug wells supplying water were probably established. On passing down-valley, the ancient town (now ruins) of al-Sidriyah is only 6 km away established at the head of a small embayment passing towards the coast (Macumber, 2010 and 2011). It is conceivable that a similar aged settlement existed on the route to the coast which emerged between Qal'at al-Thaqab and al Jumayl.

Figure 4.47: Distribution of modern and ancient features near Umm al-Kilab. Inset - 30m long rectangular structure with flanking structures at south-western end of the village
Figure 4.48: House structures near Umm al-Kilab (NE end of 400m long line)

Figure 4.49: Rectangular structure with rooms at SW end of settlement near Umm al-Kilab

Figure 4.50: Conus sp. shells amidst stones in a small heap from northeastern end of the ruins
Figure 4.51: 3D figure showing location of village (ruins) on edge of rawdha near Umm al-Kilab

Figure 4.52: Topography in the vicinity of linear ruins near Umm al-Kilab showing the site of al-Sidriyah to the west
4.2.5 Water and landscape along the northeast coast of Qatar between Al Ruwais and al-Ghariyah

In 2009 and 2010, the regional geohydrological survey was concentrated on northern Qatar, with an emphasis on the north-western coastline between Al Zubarah and Shamal. In 2011 more attention was paid to the north-eastern coast in the vicinity of Fuwairit, and extending northwards towards Al Ruwais. This region includes the areas around Fuwairit, al-Ghariyah and al Mafjar. The study centred on the rawdha and the wells known from the geological mapping such as that near the sports complex at Al Ruwais (Figure 4.54). In the course of the study a number of additional wells were added to the well distribution map.

The coastal setting for northeast Qatar is similar to that for northwest Qatar, in that there is strong representation of the high sea level impacts during which the two tier marine terrace landscape recorded for the northwest coastline also evolved. This is clearly seen at the coast where the high level wave cut platforms are exposed in coastal sections to the east of Al Ruwais.

The inland limits of the mid-late Holocene Flandrian transgression are shown by the 3 m contour (light grey areas in Figure 4.53), while that of the earlier Eemian transgression is approximately marked by the 6 m contour. As is the case elsewhere the Eemian terrace is formed of marine sediments (identified by cerithids and gypsite), and by planated Dammam Formation shore platform.

Figure 4.53: Map of northeast Qatar showing relationship between wells and contours
Figure 4.54: Well and structure near sports complex at Al Ruwais

Figure 4.55: Large well/dam intersecting the shallow water table, located to the east of Al Ruwais

Figure 4.56: Infilled well in small rawdha, west of Mafjar
Figure 4.57: 3-D topographic map of NE Qatar from al-Jumayl to Fuwairit with well distribution

Figure 4.58: Soils map of far northern Qatar showing the position of the sabkha (purple) and small rawdha (green) with which shallow wells are commonly associated. Map courtesy of Neil Munro
In general the 3 m contour marks the upper limits below which active sabkha are common. This was especially clear on passing southwards between Al-Mafjar and Al-Ghariyah where an extensive area of sabkha is shown in both the geological and soils mapping and on the 3-D topographic map (Figure 4.57) and the soils map (Figure 4.58). On the other hand a large number of shallow wells are located at elevations of between 4 and 6 m on the Eemian terrace.

One clear observation from the survey was the higher density of shallow hand-dug wells between Al Ruwais and Al-Mafjar. Wells in this area were found in a number of small rawdha and commonly associated with large trees. As is the case elsewhere with the Eemian terrace, the water table lies at a shallow depth and appears as groundwater outcrop in shallow dams/wells (Figure 4.59, 4.60).

Perhaps the clearest indication of the location of wells relative to the coast comes from the 3-D topographic map (Figure 4.57) showing the coast from Al-Jumayl to Fuwairit. Here the majority of wells are located in a zone commencing from about the 10 m contour interval to a position within about 1 km of the coast. The Eemian shoreline lies at or about the position of the 6 m contour, while the sabkha between Mafjar and Al-Ghariyah is at elevation of 3 m or less. There are a number of wells on the Eemian coastal terrace, to the west of Mafjar and south of Ruwais, where the water table is shallow.

They are set sufficiently far back from the coast to avoid the problem of seawater intrusion. Between Al Ruwais and Al-Mafjar, the wells (mostly now infilled) are commonly associated with small patches of rawdha, where trees are often present, dependant on shallow groundwater. In an area of small rawdha closer to Al-Mafjar several wells occur in the vicinity of two small nearby cemeteries (shown as ‘c’ on Figure 4.58). Between Al-Mafjar and Al-Ghariyah, there is a large area of sabkha, with strongly undulating Dammam Formation bedrock and higher terrace sequences between the sabkha and the coast. However no wells were observed in the undulating area where the groundwater at a comparatively shallow depth is probably saline due to both seawater intrusion and the accumulation of salt beneath the sabkha. However, cairns (Figure 4.61) were observed on some of the higher ground in this area (marked as ‘m’ in Figure 4.58). The nearest group of wells lies on a farm (‘f’ in Figure 4.5858), where walls and hand-dug wells suggest an earlier phase of settlement (Figure 4.59).

Cairns have been recorded from along the eastern coast of Qatar, at Al-Khor and the proposed Aerospace City. At Al-Khor, where there is Ubaid pottery, 16 cairn burials were recorded of which 6 were excavated. Dates from Al-Khor were 6,290 +/- 100 BP, 6590 +/- 120 BP and 6,420 +/- 100 B.P (Inizan, 1988). A little to the south of Al-Khor, at Aerospace City, a number of cairns are located on a 4–5 m high Eemian terrace protruding as a small peninsular into the former mid-Holocene sea (Macumber 2011). Like the Al-Khor sites, they overlook the mid-Holocene high level shoreline, and are probably of similar age.

Figure 4.59: Modern and hand-dug wells on farm, walls are also present
Figure 4.60: Infilled well with cerithids exposed in nearby sediment (inset) indicating that the site is developed on the Eemian marine terrace

Figure 4.61: Cairns on higher ridges of Dammam Limestone between al-Mafjar and al-Ghariyah
4.2.6 Conclusion-Discussion

A large number of wells are shown on the geological map of northern Qatar (Hunting 1980), and this was used as a basis to investigate the environmental setting in north-eastern Qatar between Al Ruwais and Fuwairit. In addition further study was carried out on the relationship between occupation and environment in the hinterland between al-Zubarah and Fuwairit.

There are a large number of shallow wells commonly associated with small rawdha scattered across north-eastern Qatar between Al Ruwais and Fuwairit. The largest distribution is between Al Ruwais and al-Mafjar, and inland of a large sabkha located between al-Mafjar and al-Ghariyah. The number of wells falls off to the south of al-Ghariyah reflecting the decline in small rawdha, but perhaps also reflecting the proximity of the water quality change from the fresher carbonate facies to the gypseous facies of the Rus limestone. Whatever the case, for the towns and their water supplies, the pattern is similar to that in the Al Zubarah region whereby coastal towns receive their water supply from wells located further inland. At al-Ghariyah and Fuwairit, small well-fields occur back from the coast, however the towns also appear to be ‘paired’ with larger settlements, as is the case of Adhbar and al-Ghariyah, and Ayn Shan and Fuwairit.

On the hinterland well away from the coast, there were fewer areas of rawdha but they were considerably larger. This was the case at Umm al-Qubur, and near Umm al-Kilab. The larger rawdha have larger local catchments, and flood during winter storm events. This leads to groundwater recharge. In a number of instances shallow fresh groundwater was implied by the presence of scattered large trees, and supported by the presence of wells, indicative of occupation.
4.3 Regional Survey and Mapping

David Mackie and Daniel Eddisford

4.3.1 Mapping work at Al Zubarah

A ground survey of the remains at Al Zubarah (QNG 181064/469326) and its immediate hinterland was undertaken in 2009 by Richard Hugh Barnes (Figure 4.62). Initially, roughly scaled sketches of the site were drawn followed by a digital survey using a total station. Each area has one control station established by resection from known existing fixed control points and the level is transferred from the fixed point using an automatic level. During this season previous excavation areas QMA1, QMA2, QMA3 and QMA4 were surveyed to provide wall plans for the conservators. These plans have allowed them to carry out a condition survey for each area. Previous excavation areas, ZUEP01, ZUEP02 and ZUEP04 were extended. A new area ZUEP05 was opened on a midden mound outside the outer city wall south of tower 9. A small sondage was excavated on the higher ground to the north of ZUPE01.

On excavation areas ZUEP01 and ZUEP04 additional control points were established for the laser scanning team to use.
4.3.2 Mapping of Shuwail

This site is situated c.1.1km east of Al Zubarah Fort (QNG 184076/469378) and is comprised of a small, ruined fort situated on the higher rocky ground within a large shallow irregularly shaped depression (Figure 4.63). The fort is a square structure with a round tower on its east corner and a rectangular tower on its west corner (Figure 4.64). The building measures c. 20 x 20m, with the entrance on the southeast side and includes two small buildings on the west side and one on the east side. Within the compound there are four rooms along the northwest wall with at least two along the southwest wall. The rectangular tower on the west corner still has remnants of the mud brick architecture surviving on a stone foundation.
This site was previously reported by Beatrice de Cardi in her Qatar Archaeological Report as site ‘13b Ain Al Shuwail’, where she describes an 18th to 19th century fort amid several ruined buildings. Beside the fort is a fine stone lined well 2m in diameter with water at a depth of 5.20m.

Located to the east about 200m close to the edges of the depression are another eight scattered ruined buildings (Figure 4.65). Another building is located on the northern edge of the depression with other possible buildings around the western edge of the depression.

The main settlement consists of twenty two dispersed buildings and is located 478m to the south of the fort close to three stone lined wells. The western well measures 4 x 4m and is surrounded by a circular eroded spoil heap. The central well is circular, approximately 4m in diameter and still contains water at a depth of 5m. It is likely that this is the well described by de Cardi. There is a denuded spoil heap around this well and it has two modern concrete water troughs adjacent to it with the remnants of a stone walled enclosure to the south east. The third well is located 75m to the south east of the central well and measures c. 5 x 5m surrounded by a large spoil heap.

To the north of the settlement and the wells within the depression are two sub circular cuts surrounded by large eroded spoil heaps with small eroded channels running into each. They are both unlined and appear to act as sumps rather than wells collecting and retaining water following rainfalls.

Within and around the edges of the depression are a number of temporary tent positions with one large cleared area to the north east bounded by low stone walls around a sand covered interior with a clay moulded hearth, drainage gullies, and clearance cairns (Figure 4.66). This is relatively recent as are the bulldozed spoil heaps and former tent positions to the south on the edge of the depression. This may be a former position of the existing sheep and goat farm to the west.
Figure 4.65: Ruined buildings at Shuwail

Figure 4.66: Temporary camp at Shuwail
4.3.3 Mapping of Ruwais

This site is comprised of two partly collapsed stone walled enclosures and associated wells located north of the Al Shamal sports ground (QNG 200414/485340). (Figure 4.67), Beatrice de Cardi makes no reference to this site in her Qatar Archaeological Report.

The northern enclosure is square in shape and measures c. 64 x 70m. The wall only survives to a height of one to four courses and is between 0.60m and 0.65m in width. Near the south east corner is a stone lined square well with the remains of a building on its northern side, the walls of which survive to a height of 1.23m and are 0.80m thick (Figure 4.68).

The southern enclosure is located c.130m to the south east and is sub square in shape and measures c.53 x 56m (Figure 4.69). The enclosure wall is constructed from large irregular undressed blocks of stone with an internal packing of mud and smaller stones. It is 0.70m in width at the base tapering up to 0.46m wide at the top, and survives in places to a height of 1.07m. Located on the western side is a partially collapsed disused stone lined well. To the northwest outside the enclosure is a small round concrete capped well which has been partially backfilled. Another disused square concrete capped well with a concrete water trough is situated on the north east corner of the enclosure.

Figure 4.67: The Ruwais enclosures with Al Shamal sports ground to the south
Figure 4.68: Northern enclosure at Ruwais

Figure 4.69: Southern enclosure at Ruwais
4.3.4 Mapping of Ain Mohammad

The abandoned settlement at Ain Mohammad is situated c. 4km northeast of Al Zubarah town (QNG 183897/472065). The settlement is defined by twenty relatively recent dispersed derelict buildings and a demolished mosque. Amongst these buildings are earlier ruined compounds, buildings and disused wells. Two walled cemeteries are situated to the northeast of the site. The centre of the site is comprised of a sub square walled enclosure with two later extensions to the north and south defined by reused oil drums surrounding a central well with a concrete cistern (Figure 4.70). Located to the northwest of this is a ruined square compound with a round tower on its southeast corner which is similar to the fort at Shuwaik to the south (Figure 4.72). To the southeast there is another ruined stone walled compound which has a tower on the northeast corner and the remnants of another possible tower on the southwest corner (Figure 4.71).

To the south of this structure is a collapsed stone lined well associated with a small walled enclosure. To the south west of this enclosure, adjacent to the access road to the military compound, is another concrete capped well and cistern. Another concrete and stone capped well is located to the east.

Located along the eastern edge of the site are nine small ruined structures and former temporary camp positions.

Immediately to the south of the access that gives access to the military compound is another ruined small settlement, comprised of a linear group of collapsed stone buildings and enclosures with one standing building at the north western end. These buildings probably represent the southern extent of the settlement north of the road, but have been truncated by a modern road leading to a military installation further east. Since last year the northern edge of this site has been partially destroyed and covered by spoil excavated from a new service trench. Another two collapsed stone structures are situated to the southeast of this site.

Figure 4.70: Main enclosure, derelict buildings and cemetery at Ain Mohammad
Figure 4.71: Photograph of the southern compound at Ain Mohammad

Figure 4.72: Ruined northern compound at Ain Mohammad
4.3.5 Mapping of Fuwairit

Introduction

The site of Fuwairit survives as a series of poorly preserved and partially buried low walls. The topography of the site, along with all visible archaeological features was recorded by total station. A detailed digital terrain map of the site was produced, as well as an interpretive site plan and a 3D model of the site. The previously undocumented, fortified site of Zarqa was identified inland of Fuwairit, and would have been the costal site's source of water as well as providing agricultural land. A photographic record of both sites was made, historical references were investigated, and aerial photos examined. The preliminary results of the survey are presented along with recommendations for further work in the area of Fuwairit, and measures to ensure the protection of the archaeological remains.

Site Location

The archaeological site of Fuwairit is located on the northeast coast of Qatar, centred on Qatar Nation Grid (QNG) reference 215295 475177 (Figure 4.73). The site is bounded to the north by Jabal Fuwairit and to the east by dense mangrove. Beyond the mangrove is a popular sandy beach, known as Fuwairit beach. To the west the site is bounded by an area of sabkha. The southern extent of the site lies on a sandy peninsula, and is bounded by an area of tidal mudflats and patchy mangrove.

The site of Fuwairit is a little over a kilometre long, with the main area of ruined architecture measuring c.750m long by 160m wide. To the north a wall extends c.500m along the coast to the foot of Jebel Fuwairit, enclosing a tidal area and beach frontage that may have acted as the settlement’s harbourage. To the west of the ruined architecture an area of associated midden dumps extend c.175m to the edge of the sabkha. Two walled cemeteries are also located on the edge of the sabkha.

Approximately 500m directly south of the archaeological site of Fuwairit lies the village of Fuwairit, which is largely abandoned with many buildings having fallen down or in an advance state of decay. The village consists of low demolished walls, partially ruined buildings including a mosque, as well as more recently constructed compounds that are still in use.

Inland from Fuwairit c.1.5km the site of Zarqa is centred on QNG 213843 474412. Adjacent to a small farm are the remains of a mosque, fort and a number of other ruined buildings. These represent a fortified site that would have provided the water and agricultural areas utilised by the former inhabitants of Fuwairit.

Historical background

Fuwairit is historically poorly documented and not shown on Carsten Niebuhr’s 1765 map of the Gulf region. According to oral tradition Fuwairit was the residence of the Al Thani family until they left for Bida in the mid 19th century after tribal conflicts.

Colebrook describes in 1820 “Phoerol” [Fuwairit] as being “to the East of Ras [cape] Reckan, the inhabitants removed to Bahrain, has no Khoor the coast on this side the cape, is bolder and may be approached by vessels within gunshot” (Rahman 2005, 3). A British maritime survey of the Arabian Gulf was conducted between 1820 and 1825, and makes mention that at “Affeeraat [Fuwairit] a few cattle and water may be procured” (Hughes Thomas 1985, 561).

In 1920, Fuwairit is described as a little walled town, with several towers, on the shore of a small khor (US Hydrographical Office 1920, 117) and an aerial photo from 1958 shows the site of old Fuwairit to be abandoned and in ruins. The site was by then replaced by the village of new Fuwairit located directly to the south.
Previous archaeological work

The area of Fuwairit was visited by Beatrice de Cardi as part of the British Archaeological Expedition in Qatar, undertaken between November 1973 and January 1974. Although no excavation was undertaken at Fuwairit, a summary of the site is included in the project’s gazetteer of finds.

The archaeological site of Fuwairit is described as a “large low site covering about 13 hectares, stands on a spit of sabkha jutting into the sea at the southern end of Jebel Fuwairit. The mound which represents individual houses shows that the town was well planned with building lines running parallel in an area of 860m x 170m. As at Al Zubarah some rubbish middens lay outside the town by the ‘fort’ and yielded pottery, glass bracelets and porcelain of eighteenth century date” (de Cardi 1978:190).

On Jebel Fuwairit a small scatter of 18th century pottery and a number of rock carvings similar to those on Jebel Jusasiyah was recorded by de Cardi (1978:190). The date and function of the rock carvings was not ascertained, although de Cardi suggests they may have been a gaming board. The carvings on the top of Jebel Fuwairit (QNHER 10627) consist of cupmarks and ‘boat’ depictions. A similar rosetta of cupmarks was recorded at the base of the Jebel, just north of the northern city wall (QNG 215106 476038).

Results - Fuwairit

From the Fuwairit survey data (Figure 4.74) a digital terrain model of the Fuwairit site was produced, this can both be represented as a contour map of the site (Figure 4.75) and used as the basis for an interpretive site plan of the buried architecture (Figure 4.76).
These compounds are rectangular in plan, measuring between c.15m and 40m across. The compounds generally consist of a large central courtyard, surrounded by a number of small rooms, measuring c.3m to 7m across. The architecture at Fuwairit closely parallels other coastal settlements in northern Qatar, such as those excavated at Al Zubarah and Freiha (Richter 2011). All the structures on the site are built of roughly finished beach rock, which is available within a few hundred metres of the site. Walls are constructed of two parallel rows of stone, sometimes with a packed core of smaller stones.
A possibly defensive wall was recorded as running east-west along the base of Jebel Fuwairit, then turning south and running to a small creek directly north of the main settlement. This wall encloses Fuwairit beach, and may have protected the site’s harbourage. The northern extent of the wall is almost entirely buried under sand dunes but appears to be well preserved, surviving to over 1.50m high. At its northeast extent a series of walls abut the southern face of the defensive wall, indicating there are structures directly inside the wall in this area. Possible structures are visible in this area on the 1958 aerial photograph of the site. The northern area has already been adversely impacted on by development, and this is one of the most threatened areas of the settlement.

The main domestic architecture at Fuwairit is located to the south of the creek on a narrow peninsula surrounded by tidal salt flats on all sides. The remnants of a defensive wall can be detected along the western side of the site, the northern extent of which is buried under later midden dumps.

The northern area of the site appears to have the mostly densely packed architecture. In this area the more irregularly shaped compounds may represent infilling between buildings as the settlement expanded. Groups of compounds can be identified, separated by narrow alleyways. The northwest area of the site lacks any obvious walls; however a series of low rectangular depressions may be the remains of more ephemeral wooden structures on the edge of the site.

An intriguing structure is located some distance to the west of the main area of architecture. Measuring 34.5m by 28.50m, the building is constructed of beach rock in a similar manner to the rest of the site. However, the plan of the structure, with a double western wall, is clearly different from the domestic compounds seen across the rest of the site. This building is presumably the structure de Cardi identified as a ‘fort’ (1978:190) in her survey of the site. The building has midden material dumped against the outside of it, as de Cardi described. The plan of the structure does not suggest it is a fort, but probably a mosque. Its location with respect to the settlement would mirror that of some other mosques in villages in northern Qatar. As in Fuwarit, the mosques at Freiha and al-Ghuwair, for example, are the westernmost buildings in the settlements.

The central area of the site contains further domestic compounds, one of which is distinctly larger than the surrounding structures. It consists of two large courtyards that measure over 40m across, and ruined walls survive to almost 2 m high. This structure may also represent a domestic building; however, it is the largest compound on the site, and may have originally stood at least two stories high. This likely represents a fortified compound or fort within the settlement, which would have presumably been an important building.

A more open area in the centre of the site represents a marked change from the closely packed domestic architecture seen across other parts of Fuwairit. A series of alleyways lead into this area, and the poorly preserved remains of smaller structures are visible on the surface. It is likely this represents a suq area, an interpretation that is supported by the presence of rows of small rooms, possibly shops, visible on the 1958 aerial photograph of the site.

The southern area of the site also contains compounds, but they are less tightly packed, and appear to show less addition and alteration. The southern area of the site also has more midden dumping visible within the compounds, suggesting that this area may have fallen out of use earlier in the site history. Large mounds of midden material are also present along the western side of the site, extending out to the sabkha.

Several fish traps are visible directly to the south of the site (Figure 4.73). The early aerial photography suggests some of these are relatively recent constructions, dating to the last quarter of the 20th century. However, some are visible on the earliest aerial photography of the site and may be associated with earlier occupation at Fuwairit.
Figure 4.75: Fuwairit contour map

Figure 4.76: Fuwairit site plan
About 1.5km inland to the west of Fuwairit, the site of Zarqa was identified, centred on QNG 213843 474412 (Figure 4.77). Adjacent to a small farm are a number of ruined buildings, representing a fortified site that may have provided the water and agricultural areas utilised by the inhabitants of Fuwairit. The QNHER lists one of these buildings (QNHER 10167) and the cemetery (QNHER 1068); however the site is incorrectly recorded as Feleeha.

The structures at Zarqa are built of unworked sub-angular pieces of limestone, a building material abundant nearby. The remains of a fort survive as a large mound of stone, measuring 26m across and 1.80m high, with deflated walls clearly visible on the surface. The fort is rectangular in plan, with a tower on each of its four corners. The fort, like all the structures on the site, has been heavily impacted by modern inhabitants. The southeast tower of the fort has already been largely destroyed by a mechanical excavator, as has part of the northern wall; it appears that the fort has been used as a convenient source of stone building material. In addition the western side of the fort is partially covered by modern dumps of building activities.

To the northwest of the fort a rectangular building measures 13m by 15m in plan. This structure is the only building on the site in which beach stone as well as limestone was utilised in construction. The building is divided roughly in half, and consists of an open courtyard to the east and a slightly smaller rectangular room to the west. The orientation and layout of this structure strongly suggest that it is a mosque. Similar to the fort this mosque is unprotected and is highly vulnerable to further disturbance.

There are a series of small buildings, measuring between 5m and 10m long, in the area to the south and west of the modern farm. These are all constructed of unworked limestone, and their function is not clear. Given the size of the fort and mosque there are relatively few other structures present, possibly suggesting much of the site was constructed of perishable material such as wood, or that the site was not intensively occupied and that the main bulk of the population in the area lived at Fuwairit. The original size of the site is also indicated by the presence of a cemetery measuring c.30m in diameter. The cemetery has been protected by a mound of dirt that has been pushed up to it by a mechanical excavator.

It is likely that the primary function of the Zarqa site would have been to provide water and ag-
Results - New Fuwairit

To the south of the archaeological site of Fuwairit the village of new Fuwairit is also largely in ruins (Figure 4.78). Constructed in the mid 20th century, it is not entirely clear if the site was ever entirely abandoned. Ruined walls of beach stone constructed compounds appear to be very similar to those surveyed to the north, and a contemporary date cannot be ruled out.

Most of the buildings in new Fuwairit are constructed using a mixture of beach rock and cinder blocks (Figure 4.79). The buildings are roofed with a combination of wood, palm fronds and packed mud. The construction techniques observed here are likely to have direct parallels in the ruins of the earlier settlement.

Figure 4.78: Ruined compounds (foreground) in New Fuwairit looking southeast

Figure 4.79: Cinder block and beach rock construction
Surface Finds

A detailed, systematic surface collection of artefacts was not conducted at Fuwairit. Given the degree of midden dumping, modern activity and disturbance on the site it is unlikely that the surface distribution of artefacts accurately represents previous activity areas at the site. However, during the survey a number of surface finds that were in danger of being damaged or that could give strong dating evidence were collected. The locations of all the artefacts collected were recorded in three dimensions using a total station. In addition a brief overview of the surface pottery was undertaken, with the help of QIAH pottery expert, Agnieszka Bystron.

Surface pottery

Surface pottery observed on the Fuwairit site included bowls with manganese painted decoration and a yellow glaze of 16th to late 19th century date. Iranian Khunj wear bowls were present, with a similar date range. Chinese blue on white porcelain were present on the surface. In addition poor quality blue on white wear were was noted, with crazed and blistered glaze, probably representing low quality local imitations of Chinese ceramics. One single sherd of block printed blue on white glazed porcelain dates to the 19th century. European semi porcelain from the site, of probable Dutch or English manufacture, dates to the late 18th or 19th century. Fragments of green glazed bowls were collected, although no diagnostic sherds were found. Large reduced wear ware vessels probably represent Julfar wearware, and date to the late 16th to 19th century. Collectively the surface pottery at Fuwairit appears to be very similar to the assemblages from the excavations at Zubarah and Freiha. Most of the surface pottery examined has a broad date range from the 16th century until the 19th century. However, certain pieces such as the European semi-porcelain suggest a later 18th or 19th century occupation. Surface pottery at Zarqa was significantly less common, reflecting the sparse and more spread out architecture. Here the surface pottery included sandy creamy wears wares and coarse tempered red brown domestic pottery.

Small finds

The surface finds from Fuwairit included several small, heavily corroded coins. In addition there were two more easily identified coins. An Indian Rupee dating to 1917 (SF4, Figure 4.80) and Chinese coin with a small square hole in the centre (SF9, Figure 4.81). A small padlock (SF7) has writing on one side of it, and will probably be able to be dated once it is fully cleaned. Two cartridge cases (SF8) appear to have been utilised as a stamp tool. One end of the casing has been shaped into a square pattern and may have been used to stamp decoration into the wet render on the buildings. Two stone artefacts were recovered from the surface of the site, both attesting to the importance of maritime activity. A small stone weight probably represents a net sinker; a fragment of a larger stone artefact with a hole through it is part of an anchor.
Conclusions and Recommendations

Maritime connections were essential to the inhabitants of the Qatar peninsula in the early modern period. The site of Fuwairit gave maritime access as well as being relatively defensible. This latter attribute was an essential requirement during a period when tribal rivalries in the region often resulted in violent conflict. The site of Fuwairit lacks on-site fresh water, and this need was met by the complimentary site of Zarqa. Located a short distance inland this site provided water and agricultural land to those living on the coast.

Both Fuwairit and Zarqa are threatened by development and damage from vehicular traffic, which are causing tangible losses on both sites. At Fuwairit the main site has been badly damaged by heavy vehicle traffic, in part due to its proximity to the popular recreation area of Fuwairit Beach. A modern structure on the northeast corner of the site has destroyed archaeological deposits, and the possibility of continued development of the beach would result in further losses. The site of Zarqa has been partially destroyed, either for the deliberate recovery of stone, or out of a lack of knowledge of its history and importance. The full extent of the site is unknown, due to the proximity of a modern farm.

In conclusion, the survey conducted in the Fuwairit area provides a basis from which to expand research of this region. Further research would include a survey of Zarqa, building recording at new New Fuwairit, and a series of excavations at the archaeological site of Fuwairit. The excavation and survey data from Fuwairit, along with oral histories would complement the ongoing research undertaken by the QIAH project in northern Qatar. The exploration and preservation of this area is important to understanding major social and political shifts in the recent history of Qatar and of the region. Excavation at Fuwairit would also allow the cultural heritage of the site to be presented to the public in situ, and allow future development of Fuwairit beach as an integrated recreational, cultural and environmental area.
4.3.6 Survey of the coastline between Fuwairit and Ras Laffan

Introduction

The coastal area of northeast Qatar, between Fuwairit and Ras Laffan industrial city, was examined in detail as part of QIAH’s regional survey (figure 4.82). Aerial photographs, Google Earth satellite imagery as well as data from surveys conducted by the British Archaeological Expedition in Qatar (de Cardi 1978) and Birmingham University (Beardmore et al. 2010) was utilised to locate archaeological sites in the area. The sites of Al Marrouna and Al Huwailah were mapped for the first time. An archaeological site at Al Jethay was recorded directly inland from Al Marrouna. Two smaller coastal sites were identified between Al Marrouna and Al Huwailah. This report presents a brief summary of the nature and location of these sites, as well as recommendations for their protection. All the sites identified were threatened with destruction, or had been adversely impacted on by recent development.

Figure 4.82: Location of the site discussed below
Al Marrouna (QNG 218328 470988)

According to Brucks 1829 (in Hughes Thomas 1985, 561) a settlement called Ras-oool-Maroona was at “lat. 26° o’ 50” N., and long. 51° 27’ 40” E”, clearly situated between al Huwailah and Fuwairit; however the author gives no further details of the site.

De Cardi mentions a site “five kilometres south of Fuwairit some buildings, very heavily sanded up, lie parallel to the coast just behind the beach. Mortared wall lines of large courtyarded houses stand up to 2.50m high. The site is very unusual in that the stone masonry is bonded with good lime mortar. No pottery was visible, but the site may be of eighteenth century date” (1978, 190).

The site of Al Marrouna has received little attention, in part no doubt due to the brief nature of the documentary references mentioned above. However, the remains of Al Marrouna were identified during the 2011 survey and found to consist of a substantial settlement, centred on QNG 218328 470988.

The archaeological site of Al Marrouna consists of a series of substantial walls constructed of beach rock, measuring 0.40-0.50m wide and possibly surviving up to 2m high. The site lies parallel to the coastline, and represents the remains of a relatively large settlement. The site has been partially destroyed by the construction of modern buildings (Figure 4.83). The surviving area of walls visible on the surface measures approximately 330m north-south and 150m east-west, but originally the site would have extended further to both the north and south. Recent development of the site has resulted in a significant proportion of the site being destroyed. The surviving areas of the site are threatened with imminent destruction, unless urgent measures to preserve them are undertaken.

The site is currently covered with low sand dunes, and rapid inundation by sand appears to have resulted in the structures on the site being unusually well preserved. Since the site is largely buried under sand it is difficult to identify from satellite imagery, and as a result it does not currently appear to be listed on the Qatar National Historic Environment Register (QNHER). The site contains a number of rectangular domestic compounds, consisting of central courtyards surrounded by smaller rooms. This architecture is typical of the 17th-19th century villages of the region, a date supported by the pottery sherds visible on the surface. In addition to the walls visible on the surface it is likely that midden dumps, possibly along with more ephemeral structures, extend to the west and are completely buried under the sand (Figure 4.84).

The unusual white mortar that caught de Cardi’s attention is visible on the exterior faces of many of the walls on the site. This “lime mortar” is in fact more likely to be dehydrated anhydrite (Ca SO4), which occurs when gypsum is naturally dehydrated by being baked in the sun (Macumber pers. comm.; see also Macumber 2009: 18).
Figure 4.83: Extent of surviving archaeology at Al Marrouna

Figure 4.84: The site of Al Marrouna looking south
Al Jethay (QNG 217340 470482)

Approximately one kilometre inland from the coastal site of Al Marrouna is an area of earthworks and low buried walls, centred on QNG 217340 470482. This represents a second settlement, which would have presumably provided water and agricultural land to the coastal site of Al Marrouna. This pairing of coastal settlements and inland well sites is a pattern seen along the northern coastline of Qatar; for example the sites of Fuwairit and Zarqa directly to the north or Al Zubara and Murayr on the northwest coast. It is likely that the archaeological remains at al-Jethay are contemporary with Al Marrouna, and date broadly to the 17th to 19th century.

The site of Al Jethay was recorded from aerial imagery (Figure 4.85) as QNHER 10263; “a large area of former structures visible as earthworks, unknown date, with modern development occurring around and on top. Alignment appears to respect sabkha-former coastline.” However, the site appears to have been wrongly referred to as “Al Maroona” in the QNHER.

The structural remains cover an area of at least 200m by 150m. It is unclear from the brief examination of the site undertaken whether the remains represent domestic buildings, agricultural enclosures, or a combination of both. There is no immediate evidence of any defensive structures. While there is no evidence for backfilled in wells on the site the modern building constructed on the southern area of the remains has a functioning well. A large farm c.400m to the west also has access to water through wells.

As well as the ruined remains of the earlier occupation at Al Jethay, there are the standing remains of buildings, representing 20th century occupation (Figure 4.86). In addition there are modern structures on the site and to the west that are still in use.

Building and possible cemetery (QNG 218587 467351)

Between the sites of Al Marrouna and Al Huwailah is a large, gently curving bay, with a shallow reef extending some distance from the shoreline. Along this stretch of coastline two sites were identified, both consisting of the buried remains of what appear to be isolated structures.

Located approximately 450m inland, centred on QNG 218587 467351, a low mound measured 3.5m across and survived to c.1.m high. Blocks of beach rock on top of the mound appear to be associated with a buried building. The mound and the area surrounding were covered with a relatively high concentration of pottery sherds. Many of the sherds were of 18th-19th century date; however, a sherd with fragments of turquoise glaze may suggest earlier activity.

In addition to these remains a second mound located c.100m to the east, centred on QNG 218686 467383, may represent a cemetery. The flat-topped mound measured 50m by 24m and c.1m high. Although poorly preserved, these deflated mounds of stone may have once been burial cairns. If this is a cemetery it suggests there may have been a larger settlement at this location at some point in the past.

Building (QNG 222382 465495)

Four kilometres to the east, at the other end of the bay, a second similar mound was centred on QNG 222382 465495. Located approximately 400m inland the mound measured c.20.m in diameter. Beach rock walls were visible on the surface, and the building was surrounded by a dense concentration of pottery sherds.

This site probably represents the remains of a building, with significant activity occurring in the immediate vicinity. The pottery suggests an occupation in the 18th-19th century. The function of the structure is unclear; although it is possible it was a watchtower, a small defensive structure, or merely a more mundane isolated domestic building.
Figure 4.85: Satellite image of the structural remains at Al Jethay

Figure 4.86: Later structures at Al Jethay and earlier buried walls in the foreground
Al-Huwailah (QNG 224167 465677)

Historical background

In Major Colebrook’s Report on the Persian Gulf littoral of 10 September 1820 Al Huwailah is described as being “defended by a square Ghurry, containing good water, and is frequented by fishermen in the season. It was inhabited by a remnant of the once powerful tribe of Musellim (al-Musallam), now incorporated with the Utubis.” (Rahman 2005:3-4).

According to Brucks “Al Owhale (Huwailah) is a town…defended by a small square Ghuree, and is the principle place on the coast. It is inhabited by about four hundred and fifty of the Abookara tribe…It has few boats belonging to it, contains water, and has some supplies of cattle. The people are mostly employed as fishermen, or in coasting trade. This is one of the principle stations during the pearl fishery season” (Hughes Thomas 1985:560).

A century later a US navy survey of the coast of the Qatar peninsula reported on the same site. While the fort still stood to a considerable height, the site appears to have been abandoned. “Al Howeila (Huwailah), 6 miles northwest of Ras Laffan, is a small town, with a square fort some 30 feet high. Westward of the town is a small bay. The people were formally pearl fishers, but in 1887 the place was found deserted” (US Hydrographical Office 1920, 117).

Previous Archaeological Investigations

In 1973 Al-Huwailah was the subject of a two-day investigation by a team of archaeologists led by Beatrice de Cardi. The survey consisted of an aerial survey by helicopter, a brief walk-over of the site, and systematic pottery collections (Garlake 1978). The site was found to contain the stone-built foundations of “perhaps ten or twelve complexes, each consisting of four or five small separate rectangular rooms, grouped round compounds and not adjoining” (Garlake 1978, 173). A series of low earthworks formed a rectangle and “seems to reflect a rectilinear planning system, the buildings of which have now completely disappeared, or at least any remains of which are entirely covered in sand” (Garlake 1978, 173). These possible remnants of earlier occupation were covered by the town middens, measuring up to two meters high with “surfaces of wind-blown sand strewn with great numbers of potsherds and glistening from an abundance of oyster shells” (Garlake 1978, 173). The ceramics collected appeared to be “typical of an eighteenth-century trading centre of the Gulf” (Garlake 1978, 178).

In 1977 and 1978, the French Mission in Qatar conducted limited excavations at Al Huwailah, overseen by Claire Hardy-Guilbert and under the director Jacques Tixier. The excavations recorded a 32m by 32m rectangular fort with corner towers. The interior of the fort was comprised of a group of small rooms built adjacent to the exterior walls, with a central rectangular building. The walls were made of “quarry limestone and white coral stone or seastone, bound together with mortar” and “smearred with thick rosy-coloured plaster” while the floors were made of “lime-rich plaster” (Hardy-Guilbert 1980, 186). The pottery recovered from the excavation suggested a mid-19th century occupation at the fort. However, beneath the layers associated with the fort an ash layer contained glazed pottery that may have been of Iranian origin was found, thought to date to the 14th century.

Al Huwailah Today

Despite its position as the most important settlement in Qatar in the 18th century, and being the subject of two separate archaeological investigations, the location of the site of Al Huwailah had been forgotten over the last three decades. Although the site appears on numerous maps of the region, none are detailed enough to provide more than a generalised location. The QNHER has an entry for Lehwaila (10431) at QNG 221427 465904, however examination of this site showed it to be a modern structure.
De Cardi describes the location of the site as “an open and largely featureless stretch of shore on the north-east coast of Qatar. The coastline in this area, of which al-Huwailah is at the centre, faces due north, the only substantial part of the Qatar shoreline to do so. It is entirely unbroken, shallow shelving, sand beach unprotected by bays, headlands or fringing reefs …The visible remains of the town lie 400m. back from the shore on a bar or low ridge of sand that rises very slightly to a maximum height of 4m between the coast and extensive sabkha depressions running parallel to the coast and 2-3km behind it” (Garlake 1978: 180).

Early aerial photographs of the site (Garlake 1978: Plate XXIX; Hardy-Guilbert 1980: Fig.60) show the size of the site with well preserved buildings; however, they show no easily recognisable landmarks. These aerial photographs do show the coastal road curving inland to pass to the west of the fort at this point. Despite the construction of numerous new roads in this area over the last decade, the line of the old coastal road is still visible, and can be roughly aligned with these photographs. This location, at the very eastern end of the large bay described above, corresponds with more detailed map locations for the site.

From the descriptions of the location of the site, and the images described above the site of al Huwailah was successfully located at QNG 224167 465677. Sadly little of the site survives, having largely been destroyed by development over the past decade (Figure 4.87).

There is no longer any visible architecture remaining at Al Huwailah. The town and the fort were presumably destroyed by the construction of the large mosque and the mosque’s parking lot. The parking lot does not appear on the 2009 Google earth satellite imagery of the site, and this area appears to have been destroyed in the last two years. A pile of beach rock and pottery sherds to the west of the mosque attest to the destruction of this part of the site.

The western extent of the site has been heavily disturbed by mechanical excavators, and it seems unlikely any archaeological remains survive. A very large mound has been constructed on the eastern side of the site, which presumably has a military function (Figure 4.88). The construction of this feature has disturbed much of the site, and machine tracks radiating from the mound are clearly visible on the 2006 Google Earth satellite imagery of the area. In addition two small modern structures have been built on the southern edge of the site.

The central area of the site appears to be the least disturbed, and in this area the ground is covered with a dense scatter of 18th and 19th century pottery. A series of low mounds in this area of the site may be the earthworks recorded by Garlake (1978, 173). These earthworks were likely to be associated with an earlier phase of occupation, possibly the associated with the 14th century deposits recorded below the fort (Hardy-Guilbert 1980: 186).

**Ras Laffan**

Directly to the east of Al Huwailah, Ras Laffan industrial city covers an area of roughly 8.5 km by 12 km. Access to the site is restricted, and no survey was conducted in this area. The intensive development of this area implies that any archaeological remains are unlikely to have survived. No evidence of archaeological remains are visible on the satellite imagery from the area of Ras Laffan industrial city.
Figure 4.87: Extent of surviving archaeology at Huwailah

Figure 4.88: Al-Huwailah looking east
Conclusions and Recommendations

Several sites identified along the area of coastline between Fuwairit and Ras Laffan were examined, helping to build a more complete picture of the Qatar peninsula in the later Islamic period. All the sites identified have been adversely affected by recent development, or are imminently threatened with destruction.

Despite its historical and archaeological importance, Al Huwailah has been virtually destroyed over the last century, coming to near total obliteration in the last decade. Walls of the fort that stood almost 10m high in the early 20th century were reduced to a height of two meters by the 1970s and now are nearly invisible. Further rapid and unchecked development of the Qatari coastline may pose similar dangers for other sites in the area.

The sites of Al Marrouna, Al Jethay and Al Huwailah all require protection from further development. Any further development or construction on the sites should be halted. Land ownership needs to be ascertained to ensure the protection of these sites. Where appropriate the sites should be securely fenced and signposted. The isolated structures identified at QNG 218587 467351 and QNG 222382 465495 should also, at the very least, be clearly signposted as historic monuments.

At Al Huwailah an area of archaeological deposits measuring c.175m x 175m possibly survives in the centre of the site (see Figure 4.94). A detailed surface survey, including systematic pottery collection should be undertaken. Limited test pit excavation would allow the remains to be better evaluated. The aims of this work would be to assess the level of archaeological preservation, and the nature of the archaeological deposits present. It seems likely from the previous archaeological work undertaken on the site that it was occupied as early as the 14th century. If these early deposits survive they are of national significance, and would contribute greatly to the Islamic history of the region.

The sites of Al Jethay and Al Marrouna should both be surveyed in detail. A great deal of the site plan is visible on the surface, and much information could be gained in this manner. Limited surface collections of pottery would allow the more secure dating of these sites.
4.3.7 Survey and Rescue Excavations at Ruwais/Khasumah

Introduction

A program of archaeological assessment and excavation was conducted at the site of Khasumah near Ruwais in northern Qatar. The site consists of a series of substantial midden dumps, significant quantities of pottery as well as masonry walls. The site is threatened by the expansion of the town of Ruwais.

Three test pits were excavated through three separate midden dumps on the site. Additionally, two areas measuring c. 4.00m by 4.00m were scraped in an area where masonry could be seen on the surface. Finally a brief walkover survey was conducted of the area to the south of the site. The test pits revealed a complex sequence of pottery-rich midden deposits, sealing earlier pits and wooden post-built structures. The area of the site that was scraped back revealed substantial walls belonging to a large building. This structure was built of roughly finished beach rock (faroush) and limestone blocks, with walls measuring up to 0.60m thick.

Directly inland of the site several deflated stone cairns were recorded and worked lithics were recovered.

Site Location

The site of Khasumah is located on the northern Qatar coast, approximately 0.5 km east of the present day town of Ruwais. The site measures at least 350m east - west and 100m north - south, running parallel to the present day coastline. The site consists of a series of substantial midden dumps, measuring up to 50m in diameter and surviving to 1.50m high. Significant quantities of pottery and masonry walls are visible on the surface.

The coastline consists of a sandy beach above a wave cut platform of beach rock. To the east a number of large fish traps are visible. A modern house and walled compound occupies the eastern end of the site. To the east of the walled compound a fence line encloses an area of undulating ground. To the southeast, approximately 300m from the site is a walled cemetery. The area to the south and to the west of the site is being developed as residential units; a series of concrete property markers across the site indicates that this development will engulf Khasūmah (Figure 4.89). To the south of the site an area of sabkha extends for c.800m, before rising several metres to a low stony raised beach, representing a relic early Holocene shoreline.

Research Background

Beatrice de Cardi visited Ruwais in the early 1970s and describes a site with masonry buildings and middens in the area of Ruwais/Khasumah. She believed the site to be occupied from at least the thirteenth century.

“About half a kilometre to the east of Ruwais the remains of buildings are grouped near the sandy beach together with a number of middens and ash-pits. Surface pottery included thirteenth-century wares, a fragment of celadon and glazed Persian wares of the eighteenth century. The site would appear to have been in occupation, possibly intermittently, at roughly the same periods as Yusufiyah [located 1 km to the west of Ruwais], i.e. the thirteenth to eighteenth century” (De Cardi 1978, 189).

Methodology

Three test pits were excavated, measuring 1.00m by 1.00m at their base. The pits were located along the length of the site, targeting three separate areas of midden dumping. In order to ensure safe working conditions, Trenches 2 and 3 measured 1.50m by 1.50m, as they
were excavated to a depth of 1.95 and 0.90m respectively. All trenches were excavated stratigraphically, using a single context recording system. The small excavation areas, combined with often homogenous midden deposits, meant the definition of separate contexts was at times difficult. In these instances contexts were set at 0.20m arbitrary intervals to provide stratigraphic control. A 50% sample of all deposits was dry sieved, with the remainder being hand sorted for finds. Thirty litre bulk flotation samples were taken from each deposit and charcoal samples were collected from the sections of the trenches.

An area of masonry was visible on the surface between Trenches 2 and 3. Here a 50mm-100mm layer of topsoil was removed to expose the underlying wall lines in plan. These were then planned, and tied into the Qatar National Grid (QNG), although no excavation was undertaken. A brief walkover survey of the area north of the site was conducted. Archaeological features and finds were identified and subsequently located using a handheld GPS and photographed.

Trench 1 (KHA01)

Natural sand (24), recorded at 2.08mOD, in Trench 1. Three small pits or postholes [20], [22] and [23] cut into natural sand (24). Extending beyond the limits of the trench in the NE corner cut [23] was not fully exposed, and measured 0.15m x 0.12m, with a depth of 0.08m. The fill (19) of the cut [23] was mid greyish brown, and possibly burnt (Figure 4.98). A C14 sample was taken from the fill matrix. Extending into the east-facing section of Trench 1 was a circular cut [22], measuring 0.71m N-S, and 0.21m E-W, with a depth of 0.12m. The fill (18) of cut [22] was again burned, and a C14 sample was collected. A third cut [20] extended into the southern section of the trench, measuring 0.38m N-S x 0.53m E-W, with a depth of 0.19m. As with the fill of the previous cuts, the fill (17) of cut [20] was burned, and a C14 sample was taken from the fill matrix.

Mid greyish brown silty sand (15) sealed these cut features, and contained burned stones, shells, fragments of glass bracelets, a coin, 18th century pottery, bone, glass, and metal. While the section contains a series of laminated deposits, these were difficult to ascertain in plan and the division between (15) and the previous locus (14) was hard to define. Grey brown midden deposit (14) contained similar finds and inclusions to (15). The boundary between the topsoil, locus (13) and underlying locus (14) was again
hard to define plan. Topsoil (13) was heavily disturbed by roots, animal burrows and vehicle traffic.

*Trench 2 (KHA02)*

The natural deposits, (27), in the base of Trench 2 consisted of yellow brown sandy silt, sealed by a thin 20-50mm thick layer of beach rock and rounded gravels, representing the remnants of a wave cut platform and associated beach deposits. The natural was cut by a sub-circular undercutting pit (26) (Figure 4.99), extending beyond the trench to the south and measuring 0.46m N-S and 0.52m E-W. The feature was not fully excavated, as the depth of the deposits made work unsafe. The mid brown silty sand fill (25) was excavated to a depth of 0.40m and contained a small amount of pottery and fishbone. A C14 sample was taken from fill (25).

Fill (25) was sealed by a laminated mid greyish brown midden deposits (21). Individual layers were hard to define in plan, but can be seen in section as the accumulation of many individual dumping events. This layer was sealed by similar midden layers, (16), (10), (9). These deposits varied slightly in colour, but contained similar find assemblages, including large unglazed pot sherds, frequent fish bone and burnt stone and occasional fragments of glass bracelet.

The upper layers of midden were considerably less sandy, containing more ash and dark brown silty material. The finds in the upper layers were less well preserved, with smaller pieces of pottery and bone present. Midden dumps (8) and (7) were the latest in the sequence recorded. Both deposits had animal burrows running through them. Deposit (7) was sealed by more compact ashy silty sand that contained frequent small, sub-angular gravels. This topsoil layer (6) was eroded, deflated and heavily intruded upon by animal and vehicular traffic.

*Trench 3 (KHA03)*

Mid yellowish grey natural beach sand (12) was recorded at a depth of 2.11mOD in Trench 3, corresponds roughly to the level of natural deposits found in Trenches 1 and 2. Overlaying this natural sand was a series of midden deposits. The first of these (11) was mid yellowish orange with fine lenses of mid brownish grey, and contained pottery and a fragment of a glass bracelet. This layer was sealed by mid yellowish grey midden (5), this deposit contained a small lens of burnt material, possibly a fire spot. This layer is sealed by further loose laminated ashy midden deposits (2), (3) and (4). All contained a similar assemblage of pottery and animal bone. The top soil (1) was again very disturbed by animal burrows and vehicle traffic.

*Structural Remains*

Two small areas were scraped back to expose part of a large masonry building. The area of the structure that was exposed measured over ten metre in length and 4.00m wide, although the building probably survives over a much larger area. The masonry was recorded as (29) and (30), and was sealed by 50-100mm of mixed mid grey brown topsoil (28).

The walls measured 0.50 to 0.60m thick and were constructed of a mixture of rough beach rock and limestone. The building was orientated east-west, running along the beach. The southeast corner was exposed, along with a row of small rooms along the southern extent of the structure, measuring c. 2.60m across. The building continued to the north and west, beyond the limits of the trench. It is likely that the building represents a large, walled residential compound. The midden deposits, similar to those excavated in Trench 1-3, appear to be deposited against the southern side of the structure and are probably contemporary with its occupation.

*Possible cairns*

Inland from the site c. 500m several heavily deflated stone cairns were recorded. A single cairn
was recorded at QNG 201317 486744 and a group of several smaller cairns were recorded at QNG 201111 486863. Built of unworked beach rock, the cairns measured 1.00-1.50m in diameter and survived to 0.10-0.20m high. These ephemeral features were poorly defined, and no artefacts or dating material was found in association with them. It is possible they represent burial cairns of a pre-Islamic date.

**Lithic scatter:**

To the south of the site the sabkha extends for c.800m, before rising several metres to a low stony rise, representing a relic early Holocene shoreline. A poor quality mid brown chert is present along this raised plateau in significant quantities. Several worked fragments of chert were identified, including two scrapers that were collected for further investigation. Both scrapers were retouched. The larger of the two scrapers has cortex present on one side.

**Conclusions and Recommendations**

The archaeological site of Ruwais/Khasuma is covered by extensive midden dumps, resulting from the disposal of domestic waste. A preliminary examination of pottery from the upper levels of Trench 3 identified creamy sandy wares, Julfar II painted pottery, Iranian Khunj wares, but almost no blue on white glazed pottery. Collectively the assemblage from the upper levels of midden in Trench 3 suggests a deposition date in the 18th - 19th century.

The site covers an area of c.400m², of which only 3.00m² has been excavated, representing a sample of 0.75% of the total site. In this small area earlier wooden post built structures and pits were identified in two of the three trenches excavated. At least one stone building was identified running parallel to the coastline, and it is likely that similar buried structures are present along the length of the site. The building was not excavated, and it is unclear whether it is of a contemporary date to the middens, or represents an earlier structure buried under the midden material.

It seems very likely that the site of Ruwais / Khasuma is the same location as the middens and buildings de Cardi identifies “about half a kilometre to the east of Ruwais” (1978, 189). De Cardi believed this site to be occupied, at least intermittently, from the thirteenth century onward. The structures on the site, the cemetery located to the southeast, and the substantial midden deposits, all indicate a relatively large and possibly long lived settlement. The presence of early, possibly prehistoric, archaeology directly inland of the site attests to the long human presence in this area.

The site is currently threatened with destruction as the area is being developed and incorporated into modern Ruwais. The site of Ruwais/Khasumah is clearly of significance and could represent one of the last surviving elements of Ruwais’ old historical fabric. Elsewhere in the Ruwais area this has been almost completely displaced by modern development. We recommend that the site is either protected, and current development plans adapted to reflect this, or alternatively fully excavated and recorded archaeologically prior to construction.
4.4 CONCLUSIONS

The diverse research carried out as part of the regional survey across northern Qatar produced a range of new insights into the historic landscape and rural archaeology of the region. It also created a detailed record of a number of key sites (Qal‘at Shuwayl, Ain Muhammed and Fuwairit) in northern Qatar that had hitherto only been preliminarily documented. Philip Macumber’s hydrological and geoarchaeological survey reinforced findings from previous seasons, documenting how closely related the availability of fresh water wells and rural settlements was.

An emerging theme is the relationship between numerous coastal sites that lack fresh water, and inland satellite settlements clustered around wells. Al Zubarah, with the hinterland sites of Qal‘at Murair, Qal‘at Shuwayl, Lisha and Helwan, certainly falls into this group, although this pattern is replicated at Freiha (Ain Mohammed), Fuwairit (Qal‘at Zarqa) and Jumayl (fort at the inland field system). These satellite sites, often associated with small fortified compounds or homesteads, provided a crucial resource infrastructure to these coastal settlements, protecting water sources, grazing areas for livestock and other agricultural activities (such as date plantation). The precise relationships between the coastal sites and these satellite communities, as well as the wider rural landscape, requires further, more detailed work, but the initial steps taken by QIAH as part of this season mark a decisive step forward in generating a better understanding of these relations and localities.
5. **Finds from the 2010-2011 Season**

The following report will give a brief summary of the bulk finds and samples and a more detailed description of some of the catalogued field objects.

5.1 **The Bulk Material**

Bulk finds are those that are recovered in large quantities during excavation and are bagged up by material and context to be studied by a relevant specialist. They include the following main material categories: ceramic sherds, animal bone, shell, glass, metal, bitumen and tabun. The glass finds include fragments from vessels, window glass and bracelets. The metal consists mostly of fittings such as nails, spikes, hinges, hooks etc.

The following are the total number of bags of each of these bulk materials recovered from Al Zubarah and Freiha. The quantities reflect the size of the two sites, with Al Zubarah being considerably larger than Freiha.

<table>
<thead>
<tr>
<th>Material</th>
<th>Al Zubarah</th>
<th>Freiha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic</td>
<td>702</td>
<td>273</td>
</tr>
<tr>
<td>Bone</td>
<td>576</td>
<td>150</td>
</tr>
<tr>
<td>Shell</td>
<td>61</td>
<td>92</td>
</tr>
<tr>
<td>Glass</td>
<td>167</td>
<td>45</td>
</tr>
<tr>
<td>Metal</td>
<td>296</td>
<td>55</td>
</tr>
<tr>
<td>Bitumen</td>
<td>14</td>
<td>54</td>
</tr>
<tr>
<td>Tannur</td>
<td>20</td>
<td>2</td>
</tr>
</tbody>
</table>

The number of shells may seem to be rather low, given the coastal location of the sites, but it reflects to a large degree the recovery strategy. Small shells are found within much of the building material, both in wall and surface make-ups and so shells were only collected when a significant number were found together or if they were worked. The latter comprises mostly cowrie shells. This last season many oyster shells were found at Freiha which will hopefully prove to be evidence for the pearl diving industry. Bitumen was also collected when significant deposits were found, and the study of this material should prove fruitful as it occurs in many forms – coating the inside of and plugging holes in ceramic vessels, compact layers and lumps, and small rounded or bath-plug formed pieces.

The following table gives the individual bag total of bulk material by excavation area.

<table>
<thead>
<tr>
<th>Excavation</th>
<th>Ceramic</th>
<th>Bone</th>
<th>Shell</th>
<th>Glass</th>
<th>Metal</th>
<th>Bitumen</th>
<th>Tannur</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZUEP01</td>
<td>251</td>
<td>215</td>
<td>21</td>
<td>37</td>
<td>90</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>ZUEP02</td>
<td>250</td>
<td>202</td>
<td>9</td>
<td>52</td>
<td>157</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>ZUEP04</td>
<td>162</td>
<td>117</td>
<td>17</td>
<td>21</td>
<td>19</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>ZUEP05</td>
<td>39</td>
<td>42</td>
<td>14</td>
<td>57</td>
<td>30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FREP01</td>
<td>85</td>
<td>29</td>
<td>12</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>FREP04</td>
<td>158</td>
<td>104</td>
<td>62</td>
<td>28</td>
<td>36</td>
<td>44</td>
<td>1</td>
</tr>
<tr>
<td>FREP05</td>
<td>24</td>
<td>12</td>
<td>11</td>
<td>5</td>
<td>8</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>FREP06</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
At Al Zubarah two brief observations can be made from the above figures: firstly the area ZUEP04 has noticeably less material than ZUEP01 and ZUEP02 despite being of similar size and likewise a domestic habitation. Further study and analysis of the finds will hopefully shed light on this, but one possibility is that ZUEP04 was cleared out before its abandonment whilst the other areas may have seen a gradual decline or a rapid desertion. ZUEP05 was expected to have less material being a small slot trench but given its size the area produced a high number of finds, a reflection of the nature of the deposit being one of the town’s middens. At Freiha the difference in find quantities again reflects the nature of the area being excavated. FREP01 as the town’s mosque is unlikely to produce as much material as the domestic building that is FREP04.

5.2 The Samples

The following are the number of soil samples taken within each area.

<table>
<thead>
<tr>
<th>Area</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZUEP01</td>
<td>159</td>
</tr>
<tr>
<td>ZUEP02</td>
<td>266</td>
</tr>
<tr>
<td>ZUEP04</td>
<td>146</td>
</tr>
<tr>
<td>ZUEP05</td>
<td>25</td>
</tr>
<tr>
<td>FREP01</td>
<td>43</td>
</tr>
<tr>
<td>FREP04</td>
<td>113</td>
</tr>
<tr>
<td>FREP05</td>
<td>21</td>
</tr>
<tr>
<td>FREP06</td>
<td>6</td>
</tr>
</tbody>
</table>

Once again the figures reflect the character of the excavation area. The notably high number from ZUEP02 is due to the large number of postholes in the open courtyard at different phases. A few other samples were taken where necessary, for example of building material such as mudbrick, carbon for dating purposes, charcoal for wood analysis and, from the midden ZUEP05, botanical samples and one sample of animal hair.

5.3 The Catalogued Field Objects

Field objects are finds that are considered important enough to separate out from any bulk category, for example coins, complete glass vessels, bracelets, stone tools and ceramic vessels. They are given an identification number in the field and their location is plotted. They are subsequently catalogued by the finds registrar.

A total of 575 objects were catalogued during the 2010/2011 field season. Of this number 13 are from Fuwairit, 128 from Freiha and 434 from Al Zubarah.

5.3.1 Material

The following 35 materials, listed alphabetically, are represented between the three sites:

Amber, basalt, beach stone, bitumen, bone, carnelian, ceramic, coral, cork?, copper alloy, fabric, faience, flint/chert, glass, granite, haematite, iron, ivory, lead, limestone, pearl, plaster, plastic, quartz, quartzite, rope, rubber, sandstone, shell, silicified limestone, turquoise, unknown metal, unknown stone, styrofoam and wood.

Unsurprisingly, Al Zubarah has the most variety, with 31 types of material; Freiha has 22 whilst Fuwairit has just three. The four most common materials are copper alloy, glass, stone (of various types) and ceramic. Their totals are as follows: copper alloy – 300 objects, glass – 65, stone – 64, ceramic – 38. Of copper alloy about half are coins whilst the rest include fittings and attachments of various kinds, and jewellery. Glass objects mainly consist of bracelets, beads and vessels. The stone objects include hand-held tools, querns, weights, jewellery and building elements. The ceramic finds include vessels, shisha bowls, tobacco pipes, reused sherds and beads.

5.3.2 Object Type

The following object categories were recorded this season:

Architectural elements: door-jamb, door-socket, door-spring, hinge-socket, window-jamb.
Qatar Islamic Archaeology and Heritage Project, 2010-2011 End of Season Report

Commerce: coin.

Jewellery/Ornaments: bead, bezel, bracelet, button, earring, inlay, pendant, pin, pin/clasp, ring, toggle.

Metal Fittings: buckle, chain, disc, finial, fitting, hanging element, hinge, hook, nail, nail/tack, padlock, plate metal, ring link, rod, rosette, shaft, sheet metal, strip, wire/link.

Miscellaneous: small ball, bullet cartridge, game piece, pearl in a shell, plastic sheet, reused ceramic, rope, shot, spinning top, textile, worked bone, shell, coral and wood.

Smoking Utensils: shisha bowl, tobacco pipe.

Tools: blade, hammer-stone, knife, pestle, plumb bob, rotary hand quern, stopper, tweezers, weight.

Vessels: bottle, bowl, cup, jar, lamp, vessel.

The majority are found in quantities of less than 10. Those whose occurrence is greater include the following: weights x 17 of beach-stone, ceramic, copper alloy, granite, haematite, lead, limestone, plaster, sandstone and unknown stone; chains x 12 of iron and copper alloy; worked bone x 13; small balls x 18 of bitumen, ceramic, haematite, limestone; bracelets x 33 of copper alloy and glass; beads x 51 of amber, bone, carnelian, ceramic, coral, faience, glass, ivory, pearl, rubber, turquoise, unknown stone, and coins x 192 of copper alloy.

5.3.3 Specific Finds of Interest

Rotary Hand Querns

From Freiha in FREP04 seven rotary hand querns were recovered, including one intact upper grinding stone (cat. no. 69, locus 297). This quern is made of silicified limestone, a good choice for it contains many small shell inclusions which are self-sharpening to a degree as the surface is worn down.

Grinding face: diameter 36 cm, level to slightly concave, smooth, polished with visible striations. Upper face: diameter 32 cm, level, rough. Edge: thickness 5 – 6 cm, convex to oblique tapering into the upper face, rough. Central perforation: diameter 5.4 – 7.1 cm, wider at the grinding face to allow better dispersal of the substance being ground onto the grinding face. The surface is rough and has traces of iron colouring on the lower part, probably stains from an iron rynd. These are small perforated cross bars that fit into the perforation. The spindle that is fixed in the lower grinding stone passes through the rynd thus securing the upper stone during rotation. Vertical handle socket 3.1 x 2.3 cm that perforates the stone and is lined with bitumen, presumably used to fix the handle in place.

These querns are mainly used for grinding grain to produce flour, but can also be used to grind pulses to remove the shells. What is interesting is that some were found in a room that has a date press installation, raising the question of whether they were used in this process in some way. The future analysis of the environmental material from the soil samples plus research into the local agricultural system and possible importation of grain will enable a fuller understanding of their exact function.

Whilst some of the querns from FREP04 were just broken fragments, this complete upper stone appears to have been simply left when the building was abandoned and the occupants moved on elsewhere. A skeleton of a cat found in one corner, in the same locus (297), indicates that the room was no longer in use.
**Diving Weights**

Several diving weights have been found at Al Zubarah including a group of 14 from ZUEP02 last season and one from ZUEP01 (cat. no. 1026, locus 1735) this season. They are mostly sub-conical in shape, rounded/level on the base and top and with a lateral perforation through the upper body. Some have a distinct groove on the top. The dimension of the ZUEP01 example gives an indication of their size – length c.16 cm, width c.14 cm, thickness c.11 cm, perforation diameter c.3.5 cm. Weight 5231 grams. Most of these weights are made from haematite, a stone not local to Qatar. They are dark grey-black in colour with many small mica inclusions making them exceedingly eye-catching as they glitter and sparkle in water and sunlight. They are very heavy given their relatively small size and thereby perfect for their function. They would have been attached to the boat by a long rope which in turn would have been held by the pearl diver. A loop in the rope was made where the divers would place their feet before jumping into the water. The weight would then have carried them quickly to the required depth to look for the oyster shells.

The pearl diving industry is still within living memory and there are books with photographs and written accounts. In the souk in Doha one can find shops displaying diving weights, fishing nets, nose clips and even the tools used for weighing and trading the pearls. To find these weights in situ within a context of use adds a new dimension to this aspect of Qatar’s history. Further research will hopefully shed light on the source of the haematite, and on their manufacture. Other questions might be answered through ethnographic work with people who still remember the pearl divers – for example, were the weights personal possessions?

**Worked Ivory**

Two decorated objects of worked ivory are intriguing though their function is as yet not known; they may have been used in textile production or are possibly ornaments. One (cat. no. 523 locus 1428) from ZUEP01 is incomplete but this season a second intact example was found in FREP04 (cat. no. 146, locus 426). Both are roughly cylindrical in shape with a central vertical perforation and a second lateral perforation in one side. Both have incised decoration of rings around the circumference and small circles with central dots. The dimensions of the intact Freiha example are as follows: Height c.3.6 cm, diameter maximum c.3.7 cm, minimum c.3.1 cm, perforations – vertical, diameter maximum c.0.8 cm, minimum c.0.5 cm, lateral, diameter c.0.7 cm, weight 42 grams. The side perforation is drilled at an angle from the right and has distinct wear marks on its right edge. In addition there are patches of indented cross hatches on the upper part of the body. These various patterns are indicative of a possible textile function, as a whorl or bobbin perhaps, where something has been passed through the lateral hole repetitively and wound around the top of the object. A worked, broken shaft of mother of pearl was found protruding from the central vertical hole, length c.3.5 cm, width c.0.7 cm. It is this item, if broken off in situ that may indicate an ornamental use, as a hair or clothes pin for example.
6. **THE 2010-2011 SEASON: SUMMARY AND CONCLUSION**

6.1 **INTRODUCTION**

The 2010-2011 archaeological fieldwork season of the QIAH carried out a wide ranging and successful program of investigations across northern Qatar over the course of its five month season. These various fieldwork endeavours have provided a wealth of new data and insight into the Islamic heritage of northern Qatar, which will be briefly summarised here.

An emergent theme in dealing with the archaeology of northern Qatar is the increasing pressure posed by development and construction work across the region. Qatar’s fast paced development of national infra-structure, as well as a rapid rise in construction of housing areas, poses a challenge to efforts in mitigating their impact on the historic environment. Hence, QIAH carried out rescue excavations at one site this season, while expanding its program of archaeological survey to monitor existing and emergent threats to archaeological sites and historic buildings and places.

At the same time, the project continued its intensive program of research into the settlement of Al Zubarah and Freiha. The work here has begun to provide us with an ever more vivid picture of daily life, economy and trade in these early modern, historical sites. They provide unique perspectives on the life on Qatar’s northwest coast during from the 17th to the early 20th centuries.

6.2 **EXCAVATIONS AND SURVEYS IN AL ZUBARAH**

Following on from our initial 2009 survey of Al Zubarah, work was carried out this season to complete the plan of the settlement, including the extant previous excavation areas from the 1980s and 2000s. A newly discovered small settlement within the area of the Al Zubarah Archaeological Site perimeter fence was also fully mapped, as was an enclosure to the south of the southern screening wall. This work now provides us with a complete and up-to date plan of the Al Zubarah Archaeological Site.

Excavations in ZUEP01 succeeded in fully excavating ‘Compound 2’, a courtyard house situated to the north of ‘Compound 1’. This building displayed a complex series of alterations and development, as parts of the house fell out of use, walls were realigned and an open yard established to the west. This shrunk Compound 2 to a much smaller size. The alleyway to the north of Compound 2 is similar in width and overall appearance to the east-west running alley between Compounds 1 and 2 in ZUEP01. These formed an integral part of a distinct, secluded neighbourhood. A building at the northern edge of ZUEP01, north of the alleyway, was at one point dismantled and a more temporary occupation established. These consisted of postholes, occupation floors and clay-lined hearths. Significant archaeological deposits were noted in the walls of pits and when the courtyard of Compound 2 was half-sectioned. These clearly belong to Phase 6 of the occupation of Al Zubarah. They appear to be more substantial than previously observed and warrant further excavations in ZUEP01 as part of the 2010-2011 season to better determine their function, date and distribution.

Excavations in ZUEP02 are at an intermediate stage at this point. It is fair to say that the excavations here are probably the most complex and time-consuming in the entire excavation area of Al Zubarah. This is because of the large area that was opened to fully expose structures in plan, the number of features and deposits encountered within the area, and the fact that ZUPE02 preserves evidence for the entire Al Zubarah sequence (Phases 6-1). Nevertheless, excavations have made significant progress during this season. The northern extension linking ZUEP02 with the former souk excavation area will in the next season allow us to tie in these two disparate elements and understand the development of the souk area holistically. Almost all of the Phase 3 architecture, and most of the Phase 4 archaeological features, have been dealt with and it is expected that a wider exposure of Phase 5 architecture across this excavation point can be achieved during the next season.
Work in ZUEP04 made significant progress over the course of the last season and achieved important results. Following on from the excavations in a small part of the fortified palatial compound in 2010, this year’s excavations exposed an entire courtyard area and adjacent rooms within Al Zubarah’s largest single building. Excavations of the courtyard area and individual rooms reinforced the impression gained from last year’s excavations that this building did not have a primarily militaristic or defensive function. The discovery of a madbasa (date press), hammams, a storage room, and a food preparation or kitchen area, showed that rooms in the building fulfilled some of the same functions as those found in the courtyard houses in ZUEP01. A staggered, blind entrance which provided access from alleys into the courtyard, which was found in this year’s excavations, furthermore shows that privacy was a concern for the inhabitants. This indicates the overall rather domestic character of this complex of rooms and courtyards. The palatial compound shares many features with similar buildings throughout urban sites in the Gulf. Its palatial character is nevertheless evident in the size, shape and positioning within the town. The palatial compound is the largest single building within Al Zubarah. Its towers and perimeter wall make as much a statement about status and importance of the occupants, as they are defensive. The building appears to have been constructed in tandem with the outer town wall and reinforced the defense of the town at this particular point. Nevertheless, on the inside it housed people who likely belonged to a large extended family group or clan, who very probably played an important role in the administration of Al Zubarah’s affairs and trade.

Excavations in ZUEP05 targeted one of the extra-mural middens of Al Zubarah. This is the second midden yet excavated in Al Zubarah – the first being located between the palatial compound and the outer town wall in ZUEP04 (excavated in early 2010). Excavations here documented the full depth of the stratigraphy of this midden and retrieved copious samples of ceramics, fauna, botanics and other items that will – once analysed – provide crucial insights into the diet, culture, economy and trade connections of Al Zubarah’s inhabitants. A small segment of the outer town wall was also revealed in the excavations, providing a further glimpse of its original construction techniques.

A recurrent question in the excavations at Al Zubarah has been to establish the age of the main settlement at Al Zubarah. Written sources have long suggested that the primary settlement was founded during the 1760s, but there is ambiguity whether this expanded a previously existing settlement or whether the major phase of occupation was stamped out of the ground from nothing. Ephemeral evidence for a pre-Phase 5 occupation in the form of post-holes and clay-ovens was found in both ZUEP01 and ZUEP04, but has so far not amounted to any substantial image of the pre-Phase 5 occupation. ZUEP06 was put in place to attempt to gain additional data on these earlier phases. Excavations in this area of high ground, however, proved somewhat inconclusive. Although evidence for dumping of production waste and multiple pits relating to possible industrial processes (such as bitumen processing) were documented, natural deposits were encountered relatively close to the modern ground surface. This appears to suggest that prior to settlement the Al Zubarah area was dominated by an undulating landscape consisting of bedrock and sand dunes. Further work with the material culture recovered from ZUEP06 is necessary to gain a better understanding of the time-depth documented in this excavation area.

Overall then, the phasing scheme suggested in QIAH’s previous End of Season report 2009-2010 (Richter and Walmsley 2011), has been confirmed by the excavations in 2010-2011. ZUEP01 and ZUEP02 are the only two areas which preserve the entire sequence, while other areas (ZUEP04 and ZUEP05) appear to preserve evidence for only some parts of this sequence (i.e. the earlier part). While excavations as part of this season have confirmed this phasing, we are still some way from understanding both the chronology and sub-division in more detail. Excavations in
ZUEP01 and ZUEP02 in particular have shown that these phases are coarse grained divisions. Each phase, in particular Phases 5 and 3, preserve multiple sub-phases that incorporate construction of architecture, occupation, refurbishment, re-occupation and abandonment.

**Excavations in Freiha**

The 2010-2011 season saw the first full five-month excavation at Freiha, building on the promising initial results from the 2009-2010 survey and small scale excavations. Work was concentrated on the supposedly later, central part of the settlement to the west and north west of the fort at Freiha. Here, the remains of a large mosque and an area containing the remains vernacular buildings were excavated.

The mosque underwent multiple phases of rebuilding and restructuring, interspersed with apparent abandonment and partial collapse. Presence of a minbar adjacent to the mihrab at one point during the sequence of mosque development highlights the similarities of this building with many other extant mosques in Qatar (for examples see al-Kholaifi 2006). Although the mosque was restructured and expanded it remained located at the same spot over the course of the occupation. This suggests that this area remained the focus of settlement for some time and that the restructuring and rebuilding of the mosque reflects the changing economic and social fortunes of the community at large.

Excavations in the central zone of the settlement in FREP04 revealed the remains of several linked courtyard houses of different size. In their simplest form they consist of a single room with an added perimeter courtyard wall. In general terms, they are smaller than the Al Zubarah courtyard houses and contain fewer rooms, probably reflecting fewer economic means. The excavations in FREP04 have revealed a multi-faceted sequence of construction, which begs further exploration in the forthcoming fieldwork season. We stand to learn a great deal from exploring the settlement’s core, so as to gain a complete stratigraphic sequence of the occupation.

One emergent theme from the work in Freiha is the cyclical nature of the occupation at the site. Episodes of construction and occupation are interspersed with abandonment, partial decay of buildings and reoccupation. This highlights the at times transitory nature of settlement at Freiha, perhaps fitting in first with the emergence of Al Zubarah as a major site and likely focal point in the landscape, followed by Al Zubarah’s partial abandonment and the reoccupation of Freiha. This forms part of an emergent, incredibly interesting story of the local settlement sequence.

**6.3 Surveys and Rescue Excavations in the Al Zubarah Hinterland**

The QIAH team carried out extensive survey work as part of the 2010-2011 field season, which included both field walking surveys, as well as topographic and mapping surveys. In addition, QIAH staff engaged in rescue archaeological work at the settlement of Khasuma near Al Ruwais.

Topographic mapping at archaeological sites — including Al Zubarah — is creating a lasting and detailed record of regional settlements. In addition to completing the town plan of Al Zubarah, key sites in the surrounding landscape were also mapped, including Qal‘at Shuwayl, Ain Mohammed and sites near Ruwais. The largest topographic mapping work, however, was undertaken at Fuwairit, a major settlement on the east coast. Here, the entire settlement was surveyed generating a detailed topographic map of the site.

Fuwairit is an important site on the east coast of northern Qatar, occupying a narrow sand strip that is situated in a narrow, shallow bay. The survey of the site has shown that the layout of a complete 19th century village is preserved here. Individual buildings, alleys, at least one large compound and a mosque were identified from the detailed topographic data generated by the survey. This provides a detailed and thorough characterisation of the archaeological remains at the site, which now requires urgent attention to protect it from being damaged. Trackways pass the site nearby and vehicle traffic on the site is not uncommon. Fuwairit beach, situated to the
east of the site, is a popular weekend picnic and swimming spot, and the popularity of this beach is contributing to the further damage of the site by vehicle traffic.

Situated c. 1.5 km west inland from Fuwairit lies a small fort accompanied by some outbuildings, a mosque and a well. The small settlement of Az Zerqa appears to have functioned similarly to Ain Mohammad and Qal’at Shuweyl did to Freiha and Al Zubarah: as a small fortified site protecting crucial fresh water sources. Similarly to Freiha and Al Zubarah (and Ruwaidah for that matter) fresh water is not available immediately at Fuwairit. Sources inland provide the only reliable supply of fresh water and therefore required protection. This pattern of a paired appearance of coastal village sites with inland, fortified satellite settlements is therefore characteristic of the northern Qatar peninsula settlement pattern during the 18th to 19th century.

Topographic surveys at Qal’at Shuwayl and Ain Mohammad near Al Zubarah confirm this pattern. Both sites have small forts associated with wells, in addition to small settlements. The Shuwayl settlement appears to be smaller and somewhat more dispersed, whereas the Ain Mohammad settlement appears to be more concentrated around the two small forts. Recent road works and bulldozing in the area has truncated parts of this quite large site, which also contains evidence of more recent occupations in the form of breeze block buildings.

A field walking survey along the coastline between Fuwairit and Ras Laffan Industrial City was also carried out this season. This work aimed to characterise the occupation of this zone to gain an initial understanding of this particular region. This brief survey located a number of sites, some of which had hitherto not been recognised. The settlement of Al Marrouna, in particular, has to be highlighted. It is a today almost buried site, which has been heavily impacted and truncated by domestic compounds. This likely 18th - 19th century site requires some urgent attention, as it is reasonable to assume that it may soon be completely lost. The same survey also attempted to relocate the important site of Al Huwailah, once a prominent settlement on the east coast of Qatar. Sadly, the archaeological fieldwork confirmed that this settlement has been almost entirely lost due to modern development. The location of the fort and settlement of Al Huwailah are barren ground on the surface, although it cannot be completely excluded that there may be some sub-surface preservation of archaeology. Further investigations – perhaps using geophysical techniques – may be required to verify the presence of sub-surface archaeology here.

Lastly, the project carried out rescue excavations at one site to the immediate east of the modern settlement of Al Ruwais. Survey in the area had indicated the presence of four distinct midden mounds in a group along the shoreline here. Since this area is earmarked for development rescue excavations were carried out at this site to gain an insight into the character and chronology of settlement. The two excavated test units did not only produce some significant samples of material culture, fauna and other finds, but also produced evidence for at least one building buried beneath midden deposits. This site is therefore of some interest and importance and further work may well be required here.

Surveys and small scale excavations across northern Qatar are providing us with an ever better understanding of the settlement pattern and relationship between the environment and human land use. Macumber’s important geomorphological and hydrological research reinforced again the idea that well locations and their exploitability and reliability governed the settlement pattern during the medieval and post-medieval periods in northern Qatar. Further mapping of key sites and more extensive field walking in northern Qatar will provide us with an ever more detailed understanding of the region’s archaeology and heritage.
7. **BIBLIOGRAPHY**


Hunting 1980 Qatar geological Map. Geology and Geophysics Ltd


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1. **INTRODUCTION TO THE END OF SEASON REPORT, 2011-2012**

*Stephen McPhillips*

1.1 **QATAR ISLAMIC ARCHAEOLOGY AND HERITAGE PROJECT IN 2011-2012**

The Qatar Islamic Archaeology and Heritage Project (QIAH) was launched in 2008 at the initiative of their Excellencies Sheikha Al Mayassa Bint Hamad Bin Khalifa Al Thani, Chairperson of the Board of Trustees of the Qatar Museums Authority, and Sheikh Hassan Bin Mohammad Bin Ali Al Thani, Vice-Chairperson of the Board of Trustees of the Qatar Museum Authority (QMA). The project is run in collaboration between the QMA and the Institute for Cross-Cultural and Regional Studies at the University of Copenhagen. This collaborative project is under the co-direction of Professor Alan Walsmsley (Archaeology), Professor Ingolf Theusen (Conservation and Heritage Management), Professor Morten Meldgaard (Environment) and Professor Jørgen Bæk Simensen (History). This report presents the results of archaeological excavations and survey in northern Qatar by QIAH in the 2011-2012 season (October 2011 to March 2012).

![Figure 1.1: Map of northern Qatar showing the QIAH archaeological sites and survey area](image-url)
1.2 Archaeological Investigations at Al Zubarah in 2011-2012 (Section 2)

The primary focus of work in 2011-2012 consisted of targeted excavation at Al Zubarah, and at the nearby site of Freiha. These addressed the key issues of the historical development of the two settlements, throwing new light on the towns’ economy and aspects of everyday life. Excavation areas at Al Zubarah referred to in this report are shown in Figure 1.2 (for discussion of the open area excavation methodology employed by the project see: Richter et al. 2010: 37).

This season saw the completion of critical work at the Excavation Point 1 (ZUEP01), which provides a complete historical perspective of Al Zubarah from its formative development in the mid-eighteenth century, through to the twentieth century. Excavation point ZUEP01 affords us an unparalleled vista of the first settlement in this central area of the town, the earliest occupation attested thus far, Phase 6. The complex build-up of inter-related archaeological features provides an insight into everyday life in mid-eighteenth century households in Al Zubarah: tannurs, hearths, post-holes, and rubbish pits, constituting deposits rich in material culture (stone, metal and pottery artefacts) and ecofacts (botanical, faunal and marine-faunal specimens).

The expansion of archaeological investigation at Excavation Point 2 (ZUEP02) in 2011-2012, adjacent to what is likely to be the central commercial district of the city, revealed significant new results which graphically illustrate the significance of Al Zubarah in interregional trade networks. Attested in literary sources as a pearl-fishing centre, the presence in this excavation area of large quantities of ceramics imported from as far afield as Europe, East Asia and East Africa, as well as parts of the Arabian Gulf, is indicative of Al Zubarah’s international trade connections in the eighteenth and nineteenth centuries. The discovery here of three large madbasas (date-presses), suggests that the compound had a function closely linked to storage and production, and related to the excavated sq located further to the north (QMA1). A significant number of large storage vessels were recovered as in situ abandonment deposits on floor surfaces in excavation spaces in ZUEP02.

A primary component of QIAH excavations at Al Zubarah in 2011-2012 was the expansion of work on the palatial compound (ZUEP04) on the southern perimeter of the site. Exposing more of this sizeable structure, the largest extant building in the town, revealed significant results which illuminate the life of its rulers and ordinary inhabitants alike in this domestic space. Extensive deposits of datable material include pottery, small finds, and significant numbers of coins, which confirm that this structure was founded in Phase 5. Examination of the central courtyard deposits revealed five sequences of surface resurfacing, which allows us to demonstrate that the palace underwent a continued process of renewal while occupied.

One further excavation area was opened at Al Zubarah in 2011-2012, Excavation Point 10 (ZUEP10), to better understand the northern outer city wall, and investigating aspects of its construction in order to inform conservation work. This established the function of the area around Tower 8 and determined a dating spectrum based on the established Al Zubarah phasing. Work here revealed a tightly packed sequence of archaeological deposits, representing continued activity in this part of the site throughout the main phases of Al Zubarah’s occupation and subsequent abandonment. Most significantly, it shows that a refortification of the wall took place potentially at the turn of the nineteenth century.
Figure 1.2: Plan of Zubarah showing QMA and ZUEP excavation areas
1.3 Archeological Investigations at Freiha in 2011-2012 (Section 3)

Freiha, located four kilometres northeast of Al Zubarah, provided the other main excavation focus this season (locations shown in Figure 3.1). Work concentrated on the domestic structures and adjacent outdoor living areas in FREP04, adding considerably to pre-existing knowledge of the site gained from the earlier excavation of the congregational mosque (See Richter et al. 2011). The 2011-2012 season revealed that the first period of occupation at Freiha was extensive, which is significant given that this phase is likely to predate the foundation of Al Zubarah. The excavations uncovered a complex occupation sequence, with post-built structures, succeeded by new constructions in pisé and mud-brick, which were eventually replaced by stone buildings.

1.4 Archeological Investigations at Fuwairit (Section 4)

The QIAH project continued to assist the QMA in defining and protecting the archaeological heritage of northern Qatar. As part of this, in early 2012, excavation took place at Fuwairit, a site on the northeastern coast closely associated with the history of the ruling Al Thani family (locations shown in Figure 4.1). Work focused on recording the archaeology revealed in a series of small interventions along the western edge of the main settlement. This saw the investigation of the large building which proved to be a principal town mosque, and the documentation and sampling of a stratigraphic sequence through one of several large middens. An extraordinarily rich material culture was collected during the excavations, with a particular preponderance of marine fauna.

1.5 Mapping and Survey in the AZAS Buffer Zone and Northern Qatar (Section 5)

A major aim of archaeological work in 2011-2012 was the geodesic survey and mapping of key sites in the Al Zubarah Archaeological Site (AZAS) UNESCO buffer zone, ensuring compliance with the UNESCO Management Plan that deals with the regulation of tourism and visitor access to AZAS (indicated in Figure 1.1). In addition to this, an extensive programme investigated in greater detail the QIAH survey area in northern Qatar (area indicated in grey in Figure 1.1). The main results of mapping and investigation of buffer zone sites included the recognition of early Islamic occupation at Ain Mohammad, and a greater understanding of the three settlement areas of Musaikah documented this season, showing it to be an early Islamic archaeological site of major importance, at least as large in extent and architectural complexity as the better known Murwab. In the southern portion of the buffer zone, Helwan and Muhayriqat revealed early Islamic and pre-modern occupation. Muhayriqat is unique in that it incorporates major field systems and agricultural and horticultural remains; significant for understanding the economy and subsistence strategies of Al Zubarah itself.

Ground survey was an integral component of the project work this season, in the face of quickening development in the region, as defining archaeological sites and features in the landscape is necessary before they can be effectively managed and protected. This season the ground-truthing of Birmingham Unit’s QNHER survey results was completed, while new survey saw the identification of many previously unknown sites. Critically, the work led to a major expansion in our understanding of the Early Islamic settlement horizon in the Qatar peninsular. In addition it encompassed the detailed mapping of petroglyphs in Jabal Fuwairit (see Eddisford 2012b), and at the later Islamic site of Marrouneh on the east coast, threatened and indeed mostly destroyed by recent development activities.
1.6 FINDS AND CONSERVATION (SECTION 6)

In an archaeological operation as wide-ranging as QIAH, the effective management of finds and data are critical. An introduction to the principal activities undertaken by the finds team is presented here, along with a short exposé on finds conservation work undertaken by the specialist team working at the Al Zubarah Research Station. This work has played a primary role in informing the National Museum of Qatar’s planned exhibitions which are scheduled to contain a significant component relating to Al Zubarah and the other archaeological sites investigated by QIAH.

1.7 ARCHIVAL MATERIAL RELATED TO LATER ISLAMIC AL ZUBARAH (SECTION 7)

Alongside archaeology, the investigation of historical sources is of major importance in building up a detailed picture of the past of northern Qatar. In this section, Hanne Nymann provides an overview of the major documentary source materials and archival collections available providing access to the Later Islamic history of Al Zubarah.

1.8 SPECIALIST REPORTS (APPENDICES)

A range of specialists have contributed their expertise to the QIAH project. Appended to this End of Season report are two reports dealing more closely with specific analyses carried out by members of the QIAH team in 2011-2012. These are Dr. Philip Macumber’s study of the impact of environmental disparity on human occupation in the Qatar peninsula, and Dr. Lisa Yeoman’s analysis of marine faunal material from the excavations at Al Zubarah. A list of further publications and reports is included.

Figure 1.3: Fish mandible from Lisa Yeomans’ typological series
2. **Excavations in Al Zubarah**

2.1 **Al Zubarah Excavation Point 1 (ZUEP01)**

*Lisa Yeomans*

2.1.1 **Introduction**

Excavations in ZUEP01 during the 2011-2012 season focused on providing a large exposure of the Phase 6 occupation with the intention of highlighting the density of features from this phase. To expose an area of the Phase 6 archaeology, whilst leaving complete Phase 5 courtyard houses for future display, this season’s work was limited to the area of Compound 4 and the area to the north (Figure 2.1). The excavation area was extended to the northwest, thereby fully revealing the partially exposed Space 188. The full excavation of the southern part of Compound 4 south revealed an extensive number of Phase 6 features resulting from repeated occupation. These include large rubbish pits, tannurs, hearths and postholes, with many of the features intercutting one another. The density was such that it was impossible to excavate all of the features and priority was given to pits rich in cultural material, intercutting sequences providing stratigraphic dating and features where C14 samples could be taken.

![Figure 2.1: Extent of area covered by 2011-2012 season (bounded by red line)](image-url)
The Phase 6 features provide evidence for the occupation of Al Zubarah either before the arrival of the ‘Utub or possibly during their initial occupation prior to the layout of the town with extensive architecture. Archaeological evidence from Phase 6 provides us with physical remains of this period in the early development of the town and, although less impressive visually than the Phase 5 architecture, is very important for understanding of the expansion of the town.

2.1.2 Phase 6 Occupation in ZUEP01

Phase 5 architecture was built on a layer of mixed sand and cultural material. During the 2010 to 2011 season, this sand was exposed below the southern end of Compound 4 and below parts of Compound 2. This season a much larger horizontal exposure of the Phase 6 features was detected and selectively excavated. Many of the postholes contained a single fill that was relatively sterile in material culture, and minimal information would be gained by excavating all of these. Instead, the focus was on excavating the pits containing abundant pottery and faunal assemblages, as well as the hearth and tannurs which would provide environmental evidence.

The density of the features was exceptionally high resulting from repeated occupation in tents or palm frond (‘arîsh) structures constructed from wooden poles with bound date palm branches. Discerning a pattern to the high density of features is difficult. The postholes with burnt fills tended to be amongst the latest stratigraphically and some spatial patterning is evident (Figure 2.2), with these generally occurring on a northeast to southwest aligned strip within the excavation area. The density of unburnt postholes was also higher in this area, whilst the large rubbish pits are generally located to the northwest of this zone. Tannurs and hearth/firepits tended to cluster into groups, probably representing the use of the same part of a structure as a cooking area over time. Most of these concentrations occurred in the same northeast to southwest aligned area as the postholes. This spatial evidence suggests that the repeated occupation in Phase 6 consisted of a row of structures possibly with rubbish pits behind. This may have been a pattern that developed later in Phase 6 and prior to the Phase 5 occupation, when some of the later structures were destroyed by fire, either deliberately or accidentally.

Many of the rubbish pits contained a substantial assemblage of pottery and bone. In one instance, two pots were found stacked upside-down (Figure 2.3). These pots (Figure 2.5) were jars and must have been placed in a pit. An example of one of the hearths is shown in Figure 2.6; this was probably a cooking pit and was surrounded by numerous postholes cutting the natural sand.

2.1.3 Phase 5 Settlement in ZUEP01

Most of the Phase 5 architecture and occupation sequence was excavated in 2010/2011, but additional work was conducted in the extension of the trench to the northwest and, furthermore, Phase 5 deposits were removed to expose those of Phase 6.

Phase 5 Space 189/190 D: Street prior to the construction of Compound 4

The earliest street layers were exposed as continuing under the walls of Space 187 and Space 188, and therefore the street predates the construction of Compound 4. To the north of the street was an open area which had several phases of use as an open cooking site, and an area for tents or other ephemeral structures. In the earliest phase of the use of the space there was no formal wall delimiting the space from the street, and during this time, prior to the construction of Compound 4, the area was used as an external cooking area. Numerous tannurs and hearths were excavated here.
Figure 2.2: Phase 6 features showing burnt postholes, postholes, pits, tannurs and hearths

Figure 2.3: Stacked pots found in ZUEP01
Figure 2.4: ZUEP01 - Phase 5, Compound 3
Figure 2.5: Illustration of cooking pot from Locus 7574 (Pot Ref 55)

Figure 2.6: Hearth surrounded by post holes in ZUEP01
Figure 2.7: Doorway leading to Space 187

Figure 2.8: Postholes interpreted as temporary support posts
Phase 5 Compound 4 F: Construction

Compound 4 was mostly excavated in the 2011/2012 season with the excavation area located so that only the eastern side of the compound is visible. In its earliest phase this complex appears to have been a specialised date storage and date syrup production unit. The compound comprised of a southern open space (Space 197), a small multi-function room (Space 195), two further open areas divided by a north-south wall (Space 196 and Space 193), with Space 193 leading into a date press room Space 192. To the north of the compound another date press room (Space 187) was accessed through Space 188. Description of the rooms and the deposits excavated within are given in the 2010-2011 End of Season Report. Space 188, not fully exposed last season, measures 6.40m by 2.35m. The western wall of the room is at an oblique angle to the other walls so that the northern side of the room is slightly longer than the southern side. The internal walls of Space 188 are plastered, and a stepped and plastered doorway was built into the eastern end of the southern wall. To the west of Space 188 is a partially exposed room Space 199, which was only seen in a small area within the excavations, and it remains uncertain if this was part of Compound 4 or part of an adjacent compound. The western wall of Space 188 is aligned at right angles to the orientation of the southern wall of the compound, and it is possible that Space 199 was one of a series of rooms which had their long axes forming the western side of the compound. Space 188 functioned as a date syrup collection area, and probably a storage room, with a doorway leading to Space 187 (Figure 2.7). The placement of the plastered doorway between the two rooms seems strange, as the collection pit is located immediately in front of the doorway. However, the collection pit would usually be covered with a wooden lid that could be walked on, enabling easy access into the date press room.

Phase 5 Space 189/190 C: Occupation

Two postholes parallel to the eastern wall of Space 187 were cut into the street. Their position would have blocked the entrance into Compound 4, and very few other cut features have been found within the street. These postholes are therefore interpreted as temporary support posts used during the construction of the date press (Figure 2.8). Occupation debris and street surface built up, sealing these two features, and the excavation of these deposits yielded substantial quantities of bone, pottery and numerous coins. In this phase the wall delimiting Space 190 from the street was constructed, and a surface was laid down to respect this wall.

Phase 5 Compound 4 B: Change in function to domestic compound

Compound 4 was extensively remodelled in this phase and turned into a domestic courtyard house. Both date presses went out of use, Space 195 was knocked down, the southern wall of Space 192 was realigned and three additional rooms were constructed. A full description of the archaeological sequence is given in last year’s report. In Space 187 a shell surface was laid over the date press, and Space 188 was converted into a latrine. At this stage the southern wall of the two spaces was partially knocked down, allowing the drains for the latrine to be inserted. The southern wall of Space 187 was removed to the height of the courtyard deposits. These had built up with the blocking of the doorway from Space 188. The date collection pit was infilled and a sand levelling layer was spread across the room. Within this layer a miniature ivory pot measuring just a couple of centimetres in size was recovered complete with its lid (Figure 2.9).

In the area where the date collection pit was located, a plastered wash basin was built. In the southeast corner of the room the latrine and a screening wall were constructed. The plastered surface of the latrine sloped to the south where it fed into a gypsum plaster pipe draining into a stone-lined cess pit located in the central courtyard (Figure 2.10).
Figure 2.9: Miniature ivory pot with lid (Locus 7540, Cat.1114)

Figure 2.10: Plaster lined drain and latrine in central courtyard of ZUEP01
Phase 5 Compound 4 A: Change in layout of domestic unit

In this phase the layout of the courtyard house was modified slightly, with Space 192 extended to the north and the room divided into two by a narrow partition wall. There were no associated changes within Space 188: this room continues to function as a latrine until the abandonment of the house. In Space 199 a spread of ceramic sherds lying on the surface probably represent a complete vessel left at the abandonment of the building, and subsequently broken by the collapse of the architecture.

Phase 5 Space 189/190 B: Occupation

Most of the deposits from this phase were excavated in 2010/2011. Based on the levels of the street deposits excavated last season and those from the extension of the trench to the west, two deposits have been assigned to this phase. Both layers were laminated sequences of occupation debris and laid deposits.

Phase 5 Space 189/190 A: Occupation

Further laminated street layers were assigned to this phase. At the western end of the exposed street the surface was truncated by a drain. This was lined with beach stones with sandy silt and areas of gypsum plaster used as mortar. The drain was capped with two flat stones covered and sealed with gypsum plaster. This plaster was also applied to wall and moulded into a recess in the wall to form a channel leading into the drain (Figure 2.11).
2.1.4 Conclusion and recommendations for further work

The excavated sequence in ZUEP01 provides a comprehensive sample of the Phase 6 settlement in this part of the site, as well as the occupation of two complete courtyard houses from Phase 5. The excavated sequence also provides evidence from a specialised date production facility and its eventual change into a domestic house. Parts of additional structures have also been excavated, and there is evidence for the layout and maintenance of a street. In the 2011 to 2012 season excavation work focused on providing a large sample of the Phase 6 occupation, showing that this phase of the occupation of the site is represented by tents and/or palm frond structures. The numerous postholes and the intercutting features show that this occupation witnessed numerous rebuilds and repairs to the structures. Spatial patterning suggests that, perhaps towards the end of this occupation, the structures were orientated in a northeast to southwest alignment with rubbish pits to the northwest. Burning of some structures may have occurred towards the end of the Phase 6 occupation. Preliminary analysis of the pottery from some of the rubbish pit suggests that there are some earlier pottery forms as well as the pottery types that are found in Phase 5.

No further fieldwork is recommended for ZUEP01, barring post-excavation analysis. A comprehensive stratigraphic report tying together the work from the four excavation seasons needs to be produced, and this would form the basis for future publication. Analysis of the material excavated from ZUEP01, perhaps focusing on specific research questions to date and understand the occupation sequence of the area, should be a priority. The stratigraphic sequence from ZUEP01 provides evidence to examine the initial occupation of the town and economy as the settlement developed. Additionally, the courtyard houses provide evidence of activities at the household level.
2.2 Al Zubarah Excavation Point 2 (ZUEP02)

Michael House

2.2.1 Introduction

Al Zubarah Excavation Point 2 (ZUEP02) is located inside the inner town wall, slightly to the north of centre overlooking the beach, 50m southeast of the QMA excavations of the area identified as a suq. Last season’s work saw a link, the Northern Extension, inserted between the suq excavations and the main open area excavations in ZUEP02. Excavations over the previous two seasons had identified a Phase 3 domestic compound similar in its piecemeal development to the compound in the main excavation area to the south. A continuation of the Phase 5 suq to the north (Figure 1.2) is currently being uncovered. The Phase 3 suq appears to have been smaller, reflecting the economic downturn directly related to the settlement shrinkage to the inner town wall identified in excavations at ZUEP01 (Figure 2.12).

Within the main excavation area to the west, the goal this season was to remove the remaining Phase 3 material and understand the complicated development of this large domestic compound, based mainly on the two distinct sub-phases of the central courtyard development. In the east

Figure 2.12: ZUEP02 Phase 5 Suq (North to right of image)
of the main excavation area, this season has seen the removal of the final Phase 4 material, most notably the madbas (Space 11), giving greater exposure of the Phase 5 compound plan layout. The removal of the fills of several of these Phase 5 rooms and spaces has truly defined the compound’s function first and foremost as a storage facility with a secondary function of production, indicated by the presence of three date storage rooms and the smaller spaces associated with collection of the syrup.

Fieldwork this season was a direct continuation of the work conducted over the last three seasons, and as a result most of the aims remained the same; that is, getting a better understanding of the area and its function (either static or changing) throughout the development of Al Zubarah.

### 2.2.2 Phase 5 - Plastered Beach & Limestone Architecture

This is the first of two major architectural phases identified at Al Zubarah, consisting of well-constructed walls of beach rock and limestone with fine hard plaster on the walls and many of the surfaces. This phase clearly demonstrates pre-determined town planning, and evidence of a well-established hierarchy. Within the excavation area, this phase is represented architecturally by two large courtyard compounds separated by a street (Space 03), and within the northern extension by a possible continuation of the suq or khan (Figure 2.13). The architecture is generally on an east to west alignment unlike architecture in the later Phase 3.

**Western Excavation Area**

In the western area one intriguing structure was exposed this season, located below where the Phase 3 room stood. This beach front structure appears to be separated from the main Phase 5 compound (eastern area) by a north-south aligned street 5.80m wide. The exposed extant structure measures 9.30m x 4.50m and appears to consist of at least two distinct spaces and a possible stair-well allowing access to the roof of an adjacent long, narrow (1.50m wide) room (Figure 2.14). The stairwell appears to have been accessed to the south from an external space or courtyard. No steps survive, but the stair-well is packed with stone - possibly a core for the stairs. If it functioned as a corridor, it leads nowhere, and is plastered on the northern face where the entrance to the adjacent room lies. The minimal exposure of this space has thrown up many questions regarding its function, and despite the poor survival, it appears very different to any structures we have found in ZUEP02 to date.

The only excavated material from Phase 5 this season in the Western Area was a small spread of broken ceramics mixed with ash, deposited on a corridor floor surface located to the west of the possible stair structure. The deposit also contained small quantities of fish bone and burnt shell, and is likely a cooking waste dump deposited at the time of abandonment.

**Eastern Excavation Area**

Almost all of the Phase 5 architecture exposed to date appears to be associated with two courtyard compounds bounded by two parallel streets (Spaces 03 & 28) aligned on an east to west axis, running towards the sea from the town walls. Part of the first compound was excavated in the 2009/2010 season: it consisted of six rooms, located to the north of road Space 03, with more of this compound sealed below unexcavated deposits in the Northern Extension and the unexcavated area to the east (see Figure 2.13).

The second large compound is formed of at least twenty-four extant Spaces, and like the first continues beyond the eastern limit of excavation. The compound is constructed around a central courtyard, with a second entrance courtyard to the west, enclosed on three sides and apparently open to a possible street to the west. This compound had three date processing
rooms (madbasas), each formed of two separate spaces and one containing the ridged plastered pressing channels divided by a low plastered wall from a smaller catchment room with a small pit designed to house a ceramic vessel to catch the syrup drained from the adjacent space (Figure 2.15).

The presence of these three large madbasas demonstrate that the function of the compound appears to be related to storage and production, rather than being a domestic compound, and likely has a direct link to the khan or suq located further to the north (QMA1). This is reinforced by the presence of several large storage vessels found as in situ abandonment deposits on the surfaces several of several spaces during all excavation seasons.

Located between two of these date processing rooms was a room of equal dimensions, the beaten earth floor/surface in a mix of sand and ash giving it a mid grey hue. Above this at the centre of the room was a combination of matting and matting impression formed in the vitrified (cemented) orange material (also found in other spaces in the excavation area). The matting covered an area 2.30m x 2.00m located roughly at the centre of the space, and the herringbone weave is clearly visible in the preserved remains (Figure 2.16).
Figure 2.15: ZUEP02 Madbassa and detail of catchment pit

Figure 2.16: Remains of matting in ZUEP02
Construction of the main compound occurs radially around the central courtyard. Access within the compound was restricted, with all of these spaces only accessible from the courtyard once access had been gained through the main western entrance hall (Space 59 - Figure 2.17). Later construction in the compound came in the form of two square additional wings abutting the extant western wall. The southern wing consisted of three spaces, a layout mirrored in the northern wing, however later still the northern wing was extended further to the west with at least two more spaces added and as yet unexcavated (see Figure 2.13).

**In the Northern Extension**

The removal of all of the Phase 3 architecture and some of the intermediate Phase 4 deposits has allowed a glimpse of the Phase 5 layout. At least 15 rooms/spaces are identifiable, laid out in two parallel north-south aligned groups, all or most appearing to have the hard grey plaster on the walls indicative of the Phase 5 architecture. The rooms include at least two ablution rooms, small cell like structures separated from the main room with thin plastered screen walls. At present the full plan is not completely exposed (Figure 2.13).

**Phase 5c - Post Occupation Abandonment and Demolition**

This phase was represented by a series of large deposits filling the rooms and spaces discussed above (Phase 5a and Phase 5b). These deposits vary slightly: some are reminiscent of slow periods of degradation and decay whilst others seem more in keeping with systematic demolition and infilling, and not all the spaces have the same depositional sequence even between adjacent rooms. Most of the sequences end with a deposit of windblown sands filling the hollows formed at the centre of the rooms and spaces created by the demolition/collapse process. Several of the rooms contained articulated adult cat skeletons as in situ abandonment deposits on the floors or surfaces, most likely indicative of that space’s abandonment prior to collapse.
2.2.3 Phase 4 - Open Area Spaces 51 & 65

An intermediate phase, Phase 4, is constituted by a large open area with little or no stone architecture, but with a great deal of activity. Cut into the shell and sand surfaces were many tannurs, fire pits, post and driven stake holes. This is most likely indicative of temporary seasonal camps between the major architectural phases. The plan shows the distribution of features, which are present in numerous sub-phases (Figure 2.18).

Western Excavation Area

The earliest excavated deposit in the western area this season was the upper portion of aeolian sands filling the hollow between in the large eastern Phase 5 compound and the newly discovered phase 5 beach front structure in the Western Area (discussed above). The sand covered a substantial area (27.50m north-south x 12m E-W x 0.05 – 0.10m thick) but was mainly located above a space believed to be a north-south aligned street. The deposit links in with the eastern excavation area via rubble and plaster deposit which partly covered the sands. Dug into the sand were a series of cut features, mainly fire installations related to cooking, a couple of postholes and some irregular pitting likely associated with robbing of the phase 5 stone.

Figure 2.18: ZUEP02 Phase 4
Eastern Excavation Area

Most of the Phase 4 deposits and the numerous cut features within these deposits have been systematically excavated over the last two seasons in the eastern area, leaving just a few remnant surface patches overlaying the demolition/collapse infill of the Phase 5 architecture below. The only stone structure present in this phase (the date processing room, Space 11) came into play later in sub-Phase 4b or c. This was removed this season exposing more of the Phase 5 layout below.

Northern Extension (open area Space 65)

This phase similarly consists of a series of surfacing events cut by numerous postholes, fire pits and tannurs. It represents a period of temporary settlement between the two major architectural phases, and like the excavations to the south, this open area has very little evidence of stone built structures. One of the expansive Phase 4 surfaces excavated this season was noteworthy, an occupation accumulation/surface rich in finds with numerous ceramics and iron objects, shell, animal bone, and ash, with occasional glass and copper alloy objects. Finds of note included two coins; two stone sling shots or musket balls; a copper alloy ring; a glass bead; an iron and copper alloy locking mechanism; a porcelain kohl bottle and a blue porcelain dragon dog (temple guardian) figurine broken from the top/lid of a porcelain vessel (Figure 2.19). This surface also functions as the construction horizon for the earliest Phase 3 building (Space 37).

2.2.4 Phase 3 – Later Architectural Phase

This second major architectural phase consists of two large courtyard compound enclosures and their associated out-buildings, one in the main excavation area and a second identified last season in the Northern Extension. This second compound, like the first, developed with several rooms finally being drawn together with an enclosing outer wall forming a central open courtyard. These rooms all appear to have had domestic function (Phase 3 plan – Figure 2.20).

The walls of these structures are generally rough beach-stone walls with selective mortar render, but generally poorly finished. Many of the structures within this phase showed evidence of major fire damage prior to abandonment. Some of the structures appear to have lived on for a short time after, but generally speaking, they seem to represent the end of this phase.

Western Excavation Area

A main drive of our work in the Western Area this season was to remove the remnants of the Phase 3 architecture in order to gain a greater understanding of the main courtyard development. This development can be split into two broad sub phases based directly on changes made to the courtyard space. The first of these, Sub-Phase 3a, is centred on the earlier courtyard Space 49. This early enclosure appeared to have developed around two existing rooms and, based on the amount of associated surfacing events, appears quite short lived.

Later in Sub-Phase 03b the eastern boundary wall of the courtyard Space 49 was removed (Figure 2.21) and the courtyard compound expanded to the east to incorporate Space 02 (Figure 2.22), which was structurally similar in construction and thus likely contemporary with Space 07 & 09. This new larger courtyard compound (Space 50) appears directly linked to several other structural adjustments including; the enclosing and formation of Space 008 to the north. Some minor structural changes occur, such as the insertion of air vents in the western wall of Space 010 and the blocking of entrances or through spaces. The construction of the large rectangular southern enclosure Space 05 (and its internal division in the form of Spaces 04 and 06) appears to have occurred a short time after the construction of the larger courtyard Space 50.
Both sub-phases can be linked to external activity to the southeast, and both courtyards were the focus of domestic activity in the form of tannurs and their associated charcoal pits, postholes and larger stone lined pits cut for storage (Figure 2.23).

*Northern extension*

This has very complex stratigraphy owing to the very fluid nature of the Phase 3 development. New rooms and spaces were constructed that often encroached and changed the form of existing spaces, in particular the open courtyard (Space 42). Like the Phase 3 structures in the main excavation area, the structures in the Northern Extension developed in a piece-meal or ad hoc fashion unlike the formal structured layout seen in the Phase 5 architecture.

The Phase 3 buildings are still aligned roughly north-south, but with less regularity to their forms, and several are more on a NNE-SSW axis. The walls are constructed predominantly with angular beach stone and beach stone conglomerate, with occasional more exotic stone like dolomite and gypsum particularly around possible entrances and in thresholds.

All eight of the spaces and or rooms identified form a single complex enclosed with boundary walls forming a courtyard Space 42. The western limit of the compound falls within the excavation area, however the eastern limit is unknown as the rooms and walls continue to extend beyond the limit of excavation, some below the current location of the spoil heap.

The compound development is best viewed via the development and changes made in and around the form of the central courtyard Space 42, which includes and is linked to the construction of several new rooms - as such it has been divided into five development sub-phases (a-e).
2.2.5 Conclusions and Recommendation

Future work should focus on the continued exposure and excavation of the soft deposits above the Phase 5 architecture, particularly in the courtyard storage compound where only three to four spaces remain unexcavated, and to gain a better understanding of the newly exposed Phase 5 structure in the Western Area.

In the Northern Extension the goal is to excavate of any Phase 4 material and removal of the fills within the exposed Phase 5 architecture in order to gain a better understanding of the suq, hopefully with some in situ floor deposits, and understand the link between the suq and the two southern storage compounds.
As noted earlier in this report, the nearby area of ZUEP01 has provided us with an extensive densely packed occupation Phase 6 comprised of a myriad of cut features not dissimilar to Phase 4 in ZUEP02 area. However a Phase 6 equivalent has not yet been seen within the ZUEP02 area and it would be of interest to see if it is represented here and if it has a similar density to that seen in ZUEP01 to the east. This could be done with some targeted trenches within the open spaces, the courtyards and streets providing a stratigraphic view of the depth of surfaces in these spaces as well as looking for earlier phase material culture, providing us with a more complete view of the site development.
2.3 Zubarah Excavation Point 4 (ZUEP04)

Tom Collie

2.3.1 Introduction

Excavation Point 4 (ZUEP04) is located at the southern end of Al Zubarah (see Figure 1.2). It focuses on a large compound enclosing rooms and courtyards supported by parameter walls with corner towers. This compound was divided into nine separate areas circumnavigated by streets and passageways (Figure 2.24).

Excavation work in season 2011/12 was extensive, and investigated the majority of the extant archaeology within the south western most compound section (hereafter named Precinct-Section 8, or PS8). It proved that the section was domestic accommodation for a family unit living in Zubarah during its earliest stages of development (see Figure 2.25). Work in season 2011/12 aimed therefore to continue this investigation and centred on three main objectives.

The first objective was to examine remaining deposits and architecture within the central courtyard area and unexcavated Space 3010. The second focused on an area to the north of PS8. The possibility of a northern corridor with an associated entrance to the outside compound area was highlighted from work in season 2010/11. With an extension of the site as a whole directly to the north, excavation therein would link interior deposits and dating evidence to
those from the exterior. It would also illuminate methods of communication between compound sections and confirm whether they were linked internally. The third and last objective focused on the exterior area around the tower. Excavation of the south western exterior area would not only reveal the true extent of tower <4012> but also recover vast quantities of material dating evidence from the remaining midden deposits heaped against the architecture.

2.3.2 Objective 1

Space 3010

This small space contained layers of shell and silt forming surface layers that had been in constant use during the compound’s occupancy. Most deposits within this room spread north into the south-eastern area of the central courtyard. Whether this was a result of visitations to the ablution Space 3013 or the far southeastern Space 3011 is unknown. Certainly, Space 3010 was a transitional area between the exterior and the interior areas beyond. It is also similar to Space 3004 which shared a similar sequence of shell and occupation spilling out into the central courtyard. These rooms therefore could be classed as transitional spaces, neither exclusively interior nor exterior.

Figure 2.26: ZUEP04 - Drain not corresponding to the compound’s original construction
**Space 3012**

The excavation of Space 3012 was limited to an area focused outside both the southern and eastern wings of the compound (see Figure 2.25). This area stretched approximately 5m from the central courtyard walls and was strategically placed to facilitate the conservation process. Since only the southern and eastern ends of the courtyard were excavated, not all deposits observed and recorded from season 2010/2011 were examined and were therefore left for investigation in future seasons. Deposits within the courtyard were organised into five main sequences, each one representing a main courtyard surface which had been truncated by features such as post holes, soak-aways, simple pits and plastered drains. The presence of these sequences strengthened the idea that the compound was in constant use and underwent modification. This development not only extended to the cleaning of the shell surfaces and their subsequent replacement but also to the improvement of thresholds to Spaces 3002, 3014 and 3015. These sequences strengthened the idea that the ablution block was a later addition to PS8. The excavation of middle to later courtyard sequences demonstrated the existence of a cut that housed a drain not corresponding to the compound’s original construction (see Figure 2.26).

**Space 3016**

In Space 3016, further investigation indicated that the ground surface consisted of compact silt containing small tabular beach stone and weathered beach stone fragments (locus 4664). Excavation clearly displayed that the plaster door-post sockets at the doorway to Space 3016 were built on top of this deposit. It showed that the doorway was itself restored and reconstructed - the beach stone fragments present in the floor surface may have originated from this rebuild. Investigation of the threshold to Space 3016 revealed an earlier feature below the horizontal threshold (see Figure 2.25 and Figure 2.27). It is clear from this evidence that the threshold

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*Figure 2.27: ZUEP04 - Earlier feature below the threshold*
Figure 2.28: ZUEP04 - View of northern area of excavation

Figure 2.29: ZUEP04 - Architectural feature <4813>
was raised by 0.1-0.2m and, consequently, deposit (4664) may have been laid as a means to gradually grade the entrance level down to the courtyard levels. This is yet more evidence that the PS8 went through a series of refurbishments before abandonment.

2.3.3 Objective 2

Corridor Spaces 3026-7

New architectural features were discovered when the excavation was extended approximately 5m to the north (see Figure 2.28). Investigation revealed the presence of an east/west running corridor, Space 3026, linking the interior compound to the exterior via a doorway. Entrance way Space 3016 clearly linked this northern running corridor to Precinct Section 8 (PS8). In the southern end of Space 3027 lay another doorway, probably running into the Precinct Section 1 (PS1) to the east (see Figure 2.24 and Figure 2.25). Clearly, the corridors linked the internal compound to the outside world and, given its position between PS7 and PS1, were key walk-ways facilitating safe passage between other internal compound subdivisions.

The western end of the corridor is the most intriguing since it contained architectural feature <4813> (see Figure 2.25 and Figure 2.29). This small stone block was built butting both the main northern corridor wall and the exterior western compound wall and together helped form a doorway to the outside. The opening was partially excavated in season 2010/2011 but time constraints last year did not allow for complete excavation. Work here this season confirmed an entrance way to the interior of the compound. The feature was constructed from sandstone, as opposed to the commonly found beach stone, and was rendered with a pink grey plaster. Moreover, the top featured a small narrow rectangular slot, 0.12m wide and 0.15m deep, which was believed to have contained a latch or bar for a door.

Other architectural elements revealed through the initial excavation of Space 3026 were small plaster features set onto the northern face of wall. Plaster features resembled the remnants of vertical frames that ran up the face of the southern corridor wall. They were badly damaged so interpretation was limited, but they may have represented the partial remnants of door frames or bracket-features for down-pipes from the roof.

Spaces 3028-32 in Precinct Section 7

As previously mentioned, the northern corridor wall also formed the southern extent of another discrete compound division, namely Precinct Section 7 (see Figure 2.24). It was butted on its northern side by four walls which formed Spaces 3028 to 3032. These walls were not excavated fully since they lay beyond the limit of excavation but were built from the same standard beach stone found in the other walls of PS8.

Twelve plaster niches were set into the very top of corridor wall <4793>, which were very similar to other plaster features in the structure. Every space in PS7 except Space 3030 contained 3 niches set into the wall. No architecture was discovered to form the northern extent of these rooms since they ran beyond the Limit of Excavation.
Figure 2.30: ZUEP04 - Excavation outside the compound and around tower <4012>

Figure 2.31: ZUEP04 - traces of temporary external structures
2.3.4 Objective 3

Space 3024

Space 3024 extended and amalgamated Space 3001 from season 2009/10 (see Figure 2.30). It focused on deposits and features that lay directly outside the compound and around the southwest tower <4012> of the compound. Deposits and features within Space 3024 were numerous but could be divided into 6 groups which related to order of deposition. The archaeology within this area was dominated by midden dumps which were located mainly in the south. These were piled high around the tower which then sloped and spread towards the north. Many of the post holes found towards the base of construction horizon were also located around and near to the buttress supporting the outer city wall. The northern area did hold some large truncations but the number of features located was small compared to those of the south.

The deposits in Groups 1 to 6, although complex and numerous, were interesting since they displayed the development of Al Zubarah from construction to decline. Groups 1 and 2 showed the initial construction of the building. They hinted at subsequent temporary structures that were erected either to house humans or animals or to be used as construction supports for the erection of the architecture (see Figure 2.31). They revealed that the dumping of midden deposits began almost immediately after the construction of the walls and tower. Additionally, they showed the increased defence of the outer city wall provided by buttressing (see Figure 2.32). Group 3 continued the themes set from the loci stratigraphically below, developing the idea that the area around the tower was a waste-dumping ground while simultaneously illuminating indications of strong temporary structures that lay outside the tower. Group 4 displayed large-scale dumps of material waste but introduced the presence and need for massive pits cut through the stratigraphy perhaps to gain access to the natural shell layers below. It is within this group that the first signs of architectural collapse and dilapidation are seen. Groups 5 and 6 belong to the later stages of Al Zubarah’s development. They still contained large amounts of dumped midden deposits as well as later pitting activities but were characterised by larger deposits of architectural debris.

Space 3025

This exterior area was situated directly outside the outer city wall and was positioned directly west of the original trench from season 2009/2010. It contained a sequence of dumped midden deposits along with signs of architectural dilapidation. These slumped gradually down in level from the outer city wall and contained mixtures of dark grey and orange silty sand together with thin beige lenses of dumped ash and organic refuse. They were packed with a multitude of material finds including copper coins (providing good dating evidence), copper broaches and pendants, beads, stone musket balls and very large quantities of animal bone and pot. All deposits displayed the fact that domestic waste was being dumped liberally outside the city wall as well as around tower <4012>.
Figure 2.32: ZUEP04 - Buttressing of outer city wall
2.3.5 Conclusion and scope for further work

The excavations at ZUEP04 clearly achieved the main objectives established at the beginning of the season and revealed exceptional archaeological remains, adding seven more interior spaces to the twenty already examined from season 2010/2011. These spaces, continued the idea that Precinct Section 8 was geared towards domestic living. Tantalising glimpses of the compound areas both to the north and the east showed that the compound was connected by passageways and interlinked, not only just internally but to the outside as well. Spaces 3026-7 revealed that each domestic unit was connected by corridors embellished with moulded intricate plaster work and large impressive archways.

Examination of the external areas allowed a massive recovery of datable material including pottery, small finds and more importantly coins, the total number of which dwarfed the collective total found from the previous two seasons. Moreover, the extension of the original trench from 2010 allowed a further larger examination of the outer city wall and the associated buttress.

Deposits and features revealed the slow development of the exterior area from construction through to dilapidation. The six groups separating the deposits within Space 3024 illuminated the sequence of building construction with its accompanying temporary structures, through to the extensive waste-tipping activities and pitting centred around the tower and then finally to the general dilapidation and abandonment of the building. Examination of the central courtyard deposits also proved interesting and the five sequences of surface renewal strengthened the argument proposed last season that the compound, when occupied, underwent a continued process of renewal.

Future work would ideally aim to finish the excavation of the central courtyard surfaces, ahead of the conservation process which would finish preserving the eastern wing. Since these deposits run beneath the remodelled threshold into Space 3020, it is likely that excavation will be needed here too. Investigation into Space 3020 would also be beneficial since it contained a blocked doorway through to corridor Space 3026. It would be ideal to see if the stratigraphy within the corridor is linked in any way to the small north-western courtyard. Space 3026 and 3027 would therefore have to be fully cleared of the rubble collapse of Phase 4 for this to begin. The corridor stratigraphy will also be examined in conjuction with the exterior areas in the west, including external areas 3022 and 3023. The main aim here would be to connect the stratigraphy found around the tower to the stratigraphy of the interior compound. In short, it would aim to physically link the white construction horizon surface (4731) at the base of the central courtyard to the white construction horizon around the tower (limestone surface 4576, presumed to lie at the bases of Spaces 3022 and 3023). This is a large task but judging by the limited stratigraphy in the exterior zones it could be possible. This would therefore link all the stratigraphy neatly, forming a very decently dated picture of Phase 5 of early Zubarah. Once this possible link had been established, strategically placed sondages through the white construction surface could be excavated to check for earlier archaeological features.
2.4 **Al Zubarah Excavation Point 10 (ZUEP10)**

*Daniel Wheeler*

2.4.1 **Introduction**

The principal aims for ZUEP10 were to:

- establish the depth of the Al Zubarah outer city wall, determine its construction method and remove all deposits later than its initial phase, allowing for continued preservation
- ascertain whether the small gateway within the wall to the north of Tower 8 was contemporary with its construction or added during earlier preservation work on the tower during the 1980s
- gain an idea of the function of the area around tower 8 and determine a rough dating spectrum based on the established Al Zubarah phasing

ZUEP10 revealed an unexpectedly dense sequence of archaeological deposits representing continued activity in this area throughout the main phases of Al Zubarah’s occupation and subsequent abandonment (see Figures 2.33 and 2.34). The earliest activity, represented by a number of postholes, pits and patchy surfaces, seems to be directly associated with the construction of the main city wall, with little or no evidence of any prior occupation. Once the wall was in place, the immediate vicinity appears to have been used mainly as a thoroughfare with trampled surfaces forming across the area. Soon after, the construction of a *banquette* walkway on the inner side of the city wall, turning the higher part of the wall into a defendable

![Figure 2.33: ZUEP10 - Post-excavation plan](image-url)
parapet which could be patrolled, and if necessary, fired from, seems to mark a transition in the area. This refortification, probably coinciding with increased tribal tensions around the turn of the 19th century begins, a period of increased activity and potentially semi-permanent occupation in the area. A number of laid surfaces cut by postholes suggest the possibility of barasti-style dwellings built against the lower wall complete with a nearby tannur installation set into the wall itself, and other evidence of cooking and domestic activity. Hereafter, this type of occupation becomes more sporadic and probably represents the period after the sacking of the city by forces from Muscat in 1811 and the town's subsequent contraction behind the smaller, inner wall. Even after this shift, the presence of tannurs, small working surfaces and large concentrations of finds indicate that there was still activity in this area, suggesting that the outer wall and Tower 8 were still used sporadically as a lookout post and shelter. Eventually, as the town falls towards full abandonment, only a few opportunistic fire pits and hearths underlie the inevitable mix of collapsed wall and wind-blown sand. Cut into this wall tumble to the north of Tower 8, and filled with modern material, is an access-way attributable to the reconstruction team of the 1980s who clearly installed the small gateway in the wall to allow themselves easier entry to the inside of the city and the western side of the tower.
Figure 2.35: ZUEP10 - Postholes and quarry pits associated with the tower and wall

Figure 2.36: ZUEP10 - Banquette acting as a walkway against outer parapet wall
2.4.2 Methodology

ZUEP10 was opened at the beginning of the 2011-12 season against the inner side of the city wall in the north-east of Al Zubarah. Running approximately north-south, the area was 21m long and 5m wide and focused on the area of wall flanking Tower 8 (Figure 2.33). Due to the ephemeral nature of much of the archaeology and the lack of large stratified architecture it was sometimes difficult to directly associate the established Al Zubarah phases to deposits seen in ZUEP10. However, some broad phasing can be applied.

2.4.3 Phase 6

Approximately 36 post and stake holes cut into the natural sand represent the earliest activity in ZUEP10, possibly indicating the use of tents or barasti prior to the town’s large Phase 5 expansion (Figure 2.34). However, the nearby presence of a large mortar construction deposit next to Tower 8 and two substantial pits seemingly aimed at quarrying large stones from the underlying natural limestone probably indicate that all of the earliest activity was in fact associated with the construction of the city wall at the very end of Phase 6 or the beginning of Phase 5.

2.4.4 Phase 5

After the construction of the city wall a number of accumulation surfaces built up along the inside suggesting that this area was initially used as a trackway and thoroughfare for moving around in the gap between the wall and the extents of the town. This transitory period ends with the construction of a lower walkway against the inside of the city wall and an increased
Figure 2.37: ZUEP10 - Tannur installation against banquet wall

Figure 2.38: ZUEP10 - Stakeholes supporting temporary structures
focus of activity in the area. Approximately 1.1m tall and made of locally sourced beach rock and gypsum with a rough plaster face, the lower wall acted as a fire-step or banquet allowing sentries to patrol along the length of the city limits and use the higher outer wall as a parapet from which to return enemy fire (Figure 2.36). This refortification appears to be city-wide with a similar addition seen in ZUEP04 (see above).

A small mortar-rendered bench containing two tannur ovens installed into the side of the lower wall is indicative of the change in use of this area at this time (Figure 2.37). Owing to the increased prospect of attack during the early 19th century, there was likely to have been greater activity around the city limits with guards using the towers on either a permanent or semi-permanent basis. This is seen in the increased appearance of domestic evidence in ZUEP10; an initial phase of compacted surfaces with postholes and stake holes perpendicular to the wall indicate that wind-breaks or palm-frond shelters were erected against the wall with a series of tannur ovens to the north used for cooking (Figure 2.38). A secondary phase of potential structures follows a mortar resurfacing of the area, this time focussed around a central hearth and surrounded by accumulation deposits rich in domestic detritus.

2.4.5 Phase 3 and 4

The transition from Phase 5 is not obvious within ZUEP10 with no evidence of the widespread destruction deposits caused by the attack on the city in 1811 or the subsequent period of inactivity. This is hardly surprising with lack of architecture and the location’s distance from the centre of the city. There is, however, a noticeable decline in activity in the area corresponding to the abandonment of the outer extent of the city and the withdrawal behind the inner wall. The shelter and vantage point afforded by Tower 8 and the wall may have seen its use continue past the area’s desertion with evidence of patchy surfaces, tannurs and burnt areas still indicating some short-term occupation.

2.4.6 Phase 1 and 2

Phase 2 archaeology consists of small burnt areas and fire pits up against the inside of the wall probably made by passing travellers or shepherds utilising the shelter of the still-standing architecture. A layer of wind-blown sand then seals all the previous deposits before the wall gradually collapses on top of it. A layer of modern overburden is only interrupted by an opening knocked through both the main wall and lower walkway by the reconstruction team of the 1980s who later conserved the gap as part of the wall.
3. **FIELDWORK IN FREIHA**

*Gareth Rees*

3.1 **FREIHA SURVEY**

3.1.1 **Introduction**

Work at Freiha during the 2011/2012 season of fieldwork consisted of two excavation points, survey, aerial photographic survey and targeted field walking. Additional survey work was carried out to the south of the settlement, where fragmentary remains of buildings and middens were identified. Work focused on Excavation Point 04 (FREP04), which was opened during the previous season, whilst a smaller excavation point (FREP07) was placed over one of the middens in the newly identified southern area of the settlement (Figure 3.1). Targeted field walking aimed to pick up surface finds from each of the zones of activity in order to establish a closer chronology for the morphology of the settlement.

3.1.2 **Digital Survey**

At the beginning of the most recent season of fieldwork it was observed that house platform features were present in an area to the south west of the unwalled cemetery. This area was the focus of a survey using TS09 Leica Total Station, located 350m to the south of the mosque, 30m to the north of the modern villa compound (Figure 3.1) and was bounded to the west by the sea and the east by the cemetery. Five large middens were identified in this area and could be seen to contain ceramics. No complete buildings were identifiable but seven distinct mounds were visible, some of which contained wall footings. Two large house platform mounds were surveyed in the centre of this area and may have been the focus of occupation here. A large modern feature was also surveyed. This appears to be a ridge of material bulldozed up from the east which created a track running from the modern villa wall to the sea. This feature can be seen first on the 1963 aerial photograph of the settlement. A midden was located 178m to the south of the mosque, a short length of dolomite wall located in the north east quadrant of this feature may indicate that it overlies architectural remains.

3.1.3 **Kite Photography**

The aim of this survey was to photograph the well preserved building remains to the south of the fort and up to FREP04, 260m to the north. The photography and subsequent rectification was designed to provided high definition aerial mapping of these buildings in order to add detail to the pre-existing plan of the site. A secondary aim was to establish the physical and temporal constraints of large scale kite photography on the site. A grid was laid out in order for the photos to be rectified. Preliminary results indicate that this method of photography would add greatly to what is already known of the settlement if it were applied to the entire site.

3.1.4 **Fieldwalking**

A walkover survey was conducted over a north to south and an east to west transect across the site in order to gather detailed artefactual dating evidence from which to establish a chronology for the settlement morphology.
Figure 3.1: Freiha excavation points
Figure 3.2: Phase 6 Post built structures

Figure 3.3: FREP04 - Phase 4
3.2 FREIHA EXCAVATION POINT 4 (FREP04)

3.2.1 Introduction

Previous excavations in this excavation area had uncovered the remains of two courtyard compounds, a midden and traces of mud-brick buildings. Each of the compounds consisted of a rectangular room (Space 7 and Space 14) with a doorway to the south-south-east facing onto a courtyard (see 2010/2011 end of season report). These rooms appeared to have been amongst the earliest stone-built structures in the area. Space 14 had a single courtyard associated with it whilst the external area associated with Space 7 was added to and altered several times. The aims of the most recent season of fieldwork were to establish the foundation level on to which Space 7 and Space 14 were built as well as to investigate the mud-brick buildings which were thought to represent an earlier phase. The overall aim was to establish the complete sequence of deposits down to bedrock. This was achieved to the east of the trench; however, the high density of occupation associated with Space 7 compound to the west meant that only the top of the Phase 3 occupation was exposed by the end of the season. Six phases were uncovered in total.

3.2.2 Phase 6: Post-built structures on natural sands

Occupation during Phase 6 was characterised by substantial post-built structures and multiple fire pits. Features in this phase were cut directly into the natural sand or were closely associated with it in the east of the trench. This phase is yet to be uncovered in the majority of FREP04. A compacted sand layer may have been the result of occupation on the original natural beach-sand surface. It was from this surface level that a pearl bead was recovered. The remains of two small buildings, in the form of deep postholes in rectangular arrangements, may indicate the location of small shelters or wind breaks (Figure 3.2). The depths of the postholes and the packing material used to stabilise them is indicative of semi-permanent occupation. Evidence of activity within these structures consisted of multiple firepits and a single tannur. To the north of these structures an area of intense activity was uncovered, consisting of fifteen fire pits and four tannurs. Several of these fire pits had been dug into one another indicating returning occupation in the same area. Although no structural evidence was uncovered, the alignment of these features may be indicative of their location near a wall line, tent or wind break.

3.2.3 Phase 5: Barasti-style temporary structures

Evidence from Phase 5 consisted of insubstantial post-built structures associated with pits, surfaces and tannurs indicative of more temporary occupation. Three areas of activity were located. These were evidenced by sand and shell surfaces and occupation horizons associated with multiple fire pits and occasional tannurs. A clay-lined pit with beach stone slab in the northern area may have been a basin for washing or processing whilst a large sub-rectangular pit may have been used for storage.

3.2.4 Phase 4: Pisé and mud-brick buildings

The first evidence of permanent occupation of the site occurred in Phase 4 when pisé and mud-brick buildings were constructed (Figure 3.3). These were associated with substantial surfaces and many tannurs but also several barasti style dwellings. The intensity of activity in this phase has led to it being divided into four sub phases.
Figure 3.4: FREP04 - Pisé remains of Space 32 during planning, facing northwest

Figure 3.5: FREP04 - Mud-brick footing, facing west
Phase 4.1

Three buildings (Space 32, Space 43 and Space 33) with pisé footings were constructed in this period to the east and centre of the excavation area (Figure 3.4). These buildings remain unexcavated but appear to form part of a series of rooms aligned NNW-SSE against the prevailing wind. The eastern most room may have contained a post-built internal dividing wall. Three activity areas were located to the east of this room. These areas comprised tannurs, mortar and clay-lined pits and an elongated pit, thought to be used for making charcoal. These activities may have taken place outside of the building perhaps in a tented space. A rectangular earthen (mud-brick) wall footing was located to the north of these buildings and contained only a single pit containing rice husks (Figure 3.5).

Phase 4.2

After the construction of the pisé buildings intensive occupation took place around them with a series of activity areas uncovered in all parts of the excavated area. This activity consisted of tannurs, clay-lined basins, fire pits and postholes, indicative a multi-functional, semi-permanent use of these areas. A post-built structure to the north of the mud-brick building may have been used for penning animals.

Phase 4.3

An expansion of activity to the east took place in this period with a rectangular earthen footing for a mud-brick wall replacing one of the post-built structures of Phase 5 (Space 29). Activity external to this room was present to the east in the form of fire pits, a tannur and a lime mortar pit.

Phase 4.4

This period was characterised by the collapse of the mud-brick and pisé buildings. Thick layers of mud-rubble accumulated around these buildings and a midden deposit was formed in the south east corner of the excavation area.

3.2.5 Phase 3: Intensive, semi-permanent occupation

Occupation activity in this phase was located on the rubble layers of the previous phase indicating a hiatus in use of this area. It was typified by a variety of activities, specifically tannurs, mortar making pits, fire pits and charcoal making pits (Figure 3.6). These were uncovered across the excavation area but the highest density of activity was in the west over the rubble of Space 32. Alignments of features, associated with very little structural evidence, were indicative of activity focused in or around tents. The density of activity suggest semi-permanent tented occupation. The number of lime-mortar making pits (Figure 3.7) uncovered may also be indicative of stone-built structures being constructed elsewhere in the settlement.
Figure 3.6: FREPO4 - Charcoal pit and tannurs

Figure 3.7: FREPO4 - Arrangement of anhydrite mortar pits in the southern area

Figure 3.8: FREPO4 - Plan of Phase 2
3.2.6 Phase 2: Stone-built structures I

Two rectangular rooms (Space 7 and Space 14), around which all subsequent occupation was based, were constructed in this phase (Figure 3.8). Space 7, contained a madbas whilst Space 14 contained a plastered basin. A temporary structure was built to the west of Space 14 before the construction of a large courtyard to the south the rectangular room. A third stone-built room (Space 26), located to the north of Space 14, contained domestic activity in the form of fire pits, tannurs and lime-mortar making pits (Figure 3.9). Small cellular rooms, constructed from anhydrite rock walls, were uncovered to the west of the trench whilst a fourth stone-built wall was located to the far east. Although fire pits and tannurs were present in this phase they were considerably less prolific than had been the case in the previous phase. A large pit located to the north east may have been used to heat anhydrite and limestone to make mortar for bonding the stone walls of this phase (Figure 3.10).

Figure 3.9: FREP04 - Space 26, facing west
Figure 3.10: FREPO4 - Large pit for making lime-mortar

Figure 3.11: FREPO4 - Phase 1.1 and 1.2 architecture
3.2.7  Phase 1: Stone-built structures II

Phase 1.4 (Figure 3.11)

Several walls were constructed in this period, adding new rooms (Space 20, Space 15, Space 28) to the courtyard space south of Space 7 as well to the north of Space 14. Whilst these rooms did not contain many features, extensive external activity was taking place to the south and the north-east where multiple tannurs, fire pits, basins and occupation horizons were uncovered. To the north-east of the trench, four zones of domestic activity could be identified from the location of these features whilst postholes located between them may be indicative of animal pens. It is notable that domestic activity, probably in tents, was taking place away from the stone structures.

Phase 1.3

The courtyard of Space 7 was formalised into a trapezoidal space by the construction of stone walls to the south and east. These walls added several rooms (Space 13, Space 25, Space 81) to the complex and left entrances from the east and the south. The southern entrance appears to have been an area where midden material was dumped during this period. Space 28 is likely to have gone out of use and may have been deconstructed by this time. A substantial mud-brick and stone-built wall footing was constructed to the south east of the excavated area. This wall formed a rectangular room (Space 23) aligned NNW-SSE that was distinctly different in orientation and construction method from any of the others uncovered (Figure 3.12). It

Figure 3.12: FREP04 - Mud-brick footing, Space 23, facing west
Figure 3.13: FREPO4 - Phase 1.3 and 1.4 architecture

Figure 3.14: FREPO4 - Phase 1.3 courtyard, facing west
contained several periods of shell surfaces followed by collapse and rebuilding. The collapse was evidenced by mud-rubble layers indicative of mud-brick, which was then cut through by scaffolding posts before re-surfacing. This space may have been part of a separate building complex to the south east.

**Phase 1.2 (Figure 3.13)**

Three of the rooms (Space 23, Space 20 and Space 15) fell out of use by this time and the Space 7 courtyard area became smaller as access was no longer required to these rooms. The eastern courtyard entrance was blocked off and construction of two walls to the west left only a narrow entrance out to Space 22 (Figure 3.14). A room (Space 8), possibly for storage, was added to the south of Space 81. Rubble walls were added between buildings to the north of the trench creating a large irregular shaped courtyard (Space 21) and an external area to the north of Space 14. A small room with a thick shell surface was also added to the north (Space 19).

**Phase 1.1**

The final activity in this area consisted of further remodelling of the Space 7 courtyard with the western entrance blocked leaving only one narrow entrance to the south. This blocking may indicate that Space 22 had fallen out of use. The courtyard was resurfaced and was later used for fire pits. Two rooms accessed from the courtyard were added one of which (Space 18) contained a stone lined pit and thick shell surface. This room may have been open to the west. The room to the south east of the courtyard appears to have fallen out of use leading to the blocking of the entrance to Space 8, which was facing the prevailing wind. This may have led to the construction of a new storage room to the south, outside of the courtyard. A large midden located to the north east of the trench may have built up during Phase 1 and 2 occupation.

### 3.3 Freiha Excavation Point 7 (FREP07)

#### 3.3.1 Introduction

Additional survey work carried out to the south of Freiha identified several buildings and middens (see above). The state of preservation of these buildings, was similar to that which had previously been recorded to the east of the settlement. Excavation of one of the buildings to the east (FREP03) had demonstrated a comparatively early date for this area. Given the similarity of the newly identified buildings to the south it was decided to excavate a 2m x 2m trench in one of the large midden mounds in this area.

#### 3.3.2 Stratigraphic Sequence

The midden was excavated in six loci (Figure 3.15). The upper layers had been disturbed and all but the lowest locus contained ceramics with the highest concentrations of artefacts, including metal, glass and bitumen, being recovered from the uppermost three loci. The midden consisted of dumps, rich in dark organic material and charcoal, interspersed by wind blown sand. A sand layer with features cutting through it, may have constituted the land surface prior to midden dumping. The laminated deposits uncovered in this midden are indicative of regular dumping, presumably from occupation nearby. The size of the midden is a good indication that it was in use for a sustained period of time. Artefacts recovered from this feature will add the current knowledge of the overall settlement morphology of Freiha which had previously not been identified this far south.
3.4 DISCUSSION

Evidence of the remains of settlement, in the form of house platforms, at the southern extent of Freiha suggests that the first period of occupation was more extensive than previously thought. This new area of settlement centres the domestic building activity in the area of the mosque and fort, suggesting that the latest occupation had shrunk back to a central core. The buildings encountered in FREP04 Phase 3 were similar in construction to those uncovered in FREP03 to the east, whilst those of FREP04 Phase 5 were similar to those found in FREP05 to the north. These comparisons along with the ceramic and radio carbon dating recovered from excavation and field walking will lead to a much closer chronology for the growth and abandonment of the settlement. The excavations in FREP04 have continued to uncovered a complex and dense occupation sequence. This began with post-built structures, followed by pisé and mud-brick permanent dwellings which were replaced, after a structural hiatus, by stone structures. The most extensive activity was most commonly found in external areas with internal spaces only containing a few features. This pattern may imply that the rooms tended to be used for storage or sleeping but not domestic activity.
4. **EXCAVATIONS IN FUWAIRIT**

4.1 **FUWAIRIT EXCAVATION POINTS 1-20 (FUEP01-20)**

*Daniel Wheeler*

4.1.1 **Introduction**

Excavations in Fuwairit during early 2012 were focused on recording archaeology revealed by a series of small interventions along the western edge of the main settlement (Figure 4.1). The primary objectives were to:

- Characterise the large building on the western edge of Fuwairit that appeared likely to be a town mosque.
- Provide a stratigraphic sequence through one of the large middens that flank the western side of the town and gather an assemblage of material culture for analysis and dating.
- Compare this assemblage of finds with those from others deflated middens in the area.
- Ascertain if there is any evidence for a town wall running along the western edge of Fuwairit that has subsequently been buried beneath these middens.
- Investigate the large blank areas to the north-west of Fuwairit to establish if there is any archaeology present.

![Figure 4.1: FUEP - Location of excavation points within Fuwairit](image)
Figure 4.2: FUEP17 - Plan

Figure 4.3: FUEP16, 17 and 18 - mihrab extending from qibla wall
Excavations in Fuwairit took the form of twenty individual excavation points (FUEP01-20) and provided a large and varied range of archaeological information. The majority of these excavation points were only small enough to make basic conclusions but the more significant areas were expanded to gain additional information. Investigations confirmed the large building on the western edge of the town to be the town mosque and identified the qiblah wall and mihrab. A large amount of finds were recovered from a number of middens situated outside the main settlement including one particular example that was excavated down to natural beach sand. Analysis of this material culture should provide an unparalleled insight into the everyday lives of the inhabitants of the town. An extraordinary amount of fish bone and marine shell was found across all of the excavation points in Fuwairit, further emphasising the dependence people had on the sea during this time. A highly-degraded and enigmatic circular structure was discovered positioned upon one of the large middens; its purpose – perhaps defensive or domestic – remains unclear. An abundance of discrete features cut into the natural sand to the north-west of the town showed that this area on the periphery of Fuwairit, despite appearing blank, was rich in important archaeological activity.

4.1.2 Mosque (FUEP16, 17 & 18)

The three excavation points along the western wall of this large structure proved irrefutably that it was a mosque (see Figure 4.2). Each area revealed a stretch of the qiblah wall which was solidly-built and capable of supporting a large, heavy roof. The central area (FUEP17) was expanded to reveal the mihrab and the prayer room wall (Figure 4.3). The mihrab was rectangular in shape and accessed by a gap within the qiblah. Constructed of generally poorer material and less substantial in width, the mihrab appeared to abut the qiblah wall. The prayer room wall was similar in size and make-up to the qiblah and is likely to be of the same construction phase. A small entrance way was also seen in the prayer room wall on a similar alignment to the mihrab doorway. The earliest deposit seen within FUEP18 was seen to run underneath the qiblah wall indicating that there was activity in this area prior to the construction of the mosque.

4.1.3 Midden and circular structure (FUEP19)

The initial intention of FUEP19 was to create a large cross section across one of the substantial middens that lie along the western edge of Fuwairit. The early discovery of a badly-degraded circular structure set atop of this particular mound meant, however, that a section could only be recorded in three separate parts (Figure 4.5). The wall of this structure was constructed of a mud and mortar combination mixed with a small amount of stone and had collapsed so much that only a very small amount still stood. On the interior, the wall seamlessly joined into a badly-laid floor that had entirely eroded in the centre. The inside of the wall had a smoothed, well-finished facing whilst the exterior side was rough and un-faced. A slight difference in the wall construction in the north, south and east edges perhaps suggested the structure was constructed initially from four supporting pillars or buttresses before the adjoining edges were added. The true function of this structure remains a mystery but its position atop the mound may indicate that it was a late and temporary defensive tower. The size and general poor-quality of the construction may however suggest that it was a something akin to a dovecote (Figures 4.4 and 4.5).

The underlying midden was a typical accumulation of multiple layers representing dumped
Figure 4.4: FUEP19 - Circular structure built atop midden

Figure 4.5: FUEP19 - Section through midden
everyday detritus. Each deposit was very rich in finds and material culture with an extremely large percentage of fish bone and shell. The main objective was to gather as much of this for later analysis as possible. Therefore, each context was sieved in its entirety through a 4mm mesh and a large unsieved sample was taken for flotation. A smaller sequence of samples through each individual lens within the northern extent was also taken for chemical analysis (Figure 4.5).

Figure 4.6: FUEP19 - Plan
Figure 4.7: FUEP09 - Wall remnant
4.1.4 Deflated middens (FUEP01-09, FUEP20)
Investigations to the south of the mosque revealed a series of deposits spread from the line of deflated middens that flank the western edge of Fuwairit. These were typical midden dumps rich in everyday material culture. This arrangement of middens may mark the town boundary, being placed upon the outer wall of the settlement. A ridge seen in the south-west of the town, seemingly heads towards the mosque before disappearing in this area. Potential walls seen in FUEP07 and FUEP09 may be part of this boundary, the upper extents having been later robbed away (Figure 4.7).

4.1.5 North-western area (FUEP10-15)
From the surface, the area to the north-west of Fuwairit appears to be blank, with no evidence of any extant architecture. Investigations here proved however that there is a plethora of features cut into the natural beach sand indicating substantial activity. A number of pits with sterile fills is perhaps to be expected but the presence of postholes, fire-pits and a clay lined tannur perhaps suggest occupation in this area, on at least a short-term basis (Figure 4.8).

Figure 4.8: FUEP10-15 - Clay-lined tannur and intercutting pits
5. **Regional Survey**

5.1 **Geodesic Survey of Sites in the Al Zubarah Buffer Zone**

*David Mackie*

![Map of Al Zubarah area with sites marked: Ain Mohammad, Al Zubarah, Musaikah, Helwan, and Murayiqat.]

Figure 5.1: Sites surveyed in the hinterland of Al Zubarah in 2011-2012

5.1.1 **Introduction**

During the 2011-2012 season the mapping team has continued to undertake topographic surveys of sites within the hinterland of Al Zubarah. This season surveys were completed at Ain Mohammad, Musaikah, Helwan and Muhayriqat (Figure 5.1).

5.1.2 **Methodology**

The survey methodology remained the same as last season with regard to the surveying of features. Since wall lines are not always clearly defined on collapsed structures, the bottom of slope or collapse and the top of slope are surveyed. Where wall lines survive the wall face is surveyed, if the wall line is partially visible in plan and the centre line of the wall is surveyed. These lines with additional spot heights help if contouring is required at a later date while providing a realistic impression of the feature. Conjectured wall lines can be added post survey if required. This system allows both topographic, archaeological and other features to be surveyed.

Permanent survey control points were established on each of the sites with Qatar National Grid...
Figure 5.2: Ain Mohammad (QNHER 10192)
(QNG) coordinates using a differential GPS. The surveys were carried out using a total station and differential GPS.

5.1.3 Ain Mohammad, QNHER 10192 (QNG 183897E/472065N)

The site is situated c.4km north-east of Al Zubarah town and is characterised by twenty scattered relatively recent derelict buildings and a demolished mosque, with two walled cemeteries situated to the northeast of the site (Figure 5.2). Among these buildings are at least two earlier ruined compounds, one still has upstanding walls and the internal layout is clearly defined with rooms arranged along the north and east sides of the compound. Another room is located on the western wall and there is a round tower on the south-west corner. To the north-east are the remnants of another compound, all that now remains is a small ruined building on the south-west corner and traces of the compound walls can be seen in the ground.

An aerial photograph from 1958 shows this compound with other internal buildings and at least three other structures to the north but these have since been demolished when the later present buildings were built. This western compound appears to be in a ruined state in 1958 (Figure 5.3).

Figure 5.3: Western compound at Ain Mohammad
Figure 5.4: Ain Mohammad - walled enclosure constructed on the rawdah with a central well, concrete cistern and troughs

Figure 5.5: Ain Mohammad - ruined heavily deflated stone-walled compound
The centre of the site is dominated by a relatively recent walled enclosure constructed on the rawdah with a central well, concrete cistern and troughs. (Figure 1.4) Within this walled area there are the faint traces of cultivation and two date palm stumps. Two later extensions were added to the north and south side of the enclosure defined by stone filled oil drums, and the southern extension still has clearly defined cultivation patches. The 1958 aerial photograph shows that originally the enclosure was smaller, enclosing the north-east quarter of the present enclosure with the present well situated outside the south-east corner of the enclosure. The northern and eastern sides of this enclosure were retained when the enclosure was extended to its present size by the 1970s.

To the south-east of the walled enclosure situated on the rawdah is a ruined, heavily deflated, stone-walled compound which has at least three internal buildings arranged along the walls. There is a tower on the north-east corner and there may be the remnants of another one on the south-east corner but a later bulldozer scar has partially obscured this area (Figure 5.5). South of this structure is a line of four wells which are all visible on the 1958 aerial photograph. The south-eastern one has a later concrete lining and concrete cistern, the second collapsed stone lined-well has a small walled enclosure to its south. To the north-east of this is another stone lined-well that still retains water, and this has a later concrete capping and lining. The north-eastern well, appears to have been backfilled and has a small ruined stone structure constructed on the spoil heap. Another possible well lies on the eastern side of the main enclosure wall.

The other features picked up during the survey were the small ruined rectangular and square stone structures scattered along the eastern edge of the rawdah along with remnants of temporary camp positions. There are a number of wall lines scattered around the main enclosure and amongst the wells, some are clearly remnants of buildings while others may be remnants of enclosures.

Immediately to the south of the present access turning to the modern compound is small ruined small settlement QNHER 10239 comprised of a linear group of ruined stone buildings with enclosures on the south-eastern side. There is one abandoned standing building at the north-western end which is contemporary with the other derelict buildings on the site. This
settlement is aligned south-west to north-east and may have extended further to the north-east but has been truncated by the construction of the access road and by an easement running parallel to the existing Al Shamal road.

5.1.4 Musaikah

Three sites are situated c.7km south-east of Al Zubarah outside the boundary of the present farm at Musaikah (Figure 1.6). Although the interior of the farm has been intensively cultivated the remains of the Early Modern fort and some footings still survive on the eastern edge.

Musaikah A, QIAH 40 309, (QNG 187882.343E/467237.027N)

This site is situated on the south side of the present farm and is comprised of a linear group of ruined buildings constructed on platforms with associated compounds or courtyards along the south side, with another two on the northern side. The buildings are square and rectangular in shape some of which are further divided into two rooms. Although in a ruined state the platforms and rubble from the buildings still survive to a considerable height. Due to the collapsed rubble the walls are not always discernible; however, some of the wall alignments and platform edges suggest that there may be more than one phase to the site. The site is aligned south-west

Figure 5.7: Musaikah A
Figure 5.8: Plan of Musaikah B
north-west and may have once extended further north-east but has been truncated by the farm boundary wall. The site has a later cemetery (QIAH 40 310) located on the northern side (Figure 5.7).

**Musaikah B, QIAH 40 200, QNHER 10378, (QNG 188786.624E/467349.509N)**

The site lies on the western side of the present farm and consists of a linear group of four buildings, constructed on platforms aligned south-west to north-east. The two central buildings have one large room with two smaller rooms and share a compound or courtyard on the northern side, while the north-eastern building has an additional small courtyard on its south-east side. There are other small ancillary buildings, walls and four raised areas that look like natural features but some appear to have been levelled. To the north are the ruined remnants of an enclosure wall around an area of rawdah with a number of temporary camps positions (Figure 5.8). Beatrice de Cardi does not mention this site in her description of Musaikah and it is not known if this is contemporary with or later in date to the other sites.

**Musaikah C, QIAH 40 120, (QNG 188203.475E/467889.914N)**

The site is situated on the northern side of the farm boundary wall and is comprised of a linear group of 20 or more small structures aligned south-west to north east. Some are little more than raised platforms while others have fragments of wall and platform edges visible, but in general it is very hard to discern walls alignments within the rubble. The buildings are either square or

Figure 5.9: Plan of Musaikah C
Figure 5.10: Plan of Helwan
rectangular in shape, some being further subdivided into two rooms. Unlike Musaikah A there are no large enclosures although some of the structures appear to have a small associated courtyard. Among the buildings are a couple of very weathered middens. The site may have extended further to the south-west but has been truncated by the farm boundary wall (Figure 5.9).

5.1.5 Helwan, QNHER 3 (QNG 184578.350E/466078.276N)

The site is situated on the higher ground north-east of a large irregular area of rawdah, covers an area of 140m² and includes a number of ruined stone buildings and middens. Unlike the sites at Musaikah A and the ruined settlement at Ain Mohammad, where the buildings form a line with a courtyard on one side, at Helwan the buildings are concentrated and are comprised of a series of rooms surrounding a central courtyard. Parts of the site have been mechanically graded so that large areas are covered with levelled material obscuring the layout. Although obscured the larger compound on the south-west side may be a fort and other courtyard buildings can be inferred. There are two cemeteries, a walled one located to the south-west of the site with the other situated to the south of the site. Material from the middens is very similar to that from Al

Figure 5.11: Plan of Helwan and associated rawdah
Figure 5.12: Plan of Muhayriqat
Zubarah (Figure 5.10).

Within the area of rawdah to the south-west there may have been more associated features to this settlement but the whole area has since been enclosed by a farm and subsequently abandoned (Figure 5.11). A 1958 aerial photograph as present for other surveyed sites has not been available for Helwan to date, and it will be interesting to see the area before the farm was established once a photograph can be sourced. Aerial photographs from 1963 and 1971 show the area under cultivation, with fields and buildings on the southern and western side and at least one near the centre. Only one stone-lined well capped with concrete remains situated roughly in the centre. Five small 0.45m diameter circular cuts were surveyed on the edges and near to the centre of the farm, close to the positions of demolished buildings. Some are capped and lined with concrete and others have a concrete or metal lining and it is possible that they are borehole positions or tannur ovens.

After the farm was abandoned the area has been extensively bulldozed and all of the buildings have been demolished and material has been pushed around the existing trees and along parts of the boundary. Today there are a few remnants of the fields defined by stumps from the bushes and palms that lined them while the main tree-lined area to the north-east still remains. The cemetery to the south-west of the site is now pedestalled suggesting that the ground level around has been reduced.

Within the farm area are two artificial mounds made up from stone and earth, have been described as towers, but neither of them has any obvious core or structure visible. Although the aerial photograph from 1971 is not of the greatest resolution neither of the mounds appear to show on the image. They could be spoil dumps from the clearance of the interior.

Along the western side of the former farm boundary are a number of small sub circular stone lined depressions situated on the higher ground, although one is situated in a one of the lower areas and it is thought that these are for storing fodder.

5.1.6 Muhayriqat QNHER 5 (QNG184184.380E/464810.803N)

This site is situated c.5.5km south-west from Al Zubarah and 1.3km south from Helwan on an area of rawdah. (Figure 5.12) The main feature of the site is a field system of at least 30 interconnected regular and irregular walled enclosures and 13 wells and associated spoil heaps. The settlement as such is comprised of a series of scattered ruined buildings mainly located along the northern side of the area, with one building to the south-west and another situated on a higher area to the north of the field system. The buildings are rectangular in shape and constructed on raised platforms, and some have small associated enclosures or cleared areas. The largest building is situated on the northern side and has a round tower on the western end and it is possible that this is a fort.

The northern end of the field system has been graded with a bulldozer which has either destroyed or covered some of the field system walls. All of the wells are disused and have silted up. On the northern side of the field system there is an artificial mound constructed from stone
and earth, larger than those at Helwan and it appears in all the aerial photographs, so this may well be the remains of a tower even though it has no obvious structure to it.

There are two cemeteries; a small one to the north and one to the south of the site, and scattered around the area of rawdah are a number of temporary camps of different periods. There are the remains of some demolished modern buildings and stock enclosures on the northern side.

5.1.7 Conclusion

All the sites surveyed this season show a continuity of use over time despite the changes brought about by the construction of modern farms as seen at Musaikah and Helwan. All of the sites probably have a phase of activity contemporary with Al Zubarah and at Musaikah two of the sites are believed to date to the Abbasid period, characterised by their linear settlements orientated south-west north-east. The ruined settlement (QNHER 10239) at Ain Mohammad is similar but it is not known if this is earlier in date to the rest of the site. Ain Mohammad was mentioned by Warden in 1850 as being contemporary with Al Zubarah and its other phases of activity are clearly visible up to the site’s abandonment in the 20th century. There is no settlement similar to that found at Musaikah A at Helwan or at Muhayriqat and it is likely that they also had phases contemporary with Al Zubarah.
5.2 Regional Survey

Daniel Eddisford

5.2.1 Introduction

An archaeological survey of northern Qatar was conducted between November 2011 and March 2012. The survey area consisted of the northern tip of the country, north of the major highways linking the site of Al Zubarah to Ras Laffan (Figure 5.13).

The regional survey project aimed to record the historic environment of northern Qatar throughout its human occupation. The goals of the project were to build a better understanding of the history of the region; to create a robust dataset that could be used as the basis for further investigations; and finally to enable the better informed protection and preservation of the historic landscape by the QMA.

The survey recorded 363 sites within the survey area, although a significant proportion of these are modern features and disturbances. The data collected was entered into a specifically designed GIS database. Several possible prehistoric find spots were identified. A number of rock carvings were recorded on coastal aeolianite outcrops, although the date of these carvings is unclear. A relatively large number of sites consist of distinctive linear arrangements of small rectangular

Figure 5.13: Area of the 2011-12 season survey
structures, all with an east-west or northeast-southwest alignment. The layout, architecture and surface finds at these sites all have clear similarities with the site of Murwab which is dated to the Early Islamic period (Guérin, and al-Naimi 2009; Guérin and al-Naimi 2010). Extensive evidence of later Islamic occupation was recorded, ranging roughly from the 16th century to the 19th century. A variety of different site types were identified including settlements, fortified structures, cemeteries, field systems, enclosures, wells and more ephemeral remains associated with nomadic Bedouin occupation in the area.

5.2.2 Methodology

Phase 1: Ground truthing sites

The initial phase of the regional survey consisted of ground-truthing possible sites identified from several sources. The main source of potential sites was the QNHER, a database of sites based on extensive examination of satellite and aerial photographic imagery (Breeze et al. 2011). Other potential sites that were ground-truthed include sites identified by previous archaeological surveys of the area (Kapel 1967, de Cardi 1978, Inizan 1978, Macumber 2011, Eddisford and Morgan 2011), as well as more informal observations made by team members.

A key aim of the survey was to cover a large area quickly, identifying and recording as many archaeological sites as possible. The level of recording undertaken reflected this goal; the aim being to locate each site in the landscape, briefly describe and document it, assess its age, and evaluate the potential of the site and the degree to which it is threatened. The minimum data
collected for each site consisted of a record of the site name; site location (QNG coordinates); site type; a site description and sketch plan; a provisional date for the site; the condition of the site; a risk assessment of the site; the geology, ground cover and land use of the area; at least one photo of the site. In addition surface artefacts were collected to assist in the dating of the sites identified.

**Phase 2: Systematic field walking**

A second phase of work consisted of a programme of systematic fieldwalking, intended to test the validity of the site distribution and range of site types that had been established. Six areas were targeted for more intensive survey (Figure 5.14). The fieldwalking methodology consisted of the systematic fieldwalking of one kilometre long transects, aligned to the Qatar National Grid. Each transect measured 100m wide and was walked by two team members. Each transect was sub-divided into ten segments, each 100m long, and the surface finds from each subdivision were collected separately.

### 5.2.3 Results

**Prehistory**

A limited amount of evidence of possible prehistoric activity was identified within the study area. Evidence of possible prehistoric activity consisted entirely of isolated surface finds of struck flint, with no evidence of structures of habitation identified. The raw material used for all the artefacts collected consist of a brown chert, which is found in some quantity on the surface at a number of locations within the survey area. The site of Helwan, although heavily disturbed by later Islamic occupation and modern irrigation, produced a number of struck stone artefacts, including a scraper with clear retouched edges (Figure 3, top left). Similar waste flakes and retouched flakes of brown low quality chert were recovered from Jabal Freiha.

![Figure 5.15: Struck flint from Helwan (QNHER 3)](image)
Figure 5.16: Distribution of early settlements and structures

Figure 5.17: Settlement QIAH40-276
Struck lithic flakes were occasionally found along the coast close to the 3m contour, which represents a raised Neolithic shoreline. Some of these find spots represent sites identified by the French survey of the area in the late 1970s (Inizan 1978). These finds are mostly waste flakes, however a small lithic assemblage collected near Ruwais during the 2010-2011 season, site QIAH40-435, includes retouched scrapers.

*Early settlements and structures*

The regional survey identified a number of distinctive linear arrangements of small rectangular structures, all with an east-west or northeast-southwest alignment (Figure 5.16). In addition several isolated structures were identified that are also probably of a contemporary date.

The sites of Musaikah and al Nehayy were identified by an archaeological survey undertaken between 2005-2006 (Guérin and al-Na’imi 2009). Guérin identifies a number of structures at these sites, and notes that “the ceramics collected on the surface...provide samples similar to those of Abbasid [9th century CE] Murwab” (2009: 182). Three separate elements to the settlement of Musaikah were recorded by our more recent survey, Musaikah C, Musaikah A and Musaikah C. These correspond to the northern and southern element of the site described by Guérin and al-Na’imi (2009: 182) as well as a large, and apparently previously unknown, courtyard structure directly to the east of the present day farm (See Fig. 5.14). At al Nehayy a large rectangular multi-celled structure, QIAH40-144, potentially represents a khan. Two groups of smaller structures, QIAH40-153 and QIAH40-156, are probably domestic dwellings.

At least four northeast-southwest aligned rows of structures, QIAH40-194, QIAH40-276, QIAH40-277 and QIAH40-286 were recorded close to the site of Al Zubarah (Figures 5.17 and 5.18). These rows of buildings appear to be contemporary, and consist mainly small single cell structures.
Figure 5.19: Fuwairit, QIAH40-231, from the air

Figure 5.20: Umm Al Qubur
Two alignments of similar structures were recorded at Al ‘Athba, QIAH40-433 and QIAH40-434, however it seems likely that several more similar groups of structures are located around the present day settlement and associated gardens. Two similar alignments of structures were recorded at Makin (QIAH40-184) and (QIAH40-242), as well as at Umm Al Kilab (QIAH40-191), Umm Al Suf (QIAH40-188) and Rakayat (QIAH40-427). Several isolated structures appear to be contemporary with these settlements.

Later settlements and structures

Coastal settlements are abundant along the northern coast of Qatar, many apparently falling out of use in the later 19th century. The largest of these, QIAH40-168, measures over a kilometre long and may represent several phases of occupation. On the east coast the settlement of Fuwairit, QIAH40-231, consists of a large number of walled compounds which again survive as low, partially buried ruins (Figure 5.19). Approximately 500m directly south of the archaeological site of Fuwairit a second settlement, QIAH40-360, is now also largely in ruins, was probably abandoned due to the salination of the aquifer in this area in the second half of the 20th century (see Macumber 2009). Inland from Fuwairit c.1.5km the site of Zarqa, QIAH40-359, represents a fortified site that would have provided the water and agricultural areas utilised by the former inhabitants of Fuwairit.

The site of al Huweila, QIAH40-437, was the most prominent town on the coast of Qatar in the 18th century. The town and the fort were recorded 1978 (Garlake 1978), but have been largely destroyed by various construction projects on the site. The central area of the site appears to be the least disturbed, and in this area the ground is covered with a dense scatter of 18th and 19th century pottery.

There are also a number of later Islamic settlements inland, often associated with wells and agricultural areas. The site of Umm Al Qubur, QIAH40-38, represents a substantial inland settlement with a number of structures built of mudbrick and limestone (Figure 5.20). Many of the structures have small rectangular air vents around the base of the walls, a common feature on later Islamic sites.

A number of homesteads, representing smaller agricultural settlements, as well as isolated structures were recorded. A rectangular structure, QIAH40-278, may represent an isolated domestic structure or an agricultural storage facility. The structure is located on an area of rawdah, close to well QIAH40-279 and field system QIAH40-280 (Figure 5.21).

Within an extensive field system QIAH40-225 at Umm Jassim several long thin buildings, QIAH40-186, have numerous internal divisions and could represent storage facilities. Between Jabal Juasiiyah and the coast a large mound, QIAH40-378, measuring 45m by 35m, has significant amounts of pottery on it an may represent a large buried structure. A similar buried structure, QIAH40-379, is located c.4km to the south east.
Figure 5.21: Walls of field system QIAH40-414

Figure 5.22: Walls of field system QIAH40-414
Field systems

Several field systems were identified, these varied in size but all consisted of units defined by low poorly preserved walls and associated wells. An extensive Field system at Umm Jassim, QIAH40-225, consists of a large number of fields and associated wells. A similar field system, QIAH40-414, at Muhayriqat consisted of a number of large rectangular fields, defined by ruined limestone walls (Figure 5.22).

Fortified sites

Fortified sites were often associated with wells, and are likely to have been used in part to protect water sources and associated agriculture. The sites of Qal‘at Thaqab (QIAH40-143) and Qal‘at Rakayat (QIAH40-219) have both been heavily restored relatively recently. The forts at Zarqa (QIAH40-438) on the northeast coast and Yusufiyah (QIAH40-167) on the northwest survive as ruins. The square fort at Qal‘at Shwail (QIAH40-198) is associated with settlement QIAH40-196 and wells QIAH40-197. Most of the fort is constructed of limestone, however the larger northwest tower includes a heavily eroded mudbrick element; this tower survives to a height of 1.50m (Figure 5.23, refer to 2010-11 report for details).

Figure 5.23: Aerial view of Shwail fort QIAH40-198
Figure 5.24: Mud-brick tower near Makin

Figure 5.25: Possible animal enclosures QIAH40-105
On a small island off Lekhaire, accessible only at low tide, a large ruined fortified structure consists of two circular towers linked by a substantial wall, QIAH40-268. Near Makin, and possibly associated with the later Islamic settlement here, an eroded mudbrick tower, QIAH40-426, was constructed on limestone foundations an survives to a height of c.4m (Figure 5.24).

Cemeteries and graves

A considerable number of cemeteries and Islamic graves were recorded across the survey area and most of the settlements surveyed have one or more walled cemeteries associated with them. Other cemeteries are completely unprotected; often these features are not located close to former settlements and are presumably associated with nomadic Bedouin populations. These features may be the only surviving evidence of the associated temporary and ephemeral Bedouin occupation. As well as cemeteries a number of individual isolated graves were recorded.

Enclosures

Enclosure features, defined by stone walls or alignments of stones, are probably animal enclosures associated with pastoral farming (Figure 5.25). Other boundaries, defined by alignments of cairns, may represent property markers or other divisions of the landscape, for example demarcating the extent of an individual’s or group’s grazing rights.

Wells

The commonest type of hand-dug well encountered consists of a relatively narrow shafts lined with limestone and often rendered with grey concrete. This type of well often has one or more troughs radiating out from it. A second type of hand-dug well consists of a very large stone-lined rectangular pit, and would probably have required the fresh water to be skimmed off the top of denser salt water (see Macumber 2009). Large more recent wells, often with a distinctive keyhole shape in plan, are used as watering holes for herds of sheep and goats.

Temporary settlement and camps

The commonest site type recorded consist of temporary campsites associated with nomadic Bedouin occupation. These sites are characterised by having one or more cleared rectangular areas, representing tent sites. These areas were defined by low mounds of stones formed from the cleared material or alignments of larger stones placed around the edges of the clearing. The arrangement and size of these temporary camps sites varies, some consist of a single tent clearing and others have five or more cleared areas. In addition to the tent sites other associated features include temporary qiblah walls and a variety of rectangular or circular clearings; apparently associated with animal penning.

Cairns

A number of cairns were recorded in the survey area. These were a very common feature type, and not every cairn encountered was recorded. The cairns recorded have a number of functions, however most appear to be way markers or were used to mark Bedouin campsites. A single cairn larger cairn, QIAH40-141, measures 9m in diameter and may be a burial cairn. The cairn is located close to an extensive prehistoric burial cairn fields to the south (Schreiber et al. 2009). An extensive cairn field was recorded near the area of Ruwais, QIAH40-274, the function of this site is not clear; however it is highly threatened by development and requires further investigation.
Figure 5.26: Rock carving on Jebel Fuwairit

Figure 5.27: Circular structures QIAH40-383
Rock Carving

The carvings on Jabal Jusasiyah, QIAH 40-377, represent the best known example of rock art in the country. This important rock art site has over 800 hundred rock carvings spread over an extensive limestone outcrop (Kapel 1983; Facey 1987). Similar carvings are present on Jabal Fuwairit, QIAH40-374, and Jabal Ghariya, QIAH40-330. The designs at both sites are comparable those Jusasiyah, and include parallel rows of cup marks and rosettes of cupmarks, which could boards for mancala-like ‘capture’ games as well as boat-like motifs (Figure 5.26).

Other features

A number of circular sunken structures were recorded in close proximity to a number of later Islamic sites. All of these features were located on raised areas of the limestone lithosol, close to and above areas of rawdah. These features measured 2m to 4m in diameter and were surrounded by a low limestone wall. They were recorded at a number of sites, including Muhayriqat (QIAH40-429), Helwan (QIAH40-410), Makin (QIAH40-428) and Umm Al Qubur (QIAH40-383). Some of the features consisted of a single circular structure; others had several circular ‘rooms’ within a single feature (Figure 5.27). These features may represent small circular enclosures intended to store animal fodder, a feature locally known as *mataben*. At Umm Al Qubur a local farmer, whose parents lived in the village, suggested they represent workshops.
Figure 5.28: Decorated ceramics from QIAH40-158 and QIAH40-309

Figure 5.29: Figure 17 sherds from QIAH40-434
5.2.4 Discussion

Within the regional survey area surface finds of struck flint artefacts were concentrated in intensity in the south west corner of the study area, notable in the vicinity of the site of Helwan and on the aeolianite out crop of Jabal Freiha. Other important prehistoric sites are known in this area (Al-Naimi et al. 2010; Cuttler et al. 2011). Elsewhere in the survey area evidence of prehistoric activity is sparse, consisting of occasional waste flakes.

Petroglyphs occur on most of the rock outcrops in the region, the soft nature of the exposed rock in northern Qatar make it ideal for pecking designs. Although sometimes thought to be of prehistoric date (Bibby 1965; Kapel 1983) the majority these petroglyphs are quite possibly of a later Islamic date (Hassiba et al 2012, Eddisford 2012). The function of many of the petroglyphs remains unclear, however the repeated occurrence of linear and circular arrangements of cupmarks are likely to represent game boards for a mancala-style ‘capture’ board game.

The presence of distinctive turquoise glazed decorated jars on sites in the Arabian Gulf has frequently been used as an evidence of Early Islamic occupation. This monochrome green-glazed ware is characterized by a yellow fabric and a translucent turquoise glaze, often with applied or incised ornament. The best-known type is a large jar with barbotine decoration, examples of which are known from Samarra, Susa, Siraf, and other sites (Lane 1947; Whitehouse 1979).

Similarities between the surface assemblages at Musaikah and al Nehayy and excavated 9th century ceramic assemblage from Murwab have been noted by Guérin and al-Na’imi (2009). Distinctive decorated sherd’s from the early sites identified in this survey include barbotine decoration of rosettes, each composed of a triple circle of dots; ribbed internal and external decoration with a thinner more bleached glaze; incised wavy lines and incised grid patterns (Figure 5.28 and Figure 5.29).

The existing QNHER dataset was an invaluable tool in rapidly building a high resolution picture of the various site types in the survey area. The survey has highlighted problems with QNHER, but will also allow this data to be interpreted in the future with a greater degree of confidence. The QNHER data omits some sites, such as the settlements of Umm Al Kilab (QIAH40-191) and Al ‘Athba (QIAH40-433 and QIAH40-434).

Further intensive field survey is required to support the preliminary site distributions presented in this survey. However, given the low density of sites in much of the survey area this needs to be undertaken in a sensible manner that maximise the return and minimises manpower. Key to this will be the development of a more robust integrated survey database and GIS data set, which will allow predictive modelling and more reliable statistical analysis of the data. In addition the more intensive recording of many of the sites identified in this survey is required, both through total station survey and more intensive on-site documentation.
6. **FINDS AND CONSERVATION**

6.1 **FINDS MANAGEMENT 2011/2012**

_Holly Parton_

6.1.1 Introduction

This season the finds laboratory undertook and achieved five key objectives:

1. The processing of all new incoming finds.
2. The selection of objects for display in the new National Museum of Qatar.
3. An increase in the volume of object conservation with special priority given to Freiha coins, National Museum of Qatar objects and beads.
4. The implementation of a closed, 3-barrel flotation tank allowing the full-time processing of soil-samples.
5. The provision of additional storage and working space.

6.1.2 Incoming Finds

With excavations at the three major sites of Al Zubarah, Freiha and Fuwairit and the extensive ground survey there was a marked increase in the number of finds this season. A summary of the overall totals are as follows:

Bulk Material – 3599 bags.

Field Objects – 920 of which 607 have been catalogued.

Samples – 1335 of which 985 are soil-samples for flotation.

The following table gives a breakdown by site with the bulk bags also divided into the six main material categories. Glass bracelet fragments are found in sufficient quantities to warrant them being classed as bulk, with only complete or almost complete examples now made field objects. The different quantities reflect both the individual site sizes and the extent of excavation carried out at each. For example at Al Zubarah, the largest site, four areas were excavated whilst at Fuwairit, also a large settlement, only preliminary excavations were done in the latter half of the season.

<table>
<thead>
<tr>
<th>FIND CATEGORY</th>
<th>ZUBARAH</th>
<th>FREIHA</th>
<th>FUWAIRIT</th>
<th>SURVEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Ceramic</td>
<td>584</td>
<td>443</td>
<td>48</td>
<td>234</td>
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<td>Bulk Bone</td>
<td>520</td>
<td>310</td>
<td>41</td>
<td>0</td>
</tr>
<tr>
<td>Bulk Metal</td>
<td>197</td>
<td>146</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>Bulk Glass</td>
<td>112</td>
<td>102</td>
<td>16</td>
<td>51</td>
</tr>
<tr>
<td>Bulk Shell</td>
<td>121</td>
<td>262</td>
<td>31</td>
<td>4</td>
</tr>
<tr>
<td>Bulk Glass Bracelet</td>
<td>49</td>
<td>6</td>
<td>22</td>
<td>59</td>
</tr>
<tr>
<td>Field Objects</td>
<td>462</td>
<td>311</td>
<td>23</td>
<td>124</td>
</tr>
<tr>
<td>Samples</td>
<td>579</td>
<td>721</td>
<td>35</td>
<td>0</td>
</tr>
</tbody>
</table>
6.1.3 Selection of objects for the National Museum of Qatar

The National Museum of Qatar requested an initial selection of objects for potential display in the new museum. This became one of the key priorities of the season. Objects were selected not simply for their aesthetic, visual impact but according to various display themes that could be used to tell different stories. By the end of the season 156 objects had been chosen from the different sites covering the topics of architecture, household, industry, diet, food storage, fresh water, commerce, trade, pearling, fishing, personal items, decorated objects and children. The majority were conserved, catalogued, drawn and photographed. A few still require full conservation and these will be the first priority in the following season. In October 2012 a further 46 objects were selected, including worked stone (anchors, diving weights), decorative architectural elements, large size ceramics and a collection of stone tools. In total, 202 objects have now been designated for the new National Museum of Qatar.

6.1.4 Conservation

Four conservators worked on three priority areas: Freiha coins, objects selected for the National Museum of Qatar, and beads. The latter was a specific project undertaken by Dr. Franca Cole, a specialist in this area, who conserved and catalogued 156 beads, including the natural pearl bead from Freiha, FREP04, Locus 1017, catalogue number 240, (Figure 6.1). It is an interesting example as it has bands of calcareous material resulting from discontinuous growth. These have been incorporated into the shaping of the bead however so that they form almost a decorative feature. This season also saw the full conservation of the pearl merchant’s box from Zubarah.

Another interesting object listed for the National Museum of Qatar is a copper alloy Jeton (counter) from Al Zubarah. It has a small perforation that obscures some of the markings, but careful conservation has revealed a sun, seven stars, crescent moon and the letters E. L. S. LAUER and RECHE R/N_FEN on the reverse and on the obverse a ship with the letters PLUS UL_ and I.L.S.L. Research so far indicates that the Lauer family were the last makers of jetons in Nuremberg, Bavaria, in the late 18th - early 19th century. Our jeton bears the initials of Ernst Ludwig Sigmund Lauer whilst the other word on the reverse is probably ‘Rechenpfen(ning)’ being German for jeton and on the obverse Plus Ul(tra) is probably the family motto (The Fitzwilliam Museum in Cambridge (UK) has a number of jetons in its collection that offer close parallels. Museum Accession Numbers: CM.2469-2003, CM.2471-2003, CM.2472-2003, CM.2473-2003. http://www.fitzmuseum.cam.ac.uk).

Figure 6.1: Pearl Bead FREP04, Locus 1017, Catalogue Number 240

95
Figure 6.2: Pearl Merchant’s chest

Figure 6.3: Copper alloy Jeton, ZUEP01 Locus 1116 number 323, L. Reverse R. Obverse
6.1.5 Processing of Soil Samples

With the water supply coming from a storage tank rather than being a constant flow a closed system that uses less water is necessary. A three barrel flotation tank was built. The water is pumped round continuously but having two extra tanks allows the sediment to settle so that no contamination occurs. The barrels are emptied daily and filled with fresh water. The priority this season was Freiha from where 721 soil samples have been taken, most consisting of one bag but with several between two and six and even nine bags in one case. Nearly all of these samples were processed this season, a super human effort on the part of Dr. Murray, the project environmental specialist, and the findings are already proving of major research importance.

6.1.6 Provision of Extra Storage and Working Space

With the increase in finds and the people processing them additional work and storage space was needed. Four shipping containers were installed at the QIAH Zubarah Research Station. Two large ones are used for storing bulk finds, providing a sealed environment against animal and bug intrusion. Two smaller containers are used as workrooms, one for drying finds, and one for residue sorting. The containers have been insulated with cladding against the extreme high temperatures in the summer. A small freestanding building was also delivered which will be fitted out as the new conservation laboratory next season.

6.1.7 Conclusion

In addition to achieving the five main goals outlined above the study of the ceramics and fish bone continued as well as the drawing and photography of catalogued finds. The illustration of the fishbone reference collection for publication was also started.
6.2 Preserving the Past - Challenges in Conservation

Anna Tjellidén and Marianne Schwartz (Moesgård Museum, Denmark)

6.2.1 Introduction

The 2011-2012 season saw a team of international conservators from Denmark, Greece and the United Kingdom working at the Al Zubarah Research Station and in the laboratory of the Qatar Museum of Islamic Art. Many different materials were taken care of, including objects in ceramic, ivory, bone, various metals, glass, stone and wood. All treatments were tailored to the needs of the individual object but there was frequently a need to minimize deterioration caused by salts in the soil due to the location near the sea. When salts crystallize within an object, cracks occur and, in the worst case, the entire surface detaches. A high proportion of artifacts needed desalination in order to slowly wash the salts out. If great care was not taken, the artifact would risk falling apart, owing to the only thing holding it together being the salt itself. An integral part of the conservation work this season included the packaging and storage of objects, both treated and untreated, in order to provide a stable storage environment.

6.2.2 Conservation Treatments

Ceramics

The surface of many decorated sherds were in danger of fragmentation and disintegration because of salts. In order to maintain the fragmented, glazed surface it was necessary to brush clean it dry, lacquer the surface and then desalinate it in distilled water. Subsequently a second lacquering/impregnation was introduced to hold the fragile ceramic together (Figure 6.4).

Figure 6.4: The deteriorated surface of manganese painted, alkaline glazed ware. Patterns are visible when introducing it to water or lacquer.
Ivory

The following is a summary of the delicate conservation treatment needed for a fragmented object of worked ivory suffering from extensive salt activity.

Surface salt crystals are removed mechanically, using a scalpel and bamboo skewer. Loose crystals are brushed away. The surface is swabbed with ethanol to remove loose, powdery deposits, before air-drying. Re-deposition of surface salt became visible after three days so it was decided desalination would be needed if item was to survive intact, as the flaky area of the base was determined to be held together by salts only. This was bound in place by adhering strips of blotting paper to solid areas of the base using HMG Paraloid B-72 adhesive, and covering the flaky surface with multiple strands of human hair (Figure 6.5).

Figure 6.5: Consolidation of ivory object FREP04/426, Catalogue No. 146
Internal armature was produced to prevent internal surface loss while desalinating, while allowing salt migration. Object cavity was lined with cling-film, then a cage structure of blotting paper strips was adhered inside the space using HMG Paraloid B-72 from a tube. This was allowed to harden, then was removed, and the cling-film cut away from the spaces. The armature was repositioned inside the cavity.

The remainder of the artefact was bound first with human hair, then corners and fragile areas were padded with blotting paper and the whole was bound together using bias-cut nylon netting strips knotted into position. This gave lightweight, solvent and water permeable compression to all surfaces of the artefact, while enabling free solvent and water movement. The object was next immersed in 96% ethanol for one hour, then distilled water was added in a combination of 85% ethanol and 15% water.

10% total volume of the solution discarded and 10% distilled water added three times daily for three days. The item was subsequently transferred to distilled water, removed, blotted with tissue to remove excess water, then immersed in 50:50 ethanol: water. After three hours, it was removed, blotted with tissues to remove excess solution, then immersed in 96% ethanol. Ethanol dewatering repeated there times daily for two days. The item was then moved to 50:50 acetone:ethanol solution for six hours then removed, blotted, and placed in pure acetone. Acetone washes were repeated three times. Item then transferred to 5% solution of paraloid B-72 in acetone. After twelve hours, 40% Paraloid-B-72 added to the original solution to produce a 10% solution. Left for twelve hours. Removed, dried in an acetone vapour environment for twelve hours, then left to dry in air for twelve hours. Surface wrappings are removed. The surface was swabbed with acetone to remove excess consolidant and re-deposited sediment, before being reconsolidated with 3% solution of Paraloid B-72 applied with a soft brush. This is then air dried. Fragments are adhered with Paraloid-B-72 (Object following conservation, Figure 6.6).

Figure 6.6: Ivory object after conservation, Catalogue No. 146, OD-6937
Figure 6.7: Working shot: coin prior to conservation

Figure 6.8: Working shot: bronze object prior to conservation

Figure 6.9: Lacquering the metals under vacuum
**Metal**

As bronzes are highly sensitive to salts in combination with fluctuating humidity, the surface of many objects was highly corroded (Figure 6.7 and Figure 6.8). The conservation of objects such as coins, jewelry and tools included mechanical cleaning under microscope using scalpel and ultrasonic dental chisel. Then lacquering with *Inca Lacquer* was necessary in order to prevent the artefact from further corroding (Figure 6.9).

**Composite objects in wood, metal and organic materials**

A conservation project of high priority was the pearl merchant’s box carried out at the Museum of Islamic Art. After cleaning the wooden surface with its bronze decorative elements and remains of red dyed textile using brushes and tools, it was crucial to stabilize the box by slowly impregnating it with consolidant (Figure 6.10, and after conservation: Figure 6.2). For a detailed report on conservation of this object, see document QIAH-0101F002 “The Pearl Merchant’s Chest. Conservation report”, by K. Tsatsouli.

**Packaging and Storage**

The correct packing and storage is essential for object preservation. This season textile fragments were packed with the RP System with an oxygen scavenger and an oxygen eye in each Escall bag. Organics and fragile objects were packed with acid free tissue paper in boxes. Metals were stored with silica gel and humidity indicator cards and some were vacuum-packed. These step are necessary in order to prevent the excavated and untreated objects from deteriorating in the aggressive climate of Qatar. The conservators of following seasons will continue the professional care and knowledge necessary to preserve the past of Al Zubarah for future generations.

![Figure 6.10: Pearl merchant’s box during conservation](image)
7. **Archival Material Related to Later Islamic Al Zubarah**

*Hanne Nymann*

7.1 **Introduction**

There is no single historical source that explains why or how Al Zubarah was established. Rather, understanding the history of Al Zubarah requires an analysis of a broad range of historical and archival sources in order to understand the context, in which the town was conceived, grew and ultimately succumbed. Potentially relevant archives, repositories and manuscripts have been collated. This section provides a short overview of this work, listed according to the main language of the source.

7.2 **Ottoman Sources**

The Başbakanlık Osmanlı Arşivleri, Istanbul, is one of the largest archival holdings in the world with nearly 100 million documents. Material from here should in theory provide an Ottoman perspective on developments in the Gulf, developments which previously were much influenced by British Gulf historiography and the idea of hegemony of European powers (Fuccaro 1999; Valenti 2011). Regrettably, the Ottoman administrative archives from Nejd and Hasa, kept in Baghdad and Basra respectively, have been destroyed and very few documents related to the Gulf in the 18th century are thought to have survived (A. Meier pers. com.). Ottoman influence on the area of Eastern Arabia in the second half of the 18th century was negligent, although they kept a theoretical claim to it until 1870.

The Hijaz portfolios kept at the National Archives of Egypt is a rarely used source on the development of the first Saudi state, as seen from an Ottoman perspective, and could offer insight into the expansionist politics that implicated Al Zubarah from 1790s.

7.3 **Arabic Sources**

Only a few primary Arabic sources have been identified so far, foremost amongst here the so-called Wahhabi chroniclers. Forthcoming work will focus on Ibn Bishr Unwan’s al-Majd fi Tarih Najd (1854) and Ibn Ghanim's Rawdhat al-Afkar wal-Afham, which ends in the year 1797. The anonymous Kitab Lam’ al-Shihab fi Sirat Muhammad ibn ‘Abd al-Wahhab (1817) which until recently was considered a Wahhabi chronicle was most likely commissioned by the British officer Robert Taylor (Davies 1997: 132). It contains several specific references to Al Zubarah and is a near-contemporary source of great importance.

Another promising source is ‘Uthman Ibn Sanad, Saba‘ik al-‘Ašjad fi Akhbar Ahmad Najl Rizq al- As‘ad. This book, written in the 19th century, is a biography on one of the wealthy pearl merchants that partook in the founding of Al Zubarah. Of particular interest are the references to religious and scholarly life in Al Zubarah (Fattah 1997: 27).

In the 1780s Al Zubarah merchants began to supply the inner Arabian tribes with commodities, especially coffee (Manesty and Jones 1791). Another potential source is therefore Kitab tarikh kayf kana dhuhr Shaik al-Islam Muhammed Ibn Abdul-Wahhab. Most likely written around 1803 by a Nadji merchant, this manuscript offers information of inland trade in Eastern Arabia (Fattah 1997: 68).
The destruction of local archives and private collections has been intensive and often oral histories are the only source of information. Unpublished family archives, especially of local (Eastern Arabia) native East India Company agents, still exist but it is a difficult task to locate these (Onley 2007: 5-7). This material is particular valuable as resent historical research, inspired by revisionist approaches, tends to highlight the economic dimension of local groups (Abdullah 2001; Segal 2009).

For various reasons there is a dearth of Qatari documents (Anon. 1998: 6), particularly before 1820 (Tuson 1991).

The Zanzibar National Archives (ZNA) holds a rich collection of documents from the era of Omani rule (1800-1890) that until now has been overlooked by Persian Gulf researcher (Bang 2008: 349) These contain essential details on Arab trading diasporas in the Indian Ocean and their role and relations to mercantile dynamics in the Gulf region. Despite fluctuation on the political relationship Omani Muscat was an important trading partner. The archives may also provide more information on the Omani dynasty’s shifting attitude to the Khalifa Utub, as well as the attack on Al Zubarah in 1810.

### 7.4 Dutch Sources

When the Dutch East India Company went bankrupt in 1795, the Dutch state inherited their archives, leaving a large coherent material of which a large portion is kept at the National Archives of the Netherlands. The material is particularly informative on the condition in the Persian Gulf prior to the establishment of Al Zubarah but less so after 1766 where the company left the Gulf. This is evident in the works of Ben Slot and Willem Floor who until 1757 use Dutch sources but thereafter mainly British ones. The reports by Tiddo von Kniphausen from the 1750s are particularly informative about the history of the Utub (Floor 2007). This material is presently being digitalized.

By far the largest archive on Dutch interaction with the Indian Ocean world is the central administrative archive in Jakarta. In contrast to other company archives, the archive was not discontinued in 1795. The archive is not digitalised and has to my knowledge never been used in connection with Persian Gulf research.

### 7.5 Indian Sources

An important Indian document of the late 18th century is the Waqai-i Manazil-i Rum: diary of a journey to Constantinople (Hasan 1968). In 1786, Tipu Sultan, the Muslim ruler of Mysore, southern India, made attempts to expand his diplomatic and commercial network into the Persian Gulf and therefore sent a group of diplomats. One of these, Abdul Qadir, kept a diary which has survived in the Waqai-i Manazil-i Rum. The journey took them by ship via Muscat to Bushire and then to Basra via Kharg Island. The Waqai contains geographical inaccuracies which might be a result of Abdul’s reliance on informants (Brittlebank 2005: 210). The text is only available in Farsi with an English summary that not always follow the structure of the Persian text (Brittlebank 2005: 211) and Al Zubarah is mentioned briefly as an important pearl fishing town (translation provided by Claus Pedersen). Despite this, it provides valuable information on customs and local conditions, albeit to a lesser degreein the Eastern Arabian area.

After the conquest of Bahrain, the Khalifa Utub had direct commercial ties with Surat, Gujarat. Further research into archival material from this area therefore seems relevant. However, present research on Indian traders tends to rely on European sources (Nadri 2008), perhaps an indication of a lack of local sources.
7.6 BRITISH SOURCES

The primary source for the Persian Gulf and Qatar are the archives of the East India Company (EIC). Although a private company the EIC often acted as a state institution, assuming diplomatic and military functions and the material therefore contains a variety of information. There are two main repositories of EIC material that relates to the factories (trading stations) of Gombroon (Bandar Abbas), Bushire and Bussora (Basra): the India Office Records (IOR) in London and the Maharashtra State Archives (MSA) in Bombay. IOR are administered by the British Library, London, and deposited at the Asia Pacific & Africa Collections.

Contrary to other India Office material the Persian Gulf records do not contain a basic core of records actually produced and maintained at the factories concerned. The series is made up of various materials relating to Persia and the Persian Gulf that appear to have accumulated in London (Tuson 1979). The central groups of IOR records relevant for Al Zubarah are the so-called Gombroon Diaries (reference numbers G/29/1, G/29/4, G/29/6-14) and the archive of the British Residency at Bushire (R/15/1/1 - 13) which covers the period 1763-1813. Of particular interest is G/29/25 (Report on the British Trade With Persia and Arabia, 1791) which have two short sections dedicated to trade at Al Zubarah.

All historical material presently held at the India Office that concerns the Gulf is in the process of being digitised, courtesy of the British Library and sponsored by the Qatar foundation. A fully searchable web-site will be available from 2015 which will facilitate research immensely.

The MSA archive contains records from EIC Bombay administration including several papers relating to political history. Of particular interest are the Bussora (Basra) and Gombroon Factory diaries. A closer look at this archive is of interest as it apparently contains material not used systematically in modern research. A selection of very central records on Eastern Arabia was compiled and edited by Hughes Thomas, 1856, and reprinted by Oleander Press in 1985. It contains information that Lorimer only partially included in his Gazetters. The latter has since its declassification in 1970 been the most used secondary source for the 19th century history but contains very little material on the 18th century. MSA is housed in Elphinstone College Building, Mumbai, an open-air structure built in 1888. As a result the archive is not in an optimal condition.

Approximately 11000 photocopies pages selected from the Bombay Secret and Political Department Diaries for the years 1778 – 1820 are kept at University of Exeter.


7.7 OTHER SOURCES?

There were Jewish, Armenian and Indian trading communities present in the Gulf but little is known of them outside Basra, although an Indian group had resided at Bahrain since the seventeenth century (Abdullah 2001; Segal 2009; Markovitz 1999). Persian chronicles relate occasionally to Gulf events but are often unclear and of limited value (Tucker 2012). Apart from the 17th century Carmelite sources few reliable French sources have so far been identified. Billecocq (2008) only identifies two 18th century French sources, both minor travel reports.
7.8 **Conclusion**

The Eastern Arabia Gulf settlements and hinterlands consisted in the 18th century of a diverse group of people bound together mainly by ties defined by genealogy or commercial partnership (Anscome 2005). Various tribal identities existed side by side, both nomadic (badu) and settled (hadar) (Zahlan 1979:16). Sunni tribes adhered to various religious schools and Shi’a populations were present in Bahrain and Qatar. Also present were the Huwalah, Arabs who came from the Persian littoral, and Persians themselves. Africans had only been present in a limited number, mainly as domestic servants; however their number grew rapidly in the two last decades of the 18th century as the demand for more manpower in the pearl fishing industry increased (Ricks 1987). These groups have left little material in writing and only a sketch can be drawn.

What the Eastern Arabian coast did not have was direct interaction with Europeans. Visitors to the Gulf, so such Niebuhr, usually travelled along the Persian side of the Gulf, either by boat or overland. The East India companies likewise favoured the Persian littoral or Basra. No EIC factories, residencies or political agents were present until the 19th century, with a native EIC agent appearing only 1816 (Onley 2007:63). English intelligence officers only started reporting from the area after the destruction of Al Zubarah, see for example Taylor (1818) and Warden (1819), both in Hughes Thomas (1985). No proper map existed until Brucks’ survey with the Bombay marine in the 1820s. The European sources are therefore often based on hearsay of informants, informants that was not always local, and using these sources is methodologically challenging (Valenti 2011).

Also, owing to the nature of the presently available data, the discussions clearly favour economic history. Although this might present a one-sided historical view commercial activity did shape a large part of the history of the region and is intimately intertwined with the fluctuating fortunes of Al Zubarah. Understanding the nature of economic relations will therefore also informs us on the political and social nature of the region.

Research into the local and regional history of Eastern Arabia and the Persian Gulf in the later half on the 18th century suffers from a paucity of primary sources. The difficulty in accesses some of these is a further hindrance. As few events are covered or confirmed by other contemporary records, judging the validity of the sources is difficult.

Overall, there are at present only a few in-depth studies of the complex social and economic dynamics that facilitated the regional development and trans-regional trade in the 18th and early 19th century, Fattah (1997), Abdullah (2001) and Onley (2007) as noticeable exceptions. Even the most recent and thorough publication on pearling in the Persian Gulf only utilized primarily IOR material much the author’s own regret (Carter 2012). As a result there is a limited and uneven but nonetheless complex body of sources for the history of Al Zubarah and the Persian Gulf in the second half of the 18th century.

7.9 **Future work**

An international workshop held in collaboration with Qatar University is planned for late 2013. The present ambition of this workshop is to further identify relevant textual material, in Arabic, Persian, Turkish, Indian, Dutch, Portuguese and English, and an assessment of the appropriate methodological approach to these.
8. BIBLIOGRAPHY


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An examination of the impact of environmental disparity on the occupation of Qatar

Phillip G. Macumber
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An examination of the impact of the environmental disparity of Qatar on its occupation

Summary

Physically, Southern Qatar is markedly different from northern Qatar by dint of its thick sand sheets and dunes, which influence the nature of the rawdah and associated vegetation. Moreover, there is no surface water in Qatar and the only continuous source of potable water is from the groundwater system. Therefore, from an occupational viewpoint, a more significant comparison of northern and southern Qatar is hydrological, and stems from the crucial differences in the quality of groundwater, with good quality groundwater being present in the north and poorer quality groundwater in the south. This disparity in water quality is reflected in the nature of occupation across Qatar both today in the distribution of modern farms; and in the past, in the distribution of settlements and remnant structures. More permanent settlements occurred in the north, especially closer to the coast where the water table was within ready reach by hand-dug wells, while in the south occupation appears to be more in terms of nomadic visitations, probably during sporadic periods when ephemeral surface or groundwater became available in response to storms or favourable seasons. However, even where/when there was no potable water, wells with more saline groundwater enabled year-round visitations, since the water was suitable for camels. In this respect the camels may be seen as portable desalination plants, converting non-potable brackish/saline water into milk.

The groundwater salinity differential across Qatar is reflected by the presence of early permanent settlements, stretching from the Abbasid Murwab on the western coast to beyond Fuwayrit on the north-eastern coast. This is not reciprocated in the south. Similarly, the large number of cairns and cairn-fields present in the north showing human presence since Neolithic times are not matched in the south. Instead, cairns and ubiquitous small round structures are more thinly scattered; perhaps the next most common architectural features are the small mosques, represented only by a qibla wall and mihrab, which are most commonly found in small lightly-treed depressions scattered across the landscape. This pattern of settlement or visitations, rather than permanency, remained constant over the period for
which occupation of Qatar occurred. The 7,000 year old Shagra site where a small fisherman's hut was excavated in the 1980s, fits into this pattern.

Figure 1 Locality map for selected towns across Qatar

1 Introduction - Potable water is the one essential requirement for settlement

Central to any holistic archaeological study is the relationship between occupation and the natural environment – why people live where they do. This is especially the case in Qatar where low rainfall coupled with low relief results in the absence of fresh surface water. The only natural water source is from groundwater occurring in the Tertiary marine limestone
aquifers, the Umm er-Rhaduma, the Rus, and closer to the coast the Dammam Formation which outcrops across much of Qatar. In the past, the distribution and availability of potable groundwater was a critical constraint to occupation across Qatar. Without a source of permanent fresh water, there can be no permanent settlement.

1.1 Qatar landscape and occupation

Qatar lies on a limestone peninsula extending northward from the mainland of Saudi Arabia into the Arabian Gulf along a north-south anticlinal structure referred to as the Qatar Arch (Figure 4). Tertiary sedimentation commenced in Palaeocene times with the marine limestone sequence of the Umm er-Rh aduma Formation. It continued until the end of the Eocene with deposition of the Rus (lower Eocene) and Dammam Formations (upper Eocene) under marine to paralic conditions with the development of a limestone-evaporite sequence in the Rus Formation.

Almost all of Qatar has a relief of less than 100 m and an arid to hyper-arid climate with a highly variable annual rainfall, averaging 80 mm in the north and less in the south. Rainfall is extremely unpredictable and highly erratic across the country. Temperatures during summer are high (> 40 °C), and annual average evaporation rates of 2,200 mm, with very strong winds and high relative humidity (Abu Sukar et al, 2007). Evapotranspiration ranges from less than 2 mm/day in December to a maximum of 10 mm/day in June. Rainfall is mostly in winter, from winter westerlies, causing recharge into the Tertiary limestone aquifer system, especially following storm events. The low relief coupled with the high aridity results in no permanent surface water and occupation in the past was dependent on groundwater, accessible by hand-dug wells. Even where water was readily accessible, water quality was crucial. In more recent times, the use of modern drilling techniques has enabled water to be exploited from deep within the aquifer. Therefore a combination of groundwater depth and salinity determined the location and extent of settlement in Qatar up to the modern era of deeper drilled wells and desalination.

An indication of the distribution of usable groundwater may be had from examining the distribution of the main farming areas across Qatar in 1980 (Figure 2), which shows that the bulk of the farms lie in the north. Since water availability is central to permanent settlement, this is deemed to also more generally reflect the relative habitability across Qatar. One rider is that the farm well plots do not take into account the numerous hand-dug wells which pre-date modern (post 1950s) farming. This is especially the case in the coastal areas of northern
Qatar between Fuwayrit and Al Zubarah (Figure 1), and, along the north western coast line, a zone of shallow wells (Figure 3) is distinguished by Lloyd et al., (1981).

Figure 2  Distribution of agriculture (from Dastane and Al-Faihani, 1980) and bore localities (Eccleston et al., 1981)

Figure 3  Northern Qatar with the zone of shallow wells and tritium content of groundwater (from Lloyd et al., 1981)
As occurs throughout much of the Gulf region, the major aquifers are located in lower to mid Tertiary marine sequences. These are principally the Umm er Rhaduma limestone and the overlying Rus limestone and anhydrites. The Dammam Formation forms the surface across much of Qatar (Figure 4).
In practice, given that inland recharge and coastal discharge occur via the Dammam Formation, the Rus and Dammam sequences are lumped together as a single aquifer. This is aided by the significant absence of lower Dammam shales in the centre of the peninsula. Permeability in the aquifers is mostly secondary and induced by extensive dissolution, especially of the Rus Formation, which occurred during wetter periods in the Quaternary. This has in turn led to widespread collapse, creating cavities and fractures in the limestone and rawdah at the surface. These features provide a mechanism for recharge.
1.2 Northern Qatar physical environment

In the north of Qatar, the rawdah are small basins of internal drainage with localized
catchments, ranging in area from 0.25 to 45 km², but catchment boundaries may sometimes
be imperceptible with flat interfluves creating a subdued landscape. Colluvial soils made up
of calcareous loam, sandy loam and sandy clay loam have accumulated in the rawdah to
depths ranging from 30 to 150 cm, overlying limestone fragments and bedrock. At times,
intricate meandrine erosional patterns ('playettes', Macumber 1968; 2011b) appear on the
floors in the deeper parts of the depressions, which are often treed, and reflect the presence of
shallow groundwater. The rawdah depressions which collect surface water from direct
rainfall and from runoff from surrounding bedrock areas, are the main source of recharge into
the aquifer system.

The development of groundwater mounds beneath depressions, both seasonally and
intermittently after discrete storm events (Figure 6), was described by Eccleston et al., 1981,
who established piezometers in depressions at Musaykah and Rawdat Al Faras, where water
tables were between 8 and 8.5 m below the surface (Figure 6).
Measurements made over the winter and spring periods in 1976 and 1977 show the development of recharge mounds developing both seasonally over spring, and after discrete storms (rainfall shown in the inserts at the top of graphs). The levels shown in Figure 6 represent water table height above sea level, showing more general rises of 3-4 m, and 3-4m after single events in the case of Rawdat Al Faras, which had only partially declined two weeks later. Superimposition of discrete rainfall events during wetter seasons may create significant temporal mounds beneath the rawdah. Such rises are capable of producing groundwater outcrop (surface water) wherever water tables are initially close to the surface. This may occur even with deeper groundwater tables in response to superimposed or prolonged rainfall events. It is considered that similar rises play a part in the development of the playette patterns seen across northern Qatar, with channels formed by water out-seeping from the sides of depressions (Figure 8). The presence of water at the surface in such instances is therefore not simply a ponding effect of rainfall and runoff, but is also a reflection of the rapid response of the water table to wet events. The rate of decline of the
underlying groundwater levels then determines the period for which water remains visible at the surface.

Shallow hand-dug wells are commonly found associated with the rawdah, which form a focus for the numerous farms that were established in recent times.

Figure 7 Well in grassed rawdah at Umm al Qubur

Figure 8 Typical channelled 'playette' drainage pattern (foreground) formed on the lower-most parts of the rawdah floor, where the channels are commonly associated with trees – al-Sidriyah
Figure 9 Flooding of the rawdah in the vicinity of Umm al-Qubur (photos courtesy of Dr Tobias Richter)

Figure 10 Infilled well in small rawdah, west of Mafjar

Figure 11 Infilled well in the Muharaqit irrigation area, near Halwen
1.3 Occupation in southern Qatar

1.3.1 Physical Environment

In southern, central and western Qatar, the landscape is dominated by low Neogene hills and extensive limestone peneplains across which there are large areas of barchan sand dunes. The deeply eroded central plateau reaches a height of 103m, however the bulk of the plateau lies between 40 m and 60 m (Figure 5). Across the region the landscape is subject to intense sandblasting during the frequent sandstorms, which has resulted in scalloped and fluted limestone bedrock (Figure 17) and also the Pleistocene limestone strandlines (Figure 16). While rawdah-like depressions occur in the south, they are fewer, and are small and isolated, with sandy floors and scattered vegetation. There are also a limited number of large depressions such as those near Turayna and Karana, with the floor sometimes as much as 20 meters below the general plain surface, which may form a distinct rim. The floor of the large depressions range from rocky to flat with low points variously covered by vegetated aeolian sands.
Figure 12  Sand and rock landscape in south-eastern Qatar

Figure 13  Erosion remnants of Neogene sediments with sand accretion

Figure 14  Semi-treed base of a depression with a sandy floor, during sand storm
Figure 15  Triangulation point G08, established on a remnant of Pleistocene strand line.

Figure 16  Wind/sand fluted aeolian limestone surface

Figure 17  Wind and sand striated Dammam Formation limestone
1.4 Groundwater and occupation

1.4.1 Impact of geology on groundwater quality across Qatar

The Qatar peninsula was formed by uplift along a N-S structure called the Qatar Arch (Figure 5). In northern Qatar, deposition of the Umm er Rhaduma and Rus Formations was strongly influenced by the Qatar Arch, resulting in two distinct facies – a calcareous facies straddling the structure and a gypseous facies on the flanks lateral to calcareous facies (Figure 18).

Figure 18 Relationship between the freshwater carbonate zone and town distribution across northern Qatar
While the different depositional environments have led to the two major facies, this distinction has been modified by post depositional anhydrite (Ca SO₄) dissolution, causing the original carbonate-gypsum facies boundary to migrate southwards, where it is now seen as a "V" or fan shaped boundary with its apex in the vicinity of Rawdat Rashid in central Qatar. To the north, the Rus Formation is a predominantly carbonate facies with only residual deposits of inter-bedded gypsum. To the south, the Rus Formation is mostly gypseous (Figure 18 and Figure 19). The calcareous facies is largely absent from southern Qatar, although a narrow band occurs in the west, associated with the northwards trending Dukhan anticline passing southwards through Umm Bab towards Turayna (Figure 19). Because of the strong effect of the gypseous sediments on reducing groundwater water quality, Qatar is divided into two separate hydrogeological provinces: one in the north and the other in the south (Figure 19).

![Figure 19 Litho-facies in the Rus Formation and hydrogeological provinces (Eccleston et al, 1981)]
The distribution of farm pumping wells (hand dug and drilled) in Qatar within the extended carbonate line (Figure 20) clearly shows the fresher water distribution and hence the influence of the carbonate facies on groundwater quality across Qatar. There is a very low density of farm wells in southern Qatar compared with that in the north, and this difference echoes the asymmetric distribution of occupation of Qatar in the past, and hence gives an insight into its archaeology. The extended carbonate line is also shown in Figure 20.

Figure 20 Distribution of farm pumping wells across Qatar (Dept of Environment 2011)
1.4.2 Presence of a freshwater lens in the north

Despite very low rainfall, localized recharge via the rawdah has resulted in the development of a complex fresh groundwater lens within the calcareous facies of the aquifers across northern and central Qatar (Figure 21). The fresh water overlies more saline regional groundwater deeper in the Umm er Rhaduma aquifer. Elsewhere in Qatar to the south of the calcareous zone, the aquifer system is mostly gypseous and the groundwater is normally brackish to saline (Figure 31).

Groundwater recharges in the hinterland and flows coastward where it discharges into the saline sabkha system. On approaching the coast the depth to the water table shallows, as does the depth to which hand-dug wells were required to go. Settlements were therefore concentrated closer to the coast, and those directly on the coast like Al Zubarah and Fuwayrit, where intruded seawater precluded a direct water source, received their water from nearby inland settlements such as Murayr and Athbar respectively. In a broader sense, the influence of water table depth and salinity in determining the distribution of archaeological sites across Qatar is clearly seen in the case of the early Islamic linear sites found between Al Athbar in the east and Al Haddayah in the west. All were associated with nearby rawdah with ready access to shallow potable groundwater. By contrast, permanent occupation in southern Qatar where the water was largely brackish to saline is sparse, with relatively few modern day or ancient settlements.
Therefore, while groundwater salinity plays the most crucial role in the distribution of early settlement, the depth to the water table is also influential, even where the groundwater was fresh. Since depth to the water table determined the availability of potable groundwater in the past, an understanding of the pre-development groundwater levels (potentiometric surface) provides some understanding of where potable groundwater was accessible by hand-dug wells, and hence where settlements might have occurred, or conversely, where they couldn't have occurred. The pre-development levels are notably different from the present groundwater levels given the intense degree of groundwater exploitation that has occurred over the last 50 years. The following section establishes the approximate depth to groundwater under Qatar prior to the recent phase of groundwater development since the 1950s.

1.4.3 Pre-development groundwater Levels and hand dug wells

The water table has fallen markedly in response to the development of the groundwater systems over the past 50 years. Given that in pre-development times there was a practical depth limitation to which hand-dug wells might go in order to intersect the top of the freshwater lens, the pre-development depth of the water table provides a gauge to the areal distribution limits for which permanent settlement was likely to be found. In practice, it implies that since the water table is relatively flat, settlements were far more likely to be found in the lowlands and unlikely to be present in the higher areas of Qatar (Macumber 2009). Measurements of the potentiometric surface (groundwater level relative to sea level) were first undertaken in 1958 by Le Grand Adsco and later again in 1979. The 1958 surface was assumed by workers to represent the steady-state equilibrium condition which existed prior to the onset of the modern development. It therefore represents the base condition of the water table in the period prior to 1958, at a time when aquifer recharge in the hinterland was balanced by outflow at the coast. It is therefore the closest understanding that can be had to the pre-modern groundwater levels that existed from 6000 years BP (following the end of previously wetter conditions of the early Holocene) up to the 1950s. Prior to the late 1950, agriculture in Qatar was confined to a few farms and date gardens within the environs of Doha and some of the other main centres of the country, but from about 1958 onward the number of farms increased steadily to reach a total of over 350 by 1967 and was in excess of 500 by 1980. This is also shown by the rise in groundwater pumped between 1950 and 1972 and between 1975 and 2010. (Figure 22 and Figure 23). During this period there was a
significant fall in groundwater levels across Qatar. The decline starts just prior to 1958, and the groundwater levels of 1958 are taken as representing the pre-development situation across Qatar. It provides an approximate depth to water tables for which hand-dug wells were required to go. Amer et al (2008) show a five-fold increase in groundwater extractions since 1975.

An approximation of the pre-development water table depth across all of Qatar may be obtained by taking the 1972 potentiometric surface (Figure 24) for all of Qatar and adding the amount that the water table fell between 1958 and 1972 (Figure 25), using the potentiometric head and decline figures provided in FAO (1974). The 1972 potentiometric surface shows two small (ca 4 m high) groundwater mounds - one in the north and one in the south.
Adjacent to the coast, groundwater levels were generally less than 1 m above sea level in 1974. Groundwater development began in approximately 1958, and the subsequent decline in levels by 1972 is shown. However, it is notable that this decline extended only across north and central Qatar, reflecting the insignificant pumping in the south due to the lack of bores. The 1972 (Figure 24) and 1958 (Figure 26) groundwater levels are overlaid on the coloured topographic map (legend shown).

Figure 24   Potentiometric surface 1972  (amsl)
Figure 25 Groundwater level decline 1958 to 1972 (m)

The pre-development 1958 groundwater levels may be obtained from adding the decline between 1958 and 1972 to the levels at 1972. This is seen in Figure 26 where the groundwater levels are shown as metres above sea level in 1958. This shows that beneath the higher areas of Qatar, groundwater levels were mostly greater than 25 m below the surface and therefore beyond reach by hand-dug wells.

A further depiction of a 1958 potentiometric surface for northern Qatar alone comes from Eccleston et al (1981), based on Le Grand 1959. This is roughly similar to that calculated
using the earlier 1974 FAO data set but with the water table at 12 m above sea level (25 or more metres below groundsurface) in parts of central northern Qatar (Figure 27). All plots suggest that hand-dug wells were concentrated closer to the coast where the depth to the water table was relatively shallow. This is also clear from Figure 28, Figure 29 and Figure 30, which show the west-east water table profile using groundsurface sections across Qatar at Ghuwairiyah, Doha and Umm Said - based on the data given in FAO (1974).

Figure 26  Potentiometric surface in 1958 obtained from 1972 FAO data
Three W-E coast to coast sections across Qatar show the potentiometric surface and hence the depth required to excavate a hand dug well to reach the water table - in the north through Ghuwairiyah (Figure 28 - locality Figure 1), in central Qatar through Doha (Figure 29), and in the south through Umm Said (Figure 30). In general, the depth to the water table increases markedly on passing southwards as the landscape elevation increases.

The depth to the water table is shallowest in near-coastal settings where the groundwater systems outflow, and are most readily tapped by shallow wells. This is the case with the towns around northern Qatar from Al Zubarah to Al Ghariyah, and readily seen at Al Zubarah where fresh water was obtained from a number of hand-dug wells located on the higher ground at Murayr. Further inland as the land surface rises, the depth to the water table concomitantly increases to a point where the groundwater was largely beyond practical reach by hand-dug wells. This was no longer the case with the introduction of modern drilling techniques.

Figure 27 Potentiometric surface in 1958 (m asl) across northern Qatar (Eccleston et al., 1981) overlaid on topography emphasizing the 30 m (red) and the 40m (green) contour
1.4.4 Groundwater salinity

Clearly, even where water is within reach by hand-dug wells, its potability is crucial if there is to be ongoing settlement. World Health Organization (WHO) requirements put the desirable upper limits for salinity as about 5-600 mg/l TDS. More generally, it is perceived that water over 1000 mg/l becomes unpalatable. However, there are great many areas where these levels are exceeded, and in such cases an extreme upper limit ranging of 1500-2,000 mg/l is varyingly set. This is the case for example in India where the Bureau of Indian
Standards (BIS) has set a limit of 2,000 mg/L. The Council of Medical Research (ICMR), which prescribes 500 mg/L as the desirable limit of TDS for drinking water, places the uppermost limit, in the absence of alternate sources, as 3,000 mg/L. WHO also comments that while water with a TDS level of less than 600 mg/L is generally considered to be good, drinking-water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/L.

Figure 31 Salinity of Qatar groundwater in 2009 (TDS (ppm)).
(Dept of Environment, 2011)
Beneath the Qatar peninsula, potable groundwater occurs as a freshwater lens overlying saline water, which is recharged in the interior and discharges at the coast (Eccleston, Pike & Harhash 1981; Lloyd et al. 1987). The freshest groundwater occurs in the north and is associated with the carbonate facies of the Rus Formation. Groundwater flow is radial from the hinterland towards the coast, where between al-Zubārah and Fuwayrit in the north, it has supplied a number of settlements including those along the north-western coast at al-Zubārah (from Murayr), al-Furayhah, al-Jumayl, al-Arish, and Ayn Mahomed.

While temporary visitations may occur in response to seasonal rainfall, more permanent settlement is Qatar is dependent on groundwater and hence wells. Indeed, the history of Qatar may be deemed to be intimately interwoven with the history of its wells, the sites of which are commonly associated with a number of phases of occupation. A number of salinity maps of Qatar have been produced over the last 50 years, all showing the location of the centre of the freshwater lens in the north. The most recent was the 2009 survey prepared for the Department of Environment (Figure 31). On the map the 2000 ppm (~mg/L) salinity contour from the earlier survey undertaken for the 1974 FAO report is shown in blue with hachures, while the boundary between the carbonate and sulphate zones is shown as passing near Rawdat Rashid (Figure 31). An earlier map showing the groundwater salinity (referred to as ‘irrigation salinity’) was produced by Dastane and Al-Faihani 1980 (Figure 32). This map - while not as detailed as the 2009 map - more closely reflects the salinity patterns that existed prior to development.

The 2009 map shows clearly the disparity in groundwater salinity between north and south Qatar, delineated by the V-shaped line passing near Rawdat Rashid. Only a minute area to the immediate south of Rawdat Rashid is shown as having water within the 3000 mg/L category, while that with a salinity of 2000 mg/L or less all lies northwards of Doha. The V-shaped boundary stems from a southwards retreat of the former gypseous (anhydrite) zone within the Rus Formation following the leaching of CaSO₄, leaving a calcium carbonate enriched residual which does not contaminate the groundwater with gypsum, as occurs in the gypsum enriched facies. Groundwater salinity is lower in the leached zone than it is in the remnant gypseous zone.

The near coastal salinity shown in the salinity map is greater than 30,000 ppm (mg/L), which is consistent with sea water salinity of 35,000 mg/L TDS. While the freshest water is
shown as being well inland of the coast this is the result of two factors. Firstly, there has been a significant inland intrusion of the seawater wedge as a consequence of the depletion of the freshwater lens in the post-development era with the rate of sea water ingress into the aquifer has been recorded as being as high as 1 km/yr in the north (Macumber, 2009). Secondly, much of the data comes from drilled bores rather than hand-dug wells and the bores are generally deeper, passing through and being screened in saline intervals below the thin freshwater lens in near-coastal settings.

Figure 32 Qatar relief and groundwater salinity (based on data from Dastane and Al-Faihani, 1980)
The earlier coastal hand-dug wells, on the other hand, tapped the top of the freshwater lens, as was the case at Murayr, near Al Zubarah, skimming the uppermost fresh water for domestic use and in some cases for irrigation (Macumber, 2009; 2011).

The broad distribution of fresher water encompasses the area shown in the 1980 FAO Report as that where agriculture was mostly practiced. The borehole data supporting this is shown in Figure 2. Dastane and Al-Faihani (1980) note that in the south, fresher water of marginal quality occurs perched above the more saline regional water, except in a narrow zone near Dukhan where a small freshwater lens occurs, sitting directly on the saline water. They also show irrigation as only occurring scattered in the north with a main concentration of farming northeast of Jamailiyah, and a water well field to the north of Rawdat Rashid. However the salinity in the wellfield was marginal, ranging from 1284 to 2700 mg/L (FAO 1974). By contrast a wellfield near Al Jamailiyah had salinities of about 500 mg/L.

1.4.4.1 Isolated groundwater occurrences and areas of settlement in the south and west

Despite having a lower rainfall, it was also observed by Eccleston et al., (1981) that in the south, vegetation is more abundant permitted by a higher retention of infiltration near the surface. This is perhaps more a property of the sandier soils which permit faster infiltration into the shallow subsurface than in the case in the north, where the higher clay content of the rawdah soils tends to slow recharge. While a broad generalized view of groundwater salinity across Qatar is provided by the various salinity maps, a number of isolated areas are shown on Dastane and Al-Faihani (Figure 32) where fresh groundwater with a salinity of less than 1000 mg/L exists in otherwise saline settings - such as to the south of Turayna and to the east of Umm Bab near Al Kharsa. It is likely that the fresher water represents several of a number of areas where despite deep regional water tables, localized recharge creates perched groundwater lying above the regional system. The latter situation was earlier suggested by Dastane and Al-Faihani (1980) who noted that in southern Qatar, fresh groundwater is confined to perched systems.

2 Regional investigations

It is clear that landscape relief and salinity play important roles in governing those areas where more permanent occupation and settlement may have occurred in the past, whatever
the time scale. The variable distribution of these two factors suggests that for occupation, the physical environment in the north of Qatar was far more hospitable than that in the south. In order to further test observations on landscape and occupation, a number of traverses were carried out, concentrating in the south but also re-examining areas in the north (Macumber, 2009, 2010, and 2011a and 2011b). This includes areas where earlier workers such as Kapel (1967), De Cardi (1973) and the French Mission archéologique française à Qatar who had demonstrated and excavated early occupation sites, such as at Shagra (Inizan, 1988), the Acila Depression and Al Khor (Inizan, 1982) and Tixier (1980). The Acila Depression to the east of Umm Bab (locality 'A' on Figure 33) was the centre of a study by the French who observed numerous surface scatters of early industries. In these instances sites were at low elevations in the landscape well within reach of the water table, with Al Khor and the Acila Depression representing northern locations with favourable hydrological settings, both with a shallow depth to water table and reasonable groundwater quality. While the Shagra site located in the south had a shallow water table, it was on the then (mid-Holocene) coast (Figure 79) and would have relied on local runoff probably collecting in shallow depressions in the dense limestone surfaces that made up the remnant Pleistocene strand line landscape (Figure 90).

Palaeogeography was important in site investigations in the south, since the southern coastline of Qatar has a number of large embayments which existed in mid-Holocene times when sea levels were higher than those at present. Adopting the 3 m contour as a mark of the then sea level, an approximation of the inland limits of the mid-Holocene sea level from 7000-4000 yr BP was obtained. At the time, a narrower peninsular connected Qatar and Saudi Arabia. This is shown as a corridor lying to the west of Sauda Nathil (Figure 33-locality G - and Figure 34). The lower adjoining areas not underwater were probably inter-tidal or active sabkha. This corridor would have been the principal (perhaps only) overland route taken for travel between the two countries. The corridor and surrounding areas provide a focus for future archaeological investigation.
Figure 33  The 40 m contour and 3 m contour (blue) of Qatar showing highland depressions and the approximate extent of the transgression of the mid Holocene sea
There were several different approaches to examining the relationship between water and occupation potential across different landscapes. One was to obtain perspective by re-examining the environmental and hydrological settings of a number of previously described sites in the south, starting with Shagra. The Shagra site in SE Qatar, perhaps best known for its fisherman's hut, is one of the earliest sites in Qatar. The Shagra site, excavated in 1982, provided an un-calibrated date of 7,520 ± 90 BP on marine shells (Inizan, 1988). Shagra was located in a depression on a Pleistocene strand line overlooking the sea during the phase of Holocene high sea levels. It now lies about 6 km inland from the Sealine Beach resort on the present coast. Priority in the 2012 field season was initially given to re-locating Shagra, as it was considered that this site may provide an understanding on the nature of early occupation (7,500-5000 yr BP) at a time when sea levels were higher and the southern coastline was strongly indented with large embayments.

2.1 Occupation in areas where there is little or no potable groundwater water

The above discussion is focused on the conditions required for settlement in Qatar; however there is strong evidence that people visited the less hospitable areas regularly, usually during
favourable seasons, when storm water temporarily ponded in the rawdah or accumulated in basins in the limestone, as probably occurred in the fossil shoreline and aeolianite areas in the vicinity of Shagra (see below). A fresh water requirement was not necessary for travel either within Qatar or on journeys to and fro between Qatar and Saudi Arabia, since camels are able to drink brackish to moderately saline water (Farid, 1989) and produce (fresh) milk. In this respect, they may be considered as portable desalination plants. Camel wells, established where groundwater was too saline for human consumption, enabled movement through areas where no potable groundwater existed, as was the case of much of southern Qatar. A historically well known example is at Muqshin on the edge of the a'Rub al Khali in central Oman where brackish groundwater upwells in Wadi Muqshin and rapidly becomes saline on evaporation. However the uppermost wadi areas and the wells around Muqshin have water with a salinity of 9,000 mg/L, unsuitable for drinking but quite suitable for camels. Muqshin was a starting point for journeys westward into the a'Rub al Khali. As Thesinger (1959) wrote of another case in Arabian Sands - “We tasted the water, but it was too brackish to drink; the thirsty camels, however, drank as if they could never have enough”. Sites associated with camel wells are described in De Cardi, and one such well occurs adjacent to the high aeolianite outcrop to the north of Shagra where a number of artefacts and pottery were found (Figure 92).

3 Preliminary assessment of occupation potential in the south based on environmental considerations

The three seasons and part of the fourth season from 2009-2012 focused in the north of Qatar, and progressively pointed to more significant occupation than was previously understood. This was especially the case in Abbasid times, as reflected by the greatly increased number of linear settlements which are now recognized. However, while there was relatively little comparable work carried out in the south during Season 4, there is strong evidence that the water availability and potability favourable for settlement in pre-modern times in northern Qatar were not similarly present. This disparity was further explored in 2012 on the basis of records available from the 1950s through to the early 1980s covering the period of initial modernization of Qatar. In order to further test this understanding, part of the 2012 field season was devoted to inspection of southern areas which tested the hypotheses including both landscapes and archaeological sites previously recorded by De Cardi and the French Expeditions of the 1960s, 1970s and 1980s.
The approach encompassed:

1. A reconnaissance was undertaken to locate Shagra and examine the areas adjacent to the mid-Holocene shore line near Shagra: this included the small peninsulas protruding into the mid-Holocene sea on which Shagra occurs.

2. Attempts were made to find sites previously recorded by De Cardi (1973) in the south, and examine their location relative to the landscape in which they occurred. Of additional interest was the relationship of sites to the narrow isthmus that connected Qatar to Saudi Arabia when the sea level came furthest inland between 7,500 and 4,000 yr BP.

3. An inspection was made of the larger, higher level inland depressions where settlement (if present) would have relied on locally recharged freshwater lenses, wherever the lenses were within reach from the surface by hand-dug wells. To this end, the 40 m elevation contour provides a basis for examining the distribution of the larger depressions, (except in a few cases such as the depression to the east of Karanah where the depression rim is defined by the 50 m contour, the floor more generally at 40 m, and the lowest point at 29 m). In these instances, while the inspections were wide ranging, no detailed survey work was carried out. They were sufficient, however, to enable a comparison between occupation density and form in the south with that in the north. The work was commonly interrupted by sand storms, reflecting the sandy nature of the south, and perhaps the time of the year. During the excavation at Shagra in 1982, Inizan notes that the work was interrupted because of a prolonged sand storm.

3.1 The nature of a localized freshwater lens - the Ma'abar Depression, Al Wusta, Oman

For perspective on the nature of a freshwater lens likely to have developed in a similar topographic, climatic and geological setting to those of the Turayna and Karanah Depressions in Qatar, reference was made to the hydrogeological study of the Ma'abar Depression in the hyper-arid central Oman desert (Macumber 1994; 2003) where a small number of bores were used to irrigate several small farms in the southern of the depression (Macumber et al, 1994). The floor of the Ma'abar Depression lies 5-10 m below the surrounding Eocene limestone plain and 19 bore holes were drilled in a number of section lines across the depression. In
general the groundwater in Al Wusta is saline, other than where such localized freshwater lenses have developed, with fresher groundwater occurring at depths of 50 m or more below the surface (Figure 36 to Figure 38).

Figure 35  The Karanah, Turayna and Ancila depressions (contoured), De Cardi sites (numbered), the mid-Holocene shoreline, Shagra site and the connection with Saudi Arabia
Figure 36  Ma'abar Depression, Al Wusta, Oman

Figure 37 W-E Section through the freshwater lens at the Ma'abar Depression, central Oman (diagrammatic)

Figure 38 Depth and thickness of the freshwater lens at the Ma'abar Depression, central Oman - diagrammatic
The Ma'abar Depression consists of a number of shallow linked depressions extending for about 25 km in a NE-SW direction. It is a maximum of 4 km wide. A drilling program, covering the entire length and breadth of the depression, showed that the freshwater lens was restricted to a southern sub-basin where the lens is about 4 km long and 1 km wide. In the area underlain by fresh water, surface water ponds during infrequent heavy rainfall events and recharges the limestone aquifer. Recharge is enhanced by localized run-off from the basin sides and by a small wadi which enters the Ma'abar depression from the south. A second freshwater lens occurs in the Haima Depression about 30 km to the west, and studies covering both the Ma'abar and Haima Depressions study show that the top of the freshwater lens is only a little higher in elevation than the top of the deeper adjacent saline water table. The 19 bores at Ma'abar were sampled vertically at 5 m intervals during drilling for both chemistry and stable isotopes (Macumber, 2003).

The high tritium values recorded in the Karanah Depression suggest that a similar situation may exist beneath some of the larger Qatari depressions, and if fresher water were attainable by hand-dug wells, more permanent occupation may have been possible. An objective therefore was to examine these depressions to see if evidence for occupation might be present, including that based around hand-dug wells.

3.2 Selected depressions in the south

3.2.1 Karanah Depression

The Karanah Depression (locality: site 'E', (Figure 39)) is a large N-S depression lying to the east of Karanah on the Salwa Road. High tritium levels were recorded in a number of bores indicating significant modern groundwater recharge within the past 50 years, and perhaps the presence of a freshwater lens. The tritium values are shown in Figure 38 (in red), with highest values (between 21.4 and 67.5) to the north of Karanah.

The rim is at an elevation of about 50 m ASL, while the floor of the Karanah Depression is mostly between 30-40 m, but reaches a low of 29 m in the central area to the south of Karanah, at Umm al Jarathim, to the south of Karanah. Given a potentiometric surface of about 4 m above sea level, the depth to the water table beneath Umm al Jarathim, whatever its salinity, would have been at a depth of about 25 m below the ground surface.
The surface of the Karanah Depression is markedly different in the north and south. In the north, the landscape is more stony with large areas of rocky broken surface, while in the south the base of the depression is a flatter, even surface. A number of bevelled surfaces form the edge of the depression. In both cases small sparsely treed depressions occur. A number of sparsely treed depressions were observed in the north; however ruins in the form of a two-room moderately recent structure were observed in one instance (Figure 40 and Figure 41).

Figure 39 The Karanah Depression (marked by 50 m contour) showing wells where high tritium content indicated significant groundwater recharge. Tritium values are shown in red as tritium units.
Figure 40 Lightly treed depression with walls in the foreground - K aranah Depression

Figure 41 Ruins consisting of a two-room structure on the edge of a rocky, treed depression northern K aranah depression.

Figure 42 Flat landscape of the southern depression, showing alluviated floor - southern K aranah Depression
Figure 43 Circular structure - southern Karanah Depression

Figure 44 Qibla with mihrab - southern Karanah depression

Figure 45 Small structure near (above) mosque on the edge of a lightly vegetated depression
Summary: while a detailed examination of the Karanah Depression is necessary before a proper assessment is made of the occupation status, the brief examination here indicated some limited structures including a small mosque associated with small sparsely treed depressions. Although indications of (seasonal) visitations were present, there was little evidence of pre-modern permanent settlement, and the walls shown in Figure 40 and Figure 41 represent more recent occupation.

3.2.2 The Turayna Depression and surroundings
The Turayna Depression lies to the south of the Karanah Depression and is elongated in a similar direction, suggesting that they are both structurally controlled (Figure 48). Only the 50, 40 and 30 m contours are marked, but they clearly show the landscape asymmetry on passing eastwards across southern Qatar, evident from the surface shown in Figure 30.
Approximate positions of numbered sites previously recorded by De Cardi (1973) are shown, one of which occurs in the northern-most area of the depression (site 38) and two others to the southeast, beyond the depression (site 33 and 34 - Figure 48). The rim of the depression is at about 50 m, while the deepest parts of the depression in the south lie at elevations of about 30 m, and in this respect they are at similar level to the low points in the Karanah Depression (29 m). The depression is not fully enclosed by the 40 m contour, while the 30 m contour passes unbroken across the outlet, suggesting that whatever drainage may have occurred in the past (or at present) is graded to that level. Evidence of incipient drainage probably following storms, in the form of eroded banks was present in places along the depression.

Figure 48   Southern Qatar showing the Turayna Depression and surroundings, with numbered De Cardi sites
Figure 49 shows the Turayna Depression incised into a terrace-like surface developed between the 40 and 50 m contours with its base about 30 m. It is uncertain as to whether the terrace is a structural bench or an erosional feature. From Figure 30, it can be estimated that the depth of the water table under the pre-modern regime was about 25 m or more, which was probably beyond the depth of hand-dug wells. This may not have been the case during the latter part of the wetter period, between 6000-7000 years BP. Evidence of stream activity is seen in the incision of the wadi floor. Flow events reflected by the incision are likely to have also been recharge events into the limestone aquifer.

Towards the southern (lower) end, outlined by the 40 m contour, the depression narrows to a small neck prior to opening onto the plain. A number of features are present in the small
semi-treed basins. They include a farmlet and circular sites associated with burned and splintered bone. Although much of the floor of the depression is bare or covered with sand, there are a number of small sub-basins in and adjacent to the depressions that have thinly scattered vegetation. On the northern edge of the Turayna Depression in a small treed depression was a small mosque consisting of a mihrab and low qibla wall (Figure 52 and Figure 53).

Figure 51  South-eastern part of Turayna Depression with locations of the mosque, farmlet and site with burned bone in treed basins

Figure 52  Stony and sandy depression floor at mosque site (top left)
Figure 53 Mosque in a small sparsely treed depression on the edge of the Turayna Depression

Figure 54 Lightly treed and grassed depression, adjacent to higher areas with structures and burned bone (foreground)

Figure 55 Structures on higher ground, adjacent to the treed depression
Figure 56  Structures on higher ground adjacent to the treed depression - during sand storm

Figure 57  Burned and shattered bone on the ground alongside structures

Figure 58  Burned and shattered bone (detail)
The floor of the Turayna Depression became flatter and sandier on passing up-basin and while a number of sparsely vegetated depressions were examined, there was no indication of significant occupation comparable with that occurring in the north. De Cardi (1973) considers her site 38 (locality Figure 48) which occurs in the northern part of the Turayna depression, as an intermittently used camping ground. This is likely to be the case with other sites in the depression, as is also suggested by the presence of the isolated mosque (Figure 53).

3.3 Areas to the east of the Turayna Depression

3.3.1 De Cardi sites 38, at the western limits, and sites 34 and 35 to the east of the Turayna Depression

Site 38 is at the western limit of the Turayna Depression, where it merges with the plains. The location of De Cardi sites 33 and 34 (locality Figure 48 and Figure 60) are down-valley from the mouth of the Turayna Depression, but also to the north of Khor al Udayd. Several other sites were also recorded in the region. The Al Udayd sites 'B1-4', and the village ruin "V" (Figure 60). The Shagra site, located in this survey alongside the G-8 triangulation point, is also shown on the mid-Holocene inland shoreline roughly marked by the 3 m contour.

The sites lie at elevations of between 10 and 30 m above sea level, and there is a steep southwards fall to the coast. Site 34 lies just to the west of the main track passing southwards through Turayna. Although not recorded by de Cardi, a further site of an abandoned village (Site "V"), now a ruin, lies 3.5 km to the north of site 33. Site 33 is close to the Khor al Udayd.

Figure 59   Landscape adjacent to Khor al Udayd (background)
3.3.2 De Cardi Site 38, Al-Huraithi district - uppermost catchment of the Turayna Depression.

De Cardi (1973) notes that: to the east of the new road to Sauda Nathil a scatter of potsherds and dreikanters lay on the plain near a ruined dwelling. The sherds, of sixteenth- to nineteenth-century date, extend to the foot of the mesa and occur also on some of the small terraces leading up to the top of the plateau. The area was probably used intermittently as a camping-ground and several stone-built graves were noted on a hillock in the same area.

The flat plain on which Site 38 occurs has several modern houses/farms on it (Figure 61). It lies at the far western edge of the Turayna Depression. There is little likelihood of concentrated surface run-off to provide significant recharge supporting any permanency of occupation. De Cardi’s description of the site as being an intermittent camping ground readily matches the landscape.
3.3.3 De Cardi Site 34. Al-Qusairah (Gusaurah)

De Cardi notes: The Danish Expedition had located a site on level ground behind a dune on which both flint implements, and pottery were noted and reference was made to a cairn nearby (Kapel, 1965, 155; 190.36, Site Q.62.8). An attempt was made to visit the area in order to check on the nature of the pottery but it proved impossible to find the site. Instead, several cairns and a camping-ground were noted in a large depression enclosed by relatively high rocky ridges. Stretches of abandoned cultivation occurred on patches of silt, and its sheltered position makes it likely that the area has been occupied from time to time for centuries although none of the surface pottery could be ascribed to a date prior to the seventeenth century – De Cardi 1973.

3.3.3.1 Landscape in the vicinity of De Cardi’s site 34 at Al-Qusairah

De Cardi’s site 34 lies down-basin of the Turayna Depression and a little to the south of Al-Qusairah, which in turn, lies near the junction of the main north-south track from Turayna and a track passing eastwards to San Ad Dhiban and San al Fuzaylan. The landscape in the vicinity of Al Qusairah and site 34 is rocky and broken (Figure 62) with large basins containing small grassed depressions. Unlike the rawdah in the north the depressions commonly have steep edges (Figure 62 and Figure 63). The broken nature of the region is probably in part a reflection of its proximity to the mouth of the Turayna Depression and perhaps from headward erosion by small coastward passing wadis. It may also reflect structural movements associated with a faulting system affecting the Turayna and Karanah basins. It is likely that the depressions would hold water for periods after heavy storms, and in one sandy depression a tiered cistern-like dam was constructed (Figure 64). It is notable that De Cardi records that in the Qusairah area there were stretches of abandoned cultivation, and it may have been occupied from time to time over centuries. Whether the Turayna Depression acts as a catchment area for surface and / or groundwater flow into the Qusairah district requires additional investigation.
Figure 62  Rocky landscape with rimmed depressions near Qusairah

Figure 63  Large rimmed depression in the vicinity of Qusairah

Figure 64  Tiered walls and dam at the base of a depression, fed by a number of inlets
3.3.4 Ruins near San Al Fuzaylan
About 4.5 km east of its junction track from Turayna, on the track passing eastwards, lie the ruins of a small settlement roughly located between San adh Dhi’ban and San al Fuzaylan. At San Adh Dhi’ban there was a large Bedouin encampment in a treed depression. The ruins were located on another treed depression about 1 kilometre to the northeast in a small, sandy wadi with a central walled well (Figure 67). It is likely that the sandy wadi floor enabled sufficient infiltration to permit a small localized groundwater lens to develop. A feature of the site was the presence of two mosques - a smaller one in the wadi (Figure 68) and a larger one on the rim, overlooking the village (Figure 66). The smaller of the two mosques had a small mound at the southern end of the qibla wall, a feature earlier observed in the mosque in the Turayna Depression (Figure 53).
Figure 67 Walled well in wadi

Figure 68 Small mosque in wadi.

Figure 69 Square (upper middle ground) and circular structures (centre right) on the wadi floor
Figure 70  Circular structure with central raised area on the wadi floor

Figure 71  Two roomed structure on the wadi floor.

Figure 72  Hill overlooking the wadi with large mosque on the skyline
3.3.5  De Cardi Site 33 - Khor Al Odeid

De Cardi (1973) notes: A cairn and some surface pottery were found on a stretch of ancient coastline near the main track leading west from al-Odeid Police Post. The pottery was scanty but included a coarse hand-made pink ware containing large white grits, cream-slipped externally; part of a cylindrical vessel, and a flat base with slight internal knop—a feature not noted on pottery found elsewhere in Qatar. No date could be ascribed to these sherds. Three tile scrapers were collected in the same area.

A group of cairns was located on rising ground looking south towards the inlet about 5 km. to the east of al-Qusairah. The cairns lie north of the coastal track in an area which contained another feature of interest. This appeared to be a prominent hillock bearing traces of masonry which may represent the remains of a hum or a dwelling. In the same area and along a level stretch leading towards the track were a number of shallow pits, possibly old camp fire-pits to judge from the ash in several of them. No pottery was found either on the hillock or near the cairns and their date is unknown.

3.3.5.1  The Al Udayd Sites to the south of De Cardi’s site 33

In the Al Udayd area there were a number of features noted close to the main west-east track about 2 km to the south of De Cardi’s site 33 (marked as ‘Al-Udayd’ - Figure 48). These include three small stone circles and several cairns (site B1-4, Figure 60). The proximity of the Khor Al Udayd is shown in the background of the cairns in Figure 74.
Figure 74  Cairns at Al Udayd site "B 1-4" of Figure 71. Khor Al Udayd in the background

Figure 75 Site B1-4 Small circular structure - Khor Udayd in background

Figure 76 Site B1-4 Small structure with two compartments
3.4 Area to the south-east of Turayna

Alongside a track which passes south east from Turayna is a small mosque in a sandy lightly treed depression. The mosque is typical of a number of similar mosques scattered throughout the southern desert in Qatar, and consists only of qibla and mihrab.

Figure 77 Mosque consisting of qibla and mihrab on the track SE of Turayna in a lightly treed sandy depression

In a more general sense, the isolated qibla-mihrab mosques found scattered across the landscape in the sandy treed depressions of southern Qatar are indicative of a through-moving nomadic population, where regionally sourced potable water was either absent, and water if present occurred as small localized recharge lenses or as ephemeral pools or shallow
groundwater often present only after storms. Whatever the case, shallow brackish hand-dug wells, wherever present, were a perennial source of drinking water for camels. The picture is one which is supported by De Cardi’s observations that the sites she observed often represented intermittent camping grounds. This was also the case with most of the sites observed during the southern reconnaissance.

While the qibla-mihrab mosques are a feature of southern Qatar, they are also found in the north, where they are interspersed with the more common walled mosques, and permanent settlements. The form, distribution and numbers of the mosques perhaps best reflects the different hydrological settings across Qatar. Yet in the north, away from the larger settlements, qibla-mihrab mosques are also found. One of the most interesting mosques located during the reconnaissance was that at Haddayah, where a simple qibla-mihrab mosque was located at the north-east end of an Abbasid linear settlement (Figure 101).

4 Al Shagra?

4.1 Re-location

As part of the Copenhagen University initiative in Qatar, an objective was to gain further perspective on the relationship between occupation and the physical environment (past and present) across Qatar. This sought to establish the relationship existing between occupation on the one hand and the environment - groundwater occurrence (and potability), geomorphology, paleoclimatology and sea level changes - on the other. That is, to examine where and how people lived in pre-modern Qatar, given its low relief and lack of surface water. While the main thrust in the previous three years has been in northern Qatar, it was considered that a more balanced perspective could be had by examining and comparing the northern situation with selected areas and sites across southern Qatar.

Of special importance to this objective was re-finding the 7,000 year old site at Shagra, excavated by the French in 1982, since, apart from having the oldest discovered house in Qatar (a fisherman’s hut), it might provide perspective on what to look for elsewhere in the south, especially in similar paleoenvironments, which are recurrent down the SE coastline and along the shores of the Inland Sea. An initial attempt to pursue this objective was carried out in 2011, by approaching the area of the Shagra Camel Station from the west. However, this was unsuccessful, and only afterwards it was found that the Shagra archaeological site is
wrongly placed on the French maps, being shown as about 4 km to the south-east of the Shagra camel station. It was discovered early this season (2012) by means of an airphoto (Fig 46) in Inizan Vol 2 MAFQ that it was to the north-east not the south-east of the camel station, and lay in the vicinity of the G08 Triangulation (Trig) Point (coordinates 51.42836 E, 24.85163 N) located on an ancient Pleistocene marine strand line (Figure 82).

4.2 Shagra fisherman's hut

The following extracts are taken from Inizan: Mission Archeologique Francais to Qatar (MAFQ) Vol 2 which clearly identifies the locality as being close to Triangulation Point G8, located about 6 km west of Sealine Beach:

The French note - *The preliminary study of aerial photographs (Fig. 46), enlarged to a scale of 1/50,000, has permitted a systematic and precise survey" - Inizan , MAFQ Vol2 2 p 99. and that "the fragments of former Quaternary marine (strandline) emerging from the dunes as G.8 (geodetic point) form a bar 2 km long with an altitude of several meters or even small massifs to the north of a vast salt lake.*

“Discovery of a structure

A concentration of lithic artifacts was initially noticed around triangulation point G8. Further inspection revealed an oval structure (5 x 3 m) which sloped gently to the south and was delimited by partially embedded sandstone slabs. The association of artifacts and structure seemed sufficiently coherent to justify excavation - and

The fragments of former Quaternary marine emerging from the dunes at G.8 (geodetic point) form a bar 2 km long with an altitude of several meters or even small massifs to the north of a vast salt lake. The presence and the relative wealth of lithic assemblages counted on the Quaternary marine surface not only pose the problem of the date and duration of these occupations, but also the significance of their geographical situation.

It is also in this region that H. Kapel obtained in 1965 the first radiocarbon date for a layer for which the industry is only lithic, from flakes debitage (5020 ± 130 B.C.).

The airphoto (Fig 46) showing the general district in the Inizan report, was turned at 90 degrees to north. On righting it, a match was found from both Bing and Google Earth (see below) using the N-S white arcuate Pleistocene strand line, shown in the north of the figure.
Figure 80. The Shagra site (as does Trig Point G8) lies on a further strongly dissected ancient ENE-WSW beach ridge strand line further south (Figure 81).

A white terrace of marine sediments forms a pediment to the eroded strand line and this represents a boundary of rising ground to the north of the mid-Holocene (Flandrian) shoreline. The transgression created a number of similar marine embayments along the south-eastern shoreline of Qatar. A simple topographic figure based on data from the NASA Shuttle Radar Topography Mission (SRTM) enables an view of the topography at the time except for the line of high peaks along the present coast to the south of Sealine Beach, which is the modern coastal dune system (Figure 79).

There are several views on the age of the Pleistocene strand lines. The traditional view based on sea level curves, is they may represent the second- last marine transgression to impact on Qatar, which occurred in the Eemian Period about 113-120,000 years ago (Macumber, 2011). An alternate, more recent view, is that the palaeo dunes and terraces commonly attributed to the Eemian period formed more recently, only 20-45,000 years ago (Wood 2011; Jerry Jameson pers. com.), and that their present elevated position reflects uplift along the southern margins of the Gulf. Vita-Finzi (1973) obtained a radiocarbon date a little further to the west of G8 on shells from the strandline of > 35,000 years, while Dr Jerry Jameson (pers com) has additional more recent dates. Whatever the case, during the time of the later Flandrian transgression from ca 7000 to 4000 yr. BP, the older Pleistocene strand line at the Shagra site
bordered the transgression (Figure 79). It was previously noted in Inizan (988), that Shagra was on the seashore (see below). The ENE-WSW Pleistocene strand line feature is clearly visible on the enlarged Google and Bing photos (Figure 81).

Figure 80 a and b. Re-oriented Air photo from MAF report (left) with matched figure from Bing (right)
Note N-S arcuate strand line and 'G8' marked in the bottom of the MAF picture

Figure 81 Picture from Bing with red Trig point 'G-8' shown, and the ENE-WSW strand line passing through G8
Inizan (1988) notes that at G8, retouched bifacials dominate:

The prehistoric inhabitants settled in a depression of the ancient consolidated Quaternary; indeed, the area of occupation is surrounded by heavily eroded mounds of sand in the form of consolidated sandstone that dominate still; the geodesic point G.8 located 2 meters above the structure has as its absolute elevation 29# meters - Inizan p 124.

The topography and the recording of the structure have been carried out (fig. 48). The proximity of the geodetic point G.8 helped connect it to the grid and specify the location of the structure in the morphology of the landscape - Inizan p 99

The remains are only lithics along the high bar and only alongside the sabkha the lithic industry left on site is very sparse. At G.8 the technique of retouched bifacials dominates but it is not exclusive since 28 meters southwest of point G.8 a ridged blade and a blade tip on a shaft have been collected; they are identical to those from sites 36"*

*Site 36 is in or adjacent to the Acila Depression east of Umm Bab).

# The elevation of 29 m is clearly wrong, as G8 is shown as being at a height of about 8 m on available maps and this fits with the floor of the adjacent sabkha being only several meters above sea level

In the vicinity of G8 are four heavily corroded iron marker pegs (French?), three still in the ground, of which two are shown in Figure 83.
Figure 83 Corroded iron pegs in the sand near trig point G8 – perhaps marking the excavation site and hence the structure. Note the corrosion on the nearer peg.

From the above it seems clear then that the location of the Shagra excavation area lies in the immediate vicinity of the G8 trig point (see note below), where perhaps the site was originally discovered during its establishment.

**Location of Fisherman’s hut** (Inizan, 1988)

*It is therefore with surprise, after identifying a concentration of lithic items around geodetic point G.8, that an oval structure, limited by vertical ‘daile’ partially buried, was found (fig. 47). It is currently protected by a rounded barchan dune that dominates it, the advance guard of a dune extending over several hundred meters to the north.*

The precise position of the French excavation is not clear however the most likely place is within a short distance (a few tens of metres) north of G8 perhaps marked in part by the iron pegs (Figure 83). Nearby cars have left numerous tracks across the suspected site as they have driven from the dunes onto a depression in the ancient shoreline sequence near G8 (Figure 87).
While there was no significant density of stone material, small pieces of flaked brown vitreous chert not native to the site were present at the time of a short visit, and a small limestone scraper was obtained. Inizan (1988) notes: “This group which practiced coastal fishing, was probably established on the seashore close to where the nearby sabkha marks the former shoreline, during the maximum of the Flandrian transgression here six or seven thousand years ago.”
The site is on the edge of a marine embayment of the Flandrian sea, with rising ground to the north and south. The Pleistocene strand line along the border of the rising ground also marks the limit of the later mid-Holocene transgression.

“A date was obtained from marine shells: 7520 ± 90 BP (Gif sur Yvette5938). That date, uncorrected, seems somewhat old if we admit that the “stalked points on blade” have preceded arrowheads with fins. Recall that 6,970 ± 130 BP is the only date obtained in Qatar for a deposit that has stalked points located close to Shagra” - Inizan - p 124.
Summary: The data in Inizan - *Mission Archéologique Française en Qatar, Volume 2* closely links the Shagra archaeological site and the excavation with the G8 trig point. Although the exact position of the excavation in the rocky, broken and sand-encroached topography at G8 remains to be identified, there are very few areas close to G8 where it might be. The most likely location is that shown in Figure 83 where two iron marker pegs protrude from the sand.

### 4.3 Archaeological potential in the vicinity of Shagra

The WSW-ENE strand line (Fig. 3) on which Shagra lies is one of a several strand lines in the vicinity of Shagra, the next most prominent being the N-S line shown in Figure 81.

A cursory examination of the area shows that the most favourable area for early occupation lies around a high aeolianite ridge outcropping about 2 km to the northeast of the northern end of the N-S strand line, in the vicinity of 24.9098 N 51.466367 E (Figure 91). It contains the trip point G07. The aeolianite lies on a pediment formed across bedrock and Pleistocene sediments, bounded in turn by the 7000-4000 year BP shoreline. Small, brown vitreous chert debitage including flakes and blades, are present both on the shoreline and on the aeolianite ridge, their presence on the aeolianite ridge suggesting that they were transported there. Badly weathered, coarse pottery was also present. Today, there is a hand-dug well immediately to the east (24.90525 N, 51.468933 E), this being the only well sighted in the area, perhaps reflects localized recharge on the aeolianite with its large internal depressions.
(Figure 93). The well is in an area which would not have been inundated at the time of the Shagra occupation; however, no claim can be made to its age. Whatever the age, it is also likely that water collected in the many large rock-lined depressions within the aeolianite during storms throughout the Holocene period. The depressions also provide excellent protection from the winds, a situation described for the Shagra fisherman's hut.
There is a clear relationship between the Shagra site near G8, and the aeolianite site at G07, since both lie at high points in the landscape on peninsulars extending into and overlooking what would have been the mid-Holocene sea occupying embayments cutting into the Dammam Formation (Figure 94). The edge of the marine transgression is approximated by the 3 m contour, while the 6 m contour approximates the upper limits of the pediment formed as a wave-cut platform and marine terrace, developed at the time of the earlier transgression responsible for the Pleistocene aeolianite and shallow marine and beach sediments from which it was derived.

Elsewhere, to the north of the Shagra site, small structures were observed on and adjacent to the N-S strand lines (Figure 95 and Figure 96).
4.4 Region to the west of Shagra

Access to Shagra may be gained from a number of directions, the shortest track is from Sealine Beach; however, there is also access from the north and west from the small village of Al Khubayb, via the Shagra camel station located about 4 km to the southwest of the Shagra site. On the track passing SSE from Al Khubayb, a group of small limestone structures partially sand-covered occurs at 51.31579 E, 24.9710 N.
Figure 97 Stony plain and sand dune topography between A I K hubayb and the Shagra camel station

Figure 98 Group of structures on stony, rocky plain between A I K hubayb and the Shagra camel station

Figure 99 Structures on a stony, sandy and rocky plain between A I K hubayb and the Shagra camel station
5 Archaeological sites in north-western Qatar – a contrast to the south

To contrast the nature of sites between the south and the north, a number of sites were examined along the north-western coast-line and its immediate hinterland. Most are well known, but in a few instances new sites were uncovered. Of special interest was the small early Islamic (Abbasid?) linear village of Haddayah, where a small qibla and mihrab mosque was located at the north-eastern end of the village.

5.1 Al Haddayah linear village

An early overlap of the two scenarios represented by isolated qibla-mihrab mosques and larger settlement mosques is seen at Al Haddayah (Figure 102) in north western Qatar, where a qibla-mihrab mosque forms part of a small Abbasid linear settlement, near the town of Abu Sidrah, (Figure 103 and Figure 109) located about 17 km to the north of Jumalaya. Al Haddayah is the most south-westerly of the early Islamic linear villages so far identified in northern Qatar. The village lies on a ridge overlooking two treed depressions on the north and southern sides. The qibla wall lies roughly at right angles to the line of the village (Figure 101). Several graves were present adjacent to the houses and coarse grained pottery and turquoise glazed pottery were present (Figure 106).
A number of earlier cairn sites in the vicinity to the north (Figure 103) and a number of other cairn sites were recorded by De Cardi (1973) across the region.

Figure 101 Qibla with mihrab at the north-eastern end of the small linear village at Al Haddayah

The Al Haddayah linear village, as do the other linear villages, has a NE-SW orientation (Figure 110), and is constructed on a small watershed between two small variously vegetated depressions, lying at levels of only 6 m above sea level. The depressions occupy a larger N-S elongated depression, with the surrounding higher ground, especially to the east, providing a local catchment for run-off and recharge. It lies within the extended calcareous zone, with its better quality groundwater and given that the water table would have been at a depth of only 5-6 m, and therefore within easy reach by hand dug wells, it is likely that at the time of occupation the water supply came from wells located in the depressions.
Figure 103 Topographic map with Al Haddayah linear village and nearby cairns

Figure 104 Vegetated depression to the south of Al Haddayah with feeder drainage lines

Figure 105 Small house at Al Haddayah overlooking a vegetated depression
Figure 106  Turquoise glazed pottery from Al Haddayah

Figure 107  Sheep grazing in a depression at Al Haddayah

Figure 108  Lightly vegetated humpy depression floor showing a playette surface pattern suggestive of seasonally shallow water tables
5.1.1 Comparison with other linear structures

The central north western coast and further inland provides a marked contrast in occupation density to that in the south of the country, with innumerable sites scattered across the landscape. Much of this area lies within the extended zone of carbonate aquifer system where potable groundwater occurs. The nearest settlement to Al Haddayah featuring linear distribution of structures is at the large Abbasid site of Murwab, located about 12 km to the north and about 6.7 west of Na'man.
Murwab and Al Haddayah have a similar orientation to other linear villages in northern Qatar, such as that at Al Kilab (Macumber, 2011); in all three sites, turquoise glazed pottery was present.

The various linear villages observed across northern Qatar have a similar NE-SW alignment. Whatever the rationale for this alignment, using the Kaaba at Mecca as a focus, the directions for the three sites above taken from the most furthest of the structures in each case are:
### Table 1 - Alignment of selected linear villages

<table>
<thead>
<tr>
<th>Locality</th>
<th>*Alignment of structures</th>
<th>Direction of Kaaba (Mecca)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Umm al Kilab</td>
<td>237°</td>
<td>248° (-111.81°)</td>
</tr>
<tr>
<td>Murwab</td>
<td>241°</td>
<td>249° (-111.17°)</td>
</tr>
<tr>
<td>Al Haddayah</td>
<td>244°</td>
<td>249° (-110.66°)</td>
</tr>
</tbody>
</table>

* approximate

#The slight change in direction is explained by the difference in longitude and latitude of the three sites.

Along the coast and hinterland between Murwab and Al Haddayah are a large number of excavated sites (De Cardi, 1973), including those at Yoghbi and in the vicinity of Umm Al Ma. This area was not part of the reconnaissance but is included to emphasize the marked difference in archaeological content to that in the south. At Yoghbi there are active and infilled wells in the rawdah, and nearby small dams have been established across the rawdah floor. A water feature is filled from one of the wells. Wells are also a feature of a large forested area at Na’man, where the strong relationship between towns and rawdah is clearly seen with well defined drainage lines in the rawdah. The high density of sites along the central western coastline and further inland, an area contained within the zone of favourable groundwater, was in sharp contrast to that observed on the southern reconnaissance.

![Figure 113 - Excavations at Murwab](image-url)
Figure 114  House at Umm Al Ma

Figure 115 Excavated cairn sites at Umm Al Ma

Figure 116  Well in rawdah at Yoghbi
5.2 Fayshakh district

To the south of Al Haddayah and west of Jamayliyah, De Cardi recorded cairns sites (Sites 8 and 8a) located in the Fayshakh area.

5.2.1.1 De Cardi Sites 8a and 8b in the Fayshakh District
De Cardi observes in her Gazetteer that at Site 8a, Faishakh District:

Thirteen fairly well-preserved low cairns built of stone slabs were located on a former coastline overlooking sabkha near the main track skirting the coast to the south of Dawhat Fayshakh. They lie on rising ground from which it is possible to see Bir Hussein Police Post across the inlet. Midway up the stony hillside behind the cairns was an extensive scatter of flint debitage and some tools. The area appeared to be of some interest and it was accordingly left untouched for future study. And:
At site 8b. Faishakh District:

A group of six or more cairns built of piled stone slabs stands on the sabkha near a coastal track to the south-east of Dawhat Hussein. The cairns are of low profile with flattened tops and the majority show signs of disturbance. No pottery was found in their vicinity.

During this reconnaissance, a number of cairns were located at what appeared to be De Cardi’s site 8 on the edge of a lightly vegetated flat (sabkha?), which probably formed as a coastal embayment associated with Dawhat Fayshakh during the period of higher sea level in the mid-Holocene period. The flat lay at the bottom of a small drainage line rising on high ground to the east, its course being determined by two small faults (Figure 120). The wadi floor was unusually sandy and a government observation bore with water level recorder is established on the wadi floor, which is lightly treed, probably reflecting shallow groundwater. The sand would have enhanced recharge from localized runoff. A number of cairns were observed where De Cardi’s site 8 was estimated to be, and from where the Bir Hussein Police Station was visible across Dawhat Fayshakh. Between the cairns and the observation well are a number of structures which appeared to be earlier settlement walls and later Bedouin encampments. The structures and encampments imply fresh groundwater was occasionally present in the depression, probably at a shallow depth below the surface. While there is no indication of the age of the structures De Cardi observed "up the stony hillside behind the cairns was an extensive scatter of flint debitage and some tools. The area appeared to be of some interest and it was accordingly left untouched for future study." It is notable that the Aburuk Peninsular with its numerous sites including Neolithic sites at Bir Aburuk (site 4, Figure 125) lies directly across the Dahwat Fayshakh and the Dahwat Hussein (De Cardi, 1973) from the Fayshakh area.

Figure 119  Observation bore in the lightly treed, sandy wadi at Fayshakh
Figure 120  Geological map with location of De Cardi site 8 and additional sites, on the edge of a small wadi-fed depression flanked by fault lines.

Figure 121  Structures on the edge of the depression at Fayshakh
The suitability of Wadi Fayshakh as an occasional water source and therefore a basis for visitations and perhaps occasional settlement was also observed at a locality lying about 2 km eastwards of the observation bore. This may have been the actual site of Fayshakh, as shown on the earlier maps. Here a small mosque and a number of nearby structures, including graves, occur on either side of the track to Jumayliyah.
The Fayshakh occurrences and the higher density of sites in the vicinity is typical of much of the north-western and northern coastline and hinterland from Umm Bab in central western Qatar to Al Zubarah in the northwest and beyond Al Khor in the northeast. The higher density of occupation and/or frequent visitations in northern Qatar is readily seen in the sites around the Acila Depression of the Umm Bab region (Inizan, 1978; 1988) which appear to mark the southernmost limits of higher density occupation in the west, and is in sharp contrast to that observed further south.

5.3 Acila depression - a northern yardstick for southern sites

The Qatar B site at Shagra is one of the earliest sites in Qatar, with a date of 7,500 yr BP. It lies on the edge of one of the many promontories and embayments in the southeast of Qatar which existed at the time of the mid-Holocene high sea level. This was much the same age as sites near A cila in western Qatar to the north east of Umm Bab, between Al K harsa and Al Bhath, where a large number of archaeological sites ranging upwards in age from ca 7000 yr
old were described by the French Expedition to Qatar and by De Cardi. A number of additional sites were noted during this study.

The central western areas of Qatar lie outside the zone of better quality water defined by the extended carbonate zone (Figure 18), and to this extent have similarities with southern Qatar. Nevertheless, the areas perhaps represent the southern-most occurrence of higher density occupation observed across northern Qatar, spanning many time periods. Given the major physical hydrological constraints to occupation in southern Qatar outlined above, the Acila setting was adopted as a reference by which the mid-Holocene 'bay-promontory' landscape adjoining the south-eastern shoreline of Qatar could be compared. Unlike the large depressions in the south, the Acila Depression occupies a low position in the landscape, the base being only about 3 m above present sea level and its rim at ca 20m; it was perhaps connected to the coast at the height of the mid-Holocene transgression, however this is uncertain.

The published Acila sites (e.g. Site 36) are best known because of the artifacts, including blade arrowheads, comparable with material Pre-Pottery Neolithic B sites in Syria and Israel. Pollen analysis suggests that site 36 may have been situated alongside a lake ringed by halophytic plants, reeds, and trees, no doubt a watering hole that attracted game.

Figure 126 Small circular structure with a cairn in the background, near Al B hath
The French sites 13 to 27 shown in Inizan (1978) are found to the south of the depression on a high-level terrace, defined by the 20 m to 30 m contour, having Al Kharsa, where small grassed rawdah first appear, at its eastern limit. The cairn sites continue eastwards to beyond Al Kharsa (Figure 127 and Figure 131), which appears to have been an ongoing centre for occupation.

Figure 127 Landscape in the vicinity of the Acila Depression showing the approximate location of the French sites recorded by Inizan, (1988)
The precise localities of the French sites were not known, however, an attempt was undertaken to re-locate them, and in doing so examine their nature in the context of the surrounding (palaeo) landscape. In addition, a traverse was carried out along the northern and eastern end of the depression during which a number of additional cairn sites were noted. The nature of the plateau landscape was bare limestone surfaces with a thin stony cover, perhaps best seen at site 25 where limestone was taken from adjacent surface outcrop to construct
cairns. Comparatively good quality pebbly chert was widespread across the area providing a ready source for artefacts (Figure 133). As is the case across much of Qatar small circular structures were noted at a number of locations, however the most prominent features were the ubiquitous cairns, concentrated both on the terrace (French site 25 - Figure 131 and Figure 135), and overlooking the northern and eastern edges of the depression (Figure 131, Figure 136 and Figure 137).

![Figure 131 Sites observed in the area between Zughan Al Bahth and Al Kharsa - the numbered sites were taken from Inizan, 1988](image)

![Figure 132 Pebbly surface of the Acila terrace](image)
Figure 133  Chert pebbles on the A cila terrace floor

Figure 134  Small circular structure located on the flat pebbly terrace

Figure 135  Cairn at French site 25 - with a thin sequence of pebbles with scattered chert, overlying limestone
The high concentration of sites found on the terrace adjacent to the Acila depression is representative of the archaeological record along much of the north-western coastline, and across much of northern Qatar. On the high promontory to the west of the mid-Holocene embayment between Dukhan and Umm Bab, a number of sites were recorded by Kapel, De Cardi and the French Expedition to Qatar. They included sites ranging in age upwards from a 5th millennium BC Neolithic coastal settlement (Smith, 1973), with ‘Ubaid pottery occurring at the Da'asa Site 46 (locality - sites 45-47 De Cardi). Smith (1973) observes that the Da'asa site 46 where arrowheads were present, suggests a seasonal settlement.

A large number of cairn-fields were described (Buckley, 1973), and these feature across the north western country-side.
Figure 138  Dukhan - Umm Bab - Al Kharsa area with the French and De Cardi sites

Figure 139  Arrowheads from the Al Da'asa site 46 (Smith 1988)
Large cairn fields have been previously described from the Abaruk Peninsular (De Cardi, 1973), and further to the north along the coast various aged sites were described and excavations undertaken from a number of locations, such as Bir Husain (De Cardi), and at Umm al-Ma (Shreiber et al., 2008/9). South, beyond Umm al-Ma, is the most southerly known occurrence of an early Islamic linear village at Al Haddayah, with similarly aligned settlements at Murwab (Guerin and Al-Naimi, 2010) and others occurring scattered across northern Qatar to Umm Kilab, and Athbar in the far north west.

Similarly to the north on the Abaruk Peninsular a number of sites were described. A feature of the region overall is the presence of a low coastal terrace representing deposition during the Pleistocene high sea level (Figure 141). The terrace abuts higher deeply eroded limestone plateau sequences on which the cairns are a prominent feature. The terrace is also an important archaeological area since it borders the higher shore-line present during the mid-Holocene Flandrian transgression, and was a favourable area for chert accumulation and associated sites. This is the case at sites 7 and 6 to the east of Dukhan (locality Figure 138)

Figure 140  Excavated structure on the limestone plateau in the Dukhan area

Figure 141  Plateau-terrace landscape bordering the shoreline of the mid-Holocene sea
6 Conclusion and Discussion.

In Qatar there is no permanent surface water, and potable water was obtained from the groundwater system using shallow hand-dug wells. Permanent settlement was determined by the presence of potable groundwater within ready reach by hand-dug wells. The distribution and nature of the sites described here represent two markedly different physical settings, resulting primarily from groundwater availability and salinity distribution across Qatar.

In the north there is a wide diversity of occupation sites ranging from those representing temporary visitations to those of permanent settlement. Permanent settlement occurred in areas where there was potable groundwater within reach by shallow hand-dug wells, most commonly closer to the coast. In the south, there were relatively fewer settlements and instead occupation took the form of temporary encampments and visitations during and often in response to wet seasons or following discrete wet events.

In addition there was a more general passage across Qatar made possible by the ability of camels to utilize brackish to saline groundwater.

7 References


Al-Yousef (2003) – from Le Blanc, 2008 *Geological map of Qatar*


Macumber, P.G. 2011a Geomorphology, Hydrology and Occupation across North-Eastern Qatar. Geomorphological and Geoarchaeological Results from the Third Season of the Copenhagen University Study in Northern Qatar


Smith, G.H. (1973). Test excavations in the oasis of Bir Abaruk, in De Cardi, 1973


Appendix 2

REPORT ON THE FISH BONE FROM FREIHA AND AL ZUBARAH

Lisa Yeomans

1.1.1 Introduction
Past exploitation of the abundant fish resources resulted in fish bone forming a large proportion of the faunal material excavated from Al Zubarah and Freiha. During the 2011 to 2012 season progress was made on developing a fish bone reference collection, creating a reference guide for fish bone identification and starting to analyse the fish bone recovered from ZUEP01. The analysis of the fish bone began with the material recovered from two cooking rooms, Space 110 and Space 166, in two courtyards houses (Compound 1 and Compound 2). These two rooms produced large fish bone assemblages that derived from cooking activities and provide an interesting comparison of the diet in two Phase 5 courtyard houses. The information provided by the fish bone analysis will eventually allow a much greater interpretation of the use of marine resources and future research questions are also discussed.

1.1.2 Reference collection
A total of 62 specimens of fish have been prepared for the reference collection. These derive from 56 species of fish representing 37 families and cover the majority of the families of fish commonly found in the archaeological assemblage. The reference collection is, however, still incomplete and a small proportion of the archaeological material cannot yet be identified because of the gaps in the reference collection.

In addition to the creation of reference collection of bones, work has started on a guide to aid in the identification of fish bones using photographs of the reference bones and annotated drawings. An example of some of the work is shown in (Fish Bone-Fig 1)

1.1.3 Methodology
In the analysis of the archaeological material, after the initial sorting of fish bone from mammalian and bird bone, the different classes of bone were weighed and general description of the fish bone in the locus was noted. The next stage is to record the individual fish bones that can be identified to family, genus or species level. Not all elements of the fish skeleton are recorded due to the size of the available fish bone assemblages and the difficulty in identifying some elements to specific families or beyond. Previous researchers working on Arabian Gulf fish
assemblages (Beech 2004) and on fish bone assemblages in general (Colley 1990) selected specific elements to be recorded further. Elements recorded were the articular, basioccipital, cleithrum, dentary, hyomandibular, maxilla, post-temporal, premaxilla, opercular, quadrate, vertebra and vomer (Fish bone Fig 2). A few additional elements specific to certain species were recorded such as the pharyngeals of parrotfish.

1.1.4 Fish bone from cooking rooms in courtyard houses

Space 110 and Space 166 are two cooking rooms within two courtyard houses. The stratigraphic sequence in these rooms comprised of occupation deposits and trodden surfaces building up as tannūrs were used for cooking within the rooms. The tannūrs were replaced over time with the later tannūrs often cutting earlier ones. The occupation deposits yielded a substantial quantity of bone, of which the majority was fish bone. A large proportion of the fish bone from Space 110 and Space 166 has been recorded. However, an important part of the analysis of the fish bone from these rooms will be the material found within the numerous tannūrs that were excavated and fish bone from these features will be in the flotation samples taken from the tannūr fills. Additional flotation samples were taken from the occupation deposits so the recorded fish bone assemblage is not yet complete so a detailed statistical analysis of the fish bone is not yet possible.

In total 3832 fish bones have been identified to family, genus or species level with groupers (Serranidae), emperors (Lethrinidae) and seabream (Sparidae) dominating the assemblages from the cooking rooms in both courtyard houses. These families of fish are demersal and inhabit the coastal waters around Qatar. Of the groupers, the orange spotted grouper (Epinephelus coioides) is the most common species and occurs in coastal waters up to a depth of 100m inhabiting coastal reefs and brackish water associated with sand and mud substrates (Grandcourt et al 2005). Orange spotted groupers are commonly caught in dome-shaped fish traps set in strings sea floor. The same traps are often used to catch emperors which occur in near shore waters. The spangled emperor fish (Lethrinus nebulosus) for example occurs to a depth of 75m over a variety of habitats with large schools of juvenile fish found in shallow, sandy, sheltered water and adults living solitary or in small schools (Grandcourt et al 2006a). Several species of sparids have been identified within the archaeological assemblage. The kingsoldier bream (Argyrops spinifer) inhabits coastal waters from a depth of 100m over a range of substrates (Al Mamry et al 2009). Haffara or goldstripped seabream (Rhabdosargus sp.) and the various species of sparids with the Acanthopagrus genus also occur in shallow coastal waters (Grandcourt et al 2004). A large proportion of the fish consumed in the two courtyard houses were probably locally caught using fish traps (gargour).

Carangids are a large family of open water fish ranging from coastal to deeper waters. Amongst the species identified were queenfish (Scomberoides sp.) which are a species commonly caught
in intertidal fixed stake traps (hadza) (Al-Baz et al 2007) and still caught in the stone fish traps near Freiha. Further evidence for the use of the stone fish traps found in the intertidal are the bones of mojarra (Gerres sp.); this family of fish are often targeted by intertidal traps (Grandcourt et al 2006b). Other fish potentially caught in the stake traps are mullets and to lesser extent rabbitfish (Siganus sp.) and some species of seabream (Acanthopagrus latus).

Parrot fish were also well represented in the faunal assemblage and would have been caught near the local reefs. Lower proportions of fish from non-local waters are also present in the faunal assemblage from Spaces 110 and 166. Kingfish (Scomberomorus sp.) and tuna bones were present, although uncommon. These species of fish are more common in deeper waters to the northeast of Qatar. In addition to the species mentioned small numbers of other fish were present including sea catfish, needlefish, requiem shark, flathead and silver pomfret. At present the preliminary analysis suggests that the fish consumed in the two courtyard houses at ZUEP01 were similar. Both contained a high proportion of locally available fish caught using the gargour type of fish traps and to a lesser extent the intertidal hadza fish traps.

1.1.5 Future research questions

In the future, once more of the faunal material from Al Zubarah and Freiha is analysed it will be possible to address a wider range of questions relating to the use of fish. For instance how does the use of the marine resources vary spatially and temporally? Where different fishing methods used prior to the Phase 5 settlement? Did the higher status occupants of the compound excavated at ZUEP04 have access to different resources compared to the locally available fish consumed by those people living in the courtyard houses excavated at ZUEP01? How did the use of marine resources at Freiha compare to Al Zubarah?

Future research will also examine the fish preparation and cooking methods though the evidence of butchery marks and burning. Is there any evidence of drying and trading fish? Thin section analysis of otoliths and the presence of seasonal species such as the kingfish may also help us to examine the seasonal use of the site and tie into the evidence for the sequence of activities that took place throughout the year. Osteometric studies will be used to reconstruct the size of fish caught adding more information on the exploitation of fishes found at different depths and possible over exploitation of fish resulting in the diminution of fish and the capture of juvenile fish.


Ariidae
*Arius thalassinus*

Carangidae
*Carangoides malabaricus*

Carangidae
*Scomberoides commersonianus*
Appendix 3

Qatar Islamic Archaeology and Heritage Project Bibliography, 2. ed. (January 2013)

Publications:

Muhesen, S, al-Naimi, F. and Thuesen, I.

Petersen, A.
2011 Research on an Islamic period settlement at Ra’s Ushayriq in northern Qatar and some observations on the occurrence of date presses. *Proceedings of the Seminar for Arabian Studies* 41: 245-256

Petersen, A. and Grey, T. (with contribution by C. Rees)

Petersen, A. and Grey, T.

Rees, G. al-Nai’imi, F., Richter, T., Bystron, A. and Walmsley A.

Rees, G., Richter, T and Walmsley, A.

Richter, T.
2010 The Pearldivers of Qatar, *Current World Archaeology* 40: 18-26

Richter, T., al-Naimi, F., Yeomans, L., House, M., Collie, T., Bangsgaard, P.J., Rosendahl, S., Wordsworth, P. and Walmsley, A.

Richter, T., Wordsworth, P. and Walmsley, A.
2011 Pearlfishers, townsfolk, Bedouin and Shaykhs: Economic and social relations in Islamic Al-Zubarah *Proceedings of the Seminar for Arabian Studies* 41: 317-332

Thuesen I. & Kinzel M.
Thuesen, I. and Walmsley, A.

Walmsley, A., Barnes, H. and Macumber, P.G.

Walmsley, A.
2011 The Legacy of Zubarah. *Qultura: The world of art and culture* 1: 58-65

**Forthcoming publications:**

Kinzel, M., Thuesen, I and Sobott, R

Walmsley, A.

**Reports:**

Bangsgaard, P., Møbjerg Kristensen, R., Rask Møller, P and Nymann, H.

Bille, M. (ed.)

Eddisford, D. and Morgan, C.

Eddisford, D.
2012a The Archaeological remains at Al Athba (special archaeological report), 7 pp.

2012b The Rock Carvings at Jebel Fuwairit and Jebel Ghariya (special archaeological report), 30 pp.
Hofmann, P.

Hofmann, P., Sobott, R. & Kinzel, M.

Kinzel M. (ed.)

Macumber, P.G

2010b Examination of the archaeological potential of Areospace City in the vicinity of Al Khor (special geomorphological report), 22 pp.

2010b Examination of Two Areas in the Vicinity of Al Khor for Archaeological Potential (special geomorphological report), 21 pp.


2012a Where is Shagra? (special geomorphological report), 11 pp.

2012b An Examination of the Impact of Environmental Disparity on the Occupation of Qatar (special geomorphological report), 97 pp.

McPhillips, S. (ed.)

Mohammed, N.

Nymann, H.
2011 Brief report on the early attestations of Al Zubarah and Qatar (special history report), 6 pp.

2012 Boom and Bust: The Port of Al Zubarah in Northern Qatar in the 18th and early 19th centuries (special history report), 24 pp.

QIAH team
Richter, T. (ed.)


Saca, I.
2013 Al Zubarah Archaeological Site Community Archaeology Program (special outreach report), 29 pp.

Schäfer, B.


Sobott, R.

Yeomans, L.

Forthcoming reports:

Dropmann-Fischer, T.
Survey Report about the Wooden Construction at the Fort Al Zubarah, Qatar, 49 pp.

Kinzel, M. (ed.)
Qatar Islamic Archaeology and Heritage Project: Heritage Section, End of Season Report, 2010-2011

Kinzel, M. (ed.)

Murray, M. A.
Archaeobotanical report 2012 (special archaeological report)
UNIVERSITY OF WALES REPORT 2011-12
RUWAYDA
SUMMARY

The University of Wales excavations and survey at Ruwayda were carried out between November 2011 and April 2012. The team comprised a total of fourteen people working for four months with a reduced staff of seven working on post excavation and conservation work during March. The principle aim of the 2011-12 season was to concentrate the excavation on the area of the fortress and the area immediately in front (to the north) next to the sea. Survey and excavations in the previous excavation season had indicated a considerable number of structures and occupation in the area between the sea and the fortress. During the 2011-12 season several of these structures were excavated which re-enforced the idea that this was a particularly important part of the settlement. Structures excavated during this season include the sea mosque, a workshop, a series of store rooms and one of the outer towers of the fortress. In addition further work was carried out on the round tower in the centre of the fortress which appears to be the largest tower on the site. Conservation work was concentrated on plastering the external faces of the round tower and the north west corner of the small enclosure using mud mortar. Post excavation work was concerned with documenting the material from the current season and research work on finds from previous seasons at both Ruwayda and Rubayqa.
EXCAVATION AREAS 2011-12

During the 2011-12 season seven areas were excavated all within the general vicinity of the fortress. Some of these areas had previously been excavated (Areas A & B, E and H) whilst the other areas (L, N, P and Q) each focussed on a separate structure so that considerable new information was obtained about the structures in the area. In almost all of the areas there was evidence for at least two phases of occupation and/or construction. Each area was assigned a unique set of context numbers to enable easy recognition of the origin of particular finds.

Areas A and B

Areas A and B are located in the south west corner of the smaller of the two surviving enclosures. Area A represents the remains of a tower whilst Area B is the internal corner of the small enclosure and comprises two rooms one of which contains mud plastered installations. Areas A and B were first excavated during the 2009 season (Petersen and Grey 2010) and because they are next to each other they will be treated as a single excavation unit for the purposes of this report.

In 2009 the exterior of the south side of the tower was excavated to reveal the curved shape of an external tower. The interior of the tower was filled with dense packed mud and small gravel sized stones (i.e. max dimensions 50mms). It was presumed that the interior was designed to have a solid interior and that there was never any internal chamber. This view is to a certain extent supported by the fact that the inner face of the tower wall. After the 2009 season it was assumed that the tower had a ‘D’ shaped profile however to prove this it would be necessary to excavate the rest of the tower.

During the 2011-12 season the northern part of the tower was excavated to expose the outer face and to clarify the relationship with the west wall of the larger enclosure wall to which it appeared to be joined. The excavation was carried out over a period of three month with considerable care to maintain the structural integrity of this building. Important results of the excavation are

1) The excavations indicate that the tower has a round outline rather than the ‘D’ shaped profile hypothesised after the 2009 season.
2) This round tower is exceptionally large with a diameter of nearly 17 metres making it one of the largest towers of this type in Qatar.
3) The masonry on the exterior of the tower is built in alternating layers of stone with three or four courses of small rubble stones (average size 200x 200mm) alternating with courses of much larger stones (500mm+).

4) The 2011-12 excavations clarified the relationship between the tower and the corner of the small enclosure and the west wall of the large enclosure. The tower butts onto the NW corner of the small enclosure thus it appears that the tower was an addition to the original small enclosure. Also the west wall of the large enclosure butts onto the north side of the round tower and was therefore built afterwards. These results are particularly significant for refining our understanding of the relative chronology and development of the series of enclosures which make up the fortress of Ruwayda.
Area E

Area E is located at the junction of the large and small enclosures. Specifically Area E is laid out over the north-east corner of the small enclosure where it joins the eastern section of south wall of the large enclosure. The area was first excavated in 2009 (Petersen and Grey 2010, 38) and produced evidence that the large enclosure was later than the first enclosure with the south wall of the large enclosure butting up to the small enclosure.

The aim of the 2011-12 season was to extend the size of Area E northwards to include the north face of the enclosure walls and to better define the relationship between the two enclosures. In addition there was a need to understand the interior of the north east corner i.e. was there a room or internal tower at this point. In particular this would form a useful comparison to the interior of the north-west corner contained in Area B.

Important results of the excavation in Area E included:
1) the south wall of the large enclosure which butts on to the small enclosure was 1.5 metres wide and was built in a single phase (i.e. there was no addition of a extra layer inside the wall).
2) the north wall of the small enclosure was also 1.5m wide built in a single phase but lower down there was an additional internal thickening 0.2-0.5 meters wide on the inside face. It is not clear whether this formed a walkway or parapet or was a thickening of the base of the wall.
3) The interior of the north-east corner of the small enclosure comprised a square room filled with rubble collapse containing remains of a collapsed roof (i.e palm frond lattice and fragments of wood).
4) The north face of the two enclosure walls was exposed to ground level providing clear confirmation of how the two enclosures are joined and also a dramatic indication of the height of the standing ruins once cleared of rubble.
Area H

Area H is the mosque located next to the sea and immediately to the north-east of the fortress. Another mosque has been identified on the site approximately 700 metres to the west. The mosque in Area H was first identified in 2009 based on a local informant and the shape of the ruins. Confirmation for the identity of the building came in the 2010-11 season when amongst other features the excavation revealed a *mihrab* clearly oriented towards Mecca. The 2010-11 season concentrated on the excavation of the courtyard of the mosque both to get an idea of the stratigraphy and also to get ideas of the construction techniques. During the 2010-11 season the base of a minaret was revealed as well as the outlines of an earlier mosque courtyard revealed on one side by the foundations of a wall and on the other by a robber trench distinguished by a darker coloured sand infill (Petersen and Grey 2012,5-6).

During the 2011-12 season the objectives were to carefully excavate within the prayer hall of the mosque and define a strategy for the excavation and eventual conservation of the building. From the surface it appears that the prayer hall of the mosque was divided into eight bays supported on three free standing and two engaged piers. Excavations in the south portion of the prayer hall confirmed this arrangement and also identified a sandy floor surface at approximately the level of the threshold of the door in the centre of the east wall.

Plan of Area H (mosque) showing earlier alignment
As the outline plan of the building seemed fairly clear the focus of the remainder of the 2011-12 season was around the area of the mihrab the outer edge of which had already been defined in the 2010-11 season. Excavation below the floor level revealed an earlier wall on a different alignment together with an earlier opening for a mihrab niche. This earlier wall was made of small rubble stones set into a thick mud mortar and plastered with a white lime plaster. Comparison of the orientation of this earlier wall confirmed that it was the same as the earlier alignment of the courtyard walls identified in the 2010-11 season suggesting that the entire outline of the earlier mosque will be visible beneath the floor of the later structure. Examination of the east wall of the prayer hall facing the courtyard indicates that the two different alignments of the mosque are only part of the structural history of the building and at least five different phases of masonry can be identified.
Area L

This area was excavated in November and December of 2011. Area L is located immediately to the west of the mosque (Area H) and prior to excavation comprised a low mound (max elevation 0.5m) covering an area with an approximate diameter of 10m. Area L was one of a number of mounds of similar shape and size located between the sea and the fortress. Another mound Area M was also considered for excavation though this was not worked on due to time constraints.

Despite the low elevation and lack of walls visible on the surface excavation revealed a small ‘L’ shaped building complex comprising one well built rectangular room, a less well built lean-to structure and a courtyard defined by the two rooms and an outer enclosure wall on the south side. The rectangular room contained considerable traces of occupation including several fire pits and *tannurs* as well as extensive interleaved layers of ash to a depth of 200mm. Considerable quantities of finds were retrieved from this area including mammal and fish bones, marine shells, bitumen, ceramics, glass and metalwork. Cleaning of the courtyard area also revealed a number of small post holes (d.100-150mm) which also ran underneath the building. It is probable that there were wooden structures or canopies around the building and aso that the building was preceded by a wooden *barisstti* (palm thatched) structure. Although a full analysis of the finds from this area has not been completed the presence of some iron rivets together with finds of bitumen and the location of the building next to the sea all suggest that this may have been a workshop connected with the repair or maintenance of ships.
Area N

This area was excavated during January and February 2012. Area N is a linear mound located directly to the south of the fortress and parallel to its northern enclosure wall. Although the mound had first been identified as a building in the 2009 season (Petersen and Grey 2010, 36 Fig 3) little of the internal arrangements of the building was visible on the surface. Following the 2010-11 season it became apparent that this linear mound was located directly next to the only entrance to the fortress so far identified. Moreover this entrance also led via gatehouse into the palace identified in 2010-11 (Petersen and Grey 2012, 11).

Excavation of this mound began at the east end next to the entrance to the fortress and worked towards the west with a series of baulks retained to maintain stratigraphic control. The excavation revealed a series of eight rooms extending for a distance of more than thirty metres. At the East end of the complex there was a large square room (courtyard?) with a rectangular central pier and to the north a rectangular room aligned East-West. All the other rooms identified were rectangular rooms aligned North South with doorways facing north towards the sea. It is noticeable that although this complex was built as a single structure with the same alignment over more than thirty metres with the exception of the two rooms at the east end there were no connecting doors. Also none of the buildings have built floors and in many cases the floor surface are difficult to distinguish from the beach sand. Analysis of the wall lines and levels within the building indicate that the walls were built directly on the beach surface and slope downwards towards the sea (i.e. North) with a difference of as much as half a metre from North to south.

One of the more interesting features of this complex is that it appears to have been built from East to West with the West end going out of use and being demolished before the East end was built. Evidence for this can be found in the way that the walls butt against it each other showing a clear progression from West to East. Also the walls of the rooms at the west end have been carefully dismantled down to ground level so that the westernmost room was not visible on the surface prior to excavation.

Beneath the walls of this complex there is considerable evidence for earlier occupation. For example the complex appears to be built on an earlier midden composed of dark ashy sand which runs from the north wall of the fortress down towards the sea. Incidentally this suggests that the warehouse complex was built after the construction of the large enclosure of the fortress. Also in the westernmost room which was demolished there is a very damaged date press. It is not clear whether the
date press was inserted before or after the demolition of the room. Beneath the date press there is a wall running approximately East West which pre-dates the warehouse and appears to have the blackened sand of the midden resting against its south side.

The interior of the rooms revealed very few finds except from the layers beneath the building (i.e. the midden)- this re-enforces the impression that these were not domestic buildings. A similar range of buildings was excavated at Zubara in the 1980’s and was interpreted as a *suq* though the arrangement of rooms at Ruwayda with doorways facing the sea is more suggestive of merchant’s store rooms.
Area P

Area P is located at the north-west corner of the large enclosure and is laid out around the remains of a tower which projects from the north wall of the enclosure. This area was selected for excavation for a number of reasons which can be summarised as

1) the tower is within the same general area as the other areas of excavations for 2011-12 which is both logistically convenient and also helps in the understanding of this area.
2) the position of the tower next to the corner but not at the corner of the large enclosure requires some explanation. In defensive terms it does not make sense to have an undefended corner.
3) visual examination of the tower revealed considerable quantities of occupation debris within the tower including ashy layers, glass, ceramics and fish bones.

In order to maximise the results from the area was laid out to include not only the tower but the corner of the large enclosure as well as areas to the north and south of the fortress wall. Whilst it was desirable to excavate within the tower it was also necessary to maintain a stratigraphic control in the form of a half section through the tower so that layers of deposit, occupation and abandonment could be identified within the tower. Due to the unstable ashy nature of the deposits within the tower it was not possible to maintain a deep section therefore it was decided to excavate the interior with a running section.

Excavation of Area P revealed a complex series of events visible in the construction of walls and the layering of deposits. First of all it was evident that the thickness of the north wall of the fort was narrower behind the tower than it was on either side. Whilst this makes general sense it also points to the fact that the rest of the wall was thickened at some point in its history. Elsewhere in the excavations in the vicinity of the palace (Petersen and Grey 2012, Fig 4) it was clear that an inner lining had been added to the walls of the fortress making them three times their original thickness. The same process had been carried out around the tower. It is not clear why the area behind the tower was left at a single thickness though there may have been a doorway or entrance to the tower which lies in the as yet unexcavated half.

The question of the wall thickness becomes more clear at the corner of the large enclosure. At this point both the north wall and the west wall of the large enclosure are of the same size (approx 1.5m) compared to 0.5 metres behind the tower. However examination of the west wall of the
enclosure shows that it was built in a single block, i.e. not with an inner and an outer skin. However the most telling piece of evidence is that the foundations of a wall running west from the corner of the large enclosure were discovered immediately outside the corner. This is not surprising in itself as it was known from the survey and first season that there were outer enclosure walls which only survived in foundation form, however what is interesting is that this wall is only 0.5m wide and the wall was clearly demolished or removed before the west wall of the large enclosure was built. This enhances our understanding of the development of the fortress and shows a clear sequence of construction, expansion and re-fortification.
Area Q

Area Q is a small area one metre square which is located within the demolished west enclosure of the fortress. Although this area was not within the research plan it was chosen for excavation because of the remains of a large ceramic jar (d 0.6m at the shoulder) which was seen protruding from the ground. The jar was located next to a small drainage channel and was gradually being eroded by winter rains. Also the top of the jar was liable to damage from people driving over the area (this was before the installation of the fence). The carinated pot was decorated by a thumb impressed band around the shoulder and appears to have been set into the ground in antiquity. The interior of the pot was filled with thick grey ash and fragments of ceramic. The base of the pot had been removed and it was evident that a large storage jar had been re-used as an oven or *tannur*.

Area Q re-used storage jar during excavation
Faunal remains from Ruwayda, northern Qatar; a summary

Introduction

A diverse assemblage of faunal remains have been recovered during excavations at Ruwayda. These can be divided into two main groups; vertebrates and invertebrates. The vertebrates include members of the classes mammalia (mammals), aves (birds), actinopterygii (bony fish), chondrichthyes (cartilaginous fishes) and reptilia (reptiles), while the invertebrates include marine forms of bivalvia (bivalves), gastropoda (gastropods), brachyura (crabs) and Echinoidea (including sea urchins and sand dollars).

The faunal remains recovered from the site can inform us about many aspects of Islamic life at the site. The remains of animals can tell us about the dietary resources that were being exploited in the past, but in some cases we can also learn about craft production, seasonal activities, animal husbandry techniques, and environmental conditions.

Fish bone reference collection
Taphonomic assessment
The preservation of faunal remains at the site is wide ranging, with some material being very well preserved while other material displaying extremely poor preservation. Poorly preserved material includes fragmentary remains but also more complete remains with eroded surfaces. In both cases identification is impeded; this is a particular problem for identification of the small bovids (Ovis (sheep), Capra (goat) and Gazella (gazelle)) which vary little in skeletal morphology. Evidence for burning and butchery in the form of cut- and chop-marks are present throughout the skeletal assemblage (not in the invertebrate assemblage). Burning, cut- and chop-marks are an important aspect of the assemblage and confirm the anthropic nature of the material.

Vertebrate remains
Abundant remains of vertebrate species have been recovered from Ruwayda. While these represent mammals, reptiles, fishes and birds, by far the more abundant are the mammal and fish remains.

Reptiles are represented by chelonia remains, specifically sea turtle. Five species of sea turtle inhabit the Arabian Gulf; however, two of these are more common; Chelonia mydas (green sea turtle) and Eretmochelys imbricata (hawksbill sea turtle) (Carpenter et al. 1997, 243-244). It is likely that the remains represent one, or both, of these species, but identification at species level was impeded due to lack of a comprehensive reference collection of sea turtle specimens. The bird remains were dominated by cormorant (either Phalacrocorax carbo (Great cormorant) and/or Phalacocorax nigrogularis (Socotra cormorant)).

More significant are the mammal remains which represent a range of domestic and wild species including Ovis aries (domestic sheep), Capra aegagrus hircus (domestic goat), small gazelle species (either Gazella leptoceros (rhim/sand gazelle) or Gazella dorcas (Dorcas gazelle)), Camelus dromedarius (dromedary camel), equids (including Equus ferus caballus (domestic horse) and Equus africanus asinus (donkey/ass), and potentially Equus ferus caballus x Equus africanus asinus (mule)), canids (either Canis lupis (domestic dog) or Canis aureus (golden jackal)), Felis catus (domestic cat)as well as some large bovid remains within which it is difficult to distinguish between small examples of Bos taurus (domestic cattle) and Oryx leucoryx (Arabian oryx).
The fish remains represent the most diverse class of vertebrate faunal remains. The families ariidae (sea catfish), belonidae (needlefish), carangidae (jacks, pompanos, jack mackerels, and scads), lethrinidae (emperor), scaridae (parrotfish), sparidae (seabream) and sphyraenidae (barracuda) are present. Cartilaginous fish are also represented in the form of ossified vertebrae; these can be identified as being from fish of the family pristidae (sawfishes).

Hamoor (Grouper) from Ruwayda

Invertebrate remains
The remains of marine molluscs are in abundance at Ruwayda. Shells recovered from the site were identified using modern reference specimens collected close to the site in northern Qatar and published identification guides (Carpenter et al. 1997; DuPont & Altamimi 2008). The majority of the mollusc remains are small (up to c. 15 mm in length) marine gastropods and bivalves that make up the natural ‘background’ shell; notably, taxa of the cerithiidae and potamididae families are particularly abundant. In addition to these naturally accumulated/occurring shells there are the remains of larger molluscs that served as dietary resources as well as providing raw materials for jewellery and tool production. The most abundant of the larger mollusc species are Pinctada radiata (pearl oyster) and muricincae (murex).
Potential
The data presented in this report are based on preliminary analysis of the faunal remains recovered from the site. Further work on the archaeological remains alongside the development of a comprehensive reference collection of modern skeleton will allow identification of more of the remains to species level. In turn this will, 1) give a better understanding of the role of meat and fish in the diet during the Islamic period; 2) allow the development of a basis for understanding the environment in which the people at Ruwayda lived, and variation within environmental conditions over time, and 3) permit in depth interpretation of animal husbandry and the exploitation of wild resources, especially in the case of fish, which even on initial assessment appear to have formed a major part of the diet at Ruwayda.
Building Conservation

Following detailed examination of the extant mortars, plasters and render uncovered during the excavation at Ruwayda a plan for conservation of the standing excavated remains was drawn up. Laboratory analysis of the mortars at Ruwayda indicates that they are composed primarily of loess and sand with some lime. The basis of the conservation undertaken at Ruwayda are:

1) all conservation work must be reversible so that any adverse effects or historically inaccurate reconstruction can be rectified without damage to the excavated structure. In practice this means an avoidance of strong cement based mortars which in some cases are stringer than the local stone and would produce cracks in the actual stone making up walls
2) as much as possible to use materials that are available locally in preference to imported materials. This is not just a question of cost but reflects an important concept in conservation that repairs and consolidation should be close to the materials originally used.
3) preferably use material similar to those which were used in the past-this is not just an aesthetic consideration but is likely to be physically compatible with the archaeological remains.
4) where possible avoid alterations to the form or dimensions of the excavated ruins. Where changes or additions are made to the original structure this should be clear and also documented during the conservation work.
With these principles in mind the conservation team selected the round tower in Area A for the first major conservation work. The tower was selected because it is the largest and tallest standing structure on the site and with the north facing side now exposed it is vulnerable to erosion from the north (shamal) wind. Although the tower was in evident need of some consolidation work it posed significant practical problems because of its considerable height, uneven surfaces on the upper level and because of the significant area on the top which could collect rainwater thus casing water borne erosion.

Prior to the conservation work on the tower an area of wall next to the tower was selected for trial applications of different mud mortar combinations. In each case the ingredients were the same, fresh water, excavated soil retrieved from the soil tips, small stones derived from soil through sieving. Variations in the proportions of each of these ingredients were tried as well as variations in the application of the mortar e.g. number of coats, drying time, use of a trowel or hands (using gloves). The trials were carried out at the start of the season in November and December to allow time to see how ell they survived and monitor any adverse effects. Following the trials a specific mix was selected as well as method of application. The exterior of the tower was fully coated with three layers of mud plaster during March. The results will be monitored and if satisfactory this method will be applied to the rest of the site.
References


Boom and Bust: The Port of Al Zubarah in Northern Qatar in the 18\textsuperscript{th} and early 19\textsuperscript{th} centuries

Introduction
Recent and ongoing investigations of the coastal archaeological site of Al Zubarah in Northern Qatar is generating new knowledge of a poorly understood phenomenon that not only changed the demography and socio-economic structure of Eastern Arabia but ultimately led to the foundation of present day Arab Gulf states. Growth of new settlements and new types of urban configurations in the second half of the 18\textsuperscript{th} century were the result of a series of interrelated developments, whose precise dynamics are still not well understood (Fattah 1997; Fuccaro 2010:19). A vital component in the QIAH history study programme is therefore the examination of the political and socio-economic conditions in the Persian Gulf prior to and contemporary with Al Zubarah.

A profound change in settlement patterns occurred as a result of these developments (Abdullah 1998:57-8). New towns, whose primary economy was based on pearl fishing and trade in commodities, appeared at a fast rate. The emergence of Al Zubarah in 1762 or 1766 was directly related to the pearling boom, as was the contemporary town of Abu Dhabi, founded in 1761 by the Beni Yas tribe (Carter 2005:179). In the mid 18\textsuperscript{th} century there were rarely more than two pearling centres functioning at any one time (Carter 2008:266), but by the beginning of the 19\textsuperscript{th} century there were more than twenty-five such coastal towns (Onley 2004:134). In 1810, Captain John Wainwright reported of the Arabian coast: “\textit{along its whole extent a valuable Pearl Fishery is carried on by the Arabs}” (Davies 1997:140). All these new settlements, combined with the old, competed for control over littoral and maritime space and routes.

In order to further develop our understanding of the fabric of Al Zubarah, and the way of life for its inhabitants, an introduction to the historical context of Al Zubarah is provided from the mid-18\textsuperscript{th} century to 1811, according to the textual record. However, it is not intended to provide a detailed chronological narrative of Al Zubarah’s history.
Increase in tribal power
The Northern Najd had witnessed a series of gradual but ultimately widespread Arab tribal migrations in the 17th and early 18th century. For reasons that are still not understood (and understudied; but might relate to climate changes), large tribal coalitions such as the Shammar and Anaiza (or Anizah) relocated, mainly to the north and east of Arabia (Rentz 2004:124). Secondly, the disappearance of regional hegemonic power after the collapse of the Safavid dynasty in 1722, combined with a weak Ottoman presence in southern Iraq and the rise of the first Saudi state in Central Arabia, created a political vacuum. Thirdly, there are several indications that an integral component of the changes that took place in the Gulf was related to control of pearl banks and pearl fishing, due to an international demand for pearls (Carter 2005:179).

It is difficult to ascertain which of these phenomena came first but there is a correlation between tribal migrations and the proliferation of new coastal towns (Fattah 1997:27). Many of the new towns depended almost entirely on the import of staples (Floor 2006), particularly from India and Basra, and only areas such as Bahrain and Julfar were capable of supporting a larger population through local agriculture. This phenomenon was not entirely unknown. Hormuz, on the Persian side, had been entirely dependent on supplies from the outside, including water, since the 15th century (Kennet 2003).

More localised developments, such as an increase in conflict between the Banu Khalid and the Saudi dynasty (also known as the Wahhabi), may also have been important (Fattah 1997:27). One of the tribes that benefitted from the Banu Khalid’s loss of power was the Utub, who until then had been obliged to pay tribute to the Banu Khalid. By the end of the 18th century the Utub had risen to prominence socially and financially and Utbi tribal sheikhdoms were established in Kuwait, Qatar and Bahrain (Hakima 1965).

The European trading companies seemed at first to have been oblivious to the local Gulf developments, although an agent of the Dutch East Asian trading company (VOC) reported in 1749 that “every Arab lord has become an independent ruler” (Slot 1993:331). Around 1750, the vessels
owned by the Arab tribal families were still small\textsuperscript{1} but a local Persian power warned the English East India company (EIC) in Bandar Abbas in 1751 that Arabs were embracing navigational skills and “\textit{will soon make the whole Gulf dangerous for foreign vessels}”.\textsuperscript{2} In 1756, Tiddo von Kniphausen, a VOC representative, noted the low volume of trade, caused by continuous disturbances resulting from disagreements between local sheikhs (Slot 1993:14). Five years later, in 1761, another VOC agent based on the Kharg island noted: “\textit{all is in the utmost turmoil on our side of the Gulf, and the rulers of both sides are at war with each other}”. Some foreign travellers, such as Ives and Parson (and, to a lesser degree, Carsten Niebuhr), made reference to the complicated political situation (Slot 1998:143). However, in 1750, when the EIC came up with a plan to conquer Bahrain, it was to prevent the Dutch from doing the same, not to curb growing tribal power. The British plan was fostered as a result of a false rumour of Dutch intervention (Slot 2000:127 n 37), but then four years later Kniphausen actually tried to promote such a plan (Floor 2007: 23f). His suggestion was turned down by VOC and in 1766 the company departed entirely from the Gulf, unable to make a profit.

The autobiography of the Shi‘ite scholar Yūsuf ibn Aḥmad al-Bahrānī (1696-1772) gives a vivid description of the unruly times in Bahrain. During his lifetime, Bahrain was attacked repeatedly: first by an Omani tribe in 1717, then it was reoccupied by the Safavids and later it was caught in the middle of a competition between Nadir Shah of Bushire, the Huwala Arabs and the Utub. The repeated Sunni tribal invasions crippled the Shi‘i establishment (Cole 1987:195-7), and would ultimately bankrupt the al-Bahrānī family’s pearling business (Reynolds 2001:217).

Qatar
We know very little about the population of Qatar prior to the mid 18\textsuperscript{th} century. According to Niebuhr’s survey in 1765, the Qatar peninsula was inhabited primarily by the Al Musallam tribe who paid tribute to Banu Khalid; the latter inhabited al-Hasa further inland (Niebuhr 1772:341-344). Local pearl divers fished during the season; many moved back and forth between the coast and the interior and therefore only stayed on the coast in a temporary basis. Four permanent

\textsuperscript{1} Factory Records, EIC, vol 6, entry of Oct 9, 1750 quoted in Sweet 1964:265
\textsuperscript{2} Factory Records, EIC, vol 6, entry of Sept 28, 1751 quoted in Sweet 1964:263
\textsuperscript{3} Jan van der Hulst 22 June, 1761 in Slot 1998:143
coastal settlements relating to the area of or near the Qatar peninsula (which was not recognised as such until Colebrook’s survey in 1820) are evident from Niebuhr’s map (Figure 1). Huwailah and Freiha can certainty be located on the Qatar peninsula. The identity of Adsjar is unknown. The locality of the toponym Gattar (Qatar) is also unknown but is clearly identified as a port by Niebuhr (1772:341):

“Gattar, ein hafen auf dieser Küste, der Insel Bahrein gegen über”.

Robert Carter (2012:116) suggests that it refers to Bida (Doha), whereas Billecocq’s suggestion (2008) that it might refer to a previous settlement at the site of Al Zubarah cannot be ruled out.

Figure 1: Niebuhr 1772:310
The Utub – from dependent pearl divers to independent pearl traders

Following the death of the ruler of Persia, Nadir Shah, in 1747, several groups fought for control over the pearling banks of Bahrain. According to *Description of the Persian Gulf*, authored by Kniphausen in 1756, the sheikh of Bushire offered the Utub tribe to fish pearls without taxation, in exchange for an alliance. Kniphausen’s report leaves little doubt that the main livelihood of the Utub was pearling:

“They (the Utub) is dependent on the Sjeek of the Desert (Banu Khalid tribe) to whom they pay tribute, although very little. They possess about 300 vessels, most of which are small, which they only use for pearl-diving; this, apart from fishing in the bad monsoon, is their only means of livelihood”…[“Meanwhile, Sjeek Nassier was able to induce the Etoubies, a caste of Arabs whom we shall mention below, to assist him with the conquest of Bahrehn, having induced them to do so by having promised them that in such a case they would be allowed to dive on the [pearl] banks without having to pay the usual impost. Because almost most of them are divers this was of no small importance to them” (Floor 2007:31).

From 1752, the Matarish (Omani) rulers of Bahrain paid tribute to the Utub, a clear indication of their growing strength. The local inhabitants there apparently suffered whenever the pearl fishers were in the area:

“…the pearl divers both from the Etoubis and the Houlas, who dive during a 4-months’ stay within the sight of the island, come ashore daily and ruin all the tamer bearing trees and gardens near the beach]…[Sjeek Nassir is unable to prevent this marauding, because they are partly done by his allies…” (Floor 2007:32).

Kniphausen’s observation on the importance of pearl fishing was confirmed some sixty years later by Francis Warden, Chief Secretary to the Government, Bombay. In his historical review from 1817 on the Utub, he asserted that it was the rich reward of income from pearling that had facilitated the move (Hughes Thomas 1985:362-3). Taylor likewise stated in 1818 that the Utub went to the pearl banks of Bahrain: “to procure a share of that fishery for themselves, instead of continuing to purchase from other hands” (Hughes Thomas 1985:28).

Members of the Utubi tribe were therefore already fishing at the pearl banks near Qatar prior to 1766, and were familiar with the area, and the Utub sheikh Mohammed b. Khalifah had visited Bahrain in order to buy pearls (Rentz 2004:126). It is likely that the decade-long, untaxed fishery and pearl trading generated the necessary revenue for the Utub to take the next step.
Foundation of Al Zubarah

Local Utubi traditions have been credited as sources for the foundation of Zubarah, either in 1762 (Khalifa & Hussain 1993:303) or 1766 (Hakima 1965:16). The traditional explanation for this event states that the mercantile branch of the Utub, headed by the Khalifah family, decided to move from Kuwait to Qatar, motivated by conflict with another Utub branch the Al Sabah (Hakima 1965:17).

This contrasts with Kniphausen’s report that the Utub were governed by several sheikhs that “live together in reasonable unity” (Floor 2007:35). Kniphausen did note, more in line with the oral narratives, however, that the sheikh of the Sabah was the most important, although poor, whereas the head of the Khalifah, Mohammed b. Khalifah was a wealthy owner of many vessels.

Although the oral narratives might conflict with the textual material they serve as valuable examples of foundation myths and community-building genealogies (Crystal 1990:20). As Davies (1997:21) points out, these stories told a lesson of a system that “could not easily accommodate the ambitions of rival families”. The migration route of the Utub tribe is not easy to follow and according to Ben Slot, Utub members had already been present in Qatar on a previous occasion in 1701 (Slot 1998:164; al-Hijji 2006:4-5). There can be little doubt that a critical factor for the final move to Qatar was the economic incentive provided by pearling.

From a geographical perspective, Northern Qatar is an obvious place for pearling settlements, as it was only a short distance from some of the best pearling banks. The maritime waters just off the coast of Al Zubarah had been associated with pearls since the 10th century (Al-Shamlan 2000:34), but despite its proximity to the pearling banks there is no historical evidence that northern Qatar had any pearling settlements prior to the 18th century (Carter 2005:147), although the numerous early Islamic settlements uncovered in the recent QIAH surveys might contest this view. The main obstacle was the climatic conditions and a lack of local resources. Al Zubarah is situated in an environmentally arid zone and the principal source of water is found further inland, where water could be drawn from shallow wells by skimming surface water, occurring as a freshwater lens on top of more saline water. The amount of water is limited and primarily relies on rainfall (Macumber 2011).
As stated above, Mohammad b. Khalifah is usually credited with the founding of Al Zubarah. There are, however, indications that the situation was more complex than this. According to the biography by Sanad⁴, Rentz asserted that Al Zubarah was founded by a certain sheikh Ahmad b. Rizq (2004:126 n 44) and that the Khalifah family moved there shortly after this. Rizq was head of an important merchant family that became known for its quasi-monopoly on pearl trading. He was a member of a tribe that, like so many others, had migrated from the Najd before his family had settled in Basra (Fattah 1997:27). Sanad also relates that it was the decision of both Khalifah and Rizq to make Al Zubarah a tax-free port in order to attract trade (Hakima 1965:72). Al-Shamlan (2001:71) claims that b. Rizq migrated together with Al Khalifah, thus making it a joint decision.

There are three primary aspects that merit attention. Firstly, Al Zubarah seems to have been built within a remarkably short time span. Secondly, the urban layout shows traces of extensive urban planning and large-scale construction. Thirdly, what is particularly remarkable is its location in an area that had previously only been able to sustain a small number of mobile populations. Although there is evidence that the foundation of Al Zubarah, at least later on, was accompanied by some degree of agriculture, the subsistence base was initially not large enough to feed a population of an estimated 5000-6000 people and the city depended on the importation of staples. Regardless of the precise identity of the people involved, somehow a crucial moment was therefore reached when there were enough resources, entrepreneurial spirit and revenue to be raised to overcome the climatic and logistical challenges. How this came about requires further study.

Al Zubarah expands
Notwithstanding the precise date, Al Zubarah seems to have established itself as a pearl fishing town with immediate success. In 1767, the British agent in Basra noted in a letter that an Utubi fleet had been send from Basra to Al Zubarah in order to gather pearls for the market. Upon arrival they discovered that members of the Qawasim tribe had raided Al Zubarah and stolen pearls and cash worth 30,000 tomans.⁵ The Qawasim came from the southern part of the Gulf,

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⁴ ‘Uthman Ibn Sanad, Saba‘ik al-‘Asjad fi Akhbar Ahmad Najl Rizq al-‘As‘ad.
⁵ MSA, Bussora Factory Diaries, no 197, entry dated August 22, 1767 in Abdullah 2001:142
principally from what are today Ras al-Khaymah and Sharjah Emirate, where they had come from the Persian coast.

It is difficult to assess the exact value of these pearls as the exchange rate fluctuated. In 1747, one Persian toman was worth approximately 1.18 British pounds and, in 1800, it was worth 1 British pound (Issawi 1971:387). In comparison, Niebuhr (1772:331-32) reported that in 1765 the then ruler of Bahrain, the sheikh of Bushire, had an annual income of 100,000 rupees (which is almost equivalent to 100,000 tomans), deriving from a combination of pearl and date production. One of the wealthiest merchants in Basra owned land and property, estimated at 12,000 tomans (Abdullah 1992:87). The 30,000 tomans must therefore have represented a considerable sum.

The letter indicates that, despite successful pearl fishing, no pearl market had been established at Al Zubarah. According to Abdullah (1998:56), the Utub continued to bring pearls to the port of Basra (and, to a lesser extent, to Musqat and Bushire), thereby continuing a tradition already noted in 1742 by the traveller Jean Otter (Carter 2012:126).

The pearl robbery incident may explain why a fort and protective walls were built the following year, although the anonymous *Kitab Lam’ al-Shihab fi Sirat Muhammad ibn ‘Abd al-Wahhab* (1817)\(^6\) claimed it was built to protect against the local tribe al-Musallam (Hakima 1965:69-70).

According the Utub narrative, the success of Al Zubarah did create intertribal conflicts and drew the attention of other tribes who, on several occasions, tried to attack Al Zubarah.

Notwithstanding these skirmishes, Al Zubarah continued to receive a steady influx of merchants.

In 1773, yet another epidemic broke out in Basra, the major trading town in the Upper Gulf. This was followed by pillaging by some of the tribes surrounding Basra (Abdullah 2001:53). Several merchants therefore moved on a more permanent basis to Al Zubarah, bringing their business with them. The English agents Manesty and Jones observed:

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\(^6\) most likely commissioned by the British officer Robert Taylor (Davies 1997:132)
“a favourable change has lately taken place in the commercial interest of Musqat, Bahren, Zebarra [Zubarah] and Grain, the commercial importance of Bussora has since the year 1773 most materially decreased”. 7

A few years later this trend was further accelerated by a Persian siege and the ensuing occupation of Basra, as reported by William Latouche, the EIC resident in Basra, to his superiors in London. In a letter, dated 4th November, 1782 he writes:

“It is not many years since Grain, was obliged to pay a large tribute to the Chaub, and the name of Zebarra, was scarcely known. On the Persians attacking Bussora, one of the Sheiks of Grain, retired to Zebarra, with many of the principal People. Some of the Bussora Merchants also retired thither. A great Part of the Pearl and India Trade, by this means entered there” (Hakima 1965:190).

As Al Zubarah boomed, the British interest in the Gulf declined. In the 1770s EIC only exported, on average, 200 bales of woollen goods per year. A decade earlier the sale usually exceeded 1500 bales (Amin 1967:151). EIC was actually now losing money on textiles, a trend that was set to continue. In 1805, the value of British trade in the Gulf averaged a mere £3000, a fraction of the combined imports and exports from Madras and Bombay to the Gulf, which totalled over £500,000 (Issawi 1971:83).

Bahrain

The mercantile success, and probably also the political aspirations of the Khalifah family, brought Al Zubarah in conflict with the sheikh of Bushire, who at that time still controlled Bahrain. Latouche informs us:

“The Zebara, and the Grain (Kuwait) People, have lately taken and plundered Bahreen...Sheik Nassir of Bushire, in return is collecting a Marine, as well as a Military Force, at Bushire, Bunderick, and other Persian Ports – he gives out he intends to revenge these Hostilities by attacking Zebarra, and has wrote for a Supply of Money to Aly Morat Caum at Isphahan. Notwithstanding this show of vigor however, it is said, that he has lately sent to Grain to request a Peace, but that the Sheik had refused to grant it, unless Sheik Nassir pays him half the Revenues of Bahreen, and a large Annual Tribute also for Bushire.”8

7 Manesty and Jones 1791, Report, folio 213. Indian Office Records G/29/25
8 Latouche at Basra to London, 4th Nov, 1782, in Hakima 1965:190
The following year, in 1783, another combined force of Utub members from both Al Zubarah and Kuwait again attacked Bahrain and this time managed to gain a more permanent foothold there. In response, the Persians tried to uphold a maritime blockade on Al Zubarah and Bahrain. After unsuccessful negotiations, a fleet landed at Al Zubarah but was successfully rebuffed. Fortunately for the Khalifah, another attempt to retake Bahrain was aborted in 1785, due to the death of one of the leading men (Bunney 1997:19). For the next three decades Khalifah’s control of Bahrain remained tentative at best.

**The nature of trade – the Manesty & Jones report from 1790**
Mohammed Al Kalifah died in 1782, on a pilgrimage to Mecca, and was succeeded by his brother Ahmad bin Mohammed. According to Utubi history, the majority of the Utub moved to Bahrain following the conquest. Ahmad continued to maintain a winter residence in Al Zubarah until his death in 1796, staying in Bahrain only during the summer (Khouri 1980:25).

Despite this, the political and financial focus seems to have shifted gradually towards Bahrain. An indication of this can be found in the enlargement of the Bahraini fleet that grew substantially after 1783. Moreover, there was an important shift in the nature of the trade. Not only did the Bahraini fleet as a whole grow bigger but the boats also increased in size, enabling the merchants for the first time to trade pearls directly with the Gujarati port of Surat, then a major pearl trading centre. The main source of this information is a British manuscript, Manesty and Jones 1791, *Report*, folio 213, Indian Office Records G/29/25. Unless otherwise specified, the following discussion refers to this document.⁹

In 1791, two EIC employees residing in Basra, Samuel Manesty and his assistant, Harford Jones, sent a report to the EIC board in London. The report had been requested by the board in order to evaluate whether it would be worth engaging in trade again, after a long period of limited British activity. As EIC agents, both men received only a small salary and they were permitted to engage in commercial activity on their own. Understanding the nature of trading activities in the Gulf was therefore vital on both a professional and a personal level. Despite this, the report by Manesty and

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⁹ The report is printed as an appendix in Bashir 1979, which is the version used here
Jones was restricted by their inability to secure data from the Arabian coast. The European ships were large and deep draft vessels, too big for the shallow waters of Eastern Arabia. The foreign trading companies therefore had little or no direct contact with the Eastern Arabian littoral (Sweet 1964:265). No European sources, for example, noted the rise of the first Saudi state – or the rise of the Beni Yas – until very late because they represented a tribal system whose principal interests lay inland instead of along the coast. Local inhabitants seem to have been unwilling to share information and it was not until the early 19th century that the first British intelligence officers visited the area in person.

Manesty and Jones' report covers the period 1763-1790 and identifies six major trading ports: Muscat, Bahrain, Qatif, Al Zubarah, Kuwait and Basra. Strangely, it is noted that Al Zubarah, in contrast to Bahrain, had partaken in pearl fishing but only "in an inconsiderable degree". A reason for this assessment might be that pearls, fished by Al Zubarah inhabitants in 1790, went through Bahrain before they were sold and that this transfer was unknown to Manesty and Jones. EIC had never been directly involved in pearl trading but instead concentrated on bulk goods and thus had limited understanding of the pearling business. Their view also contradicts the previous letters by the former Basra residents (see above) and other sources. A memo written by the French astronomer Joseph de Beauchamp in 1784 describes Al Zubarah as being "prosperous due to the fact that many key merchants are settled there. Pearl trade brings in significant profits" (Billecocq 2008:61-2).

When Khawaja Abdul-Qadir, an Indian diplomat and traveler from the Muslim kingdom of Mysore, passed by two years later, he only referred very briefly to Bahrain and Al Zubarah but in both instances he mentioned them as important pearl fishing towns (Hasan 1968). There is no reason to doubt that the pearl industry was much larger in Bahrain but Al Zubarah must still have retained a fair part of the pearling activity, and Manesty and Jones partly confirm this later in their report: "The incentives which actuate the Merchants of those places [Zubarah and Qatif] to Commercial Enterpizes cannot materially vary. They must ever possess their present share of the Pearl Fishery..."
The merchants at Al Zubarah imported from Surat (India) various cloths and textiles as well as bamboo used, amongst other things, for roofing. From Muscat came coffee and basic food staples such as rice, oil and ghee. This was followed by sugar, pepper and other species and various metals; iron, lead, tin. The coffee that the merchants obtained in Muscat had been imported by Omani traders from Yemen. Although the price of coffee had fallen throughout the 18th century it was still considered a very valuable commodity. Some of the goods were shipped onto Basra, and the ships returned with dates and grain, necessary for local consumption only.

Until the acquisition of Bahrain, all imports of European- and Indian-traded commodities had come from Northern India via Muscat. The route from India to Muscat was made in vessels belonging to European or Indian Muslim traders. Arab traders at Muscat apparently did not engage in this trade; their primary task was to further export goods into the Gulf instead. With the change in the Utub fleet after 1783, merchants at Al Zubarah directly imported rice, sugar, oil and ghee, and various cotton fabrics, from Gujarat and Surat in particular. For reasons not made clear in the report, all imports from Surat by Al Zubarah and Qatif merchants called at Bahrain first. Coffee was still imported from Muscat but now it came on vessels belonging to the port of Al Zubarah.

As a result, the Utub tribe had by 1790:

“engrossed the whole of the freight trade carried on between Muscat and the ports on the Arabian shore...and a principal part of the freight trade carried on between Muscat and Basra”.

This observation is confirmed by another source. According to Captain Seton, Chief EIC officer at Surat, the Utub carried on a “brisk trade direct from Bahrain to India, without touching at Muscat, and thus evading the half duties paid by the other States” (Hughes Thomas 1985:367).

The value of this trade was estimated at 500,000 rupees. In order to understand this figure, a comparison is usually made with other figures for pearl fishing from other years. See, for example, Carter (2012:129), who illustrates the value for the period 1663-1818. Such numbers typically show an increase in value during the 18th and 19th centuries. An issue not discussed so far, and
which deserves attention, is how the value of the pearl fishing compared to other kinds of trading activities in the Gulf. It is worth noting that the value of trade in dates, from Basra alone, was 1,000,000 rupees, clearly exceeding the Utub trade.

Together with Qatif, Al Zubarah also became one of the principal transit ports for Eastern and inner Arabia. From early on, Al Zubarah merchants were supplying inner Arabian tribes with coffee and other necessities, especially Diriyah in Najd, capital of the first Saudi dynasty 1744-1818. According to Manesty and Jones this happened “by means of camels at a moderate expense and without any considerable risk”. It did, however, bring the merchants into the orbit of Saudi expansionist politics that increasingly took on an economic dimension, targeting Eastern Arabia and Al Zubarah and potentially explaining subsequent political events (Fattah 1997:45f).

The dynamics of intraregional trade in Arabia, from the inner reaches of the peninsula to the coast, have not been studied in depth, however al-Hijji (2006:124-25) asserts that the desert trade, known as al-Musabalah, was a crucial factor in the economic growth of Kuwait, along with its maritime trade. There are hints in Manesty and Jones’ report that goods were sent from Qatar to Kuwait via the land-based route, not by sea. It is likely that the inland trade at Al Zubarah constituted a larger part of the overall trade than was previously thought.

Manesty and Jones noted that Al Zubarah was a tax-free port, whereas Qatif had a small tax on coffee and pepper. They also commented that trading was safe under a government that protected both foreign travellers and resident merchants and their property. The report ended with an overall assessment that it would not be profitable for the EIC to revive trading with the Gulf and that this matter was better left to private traders. The one exception was the area of Eastern Arabia, where they saw potential. They therefore recommended that the EIC establish a factory in Muscat, with the particular goal of trading with Eastern Arabia. This advice was apparently not followed and perhaps wisely. In a similar report ten years later by John Malcolm, political developments had in the meantime made such a recommendation impossible.
Political disturbances and decline

Warden, who mainly constructed his historical overview on material in the Bombay archive, which primarily contains earlier EIC material (including the letters from Latouche), offers no information on the vital years between 1785 and 1799, except to state that the Utub were left in “in quiet possession of Bahrain” (Hughes Thomas 1985:366). He must therefore have been unaware of the political development that took place in inner Arabia.

In 1793, a group of merchants again departed from Basra, owing to political turmoil. This time, however, they went to Kuwait, Muscat or Bombay and not Al Zubarah (Abdullah 1992:182), an indication that perhaps Al Zubarah was not considered a safe place. According to the chronicler Ibn Ghannam, the city instead received refugees from al-Hasa, after Saudi attacks in that area from 1793-95 (Hakima 1965:154). According to Lam’ al-Shihab, the general of the Saudi army, Ibrahim bin Ufaysan thereafter requested permission from the Saudi ruler to attack Al Zubarah, which he did in 1795. It is noticeable that the attack was begun by cutting the inhabitants from their good water sources (probably at Shuwaila\textsuperscript{10}). An extended siege followed, during which Freiha, Huwailah, Yusufiya and Ruwayda were taken and a mass evacuation of Al Zubarah inhabitants to Bahrain took place, after which the Saudi withdrew.

Rizq, the merchant, was still based in Al Zubarah after the conquest of Bahrain but he moved to the first Utub settlement, at Al-Jaww, on the east coast of Bahrain, together with other leading merchants, after the Saudi invasion (Fattah 1997:225 n 117). He was still alive in 1797-98 and his five sons managed a large firm specialising in pearls and trading with India.

Final Demise

The inhabitants of Al Zubarah faced two major threats towards the end of the 18\textsuperscript{th} century: the Omani Imamate and the expansion of the first Saudi state. As a consequence of direct trade with Surat, the merchants of Al Zubarah no longer paid custom duties to the Imam of Muscat. By the end of the 18\textsuperscript{th} century the ruler of Oman therefore wanted to collect tribute from ships passing through the straits of Hormuz, most likely in an attempt to recover lost revenue. A series of

\textsuperscript{10} Alan Walmsley, pers. com.
hostilities ensued and, in 1799, the Imam of Muscat attacked Al Zubarah and Bahrain. In the process, the Utub fleet returning from Surat were seized, together with its cargo. According to Warden (Hughes Thomas 1985:366) this consisted of a total of three ships. This seems a very small number of ships and suggests that perhaps not all the ships were taken. By comparison, in 1807, the Qawasim had approximately 60 larger ships for long distance trading and war, and 200-300 smaller pearling boats (Carter 2012:124).

Another result of this attack was the return of a significant part of the Khalifah, who resettled temporarily in Al Zubarah, this time under Saudi protection. The settlement patterns of the Khalifah and the relations between the Utub, the Omani dynasty and the Saudis are complex, and shifting alliances became the norm rather than the exception.

Adding to the complexity is the fact that, despite the clear prominence of the Khalifah family, it is unlikely that they exercised unrivalled control over Al Zubarah or Bahrain, although they seem to have had an extensive tributary network. Onley (2004:44) lists a minimum of 15 tribes between 1766 and 1871, however the names or number of local tribes that had affiliated themselves with the Khalifah cannot be stated with precision (Heard-Bey 2001:100).

Apparently regretting the alliance with the Saudis, Al Khalifah shifted his alliance to the Omanis, which eventually resulted in the Saudis taking control of Al Zubarah and Bahrain in 1810. The Utub continued as administrators under Saudi rule, paying tribute (Hughes Thomas 1985:140).

Prior to these events, the sheikhs of Al Zubarah and Kuwait had actually engaged in secret negotiations with the British government. As they explained, the Saudis were pressing them to go on a “piratical cruise to India” and they had so far avoided complying with this wish, partly because the Saudis feared that they would return to Bahrain from Al Zubarah (Hughes Thomas 1985:367).

The sheikhs specifically asked the British if they withdrew from the alliance with the Saudis and retired from what we now know as Qatar, would the British help them to “remain undisturbed” in Bahrain. As they stated:
“the greatest assistance they would require would be a vessel or two for a short time” (Hughes Thomas 1985:367).

This is interesting as, according to Al Khalifah history, they had already settled permanently and securely in Bahrain in 1800. Crystal (1990:37) concluded on that basis that the move had not only severed the ties between the Utubi factions but had left Al Zubarah without any administrative apparatus or ruling elite, which in both cases is contradicted here by Warden. If, contra Crystal’s assessment, there were still a significant number of the Khalifah and their allies in Al Zubarah, it might also explain why the Omani later targeted Al Zubarah instead of Bahrain. Manesty and Jones also stated in their report from 1790 that Kuwait, Bahrain and Al Zubarah were headed under one government, by Sheikh Ahmad of Bahrain and Sheikh Abdullah of Kuwait.

Captain Seton, the political agent in Bombay, supported a British intervention but his advice was clearly not followed. While the Saudis were engaged in confrontation with the Ottomans elsewhere, the Omani Imam seized the opportunity and attacked Al Zubarah, which suffered an irreversible blow sometime between mid April and the end of May, 1811 (Hughes Thomas 1985:368).

After the destruction the site fell into ruin, although Bruck notes in his survey from 1829 that horses from the Najd were still exported from there by a Bedouin tribe (Hughes Thomas 1985:562). Meanwhile, Rizq and his sons continued to trade in Bahrain and today their descendants can be found in Basra, Kuwait and Bombay (Abdullah 2001:147 n 12).

The social and human fabric of Al Zubarah
The Eastern Arabia Gulf settlements and hinterland consisted in the 18th century of a diverse group of people bound together by ties of genealogy or commercial partnership (Anscombe 2005). Two main types of power therefore characterised Al Zubarah society: social and economic organisation, defined – with a large degree of overlap – by tribal kinship and the importance of the merchant stratum.

The merchant elite enjoyed relative economic independence and moved freely between both Persian and Arabian ports (Floor 2009). A typical career for a freight merchant began as an
apprentice in the family business taking charge of a single cargo, followed by more wholesale experiences. Enterprising young men, who wished to become a merchant but did not have a family who could financially support them, would not enter an established firm of another family but instead borrow the necessary capital needed for a particular venture (Abdullah 1992:125ff). The merchant b. Rizq, mentioned above, became wealthy this way. In Basra, he had obtained a loan from the local wakil and within a short time he had generated a large profit (Abdullah 2001:85).

Owing to the high risk involved in long distance trade it was not uncommon for merchants without good connections to go bankrupt. In 1781, two French ships seized an Omani ship en route to Al Zubarah, Qatif and Basra. The ship itself was owned by the Imam of Muscat but the highly valuable cargo belonged to merchants in aforementioned towns. According to Latouche, who was personally involved in this type of trade (Risso 1986:64), the confiscation of the cargo had severe economic implications for the merchants:

“...the Merchants of Jebra [Zubâra] and Catiffe [Qatîf] have nearly been ruined by the capture of the Muscat Ship, the cargo of which is valued at 8 Lakhs of Rupees...”\textsuperscript{11}

The more wealthy and influential merchants usually diversified their investments, often investing in property or part ownership of vessels, in order to avoid these situations (Abdullah 1992:129).

Notwithstanding occasional bankruptcies, the boom in the pearling industry and trade in commodities meant the merchant class were at the top of the social hierarchy. However, it is more difficult to assess their political influence. They did apparently enjoy easy access to the ruling class (Crystal 1990:261) but as the influence was informal they seldom left any written record (Onley 2005:71).

The wealthy merchants also acted as patrons and sponsors of the religious and scholarly community (Fattah 1997:27). This community, which also included visiting scholars, discussed topics ranging from the šariʿa, ie Islamic low studies, including hadith and fiqh, as well as literature

\textsuperscript{11} Latouche at Basra to London, 21st Oct 1781, in Risso 1986:64
and linguistic studies including poetry, grammar and other linguistic issues. This was facilitated, according Uthman b. Sanad who wrote the biography of b. Rizq in 1810, by the construction of various places for teaching, including schools (madrasa), mosques, and libraries (Sanad 2007). The so-called ‘writing office’ of b. Rizq was headed by a scholar who supported other scholars by buying books that were then shared among them (al-Atiqi 2012:454-455). Sanad himself was acting as supreme judge in Al Zubarah. Another noticeable scholar (and merchant) was al-Tabatabai, who settled in Al Zubarah in 1766; and in a poetic style he commented on historical events and on the scholarly community living there (Al-Tabata’1964).

Numerous other scholars were also present in Al Zubarah. Further studies on these aspects promise not only to inform us on the scientific community and the schools of thought that prevailed in Al Zubarah but also how this impacted on the everyday life of its citizens. It will also help place Al Zubarah within a wider context of Islamic science traditions.

Aside from the presence of merchants and scholars there are other indications of an increasingly stratified society, although the lower classes are practically invisible in the textual material. Manesty and Jones noted in their 1791 report that the presence of many rich Arab merchants gave “employment to many people of the lower class”. Although they provided a living for these people it was not necessarily a profitable one. In 1818, Huwailah had a maritime population that made a living on pearl fishing and a hinterland population that lived on husbandry. Taylor notes that the latter was not as impoverished as their clansmen at sea (Hughes Thomas 1985:17).

There were also other tribal groups present, both nomadic and settled, not just the predominantly Arab groups, as well as people of non-tribal origin (Zahlan 1979:16). Two prominent groups were the adjam (Persians) and Africans. The last two decades of the 18th century witnessed an increase in the number of slaves imported from Omani-controlled East Africa as demands for labour, especially pearl divers, rose (Khoury 1980:21). This shift in slave practice, which in East Arabia originally constituted a few domestic slaves, was financed by Gulf merchants (Ricks 1988).
Daily life and customs

Textual sources so far reveal practically nothing about daily life in Al Zubarah, which would have been structured around the pearling industry and the changing seasons of the monsoon. A large part of the archival material uncovered so far comes from trading companies and deals mainly with trade and economic history. This does not imply that some kind of information on daily life and customs cannot be extracted, using the right approach. The materiality of food and clothing, which are both human necessities, can be used to express social identities that are subject to change under internal and external influences. Patterns of regional and international trade are therefore closely linked with domestic consumer culture. A comprehensive study of trade is in this manner also a study of consumption and it should not only be restricted to a discussion on merchants, trading networks and market statistics but also focus on what was traded, why and to whom.

Rice, sugar, coffee and tobacco were strongly represented in Manesty and Jones’ report and are all commodities that not only reshaped agriculture and trade but also reconfigured patterns of commensality. For example, tobacco smoking and coffee drinking habits are deeply embedded in long-standing rituals of sociability. Changes in consumption can therefore indicate changes in religious, political and social practices (Matthee 1996).

Furthermore, rice, to name another example, was used in the 19th century to pay the tax on pearling boats (Lorimer 1970:2284), despite the presence of a monetary economy. It was imported to the Gulf from Indian Ocean ports already in the 17th century, primarily to the Persian littoral and later to Muscat (Klein 1994) but the rise of new settlements on the Arab littoral increased the need for rice for basic subsistence, a fact pointed out already by Manesty & Jones in 1791.

The importance of rice, not just among the pearl divers, but among the whole Eastern Arabian community, is evident from both textual sources and ethnographic research (see for example Wilson 1833, Holes 2005). Preliminary archaeobotanical results from Freiha and Al Zubarah, which abounds in rice and date remains, also supports this (Murray, forthcoming). Today, rice is known in the Gulf Arabic dialect as *aish* – literally meaning ‘life’ – contra *aruz* elsewhere. Rice is noticeably also grown today in the al-Hasa oasis in Saudi Arabia but the date of the establishment
of this agricultural production has not been researched and any link to the 18th century pearling boom is speculative.

The customers of the Persian Gulf preferred Persian or Bengali rice over Java rice (Floor 2007), and likewise Mocha coffee over Java coffee, much to the dismay of the VOC who was the main exporter from Java. The commodities therefore also attest to the interconnectedness of the pre-modern world and an increasingly globalised consumer culture.

The archaeobotanical material has also produced interesting results not visible in the written records. A diverse range of imported fruits and nuts, for example, indicates the presence of a clientele that demanded other products, and could afford so. Taken together with the zoo-archaeological material, however, there can be little doubt that the majority of the population relied on a dietary regime of rice, dates and fish.

Al Zubarah offers, with its rich material cultural remains, a unique opportunity for a holistic approach to many of these questions. Is the intention of the QIAH history programme to further pursue these issues, in close collaboration with the ongoing study of the archaeological material.

**Discussion**

Many scholars studying 18th century Gulf history have emphasised the dearth of sources. Much of the Gulf’s locally written sources remain hidden in private libraries or are simply lost (Hakima 1965:14; Onley 2005:62; Slot 1993:386; Segal 2009:709). A serious lacuna is the lack of official local documents on tax and land tenure, court documents, trade statistics and similar material. Hence we are dependent on a limited and uneven but complex body of sources. The reliance on English sources, in particular, mainly because these are the most accessible, has resulted in a historiography that embodies themes that focus on the impact of foreign politics and foreign trade, but disregard the local power play and trade. Several recent studies have challenged this assumption of foreign hegemony in the Gulf in the 18th and early 19th century and highlighted the indigenous contribution, both politically and economically (Fattah 1997; Abdullah 2001; Onley 2007).
As testified at Al Zubarah, there was a remarkable degree of local agency, often not directly visible in the textual material. Matthee has remarked that

“In studying non-Western societies, and especially Muslim ones, it was also customary to assume that the often anaemic commercial performance of these societies, marked by low investment and poor organization, was mostly due to a tendency of rapacious states to terrorize and fleece supine and hapless merchants” (2009:105).

In the same vein, tribal movements have been seen as a result of “overpopulation, poverty, warfare and starvation” (Fattah 1997:25). This explanatory model must be modified as it fails to explain how Al Zubarah was built with its massive investment of resources – financial, material and in manpower.

Research has suggested that worldwide patterns showing increased consumption in the 17th and 18th century, earlier recognised for Europe and America, also includes the Indian Ocean world and South East Asia (Quataert 2000:3). This proto-globalisation trend clearly encompassed the Persian Gulf and Al Zubarah. Commercial activity shaped a large part of the history of the Gulf region and is intimately intertwined with the fluctuating fortunes of Al Zubarah.

It is noticeable that conflicts that involved Al Zubarah were concerned primarily with trade routes and tribute, not land or territorial rights. The prime movers of exchange were not great empires but small-scale entrepreneurs.

Together with the new urbanisation of the Arab littoral came a trading network based primarily on kinship ties, and a mercantile world that was subject to much less regulation than earlier experienced. The previous centralised state-oriented model witnessed in Persia and Basra, was replaced primarily by a tribal system (Carter 2012:115); and the pearling industry was closely related to the tribal system (Davies 1997:20). The lack of custom administration, incidentally, is one of the major reasons for a lack of local sources on trade for this region. Another development was the monetisation of local economy. The import of supplies was initially paid for with pearls but, as a pearl trade evolved, the income stimulated a shift from barter economy to cash economy.
Despite the primacy of kinship ties, it is important to remember the interaction and diversity of the merchant stratum when discussing 18th century trade: In the case related to on page 15 a cargo destined for Al Zubarah (among other ports), and thus presumably belonging to merchants residing there (who may or may not have been of Utbi origin), was carried on an Omani ship and shared the hull with cargo belonging to Basra and Qatif merchants, the latter most likely of the Banu Khalid tribe. Hakima (1965:185) claimed that the Utub had achieved a monopoly on Gulf trade but also that they traded “without fear”. This seems an unduly overgeneralization.

Al Zubarah continued to be a free port throughout its history. This is in contrast to the admittedly low tax ports of Grain (Kuwait) and Qatif. This facet is usually interpreted as an indication of the prosperity at Al Zubarah (Carter 2012:118; Zahlan 1979:28). This might be correct for the early history but difficult to explain later on when a major competitor like Muscat could charge between 4.5% and 7%, depending on the ethnicity of the merchants, on all goods including provision (Brittlebank 2005). The non-existence of custom duties might indicate a problem attracting merchants or ensuring a steady flow of commodities. It might also be a reflection of tribal mercantile system or lack of political administration. The latter seems though to be contradicted by Manesty and Jones’s report. At Bahrain, the Khalifah did not introduce custom duties until 1824 (Khoury 1980). The lack of information on other tax systems makes a balanced assessment of this issue difficult. One cannot rule out that taxes were collected directly from the merchants in a different manner not visible in the archival record.

**Conclusion**

Until the discovery of oil, pearl diving was the major source of income in for the Arab Gulf littoral, in the pre-modern period. This is evident in textual, ethnographic and archaeological sources. The development of pearling settlements was dependent on tribal leaders and merchants operating in symbiosis, as a steady influx of merchant capital was necessary while the kinship ties offered the socio-economic framework. Located in an environmentally challenging zone, outside the domain
of territorial states, Al Zubarah flourished because such a symbiosis was achieved. The trading network became so profitable that the lack of local resources was no longer considered a hindrance. In this historical context, the settlement of Al Zubarah can be seen as both an heir to centuries of pearl fishing and Arab dhow trading across the Indian Ocean and as part of a new socio-economic system that laid the foundations for the modern Gulf States.

Partially abandoned after only fifty years in existence, Al Zubarah still retains a complete urban layout and a high degree of authenticity. It provides a unique example of a coastal town and offers insight into indigenous and local agency. Al Zubarah also offers a unique opportunity to work with two major strands of research that can confirm and challenge each other; the archaeologically informed narratives, reflecting archaeological concerns, and the historically informed narratives.
Bibliography


Al-Atiqi, E. 2012. *wuğud āl ḥalifa fi alʿutub w alihs ā men ḥilal alwaṭaʿq almahaliala*, Al-Ab 7-8, 437-474


Matthee, R. 1996 From Coffee to Tea: Shifting Patterns of Consumption in Qajar Iran, Journal of World History 7.2, 199-230


Sanad, U. 2007 *Saba’ik al-’Asjad fi Akhbar Ahmad Najl Rizq al- As’ad*. Doha


Al Zubarah Archaeological Site
Community Archaeology Program
QIAH Project UNESCO Phase One,
Year One (2011-2012)

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1. Introduction to Community Archaeology Program at Al Zubarah Archaeological Site

The field of Community Archaeology (which for the purposes of the QIAH Project involves education, outreach and oral history) aims at engaging and involving local communities in protecting, promoting, interpreting, as well as benefitting from the archaeological and heritage sites within their communities.

In 2009 the Qatar Museums Authority, jointly with the University of Copenhagen, launched the Qatar Islamic Archaeology and Heritage project (QIAH). From its inception, the QIAH Project included public outreach and education as an integral component of its work. Such community-based cooperation has brought clear and well-defined short and long term benefits to both the site and the project.

Working with local "communities" has both practical and ethical benefits for archaeologists and heritage specialists at Al Zubarah, no matter the definition of that community. Archaeologists and heritage specialists engage local communities and stakeholders to assist with interpreting, safeguarding and promoting the archaeological site. Such involvement gives the local communities a sense of pride, ownership and identity as they explore their own heritage. Specialists are also able to enrich their own research through the collaboration of, and involvement with, local communities in Qatar.

For archaeologists and heritage specialists, involving local communities in the "archaeological process" is not a matter of choice but a responsibility. By working with local communities, archaeologists and heritage specialists aim to protect, preserve and enrich the archaeological and cultural heritage of the area in the future. They hope to achieve this by creating a sense of shared history, cultural identity and cultural awareness. Engaged community archaeology promotes civic involvement and a better understanding of the values of archaeological and cultural heritage in Qatar.

In the longer term, the information researched, shared and gathered about Al Zubarah Archaeological Site in its cultural, historical and natural context will not only enrich the knowledge we have of the site and its associated material culture, but will help introduce the QIAH Project’s results to both national and international audiences. In doing so, the uniqueness of Al Zubarah Archaeological Site and the people of Qatar’s northwestern region will be revealed.
2. Aims and Objectives of the Program

The true success of an archaeological/heritage project (both during and post-excavation) depends on the understanding and support of the public and decision makers. Hence it is the role of archaeologists and others working in the field of heritage management to communicate their goals, results and recommendations honestly, clearly and effectively, as well as involve the community and decision makers in all aspects of the project.

There are three main aspects of the QIAH community archaeology work at Al Zubarah Archaeological Site: the first focuses on enriching our knowledge of the site, its history and the history of the northwestern region of Qatar by focusing on the accumulation of oral histories and traditions. The second is an active public awareness, education and outreach program focusing on various activities, both at the site and in Doha and Al Shamal. The third is to build knowledge and practice among QMA staff and other local professionals on issues of education, outreach and oral history.

To accomplish our objectives, the Al Zubarah Archaeological Site Community Archaeology is developed along five main trajectories:

1. **Coordinate and cooperate** with various governmental and non-governmental institutions, especially QMA, Qatar Foundation and Qatar University.
2. Focus on enriching knowledge of Al Zubarah by gathering, incorporating and **highlighting the rich oral history**, folklore and local traditions of the northwestern region and of Qatar as a whole.
3. Develop an active **comprehensive public awareness** and outreach program, to be carried out through various educational and hands-on activities on and off-site.
4. Use **archaeological heritage to serve Qatari society** in the fields of education, economy, culture, heritage, and to strengthen the national identity.
5. Use community archaeology as a vehicle to create a **well-trained and interested group of local professionals** that will carry on the mission of heritage preservation and heritage education.

2.1 Educational Outreach

The Al Zubarah Community Archaeology Program focuses on reaching out and working with schools and community centres, mainly in Doha and Al Shamal, to raise awareness of the site, its context and its importance. This is achieved through public lectures, presentations, site tours, museum visits, and practical hands-on experiences. A large number of activities are prepared for schools either during their visits to the site or when the education and outreach team visits the schools.

Other outreach efforts include producing booklets, brochures, temporary exhibits and various other activities to educate the general public and activate their interest in Al Zubarah and the archaeological heritage of Qatar.
2.2 Oral Histories Collection

The Al Zubarah Oral History program includes the gathering of oral histories, a process which involves the systematic collection of living people’s testimony about their own experiences and those of their ancestors, going as far back as their memory permits. The program focuses on tracing the lineages and histories of families; detailing documentation of village histories; tracing the movement of families from Al Shamal villages – including Al Zubarah – to Doha and Madinat Al Shamal; and gathering as much information as possible on divers and tawaweesh (traders) from their families. Understanding genealogies is an important part of this work and the lineages and histories of families of Qatari tribes, traders, tawaweesh and pearl divers have already been partially traced in the 2011-2012 QIAH work season [see Fig 2 & Fig 3 on p.4 - p.5].

The other aspect of the QIAH Oral History program is the gathering of oral traditions and folklore with a focus on verbal traditions, customs, beliefs, music and song, jokes, riddles, stories, legends, rhymes, proverbs, and language. This collection work also involves the creation of an audio and video registry of the interviews. Old photographs, historical documents and published research about the site and the region are all collected and used, and in the future information on boat building and pearling techniques and tools will also be gathered.

Through the gathered list of Al Shamal tribes, the QIAH team has been able to identify individuals that could contribute as interviewees to the oral history database. During the 2011-2012 season it has been possible to identify a list of Qatari individuals that were able to contribute to the collection work [see Fig 1]. Part of such work has also involved the gathering and acquisitions of documentation, written sources, historical photos and maps. Access to Sheik Hassan’s Arab and Islamic Heritage Library has enabled the enrichment of knowledge of the Al Shamal region and of the villages of the northwestern coast of Qatar, which include Al Zubarah.

<table>
<thead>
<tr>
<th>Person name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women folk of Mubarak Fadalah</td>
</tr>
<tr>
<td>Seif Al- Fadalah</td>
</tr>
<tr>
<td>Husain al – Fadalah</td>
</tr>
<tr>
<td>Khaled Al – Kubasi</td>
</tr>
<tr>
<td>Khalifa al Kubasi</td>
</tr>
<tr>
<td>Ali al Kubasi and his father</td>
</tr>
<tr>
<td>Khalifa Al Kubasi</td>
</tr>
<tr>
<td>Eid bin Selham – “the Grandfather”</td>
</tr>
<tr>
<td>Mohammed bin Issa bin sloum Al-Kabasi</td>
</tr>
<tr>
<td>Ali al Kubasi and his father Khalifa</td>
</tr>
<tr>
<td>Mohamed Saleh Ali al Fadalah</td>
</tr>
<tr>
<td>Khaled Ali al Kubasi</td>
</tr>
<tr>
<td>Mohamed bin Issa bin Mohamed</td>
</tr>
<tr>
<td>Mohamed bin omr aldasisim al kubasi</td>
</tr>
<tr>
<td>Ali Shebib Manan’i</td>
</tr>
<tr>
<td>Najla the wife of Mohamed bin omr aldasisim al kubasi</td>
</tr>
</tbody>
</table>
Fig 2: The tribes of Northern Qatar and their villages

The tribes of Northern Qatar and their villages

- The tribes of Northern Qatar and their villages
- Al Zubarah Archaeological Site Community Archaeology Program – Dr. Iman Saca
Fig 3: List of names in Arabic for some villages in the North
3. QIAH Project UNESCO Phase One, Year One (2011-2012)  
Community Archaeology Work

3.1 Educational Outreach

One of the first steps towards accomplishing the aims of the program has been ensuring coordination with the appropriate government and educational organisations. The QMA has been involved from its inception: the QIAH Project operates in close and regular coordination with the Director of Archaeology and Heritage, Dr Sultan Muhesen, who is also the QMA’s Senior Archaeology Advisor, and with Mr Faisal al-Naimi, who is Head of the QMA Archaeology Department and his team.

In an effort to coordinate Community Archaeology work with the appropriate governmental organisations related to education, an official letter of introduction from QMA was sent to the Supreme Council of Education (SCE) of Qatar, to introduce them to the work of the QIAH Project and inform them of its mission and goals, archaeology and heritage related activities, and the availability of the team to execute relevant activities either on-site or through schools visits.

A team from the QMA’s Department of Archaeology was trained to carry out presentations and educational activities in schools in Doha [see page 12], while at the same time a QIAH team member was responsible for giving visitors, both general visitors and students, a detailed tour of the site, as well as explaining the archaeological process [see page 11].

At first a list of all schools in Qatar was compiled by the staff at the Department of Archaeology [see Fig 4, p7]; all foreign and mustaqila schools (government-run schools) were listed according to village and region, detailing contact information for each [see Fig 5, p7]. These lists facilitated communication with the schools and helped the team plan current and future activities.

In Al Shamal, letters were sent to all schools explaining the nature of the activities taking place in Al Zubarah, and schools were also provided with a sample program for a site visit. The correspondence was then followed by regular visits and meetings with the heads of the Al Shamal schools, during which site visits and/or in-school activities were discussed and arranged.

To better understand how, and if, heritage and archaeology should be introduced to the children’s scholastic curricula in Qatar, and if so, what subjects would be covered, a team from QMA’s Archaeology Department gathered social studies textbooks currently used in government-run elementary, middle and high schools. The textbooks were reviewed with the intention of locating any information on archaeology, sites in Qatar, heritage education, and traditions of Qatar, among other similar subjects. Reviewing the school text books helped with an understanding of what is being taught in schools in Qatar and what is missing from the textbooks. This preliminary survey revealed a clear need for a comprehensive review.
**Fig 4:** Official list of schools

<table>
<thead>
<tr>
<th>SCHOOL NAME</th>
<th>LOCATION</th>
<th>PHONE NUMBER</th>
<th>PRIMARY LANGUAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arabic School</td>
<td>Arabic School</td>
<td>12345678</td>
<td>Arabic</td>
</tr>
<tr>
<td>English School</td>
<td>English School</td>
<td>87654321</td>
<td>English</td>
</tr>
<tr>
<td>Combined School</td>
<td>Combined School</td>
<td>78901234</td>
<td>Arabic &amp; English</td>
</tr>
</tbody>
</table>

**Fig 5:** Schools listed by region

<table>
<thead>
<tr>
<th>REGION</th>
<th>SCHOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al Zubarah</td>
<td>Al Zubarah Archaeological Site Community Archaeology Program – Dr. Iman Saca</td>
</tr>
<tr>
<td>Al Daayen</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig 6:** Distribution of schools across the region

- City of Rayyan: a city for the development of archaeological sites.
- City of Khareef: a city for the development of the school.
- City of Al Daayen: a city for the development of the school.
- City of Al Zubarah: a city for the development of archaeological sites.
- City of Al Daayen: a city for the development of the school.
- City of Khareef: a city for the development of the school.
of all the social studies textbooks as information on the archaeology and heritage of Qatar was rarely found in any of the reviewed textbooks. The ultimate goal is to provide schools with supplementary text information on Qatar sites, archaeology and heritage.

The team worked hard, both on and off-site, to prepare material for students and site visitors. To achieve this aim a large number of PowerPoint Presentations were prepared, targeting various issues, while materials and objects were selected for hands-on activities and show-and-tell sessions, so as to optimise student knowledge. Questionnaires and written activities were also created for students visiting the site, as were pottery conservation sessions off-site, and object sorting and cleaning activities on-site.

3.1.1 On-site and off-site activities

On site

A large number of activities were prepared and carried out by the QIAH team with the support of QMA’s Department of Archaeology. These aimed at enriching the visitors’ knowledge of the site and engaging them in archaeological processes. Various activities were conducted to highlight what archaeologists do and why. The work also focused on explaining the kind of material that can be found at an archaeological site, especially at Al Zubarah, and how it is processed. One of the main aspects discussed during the site visits is the value of preserving the archaeological heritage of Al Zubarah and why this particular site is so important for Qatari people.

Based on the outreach and educational activities carried out in 2010-2011 and 2011-2012 by the QIAH Project, the number of students from schools in Doha and Al Shamal municipalities visiting Al Zubarah or participating in outreach workshops held at the schools has increased exponentially. Numbers grew from approximately 315 students over the 5 months period during the QIAH fieldwork season in 2010-2011, to approximately 1270 students (of which approximately 650 visited Al Zubarah Archaeological Site and 620 attended workshops on Al Zubarah in Doha) for the 2011-2012 season. The average number of people taking part in the various activities changes greatly according to the size of the school involved, but on average 30-40 students made up each visiting group. The figures for school visits and workshops are expected to increase further with the development of the QIAH outreach programs planned for the next three years.
Visits to *Al Zubarah Archaeological Site* are usually preceded by a letter sent to the school to prepare them for their visit ([see Fig 7, p10](#)). Once students arrive at *Al Zubarah*, the QIAH on-site education officer, Mrs Nasreen Mohammed, accompanies them on their 2-3 hours site visit with the assistance of other archaeologists. An average visit includes:

- **Introductory talk** in front of the information pavilion to briefly introduce the group to the site, the QIAH Project and what their visit is going to include.
- **PowerPoint Presentation** prepared by the on-site education officer, introducing archaeology to the students and helping prepare them for the site visit.
- **Visit to Al Zubarah Fort**, including explanations of when and why the fort was built, as well as of the important architectural elements of the building. During the conservation process a conservator will discuss his area of work with the students.
- **A visit to the finds tent** to show the students where all the bones, pottery and sampled soil are stored. Here students hear from the finds officers about the value of these finds and the way they are processed.
- **Various objects from site** are displayed on the object table and an archaeologist explains to students what they are seeing, the importance of such finds, and the value of preserving them. Some objects can be handled by the students, which is an activity they generally really enjoy.
- **A visit to the flotation station**. The archaeologist responsible for the botanical remains at *Al Zubarah* explains how the flotation station works and why it is used. The importance of small faunal and botanical remains at an archaeological site is also explained to the visiting students and guests.
- **Pottery cleaning and sorting** is another hands-on activity that the students participate in during their visit to the site. Under the supervision of the archaeologists in charge of the finds, students engage in cleaning some of the pottery shards and learn how to sort material found at the site, and why archaeologists do it.
- **A mock excavation**, or the possibility to take part in the excavation process with the archaeologists, has been the highlight of the visiting students during the past two seasons of QIAH work at *Al Zubarah*. As this activity is very time-consuming, it requires lengthy preparations by the on-site team. This activity in particular should become an integral part of site visits and has the potential to become the main motivator for a school visit to *Al Zubarah*.
- **Students are also given the opportunity to participate in activities** that involve drawing the fort, objects and other finds at the site.
- **Short Q&A sessions** are also held regularly during site visits.
- **Last but not least**, a detailed site tour is given by the archaeologists on-site and the various areas of *Al Zubarah* are explained to the students.

It is important to note that activities carried out during each visit are modified on the basis of the age of the visiting group and their interests. Most schools are also encouraged to provide feedback by answering a questionnaire about their visit to the site, and they are asked how they can help promote and protect *Al Zubarah Archaeological Site*. 
**Things to be kept in mind before undertaking an accompanied visit to Al Zubarah Archaeological Site**

**Important notice:**

Teachers and accompanying parents are entirely responsible for the health and safety of their pupils while visiting Al Zubarah Archaeological Site (hereafter the Site). Teachers and accompanying parents must ensure the students behave in a responsible manner and follow instructions given to them by the group escort provided.

Your host is the Qatar Museums Authority, who has granted permission for your school group to visit the Site. At the Site you will be guided by members of the archaeology section of QMA and/or team members of the Qatar Islamic Archaeology and Heritage Project (hereafter the Project), a QMA initiative in partnership with the University of Copenhagen.

The site regulations below MUST be followed. Any infringement will result in the whole group being asked to leave the excavation area.

1. Suitable clothing for the outdoors is required (light, comfortable); a lot of the activities occur outdoors.
2. Suitable footwear must be worn (trainers, walking boots are the best).
3. Protection from the sun and wind is necessary: a hat or head covering, sun glasses, sun block (sunscreen).
4. Plenty of water must be available (minimum 2 litres per person).
5. A responsible first-aider must accompany the group and bring a first aid kit with them (Project staff cannot render first aid).

*All visitors need to comply with the following instructions*

1. Vehicles must be parked at designated parking areas only. Driving on the Site is **strictly** prohibited.
2. Always look where you walk as the ground is uneven (and you may trip over).
3. No running.
4. No pushing or playing games.
5. Do not wander around by yourself – you must stay on designated paths unless otherwise advised by the group escort.
6. Do not pick up or remove any stones, pottery or any other objects that you may find on the Site.
7. Do not litter.
8. When visiting the site you may only enter an excavated area when permitted and always with an escort.
9. Visitors are permitted to take general photographs of the Site for **personal use only**. Detailed photographs of areas under excavation are not permitted. Photographs must not be used for anything other than personal use.
Al Zubarah Archaeological Site Community Archaeology Program – Dr. Iman Saca

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Fig 8: Example of school visits and lecture program

<table>
<thead>
<tr>
<th>Name of school</th>
<th>Date of visit</th>
<th>Number of visitors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>French school Lycee Bonapart</td>
<td>Feb 5-6-7</td>
<td>100 students</td>
<td>Hands on activities for 3 full days. Including site visit</td>
</tr>
<tr>
<td>Cambridge school site visit</td>
<td>Feb 20^a</td>
<td>15 students</td>
<td>On site activities</td>
</tr>
<tr>
<td>Doha English Speaking school</td>
<td>Feb 27^b</td>
<td>99 students</td>
<td>In-school presentation and pottery workshop</td>
</tr>
<tr>
<td>Doha English Speaking school</td>
<td>Feb 29^b</td>
<td>115 students,</td>
<td>Follow up school visit to site with all on site activities included in visit parents and teachers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of school</th>
<th>Date of visit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qatar Foundation visit</td>
<td>March 1^d</td>
<td>On site visit</td>
</tr>
<tr>
<td>Doha Home Educators</td>
<td>March 4^e</td>
<td>On site visit- full program . 12 family 33 children 13 parents</td>
</tr>
<tr>
<td>Teachers Tour from various schools</td>
<td>March 10^f</td>
<td>36 teachers. Detailed tours and possible activities for their students</td>
</tr>
<tr>
<td>in Doha. organized by Mark Witherman</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QMA-PR office tour of site</td>
<td>March 19^g</td>
<td>See the site and possible pr activities</td>
</tr>
<tr>
<td>Al Duhail elementary school for</td>
<td>March 26^h</td>
<td>In school Pottery workshop and lecture.</td>
</tr>
<tr>
<td>boys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesaieed International School</td>
<td>March 25^i</td>
<td>In school presentation</td>
</tr>
</tbody>
</table>

Other schools

- Madrasat Maymouna Al-Eptidaiyah and did two presentations with a hands on component.
Off-site

As with the on-site activities, off-site activities were prepared by a team of five women working in the Archaeology Department of QMA (Maysa al Kwary, Rima Nugnug, Hisa Malki, Siham al Mazrou’i, al Anoud al Mutaw’a) to promote Al Zubarah Archaeological Site and the value of archaeological heritage in Qatar. These activities targeted schools and students in Doha and its suburban areas. It became evident while preparing outreach and educational activities that many schools were either not prepared, or found it difficult to visit the site.

The Doha QMA team prepared various PowerPoint presentations and they were trained on how to present these to the students, what to focus on, and how to engage them. The team also prepared presentations to focus on what archaeology is and what archaeologists do. Mr Faisal al Naimi encouraged his team to participate and took part himself in some school activities. Five PowerPoint presentations were prepared by the team, with the main objectives of introducing students to the field of archaeology, what archaeologists do, Al Zubarah Archaeological Site and other archaeological and architectural sites in Qatar, and their importance and history.

Typical off-site activities which students took part in during the workshops, which were planned in collaboration with the QMA’s Archaeology department staff, include lectures, PowerPoint presentations, handling sample boxes of artefacts from Al Zubarah, lithics presentation, photo exhibits, a film showing, and an explanation of the use of archaeologists’ tools.
One of the highlights of schools visits during the last season of work was the pottery workshop organised as part of each school visit. After each presentation students were able to handle some object or check the tool kit of archaeologists. This was followed by a lively Q&A session. Afterwards students headed to a site prepared by each school for the pottery workshops. Rima Nugnug presented on her work with pottery in the QMA office and after her short presentation students gathered in groups to begin their work with the pots [see Photo 7, p12]. At the end of each workshop, participating students received promotional material to take home, such as hats and t-shirts.

It is important to note here that although all the members of the QMA Archaeology team participated regularly in school activities, Maysa al Kwary has been the main person responsible for arranging details for off-site school workshops.

**An example of off-site activity**

As part of the QIAH and QMA outreach and education activities, the staff of the Archaeology Department at QMA participated in the National Day Celebrations at Al-Nahdah independent School for girls on December 11-14 [see Photo 11 et al, p14].

The Archaeology Department’s activities were one on the main attractions during the 3 day celebrations.

Some of the main activities included:

- A large photo display of Qatar’s and the Gulf’s archaeological heritage sites. Maysa al Kuwary was involved in setting up the display and both the activities and the movie viewing tents. Ibrahim al Mansouri also helped with the set up.
- Pottery workshop: during the workshop, which was repeated every day for three consecutive days, students listened to a brief lecture on the origins of pottery, the significance of studying pottery and reconstruction methodologies. After the lecture a hands-on activity followed, which involved students restoring pots provided by the QMA office. More than 200 students participated in this activity. Rema Nugnug led the presentation with the help of Hissa Malki
- Lithics workshop: Mr Faisal Al Na’imi presented information on stone tools, their production and what can be gained from their analysis to children and parents. He performed a live demonstration of flint knapping, the use of the bow and arrow and of other traditional hunting gear, which was extremely well received by the children.
- Presentation on the subject: what do archaeologists do at an archaeological site? This presentation was prepared by Al Anoud al Mutaw’a from the QMA’s Archaeology Department, who visited the site of Al Zubarah in 2010 and prepared a short film on her visit.
• Film on Al Zubarah: During the three days of the celebration a film on *Al Zubarah Archaeological Site* and Qatar was presented to students, teachers and parents. Dr Iman Saca of the QIAH Project gave a brief introduction to the site before the viewing. The film was continuously showing in one of the main tents at the school and was well received by the students, who asked numerous questions after the viewing.

The Team received a Thank you certificate, flowers and plaque for their participation.
Fig 9: Thank you letters and student reflections on their visit

Dear Dr. Iman, December 2005

Thank you very much for giving us the opportunity to visit Al Zubarah Fort. We all realized how fascinating and important archaeology is. We are very grateful for your guidance and for showing us the amazing site.

You are an amazing teacher. Thank you for your hard work and dedication.

Sincerely,

[Signature]

Dear Miss Iman,

I am writing to tell you how much I enjoyed my visit to Al Zubarah. It was absolutely fascinating and I had a lot of fun. As one of the many pupils at CBS, I know for sure that everyone else enjoyed it as well as myself.

I found it very interesting to see how you showed us the whole process of being a scientist. The activity was one of my favorite parts of the day.

Thank you very much for your hard work and dedication.

Sincerely,

[Signature]

Dear Miss Iman,

I really enjoyed my visit to Al Zubarah. It was an amazing experience. I learned a lot about history and the importance of preserving our cultural heritage.

Thank you for your guidance and for showing us the amazing site.

Sincerely,

[Signature]
3.1.2 Work with Qatar University

After meeting with the Chair of the History Program at Qatar University and his faculty, a proposal for cooperation during the next excavation season between the QIAH Project (University of Copenhagen), the QMA, and the History Program of the Humanities Faculty of Qatar University was submitted to Qatar University. The proposal provided QU students with the opportunity to work in close contact with a large number of experts in the field of archaeology, heritage, oral history and conservation.

Three main issues were proposed:

- A special topics course to be offered at QU in the spring semester.
- Internship programs for QU students.
- An exchange program between Qatar University and Copenhagen University.

A detailed proposal was submitted to QU and it was suggested that in the 2013 season of QIAH fieldwork a more comprehensive discussion should take place with the QIAH Executive Director regarding the implementation of such cooperation.

Lecture at QU

An important outcome of the preliminary proposal for collaboration discussed above was a series of lectures given by professors working on Al Zubarah to both students at Qatar University and the general public. The lectures were well attended and students showed interest in collaborating with the QIAH Project during future work seasons. In particular, after one of the lectures, a discussion with students revealed deep interest in learning methodologies of Oral History research and working with the Community Archaeology Program conducting interviews and gathering data.

3.1.3 Dissemination

Sharing and disseminating information has been a focus of QIAH work during the 2011-2012 season. A commonly recognised problem has been the lack of awareness among the public, and especially the younger generation of Qataris, about the importance of their archaeological heritage.
The planned public education and awareness activities target at least three kinds of audiences: decision makers in private and public sectors; students at various education levels; Qatari communities, especially local communities in the Al Shamal area, as well as visitors to Al Zubarah and northwestern Qatar.

The two main desired outcomes of the medium and long-term outreach and educational efforts are to emphasise to all stakeholders the value of Qatari archaeological heritage and the need to protect and preserve it as a matter of national importance; and to engage and involve the larger local community in learning about, supporting and participating in the protection of Al Zubarah. It is hoped this latter outcome will also extend beyond Al Zubarah to the archaeological, architectural and cultural heritage of the northwestern region and of Qatar as a whole.

Building relationships and being in direct contact and communication with the people of Qatar, working with them and learning from them was the main objective of the Community Archaeology team in 2011-2012 and will remain so during future seasons. These relationships are the main source of information for the Community Archaeology Program in the QIAH Project.

General methods used for information dissemination include:

• Creation of educational programs and activities for schools, both Mustaqilah governmental and international elementary, middle and high schools. Students are the decision makers of the future and knowledge and familiarity with Qatari cultural heritage should be a crucial part of their education.

• Educational initiatives for universities, mainly focusing on archaeology, architecture, natural history and material science. The programs being offered by local academic institutions are a critical asset because they supply Qatar with well-qualified and highly skilled specialists. In future, these students will be full-time employees and specialists working within the relevant governmental agencies and institutions.

• Enhancing the Project’s visibility and contacts within cultural centres, especially those dealing with heritage issues and promoting cultural heritage preservation and education (e.g. Katara, Museum of Islamic Art, Mathaf Museum of Modern Art, National Museum) of Qatar, Souq Waqif, Education city, which were all approached this season).

• Literature and information created for dissemination to schools, site visitors, and the general public:
  • Booklets on the site, its history and archaeology
  • Brochures
  • Postcards
  • Information boards on-site, clearly positioned to guide visitors along a track
  • Information Pavilion with large visible educational boards located near the

![Fig 11: Booklet](image)
Al Zubarah Fort, to welcome visitors and explain the site and fort in some detail
- **Al Zubarah Archaeological Site Website** (www.alzubraha.qa) and Facebook page (http://www.facebook.com/AlZubarah)
- Photo exhibit

3.1.4 **Capacity building**

Capacity building efforts are an integral part of the QIAH Project and are crucial to the creation of a Qatari group capable of working with confidence in the future and of encouraging civic involvement within the Qatari society. They are needed to promote a better understanding of the cultural, national, educational and economic values of the archaeological and cultural heritage sites in Qatar. The QIAH Project’s work with the Archaeology Department at QMA, as well as with QU students, is strongly geared towards training individuals and teams capable of carrying out education and outreach messages and activities. Five QMA employees are currently working with the Community Archaeology Program to prepare literature and presentations for schools in Qatar, as well as materials for hands-on activities and workshops.

Communication with Qatar University, aimed at attracting and recruiting students to work on issues related to archaeology, oral history, heritage education and community archaeology, is also ongoing. Short and long-term activities will be planned during the next work seasons with The Museum of Islamic Art and the National Museum of Qatar. These activities will require the establishment of relationships with museum personnel to work together and train personnel capable of carrying out specific community archaeology and oral history related activities. Cooperation with the Supreme Council of Education to create training workshops for teachers on themes of heritage education will also be essential.

One of the goals of the 2011-2012 season was introducing some of the QMA employees to the QIAH Community Archaeology Program, in the hope of creating a local team to collaborate on various aspect of community archaeology, especially education and outreach. This team is composed of staff from the Archaeology Department of QMA. Some of the accomplishments of this season in this regard are:

A team of 5 women from the QMA Archaeology Department (Maysa Al Kuwari, Rima Nugnug, Hisa al Malki, Siham Al Mazrou’i) started researching heritage education, archaeology and architecture of Qatar, archaeological preservation, and working on creating a photo exhibit for schools. They also prepared a number of lectures which were used in school presentations.

The QMA team prepared all the material required for hands-on activities, such as the very popular pottery workshops done in all schools visited during the 2011-2012 season. They also created a reference
box for mock excavation activities, and put together a sample box of objects for students to handle during school visits.

Maysa Al Kuwari was given the responsibility of coordinating with local schools in Doha, the creation of a database of all visits, and the production of a report on QMA activities concerning education, outreach and school visits. (A 40 page report was produced and given to the Head of the QMA Archaeology Department, to Dr Sultan Muhesen and Dr Iman Sac).

Mr Mubarak Fadalah, the Al Zubarah Archaeological Site Deputy Site Manager, assisted in setting up the oral history interviews.

The Library of the Department of Archaeology of the QMA has been activated and many students from QU and other schools are able to visit the library for research purposes.

Much work has been done to acquire a large office space in the QMA Archaeology Office for the outreach and education program. Should it be successful, it will be the first time a space is dedicated to community archaeology activities in Doha.

### 3.2 Oral Histories Collection

#### 3.2.1 Program of interviews, planning, and methodology

Aside from Educational Outreach, the other main aspect of the Al Zubarah Community Archaeology project is the collection of oral histories and oral traditions. Oral history brings depth to our understanding of the past by carrying us into recollections and testimonies at an individual level. Oral traditions are, in fact, non-written stories passed down from one generation to another, and kept alive in the memories of a people.

Both oral history and oral traditions enrich our knowledge of Al Zubarah and the surrounding sites by gathering, incorporating and highlighting the rich oral history, folklore, stories and local traditions of the northwestern region and of Qatar as a whole. Another goal of the QIAH Community Archaeology work is to place Al Zubarah and the abandoned villages closest to the site in a broader cultural, historical and natural context.

The process of interviewing started after researching details about the northern tribes of Qatar, as well as the basic history of the northern villages, including Al Zubarah. As mentioned earlier, a list of all the Al Shamal tribes, their internal divisions and their village affiliations was created. It became clear that each tribe has a *Fakhd* and a *Badidah* — branch and family — and lived in a specific village. For example, the Al Kubasi tribe lived in Khweir, Jumail, and Arish, while the Al Dasim branch of the tribe resided in Khweir.
Interviewees were selected on the basis of their knowledge of certain topics, their tribal affiliations, their village of residence before moving to Doha or Al Shamal, and their willingness to be interviewed [see Fig 13, p21].

The interviews took place in three main locations:
1. In the interviewee’s homes or farm.
2. On-site: these interviews involved going in the field and visiting the abandoned villages or fish traps with the interviewee.
3. In the majlis, an exclusively male gathering house or place of assembly. Dr Saca received a personal and rare invitation to visit and conduct interviews in these majalis (plural). The Majalis visited were mainly in Doha and its suburbs, but a few were located in Al Shamal.

The interviews focused on various issues, all aimed at a better understanding of the daily lives of the tribes of Al Shamal, their traditions and their recollections of life (including pearl fishing and trading) in the now completely abandoned villages. More specifically, interviews focused on the internal layout of abandoned villages, tribe or family identification, history of specific families and their connections to the villages, movement of families, northwestern coast fish traps, and water resource distribution and use.

3.2.2 Main results of interviews

The Tribes:

The QIAH team compiled a list of Al Shamal tribes, including the village of affiliation [see Fig 2, p4].

As has been previously mentioned, tribes have a Fakhd and a Badidah (branch and family) and they tended to live in a specific village. For example the Al Kubasi tribe that lived in Khweir, Jumail, and al Arish is divided into various branches and families. Below are examples of some of the branches and families:

- al Samkhan
- al Nfahi
- al Sloum
- al Rayej
- al Ayaysha
- al ‘Ajaj
- al Eid
- Albu Jmizah
- al Hareb
<table>
<thead>
<tr>
<th>Person name</th>
<th>Date</th>
<th>Location</th>
<th>Topic “in brief”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women folk of Mubarak Fadalah</td>
<td>Feb 12</td>
<td>The women’s majles</td>
<td>Information on women’s daily lives and activities. Included a field visit to collect the Kama[truffle]</td>
</tr>
<tr>
<td>Seif Al-Fadalah</td>
<td>Feb 13</td>
<td>Field visit to Matjar</td>
<td>The layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants. Water sources.</td>
</tr>
<tr>
<td>Husain al – Fadalah</td>
<td>Feb 13</td>
<td>Municipality of el Shamal</td>
<td>Follow up after June workshop. Asked about abandonment of villages, cleaning of sites, maps...etc</td>
</tr>
<tr>
<td>Khaled Al – Kubasi</td>
<td>Feb 15</td>
<td>Al Kubasi Majles in al shamal</td>
<td>Discussed the details of al kubasi tribe including the list of their branches, Their villages and information about al’arish.</td>
</tr>
<tr>
<td>Khalifa al Kubasi</td>
<td>Feb 16</td>
<td>On site in al Arish</td>
<td>The layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali al Kubasi and his father</td>
<td>Feb 21</td>
<td>Um Qabrain</td>
<td>The water source and earlier town before the move to al Arish.</td>
</tr>
<tr>
<td>Khalifa Al Kubasi</td>
<td>Feb 21</td>
<td>His farm house in al shamal</td>
<td>Life in al arish, food sources and education</td>
</tr>
<tr>
<td>Grandfather Eid bin Selham</td>
<td>Feb 25</td>
<td>In his majles</td>
<td>An 80 year old gentleman. Meet with me even while using an oxygen tank to breath!!...met for 4 hours. Main topic – fish traps and the sea</td>
</tr>
<tr>
<td>Mohammed bin Issa bin sloum Al-Kabasi</td>
<td>March 7</td>
<td>Al Jamil -Al Shamal</td>
<td>Review the layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali al Kubasi and his father Kahlifa</td>
<td>March 10</td>
<td>Fish traps of al shamal NW coast</td>
<td>A detailed tour of all fishtraps designation of owners, use, construction…etc.</td>
</tr>
<tr>
<td>Mohamed Saleh Ali al Fadalah</td>
<td>March 11</td>
<td>In his Doha Majlis</td>
<td>His life and war stories</td>
</tr>
<tr>
<td>Seif al Fadalah</td>
<td>March 13</td>
<td>Ruwais port- in al shamal</td>
<td>Fishing</td>
</tr>
<tr>
<td>Khaled Ali al Kubasi</td>
<td>March 13</td>
<td>UmQabrain - al shamal</td>
<td>Review the layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Mohamed bin Issa bin Mohamned bin sloum al Kubasi</td>
<td>March 19</td>
<td>In his Doha Majlis</td>
<td>Poetry and his life in alshmal</td>
</tr>
<tr>
<td>Mohamed bin omr aldasim al kubasi</td>
<td>March 28</td>
<td>Site visit to Khwair</td>
<td>Village tour. description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali Shebib Manan’i</td>
<td>April 1</td>
<td>His Majlis in Abu Thlouf</td>
<td>Discussed his writings and the inhabitants of Abu thlouf wa al yusefiyah</td>
</tr>
<tr>
<td>Najla the wife of Mohamed bin omr aldasim al kubasi</td>
<td>April 2</td>
<td>Visit her in her home</td>
<td>Discuss women’s life, work, traditional food and games</td>
</tr>
</tbody>
</table>
The women of Al Shamal

The insights gathered from interviewing women in Qatar are usually very different from those of men. Dr Saca had the opportunity to meet with a few women in Al Shamal who are very active within their community and very involved in some of the main issues relating to their daily life, their relations with their families, household layout and room divisions, and relations between wives. Dr Saca received a special invitation to attend a private gathering of women called Fay al Duha in Al Shamal in 2013, in which elderly women share stories and knowledge of the past with each other and with the younger generation.

Some of the women interviewed include:
- Mrs. Kalthan – Umm Seif
- Mrs. Naflah
- Umm Nasser
- Naflah al Fadalah
- Mahra- al Fadalah
- Najla’Mohamed el Dasim

Headdress

There are different kinds of headdresses in Qatar that can be worn by women or girls and they have different names and functions:

*Al malfa*. When habitually worn by Qatari women living in the city, this headdress is made of light black cotton fabric. It is usually 2 metres long. The kind worn by Bedouin women is instead called *al smadah* and is made of a thicker black cotton fabric 4 metres long. The length and thickness of the headdress is necessary for better concealment, since Bedouin women do not wear a *‘abaya* like city dwellers.

*Al batula [burka]*. The word is not of Arabic but of Persian origin. This kind of headdress is worn mainly by older Qatari women, above 50 years old, and by some younger girls. The *batula* face cover is also present in the UAE and Bahrain, and it is said that it is worn in all coastal cities of the Persian Gulf. Once the *batula* is worn, the woman should only take it off when she goes to bed. The *batula*’s length can vary; if short, it only covers the nose or the chin. The main parts of the *batula* are the fursa, a thick forehead piece for older women, thin for the young ones; the *qardah*, the opening for the eyes, and the *khad*, which covers the cheeks, nose and mouth area. The *sief* and *masater* are pieces of thin refined bamboo or *basjel* wood inserted in the *batula* just above the nose and on
the sides. The main purpose of these pieces of wood is to preserve the shape of the *batula*. The women interviewed highlighted that the production of the *batula* is the specialty of some women only. There is a special fabric imported from India or Iran, which is used to make the batula and nowadays women put tape on the inside of the headdress to prevent the blue color *nila* from rubbing on their faces.

*Al mulafa*. This headdress is made of heavy cotton fabric and is used by Bedouin women to wrap around their head, as well as their bodies.

*The abaya [biset]*. Worn by Khaliji women as well as Qatari women, this kind of black headdress is worn above the clothes and should be long enough the cover the ankles. There are many different kinds of *abayas* and each one is worn for specific occasions, times, seasons or for other reasons.

**Games played mainly by girls**

One of the women from Al Shamal, Najla' explained that the *jadairah* is traditionally a girls' game that she played with her friends in her village, al Jumail. She showed the team the one she had newly manufactured with her own hands in an effort to teach her grandchildren how to play. It is played with ten sea shells in each of the nine holes. The goal is to move them from one hole to another in a rotation.

**Food**

One of the other topics discussed by women during the interviews is the preparation of the traditional Qatari dishes. *Sh’itha, yeget, muhamarah, makhbous* are some of the foods that the women of the Al Shamal discussed at length, explaining the ingredients, how to cook them, and when they are eaten. For example, *yeget* is a yogurt based dish made of dried white yogurt-covered ghee and eaten with dates. It is served in the morning but is also taken on picnics.

Some of the interviews were conducted during truffle [*qama*] picking season, so Dr Saca joined in the truffle picking and learnt how to find them. The secret is to look for a plant called *raqrug* that would only grow close to the truffles [see Photo 15].

**The “Shell carpet”**

In Al Zubarah, archaeologists have been finding large amounts of shells scattered on the floors of excavated houses and wondered how all the shells ended up there, and for what purpose. From conversations with Najla’, one of the women interviewed, it became clear that this was common practice in all coastal villages.
In most instances a specific person was hired to go into the sea and gather the shells, which would then be distributed in the various houses, to be laid down in their courtyards.

This was done to make sure the courtyard looked clean all the time. It is, in fact, easy to clean it by sweeping or washing with water, and scorpions or other insects crawling on the floor would be more visible. Mrs Najla’ mentioned that when she and her sister used to go to the sea and collect shells to be scattered in their courtyard, they also caught fish in the fish traps (discussed in more detail below).

3.2.3 Village documentation – the people and their stories

Two months of visiting abandoned villages in the north of Qatar revealed the rich heritage of this area and the amount of information that can be gathered from the tribes who used to reside in these villages. Among the villages surveyed and researched are Arish, Al Jumail, Al Mafjar, Khweir, Umm Qabrain.

Interviewees were selected on the basis of their tribal affiliation in relation to the visited village. During each village tour an aerial map of the village was used to mark the building visited, as well as other important structures and complexes like wells, cemeteries, and rest areas [hotah].

The survey of abandoned villages focused on identifying the following issues, where possible:
- the tribe that lived in a specific village
- water sources, water reservoirs and distribution in the village
- buildings and their functions
- the owners/residents of a building
- household division
- schools
- movement between the village and the desert
- names of individuals with a prominent social role in the villages
- daily life
- fishtraps
- relation to the sea – fishing/pearling/trade.

Arish – a village coming back to life

Al Arish Village is located on the northwestern coast of Qatar, just south of Khweir and north of Freiha [see Fig 14, p25]. The field visit to the town took place on February 16th 2012 and Dr Saca was accompanied by Khalifa bin Ali ‘bade al Nifahi al Kubasi and his son Hamad, Mubarak el Fadalah, and Khalid al Kubasi. Mr Khalifa is around 60 years old and his son Hamad in his thirties. The Al Kubasi family have resided in this village since 1920.
Fig 14: Location map of North West Qatar
<table>
<thead>
<tr>
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<th>REMARKS</th>
</tr>
</thead>
<tbody>
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<td>صالح بن محمد الفصالة</td>
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<tr>
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<td>ابراهيم بن علي الفصالة</td>
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<tr>
<td>3</td>
<td>عمرو بن سيف الفصالة</td>
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<tr>
<td>4</td>
<td>ابراهيم بن محمد الفصالة</td>
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<tr>
<td>5</td>
<td>علي بن مبارك الفصالة</td>
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<td>6</td>
<td>الأخ خالد بن عبد الله</td>
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<td>7</td>
<td>ابراهيم بن محمد الفصالة</td>
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<td>8</td>
<td>براجا أبا علي بن محمد الفصالة</td>
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<td>10</td>
<td>اسماء</td>
<td></td>
</tr>
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<td>11</td>
<td>عباد بن علي الفصالة (صاحب البيت)</td>
<td>姓中文</td>
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<td>12</td>
<td>محمد بن صالح الفصالة</td>
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<td>13</td>
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<td></td>
</tr>
<tr>
<td>14</td>
<td>المجلس / علي محمد بن صالح الفصالة</td>
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<tr>
<td>15</td>
<td>الذي</td>
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<td>16</td>
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<tr>
<td>17</td>
<td>الشيخ/ كبير القبيلة</td>
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<tr>
<td>18</td>
<td>السيد طه</td>
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<td>المجلس الصفوي على بن خليفة</td>
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<tr>
<td>21</td>
<td>المجلس الثالث على بن خليفة</td>
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<td>22</td>
<td>الشيخ كان علي</td>
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<td>23</td>
<td>أو عددان (باسم)</td>
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<td>26</td>
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<td></td>
</tr>
<tr>
<td>29</td>
<td>اسماء</td>
<td></td>
</tr>
</tbody>
</table>
In order to have a better understanding of tribal genealogy it is useful at this point to briefly explain the name of the main interviewees from Arish:

- Khalifa (his name)
- bin Ali (the son of Ali - his father's name)
- al 'bade (the badidah - “house/family name”)
- al Nifahi (the fakhed – tribal branch name)
- al Kubasi (the Qabila - tribal name)

A map obtained from Google earth was printed out and all the houses were numbered. The goal was to walk through the village and, whenever possible, record names of the owners of the houses and identify the structures by function (e.g. mosque, majlis, school, and water tank) [see Fig 15, p26].

Before the visit to Al Arish, Dr Saca was invited to visit Mr Khalifa's Majlis to start the conversation and later head out to the site [see Photo 17, p29]. Mr Kahlifa was a gracious host and was very interested in the QIAH Project’s work. Part of the conversation centred on the history of Arish, the various phases of habitation of the village, daily life when the village was fully inhabited, and when the village was abandoned. Mr Khalifa stated that there were two phases of residence/ habitation there:

**The first habitation phase (al Nazla al Ulah)** was 1920-1937, during which there were predominantly eight families in Al Arish, consisting of:

1. Muhamed bin Khalifa bin Tokk
2. Khalifa bin Barghash
3. Mubarak bin Jasim bin Jasim
4. Abdullah bin Nasir bin Khalifa
5. Hashil bin Zayed
6. Abdullah bin Hashil

Mr Silham bin Eid al Kubasi acted as the “head man” during this phase of habitation of Al Arish, helping to manage the affairs of the village. This role continued until the second phase of habitation. For the residents of Arish fresh water was a serious concern, since their main source was Ain of Umm Qabrain, which was used exclusively during this habitation phase. The villagers used donkeys to deliver the water from the well to the village, which was 4km away from the village. Water was equally distributed to all.

It is important to note that during the first habitation phase the men worked as pearl divers and they were involved in the transport of lime (*jiss* and *froush*) and other materials to and from Bahrain.

**The second habitation phase (al Nazla al Thaniyah)** was 1951-1972, during which the rest of the Kubasi tribe moved to Al Arish. The spring of Umm Qrebah Ain was used as their fresh water source. The water was brought into the village by a *nashal* (a truck that transported water) and money was gathered from all the residences to keep the truck running and the water supply constant. The truck was driven by Khalifa bin
<table>
<thead>
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<td>الهز (1951) الأثرا أو الراواح</td>
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<td>Miham بن محمد بن أحمد بن أحمد</td>
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<tr>
<td>34</td>
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</table>

**Fig 16: Survey of Al Arish**

Note: Everyone with no detailed last name belongs to the Nfaihi branch of al Kubasi tribe.
Ali and the money was calculated to suit the “social condition” of the residents. For example, women and family that were in financial difficulties would pay less than half of what a regular household would pay.

It is interesting to note that during the in-between years from 1938 to 1951 Arish was abandoned, and only two “homeless” individuals called Masud and al Hmadi resided in the village. During these years (1940-1951) the Kubasi tribe resided in Umm Qabreen, near their main water source.

According to Mr Khalifa, there is no information that mentions anyone residing in al Arish before 1920, and in 1972 all residents of al Arish where removed to Doha or Al Shamal.

Due to a lack of water the village had no agriculture and most of what the villagers consumed was imported from Saudi Arabia or Bahrain. The main imports were dates, sugar, coffee, and tea. Dates were also brought in from al Gharia and Khweir, other villages in northern Qatar, where dibs (date syrup) was produced in August or September for three months.

**Arish schools**

During the tour of Arish Mr Khalifa noted that learning was significant to the villagers. Throughout its history, Arish had two schools; the first and smaller school was built in 1953 and the house was rented from the sons of Mut’ab bin Jum’a- Khamis and Mohamed. The school had four students:

- Mr Khalifa bin Ali (the informant)
- Ghanem bin Abdullah
- Ghanem bin Mohamed
- Salem [Salum] name contraction indicated “slavery” origin.

The second and larger school was built by Khamis bin Mut’ab Bin Jum’a, who was commissioned by the government to build it in 1955-56, and it had 20 students. The students (of which a list with names and village affiliations was compiled) came from Al Arish, as well as Ain Mohammed, Leesha, and Khweir. Students were instructed up to the 4th grade by Mr Ibrahim Ibin Saleh, who was Palestinian.

Girls were not instructed in Al Arish, but they went to Khweir for their schooling. The mother of Ali, son of Mr Khalifa, studied in 1962 at the elementary school in Khweir.
### Table: Umm Qabrain

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The Imams of al Arish

The *imams* are individuals that perform the call to prayer. In Arish, Sa'd bin Muhsen al-Murrani al Kubasi was *imam from* 1956-1966, when he retired from old age. Rashid bin Mubarak al Danoun was also *imam and* Saleh Mohamed al Ansari, known as Zakaria, was the religious teacher (*mutawi*'). Imam Rashid remained in his post until 1966, when he moved to al Shamal to remain the *mu'athen* until his death in 1971.

Poets of Al Arish

The Kubasi tribe appears to have counted a few poets among its members. The two mentioned by Mr Khalifa are Eid bin Selham and Abdullah bin Fayyad. They were both from the Sloum and the Simkhan branch of the Kubasi tribe. In a later interview with one of the famous Sloum poets, Mohammed bin Issa bin Al sloum Al-Kubasi, he discussed Nabati poetry, also called Bedouin poetry, which is a form of poetry written not in Fusha but in colloquial Arabic. Its main foci are love and stories of desert life. Some writers like Saad Al-Sowayan referred to Nabati poetry as the Oral Poetry of Arabia, as it is listened to, not read.

The Village of Umm Qabrain

The village of Umm Qabrain was where the main water source for the Al Kubasi tribe was located, as well as their residence from 1940 to 1951. It was also inhabited before the Al Zubarah war in 1937. On February 21st 2012 a group from al Kubasi tribe (Khaled bin Muhsen bin Khalid al Muran al Nhai/i al Kubasi, Khalifa bin Ali al Nihai/i al Kubasi, Khaked Ali, Mubarak Fadalah and Ali bin Khalifa al Kubasi) accompanied the QIAH team to the site of Umm Qabrain [see Photo 19, p30].

Khaled Ali helped with locating houses on the map since he did some work on this site for personal interest. He provided pictures of some of the residences of Umm Qabrain, as well as the names of the individuals buried in the village cemetery. Mr Khalifa endeavoured to identify the houses, since the site is not well preserved [see Fig 17, p30].

The water well was clearly marked and the mosque was also identified. One of the houses belonged to Mohammed bin Ali Obaid al Nfaihi Al Kubasi, the first person in Qatar to receive a doctorate in psychology from the USA. The other location surveyed in Umm Qabrain was the cemetery. The interviewees mentioned a few individuals from the Al Kubasi tribe in Umm Qabrain who were buried there. Interestingly, the tribe continues to bury their dead in their ancestral village. Some of the individual buried in Umm Qabrain are:

- Mohamed bin Muhsen Dandu/n al Nfaihi al Kubasi
- Sheikha bint ‘Eifan al Hajiree (from Kuwait)
- Rif’a bint Ghanem bin Touk al Kubasi

• Mohamed bin Muhsen Dandun al Nfaihi al Kubasi
• Sheikha bint ‘Eifan al Hajiree (from Kuwait)
• Rif’a bint Ghanem bin Touk al Kubasi
### Table 1: List of Important Families in Al Zubarah

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### Figure 18: Survey of Al Jumail

- **Photo 20:** Mosque at Al Jumail
- **Photo 21:** Mr Mohammed ibn Issa al Kubasi and Iman Saca in Al Jumail
**Al Jumail**

A short survey was conducted in Jumail by the QIAH team. Mr Mohammed ibn Issa al Kubasi, who is a very famous poet in Qatar, was the interviewee. Mr Mohammed lived in al Jumail until it was abandoned in 1972 [see Fig 18, p32].

Very often a house would have 2 independent sitting areas added to it. Both were mostly used by men. The *majlis* (with walls, roof and low windows) was used as a seating area in the winter and during daytime, while another space (*baraha* or *dekka*) with no roof and no walls was used for sitting outside at night, particularly after evening prayer.

The so-called sheik of Jumail inhabited a large house in the village and was mostly known as the *imam* in the village. It appears that the last *imam*’s who lived in Jumail was not actually from the region, but from Iran, and probably preached quite radical Shia Islamic doctrine, although this is still unclear at present (smoking *shisha/nargileh* for example was never really allowed in the village and was always perceived as *haram*, which it technically is according to the book, but this tradition tends to have been assimilated as part of local culture in most of the Gulf).

The mosque building appears to have been built or restored in 1964 and abandoned in 1972 [see Photo 20, p32]. It is not clear whether another mosque occupied the same place before, or whether there could have been another one elsewhere. The roof was ‘removed’ at a later date, probably indicating that when it started collapsing the villagers decided to remove the rest of the roof, in order to avoid debris falling all over the *iwans*. The existence of two *mirhabs* in the mosque is also unclear. Probably this is due to the fact that in summer it was too hot to pray inside the first *iwan*, so the inhabitants of Jumail decided to put up a second one, to pray outside during the summer months.

The fort of Jumail appears to have been abandoned already in 1816, when the Kubasi tribe arrived in the village for the first time. The walls are clearly visible and quite thick (ca. 1m), with large stones bases. The fort is located right in the centre of the village, next to the mosque.

The school was built in 1959 and abandoned in 1969, and is located a little outside the village, to allow pupils from the surrounding villages to access it more easily. The building contains 2 classrooms and a principal’s office.

The cemetery is still in use. Indeed all the Kubasi people who used to live in Jumail and their descendants are still buried here.

Agriculture in the mid-20th century was negatively perceived by the Qatari society, and farmers had a low status. Apparently most fathers would not allow their daughter to marry a farmer or a ‘planter’ (to use the Arabic slang word). People were not encouraged to plant seeds and produce oil due to the fact that once
importing became routine and water in the aquifer turned saline the farming activity gradually declined and people realised it had no future. Agriculture was no longer considered ‘modern’ and the few remaining farmers rapidly lost all support from the rest of their community.

The inhabitants of Jumail were semi-nomadic people, although the coastal villages were considered their permanent settlements. Men went herding inland for a few months a year and trading was carried out regularly. It took three days to reach Doha from Jumail on a donkey.

Khweir village

Mohamed bin Omar al Dasim al Kubasi was chosen as the interviewee for Al Khweir because he is from the Dasim branch of the Kubasi tribe and they were the main residents of this village. He took the team around Al Khweir on March 28, 2012, identifying the houses in his village and the names of the residents as much as he could. Mr Mohamed was able to identify the mosque, the majlis, and the house of Hassan Abudul Rahman, the mutawi [religious teacher] of Khweir. He asked to return to the village with his wife, who resided in a large house in the village and remembered more about living there. Another tour of the village was scheduled with Mr Mohamed and his wife for the 2013 season.

Al Khweir or Khor Hassan, as it was originally called, is located on the northwestern coast of Qatar, just north of Arish [see Fig 14, p25]. According to Mr Mohamed, more than 70 families from the al Dasim branch of Al Kubasi tribe resided in Khweir. Their main source of income was pearl fishing and trading. Their main water source was located 5km southeast of the site. As mentioned earlier, water from certain springs was designated by tribal affiliation and this “division” was respected by all tribes. Al Thaqab was the ain designated for Al Dasim branch of the Kubasi tribe residing in Khweir. This ain was their main source of fresh water and in the earlier days they delivered it to the village via donkey. At a later time, water was carried by a water truck driven by a specific person from the village, whose job was to distribute water to the houses, or deposit it in the village reservoir. In this village, as in others, a specific person was assigned to monitor the water reservoir and grant supervised access to the villagers.
Fish Traps (Masaker) in NW Qatar

The northwest coast of Qatar is dotted with fish traps (masaker) and all the coastal villages visited and studied are linked to a number of them. These fish traps represented the main source of food and income for many of the villagers; they were well kept and well maintained for years. It has become apparent from preliminary fieldwork research on these fish traps that in the past both men and women owned them, and they both did the fishing.

After discussing the construction of fish traps with our interviewees, there appears to be two main types of fish traps: one is referred to as ma’mour, a fish trap built on the base of an older trap; the other is known as the bida’, a fish trap that is intentionally and newly constructed in a specific location where there was no previous fish trap. A third kind, very specific in terms of construction and location, was also mentioned and is referred to as yeder; this fish trap is mostly constructed in deeper waters and has extensions or arms protruding from it.

Ruined fish traps are called ghair ma’mour and their history is not too clear to many people, even to the interviewees living in Al Shamal. It is interesting to note that most of the fish traps near Freiha are considered masaker ghair ma’moura. Even though these ruined fish traps were not maintained, they were used by many villages throughout history and since they were not designated to any tribe or individuals, they were used by all. More information on fish traps will be gathered from more fieldwork and a book the curator of the Library of Sheikh Hassan will acquire in 2013.

The construction of fish traps is not time consuming. All traps are made of porous and light black stones piled on top of one another and called froush. Fishing depends on the rotation of the earth and the movement of the tides, referred to in Arabic as madd and jazer. With the madd the fish comes into the trap and with the jazer, when the water recedes, the fish is trapped and subsequently collected by the villagers. In most of the visited villages and in between certain fish traps there are areas called bandar or marsa. These are areas where boats would dock to unload their goods. In order to reach the boat or ships Qatari people constructed sarouj, circular structures 4m in diameter and raised above water level, from which

![Fig 19: Fish traps between Freiha and Al Arish](image-url)
you can load or unload cargo on the boats [see Photo 22, p36]. The traps can vary in size from a few metres to a few kilometres, and while some are constructed on the sea shore, others are built out in the sea. Those built in the sea are to be considered the earlier ones, according to Mr Khalifa.

**Fish traps Identification:**

Each fish trap was owned by a family and it could be named after the family or an individual, or it could be given a cultural or fun name. Men and women could own fish traps. The tribes who lived in the coastal villages were familiar with the names of the traps and their ownership, and they did not trespass on others’ fish traps. Ownership could also be transferred between families or individuals by purchase. In the early 70s the government of Qatar gave a monetary value to the fish traps and compensated the individuals who provided clear proof of ownership of these traps.

**Documented Masaker (fish traps):**

Fieldwork focused on gathering as much information as possible on the fish traps, past ownership, use and construction. Mr Khalifa Bin Ali al Eid al Nfaihi al Kubasi from the al Kubasi tribe took the team on a tour of all fish traps.

A list of Google maps were used to locate the fish traps on the northwestern coast of Qatar and fieldwork was conducted to identify these traps and gather basic information on them. During 2011-2012 it was only possible to identify fish traps from Al Zubarah to Khidaj village, located just south of Jumail. The data gathered relates to the masaker from the shores of Al Zubarah, Freiha, Arish, Khweir and Khidaj.

Al Zubarah fish traps are located around the island of Mjatelah, off the shores of Al Zubarah. There are four Al Zubarah fish traps and they are called Bu-hid, Al Rafi’, Al Yeryan, and the fourth is a nameless, ruined fish trap, possibly owned by Albin Ali.

Due to the low level of water it was possible to drive to the island by car for 3.5km on the water. This visit provided the team with basic information on the traps. It is interesting to note that not much information is known about the Al Zubarah fish traps that fall around the island of Mjatelah, due to the fact that these fish traps are considered to be the oldest in northwestern...
Fig 20: Al Arish fishtraps
Qatar. During the next season of QIAH work, Mr Khalifa will consult with some of his tribe’s elders and try to provide more detailed information on these traps, so that a map to locate these traps can be drawn.

Below are two brief examples of the kind of data gathered about the Arish and Khidaj fish traps.

Al Arish, from south to north:
1. *Maskar Ji’ dah* (Albin Ali) in ruins (the term used is *Ghair Ma’mour*).
2. *Maskar shridah*, constructed by Eid bin Silham. The trap has an older base, so it is considered a *ma’mour* fish trap.
3. *Maskar Mi’lay*, owned by a woman known as Ya’idah, who lived in Arish.
4. *Al Yaraf*, owned by Ali bin Mohamed bin Kafnah, is a *bida’ maskar*.
5. *Maskar al E’bay* is a newly constructed *bida’* trap.

Both *Maskar Ji’ dah* and *Mi’lay* were owned and/or used by Eid bin Said, the father of Silam bin Eid al Kubasi.

Looking at the map of this part of Arish [see Fig 20, p37] it is possible to clearly see the *bandar* or *marsa*, where the ships would dock to unload and load goods coming from Bahrain and India. The two *Sarouj* discussed above can also be seen on this map.

One interesting story shared by one of the interviewees during the fish trap visit of Al Arish highlights an important episode of the village’s history. It is said that a tornado hit the village in 1924-23. Many residents of Al Arish died and numerous houses and tents were torn down. He also mentioned that many boats were ruined and a main source of income for the village was destroyed. According to the recollections of Mr Khalifa, this destruction occurred in a 30 minute period.

The example below pertains to the fish traps of Khidaj:
1. *Fshaish* is a large *maskar* going deep into the sea and used by Issa bin Khalifa al Kubasi.
2. *Al Yakoubi* fish trap (uncertain).
4. *Al Malay* fish trap. These were two separate fish traps later combined to become a larger one. This *maskar* is identified as a *ma’mour maskar* and is owned by a member of the Sloum family.

The above information is a brief of the work done in the 2011-2012 season. The work in the field and the data gathered proved to be of great value to the QIAH project’s work. It enriched our knowledge of Al Zubarah, its hinterland, and the abandoned villages of the northwest coast of Qatar. It also established a level of acceptance and trust with the local community, especially the tribes of Al Shamal, and the respected elders of these tribes, men and women alike. It also became clear that the tribes of Al Shamal are keen on seeing their villages preserved and “activated”. These tribes, through their leaders or elders, and via general town hall meetings and workshops, should be involved in the decision making process regarding the future of the abandoned villages.
Library work and oral history

Sheikh Hassan Bin Mohammed Bin Ali Al-Thani, a prominent researcher who devoted his time to studying and documenting the history and culture of Arabia, in addition to a wider interest in culture, began collecting material in the early 1980s. In 2006, the library was annexed to the Qatar Foundation for Education, Science, and Community Development. For more information, go to http://www.qf.org.qa/community-development/protecting-qatar-heritage/the-heritage-library

During the 2011-2012 work season of the QIAH Project time was devoted to library research, in order to establish the historical context for the fieldwork in northwestern Qatar and in Al Zubarah. Dr Saca obtained access to Sheik Hassan’s Arab and Islamic Heritage Library in Doha, and the research carried out at this institution helped build the framework for the oral history fieldwork. Below is a list of some important sources the library contains on the history of Al Zubarah, the villages in the north of Qatar, as well as pearling and trading activities.

1. Bombay government records.
3. Lorimer, J.G., Gazetteer of the Persian Gulf, Oman and Central Arabia, 1908 and 1915. John Gordon Lorimer (1870-1914) was an official of the Indian Civil Service. Until 1970 the 6000 page Gazetteer on the history and geography of the Gulf region was considered a classified document.
4. Samuel Manestry and Jones Hartford, 1790. Reports on commerce of Arabia and Persia
5. سياق المسجد في أحيا أحمد نجل رزق الأسعد - المؤلف: عثمان بن سند البصري طبعة يمنية 1315هـ

4.1 Educational Outreach

Since the beginning of this season, the Community Archaeology team focused on the creation of a multitude of public outreach and educational activities and programs. The main objective for the education and outreach program for the next three years is to continue the work started by the Community Archaeology Program during 2011-2012.

The focus of the 2013 season will be:
1. Formalising the relationship with the Supreme Council of Education via QMA, so as to organise both on-site and off-site school visits to Al Zubarah Archaeological Site.
2. Reassessing some of the new social sciences books and re-evaluating what is written in them about the archaeological and cultural heritage of Qatar (the first part of this literature survey was done in the 2011/2012 season).
3. Proposing to the SCE via QMA the creation of literature on Al Zubarah and other archaeological sites in Qatar, which could be taught or discussed in schools.
4. Consulting with teachers to design material to be introduced in the classroom regarding archaeological heritage and Qatari traditions.
5. The creation of literature in Arabic to be used during school visits to the site and during outreach activities. This will allow visitors to the site, the local community and Qatari students to be better informed and engaged. These publications will give a better understanding of the site and the importance of heritage preservation.
6. Continuing the training of a QMA team in the Department of Archaeology on various aspects of Community Archaeology, especially in relation to school education and outreach.
7. The use (via QMA) of the newly created website for Al Zubarah as a source of information on all Community Archaeology-related activities, including education, public outreach and oral history initiatives.
8. Continuing off-site activities for schools in Doha, such as mock excavations, lectures, PowerPoint presentations, sample archaeological finds for interactive display, pottery workshops, lithics presentations, and photo and film exhibits.
9. Continuing on-site tours and educational activities with a focus on Al Shamal schools, the ones nearest to Al Zubarah Archaeological Site.

Long term education and outreach goals:
1. Continue with the creation of literature in English and Arabic to be used in schools and in outreach activities and programs.
2. Work with the QIAH team responsible for setting up the visitor information centre at the Fort.
3. Create and update on-site educational panels, brochures, posters, postcards and other material to be distributed to the general public.
4. Continue organising workshops, public presentations, temporary exhibits, educational tours, hands-on activities for children of different ages.

5. Establish in collaboration with QMA and SCE a yearly training program for teachers on Al Zubarah and the Archaeological Heritage of Qatar.

6. Establish in collaboration with QMA and QTA a yearly training program for tour guides.

7. Create family oriented activities related to Al Zubarah, in an effort to reach out to the local community.

8. Work with education departments of Mathaf, the MIA and the National Museum of Qatar.

9. Coordinate with QMA’s PR office, and enlist the support of the local media to disseminate the information on Al Zubarah and the archaeological heritage of Qatar.

10. Cooperate with and engage in Qatari cultural centres, Katara, Suq Waqif, the Qatar Foundation and universities, especially to organise joint activities and exhibitions related to Al Zubarah and the archaeological heritage of Qatar.

11. Support and be involved in, when permissible, the ongoing project that promotes the archaeology and the cultural heritage of Al Zubarah Archaeological Site.

12. Launch a series of ‘summer camp’ activities related to Al Zubarah Archaeological Site and Qatari natural and cultural heritage in general.

13. Establish a ‘traveling school bus’ to engage students in their schools with activities related to heritage and archaeology.

### 4.2 Oral Histories Collection

In 2011-2012 the QIAH Project started a strong Oral History initiative. The work achieved during the last season of fieldwork and the data gathered proved to be of significant value. It also established a level of acceptance and trust with the local community, especially the tribes of Al Shamal and their respected elders, both men and women alike. Although the 2011-2012 fieldwork season was short in terms of oral history work, the relationships that developed and the material that was gathered in a very short time provided significant knowledge about life in northwestern Qatar. The QIAH work should continue in future years with a few main objectives in mind:

1. Create a database to store the large variety of information gathered in the field, such as maps, photos, and videos.

2. Download and archive the audio and video collection gathered in 2011-2012, as well as digitise all maps used for identifying villages and fish traps.

3. Coordinate the work with the QMA’s department interested in this work and with the National Museum of Qatar.

4. Continue the fieldwork activities, such as meeting and interviewing Qatari people from the Al Shamal tribes to discuss issues related to the abandoned villages, Al Zubarah, pearl fishing, trading, daily life, water, genealogy, as well as other aspects related to their culture and history.

5. Explore in more detail tribal movement, land use, and the use of water and natural resources as key to tribal life in northern Qatar.
6. Focus on meeting with women who are considered “tradition keepers” in Qatar, especially through attending their Fay al Duha meetings.
7. Continue working with the men of the various tribes, especially on fish traps, tribal social structure, and other historical aspects of their villages.
8. Build on the strong relationships started with the History Department at Qatar University during 2011-2012. For the purpose of Community Archaeology initiatives, there is a clear and strong interest from some faculties and their students in participating in data gathering and conducting interviews, starting with their families. This is a very positive step that will help gather information on matters related to Al Zubarah Archaeological Site and its hinterland. At the same time, this involvement will help engage a group of Qatari students and their families in keeping their historical memory alive. In 2013 the QIAH team will work closely with QU to train, prepare and work with students to undertake the gathering of oral histories and traditions.

**Long term aims of the Oral History collection program:**
1. Continue the QIAH Project fieldwork and improve coordination with QMA and other Qatari institutions.
2. Work with QMA to create an online system to archive, update and make available to the public the gathered oral histories of Qatar.
3. Train QU students and QMA staff on basic oral history methodologies, so they can assist in the process of data gathering. To prepare the students, an oral history workshop will be conducted at the university with the involvement of QU teachers.
4. Involve school teachers – mainly middle and high school teachers – in the process of oral history and tradition gathering, in coordination with SCE. This will mainly be done through the preparation of a set of questions/issues which they will present to their students.
5. Create a mechanism to strengthen relations with the tribes of Al Shamal through town hall meeting, inviting them to Al Zubarah Archaeological Site, and involve them in various activities.
6. Involve the tribes of Al Shamal that have shown an interest in seeing their villages preserved and “enlivened” in the decision making process regarding the future of their former villages, through their leaders or elders, and through general town hall meetings and workshop.
7. Discuss with QMA the possibility of installing “Oral History Booths” at Al Zubarah or in certain venues throughout the city, allowing the general public to record their stories and recollections. These personal histories can then be reviewed by curators and, if deemed relevant, adapted and uploaded onto the website (provided permission is granted to use the material).
8. Organise, with the help of Al Shamal Municipality, a photo exhibit in Al Shamal on the ongoing work with the abandoned villages.
9. Based on the interest in Al Zubarah Archaeological Site shown by the media in 2011-2012, information on the “newest” discoveries at Al Zubarah should be sent to the media, newspapers and website, on a regular basis.

Gathering, incorporating and highlighting the rich oral history, folklore, stories and local traditions of the northwestern region of Qatar has proved to be an invaluable part of the mission of the QIAH Project.
has become clear after carrying out some library research in 2012 that written information on the local history, traditions and culture of Qatar is scarce. The largest part of such information is preserved through the transmission of traditions and histories from one generation to the next in oral form. This is exemplified by the fact that on a couple of field visits interviewees asked if they could bring their grandchildren along with them, as they were very keen for them to listen to all the information they were giving, since such information is not recorded anywhere but in the memories of the elders of Qatar. There is therefore an immense wealth of oral histories and traditions in Qatar that should be documented and kept alive for future generations.
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H.E. Sheikh Hassan Bin Mohammed Bin Ali Al Thani  
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Conservation field team:  
Mike Jastrzembski - master mason, Stefan Emmig - master stone mason, Thomas Knobloch - plaster specialist, Jörg Lohse - mason, Dominik Petzold - archaeologist, Christoph Thum - mud builder, Clemens Wardezki - stone mason, Jan Thiele - architect, Karl Woitke - engineer.
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**AL ZUBARAH ARCHAEOLOGICAL SITE**

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FOREWORD

The protection and preservation of Qatar’s heritage is of fundamental importance. At a time when our world is changing at an alarming rate we need to remain mindful of our past. For it is only through our understanding of the past that can we hope to improve our lives in the future.

This Handbook is about how we can protect, preserve and present the architectural remains of Al Zubarah. This is not only important for Qatari people but for people everywhere. The site provides us with a testimony of global trade and cosmo-political connections. The concepts and methods compiled here will provide the basis to preserve and maintain Al Zubarah’s remains, so that we may continue to visit and experience the site in its true form.

Prof. Dr. Sultan Muhesen
Senior Advisor
Director of Archaeology and Heritage
Qatar Museums Authority

Carsten Niebuhr’s map from 1765 mentioning “Gattar”.

INTRODUCTION

HOW TO USE THIS CONSERVATION HANDBOOK

Since we started work on the conservation concept for Al Zubarah Archaeological Site there has been a tendency to reduce the information to a simple “user friendly” manual. As soon as we started compiling all the material related to the conservation and protection of Al Zubarah, however, we realised that a simple manual would not have the capacity to cover everything. This Handbook brings together all the existing information on the site. This includes information from site reports and archive material. It also makes the information more easily accessible to people involved in the conservation process.

The collection phase of the data also made it clear that different groups are involved in the conservation process of Al Zubarah and each of these needs to be addressed. These are groups both within the Qatar Islamic Archaeology and Heritage Project (QIAH) and within the Qatar Museum Authority (QMA).

The Handbook provides guidelines for the conservation and consolidation of architectural remains at Al Zubarah Archaeological site. It will be modified and updated according to the evaluation of regular monitoring and the assessment of executed works, in coordination with the QMA, QIAH experts, the crafts persons, conservation architects and international consultants. Notably, the section on fiches techniques will be expanded over time, with input by conservation craft persons and restorers and their on-site experience.

The Handbook has been structured into four main parts:

PART 1 Basics:
compiles available information on (building) materials and its deterioration patterns, as well as environmental conditions. It also provides also general introductions to the regional architecture, building terminology, and references.

PART 2 Conservation Concept:
introduces to the conservation concept and explains general solutions with “do and don’t” case studies to provide guidelines for conservation supervisors.

PART 3 Conservation Manual:
contains fiches techniques detailing specific technical solutions for the conservation works presented in a simple and easy-to-understand manner designed for the craftsmen and the workers. The information and instructions presented in the fiches will help the workers in the execution of the work. However, a case-by-case decision on-site by the supervisor is always necessary.

PART 4 Appendices:
provides comprehensive additional information, reports, analyses, templates, and manuals as well as conservation schemes for specific areas at Al Zubarah Archaeological Site.

Moritz Kinzel
København, September 2012
I. PREFACE

The Preface outlines the scope of the Conservation Handbook. It introduces the concept of “conservation of ruins” and identifies the visionary strategy for all concerned parties. Part Two of the Handbook reviews the overall philosophic approach to the conservation of Al Zubarah, building upon the recent evolution of the conservation theory for earthen architecture.

I.1 Conservation Handbook

This Handbook is built upon a shared vision for the future of the site, which is the result of a common perception of both the archaeologists in charge of the excavation and the heritage and conservation teams. Input from laboratories, craftsmen and conservation architects are included to make the proposed strategy and the technical fiches realistic and technically sound.

The Handbook is a tool to guide the activities and direct the work on site, setting a series of principles and techniques that can be applied in a “mechanical” and “standard” way by technicians and workers.

It presents a series of “cases” and proposes, through simple “technical fiches”, practical solutions for the teams in charge of the conservation of the site. The effectiveness and the actual impact of these techniques on the site will be reviewed over time and the handbook will be regularly updated to take in these new techniques.

The manual aims to achieve a higher degree of uniformity in the solutions applied to the site and to avoid unsuitable, personal decisions by middle-qualified foremen and builders. It is expected that the handbook will play an important role in the coming years and it is hoped that it might become a scientific reference for the entire region, beyond Al Zubarah.
1.2 Conservation of Ruins

Preserving Al Zubarah Archaeological Site is a titanic and almost impossible task. Indeed, the very idea of “preserving the ruins” is in itself both a technically controversial issue and a technical nonsense as we aim at “freezing” the decay, which has no specific significance or value but is simply the result of a combination of natural and man-made decay over time. Traditional approaches to the conservation of ruins ranges from the “freezing” of existing ruins to the almost complete reconstruction of a site. Intermediate solutions range from the abstract “plan-like” reconstruction of walls to more “romantic” partial reconstructions of the ruins as “more stable ruins” or even as “more ruin-like ruins”.

Though the concept of “preserving ruins as ruins” has a romantic touch, it is likely one of the most challenging in 21st century conservation. Al Zubarah archaeological site becomes, therefore, an extraordinary opportunity not only to test state-of-the-art techniques and methodologies, but also to reconsider the actual sense and scope of conservation and restoration of ruins from a conceptual point of view.

Our endeavour is an attempt to slow the rate of decay in a particularly harsh climatic environment. Therefore, our activity cannot be perfect or everlasting. Before we begin, we need to fully understand why we want to do this work, what it implies and what aims we hope to achieve. Aside from the essential scientific issues related to the selection of the materials and building techniques to accomplish this task, we need to consider the full scope of this project and its aesthetic and theoretical implications.

What solution should be adopted for at Al Zubarah?

At the technical level, “conservation of ruins” strictly overlaps with the concept of “continuous maintenance” based upon a state-of-the-arts “monitoring” of the evolution of the site and of the vestiges. However, it is also more than that. Not only should we continuously remove dust and sand, clean and re-point, check and replace individual stones and preserve remaining plasters, but we should also fill in voids, partially reconstruct window sills and doorways, rebuild loose masonries, and replace entire rows of decayed stones with more resistant ones. We are not simply “conserving” and “maintaining” the remains but we are actually replacing, rebuilding and transforming the site. We are working at the edge of the traditional post Venice-Charter doctrine, not only on fragile remains, but also on a “fragile” scientific and theoretic ground.

What principles should direct our actions?

What projected result are we looking for in two, five or twenty years?

QIAH Project aims at achieving a certain level of coherence, clarity and sustainability in the conservation interventions. Original and restored colours, surfaces, masonries and plasters should be able to convey a clear and understandable message to visitors without leaving room for ambiguities and misinterpretations.

The QIAH team has set general principles for the project based notably on the driving concept that “we want to preserve Al Zubarah, not to rebuild it”, in order to offer visitors, specialists and laymen alike the image of an authentic archaeological site and not of a superficial, reconstructed heritage village.
In a recent British publication devoted to the conservation of ruins and archaeological sites, Giovanna Rizzi, an Italian architect active in the conservation of archaeological sites in Europe and the Middle East, draws our attention to that:

“There is no such intervention that satisfies all the criteria of an abstract idea of ‘conservation correctness’, that is irreproachable from a theoretical and a technical point of view: each site has a different story, each calls for a specific approach. In conserving a ruin, it is impossible to be neutral. Experience teaches that, no matter how cautiously the work is designed, a conserved ruin always bears the traces of the interventions carried out. But if one cannot be neutral, one can at least try to be elegant and effective.”

Rizzi also underlines the importance of the preliminary activities to be carried out on a site before launching the conservation works. This can help us in defining the principles guiding our intervention. According to his vision, the architect in charge of the project should have a profound knowledge of the architectural body he sets to conserve, of its built form, history and of past interventions. He should have a perfect insight into its structural behaviour, a solid understanding of the materials and a deep comprehension of the mechanisms of decay active on the site. In the case of Al Zubarah these elements have been taken into consideration and high-quality scientific information has been collected and produced by the QIAH teams excavating on-site since 2009.

The comprehensive studies and analyses carried out in past seasons by the archaeological and the conservation units of the QIAH project – a large group of highly qualified archaeologists, architects, scientists and technicians – has allowed us to reach an in-depth knowledge of the history of the site and of its evolution, and a clear understanding of technical (material) and aesthetic characteristics of Al Zubarah at the height of its occupation.

Ongoing intensive archaeological research and excavations at the site have shed light upon the social, economic and ecological structure of Al Zubarah society in the late 18th and 19th centuries. Furthermore, excavations have uncovered previously unknown major architectural features and have recovered fragments of the wooden and gypsum decorative elements that composed the ornamentation of Zubarah’s mansions, forts and houses. These elements, carefully collected, stored and documented, offer us a vivid glimpse of everyday life in this pearl fishermen’s city.

The ambitious and comprehensive archaeological project launched by the Qatari authorities, with the scientific support of the University of Copenhagen, has allowed for a comprehensive survey of all archaeological sites along the Qatari northern coast and of the surviving traditional villages throughout the region, offering conservationists, archaeologists and visitors an invaluable comparative framework. Similarly, laboratory tests carried out in past seasons, and the tests carried out in situ on plasters and masonries, have enabled us to reach a good understanding of the physical, chemical and static issues typical of the ruins of the city of Al Zubarah.

Finally, the mechanisms of decay of the vestiges have also been investigated and understood, though more data on anhydride plasters and gypsum-based mortars still needs to be collected.

Likely, the only element partially missing in the vast documentation collected until now is the scientific analysis of the earlier conservation campaigns undertaken in Al Zubarah. This Preface explicitly deals with the subject, with the aim of identifying the theoretical framework of this earlier campaign and of assessing its actual impact on the physical remains.
I.3 Past Interventions in Al Zubarah

I.3.1 Historic Introduction

The ruins of Al Zubarah constitute not only the largest and most important Qatari archaeological site, but also the most complete and well-preserved pearl trading and diving town of the 18th-19th centuries. The site not only reflects the history of tribal migration in the Arabian Gulf (as it was founded by merchants arriving from Kuwait and Basra in the search for pearls), but also represents a unique mode of occupying a fragile desert ecosystem, which includes a particular system of water management.

During the mid to late 18th century, Al Zubarah was the Gulf’s most important trading hub, connecting the Indian Ocean with Arabia and western Asia. The site highlights how trade and exchange connected people from East and West economically, socially and culturally, making Al Zubarah a non-European, traditional form of settlement encapsulating unique anthropological and social historical themes. The different components of Al Zubarah’s urban plan show that the settlement was conceived and implemented from the outset. The layout of the town shows, therefore, both the sophistication of the planning principles, and the capacity of Al Zubarah’s rulers to control and direct the social and economic forces driving the town’s creation.

The site of Al Zubarah was mostly abandoned in the 19th century and it has been only briefly and partially reoccupied since then. The early abandonment of Al Zubarah at the beginning of the 20th century has helped to preserve the detailed urban layout of an 18th-19th century pearl fishing and trading town. Though some sectors were voluntarily destroyed in the 1970s (Qalat Murair), most of the decay within the area is the result of natural causes and of the restorations in the 1980s.

The site remained almost completely abandoned until the 1980s, when a major conservation campaign was launched. When considering the overall layout of the site, we should keep in mind that a significant percentage of what is currently visible at Al Zubarah is the result of that excavation campaign. These works were documented at the time by a publication in Arabic and by some colour photos (collected by QIAH), although unfortunately no complete record of the intervention has been kept.

I.3.2 The Cultural and Theoretical Framework of the 1980’s Campaign

The review of the large-scale works carried out in the 1980s underlines the strong impact of the theoretical choices that were made at the time. In order to define the new guidelines, we should not only focus on the mechanisms of decay of these earlier “restorations” but also identify the aims and implications of the conservation and presentation choices made at the time.

The team in charge of the works realised that it was impossible to uncover the ensemble of the city and opted for the definition of “priority areas”. Therefore, the campaign in the 1980s focused on the external city wall, which was extensively rebuilt with cement mortar and local stones, and on a series of punctual excavations, the so-called Northhouse (QMA2), the Suq area (QMA1), and the fortified Compound (QMA4).

3 Kholaf 1987
The 1980’s campaign did not aim at reconstructing archaeological remains and none of the remaining structures was rebuilt to the original roof level. Similarly, no interior was “completed” to offer a more complete image of what the buildings used to look like, and no new structures to favour the visit were added to the ruins, even though relatively heavy work took place and significant reconstructions of partially collapsed walls and vaults were carried out.

The driving concept of the conservation and presentation works was to present a regular plan of the ruined structures, to make the remains more easily “understandable” for the visitors. Therefore, original walls were “completed” with the addition of courses of stone to reach this abstract level, while higher standing walls were simply “capped” with a layer of hard impermeable cement-based mortar (upon which often was added a final course of stone capped with a more visually-neutral white cement mortar) to reach a regular level permitting the “reading” of the architecture.

The 1980’s project aimed at presenting Al Zubarah as an archaeological site and as a major consolidated ruin. The excavated areas were respectfully considered and treated to reach an abstract “plan-like” image underlining their “archaeological” significance and presenting them as “timeless” remains unearthed from the desert sand.
I.3.3 A Preliminary Assessment of the 1980’s Campaign

A scientific assessment of the 1980’s campaign underlines three major issues:

1) From many points of view, the driving concepts upon which the campaign was based were “modern” and coherent. The approach is notably at odds with plans that blur the line between “original” and “reconstruction”, aiming to transform archaeological sites into a pastiche “heritage” site.

2) Unfortunately, however, while the “theoretical” approach still seems scientifically correct (other tougher options for the presentation of the ruins might have been made), the quality of the technical work on the original masonries and plasters did not meet the same standards. The reliance upon strong modern building materials for mortars and masonries (cement capping and harder stones were regularly used for the added layers with a dramatic impact on the overall stability of the walls that were “restored”) on the one side, and an overall misunderstanding of the decay mechanisms of the original masonries after their excavation on the other, have led to a dramatically increased rate of decay not only of the additions in the 1980s, but also — and mainly — of the “original” parts of the structures.

3) The second major lesson to be learned from the 1980’s experience is that no single “once and for all” campaign can reach a long-lasting impact on such a vast and complex archaeological site. The evident decay of the areas “restored” in the 1980s has been further accelerated by the absence of regular maintenance at the site once the campaign was over. The 1980’s project lacked a long-term strategy and management guidelines and mechanisms for guaranteeing its sustainability.

Furthermore, the 1980’s campaign did not have a “vision” for the ensemble of the city. It focused solely on punctual elements, without proposing a comprehensive strategy for the entire site. Conservation works dealt exclusively with the areas that were uncovered and it never tackled the ensemble of the city. No comprehensive plan for conservation and presentation was ever drawn.

Simone Ricca, December 2012
Historic building stones (mainly beach rock)
Aeolianite (mainly 1980s repairs)
“Original” historic wall and floor-plaster (anhydrite or lime-based)
1980s cement
Historic wall mortars
QIAH-repairs (stones)
new plaster (QIAH) (at the moment lime-based)
new wall mortar (QIAH)
Plaster (surfaces) consolidated
(Quartz) sand
PART 1

BASICS

ENVIRONMENTAL CONDITIONS & STATE OF CONSERVATION
Introduction to Part 1

Part One of the Conservation Handbook compiles basic information on Al Zubarah Archaeological Site: its archaeology, environmental conditions, state of conservation, deterioration forms, and building materials.

The basic research upon which the conservation strategies and concepts are based are presented here. There is a brief introduction for each area of excavation and the main features of the site. The results of the analyses of climate data collected at Al Zubarah are presented, as well as some thoughts on salts in building materials. The illustrated glossaries are a work in progress. We hope to develop this further and to develop a tool to encompass building terms, building types, and building technologies.

Only through our knowledge of the basics can we formulate a conservation strategy that will be implemented in the field.

Location of Al Zubarah in Qatar and the Gulf Region.
**AL ZUBARAH ARCHAEOLOGICAL SITE**

**BRIEF INTRODUCTION**

Al Zubarah Archaeological site covers an area of approximately 400ha. Situated on Qatar’s north-west coast, it includes the town, the harbour, a sea canal, two screening walls, Qal’at Murair and Al Zubarah fort, which was built in 1938.

The QIAH Project has launched archaeological investigations in five new major areas inside the town, carrying out a survey and excavations at Qal’at Murair, and an intense conservation program to preserve the exposed architectural remains. Excavations have revealed the well-preserved remains of courtyard houses, a souq, parts of a large, palatial compound and segments of the stone build town wall. The so-called *excavation points* (so far ZUEP01 to ZUEP12) covering some *Living quarters with courtyard houses* (ZUEP01), the *suq* and harbour area (ZUEP02), some *brush huts* so-called *Barasti or Arish* (ZUEP03), the *palatial compound* (ZUEP04), an *midden area extra muros* (EP05), and a walkway with other building structures along the town wall (tower 8/ ZUEP10).

Ceramics and coins found here attest to Al Zubarah’s far-reaching trade and economic links in the late 18th century, with artefacts from eastern Asia, Africa, Europe, and the entire Gulf region. Diving weights, Anchors, a pearl merchant’s box and other material culture illustrate the close connections between daily life in the settlement, sea trading and the pearl “industry”. These close associations between the inhabitants and maritime trade and commerce is further shown by the drawing of a *dhow*, found incised into the wall plaster in a room of a courtyard building (ZUEP01).

Al Zubarah is an outstanding example of an 18th-19th century pearl fishing and trading town. It is preserved in its entire urban layout with a clearly defined, pre-planned qibla-oriented town grid. Al Zubarah is the only place in the Gulf which still shows the complete layout and fabric of a settlement dating to this crucial and formative period in the region’s history.

In the town, at least four mosques have been discovered, as have four “fortified” structures. The largest of these is seen as a palatial compound. The commercial complex of the town including, a suq area, is situated next to the harbour zone of Al Zubarah and shows storage, warehouses, shops and production areas as well as a *Khan*-like building. South of this, near the sea line, remains of *Barasti or Arish* palm leaf huts, traditionally used by newly arrived inhabitants and pearl divers, have also been recorded.

Al Zubarah is the only known town in Qatar with a town wall. The 18th century town wall is around 2.5 km long and it has 23 towers. When the town shrunk after the 1811 bombardment a second town wall was erected encircling a much smaller area of 10ha.

It is striking that the buildings at Al Zubarah are predominantly stone built houses, requiring enormous efforts, economically, and on human resources. In other settlements in the Emirates the main components of the towns were primarily palm leaf architecture and only a minority of the buildings were made of stone.

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There was, however, one very important resource they were missing: water. The fortified settlement of Qal’at Murair was built to protect and control the nearest wells and water recourse for Al Zubarah. It was linked with the town through a canal and two so-called screening walls, which might be part of a water supply system, overlaying partly the earlier canal. The canal seems to have served as a direct transport link to supply the ships in the harbour with water.

Building materials were mostly sourced locally. Beach rock and conglomerate stone were cut from the ground. Limestone (Dolomite) and Aleolite material was brought in from the plateau between Qal’at Murair and Freiha. Anhydrite as well as gypsum was extracted from the sabkah or nearby outcrops along the former shoreline. Timber had to be imported. It is unclear so far how intense the hinterland was used for agricultural activities (e.g. date palms). For some of the streets, several layers of plaster floors have been discovered and suggest a regular maintenance of the street surfaces.

On the following pages each excavation area will be presented with overview images or plans. Some of the characteristic features appear in detail.
Excavation point 01 (ZUEP01): Living quarter with courtyard houses. In one of the houses a dhow was depicted in the wall plaster. This feature was documented carefully in different techniques. It was photographed, drawn, copied with a silicon moulding, scanned with a high-resolution scanner and with photogrammetric techniques. The courtyard houses show bended entrances, reception rooms (majlis), kitchen areas and an arcaded Ivan.
ZUEP02 - Commercial Centre (Souq)

Excavation point 02 (ZUEP02): The Commercial complex of Al Zubarah is situated next to the harbour zone and includes warehouses, storage, and shops. The warehouse incorporates some date presses (madbasah) and a courtyard. The warehouse has a straight entrance to allow direct access to the central courtyard. The room cells of the suq are built in two rows and extend from the earlier excavations (QMA1) to the recently exposed areas (ZUEP02).
Excavation of the Palace started in early 2010 and has so far exposed one of the nine main courtyards. Decorated plaster and elaborate room arrangements were discovered. The walls are predominantly built from beach rock rendered with an anhydrite-based plaster.
Town wall and Towers

1. Tower 8 and ZUEP10 (2012 before the consolidation).
2. Tower 7, collapsed outer wall face (2010).
3. Town wall at ZUEP04 (2012 after stabilisation).
4. Tower 18, seen from NE (2009).
QMA 1 - Commercial Centre “Suq”

QMA 2 - “North house”
QMA 3 - “Industrial Area”

QMA 4 - Fortified Compound
GENERAL ON-SITE CONDITIONS
A SHORT SUMMARY

Al Zubarah’s status as a historic site and an authentic representation of past cultural traditions is threatened by harsh environmental conditions. Erosion caused by the sea, salt efflorescence and crystallisation, wind, drastic change of temperature during the day and human activities are the main issues affecting the conservation of Al Zubarah.

High evaporation rates and the proximity of the sea result in a very high rate of air salinity. This is coupled with very high average of daily and annual temperature ranges, which can reach up to 55°Celsius during the summer months. Sampling and subsequent analysis of exposed mortar and gypsum building materials from Al Zubarah indicate very high salinity concentrations in both mortar and gypsum, which can reach >30% in the sand and soils on-site as well as approximately 15% in the wall structures. This high salinity content causes chemical reactions between the plaster and mortar, resulting in the disintegration of the structural integrity of walls.

Furthermore, strong winds from the north/northwest have undermined the foundations, resulting in structural collapse, while the erosion of wall gypsum plaster has caused the core building materials to fall apart. Heavy winter rains and a constant change of humidity during the day (averaging around 20% to 50%) also puts a lot of pressure on the building materials.

These natural environmental agents are difficult to mitigate against. In general, there is also a huge impact from wash-out and blow-out processes on the walls, e.g. the very soft beach-stones (type “Ag”) are in a very poor state. Erosion has left voids within the wall structures, as well as the disintegration of entire wall segments.

Most of the building materials were not chosen to perform under these environmental conditions: e.g. the soft beachrock was used inside walls and was protected by plaster. The same is true for the interior plasters.

Although the architecture at Al Zubarah can be seen as “stone architecture” it shares several characteristics with earthen architecture. The decay process of the so-called beachrock has more in common with the erosion of mud bricks than with the deterioration of building stones.
GENERAL ON-SITE CONDITIONS
A SHORT SUMMARY

- Temperatures between 5°C - 55°C
- Heavy winter rains
- Strong north/northwest winds
- Up to 30% salt in soil/sand
- Up to 16% salt in wall structures
- 20% - 50% changes in humidity during day
ENVIRONMENTAL CONDITIONS
CLIMATE DATA (MONITORING)

Fig. 1, 2, 3: Temperature/humidity data loggers at QMA2 in Al Zubarah town (D1, D2) and HAB54506 at Al Zubarah Fort (indoor).

Fig. 4: Positions of the temperature/humidity data loggers in Al Zubarah town (D1, D2, D4, D5, HAB54579), at the research station (D3), and in a building of the fort (HAB54506)
CLIMATE OF QATAR
IMPACT ON THE WEATHERING OF BUILDING MATERIALS

The climate of Qatar as described by the Encyclopaedia Britannica as follows:

“a notoriously unpleasant climate. Temperatures are high, though winters may be quite cool at the north-western extremities. Summer (June to September) is very hot with low rainfall. Daily maximum temperatures can reach easily 40°C or more. Winter is cooler with occasional rainfall. Spring and autumn are warm, mostly dry and pleasant, with maximum temperatures between 25°C and 35°C and cooler night temperatures between 15 and 22°C. The sparse rainfall occurs mainly as sharp downpours between November and April and is higher in the northeast. Humidity is high. The little cloud cover is more prevalent in winter than in summer. Thunderstorms and fog are rare, but dust storms and haze occur frequently in summer. The shamal, a wind that blows predominantly from a north-northwest direction during the summer, is seldom strong and rarely reaches gale force. Squalls and waterspouts are common in autumn, when winds sometimes reach speeds of 95 miles (150 km) per hour within as short a time as five minutes. Intense heating of the land adjacent to the coasts leads to gentle offshore winds in the mornings and strong onshore winds in the afternoons.”

Temperature and humidity data for Doha on the East coast of the peninsular is summarised in Fig. 5.

Temperature, humidity and wind all contribute to the weathering of building materials. A bigger range in temperature during the day will lead to an increase in thermal dilatation and, eventually, greater potential damage to the building through the development of cracks. Building materials with distinctly different thermal expansion coefficients (> 10-5/K) are particularly prone to damage. The heating of wall surfaces depends on the duration of direct sun exposure and the absolute temperature high. Therefore, the weathering of building materials through thermal dilatation primarily takes place during summer.
Humidity is a problem during the winter months, when it exceeds 74.6%, the value of deliquescence and the crystallisation of sodium chloride (at 20°C). The repeated crystallisation of sodium chloride in the pores of building materials eventually leads to a weakening of the fabric and, ultimately, to crumbling. The effect of repeated deliquescence and crystallisation of sodium chloride can be seen everywhere in Al Zubarah, where the debris of beach rock (especially type AG) accumulates up at the bottom of walls. Strong winds and sandstorms also contribute to the weathering of building materials by the transport of sand grains which act abrasively on the surfaces.

In order to gather detailed information on the climate of Al Zubarah, seven temperature/humidity data loggers were distributed over the town area, at the research station and inside a building of the fort (Fig.1 to 3). The localities are marked in Figure 4. The data loggers were distributed with respect to different geographical positions (close to the sea, more inland) and exposure situations (free exposure, protected position in a niche, wall crevice or under a stone, inside a building). One of the data loggers (D2) failed to record data over a longer period of time (more than several days). All data loggers are listed in Table 1 with their number, geographical position, exposure situation, and recording time.

Figure 6 shows that the data collected so far is fragmentary. However, the incomplete bell-shaped average temperature curve for 2011 is in agreement with the complete minimum and maximum temperature curves for Doha in Figure 5. Figure 7 shows the corresponding humidity curves.

<table>
<thead>
<tr>
<th>Number</th>
<th>Position</th>
<th>Exposure</th>
<th>Recording time</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>QMA 2</td>
<td>free (at top of a pole)</td>
<td>22.03. - 30.05.2012</td>
</tr>
<tr>
<td>D2</td>
<td>QMA 2</td>
<td>free (at bottom of a pole)</td>
<td>22.03. - 23.03.2012</td>
</tr>
<tr>
<td>D3</td>
<td>Research Station</td>
<td>free (west gable of workshop)</td>
<td>22.03. - 30.05.2012</td>
</tr>
<tr>
<td>D4</td>
<td>QMA 2</td>
<td>protected (in a wall crevice)</td>
<td>22.03. - 30.05.2012</td>
</tr>
<tr>
<td>D5</td>
<td>EP 04, tower 8</td>
<td>protected (under a stone)</td>
<td>22.03. - 30.05.2012</td>
</tr>
<tr>
<td>HAB0054679</td>
<td>QMA 2</td>
<td>protected</td>
<td>16.01. - 16.02.2011</td>
</tr>
<tr>
<td>HAB0054506</td>
<td>Al Zubarah Fort</td>
<td>protected (inside a room)</td>
<td>21.03. - 20.09.2011</td>
</tr>
</tbody>
</table>

Fig. 6: Average temperature data at different locations at Al Zubarah
A comparison of the curves shown in Figures 6 and 7 and Figures 8 and 9 shows that temperature and humidity are inversely correlated: humidity is low when the temperature is high and vice versa.

Figure 8 shows that the daily temperature maximum occurs between 12 and 13 hours, while the lowest temperatures occur in the time interval 24 to 3 hours. The temperature peaks are lower and broader for data loggers kept in protected positions (e.g. D4, D5). The maximum inland temperature (D3) is a little bit higher than the maximum temperature close to the sea (D1, D2). The recorded temperature data – although it’s not yet complete – enables a reasonable assessment of the daily and annual air temperature course. What is missing is surface temperature data for building stones and plasters to appraise the effect that thermal dilatation may have on them.

In Figure 9, the green horizontal line marks the deliquescence of sodium chloride. At 20°C and 74.6% relative humidity solid sodium chloride liquefies to a saturated brine. According to the humidity curve shown in Figure 9 this happens during the night hours when the temperature is close to the minimum. In the morning when the temperature rises and the humidity decreases and falls below the critical value of 74.6% sodium chloride crystallises again from the saturated brine. Deliquescence and crystallisation of sodium chloride takes place preferably in the colder winter period, as is shown in Figures 10 and 11.

It can be said that salt crystallisation is a weathering factor which is most active in the winter period, while thermal dilatation occurs predominantly during the summer. Our information about the impact of climate on the weathering of building materials at Al Zubarah will be improved with more data from well-positioned data loggers over the area. The evaluated data of the seven data loggers is presented in Tables and Figures in Appendix 8.

Robert Sobott, July 2012
Fig. 8: Temperature curves from data-logger D1 - D5 for the time period 22.03. - 23.03.2012

Fig. 9: Humidity curves from data-logger D1 - D5 for the time period 22.03. - 23.03.2012
Fig. 10: Temperature / Humidity curves from data-logger D5 for March 2012

Fig. 11: Temperature / Humidity curves from data-logger D5 for May 2012
WEATHERING PROCESSES UNDER THE ENVIRONMENTAL CONDITIONS AT AL ZUBARAH

The environmental conditions at Al Zubarah are determined by distinct daily changes in relative air humidity, frequent strong winds blowing mainly from northern directions, and the abundance of sodium chloride transported by sea water and wind. These three factors give rise to intensive physical and chemical weathering of building materials. Since they are unchangeable the consequences can only be mitigated by the choice of appropriate building materials and continuous maintenance.

Physical weathering processes
Physical weathering at Al Zubarah is mainly caused by wind erosion. Strong winds carrying sand particles act much the same way as industrial sand blasting. Soft and weakly consolidated building stones such as beachrocks are preferably affected and definitely need a protective plaster.

Thermal cracking of individual or composite building materials can be the consequence of two different processes. In the first case it is caused by weakening the bonds between the components of a building material by thermal stresses induced by anisotropic dilatation of the components on a microscopic scale due to repeated rapid and great temperature changes. An example for this process is the cracking of a boulder in the desert where daily air temperature differences up to 50°C are not uncommon.

In the second case, the composite structure of a building unit is disrupted by sheer stresses in the interface of building materials with distinctly different thermal dilatation coefficients. To become effective this process requires large temperature differences. A worst case example would be a thick, insulating render with a high thermal dilatation coefficient on a stone wall surface with moderate to low thermal expansion. Thermal cracking is supposed to play a subordinate role in the physical weathering of building materials at Al Zubarah. Although absolute temperatures can be very high, daily temperature changes are gradual and the difference in the morning and early afternoon temperature rarely exceeds 20°C.

No consideration must be given to the destructive effects of ice crystallisation in the pore space of fully water-saturated building materials.

1. Physico-chemical weathering
Physico-chemical weathering comprises the chemical reactions between water and water-soluble salts in the pore space of building materials and is effected by the pressure exerted by hydrating and crystallising salts on the pore walls. Therefore, it requires water and water-soluble salts which are both present at Al Zubarah in unlimited quantities.

Water sources are groundwater, condensed air humidity, and sea spray. Salts, mainly sodium chloride (halite), and to a smaller degree alkali earth sulphates (gypsum, epsomite, etc.), are derived from the sea water. The components of salts, positively charged cations and negatively charged simple or complex anions, are bonded by electrostatic forces in a crystal structure.
Salts are water-soluble when the hydration energy derived from the interaction of strongly polarised water molecules with the ions is greater than the bond energy between the ions. The interaction with water makes salts harmful to building materials because without water there would be no transport to, into, and in the building materials and no destructive reactions. Therefore the occurrence of salts is also always an indication of moisture in the masonry.

The combination of sulphate, carbonate, nitrate, chloride, phosphate, oxalate, and acetate anions with sodium, potassium, magnesium, calcium, and ammonium cations produced some fifty different salts which were identified in building materials. Apart from simple salts, which consist of one cation and anion there are double and triple salts, frequently with several molecules of crystal water. Very remarkable species are humberstonite, $K_3Na_7Mg_2(SO_4)_{16}(NO_3)_{12} \cdot 6H_2O$, and thecotrichite, $Ca_3(CH_3COO)_{12}Cl(NO_3)_{12} \cdot 7H_2O$. However, if only the ubiquitous salts are considered, only 11 species remain of which gypsum and thenardite are by far the most frequent. Together with halite these two salts play an important role in the physico-chemical weathering processes taking place at Al Zubarah.

Salt contents in building materials are recognisable either as white efflorescences or dark patches on the surface of building stones, renders, and mortars. The crystallisation of salts takes place when the relative humidity of the air is lower than the deliquescence relative humidity. Sodium chloride (deliquescence relative humidity 75.4%), for example, occurs as crystallised rock salt or halite at 20°C and 60% relative humidity, while under the same conditions solid nitrocalcite, $Ca(NO_3)_{12} \cdot 4H_2O$, (deliquescence relative humidity 53.6%) takes up water from the air and dissolves. Salts with a very strong affinity to water practically never crystallise under ambient conditions and impart affected masonry a conspicuous dark colour.

2. Origin of salts

The formation of salts in building materials requires the presence of the cations and anions mentioned above. As a matter of fact, there are many possibilities as to how salts get into the stones and mortars of masonry. First of all, the building materials, stones and mortars, may contribute to the formation of salts. By the gradual decay of chemically less stable rock components, such as feldspars sodium and potassium, ions are set free, and the weathering of dolomitic rocks produces magnesium ions. The reaction of slaked lime (portlandite) and calcium silicate phases, the principal constituents of lime mortar and Portland cement, with water yields calcium ions which form low soluble compounds such as calcite and calcium silicate hydrates. Depending on the amount of $CO_2$ dissolved in water, calcite is partly dissolved again and therefore limestones and mortars are potential sources of calcium. If the raw material for burning lime contained appreciable amounts of dolomite then the mortar will contribute magnesium for the formation of magnesium salts.

The use of gypsum as binder introduced calcium and sulphate to the masonry, which may be mobilised by moisture. Some Portland cements contain distinct amounts of alkalis which are soluble and mobile in alkaline pore waters. Dry and wet deposition of the air pollutants $SO_2$ and $NO_x$ on building materials, in combination with catalytic oxidation sulphate and nitrate ions are formed. In the masonry they encounter a mix of cations and controlled by solubility combine with them to a variety of salts. Crystallisation of salts preferably takes place on limestone surfaces sheltered from the rain and leads to the growth of more or less thick and black gypsum crusts. However, these salt-forming processes are restricted to industrialised areas where energy is provided by fossil fuel power plants and densely populated areas with a lot of car traffic. Neither of these applies to the Al Zubarah region.
An important source of nitrates in masonry is the nitrification of organic matter by the nitrifying bacteria nitrosomonas and nitrobacter. High nitrate concentrations are quite common in the walls of horse and pig stables and, as a matter of fact, niter crusts were once a valued commodity for the production of gunpowder. Nitrates may occur in Al Zubarah where organic materials were stored and succumbed to bacterial degradation.

The high amount of sodium chloride in the building materials is derived from the sea water and like the other salts distributed in the masonry by capillary transport. The hygroscopic nitrates and chlorides are very mobile and migrate considerable distances from the spot of emplacement or formation.

Fig. 1 a Crystallisation of sodium chloride (halite) on sabkha at Zubarah.
3. Analytical methods for determining salt concentrations

There are a number of qualitative and quantitative methods for determining salt concentrations in building materials. For example, by licking a white crust on a building stone it is possible to distinguish magnesium sulphate hydrates (epsomite, hexahydrate) from sodium chloride by the characteristic bitter taste. However, the value of sensorial tests is very limited and reliable qualitative and quantitative analyses require greater effort with respect to methods and equipment.

3.1 Electrical conductivity measurements

Water-soluble salts can be extracted from building materials with distilled water. Positively charged cations (Na\(^+\), K\(^+\), Mg\(^{2+}\), Ca\(^{2+}\)) and negatively charged anions (Cl\(^-\), NO\(_3^-\), HCO\(_3^-\), SO\(_4^{2-}\)) are formed and conduct an electrical current. For diluted solutions there is a linear correlation between the electrical conductivity of the solution and the concentration of dissolved salts. The more salt the solution contains, the higher will be the electrical conductivity. A saturated and neutral calcium sulphate solution (~ 2 g CaSO\(_4\) / 1000 cm\(^3\) at 20 °C) exhibits an electrical conductivity of about 2.3mS/cm. The electrical conductivity is related to the sum of dissolved ionic species but does not inform about the kind of dissolved salts. The measurement of electrical conductivity is well suited for the rapid and uncomplicated determination of total dissolved solids and, in combination with Merckoquant\(^*\) test strips, even semi-quantitative analyses of sulphate, nitrate, chloride, calcium and potassium ions are possible.

Fig. 1 b Crystallisation of sodium chloride (halite) on wall render at Al Zubarah.
3.2 Quantitative chemical analysis (AAS, ICP-OES, IC)
The quantitative analysis of cations in the eluate of a building material is done by atomic absorption spectroscopy (AAS) or inductively coupled plasma/optical emission spectrometry (ICP-OES) while the anions are analysed by ion chromatography (IC). Conventionally, the contents of Na\(^+\), K\(^+\), Mg\(^{2+}\), Ca\(^{2+}\), SO\(_4^{2-}\), NO\(_3^-\), and Cl\(^-\) in the eluate are determined and recalculated to solid-related salt concentrations in percent. Ammonium and hydrogencarbonate ions are not included in the routine chemical analysis which is supplemented by the measurement of the electrical conductivity and pH. The determination of pH is especially necessary if the sample is a relatively young mortar which yields an eluate with a pH > 10. In this case an apparent excess of calcium ions which cannot be accounted for by sulphate, nitrate, and/or chloride contents in the sample is explained by the presence of hydroxyl ions derived from the dissociation of portlandite.

The plausibility of the analytical result should be checked by an ion balance and the comparison of the measured and calculated electrical conductivity taking also the pH into consideration. The sum of the concentrations of anions in terms of ion equivalents should equal the total concentration of cations in terms of ion equivalents. If the solubility and deliquescence relative humidity are considered the ion balance allows a forecast of the crystallisation sequence of salts from the solution. The least soluble salts will crystallise first, and the most soluble last. The data from chemical analyses can also be used for a numerical simulation of brine crystallisation at a given temperature and relative humidity conditions (Steiger 2005). The computer program “ECOS” (Environmental Control for Salt Damage) can be applied for this purpose (Price 2000).

3.3 X-ray diffractometry
Salts are crystalline solids and can be identified by X-ray diffractometry. Since the wavelengths of X-rays are in the order of magnitude of the interplanar spacings in crystals, reflection and diffraction phenomena occur at the surface of irradiated crystals and produce a compound specific diffraction pattern. Evaluation of the diffractogram with Bragg’s equation turns diffraction angles into interplanar spacings (d values) which are listed for some ten thousand inorganic and organic substances. The identification is done by comparison of listed and measured d values. Individual constituents in salt mixtures can be identified if their concentration exceeds 1 mass%. Under favourable conditions, i.e. if the constituents have similar mass absorption coefficients and no preferred orientation of the crystallites in the sample, the peak intensities may be used for estimating approximate quantities.

4. Interaction of salts with building materials
The harm caused by salts to building materials is demonstrated by damages to paint coatings on render, which may become visible after several cycles of deliquescence and crystallisation. If the paint coating is barely permeable to the brine, salt does not crystallise on the paint coating but behind it and pushes it away from the render. Analogous to this process the harmful effects of salt crystallisation in the pore space of building stones can be imagined.

If the sum of volumes of crystallised salt and residual solution is greater than the volume of the supersaturated brine, a crystallisation pressure develops inside the pores provided they have been sealed off by crystallised salt. This process is comparable to the crystallisation of ice in a bottle completely filled with water which will burst because the ice has a greater volume than the water. As suggested by thermodynamical considerations and confirmed by experiments with alum, not only the expanding volume but also the growth of crystals in preferred crystallographical directions effects a pressure which is capable of disrupting the fabric of building materials. However, the quantitative contribution of the linear growth crystallisation pressure to the damage of build-
ing stones is difficult to assess because theoretical considerations do not completely agree with observations at buildings.

According to theoretical calculations, the crystallisation of halite from a twofold supersaturated solution effects a pressure almost twice as high as the crystallisation of thenardite under the same conditions. However, in cases where salt crystallisation plays a major role in damaging building stones it is mostly linked to sodium and/or magnesium sulphate and not to sodium chloride. The decay of building stones by salt crystallisation has been the subject of a number of dissertations (Hoffmann 1994, Weiss 1992). They confirm the hypothesis that salt crystallises with a pressure build-up from a constantly supplied brine due to the lower chemical potential in capillary pores first and will continue to crystallise in micropores when the pressure in the capillary pores has reached a level at which the chemical potential of the salt crystals in the capillary and micro pores is equal (Fitzner and Snethlage 1983). The magnitude of the resulting pressure depends on the absolute pore sizes and the pore size distribution. This capillary pressure model goes along with the observation that building stones with a maximum of the pore size distribution in the overlap interval of capillary and micro pores are specially prone to damage by salt crystallisation while building stones with a maximum in the macro pore interval are much more resistant.

Next to the crystallisation pressure, the hydration pressure of salts occurring with several molecules of water of hydration contributes greatly to the harmful interaction of building materials with salt.

By the uptake of waters some salts pass from a lower into a higher hydration stage with an increase in molar volume. This effect is especially distinct for sodium sulphate, where the uptake of water leads to the transformation of anhydrous thenardite to mirabilite with ten molecules of water accompanied by an increase of the molar volume by 310%. A second example is magnesium sulphate, which occurs in five different hydration stages: kieserite MgSO₄·H₂O, starkeyite Mg₅SO₄·4H₂O, pentahydrite Mg₅SO₄·5H₂O, hexahydrite Mg₅SO₄·6H₂O, and epsomite Mg₅SO₄·7H₂O. The increas-

![Fig. 2a The phase diagram sodium sulphate – water with plotted data points from Fig. 2b.](image-url)
es in molar volume for the transformations of kieserite to starkeyite and hexahydrite to epsomite are 79 % and 10 %, respectively. Thenardite occurs very frequently in building materials.

**Figure 2a** shows the phase diagram sodium sulphate – water in which the univariant curve separating the thenardite from the mirabilite field defines the phase stabilities as a function of relative air humidity and temperature. For example, sodium sulphate is stable as mirabilite at 12.5 °C and above 70% relative air humidity, while at this temperature magnesium sulphate already occurs in the highest hydration stage as epsomite at 32% relative air humidity.

If the crystallisation and/or hydration pressure exceed the tensile strength of a building material, cracks will develop. The mechanical failure of a building material will not take place at the first crystallisation process but will be the effect of periodically repeated events with a gradual decline in material strength.

As pointed out above, sodium chloride and calcium sulphate are abundant at Al Zubarah. Therefore the occurrence of halite and thenardite in building materials is not surprising at all. From the recordings of climate data at Al Zubarah it is evident that the conditions for the crystallisation and deliquescence of halite and the transformation of thenardite to mirabilite and vice versa are realised in the winter months, with peak humidities and temperature minima during the night hours (**Figure 2b**).

A special case of interaction of salts with building materials is the so-called sulphate attack, a reaction of calcium sulphate with Portland cement components or reaction products to form ettringite and/or thaumasite. The reaction of gypsum with water and tricalcium aluminate, a component of ordinary Portland cements, leads to the formation of ettringite, while the reaction of calcium sulphate, calcium carbonate, and water with calcium silicate hydrate phases, the hydration products of Portland cement, results in the formation of thaumasite. The increase in molar volume of the product over the reactants is 62.4% for the ettingite reaction and 75.7% for the thaumasite reaction.
reaction. Both reactions are harmful to building materials due to the volume increase. Laboratory

tests with building materials from Al Zubarah have shown that there is a potential for ettringite

and/or thaumasite formation. However, as the thaumasite reaction is favoured by low tempera-
tures (T < 5 – 10 °C) which are uncommon in Qatar it is more likely that ettringite will be formed.

5. What can we do with salts in building materials

There is not so much we can do to suppress or stop the interactions of salts with building materi-
als at Al Zubarah. We are restricted to mitigating harmful effects. A very simple but effective mea-
ure is the removal of salt efflorescences from wall surfaces with a brush. However, the brushed-off
salts should not be discarded at the wall base but disposed of at a safe distance. The choice of
binding materials which give sufficient strength to mortars to cope with the attack by crystallising
and/or hydrating salts for at least several years will also help. As the salts are transported inside the
walls from bottom to top by capillary forces it is recommended that we intercept the capillary rise
of brines by a layer of impermeable building stones, such as the local dolomite at the wall base.
However, this practice is only feasible when a wall requires a partial or total reconstruction. Finally,
continuous maintenance of ma-sonry and renders will prevent small damages from becoming
larger, so as not to endanger the stability of an entire structure.

Robert Sobott, December 2012

6. References

von Salzen im Porenraum von Sandsteinen.- Sitzungsber. AK „Naturwissenschaftliche Forschung
an Kunstgütern aus Stein“. Inst. f. Werkstoffwissenschaften, FAU Erlangen-Nürnberg, 6 – 19

Heidelberger Geowiss. Abh. 72, 1 – 200, plus 16 Seiten Anhang

needed to prevent salt damage in porous materials.- European Commission Research Report No.

Steiger, M. (2005): Salt in porous materials: Thermodynamics of phase transitions, modelling and
preventive conservation.- Restor. Build. Monum. 11, 419 – 431

Weiss, G. (1992): Die Eis- und Salzkristallisation im Porenraum von Sandsteinen und ihre Auswirkun-
gen auf das Gefüge unter besonderer Berücksichtigung gesteinsspezifischer Parameter.- Münch-
ner Geowiss. Abh. (B) 9, 1 – 118, Verlag Dr. Friedrich Pfeil, München
CHARACTERISTIC WEATHERING AND DECAY ATTESTED AT AL ZUBARAH ARCHAEOLOGICAL SITE

**Aeolian out-blow and Pluvial out-wash** of loose mortar and debris material resulting in open joints, voids in wall structure, finally in instability and collapse of wall segments.

**Erosion, decay and disintegration** of single building materials components, e.g. for beachrock: Gastropods, molluscs, “sand”, salts, etc. Especially wall bases and zones where salt containing sand/soil-deposits are located resulting in heavy damages of beachrock (salt crystallisation zone!)

**Bonding of plaster** to wall stones often limited or lost

**Plaster surfaces**: powdery or cracked due to fluctuation of temperature and humidity as well as volume changes of sulphates and salt crystals. Beachrock decay reminds of mud brick deterioration processes

Instability of wall structures, due to insensitive repairs

Loss of wall structures due to **neglected maintenance**
HISTORIC BUILDING MATERIALS
WEATHERING FORMS AND DETERIORATION PATTERN

Open joints (e.g. ZUEP04, wall 4010)

Eroded Beachrock (e.g. in QMA2)

Poor bonding of plaster to wall structure (e.g. QMA4:5c)

Voids in wall structures (e.g. QMA 4:4b)
GENERAL STATE OF CONSERVATION
IN EARLIER EXCAVATION AREAS

During the 1980s the first conservation measures took place following the archaeological excavations by QMA. The restoration work focused on the then excavated buildings (excavation areas QMA 1, 3 and 4) and on sections of the outer city wall (tower T6 to T10 and T15 to T16).

As part of these works, old wall stones were re-used to add courses to some walls to prevent further structural decay. Other walls, especially in area QMA 3, were more extensively reconstructed. In this restoration campaign traditional building and masonry techniques were used, however mortars were mainly cement-based, instead of local lime and gypsum-based mortars. In addition, most restored walls were capped with a cement coat. Lack of maintenance during the past twenty-five years and unsuitable materials has led to the substantial deterioration of the exposed walls. This earlier restoration project, which did not follow contemporary international standards, provides us with a useful reference tool. It offers invaluable data for the assessment of the decay rate of the exposed materials and a visual “proof” of the negative impact of cement-based mortars and cement capping on the walls.
GENERAL STATE OF CONSERVATION
EXAMPLES FROM QMA4 (FORTIFIED COMPOUND: ROOM 4)

State of conservation (QMA4) November 2009
STATE OF CONSERVATION: TOWN WALL
exposed segments

2009 - 2012
The town wall and its 23 towers were only exposed in two longer segments during the 1980s. The exposed parts of the wall as well as the towers were consolidated, re-built and partly reconstructed. Part of the exterior wall structure was completely re-built using cement mortar. The wall capping was also built with cement mortar. In some sections the dark grey portland cement layers are the only preserved element of the former wall structure, due to the extreme erosion of beachrock wall stones. Where joints are left open, voids can occur in the wall structure. Wall segments 6/7 to 9/10 show the greater impact of the strong north wind than do the exposed segments 16/17 to 18/19 in the southern part of the town.
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

COURTYARD HOUSES - 47
WIND CATCHER AND WIND TOWER - 49
MOSQUE - 50
SUQ - 51
ARISH & BARASTI HUTS - 52
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FORTS & TOWERS - 53
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DECORATION PATTERNS AND PROPORTIONS - 55
BUILDING TECHNOLOGY - 56
BUILDING MATERIALS - 57
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Courtyard houses

(Plate 26) The 1st floor plan and the upper room of the house of Ali bin Said Al-Nahhar. The upper room is shown above the roof.

(Plate 25) A horizontal projection (layout) of the ground floor of the house of Mohamed Sadeq Naas Allah (Duka)
Source: Doha Municipality Brochure 6601 (Ministry of the Architectural Heritage)
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

Courtyard houses

A - Courtyard
B - Bended Entrance
C - Iwan or Majlis (Reception hall)
D - Kitchen area
E - Private Courtyard with an Iwan.
F - Storage Room
G - Multipurpose room
H - Stair to upper level (roof)
J - Alley

Example from Al Zubarah
Example from Muharraq
Example from Wakra
Example from Qatar
Example from Abu Dhabi
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

Traditional air ventilation systems

WIND CATCHER (Niches/Windows)

WIND TOWER (Badgir)
Mosque:

1. Jumail Mosque; A - Mirhab & Minbar in Qibla wall, B - Prayer hall, C - Riwaq (?) / Portico, D - Courtyard (Sahar), E - Ablution Room, F - Minaret, G - Entrances.
4. Minaret at Al Arish.
5. Historic Mosque at Freiha (dashed line in red indicates Qibla direction); Labels as above.
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

Suq

The suq is a commercial building complex characterised by rows of shop stalls in narrow alleys passable only for pedestrians and pack animals. Stores of the same industries are often grouped together. In general, shops, only a few metres wide, open onto the alley. They can have storage, warehouses and workshops out the back and upstairs.

At Al Zubarah’s suq (QMA1 / ZUEP02) madbasas are a common feature in the back of the shops. Roofs over the alleys of the suq, covered with wood and mats, protected pedestrians and goods. The rows of shops are complemented by warehouses and other commercial facilities, such as khans.
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

Areesh (Arish)
This was a summer house that would allow ‘the weather to come in’. It was constructed from palm tree fronds mainly without leaves and with wide spacing between the fronds at ground level (up to 10 cm) to allow the wind to penetrate. The roof could be slightly pitched or flat. Characteristically the entire front of the rectangular enclosure would be open. Areesh buildings had no doors. Similar houses would be built up in the mountain areas for a single family to live in during their summer migrations to collect dates. This Areesh (Arish) typology is still used in the Fajairah mountains as a summer house for families who continue the tradition of summer migration.

Barasti
English speakers often refer to any Arish building as a ‘Barasti hut’. What the people of Hatta call barasti, however, is a rectangular building with a flat roof and a doorway in the middle of the front wall, constructed from an Arish frond, peeled of its leaves and put together in a pattern called kasali, based on 16 cm by 10 cm spacing. Barasti buildings would always have hassir mats behind the Arish wall, where the air could not enter, and were sometimes used as mazils in the winter months of November to March. Some barasti interiors there was a small area designated as a bathroom (similar to khaimah in the coastal and northern Emirates).

Khaimah
In all seven Emirates, the khaimah is a building with a pitched roof, used as a winter house and built totally from palm leaves woven tightly together in order not to allow cold wind or moisture to come through. In traditional khaimahs, including those of Hatta, the roof frame would always be constructed from a net of Arish fronds resting on a palm tree or channel timber beam. The roof was covered with hassir mats and occasionally bilaven before the final layer of daam mats was applied. The interior of a khaimah would have sand, gravel or hassir mats on the floor. Interior walls might be covered with hassir mats, depending on the availability of materials and the status of the family.

Kada
Mountain regions offer a diverse source of building materials, stone in particular. The walls in kada buildings were built from stone, covered by palm leaves. They were used for storage or as family houses. Apart from Hatta, kada houses are found in the Al Hail Palace area of Fujairah Emirate.

from: Piesik 2012:87

A typical house in Sharjah by Khalid Al Almari
1 Arish (summer house)
2 Khaimah (winter house)
3 Kitchen
4 Mable for men
5 Entry
6 Bathroom

from: Piesik 2012:125

Kata
Palm frond (central part)
with leaves intact

Sarbal
Small of connecting palm leaf fronds, usually 16 x 10 cm rectangles

Hassir
The uppermost palm leaves

Habel
Undershrub. The shrubbery of the palm leaves connected in the center and stem leaves making it look like a habel

Palm leaf weave typologies in Hatta
Local names for some of the palm leaf patterns.

from: Piesik 2012:88
Tents

Forts

battlement: a parapet having a regular alternation of merlons and crenels.
ILLUSTRATED GLOSSARY: BUILDING TERMS

ENGLISH

WINDOW

Wall plaster
Danshal timbers
Lintel
Frame
Shutter
Wall structure
Window sill
Exterior wall plaster with "hand tooling"
Head
Jamb
Breast
Plaster Floor
EXTERIOR
DECORATION PATTERNS & PROPORTIONS

after Yarwood & El-Masri 2006: Fig.2.4
ILLUSTRATED GLOSSARY: BUILDING TECHNOLOGY

ENGLISH

LIME or CEMENT MORTAR
MUD/EARTH
MANGHOUR
BASJEEL
DANSHAL

Diagram:
- crown (of the wall)
- border line (“double”-line)
- wall top
- corniche
- “rough” surface (fiche 3.5.3)
- ledge
- plaster-surface “smooth” surface (fiche 3.5.1)
- wall face
- core (wall structure)
- beach rock wall stones
- finish
- under coat
- mortar
- wall base
- panel
ILUSTRATED GLOSSARY: BUILDING MATERIALS

1 - (Quartz) sand
2 - Al Danshal timber from East Africa
3 - Basjeel, bamboo strips (from India)
4 - Daoun, Palm leaf mats (from the Emirates)
5 - Manghour matting
6 - Soil/ Earth / Mud
7 - Plaster materials (Lime [A] & Gypsum [B]-based)
Table 1: Characteristic macroscopic features of the building stones

<table>
<thead>
<tr>
<th>Rock type</th>
<th>Colour</th>
<th>Macroscopically visible components</th>
<th>Diagnostic features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beachrock</td>
<td>light yellow grey to whitish</td>
<td>bivalves, gastropods</td>
<td>friable components</td>
</tr>
<tr>
<td>Conglomerate</td>
<td>mixed colours of rock constituents</td>
<td>bivalves, gastropods, dolomite fragments</td>
<td>components</td>
</tr>
<tr>
<td>Aeolianite</td>
<td>light yellow - medium grain size, bedding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dolomitic limestone</td>
<td>fresh surface grey</td>
<td>very hard density, fine grain size</td>
<td></td>
</tr>
<tr>
<td>Gypsum</td>
<td>yellow grey to whitish</td>
<td>scratchable with finger nail</td>
<td></td>
</tr>
</tbody>
</table>

For an identification scheme see fiche 2.2, 6.1 or Appendix 1

ROCK TYPES USED IN WALLS AT AL ZUBARAH

1: Beach rock - mollusc rudstone (AG);
2: Beach rock - gastropod rudstone (BJ);
3: Conglomerate (KA or LA);
4: Aeolianite (FR);
5: Dolomitic limestone (BL);
6: Gypsum rock (BE)
ILLUSTRATED GLOSSARY: DETERIORATION PATTERNS
ENGLISH, German

GENERAL TERMS . ALLGEMEINE BEGRIFFE

ALTERATION . MATERIALVERÄNDERUNG
Damage . Schaden
Decay . ZERFALL (VERFALL)
Degradation . ABBAU, VERSCHLECHTERUNG
Deterioration . ZERSTÖRUNG, SCHÄDIGUNG
Weathering . VERWITTERUNG

CRACK & DEFORMATION (RISS() & VERFORMUNGEN)

Crack . Riss
Fracture . Bruch
Star crack . Sternförmig verlaufende Risse
Hair crack . Haarriss
Craquele
Splitting . Aufspalten

DEFORMATION . VERFORMUNG

Cracking
Cleft
Differential erosion

DISINTEGRATION . ZERFALL IN GESTEINSPARTIKEL

Crumbling . Abreiben
Granular disintegration . Körper zerfall
Powdering . Chalking

DEFORMATION . SCHICHTSPALTN

Exfoliation . Auflöten

DEALIMATION . AUFSPALTUNG

Delamination . Schichtspaltz

DETACHMENT . ABLOSUNG

Detachment . Ablöszung
Blistering

DISCOLORATION & DEPOSIT VERFÄRBUNG & ABLAGERUNG

Black crust . Schwarze Kruste
Salt crust . Salzkruste

ENCRUSTATION . INKRUSTATION

Concretion

Enrichment . Färbung

Bleaching . Bleichung
Moist area . Feuchtezone
Staining . Fleckenartige Verfärbung

EFFLORESCENCE . AUSBLÜHUNG

Exfoliation . Aufblättern

Encrustation . Ankrustation
Concretion . Konkretion

SANDING . ABSCHALEN (DÜNNER SCHALE)

Flaking . Abschuppen

SOILING . VERSCHmutzung

Mould . Schimmel (Pilze)

FILM . FILMBILDUNG

Glossy aspect . Glanz

Biological colonization . biologische Besiedlung

ALGA . ALGEN
Lichen . Flechten
Moss . Moos

Biological colonization . biologische Besiedlung

Iron rich patina . Eisenreiche Patina
Oxalate patina . Oxalatpatina

SUBFLORESCENCE . SUBFLORESZENZ

ALCOHOL. Aissa Jardine

ICOMOS (ed.)
# Glossary: Deterioration Patterns

**English, German**

<table>
<thead>
<tr>
<th>English</th>
<th>German</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alteration</strong></td>
<td><strong>Materialveränderung</strong></td>
</tr>
<tr>
<td>Modification of the material that does not necessarily imply a worsening of its characteristics from the point of view of conservation. For instance, a reversible coating applied on a stone may be considered as an alteration.</td>
<td>Veränderung der Material Eigenschaften, die nicht notwendigerweise eine Verschlechterung des Zustands unter dem Gesichtspunkt der Konservierung bedeutet. Ein reversibler Überzug auf einem Gestein kann zum Beispiel als eine Materialveränderung betrachtet werden.</td>
</tr>
<tr>
<td><strong>Damage</strong></td>
<td><strong>Schaden</strong></td>
</tr>
<tr>
<td>Human perception of the loss of value due to decay.</td>
<td>Menschliche Wahrnehmung des Wertverlusts durch Verfall.</td>
</tr>
<tr>
<td><strong>Decay</strong></td>
<td><strong>Zerfall / Verfall</strong></td>
</tr>
<tr>
<td>Any chemical or physical modification of the intrinsic stone properties leading to a loss of value or to the impairment of use.</td>
<td>Jede chemische oder physikalische Veränderung der Gesteineigenschaften, die zu einem Wertverlust oder einer Einschränkung der Gebrauchsfähigkeit führt.</td>
</tr>
<tr>
<td><strong>Degradation</strong></td>
<td><strong>Abbau / Verschlechterung</strong></td>
</tr>
<tr>
<td>Decline in condition, quality, or functional capacity.</td>
<td>Negative Veränderung des Gesamtzustands, der Qualität oder Funktionalität.</td>
</tr>
<tr>
<td><strong>Deterioration</strong></td>
<td><strong>Zerstörung / Schädigung</strong></td>
</tr>
<tr>
<td>Process of making or becoming worse or lower in quality, value, character, etc.; depreciation.</td>
<td>Prozess, welcher die Verschlechterung des Materialzustands, die Minderung der Qualität oder des Werts oder des Materialcharakters verursacht oder der Prozess der Verschlechterung/des Zerfalls selbst.</td>
</tr>
<tr>
<td><strong>Weathering</strong></td>
<td><strong>Verwitterung</strong></td>
</tr>
<tr>
<td>Any chemical or mechanical process by which stones exposed to the weather undergo changes in character and deteriorate.</td>
<td>Jeder chemische oder mechanische Prozess, durch den Gesteine, die der Witterung im Freien ausgesetzt sind, Veränderungen ihrer Eigenschaften erfahren und zerfallen.</td>
</tr>
</tbody>
</table>

**ICOMOS (ed.)**

ILLUSTRATED GLOSSARY: DETERIORATION PATTERNS
ENGLISH, German

**ALTERATION, MATERIALVERÄNDERUNG**
Common alteration of architectural mouldings by algae.
Materialveränderung von Architekturprofilen durch Algen.


**DEGRADATION, ABBAU / VERSCHLECHTERUNG**
Degradation of red sandstone masonry due to defective rainwater gutter behind parapet.
Verschlechterung/ Minderung des Erscheinungsbildes eines roten Sandsteinmauerwerks durch schadhafte Regenrinne oberhalb des Gesimses.


**DAMAGE, SCHADEN**
Damage to the lower part of a sandstone grave slab resulting in loss of value.
Einen Wertverlust verursachender Schaden am unteren Teil einer Grabplatte aus Sandstein.


**DETERIORATION, ZERSTÖRUNG / SCHÄDIGUNG**
Deterioration of a Carboniferous sandstone masonry.
Schädigung eines Mauerwerks aus Karbonsandstein.


**DECAY, ZERFALL / VERFALL**
Limestone relief showing advanced decay.
Kalksteinrelief im Zustand fortgeschrittenen Verfalls.

France, Caen, Eglise Saint-Pierre, 2008. Head ca. 10 cm, LRMM / V. Vergès-Belmin

**WEATHERING, VERWITTERUNG**
Weathering of a Lewisian Gneiss monolith resulting from long term exposure to the elements.
Verwitterung eines Monoliths aus Lewisian Gneis durch lange Klimaexposition.


ICOMOS (ed.)
GENERAL ACTION PLAN: CONSERVATION SCHEME

1. BASICS (PART 1)
   a) Decay processes, deterioration of building materials, climate conditions, state of conservation.

   b) Recording & Monitoring (3D-Laser scanning, photo, sketch, drawing, text, Inventory), Documentation, includes mapping, etc.

   c) Analyses, assessment and evaluation of structural conditions.
2. PLANNING (PART 2)

d) Planning of measures according to assessment of state of conservation. Plan sketches to discuss strategies. Concept development; Selection and test of materials. Definition of conservation scheme and technical solutions (*Fiches techniques*).

3. IMPLEMENTATION (PART 3)

e) Fiches Techniques as step by step instructions; listing of needed materials, tools, required staff, premises, climate conditions etc.

4. DECAY PROCESS

f) Decay and deterioration of materials caused by natural and human agency. Restart of process (see Part 1).
REFERENCES

Ashurst, John (ed.)
2006 Conservation of Ruins. London: BH.

Ashurst, John und Asi Shalom

Brandi, Cesare

Cramer, Johannes
1984 Handbuch der Bauaufnahme. Stuttgart: DVA.

Dostal, Walter
1983 The traditional Architecture of Ras al-Khaimah. TAVO B:54. Wiesbaden: Ludwig Reichart

Hassler, Uta & Nerdinger, Winfried (Hrsg.)

Hawker, Ronald

Hubel, Achim

ICCROM (eds.)

ICOMOS (eds.)

Jameson, John H. (Hrsg.)

Kersten, Thomas und Mechelke, Klaus

al-Kholafí, Mohammad Jassim
2006 The Traditional Architecture in Qatar; (2nd edition); Doha: National Council for Culture, Arts and Heritage.

King, Geoffrey

Kinne, Andreas

Kinzel M., Sobott R., and Thuesen I.

Koepf, Hans
Meskouris, Konstantin, Klaus-G. Hinzen, Christoph Butenweg, Michael Mistler

Müller, Joachim

Nerding, W.

Niebuhr, Carsten

Piesik, Sandra

Pütt, Karin

Pütt, K. & Adolph, K.

Ragette, Friedrich
1974 Architecture in Lebanon. Beirut: AUB.

Rainer, R.
1977 Anonymes Bauen im Iran, Graz: Akademische Verlagsanstalt.

Richter, Tobias, Paul Wordsworth & Alan Walmsley

Scharabi, Mohammed

Seidl, Ernst (ed.)

Sobott, Robert

Thuesen, Ingolf & Kinzel, Moritz

Walmsley, Alan

Wirth, Eugen

Yardwood, John & El-Masri, Souhail
CONSERVATION CONCEPT
GENERAL PRINCIPLES

INTRODUCTION

The excavations at Al Zubarah are among the largest ongoing excavations in the world. The research and excavation programme started in 2009 has taken into consideration the issue of the conservation of the uncovered vestiges and of the archaeological finds since the beginning of the operations on the field.

While an important series of analyses and tests on building material was carried out during the first years to determine a preliminary strategy of intervention, QMA and QIAH realised that a comprehensive concept capable of dealing with the extraordinarily complex issues conservationists have to confront in Al Zubarah was needed.

In order to design such a strategy, a seminar, gathering a panel of international experts in archaeological conservation, was organised in Doha between 29 November and 2 December 2011. This first meeting will be followed by similar seminars in the coming years and the panel of experts is meant to become an “international committee” for the preservation of Al Zubarah, advising the QIAH project and reviewing the results achieved on site.

The involvement of international experts and the scientific discussions into the ongoing works are a proof of the QIAH commitment and are in full compliance with the state-of-the-art approaches to conservation and site management outlined in the UNESCO Nomination File and Management Plan.

A COMPREHENSIVE STRATEGY: CONCEPTS AND DRIVING PRINCIPLES

The conservation of an entire city buried under the sand of the Qatari desert, in one of the most challenging climates of the world and set in an extremely salty natural environment, imposes the definition of clear principles to direct the intervention. These principles should be translated into flexible technical solutions capable of adapting to the results of the ongoing excavations, studies and experiments.

The QIAH Team in charge of the conservation of Al Zubarah has followed a step-by-step approach in order to adapt the interventions to the data being collected and to the results of the archaeological excavations. The conservation activities carried out in Al Zubarah Archaeological Site can be divided into three successive phases, each one building upon the previous one.

Phase 1
Data collection: analysis of the building materials and techniques, review of the climatic and physical conditions on site, tests and preliminary interventions on the built structures.

Phase 2
Design of a conservation strategy based upon the use of lime mortars. On the basis of the scientific data collected in phase 1, the team has defined a set of solutions and a series of building materials and techniques adapted to Al Zubarah. Particular emphasis has been put on the use of local sands and soil, and on the analysis of the tooling and building techniques used in the past.
Phase 3
While continually implementing the principles of Phase 2, the conservation team will further explore the possibilities related to the use of anhydrate mortars and plasters. Laboratory exams, on-site tests and visits to other archaeological sites in the region will allow us to design more “sustainable” building materials that may withstand the extreme climatic conditions of the present-day ruined city of Al Zubarah.

The Manual details the solutions of Phase 2, constituting a coherent conservation strategy for the site. These solutions might be modified according to the development of Phase 3 in further updated versions of this document.

The methodological approach followed during the first two years of the campaigns for the conservation of Al Zubarah was driven by the will to “improve” the materials found on the site. It was mainly based upon laboratory analyses, with the emphasis put on chemical and physical data, to design new improved mortars and masonry solutions. Such an approach implied that non-traditional materials (white cement, hydraulic limes, clean salt-free quartz-sands) be used to “freeze” the situation and reduce the disruptive impact of salt crystallisation on both mortars and stones.

The laboratory analyses carried out in this preliminary phase have enabled us to get a clear picture of the characteristics of the stones and mortar used by Zubarah’s builders and to make a precise classification of the building materials used in Al Zubarah (cf. Appendix 1 and 2).

With the unfurling of the project, the focus has moved towards a different vision, a sustainable approach based upon the driving principle that new added elements should always be “weaker” and “less resistant” to the original ones (even when the original masonries were made of extremely poor quality stones) and that limited reconstructions are actually necessary for the preservation of the fragile vestiges, an approach implying regular reconstruction/maintenance interventions need to be realised on the site by a technical team, to be financed by the State of Qatar on a long-term basis.

Sustainability in the case of Al Zubarah means three distinct and complementary issues:

1) The development of an administrative and management system capable of guaranteeing the long-term commitment of the State of Qatar and the regular allocation of financial and human resources for the site preservation.

2) The development of national capacities in the fields of archaeology and heritage through capacity-building programmes and the development of new academic institutions and structures.

3) A sustainable approach to technical conservation on the field.

This last point implies that the materials and the techniques used for the preservation of the site are, as far as possible, produced in the region and that local building traditions are integrated in the overall approach to conservation and restoration. Consequently, mostly traditional and/or local materials should be used for the restoration and conservation of Al Zubarah town, while “modern” techniques and materials are generally avoided.

Such an approach has become more and more frequent in architectural and archaeological conservation in the last twenty years. The 1964 Venice Charter, which remains one of the main cultural and intellectual references for the scientific community of conservationists, affirmed that:
“the conservation and restoration of monuments must have recourse to all the sciences and techniques which can contribute to the study and safeguarding of the architectural heritage (art. 2)” and that:

“where traditional techniques prove inadequate, the consolidation of a monument can be achieved by the use of any modern technique for conservation and construction, the efficacy of which has been shown by scientific data and proved by experience (art. 10).”

However, more recent views pay more attention to material contiguity and affinity, and to technological and static compatibility between old and restored elements.

This new sensitivity has lead to the development of a rich technical literature devoted to the rediscovery of traditional constructive know-how and local technical specificities, and to a less dogmatic vision of the necessary distinction between original and restored elements.

The very concept of sacrificial layer and the idea that integrations might be required for the consolidation of the structures (because we want them to continue working according to the static system originally conceived) are the coherent consequence of these new theoretical developments. Such an approach seems particularly meaningful when conservation concerns archaeological sites and ruins, and, possibly, even more so when these ruins are made of particularly fragile or perishable materials. Indeed, the still “fragile” theory developed for the conservation of earthen architecture partially contradicts many assumptions set in the 1960s that were essentially conceived for stone and firebrick structures within the Western World.

Al Zubarah, which is neither a medieval European city nor a classic Roman ruin, and is mostly composed of extremely fragile stones and mortars whose load-bearing and weather-withstanding capacities closely resemble mud brick and adobe structures, provides us with a perfect opportunity to put these contemporary concepts into practice, rather than a mechanical application of the Venice Charter.

If sustainability is the key, and contemporary solutions adopted for earthen architecture and ruins are used as a meaningful technical reference, then the conservation of the city of Al Zubarah should be developed accordingly.
TECHNICAL PRINCIPLES

The concept presented above is not based upon a theoretical vision detached from reality, but is actually grounded on a detailed analysis of the situation on the field and on the assessment of the characteristics of the building materials and technologies found on site.

At Al Zubarah, substantial parts of the original gypsum-based (anhydrite) mortars and plasters have been preserved, notwithstanding the extremely difficult climatic conditions. While laboratory tests seemed to prove the overall incapacity of anhydrite mortars to resist the prevailing climatic conditions, the visual analysis has forced us to question why laboratory test have proven so negative.

Likely, the laboratory data did not take into consideration the fact that the original local materials present a series of “impurities” that positively influence the capacity of the gypsum to withstand the site conditions. Layers of clay within the rocks, particles of lime, traces of coal, shells and other elements — but possibly also the temperature and the length of the cooking process to obtain the gypsum from the stones — have all produced a relatively high-quality material, based upon traditional knowledge accumulated over time by local masons.

The visual analysis of the masonry seems to confirm that where the building stones and the salt presence could not be improved, the local masons tried to achieve higher resistance with more sophisticated mortars and plasters.

This statement, which needs scientific verification, is one of the starting points for the identification of the “principle” directing the overall conservation of the site. Acknowledging the quality of traditional materials and building techniques, however, does not imply that no modifications are necessary to confront the particularly difficult conditions of the site, leaving room for the scientific research of new solutions.

Research on building materials and laboratory tests can and should continue to provide valuable new information and to control the overall quality of the work implemented on site. Instead
of designing new solutions and materials, however, tests will aim to “reproduce” the original materials and will attempt to identify the technological methods used to produce them.

Similarly, masonry tests will analyse the original tooling and finishing techniques the inhabitants of Al Zubarah used in their houses. They will attempt to reproduce them as accurately as possible to achieve visual, technical, chemical, mechanical and physical homogeneity with the original materials.

At the practical level, it has been agreed that the conservation interventions will be based on lime-based mortars, while new research will be launched to verify the impact of different sands, rocks and cooking techniques in the preparation of the gypsum-based mortars and plasters similar, to those originally used in the city.

The important studies already completed by the technical team on site during Phase 1, and the data produced by the laboratories, coupled with the sustainable approach described above, have allowed us to design very satisfactory lime-based mortars and plasters and to identify the best constructive and tooling techniques to treat the ruined walls of the site. The techniques and building materials to be used in the different areas of the city are presented in detail in the technical fiches of this Conservation Handbook [see Part 3].

In keeping with the principle announced above, the finishing proposed for the restored surfaces is based on the careful analysis of the traditional techniques and on the identification of the different solutions the builders adopted, according to the functions of the buildings.

The exterior plaster of the palace tower, for instance, might share similar chemical/physical data with the internal plasters, but presents a different finishing made with different tools for a different function. The visual analysis of the inner plasters of the rooms next to the date presses — likely used as simple storage areas and not as residential units — shows that the plaster received a much rougher treatment where the traces of the trowel used by the masons has not been erased to achieve a “perfect” result that was not needed by the function.
According to the vision outlined above, the conservation of Al Zubarah as an 18th century Gulf city with unique qualities and characteristics is based upon the precise recording and understanding of its technical and architectural elements. From a theoretical point of view, this approach, far from “falsifying” the vestiges, actually aims at preserving the ensemble of ruins not only in their material elements but also in their technical, static and almost “spiritual” essence.

TECHNICAL SOLUTIONS

The original houses and palaces of Al Zubarah were very likely entirely plastered and lime-washed, both internally and externally, and their walls were covered by roofs and terraces protecting them from direct sunlight, rain and wind erosion. The strategic principle to avoid reconstructions and to preserve the site as a ruin implies that no roof is to be created and that the vestiges of the walls remain exposed to the harsh desert and marine environment. In their current state, the masonries are not able to withstand the extreme climatic conditions of the site, and should therefore be protected by a plaster acting as a “sacrificial layer” destined to decay and collapse.

The conservation strategy developed by the QIAH heritage team, and validated by the recommendations of the international seminar on the conservation of Al Zubarah held in December 2011, requests that the ensemble of the ruined walls be covered with a layer of plaster. This solution would have a significant visual impact and would radically modify the overall image of the site. The QIAH team and all the workers and supervisors on the site will have to have a clear understanding of the theoretical and technical implications of this “radical” choice. It is also essential that any new plaster be applied in a way that is compatible with an archaeological site.

When it is agreed that a protective plaster is to be applied to the original vestiges, we will need to develop a better mix and improved building techniques. The external plaster will be subject to much stronger stresses than the original plaster, which is why we are looking to make use of lime-based mortars and plasters as a coating material. The conservation team has begun to develop a series of lime-based “mixes”, taking into consideration not only the purely “scientific” data con-
cerning their physical and chemical characteristics, but also the availability of the materials, their cost, colour and visual impact on the site. The proposed mortar mixes also have good physical and mechanical qualities and acceptable colour shades.

The team has also designed a set of building techniques to be applied in different areas of the site. The Technical Fiches of the handbook detail these in a clear and simple way. They have defined the “constructive” method to be applied in Al Zubarah, to highlight the difference between the “capping” and the faces of the walls so the site can remain true to its archaeological heritage.

At the practical level, the solution adopted:
• stresses the importance of the overall image of the wall after the conservation is completed;
• achieves an architecturally significant shape for the ruined walls;
• differentiates walls from capping;
• achieves an “irregular” profile for the wall and for the plaster;
• shows the thickness of the plaster with the support of a “sharp” line;
• underlines the difference between the faces and the capping with a different finishing of the plaster;
• reduces the impact of straight corners by “softening” vertical angles with rounded curves;
• avoids covering entirely the last course of stones of the walls with new plaster to favour the visual differentiation between wall and capping.

More research is needed to achieve an even more compatible mix and a more sustainable building material (that does not require the importation of hydraulic lime from Germany), if they are to reproduce an anhydrite mortar similar to the one found in the original plasters of Al Zubarah. In the coming years new solutions, based on the development of high-quality anhydrate mortars and plasters, will be tested and included in upcoming versions of this Conservation Handbook.

Simone Ricca 2012.

Consolidation of 1980s Restoration in QMA2: Taking off cement capping; Consolidation of wall structure, and re-shaping of wall top (2011/2012).
CONCEPT DEVELOPMENT AND IMPROVEMENT

In order to develop a conservation concept, the state of conservation of the exposed architectural remains was documented and analysed. Building materials, e.g. plaster, mortars, and building stones were examined in the lab (see Appendices). On site the decay processes were studied. This diagnosis showed that the predominantly used beachrock has to be covered in order to minimise and reduce decay and disintegration processes, due to the presence of Halite in the beachrock.

The analysis of building materials and soil samples showed also that salts played a major role in the environment. To ensure at least a considerable time frame for conservation and maintenance activities, a sulphate resistant lime (Otterbein NHL) was chosen to execute first works. At the palace (ZUEP04) wall 4010 was covered with a render. The render protects the stone surfaces and preserves the existing situation. No additions were made. Architectural elements were left as they were found and not rebuilt or repaired. Wall face and wall top were executed in the same way and no differentiation was implicated.

This concept works from a technical point of view, to a point, but it does not fulfil our desire to show the remains of an 18th century town and its architecture. Preserving the excavation status makes it, in several instances, impossible to understand the architectural context as well as its character. The indifferent handling of wall surfaces makes it difficult to read the remains as walls with a wall face and a ruined wall top.

An analysis of the 1980’s restoration work made it clear that one of the main failures of the works was the non re-plastering of wall faces. The beachrock building stones, as stated before, were of poor quality and were still exposed to the harsh environmental conditions, e.g. strong winds, and were not protected by a layer of plaster, as they were when the houses were built. This resulted in the disintegration of building material components, e.g. gastropods and sand particles, followed by the collapse of wall parts.

Under these conditions, the only suitable solution is to cover the beachrock wall stones with a plaster or mortar. This ensures that the decay process caused by Halite and other minerals is slowed considerably and aeolian erosion is minimised. Although the architectural remains can be described as stone architecture, they show all the decay characteristics of earthen architecture. Taking this into consideration, the re-building of architectural elements using traditional techniques and materials seems to be the only natural course of action, to preserve the architectural remains and to protect the integrity of the town of Al Zubarah. It is hoped that we can reproduce the new plaster surfaces as closely as possible to the historic remains. The continuous monitoring, observation and evaluation of works, damage and decay processes will improve over time, as will our methods, techniques and materials.
THE RESPONSE EVOLVES IN TIME, TO ALWAYS FIT THE CONTEXT BETTER

THE SITE LOOKS ALIKE, BUT RESPONSES DIFFER ON EACH SITE, BASED ON THE INITIAL ASSESSMENT (technical, social, economic, environmental, etc.)

- Reburial (Backfill)
- Monitoring & Experiments
- Capacity Building (Maintenance team)
- Conservation
- Partial rebuilding & reconstruction
- Sheltering
CONSERVATION TESTS IN FALL 2009

1ST TEST: soil mortar

First mortar tests at Al Zubarah in November 2009: Soil mortar mix with the soil from the site. 1. Wall in QMA2 before test; 2. Close up on wall; 3. Mixing soil mortar; 4. Re-pointing of joints and fill of voids; 5. Fill hole to stone surface; 6. Same situation in December 2010.
CONSERVATION WORK in SPRING 2011

1ST APPROACH: protective lime slurry

To protect and stabilise the fragile wall structures built with beach rock a lime slurry is applied to the wall. No substantial rebuilding took place only water pockets were filled with smaller stones to eliminate these.

Wall top and wall face were treated the same way. Only a slightly different mortar mix was used. But surface followed the stone shapes as an protective layer. No plaster surfaces were reestablished.

“Preserving and Protecting only”

- Lime slurry covering wall stones
- No differentiation between wall face and wall top
- No additions
- No levelling of uneven wall surfaces
- Lime slurry differs in colour and structure to the historic plaster surfaces.
- Based on conservation concepts for stone architecture.

2. Conservation concept (since 2011/2012)

“Preserving remains, making the architecture understandable”

- Re-plastering/Resurfacing of wall faces (to protect building stones)
- Clear differentiation between wall face and wall top with a “double” line stating the wall plaster and a rough wall top surface.
- Surface treatment and appearance of new plaster material (at the moment lime based) close to the historic ones to generate a homogeneous “image”.
- Structural rebuilding
- Rebuilding of architectural elements, e.g. wall faces, niches, ledges, and doorways.
- Consolidation of historic plasters: Stabilising surfaces, cementing cracks and border lines, filling of voids and fixing of loose parts. Re-attaching of loose or fallen larger plaster fragments.
- Strategy takes the earthen architecture character of the decay processes into consideration.
- Additions are seen as a sacrificial layer.
- Use of traditional techniques and materials when possible and suitable.
GENERAL PRINCIPLES AND CONSERVATION CONCEPT

- Wall top capping with "rough" surface (fiche 3.5.3)
- Structural rebuilding (fiches 3.3 and 3.4)
- Re-pointed joints (fiches 3.1 to 3.3)
- Historic wall plaster
- Consolidated historic wall plaster (fiche 4)
- Remove soil and sand deposits
- Repair (fiche 4)
- Beachrock wall stones
- Sharp "double" plaster line
- Rough surface on wall top showing wall structure
- Blocked door with rough surfaces
- Edged corners
GENERAL PRINCIPLES
CHARACTERISTIC SITUATIONS AND PROPOSED SOLUTIONS

SITUATION 1

1. Remove of loose particles
2. Pre-fixing of loose stones
3. Insert (new) mortar
4. Add Render/plaster in layers
5. Check for waterpockets on walltop
GENERAL PRINCIPLES
CHARACTERISTIC SITUATIONS AND PROPOSED SOLUTIONS

SITUATION 2

Open joint caused by aeolian and pluvial processes
Deteriorated Beachrock
Wall plaster lost bonding to wall structure
Voids
Sand / Soil deposits contain up to 30 % salts
Original wall plaster
Building debris deposits

e.g. ZUEP01, Space 102: 604

Structural additions
Sharp edge (double line)
Consolidated plaster
Re-pointed joints
Re-bonding plaster
Repair
according to situation:
- sloping surface or
- compacted horizontal surface
GENERAL PRINCIPLES
CHARACTERISTIC SITUATIONS AND PROPOSED SOLUTIONS

SITUATION 3

Deteriorated Beachrock
Open joint caused by aeolian and pluvial processes
Voids
„Open joints“ + eroded beachrock wall stones
Sand deposits

e.g. ZUEP04, Space 3001: 4010

Additional wall stones to make the wall more visual on a case to case basis
Sharp edge (double line)
Re-pointing of joints
Re-plastering to protect beachrock
protective sand layer
GENERAL PRINCIPLES
AND CONSERVATION CONCEPTS

The following principles were developed for Al Zubarah Archaeological Site, for the conservation of architectural remains:

The conservation work respects the authenticity of the archaeological remains and contexts as well as the integrity of the site and its features. The urban fabric of Al Zubarah has to be protected to ensure its integrity.

The architecture of Al Zubarah resembles characteristics of stone and earthen architecture. This is not only true for its construction but in the nature of its decay.

No major reconstruction should take place but structural rebuilding is necessary in several cases to ensure the stability of the wall structures, to protect the soft and fragile wall stones and to maintain the integrity of the overall town plan.

Plaster surfaces should resemble historic surfaces in appearance as far as possible.

Three different tooling are attested:
1. rough surface with traces of hand tooling;
2. surface with traces of trowel tooling;
3. smoother surface with only a few traces of tooling.

The aim is to create a closed, more unified surface instead of accentuating differences. Differences will appear naturally, according to the soils and sand used in the mortar. This reflects the variety of plasters and mortars in the archaeological record. At the moment a hydrated lime produced in Qatar is used as binder, but in future we hope to replace the lime with anhydrite for the plasters. As long as the production of anhydrite is not developed further we will use the Qatari lime, which is performing well.

Areas not foreseen for presentation will be backfilled permanently. Temporary backfill of excavation areas will take place when no immediate conservation and consolidation work can be carried out or excavation work is not finished. Backfill should be done properly and should consider surface run-off water management.

Newly added materials (plaster and mortar) should be less hard and slightly weaker – or of same strength – than the “original” material.

To protect the fragile vestiges on site only limited and controlled access will be given to visitors. Clearly marked and partially raised walkways will allow visitors to explore the site but only in the areas open to the public. Permanent guards will ensure the rules set out for Al Zubarah Archaeological Site will be followed. To limit the impact of vehicle traffic, one vehicle track for visitors leading to an interim parking zone and one service track for ongoing works on site were established in 2011/2012.

Regular monitoring will help us to develop the above mentioned conservation strategies further.
GENERAL PRINCIPLES
AND CONSERVATION CONCEPTS
PLASTER SURFACES AND TOOLING TRACES

QIAH- Tests:
A - very smooth, dense surface, almost no tooling visible
Ba - rough surface with traces of hand tooling
Bb - same as A & B, but with desert sand aggregate
C - washed surface with traces of trowel tooling
D - Archaeological Record: Hand-tooling, tower EP04
PROPOSED AND USED PLASTERS AND MORTARS

In the conservation of architectural remains at Al Zubarah, several historic and modern mortars and plasters were analysed, tested and optimised to correlate with the historic settings and to withstand the extreme environmental conditions on site (see Appendix 2). These requirements often seem incompatible.

However, the following mortars performed well in fulfilling these requirements:
1. close to historic appearance;
2. use of local materials (when possible);
3. performs well under environmental conditions;
4. same strength and/or slightly softer than original plasters.

Two mixtures were based on locally produced hydrated lime. Two others are based on German Natural Hydraulic Lime Otterbein Hydradur. The cement (which should be tricalciumaluminate (C3A)-free) content is meant to stabilise the mortar before the carbonation process of the lime is finalised. In a mid- to long-term perspective, there is a plan to reproduce anhydrite mortars, as they were widely used at Al Zubarah when it was built.

Wall mortar No. 1.2
1 part NHL (Otterbein Hydradur) + 3 parts Quartz sand (0-8 mm); Ratio 1:3

Wall mortar No. 1.51
2,5 parts Lime (hydrated lime) + 1 part white cement + 12 parts Quartz sand; Ratio 1:3,4

Wall plaster No. 1.55
3,5 parts Lime (hydrated lime) + 1,5 parts cement + 3 parts Quartz sand + 6 parts sieved “Zubarah soil” + 6 parts “desert sand” (reddish in colour); Ratio 1:3.

Wall plaster No. 1.56
1 part NHL (Otterbein Hydradur) + 1,5 parts “desert” sand + 1,5 parts Quartz sand (0-3 mm); Ratio 1:3

Note: NHL should be used in the context with historic (gypsum-based) plasters; hydrated lime in combination with white cement should only be used were no gypsum-based plasters are preserved, due a possible reaction between the tricalciumaluminate (C3A) and the gypsum, which can result in the further disintegration of building materials.

Sharp “double” line defining wall face and wall top (example ZUEP04:4010)
CONSERVATION CONCEPT FOR EARLIER EXCAVATED AREAS

STATE of 1980s REPAIRS

CONSOLIDATION of 1980s REPAIRS

- Historic Building Stones (mainly beachrock)
- Aeolianite (1980s repairs)
- "Original" wall and floorplaster (anhydrite + lime-based)
- 1980s cement
- Historic wall mortars
- QIAH-repairs (stones)
- new plaster (QIAH) (at the moment lime-based)
- new wall mortar (QIAH)
- Plaster consolidation
- Sand
CONSERVATION CONCEPT:
TOWN WALL with exposed walkway, e.g. TOWER 8 / EP10

ZUEP10
TOWNWALL (Segment 7/8)
CURRENT SITUATION - January 2012

Section of wall segment North of tower 8

Wall base:
Soft Beachrock is in a poor state;
Deterioration & Disintegration of Beachrock components!

Re-plastering:
"Rough" surface with traces of hand tooling;
sharp edge (double-line) between wall top and wall face; edged corners
Conservation Concept: TOWN WALL
for segments exposed in 1980s

TOWNWALL
CURRENT SITUATION

former Walkway
1980s Cement mortar
1980s Cement capping
Blown- & Washed-out Joints
eroded Wall stones
Sand & Soil deposits
heavily damaged (deteriorated) Beachrock

Sand deposits with high salt content
Wall collapse

TOWNWALL
GENERAL CONSERVATION CONCEPT

Taking-off cement capping
Re-shaping wall top ("re-ruined")
Re-plastering: Rough surface with traces of hand tooling; clear sharp, double lined edge
Re-pointing of joints
Addition of stones due to structural needs
Exchange of damaged Beachrocks
Removal of Sand & Soil deposits
Quartz-sand fill, compacted horizontally or slightly sloping away from wall basis

"Re-buried" Walkway
Sand deposits will stay
**Conservation Concept: TOWN WALL**
for segments exposed in 1980s and by QIAH

- Re-shaping of wall top
- Re-pointing of joints
- Re-plastering, hand tooling
- Exchange of damaged Beachrocks
- Sand deposits stay
- Re-buried walkway

VAR. 2

Town wall segment 8/9 with re-shaped crown in March 2012 (VAR. 1).

Town wall segment at tower 4012 (ZUEP04) in March 2012 (VAR. 2).
Niches are a common feature throughout Zubarah’s architecture. Situated above a plaster panel/socle, centred, or in regular intervals on the walls. Due to the state of conservation it cannot be stated if some of the niches exposed in the house walls are linked to wind catchers. Some niches seem to have had plaster decorations and decorated frames. Some were obviously arched, but no complete niches have so far been found.

Niches can serve several different functions, such as to:
1. keep things in
2. place a lamp onto it
3. point to Qibla direction
4. catch wind and direct it into the building.

A) Restored example from Saudi Arabia (S. Ricca, 2008)
B) Historic example from Lamu/Somalia (S. Moriset 2009).
Windows are a common feature at Al Zubarah. The construction has an elaborated design. In several cases the window has a plaster frame on the exterior encircling a mashrabiya – Gypsum grill. In some cases (as shown here), there is a wooden frame on the interior where a shutter would be placed to regulate light and air flow. Often additional wall openings for air circulation were situated above the window. Windows are generally situated close to the floor for people sitting on floor mats.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

DOOR REVEALS

BEST PRACTICE GUIDELINES

- AVOID plaster lines on different levels
- AVOID odd arrangements
- AVOID tilted geometry

DO

- Keep it simple.
- Make the doorway recognisable.
- Stabilise fragile parts.
- Discuss detail on a case-by-case basis.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

CORNERS

BEST PRACTICE GUIDELINES

• AVOID plaster lines on different levels
• AVOID odd arrangements and forms.
• AVOID artificial lines
• AVOID too extreme amplitudes

DO

• Create logical plaster connections.
• Connect wall faces and plaster lines, where possible.
• Keep levels straight.
PLASTER LEDGE / PANEL

BEST PRACTICE GUIDELINES

Plaster panels and related ledges should be reconstructed where possible and where archaeological evidence is given. The reconstruction of these features will help to show the historic proportions, character and function of the rooms.

If no information is available NO reconstructions should take place. For interior plaster surfaces a “smooth” surface treatment with some traces of trowel tooling is recommended to reach a homogeneous image.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

PLASTER LINE DEFINING BORDERS BETWEEN WALL FACE AND WALL TOP

BEST PRACTICE GUIDELINES

AVOID

- plaster lines joining on different levels.
- illogical arrangements and forms.
- artificial lines: do not follow every stone outline with the plaster line: keep it natural
- do not make the line too wide: max. 3 to 4 cm

DO

- Create logical plaster connections.
- Try to keep levels straight and try to even out height differences.
- Keep the line running naturally.
- Do not follow every single stone outline.
- Keep the width of plaster line between 2 to 4 cm.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

STAIRS

The conservation solution for stairs and steps should be planned on a case-by-case basis. Stairs should be completed (Figs. 2 and 3) and stairwell walls should be rebuilt in keeping with the archaeological and architectural context (Figs. 3 and 5). Where a partly destroyed step can be understood as a step (Figs. 1 and 2), only the remains should be consolidated and conserved.

To stabilise, preserve, and consolidate historic plaster in situ, it might be necessary to complete a step or plaster surface (Fig. 4).
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

DATE PRESS

Over time the dates begin to release a sweet juice, and are "pressed" by the weight from sacks above.

The juice (dates) runs down the plastered gullies to one end of the madhiassa into a main gully running the length of the press.

A pot tuned below floor level collects the dibs, which is then ladled out and used for food.

Cut away diagram of a madhiassa (date press) excavated at the palace in Al Zubarah (A. Pantos)

Sacks of dates piled on top of ridged floor
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

BENCHES AND PLATFORMS

Surfaces of benches or platforms should be done with a smooth surface and a sharp plaster edge. NO double line! e.g. platforms in the Palace (ZUEP04). Same is true for benches, e.g. the reconstructed benches in QMA2.

Platform in EP04 (2012 consolidation)

Bench in QMA2 (1980s reconstruction)
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES
HAMMAM INSTALLATIONS

*Hammams* are common features throughout the settlement. Raised 10 to 30 cm above the floor level the platform shows a very smooth plaster surface. The Hammam installation drains through a sewer into an external, underground-placed sewage tank. Some hamams are showing elaborated plaster decorations (e.g. in ZUEP01 [A]), others are kept very basic and simple (e.g. in ZUEP04 [B to D]).
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

FLOORS

Historic (anhydrite) plaster floor at the palace; (03/2010).

Pavement made of conglomerate stone slabs; This kind of pavement can also be found under the plaster floors as an underbed (03/2010).

Cleaned floors should be covered by mesh or geotextile before a layer of fine sieved soil or better quartzsand is placed on. The layer of sand should be around 5 cm.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES
BACKFILL AND PROTECTION OF SECTIONS & WALLS

1. Backfilling features and trenches
2. Protection of excavation trench sections
MONITORING STATE OF CONSERVATION USING 3D-LASER SCANNING
MONITORING STATE OF CONSERVATION USING 3D-LASER SCANNING

In addition to the traditional inventory and photographic record, 3D laser scanning provides fantastic possibilities for monitoring changes and decay patterns over time. Comparing scans by overlays allows us to visualise consolidation measures, e.g. structural rebuilding, but also the decay of building materials as well as the effectiveness of conservation measures. The study and analysis of this documentation will allow us to develop maintenance cycles and to revise the conservation materials and techniques we apply.

In contrast to traditional recording techniques, 3D laser scans allow us to look at the recorded structures in 3D, not simply as two dimensional images or a plan. Defects caused by weathering, thermal expansion and salt crystallisation can be followed and documented in great detail to provide additional information on the environmental conditions at Al Zubarah Archaeological Site.

MONITORING STATE OF CONSERVATION MAPPING OF DEFECTS

Defects, deterioration patterns and weathering of materials should be mapped and recorded before conservation and consolidation measures take place to help define the methods and materials we use as well as allowing us to discuss the extent of the measures that are needed. The recording should be executed by an expert or skilled person (restorer, conservator, craftsperson). It can be done on hand drawings, photoplans and/or plan generated out of scan point clouds.

Defects and the state of conservation in general should be documented at least with photographs (with and without scale) before, during and after a conservation measure has taken place. The documentation has to be added and linked to the Inventory database (conservation log) as soon as possible to make sure that no data is lost. The mapping of defects and deterioration patterns helps us to identify patterns over time, to define conservation methods and materials and to define the necessary workforce required to preserve the remains.
CONSERVATION MANUAL (PART 3) OVERVIEW:
WHERE TO APPLY WHICH *FICHE TECHNIQUE*
CONSERVATION MANUAL (PART 3), OVERVIEW:
WHERE TO APPLY WHICH FICHE TECHNIQUE
LIST OF FICHES

Fiche No. 1 Health & Safety instructions

Fiche No. 2 Building materials
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Fiche No. 3 Wall consolidation
   3.1 Preparation and initial works
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      3.5.1 Smooth surface
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      3.5.3 Rough surface
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Fiche No. 4 Consolidation and Stabilisation of Plasters
   4.1 Consolidation of plaster surfaces
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Fiche No. 5 Protection of architectural remains
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Fiche No. 6 Monitoring
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   6.4 Indicators and Periodicity

Conservation Handbook for Al Zubarah Archaeological Site - PART 3
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Personal Security

- Wear security boots.

- Always wear gloves and glasses when you are working with lime and stones, to avoid injuries (see Fig. 1).

- Wear appropriate clothing.

In order to protect yourself against the harsh climate:

- Drink plenty of water throughout the day (Fig. 2),
- wear sun-cream with a high UV filter (Fig. 3).
HEALTH & SAFETY INSTRUCTIONS FOR AL ZUBARAH ARCHAEOLOGICAL SITE

PROTECTION OF BUILDING MATERIALS

Make sure that you have

1. a secure storage and mixing areas; clear and well organised (see figure at the bottom),

2. separated the materials,

3. placed the water tanks on secure platforms to avoid cracks in the bottom.

Materials (especially Lime, Gypsum and Sand) should be covered with fabric to avoid direct sunlight. (pictures on the right: Sand bags covered with plastic fabric and building materials stored in house).
Adjunctioned building elements should be protected, e.g. Floors, Doorways, etc. to avoid damages during the work process.

**Building up protective layers:** protective fabric, e.g. Mesh (Fig.1), 5 cm Sand layer (Fig.2) for walkway planks have to be added accordingly (Fig.3 & 6). In addition doorways, thresholds, recesses etc. have to be protected separately (Fig.4 -6).
HEALTH & SAFETY INSTRUCTIONS
FOR AL ZUBARAH ARCHAEOLOGICAL SITE

SAFE & SECURE HANDLING OF TOOLS

Safe and secure handling of power tools:
1. clear cable routing
2. clear power distribution
3. Read instructions for Mixers, Drills, Hoovers, Compressors, Generators, etc. prior to their use in field.

Tools and vehicles should be treated gently. DO NOT risk damages or losses.

Stay with vehicles on the marked tracks (ask for the latest update of the track map distributed by the site manager).

DO NOT drive, never ever, into the Sabkha!

AVOID crossing archaeological features as much as possible!

Be aware of archaeological features outside the town wall of Zubarah (e.g. cementery, screening walls and saline areas)!

How to deal with archaeological finds and architectural remains in general?

When you find archaeological objects please contact an archaeologist and/or your project coordinator.
Do not move or touch finds!
Take a photograph and ask for advice.....(see telephone list at ZRS)
**FICHE No.2.1**

**BUILDING MATERIALS**
**TO USE AT AL ZUBARAH**

Field of application: general

**STONE MATERIAL**
for Replacements, structural rebuilding and reconstructions:
KA, LA, BL, LO, AG3 according to Appendix 1 classification of building stones

**BINDER**
Natural hydraulic Lime (hL)
White cement (wC)
Hydrated lime (wLh)

**ADDITIVES**
Quartz sand 0-10; sieved on the spot to ca. 0-4
“Zubarah” Soil, sieved on the spot to ca. 0-4
“Desert” sand, ca. 0-2

Desert sand (ds)
Quartz sand 0-10 (qs10)
Quartz sand, sieved to 0-2 (qs2)
Soil from Zubarah, sieved to 0-2 (so2)

### Table: Mischungen

<table>
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<tr>
<th>No</th>
<th>hl</th>
<th>wC</th>
<th>wLh</th>
<th>ds</th>
<th>qs10</th>
<th>qs2</th>
<th>so2</th>
<th>Mix</th>
<th>using</th>
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<td>3.2</td>
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<td>1:3</td>
<td>Plaster, based on 1.51</td>
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<td></td>
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<td>1:3</td>
<td>Plaster, based on 1.2</td>
<td>3.5</td>
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</table>
In the conservation of architectural remains at Al Zubarah, several historic and modern mortars and plasters were analysed, tested and optimised to correlate with the historic settings and to withstand the extreme environmental conditions on site. These requirements often seem incompatible.

However, the following mortars performed well in fulfilled these requirements:

1. close to historic appearance;
2. use of local materials (when possible);
3. performs well under environmental conditions;
4. same strength and/or slightly softer than original plasters.

Two mixtures were based on locally produced hydrated lime. Two others are based on German Natural Hydraulic Lime Otterbein Hydradur. The cement (which should be tricalciumaluminate (C3A)-free) content is meant to stabilise the mortar before the carbonation process of the lime is finalised. In a mid- to long-term perspective, there is a plan to reproduce anhydrite mortars, as they were widely used at Al Zubarah when it was built.

**Wall mortar No. 1.2**
1 part NHL (Otterbein Hydradur) + 3 parts Quartz sand (0-8 mm); Ratio 1:3

**Wall mortar No. 1.51**
2,5 parts Lime (hydrated lime) + 1 part white cement + 12 parts Quartz sand; Ratio 1:3,4

**Wall plaster No. 1.55**
3,5 parts Lime (hydrated lime) + 1,5 parts cement + 3 parts Quartz sand + 6 parts sieved “Zubarah soil” + 6 parts “desert sand” (reddish in colour); Ratio 1:3.

**Wall plaster No. 1.56**
1 part NHL (Otterbein Hydradur) + 1,5 parts “desert” sand + 1,5 parts Quartz sand (0-3 mm); Ratio 1:4

**Note:** NHL should be used in the context with historic (gypsum-based) plasters; hydrated lime in combination with white cement should only be used were no gypsum-based plasters are preserved, due a possible reaction between the tricalciumaluminate (C3A) and the gypsum, which can result in the further disintegration of building materials.
BUILDING MATERIALS
AT AL ZUBARAH

LIME

Gypsum forms monoclinic crystals with a perfect (010) cleavage and distinct cleavages along (100) and (101). It is distinguishable from anhydrite by its lower Mohs hardness (2.0 versus 3.5) and specific gravity (2.24 versus 2.97 g/cm2). Pure gypsum is colorless, but may be tinted yellow, red, and brown because of the presence of impurities. Twinning is common along (100), forming "swallowtail twins." Gypsum is relatively soluble in fresh water (about 0.2 g/100 g H2O) and is easily dissolved or eroded in conditions of high humidity or rainfall. Anhydrite forms orthorhombic crystals with perfect cleavages along (100) and (010) and a good cleavage along (001). Anhydrite has a Mohs hardness of 3.5 and a specific gravity of 2.97 g/cm2. Pure anhydrite is colorless, but the color is variable from colorless to dark gray (Sharpe & Cork 2006:519-540).

Sabkha Evaporites
Sabkha is an Arabic term referring to a coastal tidal flat. Numerous geological studies in the 1960 and 1970s examined the formation of gypsum and anhydrite minerals along the Trucial Coast region of the Persian Gulf (e.g., Kinsman 1966, 1969; Butler 1970). These deposits are characterized by a distinctive suite of sediments, including lagoonal limestone, intertidal algal mat limestone and nodular gypsum, and anhydrite-bearing, fine-grained terrigenous or calcareous sediments. Gypsum and anhydrite form by precipitation of supersaturated brine in the pore space of the tidal-flat sediments. Nodular gypsum and anhydrite are the most common forms, but large poikilitic selenite crystals may also form (Sharpe & Cork 2006).

ANHYDRITE

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Formula</th>
<th>Lime (CaO)</th>
<th>Sulfur Trioxide (SO3)</th>
<th>Water of Crystallization (H2O)</th>
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<tbody>
<tr>
<td>Gypsum</td>
<td>CaSO4•2H2O</td>
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<td>46.5</td>
<td>20.9</td>
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<tr>
<td>Anhydrite</td>
<td>CaSO4</td>
<td>41.2</td>
<td>58.8</td>
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</table>

Mineralogy

Gypsum and anhydrite are primarily formed as a chemically precipitated sedimentary rock in the mid-1990s, gypsum reserves of 114 billion t were identified in China. The reported reserves vary from 57 to 100 billion t. In Hubei Province alone, Gypsum forms monoclinic crystals with a perfect {010} cleavage and distinct cleavages along {100} and {101}. It is distinguishable from anhydrite by its lower Mohs hardness (2.0 versus 3.5) and specific gravity (2.24 versus 2.97 g/cm2). Pure gypsum is colorless, but may be tinted yellow, red, and brown because of the presence of impurities. Twinning is common along {100}, forming "swallowtail twins." Gypsum is relatively soluble in fresh water (about 0.2 g/100 g H2O) and is easily dissolved or eroded in conditions of high humidity or rainfall. Anhydrite forms orthorhombic crystals with perfect cleavages along {100} and {010} and a good cleavage along {001}. Anhydrite has a Mohs hardness of 3.5 and a specific gravity of 2.97 g/cm2. Pure anhydrite is colorless, but the color is variable from colorless to dark gray (Sharpe & Cork 2006:519-540).
BUILDING MATERIALS AT AL ZUBARAH

IDENTIFICATION SCHEME FOR BUILDING STONES ATTESTED AT AL ZUBARAH

Fossils recognisable?

Yes

Mixture of rock fragments and fossil debris (clam shells)

No

Scratchable with fingernail

Fossil debris consisting almost entirely of gastropods

Yes

Conglomerate KA

No

Gypcrete BL

Yes

micro-crystalline fabric with suggy porosity, grey to white colour

No

Beachrock AG

Beachrock BJ

Dolomite BL

Aeolianite FR
CONSOLIDATION OF WALLS
AT AL ZUBARAH TOWN

Field of Application: general
PERSONNEL: Skilled craftsperson with trained workforce
TOOLS: Brushes, Industrial hoover, spatulae, trowel, bucket, sponge, water pump, mason hammer, etc.
MATERIALS: Water, Otterbein NHL5, Quartz sand
Fiches: 3; 3.1; 3.2; 3.3; 3.4; 3.5 (3.5.1, 3.5.2, 3.5.3, 3.5.4)
CONSOLIDATION OF WALLS RELATED TO HOUSES

Palace (ZUEP04: wall 4091)
State of Conservation December 2011

Remove debris (industrial hoover)
Prefixing of loose stones

Palace (ZUEP04: wall 4091)
Concept for consolidation February 2012
SITUATION 1

1. Remove of loose particles
2. pre-fixing of loose stones
3. Insert (new) mortar
4. Add Render/ plaster in layers
5. check for waterpockets on walltop

SITUATION 2

Structural additions
Re-pointed joints
Re-bonding of plaster

CONSOLIDATION OF WALLS RELATED TO HOUSES
CONSOLIDATION OF WALLS
TOWN WALL without exposed walkway

TOWNWALL CURRENT SITUATION

- Wall collapse
- Sand deposits with high salt content
- Former Walkway
- 1980s Cement mortar
- 1980s Cement capping
- Blown- & Washed-out Joints
- Eroded Wall stones
- Sand & Soil deposits
- Heavily damaged (deteriorated) Beachrock

TOWNWALL GENERAL CONSERVATION CONCEPT

- Taking-off cement capping
- Re-shaping wall top ("re-ruined")
- Re-plastering: Rough surface with traces of hand tooling; clear sharp, double lined edge
- Re-pointing of joints
- Addition of stones due to structural needs
- Exchange of damaged Beachrocks
- Removal of Sand & Soil deposits
- Quartz-sand fill, compacted horizontally or slightly sloping away from wall basis
Before work can take place, the walls that are being considered for consolidation work have to be recorded and registered in the building inventory (see Fiche No.6 – Monitoring and State of Conservation record). When the documentation is finalised the following procedures should be followed:

1. Hammer out and remove 1980s cement capping

2. Hammer out and remove cement mortar remains in joints.
3. Expose, strip off and clean collapsed building parts.

4. Remove loose materials and clean with an industrial hoover.
5. Pre-select stone material according to quality and (possibly) field of application

6. Pre-watering of wall stones before mortar is inserted.
1. Selection of the suitable stone material [KA (1), LA (2), BL(3)].
2. Work at unstable wall parts in manageable segments to avoid collapse.
3. Excavate wall basis down to 20 cm under the current surface level (Fig.4).
4. Insert vertical stoneslabs (KA or LA) into the trench from ca. 20 cm to 5 cm above ground. Stones set in quartz sand (Fig.5 to 7). Exterior of Wall structure to be consolidated and compacted.
5. Production of needed amounts of mortar mixture (Fig.8).
6. Wall structure: Build-up of interior wall structure with mortar and inserted BL-stone-lumbs as well as smaller stones (Fig.9).
7. Building up wall structure with mortar and BL-stones up to 25 cm above ground level. Re-pointing of joints (Fig.10 - 12).
8. Re-pointing of joints at the wall foundation with mortar no.1.2 (Fig.12)
9. Protect your work segment for at least 12 hours against wind and sun (Fig.13). Keep the mortar moist during this period!
CONSOLIDATION OF WALLS

4 5 6

7 8

9 10
CONSOLIDATION OF WALLS
FOUNDATIONS (MAINLY TOWN WALL)

Flat stone Capping (2/2011)
Re-pointed joints
Re-placed stones (2/2011)
Quartz Sand (2/2011)
cross-section through consolidated town wall
CONSOLIDATION OF WALLS

NOTES
1. Selection of suitable stone material (LO, FR, AG3; Fig. 1 to 3).
2. Preparation of necessary amounts of relevant mortar mixture (Fig.4).
3. Securing and stabilising “open” wall structure by ejecting mortar into voids and caverns (Fig.5).
4. Securing and stabilisation of partly collapsed wall segments by structural re-building; Keep an eye on the joint configuration and the height of courses! (Fig.6)
5. Rebuilding of recognisable shapes by repositioning of stones.
       Note stone cubatures and joint courses! (Fig. 7 & 8)
6. Re-pointing of joints up close under the stone surface (Fig. 9).
7. Protect area of work for at least 12 hours against wind and sun (Fig. 10).
       Keep it moist during this period.

DEFINITION:
IF THE ADDITION OF MATERIALS (STONE & MORTAR) GOES BEYOND THE ATTESTED SHAPE OF A STILL RECOGNISABLE WALL STRUCTURE, IT CAN NO LONGER BE CALLED “STRUCTURAL REBUILDING” OR “STABILISATION”. IT HAS TO BE CALLED “RECONSTRUCTION” INSTEAD.
Mortars

- Use mortar No. 1.2 at walls with remains of historic plasters.
- Use mortar No. 1.51 ONLY at walls WITHOUT plaster remains!
CONSOLIDATION OF WALLS
STRUCTURAL REBUILDING
CONSOLIDATION OF WALLS
STRUCTURAL REBUILDING

NOTES
FIELD OF APPLICATION: general, but only according to detailed planning!
PREMISE: Work of Fiche 3.1 and 3.3 has been executed and finalised
PERSONNEL: skilled craftsperson with workmen
TOOLS:
MATERIALS: LO, FR, AG3
Mortar No. 1.2 (at walls with remains of historic plasters)
Mortar No. 1.51 (ONLY at walls WITHOUT plaster remains!)

1. Selection of suitable stone material (Fig. 1 to 3).
2. Preparation of needed amounts of mortar mixtures (Fig.4).
3. preliminary dry-setting of wall stones of the area to be reconstructed; selection of stone cubature (Fig. 5).
4. After moistening of the wall structure and selected stones, build up prepared areas (Fig.6).
5. Raise wall-tops to ensure good surface-run off of water (e.g. rainfall). Set stones in mortar and re-pointing of joints (Fig.7 & 8).
6. Reconstruction and shaping of building features, e.g. steps, door recess according to approved planning documents (Fig.9, 10 and 11).
7. Protect your work segment at least for 12 hours against sun and wind (Fig.12). Keep it moist and re-moist it in regular intervals!

DEFINITION:
IF THE ADDITION OF MATERIALS (STONES & MORTAR) GOES BEYOND THE ATTESTED SHAPE OF A STILL RECOGNISABLE WALL STRUCTURE, IT CAN NO LONGER BE CALLED “STRUCTURAL REBUILDING” OR “STABILISATION”. IT HAS TO BE CALLED “RECONSTRUCTION” INSTEAD.
FICHE No.3.4

CONSOLIDATION OF WALLS
RECONSTRUCTION
FICHE No.3.4

CONSOLIDATION OF WALLS
RECONSTRUCTION

TOWER 8 / ZUEP10
TOWNWALL
CONSERVATION CONCEPT

Backfill: compacted layers when possible sloping surface away from the wall base
Structural Re-building
Re-plastered walkway surface ("smooth")
Re-render/plaster: "Rough" surface with traces of hand tooling

Remove Flat stone capping + add wall stones to re-shape wall top

Sharp edge ("double" line)

1 m
CONSOLIDATION OF WALLS
RECONSTRUCTION

NOTES
CONSOLIDATION OF WALLS
PLASTER

1. Preparation and production of needed plaster mix (Fig.1)
2. **First application:** Even out irregularities, but follow the general form, keeping general unevenness. Plaster mortar should be inserted without smoothing. After ca. 2-3 hours scratch off peaks. This plaster layer can be 1 to 5 cm thick. Shrinkage cracks will appear. Design details have to be prepared and pre-shaped in this phase. Cover plaster with fabric! (Fig. 2, 3 & 4).
3. **Second application:** after approx. 6 - 24 hours. The underground (1st application) can be partly dried. Pre-watering of wall segment. Apply plaster mortar and strip it off. Don’t smoothen it. Plaster mortar application should not be more than 3 cm. There could still appear some shrinkage cracks. Design details have to be shaped. Plaster has to be covered with fabric (Fig. 5, 6, 7, 8 & 9).
4. **Third application:** after approx. 2 - 4 hours. 2nd application should be solid and not mouldable with the thumb. Apply plaster material with trowel and smoothen surface with a small trowel in vertical segments. Some visual traces of trowel tooling are desired (see Fiche No. 3.5.1). Plaster mortar should be applied in layers of max. 1.5 cm thickness. Design details should be shaped and completed by now. Cover plaster with fabric! (Fig.10, 11, 12 & 13).
5. Protect your work segment for at least 12 hours against sun and wind! Cover the surfaces with fabric (Fig. 14). Keep the plaster humid. (Fig.15).

**NOTE:** Applied wall plaster should cover approx. 10 cm of the wall top to create an area which forms a ledge once the wall capping is applied (see Fiche No. 3.5.3)! Salt crystallized on the surface should be brushed off after 40 to 50 hours!
CONSOLIDATION OF WALLS

PLASTER

FICHE No.3.5
FICHE No.3.5

CONSOLIDATION OF WALLS

PLASTER

8

9

10

11

12

13

14

15
CONSOLIDATION OF WALLS
PLASTER

NOTES
1. After approx. 30 mins. to 1.5 hours the mortar should be not mouldable by thumb pressure.
2. Expose, carefully, quartz particles at the surface with sponge and water. Avoid sponge traces.
3. Afterwards, smooth surface with a small trowel. Traces of trowel tooling can stay visible.
4. Steps 2 and 3 (sponge/small trowel treatment) has to repeated over approx. 4 hours with short breaks of approx. 15 to 45 mins.
5. Surface should be kept humid over the entire work period.
6. Mortar has to be covered in between.

FIELD OF APPLICATION: Building structures, Interior - wall faces (including features as niches, recessess, Doorways, etc.)
PREMISE: Work of Fiches 3.5 has been executed.
PERSONNEL: skilled craftsperson with workmen
TOOLS:
MATERIALS:
Mortar No. 1.55 (ONLY at walls WITHOUT plaster remains!)
Mortar No. 1.56 (at walls WITH historic plaster remains)
FOLLOWS directly on Fiche 3.5!

1. nach ca. 30 min. bis 1,5 Stunden sollte der Mörtel auf Daumendruck nicht mehr formbar sein.
4. Der Vorgang mit Schwamm vorsichtig waschen und mit kleiner Kelle Oberflächen nachziehen muss ca. 4 Stunden lang mit Pausen von ca. 15-45 min. wiederholt werden.
5. Der Oberfläche ist über den gesamten Zeitraum genügend Feuchtigkeit anzubieten.
6. Mörtel mit Folie zwischendurch abdecken.
CONSOLIDATION OF WALLS

PLASTER DESIGN “Smooth surface”
FIELD OF APPLICATION: in general on “exterior” wall faces at the palace, the town wall and towers (Check archaeological record!).

PREMISE: Work of Fiches 3.5 is executed!

PERSONNEL: skilled craftsperson with workmen
TOOLS: Trowel, sponge, water-sprayer
MATERIALS:
Mortar No. 1.55 (ONLY at walls WITHOUT plaster remains!)
Mortar No. 1.56 (at walls WITH historic plaster remains)

FOLLOWS IMMEDIATELY AFTER FICHE NO. 3.5!
Mortar can still be mouldable by thumb pressure.

1. Treatment of mortar surface with gloves, hessian or linen-bales to create traces of hand tooling.
2. The surface appearance suggests that the plaster was applied entirely by hand.
3. Surface has to be kept humid during the entire work period.
4. Mortar should be covered with fabric in between.

3. Der Oberfläche ist über den gesamten Zeitraum genügend Feuchtigkeit anzubieten.
4. Mörtel mit Folie zwischendurch abdecken.
CONSOLIDATION OF WALLS
PLASTER DESIGN “Hand tooling”

1. Building up of mortar layers

2. Applying final render by hand with gloves...

3. Final appearance with “tools”.
1. after 30 mins. to 1.5 hours the mortar should be not be mouldable by the thumb anymore.
2. Exposure of quartz particles at the surface by trowel, sponge and water; repeat procedure if necessary (Fig. 1 to 3).
3. This procedure applies a rough but regular appearance to the mortar surface (Fig.5).
4. Surfaces should be kept humid during the entire work period. (Fig.4)
5. Mortar should be covered with fabric in between the work steps.

FIELD OF APPLICATION: all wall cappings where NO historic wall top/crown is preserved
PREMISE: Work of Fiches 3.5 has been executed ; When used for wall capping the wall faces
(Fiche 3.5.1 or 3.5.2) should be finalised before!
PERSONNEL: skilled craftsperson with workmen
TOOLS: Trowel, Sponge
MATERIALS: Water
Mortar No. 1.55 (ONLY at walls WITHOUT plaster remains!)
Mortar No. 1.56 (at walls WITH historic plaster remains)

Follows immediately after Fiche 3.5!

1. nach ca. 30 min. bis 1,5 Stunden sollte der Mörtel auf Daumendruck nicht mehr formbar sein.
3. Der Mörtel erhält so ein rauhes aber gleichmäßiges Erscheinungsbild.
4. Der Oberfläche ist über den gesamten Zeitraum genügend Feuchtigkeit anzubieten.
5. Mörtel mit Folie zwischen durch abdecken.
CONSOLIDATION OF WALLS
PLASTER DESIGN “Rough surface”
FICHE No.3.5.4

CONSOLIDATION OF WALLS
REPAIR OF CRACKS appearing in new plaster

FIELD OF APPLICATION: general when cracks appear on plaster surfaces

PREMISE:

PERSONNEL: skilled craftsperson with workmen
TOOLS: Trowel, sponge, water-sprayer
MATERIALS:
Mortar No. 1.55 (ONLY at walls WITHOUT plaster remains!)
Mortar No. 1.56 (at walls WITH historic plaster remains)

1. Open surface cracks with trowel and clean the area with brush.
2. Water plaster / mortar and mix amounts of mortar required.
3. Fill opened crack with mortar.
4. Adjust mortar to surrounding surface.
FIELD OF APPLICATION: general
CLIMATE Conditions:
PREMISE: Performance before Fiche No. 3.5!

PERSONNEL: experienced conservator/restorer with trained assistant
TOOLS: Brushes, Industrial hoover, spatulae, trowel, bucket, sponge, water-spray
MATERIALS: Water, acryl-dispersion, Lime, Sand

CONSOLIDATION & STABILISATION OF HISTORIC PLASTERS & SURFACES

Before consolidation took place (ZUEP02)

Immediately after the consolidation took place.

plaster bordes and surfaces consolidated
cementing of edge
plaster completed: holes filled to close surface
deposits removed
FICHE No.4

CONSOLIDATION
OF HISTORIC PLASTER SURFACES

Consolidation of Plaster surfaces
see Fiche No. 4.1

Fixing of loose plaster parts
see Fiche No. 4.2

Cementing of Cracks
see Fiche No. 4.3
**FICHE No.4.1**

**CONSOLIDATION OF HISTORIC PLASTER SURFACES**

**FIELD OF APPLICATION:** general

**Climate conditions:** Avoid direct sun and too strong winds (max 5Bft & max 28°C)

**PREMISE:** Performance before Fiche No. 3.5!

**PERSONNEL:** One or two skilled restorer

**TOOLS:** Brushes, Industrial hoover, spatulæ, trowel, bucket, sponge,

**MATERIALS:** Water, acryl-dispersion, Lime

**EXTRA:**

---

**Introduction**

The historic plasters have an enormous complexity and range of preservation. This work should be executed and supervised by a conservator/Dipl.-Restorer experienced in conservation in the context of archeological field work.

**Conservation works**

Before the conservation works, all extremely deformed and loose fragments of the wall plaster, as well as debris materials, need to be carefully removed using an industrial hoover. To fill gaps, cracks, and voids a specially composed mortar is used, which is based on 1 part lime, Acryl-dispersion (2%), and 4 parts „desert sand‟.

1. Preparation and mixing of Consolidation liquids (Acryl-dispersion SF016 7% in Water) (fig. is missing).

2. Cleaning of plaster surfaces with brushes and hoover (Fig.2).

3. Regular application of consolidation liquid onto the plaster surface (Fig.3 & 4).

4. Repeat point 3 after 5 to 10 minutes according to absorbency of plaster subsurface. However additional application should be executed wet in wet (Fig.6).
FICHE No.4.1

CONSOLIDATION
OF HISTORIC PLASTER SURFACES

NOTE: AIM OF MEASURE IS TO STABILISE THE HISTORIC PLASTER SURFACES TO REDUCE WEATHERING EFFECTS. DUE TO THE HIGH SALINITY INSIDE THE MORTARS AND WALLSTRUCTURES THE DETERIORATION CANNOT BE STOPPED COMPLETELY.
FICHE No.4.2

CONSOLIDATION OF PLASTER
FIXING OF LOOSE & BROKEN PLASTER PIECES / PARTS

FIELD OF APPLICATION: general
Climate conditions: Avoid direct sun (max. 28°C) and too strong winds (max. 5Bft)
PREMISE: Fiche No. 4.1 has to be executed before!
PERSONNEL: One or two skilled restorer
TOOLS: Brushes, Industrial hoover, spatulae, trowel, bucket, sponge, drill, saw
MATERIALS: Water, acryl-dispersion, fibre glass rods
EXTRA: Avoid direct sun and too strong winds

A - Securing detached plaster by needling
1. Prepare anchor material (fiberglass rods D 4-8 mm), define drilling range, quantity and length of needling and deployed anchors (Fig. 1).
2. Drilling holes with 2mm wider diameter than desired anchor material; make sure that the holes are pointing in different directions, but drilled slightly diagonally downward (Fig. 2)
3. Cleaning of the dowel hole and prewetting (Fig. 3)
4. Glue/Fixing of dowel rods. Glue: here Lime-Acryl milk (Fig.4)
5. Closure of the dowel holes with mortar (see Fiche 4.3), (Fig.5)
CONSOLIDATION OF PLASTER
FIXING OF LOOSE & BROKEN PLASTER PIECES /PARTS

B - Re-attaching broken plaster parts by needling

6. Recover and securing fragments, Cleaning of fragments (Fig.6)
7. Mapping, sorting, and reconstruction of the original position (Fig.7).
8. Bonding of the fragments as required (Fig.8)
9. Preparation of needling (as described in paragraph A), (Fig.9)
10. Re-attachment and bonding of fragments in its historical position (Fig. 10 & 11).
11. Seal dowel holes and joints with mortar (Fig.12)
1. Cleaning of plaster borders with brush, hoover and lancettes (Fig. 1 & 2)
2. Mixing of repair plaster (1RT wLh, 4 RT ds, 2%SF016 in water) in an amount that can be used within 1 hour (Fig. 3)
3. Application of repair plaster after pre-watering to the level of the historic plaster surface: closing of holes and cracks, bridging areas to be prepared for later replastering (Fig. 4 to 6)
4. After 10 to 13 min.: Secondary- treatment with sponge, Exposure of granulation, smoothing and cleaning of plaster borders (Fig.7).
5. Protect your area of work for at least 12 hours against wind and sun (Fig.8). Keep it humid during period.

NOTE: Aim of measure is to stabilise the plaster surfaces with completing the historic plaster; including filling of holes, gaps and cracks. Border line between historic remains and additional replastering (see Fiche No. 3.5) has to be defined with the responsible conservation architect in forehand.
CONSOLIDATION OF PLASTER
CEMENTING OF CRACKS AND LOOSE PLASTER PARTS
FIELD OF APPLICATION: general
Climate conditions: Avoid to heavy winds.
PREMISE: Work is finished for the season or it was decided to backfill
PERSONNEL: Trained workmen under supervision
TOOLS: Sieve, Wheelbarrows, Shovel, Brush, Stomper
MATERIALS: Sieved soil and/or quartz sand and sand bags, mesh/membrane, Hessian
EXTRA: Protect yourself against dust and fine sand particles during the work.

GENERAL GUIDELINES

Damage to architectural and archaeological remains should be avoided in general. Damage to the fragile vestiges should be minimised by the following preventive measures:

1. Careful handling of tools, especially wheelbarrows to avoid scratches and colour marks on historic plaster surfaces or door reveals.
2. Preventive covering of architectural/archaeological features
3. Clearly marking closed areas with restricted access.
4. Cover plaster floor with mesh and sand layer. Use planks for working tracks.

FICHE 5.1 BACKFILL (TEMPORARY AND PERMANENT)
FICHE 5.2 STABILISATION AND PROTECTION
PROTECTION
OF ARCHITECTURAL AND ARCHAEOLOGICAL REMAINS

NOTES
FIELD OF APPLICATION: general
Climate conditions: avoid too strong winds
PREMISE:
PERSONNEL: Supervisor, trained labour
TOOLS: Wheelbarrow, shovel, stomper, cutter, etc.
MATERIALS: sieved soil or quartz sand, sand bags (size depends on context), Membrane (Geotextile/Tyvek), Hessian or Mesh,

EXTRA:

TEMPORARY BACKFILL will take place in areas with ongoing archaeological investigations or when consolidation work cannot take place immediately after the archaeological record is done.

The backfill should always be carried out in a way that can be easily taken out or removed again for work to continue. In principle, the temporary backfill should be carried out as carefully as a permanent one, but with the premise that archaeological/architectural remains should be protected until conservation work can take place. Therefore only sieved material or quartz sand should be used.

No stone or beachrock lumps as well as wall plaster chunks should be in the backfill material. Walls should be covered first with a membrane, mesh or hessian fabric before and bags placed along the wall structures to protect against collapse.

Backfill should be done high enough to cover wall faces and wall tops. Avoid water pools in the backfill area. Try to create a sloping surface away from the walls and wall base.

**DO NOT**
use unsieved soil from the spoil heaps mixed with stone material

**DO**
only use sieved soil or quartz sand for backfill
PERMANENT BACKFILL will take place when areas or features will not be presented to the public. Backfill should be done carefully to avoid collapse of building structures and trench profiles. Layers should be compacted. In the beginning, horizontally laid sand/soil layers should be built up. Finally, some sloping should be implemented to ensure a quick run-off of surface water away from wall foundations.

More fragile archaeological features have to be stabilised and covered separately beforehand. This has to be discussed and agreed upon with the responsible archaeologist / conservation coordinator.
Protect features and building elements against human impact. Door recesses should be protected with sandbags and fragile walls or profiles should be stabilised accordingly. Sandbags can also be used to limit access to specific areas, e.g. stairs or rooms. Using Sandbags is an easy and simple solution. For several reasons (UV-protection, aesthetics) bags made of plastic fabric should be covered with hessian or comparable materials. To fill sandbags only, sieved soil should be used to avoid damage caused by stones inside the sandbag.

If you have to remove a temporary stabilisation by sandbags, be careful to avoid damage to the protected walls and features. Additional protective measures may be necessary once the sandbags are removed.
To protect the walls or trench borders/profiles, the following preventive measures should be used:
1. Cover the remains/profiles with mesh/membrane or hessian.
2. Place sandbags in front of the segment to protect and stabilise.
3. The sandbags should be covered with hessian to provide protection against UV-sunlight.
4. Keep the hessian in position with stones placed on top and bottom.
FIELD OF APPLICATION: general, in regular intervals
related Fiches:
Fiche 6.1 State of conservation Record
Fiche 6.2 Record of Climate Data
Fiche 6.3 (Conservation) Site Journal
Fiche 6.4 Indicators and Periodicity

MONITORING has to be done in regular intervals. For details see defined indicators and interval recommendations in the Management Plan for ASAZ (Chapter 11, Tab.5 -p.75; Summary on Fiche 6.4).

WORK STEPS:
1) Photograph, Analog Data sheet (entry into digital inventory data base)
2) Mapping of Damages etc. on plan, photos, scan...
3) 3D-Laserscan and interpolation with earlier scans to show changes, interventions, etc.
4) Analyses of monitoring data and preparation of state of conservation report
5) Development of priority list for conservation measures and repairs according to monitoring record analyses.
The state of conservation should be recorded before conservation measures take place. The actual state should be also documented after the conservation measure has taken place. Then monitoring should take place on a regular basis according to the recommended interval mentioned in the inventory data base. Regular monitoring helps to identify threads to the remains and to initiate maintenance work to protect the fragile vestiges (see also Appendix 10).
The state of conservation record at AZAS is kept in an Inventory Database (Microsoft Office 2010 Access-based). Data record should be supervised by conservation architects or restorers and executed by trained/skilled staff, using photographs, 3D-laserscans and written comments and/or analyses of defects. On the basis of the 3D-laserscans and images plans should be produced to map the damages and deterioration patterns. Overlays of 3D-laserscans can be used to document structural changes and conservation measures. Manual recording should be digitalized.

(see also APPENDIX 9.5 and APPENDIX 10)
IDENTIFICATION SCHEME FOR BUILDING STONES
with colour code for mapping

Fossils recognisable?

Yes

- Mixture of rock fragments and fossil debris (clam shells)

No

- Scratchable with fingernail

Yes

- Conglomerate KA

No

- Fossil debris consisting almost entirely of gastropods

Yes

- Beachrock AG

No

- Beachrock BJ

Yes

- Gypcrete BL

No

- Dolomite BI

Yes

- Aeolianite FR
At Al Zubarah several data loggers are installed permanently (for locations see map below). The recorded data has to be downloaded from the single devices regularly, at intervals of three to six months. Data should be uploaded to the project server immediately.

Data loggers have to be reset according to the technical manual, before they are placed back. At the same time the batteries should be checked. Make sure that the batteries are replaced in time!

Temperature/humidity data loggers at QMA2 in Al Zubarah town (D1, D2) and HAB54506 at Al Zubarah Fort.

Fig. 8: Positions of the temperature/humidity data loggers in Al Zubarah town (D1, D2, D4, D5, HAB54579), at the research station (D3), and in a building of the fort (HAB54506)
MONITORING
Climate Record
1. Keep a record of your work
2. Weather conditions: note temperature, wind intensity, and general conditions; whether it is cloudy, sunny, dusty, humid.
3. Who is working: Names of colleagues and workmen (numbers)
4. What are the activities and programme.
5. List any events: visits, injuries, etc.
6. Photo documentation of work: at least one image in the morning (before the work starts), one before the main breaks and one at the end of the work day.
7. Save images to the database with a description (Meta data)!
8. Type in the site journal data and save the report as a pdf (see templates in Appendix 9; especially 9.3 and 9.4).

<table>
<thead>
<tr>
<th>Document No.</th>
<th>QIAH-01-02-HE-9000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Info on Weather</td>
<td>Sunny</td>
</tr>
<tr>
<td>Who?</td>
<td>Ingolf Thuesen</td>
</tr>
<tr>
<td>Where?</td>
<td>LOCATION: PALACE (ZUEP04)</td>
</tr>
<tr>
<td>What?</td>
<td>MEASURES, ACTIVITIES, WORK (planned for the day, as well as executed) State of Conservation monitoring</td>
</tr>
<tr>
<td>DRAWINGS / DOCs related Photos taken</td>
<td>Doc. No.</td>
</tr>
<tr>
<td>INADEQUACIES (defects, cracks, detaching, etc)</td>
<td>Historic plaster surfaces are detached, salt crystallization processes, cracks in new sacrificial plaster layers, sand deposits caused by aeolian processes.</td>
</tr>
<tr>
<td>INSTRUCTIONS</td>
<td></td>
</tr>
</tbody>
</table>

DATE and TIME

Information on materials status and needs for procurement

Basis of work and/or how is it documented

State of conservation; challenges, defects, etc.

How to solve situation. Recommendations, Proposals, etc.
Al Zubarah Archaeological Site
Conservation Site Journal

Daily Report

QIAH-01-02-HE-9000

Site Visit from Monday [Day]; 17.9.2012 [Date]; 13:00 [Time]

Sketch / Comments

Assessment should be done by experts when the season starts to execute repairs.

Tower 4012 - loss of historic plaster due to salt crystallization.

Wall 4010 - cracks in new wall plaster (sacrificial layer).

Photo of current situation

Additional information, sketches or images explaining the work or specific features, conditions, events, etc.
FICHE No.6.3

MONITORING
Site journal - Examples from 2012

- Day and Date
- Climate data from weather broadcast

- Note on needed materials
- Note on staffing and tasks
- Area of work marked in sketch plan; Note on planned tasks
- Area of work

Reference: APPENDIX 9.4
MONITORING
Site journal - Examples from 2012

Day and Date
Climate data from weather broadcast

General notes
Note on staffing and tasks

Materials in stock. Follow up to order materials in time. Proposed amounts needed for planned measure.

Area of work marked in sketch plan; Note on planned tasks

Reference: APPENDIX 9.4
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Periodicity</th>
<th>Location of Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental parameters in Al Zubarah (Temperature, humidity, rain, wind)</td>
<td>Daily records (Data Logger) Record should be downloaded regular after 3 to 6 months</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Natural changes in north-western Qatar especially within the Buffer Zone (satellite pictures – landscape scale)</td>
<td>Once a year /every second year or by notice</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Infrastructural changes in north-western Qatar (Zubarah Hinterland) especially within the Buffer Zone</td>
<td>Once a year /every second year, or by notice</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>No. of visitors (of the Visitors Centre)</td>
<td>Daily record (by Guards at the Site entrance and/or at Al Zubarah Fort, for template see Conservation Handbook Appenix 5.1)</td>
<td>Handed in monthly in double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Visitor experience (quality assessment of a visit to Al Zubarah)</td>
<td>Once or twice a year</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>State of conservation in earlier QMA excavation areas (Photos, drawings, reports, 3D-scanning, etc.)</td>
<td>Once a year or every third year (according to interval recommendation in last monitoring). For Inventory categories and record sheets see Conservation Handbook Fiche 6 (6.1 to 6.4) and Appendices 9 &amp; 10</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH); Digital Inventory data base</td>
</tr>
<tr>
<td>State of conservation in new QIAH excavation areas (Photos, drawings, reports, 3D-scanning, etc.)</td>
<td>Once a year or every third year (according to interval recommendation in last monitoring). For Inventory categories and record sheets see Conservation Handbook Fiche 6 (6.1 to 6.4) and Appendices 9 &amp; 10</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH); Digital Inventory data base</td>
</tr>
<tr>
<td>State of conservation of not excavated structures (Photos, drawings, reports, 3D-scanning, etc.)</td>
<td>General report every third year (according to interval recommendation in last monitoring). For Inventory categories and record sheets see Conservation Handbook Fiche 6 (6.1 to 6.4) and Appendix 9 &amp; 10.</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH); Digital Inventory data base</td>
</tr>
<tr>
<td>Damages caused by visitors</td>
<td>Daily, weekly or monthly report (check particularly after the weekends) see Template Appendix 9.2</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Damages caused by high tides</td>
<td>after observed high tides and each third year</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Damages caused by heavy rain</td>
<td>after (observed) heavy rainfalls</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Damages to infrastructure (walkways, panels, etc.)</td>
<td>Daily, weekly and monthly reports (by Guards and on-site personnel). Check daily by guards. Report only when damages appear! For Report use Template in Conservation Handbook Appendix 9.2</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
</tbody>
</table>

PART 4
APPENDIXES
TO CONSERVATION HANDBOOK
for Al Zubarah Archaeological Site
LIST OF APPENDIXES

APPENDIX 1 Classification of Building stones - March 2011 (revised 12/2012)
APPENDIX 2 Mortars & Plasters tested - March 2012
APPENDIX 3 Analyses of Building Materials - June 2011
APPENDIX 5 On Mortars - Feb. 2011
APPENDIX 6 Analyses of Mortar Samples - Dec. 2011
APPENDIX 7 X-Ray diffraction and chemical analysis of samples - March 2010
APPENDIX 8 Climate Data Record - July 2012
APPENDIX 9 Templates and Forms
APPENDIX 10 Manual Architectural Recording
APPENDIX 11 Manual Touristic Assessment for Heritage Sites
APPENDIX 12 Conservation schemes
APPENDIX 1

CLASSIFICATION OF BUILDING STONES
AT AL ZUBARAH / QATAR

R. Sobott, M. Kinzel and P. Hofmann
March 2011, revised version December 2012
IDENTIFICATION SCHEME FOR BUILDING STONES ATTESTED AT AL ZUBARAH
with colour code for mapping

↓

Fossils recognisable?

Yes

Mixture of rock fragments and fossil debris (clam shells)

No

Scratchable with fingernail

Yes

Conglomerate KA

No

Fossil debris consisting almost entirely of gastropods

Yes

Gypcrete BL

No

micro-crystalline fabric with vuggy porosity, grey to white colour

Yes

Beachrock AG

No

Beachrock BJ

Yes

Dolomite BL

No

Aeolianite FR
Classification of building stones
Sobott/Kinzel/Hofmann

**Petrographic type:** Beachrock (mollusc grain- to rudstone)

**Code:** AG

**Varieties:** AG 1, AG 2, AG 3

**Mapping colour:**

**Characteristic features**

**General description:** friable, variably cemented assemblage of clams (mostly pelecypods) in a silty carbonate sand matrix; non-carbonate particles include quartz and feldspar grains; very low compressive strength; very porous fabric; from variety AG 1 to AG 3 the clam content decreases and the strength increases

**Colour:** light yellow grey to whitish

**Petrophysical properties:** porosity: 30-40 Vol.%, bulk density: ~1,55 g/cm³, ultrasonic velocity: 2,6 km/s

**Weathering characteristics:** disintegrates to carbonate sand and clams which pile up at the base of walls

**Bedding:** weakly indicated by orientation of clams in the matrix

**Occurrence in wall structures:** most frequently used building-stone in the wall structures of Al Zubarah

**Appearance in wall structure**

AG 1
AG 2
AG 3

**Mineral composition**

<table>
<thead>
<tr>
<th>Magnesium calcite I</th>
<th>Magnesium calcite II</th>
<th>Aragonite</th>
<th>Dolomite</th>
<th>Quartz</th>
<th>Feldspars (Halite)</th>
</tr>
</thead>
</table>

*) determined by X-ray diffraction and thin section microscopy

**Thin section photographs** (pore space is coloured blue)
## Classification of building stones

**Sobott/Kinzel/Hofmann**

<table>
<thead>
<tr>
<th>Petrographic type</th>
<th>Beachrock (gastropod grain- to rudstone)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>BJ</td>
</tr>
<tr>
<td>Varieties</td>
<td>BJ 1, BJ 2, BJ 3</td>
</tr>
</tbody>
</table>

### Characteristic features

- **General description:** Friable interstratification of variably thick gastropod rich beds and carbonate sand beds; non-carbonate particles include quartz and feldspar grains; low compressive strength; very porous fabric; BJ 1 and BJ 3 are more or less thick gastropod rich or carbonate sand beds, respectively; BJ 2 is an interstratification of gastropod rich and carbonate sand beds.
- **Colour:** Yellow grey; gastropod rich beds are a little bit darker than carbonate sand beds.
- **Petrophysical properties:** Porosity: ~30 Vol.%, bulk density: ~1,56 g/cm³, ultrasonic velocity: 3,8 km/s.
- **Weathering characteristics:** Disintegrates to carbonate sand and gastropods which pile up at the base of walls.
- **Bedding:** Not recognisable in BJ 1, weak in BJ 3, and distinct in BJ 2.
- **Occurrence in wall structures:** Generally less frequent than AG, but locally abundant.

### Appearance in wall structure

- **BJ 1**
- **BJ 2**
- **BJ 3**

### Mineral composition

- Magnesium calcite I
- Magnesium calcite II
- Aragonite
- Dolomite
- Quartz
- Feldspars
- (Halite)

| Thin section photographs (pore space is coloured blue) | *determined by X-ray diffraction and thin section microscopy |
Classification of building stones
Sobott/Kinzel/Hofmann

Petrographic type: Peloidal grainstone (Aeolianite)
Code: FR
Varieties:

Mapping colour

Characteristics features

General description: grain-supported, very porous fabric of biogenic detritus (forams, bryozoa, peloids) Cemented by granular calcite; homogeneous particle size distribution; maximum at 200 µm, medium compressive strength
Colour: light yellow
Petrophysical properties: porosity: ~40 Vol.%, bulk density: ~1.63 g/cm³, ultrasonic velocity: 3.1 km/s
Weathering characteristics: good weathering resistance, best building stone of the Al Zubarah area
Bedding: hardly recognisable
Occurrence in wall structures: preferably in more important buildings, e.g. in walls of mosques; more frequent in Freiha than in Al Zubarah, because of greater proximity to the quarries

Appearance in wall structure

Mineral composition *)
Calcite
Dolomite
Plagioclase
Quartz
Mg calcite II

*) determined by X-ray diffraction and thin section microscopy

Thin section photographs (pore space is coloured blue)
Classification of building stones
Sobott/Kinzel/Hofmann

Petrographic type: Dolomite
Code: BL
Varieties:

Mapping colour

Characteristic features

General description: microcrystalline fabric of dolomite crystals; contains vugs which range in size from less than a millimetre to several centimetres; very high compressive strength due to dense fabric of interlocked dolomite crystals; no visible porosity

Colour: grey to white with yellowish tint

Petrophysical properties: porosity: <10 Vol.%, bulk density: 2.55 g/cm³, ultrasonic velocity: 4.9 km/s

Weathering characteristics: very good weathering resistance

Bedding: not existent

Occurrence in wall structures: seldomly used in original masonry; more frequent in repair work

Appearance in wall structure

Mineral composition:

Dolomite
Quartz

Thin section photographs (pore space is coloured blue)

*† determined by X-ray diffraction and thin section microscopy
**Classification of building stones**
Sobott/Kinzel/Hofmann

**Petrographic type:** Conglomerate

**Code:** KA

**Varieties:**

**Mapping colour:**

**Characteristic features**

**General description:** mixture of dolomite fragments and fossil debris (bivalves and gastropods) on a well cemented basal layer

**Colour:** yellow grey

**Petrophysical properties:**

**Weathering characteristics:** good resistance to weathering due to good cementation of components

**Bedding:** clearly marked by basal layer; rarely more than 2 or 3 layers

**Occurrence in wall structures:** locally abundant

**Appearance in wall structure**

**Mineral composition *)**

Dolomite
Mg calcite
Aragonite
Calcite
Quartz

* determined by X-ray diffraction and thin section microscopy

**Thin section photographs** (pore space is coloured blue)
Classification of building stones
Sobott/Kinzel/Hofmann

Petrographic type: Gypcrete
(evaporitic mudstone with rock fragments)

Code: BE

Varieties:

Mapping colour

Characteristic features

General description: porous crypto-crystalline gypsum matrix with rock and mineral fragments and little fossil debris; low compressive strength due to the porous structure and low hardness of gypsum

Colour: light yellow grey to white

Petrophysical properties:
- porosity: ~39 Vol.%, bulk density: 1.5 g/cm³, ultrasonic velocity: 2.5 km/s

Weathering characteristics:
good weathering resistance

Bedding:
not recognisable

Occurrence in wall structures: less frequent

Appearance in wall structure

Mineral composition:

Gypsum
Dolomite
Mg calcite
Aragonite
Quartz
Feldspar

*) determined by X-ray diffraction and thin section microscopy

Thin section photographs (pore space is coloured blue)
<table>
<thead>
<tr>
<th>Mörtel-Nr.</th>
<th>Verarbeitungsart</th>
<th>Datum Analyse</th>
<th>Festigkeit in N/qmm Bewertung</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Soil/dessert-sand</td>
<td>2009</td>
<td>ca. 80% Verlust des Mörtels bedingt verwendbar, Mörtel darf nicht der...</td>
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<tr>
<td>1.2</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 90% Verlust des Mörtels nicht verwendbar, teilweise auf Mw mit M-Nr. II aus 06.11...</td>
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<td>1.3</td>
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<td>2010</td>
<td>ca. 95% Verlust des Mörtels auf vorgegebenem Untergrund nicht verwendbar...</td>
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<td>1.4</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, Verarbeitung wegen Ty-Anteil und Mks schwierig...</td>
</tr>
<tr>
<td>1.5</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
<tr>
<td>1.6</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
<tr>
<td>1.7</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
<tr>
<td>1.8</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
<tr>
<td>1.9</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
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<td>1.10</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
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<td>1.11</td>
<td>Soil/dessert-sand</td>
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<td>Soil/dessert-sand</td>
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<td>1.13</td>
<td>Soil/dessert-sand</td>
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<td>1.14</td>
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<td>1.15</td>
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<td>2010</td>
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<td>1.16</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
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<td>1.17</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
<tr>
<td>1.18</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
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<td>1.19</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
<tr>
<td>1.20</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
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<tr>
<td>1.21</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
<tr>
<td>1.22</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
<tr>
<td>1.23</td>
<td>Soil/dessert-sand</td>
<td>2010</td>
<td>ca. 98% Verlust des Mörtels nicht verwendbar, möglicherweise Ty-Anteil zu hoch, seine Festigkeit ist abhängig vom Untergrund...</td>
</tr>
<tr>
<td>Probekörper</td>
<td>Anwendungsort</td>
<td>Probe-Nr.</td>
<td>Art der Anwendung</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------</td>
<td>----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>1.1</td>
<td>Fu</td>
<td>06.10</td>
<td>I-1</td>
</tr>
<tr>
<td>1.2</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.3</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.4</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.5</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.6</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.7</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
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<tr>
<td>1.8</td>
<td>Fu</td>
<td>06.10</td>
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</tr>
<tr>
<td>1.9</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.10</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
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<tr>
<td>1.11</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
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<tr>
<td>1.12</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.13</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.14</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.15</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
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<tr>
<td>1.16</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
<tr>
<td>1.17</td>
<td>Fu</td>
<td>06.10</td>
<td>X-1</td>
</tr>
</tbody>
</table>

**Bewertung**

1 = sehr gut, 5 = sehr schlecht

**Note:**

- Salzschicht
- Bindemittel / Zuschläge
- Pig (%)
- Bemerkung
<table>
<thead>
<tr>
<th>Bezeichnung</th>
<th>Masse</th>
<th>Farbe</th>
<th>Beschreibung</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fu-Mörtel</td>
<td>ca. 1984 teilweise in Probefläche belassen.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil morter</td>
<td>anstehender Boden, obere Salzschicht entfernt, alle Korngrößen mit Wasser angerührt, Fu-Mörtel nicht abgedeckt (bedeckter Himmel, hohe Luftfeuchte)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tests zur Feststellung von Farbgebung im Mörtel durch Pigmente auf der Basis von Mörtel aus Probe 1.31, Probekörper ca. 40x40x4 cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mörtel XXV</td>
<td>2,5</td>
<td>0,5</td>
<td>Rot***</td>
</tr>
<tr>
<td>Mörtel XXV</td>
<td>2,5</td>
<td>0,5</td>
<td>Ocker****</td>
</tr>
<tr>
<td>Mörtel XXV</td>
<td>2,5</td>
<td>0,5</td>
<td>Rot*** 0,1666%</td>
</tr>
<tr>
<td>Mörtel XXV</td>
<td>2,5</td>
<td>0,5</td>
<td>Ocker**** 0,1666%</td>
</tr>
<tr>
<td>Mörtel XXV</td>
<td>2,5</td>
<td>0,5</td>
<td>Rot*** 0,250%</td>
</tr>
<tr>
<td>Mörtel XXV</td>
<td>2,5</td>
<td>0,5</td>
<td>Ocker**** 0,050%</td>
</tr>
<tr>
<td>Mörtel XXV</td>
<td>2,5</td>
<td>0,5</td>
<td>Dünner rötlicher Ocker</td>
</tr>
<tr>
<td>Tabelle</td>
<td>Seite</td>
<td>Inhalte</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>1.51</td>
<td>01.12.</td>
<td>Mauerwerk zur statischen und strukturellen Sicherung, Steinaustausch, Vorbereitung für PutzXX Va 2,5 1 0,3,4 löste 1,31 ab, Verwendung als Mauer- und Fugenmörtel an T9 und Stadtmauer ca. 10 meter vor T9 von T8 kommend, oberhalb ca. 40 cm über Boden, ab 01.12.</td>
<td></td>
</tr>
<tr>
<td>1.52</td>
<td>01.12.</td>
<td>Mauerwerk VSch Vorschlemme (unmittelbar vor Auftrag)</td>
<td></td>
</tr>
<tr>
<td>1.53</td>
<td>01.12.</td>
<td>Mauerwerk VSch Vorschlemme (unmittelbar vor Auftrag)</td>
<td></td>
</tr>
<tr>
<td>1.54</td>
<td>01.12.</td>
<td>Mauerwerk VSch Vorschlemme (unmittelbar vor Auftrag)</td>
<td></td>
</tr>
</tbody>
</table>

**Anmerkungen:**
- Pu XXXVI: 2 1 2 10* 1:4 1h 3 5-40 3 2
- Pu XXXVII: 0.75 0,25 1 4* 1:5 3h 3-4 5-10 4 3
- Pu XXXVIII: 2 1 8 4* 1:4 1h 3 5-30 4
- Pu XXXIX: 1 0,25 3,5 1* 1:3,6 3h 3-4 5-10 4 3
- Pu XXX: 1 4* 1:4
- Soils aus Umgebung von EP04 (rötlicher als nahe T8)
- 1h 3 5-40 3 2

**Materialien:**
- Wzm Weißzement (Bezeichnung!)
- Qs Quarzsand (0,0-02, vereinzelt bis 0,6)
- Mks Muschelkalksand (0,75-2 und 2,5-6, gewaschen, Eigenherstellung)
- Ty Thylose MH 30.000 (Deffner & Johann)
- Pig Pigmente (Deffner & Johann)

**Bemerkungen:**
- Der bis 02.12. verwendete Wüstensand wird an Strasse nach Shamal, ca. 1000 meter nach Höhe Freya an den beiden freistehenden Felsformationen gewonnen.

**Erläuterungen:**
- * Soil = Abraum aus Ausgrabung Zubarah
- ** Sand = rötlicher Wüstensand
- *** Lichtechtes Pigment "Italienische Erde rot Veneto"
- **** Lichtechtes Pigment "lichter Ocker"
<table>
<thead>
<tr>
<th>Datum</th>
<th>Probe-Nr.</th>
<th>Monat/Jahr</th>
<th>Anwendungsort</th>
<th>Raum/Lokus</th>
<th>Wand</th>
<th>Position auf Wand</th>
<th>Ausrichtung</th>
<th>Risse</th>
<th>Absanden</th>
<th>Bröckelzerfall</th>
<th>Bemerkung</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 06.10</td>
<td>QMA2 R103 B mi.</td>
<td>un. E 3 3-4 5 X</td>
<td>sehr schnelle Trocknung</td>
<td>30x20</td>
<td>2 Pin. 1-2 4-5 12.10 1-2 4</td>
<td>kaum Wirkung feststellbar, weißer Schleier nicht verwendbar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 01.12.</td>
<td>QMA2 R144 B mi. li. un.</td>
<td>E 4-5 1 2</td>
<td>Reste ehemaliges Gewände (?), sehr stark verwittert, aktiv</td>
<td>20x20</td>
<td>1 Pin. 3</td>
<td>z.T. milchig blass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 01.12.</td>
<td>QMA2 R144 B mi. li. un.</td>
<td>E 4-5 1 2</td>
<td>Reste ehemaliges Gewände (?), sehr stark verwittert, aktiv</td>
<td>20x15</td>
<td>2 Pin. 1-2 4</td>
<td>geringe Aufnahme des Untergundes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Khy E10 | Kalziumhydroxid auf Nanobasis (kolloidales Kalziumhydroxid), Nanokalk in Ethanol, 10% |
Khy E25 | Kalziumhydroxid auf Nanobasis (kolloidales Kalziumhydroxid), Nanokalk in Ethanol, 25% |
Tyl | Thylose MH 30.000 (Deffner & Johann) |
Wzm | Weißzement (Bezeichnung!) |
Qs | Quarzsand (0,0-02, vereinzelt bis 0,6) |
Mks | Muschelkalksand (0,75-2 und 2,5-6, gewaschen, Eigenherstellung) |
Pig | Pigmente (Deffner & Johann) |
Soil | Soil anstehend gesiebt auf ca. 0-5 mm oder soil dessert= roter Wüstensand ungesiebt |
REPORT ON THE BUILDING MATERIALS
OF AL ZUBARAH CITY

ROBERT J. SOBOTT
DR. RER. NAT.

JUNE 2011
Summary

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  8.1 Laboratory tests
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Summary: An appraisal of the historic building materials of Al Zubarah city was made. All building stones encountered in the walls are available in the immediate vicinity of the city. Four main groups of building stones were found: beachrock, aeolianite, dolomitic limestone, and gypsum. The beachrock can be further differentiated into at least two or three subgroups one of which is a conglomerate made up of beachrock and dolomite fragments. The quality of the building stones with respect to strength and weathering resistance varies greatly. The beachrock varieties are generally of poor quality and should not be considered for repair work. Although endowed with totally adverse properties, the aeolianite and the dolomitic limestone are very good building stones. The first is light and porous, the latter heavy and dense. They complemented one another ideally if the dense dolomitic limestone was used for the basement and the porous aeolianite for the following stonework. The dense dolomitic limestone would act as a barrier against the capillary rise of water while the porous aeolianite with a low heat conductivity would keep the heat out of the inner parts of the building. As the aeolianite is outcropping some 15 km NE of Al Zubarah it would be possible to quarry fresh material. Also the dolomitic limestone can easily be collected from the surface.

The mortar used at the time of the building of Al Zubarah city was most probably an anhydrite mortar. While the plaster is well preserved, the wall mortar - if still present – is in a bad condition. This means that the consolidation of walls requires a lot of repointing. In many cases even this will not suffice to regain stability and a complete reconstruction of wall parts will be necessary.

For this repair and reconstruction work suitable mortars will be needed. Tests have been made with natural hydraulic lime mortar and different mixtures of anhydrite mortar. The tests with natural hydraulic lime mortar were successful and this mortar type can be used for the reconstruction of the walls and the repointing of joints. Much attention has to be paid to the selection of the aggregate so that the colour of the joints harmonizes with the colour of the stones. The longevity of the mortars will be increased if salt-free aggregate is used.

The results with anhydrite mortars are not conclusive yet. However, mixtures of anhydrite with natural hydraulic lime seem to very promising. As in the past, anhydrite mortar will preferably be used for plastering the walls. The plaster acts as a protective coating for the wall and prevents the fast erosion of joints by the ever-blowing wind. Depending on the outcome of ongoing tests, it is conceivable to use anhydrite mortar also for reconstruction work and repointing.
Part 1: The building stones

1 Introduction

In December 2010 and March 2011 the walls of the ruined city of Al Zubarah were surveyed with respect to the building materials, i.e. the building stones, the mortars, and wall plasters. The inspection revealed that a number of different sedimentary rocks was used which differ widely in the constituent components, mineralogical composition, and fabric. Consequently, also the petrophysical parameters and the weathering stability are quite different what is reflected by the variable state of preservation of the walls. Figure 1 gives an example on how the rock properties contribute to the stability of the wall structure. The gradual and specific decay of the different building stones contributes also to the decay of the mortar in the joints and both processes will eventually lead to a collapse of wall structures.

![Figure 1: Preservation state of wall structures as a function of mortar and rock stability. Left side: Homogeneous aeolianite building stones with good weathering stability and moderate mechanical strength. Right side: Beachrock type with poor weathering stability and mechanical strength.](image)

All the building materials come from the surroundings and are linked to the regional geology of the Al Zubarah region. The rock material is derived from the Eocene Dammam dolomitic limestone and the sediments deposited on it, namely the Pleistocene aeolianites (fossil sand dunes), the mid-Holocene beachrocks, and gypsum concretions of the sabkhat (Macumber, 2009). Figure 2 presents a simplified geological profile of the Al Zubarah region in which potential areas for quarrying the building stones are marked. Figure 3 shows the sand-covered relics of a former quarry of aeolianite at Gabal Freha, an outcrop of the Dammam dolomite in surrounding beachrock, and gypsum concretions on the sabkha surface.

From the city wall, a tower construction, and a housing complex of the Zubarah archaeological excavation site as well as as from rock outcrops in the vicinity of Al Zubarah several specimen were samples and subjected to a mineralogical and petrographical study. The qualitative mineralogical composition was determined by X-ray diffractometry, the rock components and fabrics were investigated by optical microscopy of thin sections.
2 The different rock types
The principal rock types present in the city walls of Al Zubarah are beachrock, aeolianite, dolomitic limestone and gypsum concretions (gypcrete). Depending on the prevalent fossil type and particle size, the beachrock can be differentiated in mollusc and gastropod grain and/or rudstones. Figure 4 shows representative samples of each type. While the beachrock is variable with regard to the fossils, the particle size, and the component/matrix ratio, the aeolianite, dolomitic lime stone, and gypcrete are structurally and mineralogically rather homogeneous. Table 1 summarizes macroscopic features by which the rocks can be determined in the field.
Table 1: Characteristic macroscopic features of the building stones

<table>
<thead>
<tr>
<th>Rock type</th>
<th>Colour</th>
<th>Macroscopically visible components</th>
<th>Hardness</th>
<th>Diagnostic features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beachrock</td>
<td>light yellow grey to whitish</td>
<td>bivalves, gastropods</td>
<td>friable</td>
<td>components</td>
</tr>
<tr>
<td>Conglomerate</td>
<td>mixed colours of rock constituents</td>
<td>bivalves, gastropods, dolomite fragments</td>
<td>-</td>
<td>components</td>
</tr>
<tr>
<td>Aeolianite</td>
<td>light yellow</td>
<td>-</td>
<td>medium</td>
<td>medium grain size, bedding</td>
</tr>
<tr>
<td>Dolomitic limestone</td>
<td>fresh surface grey</td>
<td>-</td>
<td>very hard</td>
<td>density, fine grain size</td>
</tr>
<tr>
<td>Gypsum</td>
<td>yellow grey to whitish</td>
<td>-</td>
<td>soft</td>
<td>scratchable with finger nail</td>
</tr>
</tbody>
</table>

Figure 4: The principal rock types in the walls of Al Zubarah.
1: Beachrock AG (mollusc rudstone), 2: Beachrock BJ (gastropod rudstone),
3: Conglomerate, 4: Aeolianite FR, 5: Dolomitic limestone BL, 6: Gypsum rock BE
2.1 Mineralogical composition of the building stones

The samples for the determination of the mineralogical composition by X-ray diffraction with CuKα-radiation were prepared by grinding rock fragments in a tungsten carbide mortar and separation of the grain size fraction 0.063 – 0.1 mm by sieving. If diffraction peaks of halite and/or quartz were present in the rock (or mortar) samples, they were used for the 2θ-calibration of the corresponding X-ray diffractogram. The phase detection limit was in the range of 1 - 2 mass%.

The results of the X-ray diffractometry are summarized in table 2. The phases are listed from left to right in the order of decreasing quantity. Phases put in brackets are not constituents of the rocks (or mortars) but of secondary origin such as halite which crystallizes from saline groundwater or seawater spray. All X-ray diffractograms are displayed in the appendix.

Table 2: Mineralogical composition of the building stones

<table>
<thead>
<tr>
<th>Rock type</th>
<th>Code</th>
<th>Mineral phases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beachrock type I</td>
<td>AG</td>
<td>Mg calcite II, Mg calcite I, aragonite, dolomite, (halite), clay mineral ?</td>
</tr>
<tr>
<td>Beachrock type II</td>
<td>BJ</td>
<td>Mg calcite II, Mg calcite I, aragonite, dolomite, (halite)</td>
</tr>
<tr>
<td>Aeolianite</td>
<td>FR</td>
<td>calcite, dolomite, plagioclase, quartz, Mg calcite II</td>
</tr>
<tr>
<td>Dolomitic limestone</td>
<td>BL</td>
<td>dolomite, (halite)</td>
</tr>
<tr>
<td>Gypsum rock (gypcrete)</td>
<td>BE</td>
<td>gypsum, Mg calcite II, aragonite, dolomite</td>
</tr>
</tbody>
</table>

The carbonate mineralogy of the beachrocks is determined by the presence of two Mg calcites with different amounts of MgCO₃ and aragonite. Mg calcite and aragonite are two CaCO₃ species which are precipitated from sea water with a molar Mg/Ca ratio > 2 (Ries, J. B., 2005). According to Goldsmith, Graf and Joensuu (1955) the MgCO₃ content of Mg calcite can be derived from the position of the (104) reflection of calcite by using the relationship Mol % MgCO₃ = 791,4 – 260 x d₁₀₄ [Å]. Mg calcite I contains less than 7 Mol% MgCO₃, Mg calcite II more than 13 mol % MgCO₃. Mg calcite and aragonite are metastable phases at ambient temperature and pressure conditions and transformed to stable calcite by a dissolution/precipitation process within a comparatively short time span. Koch and Rothe (1985) described the transformation of Miocene Mg calcite grains of 4 – 10 µm length and 1 – 3 µm diametre to stable calcite by the reaction with meteoric water within 10 – 20 years. Beachrock samples with different Mg calcite II/Mg calcite ratios indicate that the transformation process is controlled by the exposure to rainfall. Better protected stones inside a wall retain a Mg calcite II/Mg Calcite I ratio > 1 while exposed rocks exhibit a Mg calcite II/Mg Calcite I ratio < 1. A good example for an exposed beachrock is the “table stone” shown in figure 5 which has retained only little Mg calcite II. The transformation of Mg calcite to calcite is combined with a release of Mg²⁺ ions and a potential source for the formation of harmful magnesium salts.

Also the dolomite of the beachrock is non-stoichiometric and shows an excess of calcium (Ca dolomite). The dolomite composition was determined by evaluating the position of the (104) diffraction peak and the relationship \(d_{104} = 1.8786 \times 10^{-6} \times (\text{mol\% } \text{CaCO}_3)^2 + 5.022 \times 10^{-3} \times \text{mol\% } \text{CaCO}_3 + 2.681\) was used to calculate the mol percentage of \(\text{CaCO}_3\) (Goldsmith, Graf and Joensuu, 1955).
While quartz can also be identified in the X-ray diffractograms of the beachrocks the diagnostic potassium feldspar diffraction peak is masked by the (021) peak of aragonite. However, optical microscopy reveals that potassium feldspar and plagioclase are present in the beachrocks as detrital grains (see figures 6 and 7).

In the older Pleistocene aeolianites Mg calcite has almost been completely transformed to stable calcite by meteoric water percolating through the pores. Therefore, calcite is the dominating phase in the X-ray diffractogram of sample FR. Further low intensive diffraction peaks can be attributed to dolomite, plagioclase, quartz, and Mg calcite II.

The Damman dolomitic limestone consists almost completely of stoichiometric dolomite. The small diffraction peak at 2θ (CuKa) = 31.69° is due to halite which adhered to the sample surface.

Logically, gypsum is the dominating phase in the X-ray diffractogram of the gypsum rock which also shows diffraction peaks for Mg calcite II, aragonite, and dolomite which are less soluble in sea water than gypsum and formed as first precipitates. Interestingly enough there is no indication of the occurrence of anhydrite in the gypsum rocks. The formation of anhydrite by dehydration of gypsum might be expected since the reaction takes place at temperatures around 50 °C and this temperature will be reached on the surface of gypsum rocks during the summer period.

2.2 Petrography of the building stones

2.2.1 Beachrock type I (silty carbonate sand with abundant bivalves)
This beachrock type is characterized by the abundance of bivalves (peleycpods Chione) embedded in a silty carbonate sand matrix. Apart from the bivalves other fossils observed in the thin section are gastropods, forams, and peloids (figure 6). The latter are sometimes filled with chalcedony.

Non-carbonate particles include quartz and feldspar grains (K feldspar and plagioclase). The transformation of Mg calcite and aragonite to the stable modification calcite has not set in yet and the particles are just weakly cemented. Hence the compressive strength of this rock is very low.

![Figure 6: Thin section photographs of beachrock 1 (silty carbonate sand with mollusc debris)](image)

A. Plane-polarized light. Grain-supported fabric. Foraminifera (F) in the centre, small dolomitic rock fragment (D) at the bottom.
B. Crossed polars. Gastropod cross section (G). Chambers are filled with internal sediment (quartz (Q), plagioclase (Plg)).
C. Plane-polarized light. Grain-supported fabric with large K feldspar grain (Kfs) and bivalve fragment (B).
D. Crossed polars. Peloids, one with chalcedony (Ch) filling

2.2.2 Beachrock type II (silty carbonate sand with abundant gastropods)

The biogenic detritus of this beachrock type consists mainly of gastropods embedded in a silty carbonate matrix (figure 7). Non-carbonate particles include quartz and feldspar grains and dolomite rock fragments (extraclasts). As in beachrock type I Mg calcite and aragonite are not transformed to stable calcite and no calcitic cements occurs. Therefore this rock has also a low compressive strength.
2.2.3 Aeolianite (Peloidal grainstone)

The aeolianite has a grain-supported fabric of biogenic detritus (forams, bryozoa, peloids). Contrary to the beachrocks the particle size distribution is very homogeneous with a pronounced maximum centred around 200 µm. The observation of granular calcite cement around biogenic particles in the thin section (figure 8) is corroborated by the result of X-ray diffractometry. This rock contains no more aragonite and only very little Mg calcite which have been transformed to stable calcite under the influence of meteoric water percolating through the pores. The less soluble stoichiometric calcite was precipitated from the pore water and formed the granular cement. Apart from the biogenic components the aeolianite contains dolomite fragments and quartz and feldspar grains. The markedly higher compressive strength is due to the calcitic cementation of the particles.
Figure 8: Thin section photographs of aeolianite (peloid grainstone)
A. Plane-polarized light. Grain-supported fabric with foraminifera (F) and bryozoa (Br)
B. Plane-polarized light. Peloids with micritic envelopes, dolomite fragment (D).
C. Plane-polarized light. Foraminifera (F) with calcite filling in chambers, granular calcite around biogenic particles
D. Plane-polarized light. Granular calcite cement (yellow arrows) around biogenic particles

2.2.4 Dolomitic limestone

Optical microscopy of the thin section of the Dammam dolomitic limestone reveals a typical succrosic dolomite fabric with practically no intercrystalline porosity. With few exceptions the dolomite crystals are fine-grained (< 100 µm) and exhibit a distinct zoning (lower left photograph in figure 9). This zoning is due to different chemical composition of the core and rim. This finding, however, is surprising as the X-ray diffractogram of this rock (see appendix) shows only diffraction peaks for stoichiometric or near stoichiometric dolomite (Ca_{50}Mg_{50}). A characteristic feature of the dolomitic limestone is the occurrence of vugs which range in size from less than a millimetre to several centimetres. Also the SiO$_2$ content in the form of fibrous chalcedony is only detectable in the thin section and not in the X-ray diffractogram which means that it is below the detection limit of 1 – 2 mass%. The dense fabric of interlocked dolomite crystals gives the rock a high compressive strength.
2.2.5 Evaporitic mudstone (gypsum)

The evaporitic mudstone is a sediment of the sabkha facies. The dominant evaporitic minerals of the sabkha are gypsum, halite, and anhydrite. Therefore it is surprising that according to X-ray diffractometry the sample consists almost exclusively of gypsum and contains no anhydrite or halite. Also the optical microscopy of a thin section of this sample revealed no anhydrite which can easily be recognized by its bright second order green and yellow birefringence colours. Between crossed polars the cryptocrystalline gypsum appears as a dull dark brown mass and only where it recrystallized to greater crystals the grey and white birefringence colours are clearly visible (lower right photograph in figure 10). The mud matrix also contains dolomite fragments, feldspar grains, and shell debris.

2.3 Basic petrophysical parameters of the building stones

Prisms cut from handspecimens with a diamond saw blade and measuring 2 x 4 x 5 cm³ were used for the determination of some basic petrophysical parameters. Bulk density was determined as the quotient of the mass and calculated volume of a prism, porosity as the quotient of pore volume, measured by the imbibition method, and calculated volume of a prism. The ultrasonic velocity was measured in the transmission mode and is directly related to the density and elastic modulus.
Figure 10: Thin section photographs of evaporitic mudstone (gypsum)
A. Plane-polarized light. Evaporitic mud (gypsum) with dolomite (D) fragments and large pores (blue).
B. Plane-polarized light. Evaporitic mud with dolomite fragments, recrystallized gypsum (rG) and large pores (blue).
C. Crossed polars. K feldspar (microcline) (Kfs) grain in gypsum matrix
D. Crossed polars. Same frame as B

Abdullatif (2009) investigated the geomechanical properties of carbonate rocks from the Rus formation and Dammam dome in Saudi Arabia and established a number of linear and non-linear correlations between individual parameters such as point load strength vs. unconfined compressive strength, density vs. porosity, and point load strength vs. Schmidt hammer rebound number. The data can be used to evaluate in situ measurements on building stones at Al Zubarah city with the Schmidt rebound hammer with respect to point load strength and unconfined compressive strength.

Table 3: Basic petrophysical parameters of the building stones

<table>
<thead>
<tr>
<th>Sample</th>
<th>Rock type</th>
<th>Bulk density [g/cm³]</th>
<th>Porosity [%]</th>
<th>Ultrasonic velocity [km/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG</td>
<td>beachrock I</td>
<td>1,54</td>
<td>~ 40</td>
<td>2,6</td>
</tr>
<tr>
<td>BJ</td>
<td>beachrock II</td>
<td>1,56</td>
<td>~ 30</td>
<td>3,8</td>
</tr>
<tr>
<td>FR</td>
<td>aeolianite</td>
<td>1,63</td>
<td>~ 40</td>
<td>3,1</td>
</tr>
<tr>
<td>BI</td>
<td>microcrystalline dolomite</td>
<td>2,55</td>
<td>&lt; 10</td>
<td>4,9</td>
</tr>
<tr>
<td>BE</td>
<td>evaporitic mudstone (gypsum)</td>
<td>1,50</td>
<td>~ 39</td>
<td>2,5</td>
</tr>
</tbody>
</table>
Part 2: Historic mortars

3 Introduction

The term “historic mortar” implies that it dates back to the time of construction of a building or its restoration before the beginning of the Qatar Islamic Archaeology and Heritage Project (QIAH). A number of samples were taken from the mosque at Freha, the excavation site South field (room 005, wall C) and the area of consolidation at Al Zubarah city (figure 11), Al Zubarah fort, and the Al Rikiyat fort (figure 13). X-ray diffraction analysis was used to identify the qualitative composition of samples from which conclusions can be drawn with respect to the nature of a mortar (anhydrite/gypsum or lime/hydraulic lime mortar). Three different kind of reactions can be differentiated (compounds printed in bold characters are detectable by X-ray diffraction, mineral names given in brackets):

Anhydrite mortar: \[ \text{CaSO}_4 + 2\text{H}_2\text{O} \rightarrow \text{CaSO}_4*2\text{H}_2\text{O} \] (anhydrite) \to (gypsum)

Pure lime mortar: \[ \text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} \] (portlandite) \to (calcite)

Hydraulic lime mortar: \[ 2\text{Ca}_2\text{SiO}_4 + 4\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{Ca}_3(\text{SiO}_3\text{OH})_2*2\text{H}_2\text{O} \] (dicalciumsilicate) \[ \text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} \]

The purpose of this investigation was to get an idea what kind of mortars were used for the building and plastering of the walls. The results were also used for the development of repair mortars which are compatible with the mortar inventory of the historic buildings. Table 4 lists the investigated historic mortars with their phase composition.

Table 4: Historic anhydrite and (hydraulic) lime mortars and their phase composition

<table>
<thead>
<tr>
<th>No.</th>
<th>Sampling locality</th>
<th>Mortar type</th>
<th>Phase composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Freha, mosque</td>
<td>anhydrite wall mortar</td>
<td>dolomite, gypsum, Mg calcite I, quartz, (halite), plagioclase, K feldspar, aragonite</td>
</tr>
<tr>
<td>2</td>
<td>Freha, mosque</td>
<td>anhydrite plaster, lower layer</td>
<td>gypsum, (halite)</td>
</tr>
<tr>
<td>3</td>
<td>Freha, mosque</td>
<td>anhydrite plaster, upper layer</td>
<td>gypsum, (halite), quartz</td>
</tr>
<tr>
<td>4</td>
<td>Al Zubarah, area of consolidation</td>
<td>anhydrite plaster</td>
<td>gypsum, anhydrite</td>
</tr>
<tr>
<td>5</td>
<td>Al Zubarah, South field</td>
<td>anhydrite plaster</td>
<td>gypsum, calcite, quartz, (halite), anhydrite</td>
</tr>
<tr>
<td>6</td>
<td>Al Zubarah fort</td>
<td>hydraulic lime mortar</td>
<td>quartz, calcite, gypsum</td>
</tr>
<tr>
<td>7</td>
<td>Al Rikiyat fort</td>
<td>hydraulic lime mortar</td>
<td>quartz, calcite,</td>
</tr>
</tbody>
</table>

4 Anhydrite-based mortars

Mortars dating back to the construction of the buildings are generally anhydrite based mortars. They were produced by burning gypsum at temperatures between 400 – 1000 °C. The complete dehydration of gypsum results in the formation of anhydrite II, a complex mixture of anhydrite modifications with different water solubility. The reaction of anhydrite with water to form gypsum is very sluggish and requires an activator in order to have reasonable setting times in the range of a few days. Possible activators are sodium sulphate or calcium oxide (burnt lime).
The formation of gypsum from anhydrite is connected with an increase in volume by 60.8%, the dehydration of gypsum to anhydrite by a loss of volume of 37.8%. Since the dehydration of gypsum starts at temperatures around 50 °C this reaction could happen in gypsum wall plasters exposed to the sun. The repeated shrinkage and swelling of a surface layer of the plaster may eventually lead to its decay. The presence of anhydrite in plaster samples in the range of about 2 mass% was observed by X-ray diffractometry in two plaster samples.

Figure 11: Sampling localities at Freha and at Al Zubarah. A. Double-layered wall plaster at Freha mosque, B. wall mortar at Freha mosque, wall plaster at Al Zubarah city, South field R.005, wall C (C) and Al Zubarah city area of consolidation (D)

The phase composition of the anhydrite mortar reflects the type of production. If pure anhydrite was used as binder and small fragments of anhydrite as aggregate then the corresponding X-ray diffractogram predominantly exhibits the diffraction peaks of gypsum. Other phases present may be quartz, calcite, anhydrite, and the ubiquitous halite. If the anhydrite binder was mixed with shell sand as aggregate then the corresponding X-ray diffractogram contains X-ray diffraction peaks of aragonite and Mg calcite as additional phases (table 4). The investigated historic anhydrite mortars and plasters contain practically no or only very little anhydrite which means that the anhydrite was more or less completely transformed to gypsum and that the reverse reaction of dehydration of gypsum due to insolation is not so common as would be expected on the basis of theoretical considerations.

The optical microscopy of thin sections reveals that the anhydrite mortars are characterised by a porous matrix which contains only little aggregate particles. These may be quartz grains or sedimentary rock fragments. Usually the gypsum is cryptocrystalline but sometimes larger, recrystallized aggregates are encountered (figure 12).
Figure 12: Thin section photographs of historic anhydrite plaster from a wall in South field, Al Zubarah city (A, B) and the mosque at Freiha (C,D)

5 (Hydraulic) lime-based mortars

(Hydraulic) lime-based mortars were obviously used for earlier repair work at the forts of Al Zubarah and Al Rakayat. The corresponding X-ray diffractograms are marked by strong diffraction peaks for quartz (aggregate) and calcite (binder). Usually the aggregate contains not only quartz but also feldspar (K feldspar and/or plagioclase). Additional diffraction peaks attributed to gypsum or dolomite are derived from a contamination of the sample with adhering rock fragments. Especially the phase association of quartz and feldspar(s) is diagnostic for sand as aggregate which is usually added to (hydraulic) lime mortars.

The typical fabric of the (hydraulic) lime mortar to be observed in a thin section under a polarising light microscope consists of a more or less close packing of aggregate grains (mostly quartz and feldspar) with a filling of the interstices by calcite (figure 14). Depending on the grain shape and grain size distribution of the aggregate particles packings with pore volumes between 25 and 50 % corresponding to binder/aggregate ratios of 1:3 to 1:1 are observed. The shape of the sand grains reveals whether the sand comes from a sand pit or was produced by crushing silicate rock material. Rounded shapes are typical for natural sand grains transported by water or wind over long distances while angular shapes point either to artificially crushed rock material or rock debris transported over very short distances.
Figure 13: Sampling localities at (A) Al Zubarah fort and (B) Al Rikiyat fort (hydraulic) lime based mortars

Figure 14: Thin section photographs of (hydraulic) lime mortars from Al Zubarah fort (A, B) and Al Rikiyat fort (C, D).
B, D: Crossed polars. Same frames as A, C
Part 3: Development and testing of repair mortars

6 Introduction

The present state of most of the exposed walls at Al Zubarah city requires urgent restoration measures in order to avoid a situation in which the restoration is replaced by reconstruction work which could interfere with the authenticity of the site. The necessary restoration work is quite a challenge due to the dilapidated state of many building stones and most of the wall mortar which in many places seems to be non-existent. The ubiquitous presence of halite (NaCl) and the hot and dry climate during the summer months are further problems to be dealt with. The ideal mortar should quickly develop a sufficient strength and show a high resistance against salt attack. Observations on the results of earlier restoration work with cement mortars and knowledge of the historic building materials prompted experiments with natural hydraulic lime and anhydrite mortar.

7 Natural hydraulic lime (NHL) mortar

Natural hydraulic lime as binder combines the advantages of low alkali contents and comparatively quick hardening due to its content of cement clinker phases which are formed by the burning of marly limestone. The strength of the hardened mortar is considerably lower than that of cement mortars and goes much better with the softness of most of the building stones (with the exception of the dolomitic limestone) than cement mortars. Under the prevailing weather conditions pure lime mortars on the other hand have the risk of falling dry too quickly before the carbonation of the slaked lime is complete and the strength typical for this material developed.

The standard mixture for a NHL mortar contains 1 volume part binder and 3 volume parts aggregate. The use of sand from the beach as it is cannot be recommended because it contains at least 1 – 2 mass% sodium chloride. This salt content, however, can be lowered to about one third of the original content by washing the sand with the double volume of salt-free water. Alternatively, commercially available quartz sand can be used as aggregate. A mixture of washed beach sand containing shells and gastropods and quartz sand is probably best suited for the production of a NHL mortar which matches best with the colours of the building stones.

In order to overcome the problem of premature drying about 1 – 2 mass% tylose is added to the mortar. Tylose serves to retain the water in the mortar paste. The effect of tylose in the mixture can best be studied when water is added to the dry mixture of binder and aggregate: 2 mass% tylose in the mixture almost doubles the amount of water that can be added to get a workable mortar.

Prior to the application on site, test runs were done with NHL and anhydrite in the laboratory. The experiments with NHL were carried out with Otterbeiner Hydradur while AB 30, a product of the Südharzer Gipswerk GmbH, was chosen as anhydrite binder. For the determination of the compressive strength and elastic modulus prisms of 4 x 4 x 16 cm³ in size were prepared and tested after 9 days of hardening. The test results are presented in table 4. The strength of the AB 30 mixture is much too high and later in the field aggregate/binder ratios of

7.1 Laboratory tests

The laboratory tests were done with standard prisms 4 x 4 x 16 cm³ in size. Young’s modulus E was calculated from the length of the prism l and the measured values of the bulk density \( \rho_b \) and resonance frequency \( v_0 \) of the dilatation wave \( (E = \frac{v_0^2}{\rho_b}, v_0 = 2l v_0) \).
Table 5: Physical parameters of NHL mortars (after 9 days of hardening)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Composition</th>
<th>Density [g/cm³]</th>
<th>Young's modulus [kN/mm²]</th>
<th>Compressive strength [N/mm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 vol. part NHL 5, 3 vol. parts aggregate, 1 vol. part water</td>
<td>1.45</td>
<td>1.8</td>
<td>1.5 (^{+1})</td>
</tr>
<tr>
<td>2</td>
<td>1 vol. part NHL 5, 3 vol. parts aggregate, 2 vol. parts water, 2 mass% tylose</td>
<td>1.44</td>
<td>1.8</td>
<td>1.5 (^{+1})</td>
</tr>
</tbody>
</table>

\(^{+1}\) The compressive strength after 28 days of hardening ranges between 3 – 5 N/mm².

7.2 Field tests

In the area of consolidation at the Northern end of Al Zubarah city several test fields were prepared with NHL mortar (figure 15) and the state of the mortar studied after a period of about six month. (The test fields at the wall of tower no. 8 which were carried out in February 2011 are not considered here because the time span between preparation and sampling would have been too short for the observation of noticeable effects.) The first test was scratching the mortar with a finger nail or the rubbing it between two fingers. Already this simple test showed that the NHL mortars had developed good strength and did not fail. Small samples were taken from the test fields and prepared for examination by X-ray diffractometry and optical microscopy.

Table 6: NHL mortars from the test areas at the tower structure (after 6 month of exposure)

(see documentation by M. Kinzel, June 2010)

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Composition (^{*})</th>
<th>Phase composition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sand A       NHL B   Tylose C</td>
<td>quartz, calcite, plagioclase, K feldspar</td>
</tr>
<tr>
<td>II</td>
<td>- - 3 1 -</td>
<td>calcite, quartz, (halite), gypsum, Mg calcite II, aragonite, plagioclase, anhydrite</td>
</tr>
<tr>
<td>XI</td>
<td>1 1 1 1 1</td>
<td>quartz, calcite, K feldspar, (halite), plagioclase</td>
</tr>
<tr>
<td>XII</td>
<td>- - 1 1 1</td>
<td>Mg calcite II, calcite, quartz, aragonite, dolomite, plagioclase, (halite), gypsum</td>
</tr>
</tbody>
</table>

\(^{*}\) Sand and NHL (Otterbeiner Hydradur NHL 5) in volume parts, tylose in mass%

The X-ray diffractograms of all NHL mortars with quartz sand as aggregate are marked by the presence of diffraction peaks for quartz, calcite, and feldspars (K feldspar and/or plagioclase). Examples for this type of mortar are the samples II and XII. If shell sand which is derived from beachrock material is added additional peaks for Mg calcite II and aragonite appear (sample XI). Halite is preferably present in samples with shell sand through which it is introduced to the mortar. Diffraction peaks for gypsum and anhydrite occur if the samples are contaminated with small amounts of historic wall mortar or plaster.

The investigation of a thin section of the NHL mortar revealed quartz grains and fossil debris bonded by bridges of calcite cement (figure 16). The packing of the quartz grains is very loose and practically no point contacts between quartz grains are observed. The pore size is in the order of the particle size. Due to the loose packing of aggregate particles and the highly porous structure the investigated sample will not have a compressive strength higher than 2 N/mm². The large pore space results in a large storage capacity for salts in the mortar. A higher strength will be achieved if the packing of aggregate particles is made tighter and the whole fabric less porous.
Figure 15: Test fields with NHL mortar at Eastern part of tower structure  
(Roman numerals refer to sample numbers in table 6)

Figure 16: Fabric of NHL mortar with a mixture of quartz and shell sand as aggregate. 
Note the fairly large pores and the binding calcite between quartz grains and fossil debris. Left: Plane-polarized light, right: crossed polars

8 Anhydrite mortar

The use of anhydrite mortar in the past is clearly demonstrated by the many remnants and fragments of plaster in the ruined buildings of Al Zubarah city. The investigation result for a wall mortar sample from the mosque at Freha indicates that anhydrite was also used as binder in wall mortars. Therefore field tests were carried out with modern anhydrite mortar to test its performance. So far, anhydrite mortar was used for jointing and plastering but it should also be tested as wall mortar. The hardening of anhydrite mortar requires more time than that of hydraulic lime mortar and there is a greater risk of falling dry in a hot dry desert climate before the process of hardening is complete.
Therefore precautions such as watering and covering freshly worked sections have to be taken in order to avoid that. Anhydrite mortar for plastering the walls may play an important role because the general poor quality of the building stones makes a protective coating of the walls necessary if sustainability of the conservation efforts is aspired.

8.1 Laboratory tests

The same procedures described under 7.1 were employed to determine the physical parameters given in table 7. Further experiments showed that the compressive strength of the anhydrite mortar can be controlled by the binder/aggregate and water/binder ratios and fixed to any desired value accordingly.

Table 7: Physical parameters of AB 30 anhydrite mortar

<table>
<thead>
<tr>
<th>Sample</th>
<th>Composition</th>
<th>Young’s modulus [kN/mm²]</th>
<th>Compressive strength [N/mm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4 vol. parts AB 30, 1 vol. part sand, 1 vol. part water</td>
<td>22.4</td>
<td>33.6</td>
</tr>
</tbody>
</table>

8.2 Field tests

So far, field tests with four different anhydrite mortars (?, QMA, HAP, AB 30) for jointing and plastering were carried out at a tower construction in the area of consolidation and at the wall of tower no. 8. QMA is a local anhydrite while HAP and AB 30 are produced by the Sudharzer Gipswerk GmbH in Germany. The acronym HAP stands for “historic anhydrite plaster” while AB stands for “anhydrite binder” and 30 refers to the compressive strength (≥ 30 N/mm²) of the hardened mortar.

Table 8: Anhydrite mortars from the test areas at the tower structure in the area of consolidation (after 6 month of exposure; see documentation by M. Kinzel, June 2010) and tower no. 8

<table>
<thead>
<tr>
<th>Sample</th>
<th>Composition</th>
<th>Application for</th>
<th>Phase composition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sand Anhydrite NHL Tylose</td>
<td></td>
<td>quartz, plagioclase, gypsum, anhydrite, K feldspar, calcite</td>
</tr>
<tr>
<td>IV(2)</td>
<td>- - 2 1 - - - -</td>
<td>jointing</td>
<td>K feldspar, quartz, anhydrite, gypsum, calcite</td>
</tr>
<tr>
<td>IX(2)</td>
<td>- - 2 1 - - - -</td>
<td>jointing</td>
<td>quartz, gypsum, anhydrite, K feldspar, calcite, (halite)</td>
</tr>
<tr>
<td>X(2)</td>
<td>1 1 1 1,5 - - - -</td>
<td>jointing</td>
<td>quartz, gypsum, calcite, K feldspar, plagioclase</td>
</tr>
<tr>
<td>F(3)</td>
<td>- - 10 4 - - 1 0,1</td>
<td>plastering</td>
<td>quartz, gypsum, calcite, K feldspar, anhydrite, plagioclase</td>
</tr>
<tr>
<td>G(3)</td>
<td>- - 6 4 - - 1 0,1</td>
<td>plastering</td>
<td>quartz, gypsum, K feldspar, plagioclase, calcite, anhydrite</td>
</tr>
<tr>
<td>HAP</td>
<td>- - 2 - - 1 - -</td>
<td>plastering</td>
<td>anhydrite, quartz, plagioclase, calcite, K feldspar, (halite), gypsum</td>
</tr>
<tr>
<td>AB</td>
<td>- - 2 - - 1 - -</td>
<td>plastering</td>
<td>quartz, anhydrite, K feldspar, plagioclase, calcite, gypsum</td>
</tr>
</tbody>
</table>

1) Sand, anhydrite and NHL (Otterbeiner Hydradur NHL 5) in volume parts, tylose in mass%
2) Roman numerals refer to labelling by M. Kinzel
3) Labelling refers to protocol by P. Hofmann
While the first three tests (IV, IX, X) were done in June 2010 with an anhydrite of unknown specification the following two tests (F, G) were made in February 2011 with QMA anhydrite and NHL added as activator. For two further tests in March 2011 the ready-made anhydrite binders HAP and AB 30 from the Südharzer Gipswerk GmbH in Germany were used. The samples were about 270, 30 and 10 days old at the time of sampling.
For the assessment of the hydration reaction and quality of the mortar the quotient
\[ \frac{I_{(020)Gypsum}}{I_{(020)Gypsum} + I_{(020)Anhydrite}} \]
was used. If the reaction is complete then there should be no more X-ray diffraction peaks of anhydrite in the X-ray diffractogram. 1 signifies complete, 0 no reaction at all. Since the performance of an anhydrite mortar is related to the degree of anhydrite conversion, the quotient in a way reflects its quality. A comparison of quotients, however, is only meaningful if the mortars compared had sufficient time to react. As mentioned above, the reaction time for the samples F, G, HAP, and AB is definitely too short for a conclusive assessment of the quality. Table 9 lists the quotients for historic anhydrite mortars and the anhydrite mortars of the field tests.

Table 10: (020) gypsum and anhydrite diffraction peak intensity ratios of anhydrite mortars

<table>
<thead>
<tr>
<th>Sample</th>
<th>Quotient</th>
<th>Sample</th>
<th>Quotient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
<td>X</td>
<td>0.50</td>
</tr>
<tr>
<td>2</td>
<td>1.00</td>
<td>F</td>
<td>0.66</td>
</tr>
<tr>
<td>4</td>
<td>0.98</td>
<td>G</td>
<td>0.77</td>
</tr>
<tr>
<td>5</td>
<td>0.97</td>
<td>HAP</td>
<td>0.07</td>
</tr>
<tr>
<td>IV</td>
<td>0.50</td>
<td>AB</td>
<td>0.04</td>
</tr>
<tr>
<td>IX</td>
<td>0.39</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

As would be expected the highest values are exhibited by the historic anhydrite mortars. They are at least two hundred years old and still in a good condition with respect to their strength. The quotients for the mortars of the second group (IV, IX, X) which are about 270 days old fall behind the quotients for the third group (F, G) which were only 30 days old at the time of sampling. The anhydrite used for the tests in the second group was of unspecified quality and had probably exceeded the expiry date. The quotients for the third group are very promising and show the direction which further tests should follow. By all means tests should be made with mixtures of anhydrite and slaked lime. As the reaction time for the samples of the fourth group (HAP, AB) is too short for a meaningful evaluation of the X-ray diffractogram this will be postponed to December 2011 after the investigation of new samples from the two test fields.

9 Consolidation experiments with nano-lime solutions

A lot of the building stones in the city walls of Al Zubarah, especially the beachrocks, are in a poor state of preservation and should be either replaced or consolidated. The porous structure of the beachrocks allows an impregnation with solidifying fluids. A test was made with a colloidal solution of portlandite in ethanol (Ziegenbalg et al. 2010), the so-called nano-lime solution. Portlandite, \( \text{Ca(OH)}_2 \), reacts with atmospheric carbon dioxide to form water and calcium carbonate which is supposed to cement the disrupted rock fabric.

\[ \text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} \]

Figure 19 shows a dilapidated wall section with two beachrocks treated with differently concentrated nano-lime solutions. The sample for investigation by X-ray diffraction and optical microscopy of a thin section was taken from the red-marked stone which was treated with the higher concentrated solution so that the expected effect would be more pronounced and detectable.
Table 10: Phase composition of beachrock sample treated with nano-lime solution

<table>
<thead>
<tr>
<th>Sample</th>
<th>Locality</th>
<th>Phase composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2b E25</td>
<td>Area of consolidation</td>
<td>Mg calcite II, Mg calcite I, dolomite, aragonite, quartz, K feldspar, (halite), gypsum</td>
</tr>
</tbody>
</table>

The observation that newly formed calcite is visible in the thin section of the sample but not in the corresponding X-ray diffractogram indicates that it is below the detection limit of 1 – 2 mass%. The newly formed calcite would be a stoichiometric calcite without Mg in the crystal structure. The two calcites identified in the X-ray diffractogram are Mg calcites with 14.8 (II) and 3.7 (I) mol% MgCO₃. As a matter of fact, figure 20 shows loosely dispersed calcium carbonate in the pore space indicating that the postulated reaction takes place. However, the amount and state of the newly formed calcium carbonate is not apt to consolidate the loose fabric. In order to achieve the desired effect either the concentration of portlandite in the solution must be increased or the impregnation of a rock must be successively repeated.

Figure 20: Thin section photograph of beachrock sample treated with nano-lime solution.

10 References


Koch, R., Rothe, P. (1985): Recent meteoric diagenesis of Miocene Mg calcite (Hydrobia beds, Mainz basin, Germany).- Facies, 13, 271 - 286


Appendix (X-ray diffraction diagrams of rocks and mortars)

X-ray diffractogram of beachrock type I AG (silty carbonate sand with abundant bivalves)

X-ray diffractogram of exposed beachrock (“table stone”; see figure 5)
X-ray diffractogram of beachrock type II BJ (silty carbonate sand with abundant gastropods)

X-ray diffractogram of aeolianite FR
X-ray diffractogram of Dammam dolomitic limestone BI

X-ray diffractogram of evaporitic mudstone (gypsum) BE
X-ray diffractogram of wall mortar, Freha mosque (figure 12)

X-ray diffractogram of wall plaster, lower layer, Freha mosque (figure 11)
X-ray diffractogram of wall plaster, upper layer, Freha mosque (figure 11)

X-ray diffractogram of wall plaster, Al Zubarah city, Southfield (figure 11)
X-ray diffractogram of wall plaster, Al Zubarah city, area of consolidation (figure 11)

X-ray diffractogram of wall render, Al Zubarah fort (figure 13)
X-ray diffractogram of wall render, Al Rikiyat fort (figure 13)

X-ray diffractogram of hydraulic lime wall mortar, test area II, Eastern part of tower structure (figure 15)
X-ray diffractogram of hydraulic lime mortar from joint, test area XI, Eastern part of tower structure (figure 15)

X-ray diffractogram of hydraulic lime mortar as render, test area XII, Southern part of tower structure
X-ray diffractogram of hydraulic lime mortar as render, test area XIII, Western part of tower structure

X-ray diffractogram of anhydrite mortar from joint, sample IV, area of consolidation
X-ray diffractogram of anhydrite mortar from joint, sample IX, area of consolidation

X-ray diffractogram of anhydrite mortar from joint, sample X, area of consolidation
X-ray diffractogram of anhydrite plaster sample F

X-ray diffractogram of anhydrite plaster sample G
X-ray diffractogram of anhydrite plaster sample HAP

X-ray diffractogram of anhydrite plaster sample AB
X-ray diffractogram of beachrock after treatment with “nano lime” solution (colloidal solution of portlandite in ethanol), testfield 2b, area of consolidation, Al Zubarah city
APPENDIX 4

Analyses and Tests on BUILDING MATERIALS
AT AL ZUBARAH / QATAR

Report by Robert Sobott
covering the period of 1.10.2011 to 23.03.2012
Report II about the work done from 1.10.2011 – 23.03.2012

by R. Sobott, LfBD NMB, IMKM University of Leipzig

1. Chemical analyses of building materials
2. Investigation of particular mortars
3. Production and application of anhydrite plaster in Al Zubarah
4. Consolidation test on gypsum plaster with Xilan
5. Delivery and installation of analytical equipment for on-site laboratory
6. Identification of rocks and objects made of stone in the find magazine
7. Cooperation with Materials Science Unit of Qatar University
8. Outlook

8.1 Documentation of changes in the state of walls as a function of time
8.2 Consolidation of gypsum wall plaster
8.3 Visit to comparable excavation projects in the Gulf States

9. Stays in Qatar (Doha, Al Zubarah)

16.10. – 20.10.2011 ICOMOS
29.11. – 04.12.2011 Workshop
14.01. – 19.01.2012 Working session of strategy group
26.02. – 03.03.2101 Working session of strategy group

(All figures have been copied to the enclosed CD so that they can be viewed at higher magnification on the computer screen).
1. Chemical analyses of building materials

The ubiquity of salts in the environment of Al Zubarah is a challenge to the longevity of every building material. Foremost it is sodium chloride that can be found as white efflorescence on rocks or as a disseminated component in the beach sand or soil of the sabkha zone. Sodium chloride (rock salt) and other salts with a good solubility in water are damaging to the stability of building materials by various physical and chemical reactions. For instance, in the course of crystallization or hydration pressure will be exerted on the walls of pores inside the building material by the growing or transforming salt crystals. If this pressure exceeds the tensile strength of the mortar it will crack. Repeated or cyclical crystallization and dissolution will eventually destroy the fabric and lead to a collapse of the structure. Also chemical reactions which transform binding components such as portlandite into water-soluble compounds contribute to the destruction of the mortar. An example for this kind of mortar deterioration is the reaction of portlandite with halite in the presence of carbon dioxide to form thermonatrite according to the chemical reaction:

\[
\text{Ca(OH)}_2 + 2 \text{NaCl} + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3\cdot\text{H}_2\text{O} + \text{CaCl}_2 \quad \Delta G = 3.31 \text{ kcal/mol}
\]

Although this reaction is slightly endothermic at standard conditions efflorescences of thermonatrite on render made with natural hydraulic lime is regarded as evidence that the formation of thermonatrite takes place in this or a very similar way (figure 1). Thus by physical and chemical processes related to the presence of salt solid render and mortar is more or less quickly transformed into a poor heap of debris at the foot of a wall.

In order to get an idea in what quantities salts are present in the building materials of Al Zubarah, a number of analyses of respective materials were made. The samples were prepared by elution of the salts with distilled water. 10g of the dried sample were put in a glass container with 500 ml distilled water and shaken for 24 hours. After separation of the insoluble residue the clear solution was used for the determination of cations by ICP-OES and the anions by ion chromatography. Due to the limited solubility of gypsum in water (~ 2g/l) the amount of sulfate analysed depends on the ratio of sample mass to water volume (usually 1:50) and the amount of sulfate present in the sample.

The building materials include old mortar/render samples (6, 7, 8, 12, 13, 14) as well as a sample of “soil” (21) used for mixing mortar and the resulting mortar (15). Also samples of originally salt-free quartz sand (9, 10, 11) which were used for covering a plaster floor at EP 04 were analysed after several month of exposure to check how long it takes for salts to accumulate.

The results in table 1 show that chloride and sulfate are omnipresent while nitrate practically plays no role.
Table 1: Contents of water-soluble salts in different building materials

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
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<td>1.57</td>
<td>0.03</td>
<td>12.25</td>
<td>0.70</td>
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<td>7.5</td>
<td>0.27</td>
<td>22.45</td>
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<td>7</td>
<td>0.17</td>
<td>0.04</td>
<td>1.45</td>
<td>0.11</td>
<td>0.03</td>
<td>0.90</td>
<td>0.08</td>
<td>2.77</td>
</tr>
<tr>
<td>8</td>
<td>1.73</td>
<td>0.19</td>
<td>2.40</td>
<td>1.10</td>
<td>0.20</td>
<td>1.250</td>
<td>0.16</td>
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<tr>
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<td>0.21</td>
<td>10.35</td>
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<tr>
<td>14</td>
<td>2.71</td>
<td>0.13</td>
<td>1.91</td>
<td>1.35</td>
<td>0.16</td>
<td>1.05</td>
<td>0.12</td>
<td>7.41</td>
</tr>
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<td>9</td>
<td>0.23</td>
<td>0.01</td>
<td>0.55</td>
<td>0.13</td>
<td>0.03</td>
<td>0.38</td>
<td>0.026</td>
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</tr>
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<td>10</td>
<td>0.28</td>
<td>0.01</td>
<td>0.41</td>
<td>0.15</td>
<td>0.02</td>
<td>0.28</td>
<td>0.02</td>
<td>1.17</td>
</tr>
<tr>
<td>11</td>
<td>0.19</td>
<td>0.01</td>
<td>0.37</td>
<td>0.11</td>
<td>0.02</td>
<td>0.23</td>
<td>0.02</td>
<td>0.94</td>
</tr>
<tr>
<td>12</td>
<td>7.10</td>
<td>&lt;0.001</td>
<td>1.01</td>
<td>3.20</td>
<td>0.06</td>
<td>0.70</td>
<td>0.09</td>
<td>12.16</td>
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<td>15</td>
<td>0.82</td>
<td>0.27</td>
<td>3.19</td>
<td>3.05</td>
<td>0.000</td>
<td>1.85</td>
<td>0.17</td>
<td>9.34</td>
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<td>21</td>
<td>2.82</td>
<td>0.00</td>
<td>19.70</td>
<td>1.05</td>
<td>0.16</td>
<td>9.00</td>
<td>0.10</td>
<td>32.82</td>
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<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Sampling locality</th>
</tr>
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<tbody>
<tr>
<td>6</td>
<td>wall and joint mortar</td>
<td>ZU QMA 03 R 0002 W 0001</td>
</tr>
<tr>
<td>7</td>
<td>wall and joint mortar</td>
<td>ZU QMA 03 R 0006 W 0013</td>
</tr>
<tr>
<td>8</td>
<td>wall and Joint mortar</td>
<td>ZU QMA 03 R 0072 W 0153</td>
</tr>
<tr>
<td>13</td>
<td>wall and joint mortar</td>
<td>ZU QMA 03 R? W 131/132</td>
</tr>
<tr>
<td>14</td>
<td>wall and Joint mortar</td>
<td>ZU QMA 03 R 0072 W 0153</td>
</tr>
<tr>
<td>9</td>
<td>Sand 1</td>
<td>EP 04</td>
</tr>
<tr>
<td>10</td>
<td>Sand 2</td>
<td>EP 04</td>
</tr>
<tr>
<td>11</td>
<td>Sand 3</td>
<td>EP 04</td>
</tr>
<tr>
<td>12</td>
<td>Plaster from south tower</td>
<td>EP 04</td>
</tr>
<tr>
<td>15</td>
<td>soil mortar P 1.32</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td>„soil“</td>
<td>close to city wall and tower 8</td>
</tr>
</tbody>
</table>

From the results in table 1 it is evident that the wall and joint mortars (samples 6, 7, 8, 9, and 10) accumulate appreciable amounts of sodium chloride by and by. The accumulated salts will eventually deteriorate the strength of the mortar by the processes mentioned above. Therefore it is of utmost importance to prepare the mortars with salt-free materials. That the accumulation of salt in salt-free mortars takes some time is indicated by the data for the samples 9, 10, and 11. These are samples from the quartz sand which was used to cover the plaster floor of a room in the palace compound at EP 04. In the course of 6 - 8 month average amounts of 0.44 mass% chloride and 0.23 mass% sulfate have accumulated in the sand. Given a much lower permeability of the mortar than of a loose sand layer it can be estimated that the accumulation of considerable amounts of salt in a mortar will take at least 4 – 5 years. On the other hand, if salt-containing sand (sample 21 in table 1) is used for the preparation of mortar its salt content (sample 15 in table 1) will be right from the start as high as it will be after several years of accumulation. Therefore the pleading for the use of salt-free building materials is not based on the idea that the mortar will stay salt-free but rather on the idea of having it almost salt-free for at least one year during which it can develop undisturbedly the strength which it will need to sustain the salt attack for at least 10 years.

Salt attack will not take place equally at the exposed walls. It is to be expected most effectively at the foot zone due to the capillary rise of brines from the soil. With respect to weathering also the physical effect of wind abrasion plays an important role. Therefore the geographical direction of the exposure of a wall will have an effect on the longevity of mortars and renders. Render on luv walls is supposed to have a higher physical weathering rate due to the abrasive wear by sand particles than on lee walls.

The meticulous documentation and observation of test walls with different mortars in terms of weathering and deterioration will lead to an optimization of building materials and techniques.
2. Investigation of particular mortars

Special attention was paid to two mortar samples in connection with repair work at Al Zubarah fort and with the plastering of the walls at EP 04 and the city wall between the towers 8 and 9.

2.1 Mortar for the roof of Al Zubarah fort

The test slabs made by Kenneth were inspected on the 16th of January 2012, together with Owain Evans and Moritz Kinzel. The test outcome was very mixed and at least three different results could be observed (figure 2)

Figure 2: Lime concrete test slab (above) with different states of aggregate/matrix fabric
A quick on-site evaluation of the results led to the following statements:

1. A better compaction of the lime concrete is needed in order to avoid the formation of large voids.

2. To minimize the amount of free pore space it is necessary to blend the dolomite aggregate (maximum grainsize diameter: 8 mm) with a sand with a higher proportion of fine grains.

Samples of the old OPC concrete and the new hardened lime concrete (figure 3) were taken for the determination of the bulk density, compressive strength, and Young’s modulus. The results of the tests are summarized in table 2.

Table 2: Physical properties of aggregate and hardened lime concrete

<table>
<thead>
<tr>
<th>Material</th>
<th>bulk density [g/cm³]</th>
<th>compressive strength [N/mm²]</th>
<th>Young’s modulus [kN/mm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>quartz sand</td>
<td>1,72</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dolomite aggregate</td>
<td>1,56</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>lime concrete</td>
<td>1,76</td>
<td>3,3 / 2,8</td>
<td>4,7</td>
</tr>
<tr>
<td>OPC concrete</td>
<td>&gt; 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3: Old OPC (left side) and new lime concrete

Samples of the dolomite aggregate and quartz sand were taken for the determination of the bulk density and the grain size distribution (gsd) (figure 4).
Figure 4: Histogram and grain size distribution of quartz sand, dolomite aggregate and a 3 to 4 mixture of these
Conclusions

On-site observations and test results lead to the following recommendations:

1. As the grain size distribution of the dolomite is rather uniform the packing of the dolomite fragments will always result in a highly porous structure as shown in picture 2 of figure 1. In order to minimize the open pore space the dolomite aggregate should be mixed with quartz sand which exhibits a much more even grain size distribution. The best result with respect to the Fuller curve describing the ideal grain size distribution will be achieved by mixing 4 volume parts of dolomite aggregate with 3 volume parts of quartz sand. Such a mixture will yield a darker, more yellowish-grey colour of the lime concrete. **Maybe the resulting colour is more pleasing than the offensive white colour of the present lime concrete.**

2. The compressive strength of the tested samples falls behind the expected value of 7 – 8 N/mm². Although the tested samples (4 x 4 x 4 cm³ cubes) had not developed the final strength as a result of complete carbonatization of portlandite it is not to be expected that it will eventually exceed 5 N/mm² very much if at all. This may still be acceptable. However, a further reduction of binder to aggregate ratio from 1:3 to 1:3.5 is not recommendable. Depending on the outcome of the compressive strength tests on the samples still kept at the fort it might even be advisable to increase the WOPC content in the binder mixture from 1:3 to 1:5 : 2.5. **[As far as I am informed there ist no NHL in Qatar available. Was the imported Otterbeiner Hydradur NHL 5 used as binding component or was it the white hydrated lime ? This point needs clarification. The bright white colour and the comparable low strength of the lime concrete let me think that hydrated lime was used instead of NHL.]**

3. According to information given by Kenneth the best result with respect to the fabric of the lime concrete (picture 3 in figure 1) was obtained with a mixture containing 5 volume parts quartz sand, 9 volume parts dolomite aggregate, 1 volume part OPC, 3 volume parts hydrated lime (?) and 2.2 volume parts water. **Therefore I recommend that the water to binder ratio should be fixed at 0,55.** If the mixture is too dry (water to binder ratio = 0,45) it is hardly workable and the aggregate particles will not settle properly.

4. Compaction of the lime concrete is an absolute must. Kenneth knows about it and has proposed to build a suitable tool for manual compaction.

5. The maximum load put on to the lime concrete slab in a sort of on-site bending tensile strength test did not reach a critical value. Evaluating the data (**table 3**) and fotograffs (**figure 5**) supplied by Moritz the maximum bending force did not exceed 0,013 N/mm² which is far beyond the value of $f_{32} \sim 0,16*2,8$ N/mm² = 0,45 N/mm² where fracture may occur. Therefore the question arises what was the intention of the test?

### Table 3: Data of on-site bending tensile strength test

<table>
<thead>
<tr>
<th>mass [kg]</th>
<th>no. of sacks</th>
<th>load [N]</th>
<th>area [mm²]</th>
<th>force [N/mm²]</th>
<th>flexure [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>100</td>
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<td>981</td>
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<td>6377</td>
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<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>
Epilogue

As set out in point 2 of the conclusions the test slab was made with hydrated lime instead of natural hydraulic lime. The actual execution of the work was done with Otterbeiner NHL 5 and a change in the composition of the aggregate was made as set out in point 3 of the conclusions.

2.2 Characterization of the white ordinary Portland cement (WOPC)

Mortar for the stabilisation and reconstruction work of the walls in Al Zubarah city should fulfil the following requirements:

- rapid development of initial strength
- resistance to the chemical attack by sulfates and chlorides
- colour that fits the stonework
- easy availability in Qatar
The natural hydraulic lime mortar Otterbeiner Hydradur NHL 5 fulfils the first three requirements but is unhappily not available in Qatar. The last point being a crucial issue made it necessary to look for an adequate substitute. The general idea was to create an artificial "natural hydraulic lime" by mixing appropriate amounts of hydraulic lime and ordinary Portland cement OPC which are available in Qatar. The search yielded three products: hydrated lime (HL), Portland cement with a high resistance to sulphate attack (PC-SR, with a C3A content lower than 3 wt.%), and white ordinary Portland cement (WOPC). Laboratory experiments carried out in Naumburg with HL and Schwenk PC CEM 42.5R SR showed that an artificial "natural hydraulic lime mortar" with almost identical properties with respect to strength and resistance to sulphate attack can be mixed from HL and PC-SR, the volume ratio varying between 3:1 and 4:1 (HL:PC-SR) (figure 6).

However, tests carried out in Al Zubarah with PC-SR showed that the colour of the resulting mortar was intolerable dark. Therefore PC-SR was replaced by WOPC with very good results as far as the mortar colour was concerned.

The binding materials HL and WOPC were analysed by X-ray diffractometry and X-ray fluorescence spectroscopy in order to establish the chemical and phase composition. It turned out that the HL consists entirely of portlandite Ca(OH)$_2$ and the WOPC of the cement clinker minerals haematite, larnite, and tricalciumaluminate (C3A) portlandite and calcite (figure 7).

Tricalciumaluminate can be a dangerous component in the presence of sulphate and water because it can react with these two compounds to form ettringite and/or thaumasite which will eventually destroy the mortar. Therefore it was necessary to determine the absolute content of C3A in the WOPC and to test the behaviour of a WOPC-containing mortar in contact with sulphate (gypsum) and water. The test was carried out with the so-called soil mortar P 1.32 with sulphate content of just 0.82 wt.\%.

Figure 6: X-ray diffractometry of mortar mixtures with HL and PC-SR as a substitute for NHL
The chemical analysis showed that the C$_3$A content is as high as 11.6 mass % (table 4) which can lead to problems if WOPC is used in sulphate-rich environments due to the formation of ettringite and/or thaumasite.

Table 4: Chemical and phase composition of WOPC

<table>
<thead>
<tr>
<th>Chemical composition</th>
<th>Phase composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na$_2$O</td>
<td>C$_3$S 48.5*</td>
</tr>
<tr>
<td>K$_2$O</td>
<td>C$_2$S 29.2*</td>
</tr>
<tr>
<td>MgO</td>
<td>C$_3$A 11.6*</td>
</tr>
<tr>
<td>CaO</td>
<td>C$_3$(A,F) 0.5</td>
</tr>
<tr>
<td>Al$_2$O$_3$</td>
<td>Calcite 4.90*</td>
</tr>
<tr>
<td>Fe$_2$O$_3$</td>
<td>Portlandite 2.21*</td>
</tr>
<tr>
<td>Cr$_2$O$_3$</td>
<td>Anhydrite 3.13</td>
</tr>
<tr>
<td>SiO$_2$</td>
<td>Sum 100.04</td>
</tr>
<tr>
<td>TiO$_2$</td>
<td></td>
</tr>
<tr>
<td>SO$_3$</td>
<td></td>
</tr>
<tr>
<td>LOI (H$_2$O, CO$_2$)</td>
<td>3.00</td>
</tr>
<tr>
<td>Sum</td>
<td>99.86</td>
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These two phases are the reaction products of sulphate (gypsum) with aluminate (C$_3$A) and/or silicate (CSH) in the presence of abundant water and carbonate (calcite) and have the nasty capacity to damage masonry severely. The damage process is effected by a considerable increase in the molar volume of the reaction products over the starting materials which causes stress in the masonry and eventually its cracking.

To assess the risk of ettringite and/or thaumasite formation, a simple test in which a sample of “soil mortar” P 1.32 composition (2 volume parts HL, 1 volume part WOPC, 12 volume parts quartz sand + “soil”)) ran through several cycles of storage under water for 24 hours and subsequent drying was carried out.

Up to the 9$^{th}$ cycle no development of cracks occurred (table 5). However, by chance the sample remained in the water bath for 480 hours before it was taken out and dried again. This time several cracks had developed (figure 8) and the test was finished after the 10$^{th}$ cycle.
Table 5: Water compatibility test with “soil mortar”

<table>
<thead>
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<th>Date</th>
<th>Cycle</th>
<th>Length [mm]</th>
<th>Time [µs]</th>
<th>$v_p$ [km/s]</th>
<th>Mass [g]</th>
<th>$W_{Atm}$ [mass %]</th>
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<td></td>
<td></td>
<td>91,97</td>
<td>54.4</td>
<td>1.69</td>
<td>139.01</td>
<td>stored at ambient conditions</td>
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<tr>
<td>0</td>
<td>1</td>
<td>149.30</td>
<td>128.40</td>
<td>91.97</td>
<td>54.4</td>
<td>dried for 24h at 70 °C</td>
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<tr>
<td></td>
<td>2</td>
<td>149.06</td>
<td>122.76</td>
<td>54.4</td>
<td>54.4</td>
<td>dried for 24h at 70 °C</td>
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<td>3</td>
<td>149.08</td>
<td>123.34</td>
<td>54.4</td>
<td>54.4</td>
<td>dried for 24h at 70 °C</td>
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<td></td>
<td>4</td>
<td>91.97</td>
<td>91.97</td>
<td>149.13</td>
<td>91.97</td>
<td>dried for 24h at 70 °C</td>
</tr>
<tr>
<td>02.01.2012</td>
<td>5</td>
<td>148.93</td>
<td>123.28</td>
<td>91.97</td>
<td>91.97</td>
<td>dried for 24h at 70 °C</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>149.16</td>
<td>123.79</td>
<td>91.97</td>
<td>91.97</td>
<td>dried for 24h at 70 °C</td>
</tr>
<tr>
<td>07.01.2012</td>
<td>7</td>
<td>149.19</td>
<td>123.71</td>
<td>91.97</td>
<td>91.97</td>
<td>dried for 24h at 70 °C</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>149.33</td>
<td>123.58</td>
<td>91.97</td>
<td>91.97</td>
<td>dried for 24h at 70 °C</td>
</tr>
<tr>
<td>13.01.2012</td>
<td>9</td>
<td>150.20</td>
<td>125.60</td>
<td>91.97</td>
<td>91.97</td>
<td>dried for 24h at 70 °C</td>
</tr>
<tr>
<td>02.02.2012</td>
<td>10</td>
<td>152.13</td>
<td>125.60</td>
<td>91.97</td>
<td>91.97</td>
<td>dried for 24h at 70 °C</td>
</tr>
</tbody>
</table>

Figure 8: Sample “soil mortar” P 1.32 after 9 cycles in the water compatibility test

Material from the crack surfaces was scratched off and investigated by X-ray diffractometry and the formation of thaumasite confirmed (figure 9).
A possible explanation of the test result is that the short-term exposure of the “soil mortar” to water and the subsequent rapid drying may not be sufficient to trigger the ettringite and/or thaumasite reaction whereas long-time saturation with water leads to their formation and consequently to the cracking of the mortar.

The test result shows that the risk of ettringite and/or thaumasite formation has to be taken seriously and makes it necessary to consider where conditions of long-time contact between the mortar and water is given in the masonry of Al Zubarah and to act accordingly. As far as I am informed, no mortar containing WOPC is presently used for the stabilisation and reconstruction work of the foot zone of walls (the remaining Otterbeiner Hydradur NHL is used for this work.). But eventually we will run out of this material and it has to be replaced by something else. **By no means should WOPC-containing mortars be used for work in the foot zone of walls.** The search for alternatives to WOPC has to be continued.

**Epilogue**

With the help of the Material Science Unit of Qatar University an appropriate OPC which is available in Qatar will be found.

**2.3 Mechanical parameters of mortar samples 1.51 and 1.55 (according to list of P. Hofmann)**

In December 2011 the first mortar samples were cast into moulds in order to get mortar prisms with the dimensions 16 cm length, 4 cm breadth, and 4 cm height. The scope of mortar testing was enlarged by measuring the uniaxial compressive strength and Young’s modulus. **Figure 10** presents the two tested samples 1.51 (wall and repointing mortar) and 1.55 (render).
Before the samples were destroyed in the course of the compressive strength test they were used for measuring Young’s modulus by a method described by Erfurt and Krompholz (1996). With an ultrasonic wave generator longitudinal and quasi-longitudinal waves are excited in prismatic or rod-like samples. The measurement is recorded by an oscilloscope and the resulting oscillogram is evaluated with respect to the onset of the I-wave and the resonance frequency of the sample (figure 10). Young’s modulus is equal to two times the product of sample length, sample density and resonance frequency.

![Oscillogram of ultrasonic measurement](image1.png)  
![FFT evaluation of frequency spectrum](image2.png)  

Figure 10: Mortar samples 1.51 and 1.55

The test results for the mortar samples 1.51 and 1.55 are summarized in table 6.

### Table 6: Mechanical parameters of mortar samples 1.51 and 1.55

<table>
<thead>
<tr>
<th>Sample</th>
<th>Length [cm]</th>
<th>Resonance frequency [kHz]</th>
<th>Density [g/cm³]</th>
<th>(v_p) [km/s]</th>
<th>Young’s modulus [N/mm²]</th>
<th>Compressive Strength [N/mm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortar 1.51</td>
<td>16,0</td>
<td>4,883</td>
<td>1,79</td>
<td>1,781</td>
<td>4,42</td>
<td>1,8</td>
</tr>
<tr>
<td>Mortar 1.55</td>
<td>16,0</td>
<td>4,883</td>
<td>1,76</td>
<td>2,13</td>
<td>4,36</td>
<td>3,2</td>
</tr>
</tbody>
</table>

2.4 Analyses of plasters from the old village Jumail

Bernadeta Schäfer from the team surveying the old villages NE of Al Zubarah handed in two plaster samples from buildings in Jumail for the investigation of the binding material and the general composition. Both samples were analyzed by X-ray powder diffraction and optical microscopy of thin sections. The results are documented in figure 12.
The white and 7 mm thick render on a beachrock (upper sample in figure 11) is coated by a thin brownish paint layer and based on anhydrite as principal binding material. In the top view photograph are two fibres recognizable which were probably used as reinforcement of the plaster. The aggregate consists of shell debris (aragonite) and quartz grains. The pure (magnesium-free) calcite is most probably a part of the binding material (anhydrite mortar with addition of lime). The thin section shows that the fabric of the mortar is much less porous than the underlying beachrock in which large blue-dyed pores stand out clearly against the dark matrix formed by loosely cemented shell debris.

This white render must not be mixed up with a white render underneath a yellow grey render at Al Zubarah fort which is a lime-based render.

The yellow grey and up to 15 mm thick render on a beachrock was prepared with lime as binding material. The aggregate consists of crushed shells or beachrock (aragonite, Mg calcite) and some dolomite and quartz. There is also a little bit of gypsum present in the sample but it is assumed that it is of secondary rather than of primary origin. The fabric of the lime-based render is characterized by a loose packing of aggregate grains stabilized by calcite cement and pores in between the matrix-forming particles. The pores have about the same size as the matrix particles and add up to 40 – 45 volume percent porosity.
3. Production and application of anhydrite plaster in Al Zubarah

According to the local building tradition the walls of buildings at Al Zubarah were internally and externally coated with gypsum plaster (figure 13).

![Figure 13: Decorated wall plaster, South Field, Room 005 Wall c](image1)

The raw material for the preparation of the plaster, namely gypsum, is ubiquitous on the peninsula of Qatar. Especially in the vicinity of Al Zubarah gypsum, related to the sabkha facies, can easily be collected. The excavations at Freyha led to the discovery of a double chamber construction which is regarded as a small kiln for the burning of gypsum (figure 14).

![Figure 14: Double chamber construction at Freyha excavation site](image2)
The conservation of architectural remains of Al Zubarah city should be done as authentically as possible and therefore anhydrite plaster must play an important role in this work. Anhydrite plaster had been produced by QMA in the past but the plant is not working at the moment. Therefore the whole process from the burning of gypsum to the application of the anhydrite plaster to a test wall in the North Field was carried out in a sort of experimental archaeology project. The experiments started in January 2012 with a small and simple device for the burning of gypsum in order to study the efficiency of the process and to get samples for the X-ray diffraction analysis of the reaction products.

The first device consisted of an about 35 cm long steel tube with an inner diameter of about 6 cm which was closed at the bottom with a wire mesh. The mesh width was about 5 – 8 mm. To keep the tube in an upright position three supporting legs were welded on the outer surface at 120 ° distance. The legs were made long enough to put a gas burner under the wire mesh at the lower end of the tube. The tube was filled with a mixture of gypsum and charcoal crushed to the size of a hazelnut. The ratio of gypsum to charcoal pieces was about 3 to 5. The ignition of the charcoal lying on the wire mesh was achieved by the gas burner under the tube. To enforce the smouldering of the charcoal above the bottom layer compressed air was gently blown through the wire mesh at the bottom (figure 15). A complete burning out of the filling required about half an hour.

![Figure 15: Tube-like experimental kiln for the burning of gypsum](image)

After burning out the filling was taken from the device in three consecutive zones I - III. The gypsum pieces of zone I were completely white after the burning and could easily be crushed between the fingers. A part of this white material was mixed with water and cured to a grey-yellowish, hard mass barely scratchable by a fingernail (figure 16). The grey-yellowish colour is due to the admixture of charcoal particles to the anhydrite powder.

The raw gypsum, the firing products of each zone and the hardened anhydrite mortar were investigated qualitatively by X-ray diffraction (figure 17). The samples were labelled as A_00 raw gypsum, A_01 tube filling from zone I, A_01 02 tube filling from zone I in a second experiment, A_02 tube filling from zone II, and A_03 hardened anhydrite mortar. Table 7 summarizes the results. The phases in the system CaSO₄ – H₂O are compiled in table 8.
Table 7: Phase compositions of raw material, firing products, and hardened anhydrite plaster sample

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Phase composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A_00</td>
<td>raw material</td>
<td>gypsum with a trace of calcite</td>
</tr>
<tr>
<td>A_01</td>
<td>material from kiln zone I</td>
<td>anhydrite, calcite, quartz, bassanite</td>
</tr>
<tr>
<td>A_01 02</td>
<td>material from kiln zone I</td>
<td>anhydrite, lime, quartz</td>
</tr>
<tr>
<td>A_02</td>
<td>material from kiln zone II</td>
<td>gypsum</td>
</tr>
<tr>
<td>A_03</td>
<td>hardened anhydrite mortar</td>
<td>gypsum, anhydrite, calcite, quartz</td>
</tr>
</tbody>
</table>

An interpretation of the phase identification by X-ray diffraction runs as follows:

1. The raw gypsum used was fairly pure due to careful elimination of adhering impurities. Only traces of calcite were identified.

2. The phase assemblage of sample A_01 contained no more gypsum which means that a complete conversion of gypsum to anhydrite was achieved. Traces of bassanite indicate that the firing temperature at the upper end of zone I did not exceed 150 – 180 °C. Most probably part of the anhydrite obtained is of modification III. The presence of calcite indicates that the temperature nowhere in Zone I exceeded 800 °C.

3. The phase assemblage of sample A_01 02 contains also anhydrite as the principal phase. However, there are no more traces of bassanite and calcite. Instead lime (CaO) occurs as a new phase. This result shows that with an improved ventilation temperatures above 800 °C can be achieved. The anhydrite in this phase assemblage will be of modification II.

4. Sample A_02 shows that in the first experiment the temperature in zone II was not high enough to transform gypsum either to bassanite or anhydrite.

5. The hardened anhydrite mortar consists mostly of gypsum and contains little anhydrite. The curing process of the self-made anhydrite mortar produced much better results than the trials with commercial products from the Suedharzer Gipswerke GmbH.
Table 8: Phases in the system CaSO₄ – H₂O

Natural gypsum – crystals of plate habit. Spatial structure of the compound comprises double layers of CaSO₄ divided by parallel double layers of water particles. Ca²⁺ ions in CaSO₄ layers are set alternately with SO₄ tetrahedrons. Crystalline water particles interact with Ca²⁺ ions and form hydrogen bonds with oxygen atoms of SO₄²⁻ groups. Weak reaction between water particles in the layers is the reason for perfect cleavage of raw gypsum in this plane.

Gypsum hemihydrate has two well-soluble variations: alpha and beta. α-hemihydrate – obtained during calcination in steam atmosphere; columnar crystals. β-hemihydrate – obtained in dry calcination; crystals of no clear habit, plate-shaped aggregates of fibrous or scaly structure are formed. Both forms have crystal lattice identical with that of gypsum dihydrate. β variation, due to a larger specific surface, dissolves more easily and thus binds faster, but its products have lower strength compared to α-made ones.

Anhydrite III – occurs in two variations, α and β, retaining the crystal structure of gypsum hemihydrate. When in humid air, it absorbs water from the environment; highest solubility in water among all described here sulphates. Further heating of anhydrite III causes the transformation of its crystal structure (the distance between lattice points is reduced) into anhydrite II structure.

Anhydrite II – identical with natural anhydrite. Crystal structure of the compound is similar to NaCl. SO₄²⁻ ions are clustered and spaced uniformly with Ca²⁺ ions in all directions. Such structure makes anhydrite II the strongest among all gypsum types, of the highest specific density and sparingly soluble. Crystals are prism-shaped (Fig. 9.3). Comparison of anhydrite II with gypsum dihydrate reveals a weakening influence of crystalline water on gypsum crystal structure, and thus, on mechanical properties of the material.

Estrich gypsum (anhydrous gypsum plaster) is formed in a partial decomposition of CaSO₄II → CaO + SO₂ · ½ H₂O₂.

With the experience of the first experiments a second tubelike kiln with a volume almost ten times larger than the first one was built. It had a height of 51 cm and an inner diameter of 15,5 cm. Instead of blowing compressed air into the kiln the necessary draught for the combustion of the charcoal was achieved by mounting a 150 cm long funnel on top of the kiln (figure 18).

The experiments with the larger kiln were used for balancing the input and output of materials. The kiln was charged with 1547 g charcoal and 2243 g gypsum. After the burning a total of 1608 g burnt gypsum was handpicked from the filling which corresponds to 90,7 % of the theoretical yield (figure 19). However, it has to remarked that this excellent result is due to the small scale operation of the gypsum burning with the raw material carefully selected by hand (figure 20).

Material from the different kiln zones was again analysed by X-ray diffraction in order to check the internal temperature by the phase assemblages (table 9, figure 21). The burnt gypsum from two runs (3641 g) was used for the plastering of a 30 x 70 cm² test area at the wall of a building in the North Field (figure 22).
Figure 17: Reaction products of gypsum burning and anhydrite plaster hardening with small kiln and the use of compressed air

Figure 18: Large kiln with funnel mounted on top
Figure 19: Kiln filling from the transition of zone III (left) to zone II

Figure 20: Selecting, weighing and sieving of raw material

Table 9: Phase compositions of raw material, firing products, and hardened anhydrite plaster sample

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Phase composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-01</td>
<td>material from kiln zone I</td>
<td>anhydrite</td>
</tr>
<tr>
<td>B-02</td>
<td>material from kiln zone II</td>
<td>anhydrite</td>
</tr>
<tr>
<td>B-03</td>
<td>material from kiln zone III</td>
<td>bassanite, dolomite</td>
</tr>
<tr>
<td>B-04</td>
<td>anhydrite mortar for plastering</td>
<td>anhydrite, bassanite</td>
</tr>
<tr>
<td>B-05</td>
<td>hardened anhydrite mortar</td>
<td>gypsum, anhydrite</td>
</tr>
</tbody>
</table>
The interpretation of the phase identification by X-ray diffraction is as follows:

1. The gypsum lumps in the zones I and II (B-01 and B-02) were completely transformed to anhydrite.

2. The gypsum in zone III (B-03) was transformed to bassanite. This means that the temperature at the upper end of the kiln did not exceed 100 – 120 °C.

3. The material used for the plaster sample at the test wall in the North field (B-04) was a mixture of anhydrite and bassanite.

4. Of the two reactive components of the plaster mortar bassanite reacted completely and anhydrite partly with water to form gypsum. The findings by X-ray diffraction analysis were corroborated by the optical microscopy of a thin section of the hardened gypsum plaster (figure 23).

The principal difference in the results of experimentation with the two kilns was that the injection of compressed air led to a quick combustion of the charcoal at high temperatures while the combustion supported by the draught due to the funnel took place at lower temperatures and lasted much longer. The temperature profile was very steep in both cases with a hot zone (I) at the bottom and a fairly cold zone (III) at the top of the kiln. The presence of bassanite in zone III of the large kiln, however, showed that this zone was hotter than the corresponding zone III in the small kiln which contained unaltered gypsum.

The results of the test production and application of anhydrite mortar are very encouraging. It should be possible to transfer the experience to a plant which is big enough to produce sufficient amounts of anhydrite which can be used as plaster mortar. In cooperation with the Materials Science Unit at Qatar University a quality control programme could be installed.

![Figure 21: Reaction products of gypsum burning in the large kiln and gypsum plaster from the test wall in the North Field](image)
Figure 22: Gypsum plaster at test wall in the North Field

Figure 23: Thin section photographs of gypsum plaster shown in figure 16  
Top: plane-polarized light, bottom: crossed nicols
4. Consolidation test on gypsum plaster with Xilan

Tests for the consolidation gypsum plaster with a flaky surface were performed with Xilan® (Consolidas Kunst und Kulturgut GmbH Alte Ziegelei 96110 Schesslitz) which is a mixture of two functionalized silanes in ethanol as solvent. The amine-functionalized alkyltrialkoxyxilane component 1 (APTS) and the epoxy-functionalized alkyltrialkoxyxilane component 2 (GLYMO) react after the evaporation of the solvent in a first step with the elimination of alcohol and the formation of Si-O-Si bonds in a 3D silicate network. Simultaneously, the reaction of APTS (or the OH- ions formed in the presence of water) with GLYMO leads to the formation of chains in the form of oligo(polyether) structures of the epoxy-functionalized component. The reaction mechanisms of the components at the pore walls include the condensation of the Si(OR)₃ groups as well as the reaction of the amine group with transition metal ions in the rock. The optimal consolidation requires a perfect interplay of all the reaction steps and mechanisms which are controlled by the composition of the consolidation fluid and the conditions of evaporation of the solvent ethanol.

Prior to the application in the field tests with Xilan® were made in the laboratory. The consolidation fluid was applied to the surface of the gypsum plaster samples with a hypodermic syringe as long as the fluid was sucked into the porous structure. The effect of consolidation was monitored by measuring the ultrasonic velocity of the sample before and after the treatment. The consolidation effect is positively correlated with an increase of the ultrasonic velocity (table 10).

Table 10: Ultrasonic velocities of gypsum plasters before and after treatment with Xilan®

<table>
<thead>
<tr>
<th>Sample 1</th>
<th>Length [mm]</th>
<th>Time [µs]</th>
<th>(v_p) [km/s]</th>
<th>Mass [g]</th>
<th>Quantity [kg/m²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction 1 before treatment</td>
<td>49.32</td>
<td>20.0</td>
<td>2.47</td>
<td>42.24</td>
<td>1.0</td>
</tr>
<tr>
<td>Direction 2</td>
<td>53.55</td>
<td>22.0</td>
<td>2.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01.01.12 after treatment</td>
<td></td>
<td></td>
<td></td>
<td>44.88</td>
<td></td>
</tr>
<tr>
<td>03.01.12</td>
<td>49.32</td>
<td>18.6</td>
<td>2.65</td>
<td>42.63</td>
<td></td>
</tr>
<tr>
<td></td>
<td>53.55</td>
<td>19.6</td>
<td>2.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample 2</td>
<td>Length [mm]</td>
<td>Time [µs]</td>
<td>(v_p) [km/s]</td>
<td>Mass [g]</td>
<td>Quantity [kg/m²]</td>
</tr>
<tr>
<td>Direction 1 before treatment</td>
<td>85.86</td>
<td>31.4</td>
<td>2.73</td>
<td>86.45</td>
<td>0.9</td>
</tr>
<tr>
<td>Direction 2</td>
<td>55.68</td>
<td>19.4</td>
<td>2.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07.01.12 after treatment</td>
<td></td>
<td></td>
<td></td>
<td>90.63</td>
<td></td>
</tr>
<tr>
<td>08.01.12</td>
<td>85.86</td>
<td>31.2</td>
<td>2.75</td>
<td>86.94</td>
<td></td>
</tr>
<tr>
<td></td>
<td>55.68</td>
<td>19.4</td>
<td>2.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample 3</td>
<td>Length [mm]</td>
<td>Time [µs]</td>
<td>(v_p) [km/s]</td>
<td>Mass [g]</td>
<td>Quantity [kg/m²]</td>
</tr>
<tr>
<td>Direction 1 before treatment</td>
<td>45.74</td>
<td>18.8</td>
<td>2.43</td>
<td>43.49</td>
<td>1.4</td>
</tr>
<tr>
<td>Direction 2</td>
<td>44.77</td>
<td>18.8</td>
<td>2.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07.01.12 after treatment</td>
<td></td>
<td></td>
<td></td>
<td>46.38</td>
<td></td>
</tr>
<tr>
<td>08.01.12</td>
<td>45.74</td>
<td>18.2</td>
<td>2.51</td>
<td>43.85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>44.77</td>
<td>18.0</td>
<td>2.49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results in table 10 underline the importance of a perfect interplay of all the reaction steps and mechanisms in order to obtain an optimum consolidation result. The treatment of sample 2 led to no increase of the ultrasonic velocity what can be interpreted either as a failed process or the selection of an inappropriate sample which needed no consolidation. The initially high ultrasonic velocities of this sample argue for the second possibility.
The colour of gypsum plaster surfaces treated with Xilan® is slightly darker than the original one (figure 23).

Figure 24: Gypsum plaster surface before (left) and after treatment with Xilan®. Note the slightly darker colour of the treated sample.

Figure 25: Consolidation test with Xilan® at wall plaster (gypsum) in room with mastaba at EP 04
A field test with Xilan® was carried out on the right wall (seen from the entrance) of a room with a mastaba (date press) at EP 04. The gypsum plaster was crumbly and flaky and the surface definitely required a consolidation. Xilan® was mixed at the camp from the two components which were brought to Al Zubarah personally. [The personal transport of Xilan® is not recommended as the standard procedure of importation because the accompanying person runs a high risk of either being requested strongly by the carrier to leave the fluid containers behind or getting problems with security authorities. Although the components are not highly inflammable they are definitely not harmless chemicals and should be treated with appropriate care.]

The application of Xilan® to the wall took place in the evening hours (4.30 – 5.30 pm) and was done with a brush because a fitting spray bottle was not available. The outdoor temperature was 27 °C. The photo collage in figure 25 shows that the ethanol evaporated within less than 1 hour although there was still a faint odour of ethanol perceivable on the next day. About one hour after the application of Xilan® a fine drizzle of water was sprayed on the test area. Since the author of this report left Al Zubarah two days after the test a rating of the result would be too early now and will be done at the end of may 2012. However, a haptic test of the surface on the next day gave the impression that no particles were removed by moving a finger over the flaky surface. The environmental conditions for a successful application of Xilan® are undisputedly better in a restorer’s workshop than at the excavation site.

5. Delivery and installation of analytical equipment for on-site laboratory

In January 2012 some laboratory equipment comprising a pair of scales and a device for measuring the electrical conductivity and total dissolved solids (TDS) of aqueous solutions together with test strips and chemicals for determining the sulphate, nitrate, and chloride contents of building material samples were brought to the camp at Al Zubarah. Paul Hofmann and Karl were instructed by Robert Sobott how to use the equipment and to evaluate the measured data (figure 26).

6. Identification of rocks and objects made of stone in the find magazine

Among the many objects which were found at the various excavation places is a fairly large number of tools and commodities which were made of stones that are not to be found on the peninsular of Qatar. To these objects belong diving weights (figure 27) which are made of hematite-magnetite ore, metamorphosed peridotite, barite (figure 28), and other not yet identified stone materials. Since these rocks do not occur in Qatar they must have been imported to Al Zubarah. Potential sources from a petrographical-mineralogical point of view are Iran (barite, hematite-magnetite, ultrabasic rocks) and Oman (peridotite, ultrabasic rocks). The tracing of the points of origin of these special rocks would contribute to the understanding of trade routes and relations of the people of Al Zubarah with neighbouring countries.
Figure 27: Stone diving weights made of different materials. From top left clockwise:
(1) unidentified rock material, (2) hematite-magnetite-(goethite), (3) barite-dolomite,
(4) partly metamorphosed peridotite (olivine, lizardite)
Figure 28: X-ray diffractograms of stone diving weights 2 – 4 in figure 26
The collection of „odd stones“ also comprises a lump of dolomite (figure 29) which is speckled by black and green dots which turned out to be tenorite (black copper(II) oxide) and atacamite, Cu$_2$(OH)$_3$Cl. The two copper minerals are oxidation minerals of primary copper (I) sulphide, chalcocite Cu$_2$S. The peculiar rock is nothing less than a low-grade copper ore! And again, it would be most interesting to have an answer to the questions where does it come from and what was it used for?

Figure 29: X-ray diffractogram (EU EP 02 Loc. 6285 SP 45 CAT 1239)
Apart from the diving weights and odd stones other objects made of stone were looked at and, whenever possible, identified (table 11). In some case the identification was supported by X-ray diffraction analysis.

### Table 11: Stone objects in the find magazine

<table>
<thead>
<tr>
<th>No.</th>
<th>CAT No.</th>
<th>Area</th>
<th>Locus</th>
<th>Space</th>
<th>Find Object</th>
<th>Material</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1003</td>
<td>ZU EP 01</td>
<td>1853</td>
<td>1</td>
<td>limestone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1004</td>
<td>ZU EP 01</td>
<td>1714</td>
<td></td>
<td>hematite</td>
<td></td>
<td></td>
</tr>
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Other interesting samples were the green and blueish oxidation products on a copper coin and a small piece from the remnants of supposed leather bag which contained a mixture of a yellow earth and fine-grained gold-glittering particles.

The X-ray diffractogramm in figure 30 shows that the principal oxidation product on the copper coin is green orthorhombic atacamite, the divalent basic copper chloride $\text{Cu}_2(\text{OH})_3\text{Cl}$. The blueish oxidation product turned out to be chalconatronite, $\text{Na}_2\text{Cu}[(\text{CO}_3)_2]3\text{H}_2\text{O}$. Monovalent red copper oxide, $\text{Cu}_2\text{O}$ (cuprite), is the primary oxidation product which reacts with seawater containing sodium chloride and dissolved carbon dioxide and oxygen to atacamite and chalconatronite.

$$2.5\text{ Cu}_2\text{O} + (4.5\text{ H}_2\text{O} + 0.5\text{ O}_2 + 2\text{ CO}_2) + 2\text{ NaCl} \rightarrow \text{Na}_2\text{Cu}[(\text{CO}_3)_2]3\text{H}_2\text{O} + 2\text{ Cu}_2(\text{OH})_3\text{Cl}$$

It is interesting to note that $\text{Cu}_2(\text{OH})_3\text{Cl}$ occurs in three modifications with different crystal structure. The other two minerals are paratacamite (trigonal) and botallackite (monoclinic). In an environment dominated by sulphate instead of chloride ions the occurrence of green brochantite, $\text{Cu}_4[(\text{OH})_6]\text{SO}_4$, and green antlerite, $\text{Cu}_3[(\text{OH})_4]\text{SO}_4$, could be expected.

The investigation of the contents of the leather bag (figure 31) proved that the fine-grained gold-glittering particles were pyrite, $\text{FeS}_2$, and that the yellow earth consisted of gypsum and jarosite, $\text{KFe}_3[(\text{OH})_6]\text{SO}_4$. According to the EDX analysis the jarosite contains practically no sodium and is a jarosite proper and not a natrojarosite ($\text{Na}_x\text{Fe}_3[(\text{OH})_6]\text{SO}_4$).

The SEM investigation of a sample with the yellow earth attached to the remnants of leather (?) yielded a fibrous structure for the supposed organic material. The jarosite shows small rhombohedral crystals with about 10 µm long crystal edges.
Figure 31: Samples 1 + 2 ZU EL 02 Locus 6834 (Contents of a leather bag)
Top left: Sample 1 (yellow earth and remnants of leather (?) (dark patches of the sample). Top right: SEM photograph of dark patches with fibrous structure. Middle left: Aggregated jarosite crystals and gypsum. Middle right: Rhombohedral jarosite crystals. Bottom left: X-ray diffractograms of samples 1 and 2. Bottom right: EDX diagram of jarosite (Au coated).
Figure 32: Top: Different finds of bitumen from Freya. Bottom: Distribution of aliphatic hydrocarbons
In the collection of finds are vessels and vessel fragments which are partly coated with bitumen (figure 32). Parts of the Al Zubarah city area are littered with lumps of bitumen that were washed ashore in the wake of the Gulf War oil spill. Superficially looked at there is little difference in the appearance of archaeological bitumen and recent bitumen from the oil spill. Three archaeological bitumen samples from Freya (FR EP 04 585, FR EP 04 215, FR 0x) and a piece of recent bitumen (REF) from a spoil heap in the vicinity of Al Zubarah EP 04 were analysed by gas chromatography with respect to aliphatic (AH) and polycyclic aromatic hydrocarbons (PAH). It was expected that recent bitumen contains distinctly more and lighter AH and PAH than archaeological = old bitumen. However, as the results presented in table 12 prove this was not the case: the fractions of lighter AH (C10 – C20) and the total amount of PAH were both higher in the archaeological samples. Obviously, the general idea that archaeological and recent bitumen could easily be distinguished by chemical analysis is too simple because it assumed that the starting material had the same or at least a very similar composition before the onset of degradation and that the degradation process took place under similar conditions.

Table 12: Aliphatic and polycyclic aromatic hydrocarbon contents in archaeological and recent bitumen samples

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7. Cooperation with Materials Technology Unit of Qatar University

A link to the Materials Technology Unit of Qatar University has been established. The managing partner on the MTU side is Dr. Mariam A. Al-Maadeed, Head of the Materials Technology Unit, Office of Research. They can assist us with the testing of physical parameters of mortars and the acquisition of appropriate binding materials. There is also a direct cooperation between Dr. Al-Maadeed and the author in the publication of chemical data of pottery sherds from the excavation sites Halat Aobeer and Hazem Al-Jasrah, Qatar.
8. Outlook

8.1 Documentation of changes in the state of walls as a function of time

The photographic documentation of walls in different states of preservation and geographical orientation over time is a very effective method to get an idea about the rates and mechanisms of decay. Figures 33 and 34 show that the collapse of wall plaster at different sections of wall c in room 5 depends very much on the state of the wall behind the plaster. If the substrate is no longer consolidated and if there is no more bonding between wall and plaster then there exists a state of metastable to instable equilibrium and the plaster may drop any moment. Figure 35 demonstrates that a strongly decayed wall can persist in this state for a considerable time.

Figure 33: Loss of wall plaster at wall c, room 005, South Field
Figure 34: Loss of wall plaster at wall c, room 005, South Field

Figure 35: Loss of wall plaster at wall c, room 006, South Field
8.2 Consolidation of gypsum wall plaster

The wall plaster plays an important role as sacrificial layer in order to preserve the wall structure behind it. The decay of a wall will always begin with the decay and collapse of the wall plaster. Therefore the consolidation of existing wall plaster which is predominantly a gypsum wall plaster and the renewal of plaster where it has been lost is of utmost importance for the preservation of the wall structures.

To keep the architecture of Al Zubarah city as authentic as possible it is necessary to conserve as much of the original gypsum wall plaster as possible. Basically, there are three states to be considered and handled:

1. The plaster has no or only minor damages (detachment of gypsum flakes) and is well bonded to the wall (stable state).
2. The plaster has a more or less strongly eroded surface, exhibits deep fractures and small holes, but still preserves a weak bonding to the wall (metastable state).
3. The plaster is in a ruined state, broken into several, more or less coherent pieces, some of which are missing while the rest are largely detached from the wall (instable state). In this case not only the plaster is in ruined state but also the wall or what is left of it.

The decision whether state 2 or state 3 is present cannot be made by visual inspection alone. In order to find out to what degree the plaster is detached from the wall careful percussion tests should be made. The result of the evaluation should be documented in a map or photograph and the conserving strategy planned accordingly.

The first or stable state requires little or no attention at all. If necessary a surface consolidation with either Xilan® or acrylic dispersion will be sufficient. Unfortunately this state is rather the exception and not the rule.

The second or metastable state can be mended by filling the cracks and holes and closing possible gaps between the plaster and the wall at the margins. If possible this repair work should be carried out with anhydrite mortar. If this material is not available a lime/natural hydraulic lime mortar will also do. Mortars containing OPC should by no means be used for this work. A surface consolidation may finish the job.

The third stage is a real challenge to any conservator. Before the work starts it must be decided if it is really worth the effort to preserve the much dilapidated plaster or if the effect of a wall with a seemingly authentic surface can be achieved by less elaborate means. If the decision is made in favour of restoration/conservation the first step will be the careful detachment of the plaster from the ruined wall. The repair of the wall, especially the creation of a consolidated surface is the second step. After that the plaster pieces can be fixed to the wall again, preferably with anhydrite mortar. Cracks and holes are closed with mortar. This elaborate restoration work will most probably be restricted to walls with decorated plaster while less valuable plasters can be taken off and replaced by new plaster prepared in the old fashion with burnt gypsum.
8.3 Visit to comparable excavation projects in the Gulf States

An important thesis as far as the work at Al Zubarah is concerned has been brought to the attention of the author of this report by Prof. Dr. Alan Walmsley. It demonstrates that the same questions and problems we are facing at Al Zubarah have been dealt with in at least one other Gulf State.
The thesis is written in Arabic with an English summary which is presented here as a poor but readable photocopy. Perusing the directory gives you the feeling that it would be useful to have an English translation of the thesis. And maybe it would be even better to pay a visit to the site and discuss the topics with the author of the thesis.
By all means, it would make sense to visit similar sites in any of the Gulf States in order to study how other groups of conservators, engineers, and scientists have tackled the problems. I know that we are a good team but that does include the ability to learn from other people, too.
APPENDIX 5

On Mortars
AT AL ZUBARAH / QATAR

Report by Robert Sobott
February 2011
X-ray diffraction phase analysis of mortar samples from the excavation site at Zubarah, Qatar

In June 2010 several tests with different kinds of mortar were made to consolidate the locally dilapidated wall structures at the Zubarah excavation site. Damaged joints were repointed with hydraulic lime, anhydrite, and mud mortar and small sections of a collapsed tower structure were bricked up with hydraulic lime mortar. Historic gypsum wall plaster was tentatively consolidated with "nano lime", a dispersion of nano-sized portlandite particles in ethanol. In December 2010 the test sites were revisited and the performance of the different mortars judged by appearance and haptic tests. Already at the site it was realized that surprisingly the anhydrite mortar did not much better than the mud mortar while the test areas with the hydraulic lime mortar looked satisfactorily.

In order to put the explanations for failure or success on a sound data basis samples were taken for laboratory investigations which comprised the X-ray diffraction (XRD) phase analysis, the microscopy of thin sections, and the scanning electron microscopy (SEM).

X-ray diffraction analysis was used to identify the qualitative composition of a sample from which conclusions can be drawn with respect to the nature of a mortar (anhydrite/gypsum or lime/hydraulic lime mortar) and in the case of the mortars applied in June 2010 and sampled in December 2010 how the consolidation reaction had proceeded.

Three different kinds of reactions can be differentiated (compounds printed in bold characters can be detected by X-ray diffraction, mineral names given in brackets):

1. **Pure lime mortar:**
   \[ \text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} \]
   (portlandite) (calcite)

2. **Hydraulic lime mortar:**
   \[ 2\text{Ca}_2\text{SiO}_4 + 4\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{Ca}_3(\text{SiO}_3\text{OH})_2*2\text{H}_2\text{O} \]
   (dicalciumsilicate)
   \[ \text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} \]

3. **Anhydrite mortar**
   \[ \text{CaSO}_4 + 2\text{H}_2\text{O} \rightarrow \text{CaSO}_4*2\text{H}_2\text{O} \]
   (anhydrite) (gypsum)

In the case of the pure lime and anhydrite mortar the progress of reaction can be easily followed by the disappearance of portlandite or anhydrite and the appearance of calcite and gypsum, respectively. The hydraulic mortar shows two reactions. First, the hydrolysis of calcium silicate phases (C2S, C3S) to form calcium silicate hydrate phases, and, second, the carbonation of portlandite which yields calcite. Unfortunately the calcium silicate hydrate phases are X-ray amorphous and cannot be detected by X-ray diffraction. While the hydrolysis of calcium silicates and the formation of solidified calcium silicate hydrate phases is achieved within hours and days, the carbonation of portlandite and the formation of calcite takes several weeks, and the uncatalyzed re-hydration of anhydrite in the presence of water to form gypsum would require years. Therefore anhydrite mortars contain an accelerating agent which can be an alkaline sulfate or alkaline earth hydroxide.

In order to react completely, the starting materials require an appropriate amount of water or carbon dioxide, respectively. If water is removed from the reaction, either by evaporation and/or capillary suction of porous materials, or if the diffusion of CO₂ is hampered/blockied by impermeable barriers then the reactions will be incomplete and the resulting mortars apart from being of poor quality contain remnants of the starting compounds.

A fully reacted anhydrite mortar should contain no more anhydrite and consist entirely of gypsum. Likewise, lime and hydraulic lime mortars should contain no more calcium silicate phases and/or portlandite.

With this general outline in mind the samples compiled in table 1 were investigated by X-ray diffraction and the results listed in table 2 interpreted accordingly.
Table 1: Mortar samples from Zubarah (sample nos. 2b, II – XIII are consistent with the numbers in the “Documentation of Test Consolidation of Wall Structures, June 2010” by M. Kinzel)

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Locality</th>
<th>Material</th>
<th>Analytical problem</th>
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<tbody>
<tr>
<td>2b</td>
<td>wall structure, test field 2b</td>
<td>&quot;nano lime&quot;</td>
<td>reaction products, NaCl contents</td>
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<tr>
<td>II</td>
<td>Eastern part of tower structure</td>
<td>hydraulic lime mortar with quartz sand 1:3</td>
<td>reaction products, NaCl contents</td>
</tr>
<tr>
<td>IV</td>
<td>Northern part of tower structure</td>
<td>anhydrite mortar with quartz sand 1:2</td>
<td>reaction products, NaCl contents</td>
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<tr>
<td>IX</td>
<td>Western part of tower structure</td>
<td>anhydrite mortar with quartz sand 1:2</td>
<td>reaction products, NaCl contents</td>
</tr>
<tr>
<td>X</td>
<td>Eastern part of tower structure</td>
<td>anhydrite mortar with quartz/shell sand 1:2</td>
<td>reaction products, NaCl contents</td>
</tr>
<tr>
<td>XI</td>
<td>Eastern part of tower structure</td>
<td>hydraulic lime mortar with quartz/shell sand 1:3 and 1% tylose</td>
<td>reaction products, NaCl contents</td>
</tr>
<tr>
<td>XII</td>
<td>Southern part of tower structure</td>
<td>hydraulic lime render with quartz sand 1:1 and 1% tylose</td>
<td>reaction products, NaCl contents</td>
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<tr>
<td>XIII</td>
<td>Western part of tower structure</td>
<td>hydraulic lime render with quartz sand 1:1 and 1% tylose</td>
<td>reaction products, NaCl contents</td>
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<tr>
<td>XIV</td>
<td>Zubarah Fort render</td>
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<td>XV</td>
<td>Freyha</td>
<td>historic mortar ?</td>
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<tr>
<td>XVII</td>
<td>Fort “2” render</td>
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<td>Fort “2” thin render</td>
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<td>XX</td>
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<tr>
<td>XXI</td>
<td>local anhydrite mortar</td>
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Table 2: Summary of XRD data for stone and mortar samples

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<th>Sample No.</th>
<th>Calcite</th>
<th>Aragonite</th>
<th>Mg calcite I</th>
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<th>Dolomite</th>
<th>Gypsum</th>
<th>Bassanite</th>
<th>Anhydrite</th>
<th>Halite</th>
<th>Quartz</th>
<th>Plagioclase</th>
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APPENDIX 6

Analyses of Mortar samples
FROM AL ZUBARAH / QATAR

Report by Robert Sobott
December 2011
<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>ZU 01</td>
<td>Upper layer of gypsum plaster</td>
</tr>
<tr>
<td>ZU 04</td>
<td>Sample from Moritz</td>
</tr>
<tr>
<td>ZU 05</td>
<td>Repair mortar from 1980</td>
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<tr>
<td>ZU 06</td>
<td>Wall mortar</td>
</tr>
<tr>
<td>ZU 09</td>
<td>Wall mortar</td>
</tr>
<tr>
<td>ZU 19</td>
<td>Gypsum mortar QMA 02</td>
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</table>
The hardening reaction of a lime mortar

Sand (quartz, microcline, plagioclase) + lime + CO₂ → Calcite + Sand

\[
\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}
\]
### Comments to the results of the X-ray diffraction study of various samples

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>X-ray diffraction</th>
<th>Chemical analysis</th>
<th>Phase composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upper layer of gypsum plaster</td>
<td>X</td>
<td>Gyp, Cc, Mic, Qtz, Anh</td>
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<td>2</td>
<td>Fort Sikrit Wall and Joint mortar 27.10.2011</td>
<td>X</td>
<td>Cc, Qtz, Dol, Plg, Kao, sheet silicate?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Repair Mortar 1980</td>
<td>X</td>
<td>Cc, Mg Cc, Ara, Dol, Hal, Qtz, Gyp</td>
<td></td>
</tr>
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<td>X</td>
<td>Hal, Cc, Mg Cc, Ara, Dol, Gyp Qtz</td>
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<td>ZU QMA 03 R 0006 W 0013 Wall and Joint mortar</td>
<td>X</td>
<td>Qtz, Dol, Mg Cc I + II, Mic, Hal, Ara, Plg</td>
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<td>6</td>
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<td>Mg Cc, Hal, Gyp, Dol, Qtz, Plg</td>
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<td>Por, Cc</td>
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<td>EP 04 Sand 2</td>
<td>X</td>
<td>Qtz, Plg, Cc, Mic</td>
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<td>9</td>
<td>EP 04 Sand 3</td>
<td>X</td>
<td>Hat, Cc, Lar, Tca, Por</td>
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</tr>
<tr>
<td>10</td>
<td>ZU QMA 03 R? W 131/132 Wall and Joint mortar</td>
<td>X</td>
<td>Gyp, Qtz, Plg, Anh</td>
<td></td>
</tr>
</tbody>
</table>

- **Sulfates:**  
  - **Gyp:** gypsum,  
  - **Anh:** anhydrite

- **Carbonates:**  
  - **Cc:** calcite,  
  - **Ara:** aragoste,  
  - **Mg Cc:** Mg calcite,  
  - **Dol:** dolomite

- **Silicates:**  
  - **Qtz:** quartz,  
  - **Mic:** microcline,  
  - **Plg:** plagioclase,  
  - **Kao:** Kaolinite

- **Halides:**  
  - **Hal:** halite

- **Binding phases:**  
  - **Hat:** hatrurite,  
  - **Lar:** larnite,  
  - **Brm:** brownmillerite,  
  - **Tca:** tricalciumaluminate,  
  - **Por:** portlandite

**Major component:** Abc, Abc [75 – 100; 51 – 74]

**Minor component:** Abc, Abc [30 – 50; 6 – 29]

**Trace component:** Abc [0 – 5]

The components quartz, microcline, and plagioclase are typical for sand aggregate, the components aragonite and Mg calcite for beach sand aggregate, and the component dolomite for fragments of Damman dolomite. Calcite is the only by X-ray diffraction traceable phase representing the binding component in lime, natural hydraulic lime and cement mortars. Gypsum and anhydrite are typical for anhydrite/gypsum plaster. Anhydrite in gypsum plaster is regarded as an indication for an incomplete transformation to gypsum, thus indicating that anhydrite was the original binding material. The presence of calcite in gypsum plaster could mean that the original anhydrite mortar contained some lime (portlandite) as accelerator for the transformation reaction.
APPENDIX 7
X-ray diffraction and chemical analysis of samples from the archaeological site Al Zubarah in Qatar

Two Reports by Robert Sobott
March 2010
X-ray diffraction and chemical analysis of samples from the archaeological site Al Zubarah in Quatar

Report No. 10/2010
1 Introduction

The Labor für Baudenkmalpflege Naumburg obtained a number of samples from the archaeological site Al Zubarah in Qatar from the restorer Paul Hofmann for the determination of the quantitative and/or qualitative composition. The samples are presented in figure 1.

Figure 1: Analysed samples. Top left: Sample No. 9 (soil-salt crust), Top right: Sample No. 10 (lime mortar) Bottom left: Sample No. 12 (wall plaster) Bottom right: Sample No. 11 (beachrock)

Quality and quantity of salts derived from the evaporation of sea water in sample no. 9, a soil-salt crust, were determined by X-ray diffraction and chemical analysis. The qualitative phase compositions of samples no. 10 and no. 12, a mortar and a render, were determined by X-ray diffraction analysis. The nomenclature of sample no. 11, which consists of shell debris weakly consolidated by calcite cement, is discussed.
2 Quantitative chemical analysis

Sample no. 9 was crushed, and the water-soluble salts were extracted with destilled water. The cations \( \text{Na}^+, \text{K}^+, \text{Ca}^{2+}, \text{Mg}^{2+} \) in the eluat were determined according to DIN EN (ICP-OES), the anions \( \text{Cl}^-, \text{SO}_4^{2-}, \text{NO}_3^- \) according to DIN EN (ion chromatography). The results are given in table 1.

Table 1: Soluble salt contents of sample no. 9 (salt-soil-crust)

<table>
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<tr>
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<td>9</td>
<td>2.82</td>
<td>0.00</td>
<td>19.70</td>
<td>1.05</td>
<td>0.16</td>
<td>9.00</td>
<td>0.10</td>
<td>32.82</td>
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</table>

3 X-ray diffraction analysis

When irradiated by X-rays crystalline substances generate a diagnostic diffraction pattern which can be used for phase identification.

Samples no. 9, 10, and 12 were ground in an agate mortar to a powder which was used for the analysis. The results are presented in table 2. The amount of the phases present in the mixtures is semi-quantitatively indicated by the letter size and bold writing (large and bold letters: main constituent, middle-sized letters: minor constituent, etc.).

Table 2: Phase composition of samples no. 9, 10, and 12

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Phases</th>
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<tbody>
<tr>
<td>9</td>
<td>halite, calcite, glauberite, gypsum,</td>
</tr>
<tr>
<td>10</td>
<td>quartz, calcite, microcline, plagioclase, gypsum</td>
</tr>
<tr>
<td>12</td>
<td>gypsum, calcite</td>
</tr>
</tbody>
</table>

4 Discussion of results

According to the results of the X-ray diffraction and chemical analysis sample no. 9 contains around 29 mass% sodium chloride (halite). The contents of glauberite \( \text{Na}_2\text{Ca(SO}_4\text{)}_2 \), calcite \( \text{CaCO}_3 \), and gypsum \( \text{CaSO}_4*2\text{H}_2\text{O} \) amount to 1 – 2 mass% each.

The X-ray diffraction analysis of the mortar sample no. 10 is typical for a lime mortar. However, the amount of binding material (calcite) is rather low and a small part of it has been transformed into gypsum. The render sample no. 12 consists almost entirely of gypsum with only minor amounts of calcite. The porosity of gypsum mortars can be very low so that the penetration of consolidating agents (e. g. silanes) is not sufficient to produce satisfactory results. It is suggested to do repair work on the gypsum render (wall plaster) with accordingly pigmented gypsum mortars.

According to the Glossary of Geology, edited by Bates & Jackson, American Geological Institute, Falls Church Virginia, 1980, 2\textsuperscript{nd} edition, the term “beachrock” is quite appropriate. A beachrock is defined as a friable to well-cemented sedimentary rock, formed in the intertidal zone in a tropical or subtropical region, consisting of sand or gravel (detrital and/or skeletal) cemented with calcite.
X-ray diffraction and chemical analysis of samples from the archaeological site Zubarah in Quatar

X-ray diffraction diagrammes of samples No. 9 (salt-soil-crust; top) and No. 10 (mortar)

LABOR für BAUDENKMALPFLEGE NAUMBURG
Curia Episcopalis – Domplatz 1- 06618 Naumburg
X-ray diffraction and chemical analysis of samples from the archaeological site Zubarah in Qatar

X-ray diffraction diagramme of sample No. 12 (wall plaster)

Labor für Baudenkmalpflege Naumburg
Curia Episcopal – Domplatz 1-06618 Naumburg
X-ray diffraction and chemical analysis of samples from the archaeological site Al Zubarah in Qatar and preparation of a restoration mortar

Report No. 10b/2010

Client: Restorer Paul Hofmann
Annenwalde No. 3
17268 Densow

Date of completion: 13. June 2010
Text: 5 pages, 4 tables, 2 figures
Appendix: 1 page
1 Introduction

The Labor für Baudenkmalpflege Naumburg obtained a number of sand and mortar samples (figure 1) from the restorer Paul Hofmann in order to determine the chloride contents and phase composition, respectively. Two washed sand samples were used for the preparation of mortars with natural hydraulic lime as binder.

Figure 1: Sand and mortar samples
2 Quantitative chemical analysis of chloride content in sand samples

The chloride contents of seven untreated sand samples were determined according to DIN ISO 10304-1 (by ion chromatography). The samples with the largest chloride contents (No. 1 and 3) were flushed with a volume of tap water twice as large as the sand volume and dried. The remaining chloride contents were measured. The results are given in table 1.

Table 1: Chloride contents in sand samples (data given in mass %)

<table>
<thead>
<tr>
<th>Sand samples</th>
<th>&lt; 2mm</th>
<th>0.75 – 2 mm</th>
<th>&lt; 0.75 mm</th>
<th>&gt; 2 mm</th>
<th>0 – 4 mm</th>
<th>&gt; 2 mm</th>
<th>QMA</th>
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<tbody>
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<td>untreated samples</td>
<td>1.96</td>
<td>1.66</td>
<td>1.95</td>
<td>1.24</td>
<td>0.04</td>
<td>1.07</td>
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<tr>
<td>washed samples</td>
<td>0.36</td>
<td>-</td>
<td>0.67</td>
<td>-</td>
<td>-</td>
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<td>-</td>
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</table>

Data of table 1 shows that the local, shells containing sand contains a lot of sodium chloride which renders it as an unfavourable aggregate for the production of mortar. However, a single and simple washing procedure reduces the chloride contents effectively.

3 X-ray diffraction analysis

When irradiated by X-rays crystalline substances generate a diagnostic diffraction pattern which can be used for phase identification.

A mortar sample of unknown composition and supposedly produced by Pakistani workmen was investigated by this method. The identified phases in the compound are listed below, the diffraction diagram is presented in appendix 1.

Table 2: Phase composition of unknown mortar

<table>
<thead>
<tr>
<th>Sample</th>
<th>Phases</th>
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<tbody>
<tr>
<td>Mortar</td>
<td>anhydrite II, gypsum, calcite, bassanite, quartz</td>
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</tbody>
</table>

According to the phase composition the investigated mortar is an anhydrite binder which is produced by firing gypsum in the temperature interval 320 - 480 °C. The presence of some gypsum and bassanite indicates that either the dehydration of gypsum was not totally complete or that part of the anhydrite II (CaSO₄) took up water and reacted back to bassanite (CaSO₄*0.5H₂O) and gypsum (CaSO₄*2H₂O). Quartz and calcite can be regarded as impurities of the raw material.

4 Preparation of restoration mortar

With the washed sand samples 1 and 3 two mortar samples were prepared with natural hydraulic lime (Otterbein Hydradur NHL 5) as binder. The composition of the mortars is given in table 3.

Table 3: Mortar compositions

<table>
<thead>
<tr>
<th>Sample</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>1 volume part NHL 5, 3 volume parts aggregate, 1 volume part water</td>
</tr>
<tr>
<td>Sample 3</td>
<td>1 volume part NHL 5, 3 volume parts aggregate, 2 volume parts water, 2 mass% tylose*</td>
</tr>
</tbody>
</table>

* with reference to the combined mass of binder and aggregate
The addition of 2 mass% tylose to a mixture of 1 volume part binder and 3 volume parts aggregate doubles the amount of water which can be added to the mixture in order to produce a workable mortar. The tylose retains the water effectively, protracts the hardening process and may help to prevent the premature drying of the mortar in the arid climate at Al Zubarah. The physical parameters of the mortars are listed in table 4.

Table 4: Physical parameters of mortar samples

<table>
<thead>
<tr>
<th>Sample</th>
<th>Density [g/cm³]</th>
<th>Young’s modulus [kN/mm²]</th>
<th>Compressive strength [N/mm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,45</td>
<td>1,8</td>
<td>1,5⁺)</td>
</tr>
<tr>
<td>2</td>
<td>1,44</td>
<td>1,8</td>
<td>1,5⁻)</td>
</tr>
</tbody>
</table>

⁺) after 9 days of hardening. The compressive strength after 28 days is supposed to be higher than 2 N/mm².
5 Summary of results

The untreated sand from the beach contains a high amount of sodium chloride which makes it unfavourable for the use as aggregate for the production of mortar. However, the sodium chloride contents can be effectively reduced by a simple washing procedure which requires about double the volume of the sand. If large volumes of sand have to be washed it may be reasonable to desalt the process water so that it can be used several times.

The X-rayed mortar proved to be an anhydrite mortar. Under arid climate conditions anhydrite mortar may be a good alternative to lime mortar.

The addition of about 2 mass% tylose to the aggregate/binder mixture almost doubles the amount of water which the mortar can take up and consequently reduces the risk of premature drying. The physical parameters of a tylose containing mortar are similar to that of a tylose-free mortar. The "classical mixture" of 1 volume part binder (NHL 5), 3 volume parts aggregate and about 1 volume part of water will yield a mortar with a compressive strength of about 2 – 3 N/mm² after 28 days of hardening. In order to increase the compressive strength the water volume may be reduced but that will produce a friable mortar paste which is not so workable and has a higher risk of premature drying.
X-ray diffraction and chemical analysis of samples from the archaeological site Al Zubarah in Qatar and preparation of a restoration mortar

Appendix 1

X-ray diffraction diagram of mortar sample

LABOR für BAUDENKMALPFLEGE NAUMBURG
Curia Episcopalis – Domplatz 1- 06618 Naumburg
APPENDIX 8

CLIMATE DATE RECORD
AT AL ZUBARAH FORT / QATAR
March 2011 - September 2011

processed by R. Sobott
July 2012
### Data Logger

<table>
<thead>
<tr>
<th>Location</th>
<th>Al Zubarah Fort inside room</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of data:</strong></td>
<td>53243</td>
</tr>
<tr>
<td><strong>Sampling interval:</strong></td>
<td>4.85 min</td>
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<tr>
<td><strong>Start of data recording:</strong></td>
<td>21.03.2011 11:15:06</td>
</tr>
<tr>
<td><strong>End of data recording:</strong></td>
<td>20.09.2011 22:52:49</td>
</tr>
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<table>
<thead>
<tr>
<th><strong>Maximum Temperature:</strong></th>
<th>37,2</th>
<th><strong>Minimum Humidity:</strong></th>
<th>67,0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum Temperature:</strong></td>
<td>21,0</td>
<td><strong>Minimum Humidity:</strong></td>
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<tr>
<td><strong>Av. Temperature March:</strong></td>
<td>22,9</td>
<td><strong>Av. Humidity March:</strong></td>
<td>54,4</td>
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<tr>
<td><strong>Av. Temperature April:</strong></td>
<td>26,2</td>
<td><strong>Av. Humidity April:</strong></td>
<td>57,1</td>
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<tr>
<td><strong>Av. Temperature May:</strong></td>
<td>31,7</td>
<td><strong>Av. Humidity May:</strong></td>
<td>50,3</td>
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<tr>
<td><strong>Av. Temperature June:</strong></td>
<td>33,7</td>
<td><strong>Av. Humidity June:</strong></td>
<td>50,6</td>
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<tr>
<td><strong>Av. Temperature July:</strong></td>
<td>35,4</td>
<td><strong>Av. Humidity July:</strong></td>
<td>51,5</td>
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<tr>
<td><strong>Av. Temperature August:</strong></td>
<td>36,2</td>
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<tr>
<td><strong>Av. Temperature September:</strong></td>
<td>34,7</td>
<td><strong>Av. Humidity September:</strong></td>
<td>51,5</td>
</tr>
</tbody>
</table>

---

**HAB0054506 March 2011**

![Temperature and Humidity Chart](chart.png)
APPENDIX 9
LIST OF TEMPLATES and FORMS

9.1 Visitor Log Sheet
9.2 Damage Report
9.3 Site Journal
9.4 Site Journal VAR. 2011/2012
9.5 Record sheet for fractures in mortars
9.6 Record sheet for Architectural Documentation
<table>
<thead>
<tr>
<th>S.N.</th>
<th>DATE</th>
<th>NO. OF VEHICLES</th>
<th>NO. OF CHILDREN</th>
<th>NO. OF MALES</th>
<th>NO. OF FEMALES</th>
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</tbody>
</table>

REPORTED BY: Staff No.
# Daily Report

**QIAH-01-02-HE-9**

**SITE VISIT from** [Day]; [Date]; [Time]

**WEATHER:**
- **TEMPERATURE**
- **HUMIDITY**

**ATTENDEES (incl. workmen, craftpersons, etc.):**

**Location:**

**Materials status:**
- Hydrated Lime
- NHL
- White Cement
- Quartz sand
- Soil
- Water

**Measures, Activities, Work**
(Planned for the day, as well as executed)

<table>
<thead>
<tr>
<th>DRAWINGS / DOCs related</th>
<th>Doc. No.</th>
<th>Content</th>
<th>Date</th>
<th>handed over to</th>
</tr>
</thead>
</table>

**Inadequacies** (defects, cracks, detaching, etc)

**Instructions**
AL ZUBARAH ARCHAEOLOGICAL SITE
CONSERVATION SITE JOURNAL

DAILY REPORT

QIAH-01-02-HE-9

SITE VISIT from [Day]; [Date]; [Time]

IMAGES

IMAGES

SKETCH / COMMENTS
QIAH-Conservation Site Journal

NOTES

Weather
TEMP
HUMID
WIND
RAIN

Bahrain:

WALLS

Hyd.
Lime
White
Cement
Sand
Water

EP 10

EP 04

Hyd.
Lime
White
Cement
Sand
Water

APPENDIX 9.4 TEMPLATE  Site journal variation used in 2011/2012 season
Fractures in mortars and concrete

**Shape** (linear, curved, reticulate):

**Width** (< 1mm, > 1mm):

**Depth** (< 5mm, > 5mm):

**Frequency** (singular, multiple):

**Location** (affected part of construction):

**Mortar composition** (especially water/cement ratio, aggregate size distribution):

**Constructive details** (thickness of mortar layer, reinforcement, connection to other parts of the construction, possibly with entirely different properties):

**Date of origin of cracks after curing**:

**Remarks** (temperature/humidity conditions during curing process, exceptional events during or after the execution of work):

Main reasons for cracking: shrinkage, stress-induced failure
<table>
<thead>
<tr>
<th>QIAH - HERITAGE</th>
<th>SITE:</th>
<th>STRUCTURE:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DATE:</td>
<td></td>
<td>SEASON:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phase 1 Season1</td>
</tr>
</tbody>
</table>

**Related STRUCTURES:**
- Compound
- Domestic unit
- Mosque
- School
- Public space
- Sitting area (baraha)
- Commercial unit
- Shops/souq
- Storage
- Stable
- Workshop
- Unknown/Other

**Related ROOMS:**

**Related WALLS:**

**Related FEATURES:**

**FUNCTION**

**LENGTH:**

**SIZE**
- Length:
- Width:

**PERIOD**
- 2009 movie rebuilding
- Late occupations (cement)
- Main occupations
- Early occupations
- Other occupations

**CONDITION**
- Excellent
- Good
- Moderate
- Poor
- Unknown
- HIGH PRIORITY
- MEDIUM PRIORITY
- LOW PRIORITY

**PHOTO Numbers:**

**RISK ASSESSMENT**

**CONSERVATION INTEREST**
- HIGH
- MEDIUM
- LOW

Ref.: Appendix 10: Manual for Architectural recording.
# Appendix 9.6 Architectural Record - Room

## Site: QIAH - Heritage

### Room: Room

**Date:**

**Season:** Phase 1 Season 1

### Related Structures:

- Courtyard
- Domestic unit
- Hammam / WC
- Storage
- Kitchen
- Shed
- Shelter
- Prayer room / Iwan
- Mihrab
- Minaret
- Sitting area (baraha)
- Ablution room
- Workshop
- Unknown/Other

### Related Rooms:

### Related Walls:

### Related Features:

### Function

#### General Description

#### Plan / Sketch

### Size

- **Length:**
- **Width:**

### Period

- 2009 movie rebuilding
- Late occupations (cement)
- Main occupations
- Early occupations
- Other occupations

### Condition

- Excellent
- Good
- Moderate
- Poor
- Unknown

### Risk Assessment

- HIGH PRIORITY
- MEDIUM PRIORITY
- LOW PRIORITY

### Composition

#### Floor

- Anhydrite / Gypsum
- Mud
- Soil
- Shells

- Cement
- Fine cement finish
- Other
- Unknown

### Ceiling

- Round beams
- Rectangular beams
- Planks
- Bamboo

- Woven mats
- Mud covering
- Unknown – not visible
- No ceiling / roof

**Ref.: Appendix 10: Manual for Architectural recording.**
# APPENDIX 9.6 ARCHITECTURAL RECORD - Wall

## QIAH - HERITAGE

### SITE: WALL:

<table>
<thead>
<tr>
<th>DATE:</th>
<th>SEASON: Phase 1 Season1</th>
</tr>
</thead>
</table>

## RELATED STRUCTURES:

- Related ROOMS:
- Related WALLS:
- Related FEATURES:

## OPENINGS

- Type:
- Size:
- Description:

## RELATIONS

## GENERAL DESCRIPTION

## PLAN / SKETCH

## SIZE

- Length:
- Width:
- Height inside:
- Height outside:

## PERIOD

- 2009 movie rebuilding
- Late occupations (cement)
- Main occupations
- Early occupations
- Other occupations

## CONDITION

- Excellent
- Good
- Moderate
- Poor
- Unknown

## RISK ASSESSMENT

- HIGH PRIORITY
- MEDIUM PRIORITY
- LOW PRIORITY

## COMPOSITION

### Stones

- Beachrock AG
- Beachrock BJ
- Beachrock LO
- Gypsum BE
- Dolomite BL
- Fossiliferous limestone
- Aeolianite FR
- Conglomerate
- Coral
- Concrete blocks (old)
- Concrete blocks (new)
- Unknown

### Mortar

- Mud fine grain
- Mud coarse grain
- Cement
- Not visible
- Unknown

### Plaster

- Anhydrite/Gypsum
- Mud, fine grain
- Mud, coarse grain
- Mud slurring
- Cement
- Fine cement finish
- Other
- Unknown

## DAMAGES

- Cracks in wall
- Voids in wall
- Eroded stones
- Blown out/eroded joints
- Partly collapsed
- Collapsed
- Plaster fragmented
- Detached plaster
- Cracks in plaster
- Voils in plaster
- Plaster eroded/washed off
- Blow-in sand deposits
- Graffiti

## PHOTO Numbers:

Ref.: Appendix 10: Manual for Architectural recording.
**QIAH - HERITAGE**

**SITE:**  
**FEATURE:**

**DATE:**  
**SEASON:** Phase 1 Season1

<table>
<thead>
<tr>
<th>RELATED STRUCTURE:</th>
<th>FUNCTION</th>
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</thead>
<tbody>
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<td>Pillar</td>
</tr>
<tr>
<td></td>
<td>Terrace</td>
</tr>
<tr>
<td></td>
<td>Terrace &amp; pillars</td>
</tr>
<tr>
<td></td>
<td>Stairs</td>
</tr>
<tr>
<td></td>
<td>Fireplace/hearth</td>
</tr>
<tr>
<td></td>
<td>Bench</td>
</tr>
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<td>Basin</td>
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</table>

<table>
<thead>
<tr>
<th>RELATED ROOMS:</th>
<th>FUNCTION</th>
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<tbody>
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<td>Water tank</td>
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<td>Water well</td>
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<tr>
<td></td>
<td>Mihrab</td>
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<tr>
<td></td>
<td>Minbar</td>
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<tr>
<td></td>
<td>Timber structure</td>
</tr>
<tr>
<td></td>
<td>Portal</td>
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<td>Unknown/Other</td>
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<table>
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<th>RELATED WALLS:</th>
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</table>

<table>
<thead>
<tr>
<th>RELATED FEATURES:</th>
<th>FUNCTION</th>
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<tbody>
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</tbody>
</table>

**RELATIONS**

**FUNCTION**

- Pillar
- Terrace
- Terrace & pillars
- Stairs
- Fireplace/hearth
- Bench
- Basin
- Water tank
- Water well
- Mihrab
- Minbar
- Timber structure
- Portal
- Unknown/Other

**General Description**

**Plan / Sketch**

**Size**

- Length: 
- Width: 
- Height: 

**Period**

- 2009 movie rebuilding
- Late occupations (cement)
- Main occupations
- Early occupations
- Other occupations

**Condition**

- Excellent
- Good
- Moderate
- Poor
- Unknown

**Risk Assessment**

- HIGH PRIORITY
- MEDIUM PRIORITY
- LOW PRIORITY

**Composition**

**Stones**

- Beachrock AG
- Beachrock BJ
- Beachrock LO
- Gypsum BE
- Dolomite BL
- Fossiliferous limestone
- Aequilinante FR
- Conglomerate
- Coral
- Concrete blocks (old)
- Concrete blocks (new)
- Unknown

**Predominant:**

- Mud fine grain
- Mud coarse grain
- Cement
- Not visible
- Unknown

**Mortar**

- Anhydrite/Gypsum
- Mud, fine grain
- Mud, coarse grain
- Mud slurring
- Cement
- Fine cement finish
- Other
- Unknown

**Plaster**

- Anhydrite/Gypsum
- Mud, fine grain
- Mud, coarse grain
- Mud slurring
- Cement
- Fine cement finish
- Other
- Unknown

**Predominant:**

- Collapsed
- Partly collapsed
- Cracks in feature
- Voids in feature
- Eroded stones
- Blown out/eroded joints
- Blow-in sand deposits
- Plaster fragmented
- Detached plaster
- Cracks in plaster
- Voids in plaster
- Plaster eroded/washed off
- Graffiti
- Litter/bushes

**Photo Numbers:**

Ref.: Appendix 10: Manual for Architectural recording.
INTRODUCTION
An Access database provides detailed information on the building materials and the structural condition of the architecture in Al Jumail. The database has a hierarchic composition. Four forms dedicated to structures, rooms, walls and features contain similarly structured sets of data describing spatial relations, functions, size, building period, condition, risk assessment and conservation interest of every structural element.

STRUCTURE

<table>
<thead>
<tr>
<th>Relations</th>
<th>Related STRUCTURES, ROOMS, WALLS and FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>See appendix 1 Compound, Domestic unit, Mosque, School, Public space, Sitting area/Majlis, Sitting area/Baraha/Dekka, Commercial unit, Shop/Souq, Storage, Stable, Workshop, Unknown/ Other</td>
</tr>
<tr>
<td>Plan/ Sketch</td>
<td>Drawing produced during the survey or by detailed measurements</td>
</tr>
<tr>
<td>General Description</td>
<td>Information on the form of the structure and on the spatial connections and relations of its elements (rooms and openings) to each other. Description of the ground plan of the structure and succession of the building phases. Additional comments and remarks</td>
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<tr>
<td>Size</td>
<td>Length, Width, Surface area Information on the outer measurements and the area of the whole of the structure</td>
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<tr>
<td>Period</td>
<td>See appendix 2 21st century 20th century Pre-20th century</td>
</tr>
<tr>
<td>Condition</td>
<td>Excellent Complete structure, with no OR few cracks in the covering plaster Good Structure collapsed to slight extent OR small voids and/or cracks (width under 1cm) in the stonework Moderate Partly collapsed structure OR extensive voids and/or cracks (width over 1 cm) in the stonework; critical structural damages Poor Extensively collapsed structure, mostly rubble Unknown Predominantly non visible or inaccessible structures</td>
</tr>
<tr>
<td>Risk Assessment</td>
<td>High priority High structures (more than 1,50m) of poor condition Medium priority Structures of about 1,50m height, in moderate or poor condition Low priority Stable walls and harmless rubble</td>
</tr>
<tr>
<td>Conservation Interest</td>
<td>High Historical structures, clearly showing the traditional constructions and functions Medium Historical structures, low legibility Low Modern structures</td>
</tr>
<tr>
<td>Photo numbers</td>
<td>All DNG-Photo numbers displaying the whole structure</td>
</tr>
</tbody>
</table>
# ROOM

## Relations

<table>
<thead>
<tr>
<th>Relations</th>
<th>Related STRUCTURES, ROOMS, WALLS and FEATURES</th>
</tr>
</thead>
</table>

## Function

<table>
<thead>
<tr>
<th>Function</th>
<th>See appendix 1</th>
<th>Ablution room, Courtyard, Domestic unit, Hammam/WC, Kitchen, Mihrab, Minaret, Prayer room/Iwan, Shed, Shelter, Sitting area/Baraha/Dekka, Sitting area/Majlis, Storage, Workshop, Other/Unknown</th>
</tr>
</thead>
</table>

## Plan/ Sketch

<table>
<thead>
<tr>
<th>Plan/ Sketch</th>
<th>Drawing produced during the survey or by detailed measurements</th>
</tr>
</thead>
</table>

## General Description

<table>
<thead>
<tr>
<th>General Description</th>
<th>Information on the form of the room and on the spatial connections and relations of its elements (e.g. openings) to each other, succession of the building phases. Additional comments and remarks</th>
</tr>
</thead>
</table>

## Size

<table>
<thead>
<tr>
<th>Size</th>
<th>Length, Width, Surface area</th>
<th>Information on the measurements and surface area of the room</th>
</tr>
</thead>
</table>

## Period

<table>
<thead>
<tr>
<th>Period</th>
<th>See appendix 2</th>
<th>21st century</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20th century</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-20th century</td>
</tr>
</tbody>
</table>

## Condition

The condition assessment concerns the general impression of the room as whole. The structural condition of the majority of the walls, floor and ceiling is taken into account.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Excellent</th>
<th>Complete structure, with no OR few cracks in the covering plaster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Structure collapsed to slight extent OR small voids and/or cracks (width under 1cm) in the stonework</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Partly collapsed structure OR extensive voids and/or cracks (width over 1 cm) in the stonework; critical structural damages</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>Extensively collapsed structure, mostly rubble</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>Predominantly non visible or inaccessible structures</td>
<td></td>
</tr>
</tbody>
</table>

## Risk Assessment

<table>
<thead>
<tr>
<th>Risk Assessment</th>
<th>High priority</th>
<th>High structures (more than 1,50m) of poor condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium priority</td>
<td>Structures of about 1,50m height, in moderate or poor condition</td>
<td></td>
</tr>
<tr>
<td>Low priority</td>
<td>Stable walls and harmless rubble</td>
<td></td>
</tr>
</tbody>
</table>

## Floor composition

See Appendix 3 Anhydrite, Lime, Mud, Soil, Shells, Cement, Fine cement finish, Other/Unknown

## Floor condition

Applies only to floors with screed topping (anhydrite, lime or cement). Floors made of shells, mud or soil are always ranged as “good”

<table>
<thead>
<tr>
<th>Floor condition</th>
<th>Excellent</th>
<th>No OR few superficial cracks in the screed topping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Cracks in the plaster, small, flat voids in the screed topping</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Extensive voids and cracks in the screed topping, thick fragments of screed missing</td>
</tr>
<tr>
<td>Poor</td>
<td>Screed topping missing on extensive area of the floor, deep voids in the floor</td>
</tr>
<tr>
<td>Unknown</td>
<td>Non visible</td>
</tr>
</tbody>
</table>

**Floor damages**

<table>
<thead>
<tr>
<th>Damage Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracks in floor surface</td>
<td>Cracks in the screed topping</td>
</tr>
<tr>
<td>Voids in floor surface</td>
<td>Parts of the screed topping are missing</td>
</tr>
<tr>
<td>Loose floor surface</td>
<td>Screed topping is detached, shows voids, it is easy to remove screed layers without tools</td>
</tr>
<tr>
<td>Collapsed stones</td>
<td>Stones fallen from the walls of the room, covering the floor surface</td>
</tr>
<tr>
<td>Collapsed plaster</td>
<td>Detached plaster fallen from the walls of the room, covering the floor surface</td>
</tr>
<tr>
<td>Blown-in sand deposits</td>
<td>Sand blown in by the wind, covering the floor</td>
</tr>
<tr>
<td>Litter/bushes</td>
<td>Litter deposits or litter blown in by the wind; plants growing, damaging floor surface</td>
</tr>
</tbody>
</table>

**Ceiling composition**

<table>
<thead>
<tr>
<th>Composition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round beams, Rectangular beams, Planks, Bamboo, Woven mats, Mud covering, Unknown - not visible, No ceiling/roof</td>
<td>The roofs are usually composed of round, rectangular beams or planks supporting splitted bamboo stems and woven mats. The top covering consists of mud layer and sometimes small gravel.</td>
</tr>
<tr>
<td>Ceiling condition</td>
<td>Excellent</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Good</td>
<td>Mud covering complete, little insect damage on the beams</td>
</tr>
<tr>
<td>Moderate</td>
<td>Damage by insects and/or fungi, ceiling strongly deformed</td>
</tr>
<tr>
<td>Poor</td>
<td>Extensive damage by insects and/or fungi, ceiling partly collapsed</td>
</tr>
<tr>
<td>Unknown</td>
<td>Construction not accessible for investigation</td>
</tr>
</tbody>
</table>

### WALL

**Relations**
- Related STRUCTURES, ROOMS, WALLS and FEATURES

**Openings**
- Type, Size, Description
  - Type: Door, window, ventilation opening
  - Size: Width, Height
  - Description: Lintel construction, window frame, condition, comments

**Plan/ Sketch**
- Drawing produced during survey or by detailed measurements

**General Description**
- Information on the spatial arrangement of the openings. Indication of the succession of the building phases. Comments and remarks

**Size**
- Length, Width, Height
  - Information on the maximal measurements of the wall. As the height of the wall may differ in the related rooms or between the room and the façade, both values have to be given

**Period**
- See appendix 2
  - 21st century
  - 20th century
  - Pre-20th century

**Condition**
- Excellent
  - Complete, with no OR few cracks in the covering plaster
- Good
  - Collapsed to slight extent OR small voids and/or cracks (width under 1cm) in the stonework
- Moderate
  - Partly collapsed structure OR extensive voids and/or cracks (width over 1 cm) in the stonework; critical structural damages
- Poor
  - Extensively collapsed structure, mostly rubble
- Unknown
  - Predominantly non visible or inaccessible structures

**Risk Assessment**
- High priority
  - High structures (more than 1,50m) of poor condition
- Medium priority
  - Structures of about 1,50m height, in moderate or poor condition
- Low priority
  - Stable walls and harmless rubble
### Damages

<table>
<thead>
<tr>
<th>Damage Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracks in wall</td>
<td>Cracks, reaching deep inside of the stonework’s structure</td>
</tr>
<tr>
<td>Voids in wall</td>
<td>Stones broken off the wall, leaving voids in the stonework</td>
</tr>
<tr>
<td>Eroded stones</td>
<td>Surface of stones eroded by the influence of wind, salts and moisture</td>
</tr>
<tr>
<td>Blown out/eroded joints</td>
<td>Stones in place, mortar of the joints eroded by the influence of wind, salts and moisture</td>
</tr>
<tr>
<td>Partly collapsed</td>
<td>Wall partly collapsed, still standing parts allow the insight in the construction and the identification of the openings</td>
</tr>
<tr>
<td>Collapsed</td>
<td>Wall entirely collapsed, remains recognizable as rubble</td>
</tr>
<tr>
<td>Plaster fragmented</td>
<td>Deep cracks in plaster</td>
</tr>
<tr>
<td>Detached plaster</td>
<td>Plaster loosened from the wall, easy to remove without tools</td>
</tr>
<tr>
<td>Cracks in plaster</td>
<td>Superficial, “hair-thin” cracks in plaster, no structural damage</td>
</tr>
<tr>
<td>Voids in plaster</td>
<td>Fragments of plaster missing, fallen off the wall</td>
</tr>
<tr>
<td>Plaster eroded/washed off</td>
<td>Layers of plaster eroded by the influence of wind, salts and moisture</td>
</tr>
<tr>
<td>Blown-in sand deposits</td>
<td>Sand deposits in the eroded joints and voids of the stonework</td>
</tr>
<tr>
<td>Graffiti</td>
<td>Ornaments or text scratched or painted on plaster</td>
</tr>
</tbody>
</table>

### Photo numbers

| Photo numbers | All DNG-Photo # displaying the wall |

### FEATURE

<table>
<thead>
<tr>
<th>Relations</th>
<th>Related STRUCTURES, ROOMS, WALLS and FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>See appendix 1</td>
</tr>
<tr>
<td></td>
<td>Basin, Bench, Fireplace/Hearth, Mihrab, Minbar, Niche/Shelves, Pillar, Terrace, Terrace&amp;Pillars, Timber structure, Portal, Staircase or Steps, Water tank, Water well, Other/Unknown</td>
</tr>
<tr>
<td>Plan/Sketch</td>
<td>Drawing produced during a survey or by detailed measurements</td>
</tr>
<tr>
<td>General Description</td>
<td>Information on the form of the feature, indication of building phases, comment and remarks</td>
</tr>
<tr>
<td>Size</td>
<td>Length, Width, Height</td>
</tr>
<tr>
<td></td>
<td>Information on the outer measurements of the feature</td>
</tr>
<tr>
<td>Period</td>
<td>21\textsuperscript{st} century</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>Condition</strong></td>
<td>Excellent</td>
</tr>
<tr>
<td></td>
<td>Complete, with no OR few cracks in the covering plaster</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
</tr>
<tr>
<td></td>
<td>Extensively collapsed structure, mostly rubble</td>
</tr>
<tr>
<td><strong>Risk Assessment</strong></td>
<td>High priority</td>
</tr>
<tr>
<td></td>
<td>High structures of poor condition</td>
</tr>
<tr>
<td><strong>Damages</strong></td>
<td>Cracks in feature</td>
</tr>
<tr>
<td></td>
<td>Cracks, reaching deep inside of the stonework</td>
</tr>
<tr>
<td></td>
<td>Blown out/eroded joints</td>
</tr>
<tr>
<td></td>
<td>Stones in place, mortar of the joints eroded by the influence of wind, salts and moisture</td>
</tr>
<tr>
<td></td>
<td>Plaster fragmented</td>
</tr>
<tr>
<td></td>
<td>Deep cracks in plaster</td>
</tr>
<tr>
<td></td>
<td>Voids in plaster</td>
</tr>
<tr>
<td></td>
<td>Fragments of plaster missing, fallen off the underground</td>
</tr>
<tr>
<td></td>
<td>Blown-in sand deposits</td>
</tr>
<tr>
<td></td>
<td>Sand deposits in the eroded joints and voids of the stonework or sand deposits inside of the feature</td>
</tr>
<tr>
<td><strong>Photo numbers</strong></td>
<td>All DNG-Photo # displaying the feature</td>
</tr>
<tr>
<td>Structures, Rooms</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ablution room</td>
<td>Room for ritual purification, adjusted or located close to the mosque and provided with water (well, tank, water tap) and a washing basins</td>
</tr>
<tr>
<td>Commercial unit</td>
<td>Workshop, production building or shop, working space</td>
</tr>
<tr>
<td>Compound</td>
<td>Series of buildings interconnected and/or adjusted to each other, arranged around a courtyard</td>
</tr>
<tr>
<td>Courtyard</td>
<td>Space inside of a building or compound, surrounded by walls, without a covering</td>
</tr>
<tr>
<td>Domestic unit</td>
<td>Compound or single building for dwelling purpose</td>
</tr>
<tr>
<td>Hammam / WC</td>
<td>Restroom; mostly a part of a domestic unit separated by a wall, provided with small basin and drainage opening</td>
</tr>
<tr>
<td>Kitchen</td>
<td>Room for food preparation</td>
</tr>
<tr>
<td><strong>Mosque</strong></td>
<td>Building of worship for followers of Islam</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td><strong>Minaret</strong></td>
<td>Distinctive architectural feature of mosques, generally a tall spire, usually free standing and taller than any associated structure. Minarets are used for the call to prayer</td>
</tr>
<tr>
<td><strong>Mihrab</strong></td>
<td>Small room in the wall of a mosque that indicates the qibla - the direction of the Kaaba in Mecca and hence the direction that Muslims should face when praying</td>
</tr>
<tr>
<td><strong>Prayer room / Iwan</strong></td>
<td>Rectangular hall or space in the mosque, walled on three sides, with one end entirely open, used for prayer. The prayer room is oriented to the direction on Kaaba in Mecca by the mihrab</td>
</tr>
<tr>
<td><strong>Public space</strong></td>
<td>Open space (square or street), outside of the private domestic units Photo: See Minaret / Mosque</td>
</tr>
<tr>
<td><strong>School</strong></td>
<td>Structure explicitly dedicated for educational purposes provided with classrooms and teachers room</td>
</tr>
<tr>
<td><strong>Shed</strong></td>
<td>Simple, one storey building, may be used as storage or workshop No Photo</td>
</tr>
<tr>
<td><strong>Shelter</strong></td>
<td>Simple structure or building that provides cover No Photo</td>
</tr>
<tr>
<td><strong>Shops/Souq</strong></td>
<td>Shop or assembly of shops (souq) No Photo</td>
</tr>
</tbody>
</table>
Sitting area: Majlis
Public / semi-public gathering space in form of a free standing, single-room building. Majlis lay in a free, public space and are not adjusted to other buildings or compounds. The Majlis appear mostly as ensemble along with a Baraha/Dekka

Sitting area: Baraha/Dekka
Public / semi-public gathering space in form of a free standing platform. Baraha/Dekka lay in a free, public space and are not adjusted to other buildings or compounds. Sometimes the Majlis has an open terrace adjusted to it. In this case there is no other Baraha/Dekka that would go with this kind of Majlis

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable</td>
<td>Building for keeping of livestock</td>
<td>No Photo</td>
</tr>
<tr>
<td>Storage</td>
<td>Building for storage of goods</td>
<td>No Photo</td>
</tr>
<tr>
<td>Workshop</td>
<td>Room or building that provides space and tools for production of goods</td>
<td>No Photo</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin</td>
</tr>
<tr>
<td>Bench</td>
</tr>
</tbody>
</table>

JU_S60
JU_S61
JU_S40
JU_S58
<table>
<thead>
<tr>
<th><strong>Fireplace / hearth</strong></th>
<th>Structure designed to contain a fire for heating and for cooking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mihrab</strong></td>
<td>Niche in the wall of a mosque that indicates the qibla - the direction of the Kaaba in and hence the direction that Muslims should face when praying</td>
</tr>
<tr>
<td><strong>Minbar</strong></td>
<td>Pulpit in the mosque close to the mihrab, where the imam (prayer leader) stands to deliver sermons or where the speaker sits and lectures</td>
</tr>
<tr>
<td><strong>Niche / Shelves</strong></td>
<td>Setback in the wall, in connection with the window opening or providing space for shelves</td>
</tr>
<tr>
<td><strong>Terrace</strong></td>
<td>Raised flat platform connected to a building</td>
</tr>
<tr>
<td><strong>Pillar</strong></td>
<td>Free standing feature supporting a covering, square in the cross-section</td>
</tr>
<tr>
<td><strong>Terrace &amp; Pillars</strong></td>
<td>Raised flat platform connected to a building, pillars with covering</td>
</tr>
<tr>
<td><strong>Portal</strong></td>
<td>Representative doorway</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Staircase or steps</strong></td>
<td>Internal or external stairs</td>
</tr>
<tr>
<td><strong>Timber structure</strong></td>
<td>Ruined timber shelters found in the courtyards of the compounds</td>
</tr>
<tr>
<td><strong>Water tank</strong></td>
<td>Building or container constructed for water retention</td>
</tr>
<tr>
<td><strong>Water well</strong></td>
<td>Artificial excavation, hole or structure for the purpose of withdrawing water</td>
</tr>
</tbody>
</table>

*Photo: See Ablutory room*
Appendix 2 - PERIODS

21st century
Constructions erected for a movie set in 2009 – walls of stone or cement blocks, mud/earth mortar of coarse grain and high amount of gravel, covered with mud slurry and/or shoddy plaster. Very often the proportion of mortar exceeds the proportion of stones in the stonework. Some parts of the structures may consist of provisional constructions made of wood, textile tissue and gypsum - e.g. portals or shelves.

20th century
Constructions characterized by use of cement as mortar and/or plaster, walls mostly covered with additional anhydrite plaster finish, sometimes also with mud slurry.

Two different modes of cement use:
- Cement used as mortar AND plaster for constructions made of cement blocks or for stone masonry in buildings of particular use - the mosque, the school and some of the water tanks.
- Cement used ONLY as plaster. The walls being constructed of stones and mud mortar, the wall faces are consolidated by the layer of cement plastering. This kind of construction applies for ordinary domestic buildings. Courtyard walls are covered with cement OR lime based renders.

Pre-20th century
Constructions built of stones and mud mortar, extensively ruined

Al Jumail, S42, courtyard walls erected in 2009; the gate made of textile and gypsum plaster

Al Jumail, mosque (S40). Masonry of cement blocks and stonework covered by cement plastering (left); the ablution room’s wall has an additional layer of anhydrite finish (right)

Al Jumail, S54, stonework with mud mortar and cement plastering. Anhydrite plaster finish on the façades, no anhydrite finish on the courtyard wall (right)

Al Jumail, compounds in the northern part of the village. Ruined walls made of stone and mud mortar
## Appendix 3 - BUILDING MATERIALS

### STONES

**Beachrock AG**
- **Colour:** White to beige
- **Solidity:** Very friable/brittle, loose components
- **Characteristics:** Fine grained, high content of shells and gastropods, rough surface

![Beachrock AG stones](image1)

**Beachrock BJ**
- **Colour:** Grey to light reddish
- **Solidity:** Soft to medium hard
- **Characteristics:** Recognizable stratification - gastropods and fine-grained sandy matrix, uniform ingredients, rough surface

![Beachrock BJ stones](image2)

**Beachrock LO**
- **Colour:** Reddish to brown, grey
- **Solidity:** Medium to very hard
- **Characteristics:** Rough surface, numerous cavities (holes), few gastropods and shells

![Beachrock LO stones](image3)

**Gypsum BE**
- **Colour:** Yellow grey to white or bright grey
- **Solidity:** Soft to medium hard (scratchable with fingernail)
- **Characteristics:** Fine grained, no shells or gastropods, little holes, recognizable stratification and horizontal splits

![Gypsum BE](image4)
**Dolomite BL**

*Colour*: Beige, yellowish, reddish, bluish grey  
*Solidity*: Very hard  
*Characteristics*: No shells or gastropods, very fine matrix, fine and polish surface, larger pieces with holes

---

**Fossiliferous limestone**

*Colour*: White to bright beige  
*Solidity*: Hard  
*Characteristics*: A limestone that contains obvious fossils - normally shells, cavities

---

**Aeolianite FR**

*Colour*: Beige  
*Solidity*: Fairly hard  
*Characteristics*: Medium grained, even surface, no shells or gastropods, homogenous, looks similar to sandstone

---

**Conglomerate**

*Colour*: Beige, grey  
*Solidity*: Very hard  
*Characteristics*: Mix of dolomite fragments and shells, extremely rough surface

---

**Coral**

*Colour*: Brownish  
*Solidity*: Hard  
*Characteristics*: Very rough surface, sharp edges, small cavities of organic origin
Concrete Block (old)  

Colour: Brown, grey  
Solidity: Two qualities: hard and soft (falls apart when touched)  
Characteristics: Both types with a high proportion of small shells. Size: 20/20/40 cm, walls of about 3 cm thickness surround two square hollow spaces  

Concrete Block (new)  

Colour: Grey-blue  
Solidity: Very hard  
Characteristics: No shells, round aggregate grains, porous. Size: 20/20/40 cm, walls of about 3 cm thickness surround two square hollow spaces  

Mortars  

Mud, Fine Grain  

Colour: Light brown to brown  
Solidity: Very soft  
Characteristics: Fine, extremely brittle and susceptible to wind erosion, joins stones in the cores of historic walls of stone masonry.  

Mud, Coarse Grain  

Colour: Brown  
Solidity: Soft  
Characteristics: High proportion of coarse aggregate, size reaching small gravel. In the stonework the proportion of the mortar often exceeds the proportion of stones
Cement

Colour: Grey, bluish-grey  
Solidity: Very hard  
Characteristics: Very fine aggregate, depending on the application technique smooth or rough surface

Plasters (Renders)

Anhydrite

Colour: White  
Solidity: Soft  
Characteristics: Fine, smooth surface, often applied as finish layer to cement plaster

Mud, Fine Grain

Colour: Light Brown  
Solidity: Medium  
Characteristics: Relatively fine, fairly rough surface; mostly found on the wall faces of the buildings erected in 2009

Mud Slurrying

Colour: Brown  
Solidity: Medium  
Characteristics: Thin layer, applied like paint to the white anhydrite or cement plasters

Al Jumail, courtyard walls in the village erected partly in 2009. Left: top of the wall made of stones with earth mortar, no plastering at all. Right: the fine, thin layer of mud plaster covering the rounded wall.
**Lime**

Color: Yellow grey  
Solidity: Hard  
Characteristics: Loose packing of aggregate grains stabilized by calcite cement and pores in between the matrix-forming particles. The pores have about the same size as the matrix particles and add up to 40 – 45 volume percent porosity. Often applied to the courtyard walls.

---

**Cement**

Color: Grey  
Solidity: Very Hard  
Characteristics: Fairly rough surface, very often scratched (wavy lines) to increase the support for the following finish layer.

---

**Fine Cement Finish**

Color: Grey to dark grey  
Solidity: Very Hard  
Characteristics: Very fine, polished, smooth surface, applied to lime or cement plaster.
SCREEN SHOTS of INVENTORY DATABASE for ARCHITECTURAL RECORDING

The start when you enter the database.

Structure registry. Just the basic information.

Structure record, with no information. The grey boxes with a small black arrow pointing down are scroll downs with different options.

The grey 'things' such as 'Enter Room Record', 'PDF' etc., are buttons leading you to the next step, or showing the pdf file, refresh the page etc.
SCREEN SHOTS of INVENTORY DATABASE for ARCHITECTURAL RECORDING

Structure record, example. You can click on the blue links and see the photos.

Room record, floor. No information.

Room record, ceiling. No information.
SCREEN SHOTS of INVENTORY DATABASE for ARCHITECTURAL RECORDING

Room record, example.

Room record, related features, example.

Room record, photos, example.
SCREEN SHOTS of INVENTORY DATABASE for ARCHITECTURAL RECORDING

Relations.

Photo record.
APPENDIX 11

MANUAL FOR TOURISTIC ASSESSMENT
OF HERITAGE SITES IN THE BUFFER ZONE & THE
AL ZUBARAH HINTERLAND

by BENJAMIN FABRE
Manual for the Touristic Assessment of Heritage Sites in NW Qatar

ASSESSMENT OBJECTIVE: Collect information about heritage sites in order to assess their touristic potential. The QIAH Project has already surveyed the entire region in 2012. The data collected is mostly archaeological and this new documentation intends to expand on the existing record by adding a series of indicators measuring the inherent value of each site from a touristic perspective. These new sets of indicators are divided into 2 main categories:
- Cultural and Environmental Landscape
- Infrastructural Capacities

In order to measure the touristic potential for a given site, all indicators are attributed a specific value according to their importance. Combining the recorded values will set an overall score for each site.

COLLECTION OF INFORMATION: The documentation sheet is divided into 4 sections:
- Site Identification details (predefined indicators)
- Main Category 1: Landscape
- Main Category 2: Infrastructure
- Future Work Proposal (optional)

SITE IDENTIFICATION
(all these indicators have been defined by the QIAH Regional Survey 2012).
- QNHER #: Number assigned to each site in Qatar, Qatar National Heritage and Environment Record
- Site Name: Informal name the site is referred to by the local population - if known
- Site Period: Defined by the regional survey (Neolithic, Early Islamic, 18th century, etc)
- Site Type: Defined by the regional survey (Settlements, water source, agricultural field, etc)
- Related sites: Sites located in the same vicinity and as well as contemporary

LANDSCAPE INTEGRITY ASSESSMENT

CULTURAL Landscape

Architectural remains/ruins
- High: standing ruins with occasional complete structural remains
- Med: visible architecture amongst ruins
- Low: very limited and unattractive visible remains

Archaeological activity
- H: the site is being investigated or has been comprehensively documented
- M: the site has partly been researched (excavation, survey, geology)
- L: the site has never been explored

ENVIRONMENTAL Landscape

Vegetation
- H: presence of a number of trees and/or mangrove and/or grass
- M: scarce presence of trees and/or mangrove and/or grass
- L: dry desert with disseminated low bushes only

Wildlife
- H: repeated sightings of multiple animals (e.g. multiple bird, wild mammal species OR large flocks OR colorful insects)
- M: occasional presence of some visually interesting animal species (see the above)
- L: rare occurrence of visible animal presence

Nearby Intrusive Structure
- H: No structure visible in the immediate vicinity of the site
- M: Very limited structures visible in the vicinity of the site
- L: Presence of large structures in the direct vicinity of the site

Site Pollution
- H: No visible pollution in the immediate vicinity of the site
- M: Presence of trash within the site
- L: Continuous overflow of large amount of trash within the site vicinity
# Infrastructure Assessment

## Traditional Structure
- **H:** Presence of traditional structure that could potentially be re-used
- **M:** Presence of traditional structure but badly preserved or inappropriate for re-use
- **L:** No presence of traditional structure

## Modern Structure
- **H:** No modern structures but space available to accommodate new structures
- **M:** Presence of modern structure and space available to accommodate new structures
- **L:** No structure and very limited space for any new constructions

## Accessibility
- **H:** Direct road access to the site
- **M:** Track access under 15 mins drive from the main road
- **L:** No track access to the site or over 15 mins drive from the main road

## Parking
- **H:** Presence of a parking space
- **M:** No parking but space to accommodate a parking place
- **L:** Limited or no space available to accommodate a parking place

## Guard’s cabin
- **H:** Opportunity for the re-use of a traditional structure to put up a housing for the guard
- **M:** No traditional structure available for re-use but space to put up a modern or traditional structure
- **L:** Limited or no space available for any structure that could be used as guard’s office/housing

## Toilets
- **H:** Toilets available on the site
- **M:** No toilets available but opportunity to re-use a traditional structure for toilet purpose
- **L:** Limited or no toilet space available or new construction opportunity only

## Shelters
- **H:** Presence of features (either natural or traditional building) that could be re-used as shelters to sit/rest/picnic
- **M:** Limited features available for re-use but space to put up new features
- **L:** Very limited space available for any feature that could be used as shelters

## Walking path/hike track
- **H:** Presence of a trail/path in the site and/or connecting the site to other sites in the vicinity
- **M:** No trail/path available for re-use but space to put up a new trail/path
- **L:** Very limited space available to put up any trail/path

## Waste
- **H:** Presence of garbage cans on the site and of a nearby skip
- **M:** No garbage cans but presence of a nearby skip
- **L:** No garbage cans and no skip available in the site vicinity

# Proposition for Future Heritage Work

(optional)
General description:

Re-Use with Experimental archaeology:

<table>
<thead>
<tr>
<th>LANDSCAPE INTEGRITY</th>
<th>H - M - L</th>
<th>Value</th>
<th>Comments</th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architectural remains/ruins</td>
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<td>Archaeological/research activity</td>
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<tr>
<th>CULTURAL Landscape</th>
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<tr>
<td>Vegetation</td>
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<td>Wildlife</td>
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<tr>
<td>Nearby Intrusive structure</td>
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<tr>
<td>Site Pollution</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>NATURAL Landscape</th>
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</table>

<table>
<thead>
<tr>
<th>INFRASTRUCTURE</th>
<th>H – M – L</th>
<th>Value</th>
<th>Comments</th>
<th>OVERALL</th>
</tr>
</thead>
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<tr>
<td>Traditional structure</td>
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<td>Modern Structure</td>
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<tr>
<td>Guard's cabin</td>
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<tr>
<td>Toilet</td>
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<tr>
<td>Shelters</td>
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<tr>
<td>Walking path/hike track</td>
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<tr>
<td>Waste Management</td>
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</tbody>
</table>

| TOURISTIC POTENTIAL |
APPENDIX 12 Conservation Schemes

12.1 Town wall (segments exposed in 1980s)
12.2 Town wall segments exposed by QIAH
12.3 Fortified Compound QMA 4
12.4 Palace EPO4 (in prep.)
State of Conservation

The outer town wall of Al Zubarah was excavated partly in the 1980s. The remains were consolidated then and capped with a flat cement layer. Over the past thirty years huge amounts of soil and sand deposit had accumulated on the exterior and the exposed wall segments were heavily effected by the harsh environmental conditions. When the QIAH-Project was initiated in 2009 it was decided to remove the accumulated deposits to make the town wall more visual for visitors and to gain a better understanding of its structural conditions. Based on the initial record of the state of conservation the conservation concept for the town wall was developed.
CONSOLIDATION OF EXTERIOR/OUTER WALL SEGMENT

1. **Documentation** of State of Conservation / **Planning** of Measures

2. **Consolidation** outer wall face (Fiche 3 ; Fiche 3.1)
   a) Re-placement of damaged wall stones
   b) Inserting new wall stones and new socle zone: up right standing conglomerate (La) stone slab and one course dolomite (Bl) to avoid damages caused by salt crystallisation (Fiche 3.2).

3. **Re-pointing** of joints (Fiche 3.3)

4. **Take-off of cement capping** (1980s) (Fiche 3.1)

5. **Re-shaping of wall tops** with additional wall stones (case to case basis) (Fiche 3.3 / 3.4)

6. **Re-plastering** of the “outer” wall segment: a) Wall faces with “hand tooling” (Fiche 3.5.2); b) Wall top with “Rough” surface (Fiche 3.5.3).

7. **Sharp edge line** defines wall face and wall top. “Double” line showing thickness of plaster (Fiche 3.5).

8. Not exposed walkways should be kept uncovered or will be covered again with a soil/sand layer after works at outer wall segment are finalised (Fiche 5; 5.1, and 5.2).

9. Produce **report** on executed measures to be stored with the Inventory data base.

10. Regular **monitoring** after the measure take place to initiate repairs when needed.
CURRENT SITUATION

former Walkway

Cement mortar

1980s Cement capping

Blown- & Washed-out Joints

eroded Wall stones

Sand & Soil deposits

heavily damaged (deteriorated) Beachrock

VAR. 1

GENERAL CONSERVATION CONCEPT

Taking-off cement capping
Re-shaping wall top ("re-ruined")

Re-plastering: Rough surface with traces of hand tooling; clear sharp, double lined edge

Re-pointing of joints

Addition of stones due to structural needs

Exchange of damaged Beachrocks

Removal of Sand & Soil deposits

Quartz-sand fill, compacted horizontally or slightly sloping away from wall basis
PROPOSED WORK for 2013:

Cleaning of wall segments.
Re-plastering of segment 8/9 including towers 8 and 9.

Consolidation of wall segment 17/18,
State of Conservation Record: Nov. 2009 (Photo-Survey), planned for spring 2013

Works should follow *fiches techniques*. The fiches needed for the proposed work are highlighted in **bold**.

---

**Fiche No. 1 Health & Safety instructions**

**Fiche No. 2 Building materials**

- 2.1 Materials to use for consolidation work

**Fiche No. 3 Wall consolidation**

- 3.1 Preparation and initial works
- 3.2 Wall foundations
- 3.3 Structural rebuilding
- 3.4 Reconstruction
- 3.5 Plaster works
- 3.5.1 Smooth surface
- 3.5.2 Hand tooling
- 3.5.3 Rough surface
- 3.5.4 Repairs

**Fiche No. 4 Consolidation and Stabilisation of Plasters**

- 4.1 Consolidation of plaster surfaces
- 4.2 Fixing of loose plaster pieces/parts
- 4.3 Cementing of cracks
- 4.4 Notes

**Fiche No. 5 Protection of architectural remains**

- General guideline
- 5.1 Backfill
- 5.2 Stabilisation & Protection

**Fiche No. 6 Monitoring**

- 6.1 State of Conservation
- 6.2 Climate data
- 6.3 Monitoring (Site journal)
- 6.4 Indicators and Periodicity
GENERAL CONSERVATION CONCEPT

Re-buried walkway
Re-plotting of joints
Re-plastering, with rough surface (Fiche 3.5.3) and ledge
Re-plastering, hand tooling (Fiche 3.5.2)
Exchange of damaged Beachrocks (Fiche 3.2)

VAR. 2

Town wall segment at tower 4012 (ZUEP04) in March 2012 (VAR. 2).
CONSERVATION CONCEPT:
TOWN WALL with exposed walkway, e.g. TOWER 8 / EP10

CURRENT SITUATION - January 2012

Section of wall segment North of tower 8

Wall base:
Soft Beachrock is in a poor state; Deterioration & Disintegration of Beachrock components!

Re-plastering:
"Rough" surface (wall top) and with traces of hand tooling (wall face); sharp edge (double-line) between wall top and wall face; edged corners
PROPOSED WORK for 2013:

Cleaning of area
Stabilisation and Protection of walls endangered to collapse

Consolidation of walls and wall plasters in Rooms R.004, R.005, R.006, R.007, and R.008.

State of Conservation Record: Nov. 2009 (Photo-Survey) and April 2012 (3D-Laserscan).

Works should follow *fiches techniques.*
The fiches needed for the proposed work are are highlighted in **bold.**
**Description (2009)**

**Measurements:** 6.80m x 3.10m, 21.08m².  
**Context:** Connected with R.005 and R.009.  
**Features:** Blocked door to exterior area in the west (street?); Niche in wall a.  
Floor is covered by deposits of blow-in sand and disintegrated building materials (beach rock components as well as sand).  
Relatively high concentration of salt.  
Fragile plaster remains at wall c and d which will be difficult to keep.

**Consolidation/Conservation suggestions**

**Proposal 2012:** Consolidation of walls, including re-pointing of joints and replacing of wall stones at the wall base if necessary. Taking off cement capping and re-shaping of wall tops. Re-plastering with smooth surface showing some traces of trowel tooling. Removal of deposits down to floor level and protection of floor according to manual.
State of Conservation - R.004_wall a

<table>
<thead>
<tr>
<th>Al Zubarah</th>
<th>Inventory - State of Preservation</th>
<th>November</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>QMA 4</td>
<td>Fortified Compound</td>
<td>Date: 18.11.2009</td>
<td></td>
</tr>
<tr>
<td>R.004</td>
<td>Wall a</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Wall a

**Description**

- Niche: b:82cm, t:48cm, UK 1,25m
- Anhydrite plaster in lower part of the wall preserved. Hard cement capping, cement mortar between beach rock stones.
- Voids, gaps, holes, out-blow, wash-out in wall structure.
- At wall base blow-in sand deposits and wash-out accumulations of building material debris.

**Consolidation/Conservation suggestions**

- 2012: Remove deposits in front of wall base;
- Remove cement capping and mortar;
- Consolidation of historic plaster remains;
- consolidation of wall structure; Re-shaping wall top and re-plastering according to manual
APP.12.3 CONSERVATION SCHEME
FORTIFIED COMPOUND QMA4

State of Conservation - R.004_wall b

<table>
<thead>
<tr>
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<tr>
<td>R.004</td>
<td>Wall b</td>
<td></td>
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</tbody>
</table>

**Wall b**

**Description**

Cement coat on wall top: Crackling. Beach stone (Ag) is badly preserved, mostly eroded and effected by out-blow and wash-out processes. Blocked door in northern half of the wall. The door reveal on both sides shows well preserved plaster remains! Massive wash-out-, blow-in-deposits at wall bottom of sand and disintegrated building material components. Only in southern corner some “original” plaster fragments preserved.

**Consolidation/Conservation suggestions**

2012: Removal of deposits down to floor level; Removal of cement capping and render; consolidation of wall structure; re-shaping of wall top - capturing door reveal of blocked door; Re-plastering according to scheme.
State of Conservation - R.004_wall c

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<td></td>
</tr>
<tr>
<td>R.004</td>
<td>Wall c</td>
<td></td>
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</tbody>
</table>

Wall c

<table>
<thead>
<tr>
<th>Description</th>
<th>Consolidation/Conservation suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement coat on wall top and upper 1/3 of wall face is crackling. Beach stone material is in a very poor state and heavily effected by aeolian and fluvial erosion processes. Wall structure starts to collapse. Massive deposits of disintegrated building material debris at wall base. In lower half of the wall historic plaster fragments preserved. It is unclear if the wall opening is a result of the 1980s excavation and consolidation work or if it is a historical context.</td>
<td>2012: Removal of deposits; Sorting of wall stones and plaster remains; Removal of cement capping and render; Consolidation of wall structure; consolidation of historic plaster remains; re-plastering.</td>
</tr>
</tbody>
</table>
State of Conservation - R.004_wall d

<table>
<thead>
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</tr>
<tr>
<td>R.004</td>
<td>Wall d</td>
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</tr>
</tbody>
</table>

**Wall d**

**Description**


**Consolidation/Conservation suggestions**

2012: Remove deposits, Collect fallen plaster remains; Remove cement capping and render; Consolidation of wall structure and plaster remains (mainly at the door); Re-shaping of wall top and re-plastering.
PROPOSED MEASURES and CONSERVATION CONCEPT - R.004_wall a

QMA 4_R.004 wall a; proposed conservation works

Design & Conservation principles

STATE of 1980s REPAIRS

CONSOLIDATION of 1980s REPAIRS
QMA 4_R.004 wall b; proposed conservation works
QMA 4_R.004 wall c; proposed conservation works

Comparable situation in the Palace (ZUEP04) after consolidation and re-plastering. Historic plaster remains were consolidated and integrated in the plaster surface.
PROPOSED MEASURES and CONSERVATION CONCEPT - R.004_wall d

- **REMOVAL OF CEMENT CAPPING AND PLASTER** (fiche 3.1)
- **Consolidation of historic plaster remains** (fiche 4)
- **Consolidation of wall and re-plastering with smooth surface** (Fiche 3.3 to 3.5/3.5.1)
- **REMOVAL OF DEPOSITS down to floor level, protect floor** (fiche 3.1 and 5)
- **Re-shaping of wall top** (fiche 3.4)
- **Keep this line for the border line between wall face and wall top**

- **Remove cement capping and mortar material** (fiche 3.1)
- **Re-shaping and re-plastering with a rough surface** (3.3 to 3.5 and 3.5.3)
- **Consolidation of plaster fragments (if possible)** (Fiche 4)
- **Different mortars**
- **Missing stones**
- **Cement coating**
- **Beach-stone eroded**
- **Cracked, voids, gaps**
- **Wash-out deposits of beach-stone materials**
- **Removal of deposits down to plaster floor, Protection of floor with Membrane and Sand** (Fiche 5)
APP.12.3 CONSERVATION SCHEME
FORTIFIED COMPOUND QMA4

Consolidation of WALL a:
- Interior wall faces with smooth surface (fiche 3.5.1) check in field for plaster ledge remains.
- Wall top with rough surface (fiche 3.5.3).

Consolidation of WALL b:
- Interior wall faces with smooth surface (fiche 3.5.1).
- Wall top with rough surface (fiche 3.5.3).
- Exterior wall face with hand tooling (fiche 3.5.2).

Consolidation of WALL c:
- Interior wall faces with smooth surface (fiche 3.5.1).
- Wall top with rough surface (fiche 3.5.3).
- Re-pointing and re-shaping of wall top.

Consolidation of WALL d:
- Interior wall faces with smooth surface (fiche 3.5.1).
- Wall top with rough surface (fiche 3.5.3).
- Re-pointing and re-shaping of wall top.

Removal of deposits down to floor level.
- Protection of floor with membrane and quartz sand (fiche 3.1, 3.4, and fiche 5).

Consolidation of historic plasters:
- See Fiche 4.

Hand Tooling (fiche 3.5.2)
- All wall tops
- Rough surface (fiche 3.5.3)
PROPOSED WORK for 2013:

De-backfill and removal of stabilisation material along walls etc. to prepare further excavation, documentation and initial consolidation work.

Re-plastering of walls initially consolidated in 2012

Consolidation of walls and wall plasters

State of Conservation Record: March 2011 (Photo-Survey & 3D-Laserscan); December 2011/January 2012 (Photo survey prior to work); April 2012 (3D-Laserscan).

Works should follow fiches techniques. The fiches needed for the proposed work are highlighted in bold.

Fiche No. 1 Health & Safety instructions
Fiche No. 2 Building materials
  2.1 Materials to use for consolidation work

Fiche No. 3 Wall consolidation
  3.1 Preparation and initial works
  3.2 Wall foundations
  3.3 Structural rebuilding
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  3.5.3 Rough surface
  3.5.4 Repairs

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  4.1 Consolidation of plaster surfaces
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  4.4 Notes

Fiche No. 5 Protection of architectural remains
  General guideline
  5.1 Backfill
  5.2 Stabilisation & Protection

Fiche No. 6 Monitoring
  6.1 State of Conservation
  6.2 Climate data
  6.3 Monitoring (Site journal)
  6.4 Indicators and Periodicity
CASE STUDY: Palace ZUEP04_Space 3018
PROPOSED MEASURES and CONSERVATION CONCEPT - Space 3018_wall a (4473)
PROPOSED MEASURES and CONSERVATION CONCEPT - Space 3018_wall b (4476)

Wall 4476, state of conservation, February 27th, 2012

Wall 4476, mapped materials and planned measures
PROPOSED MEASURES and CONSERVATION CONCEPT - Space 3018_wall c (4480/4475)
PROPOSED MEASURES and CONSERVATION CONCEPT - Space 3018_wall d (4481)

Wall 4481, state of conservation, February 27th, 2012

Wall 4481, mapped materials and planned measures
PROPOSED MEASURES and CONSERVATION CONCEPT - Space 3018

- Consolidation of walls:
  - Repointing & replastering (fiche 3.3/3.5)
  - Smooth surface (fiche 3.5.1)
  - Wall tops (fiche 3.4)
  - With rough surface (fiche 3.5.3)

- Smooth surfaces (fiche 3.5.1)
- Structural rebuilding
- Stabilise structural damp wall
- Installation of floor level protection with membrane and quarry sand (fiches 3.1, 6.5)
- Consolidation of historic plaster (fiche 4)
The Conservation Handbook for Al Zubarah Archaeological Site brings together all the existing information on the site and includes information from site reports and archive material. It also makes the information more easily accessible to people involved in the conservation process.

The Handbook provides guidelines for the conservation and consolidation of architectural remains at Al Zubarah Archaeological site. It presents information on environmental conditions, building materials, weathering patterns, conservation concepts, and also fiches techniques providing practical instructions for the actual conservation work.
1. INTRODUCTION

1.1 Preamble

The second season of archaeological fieldwork in Stage 2 of the Qatar Islamic Archaeology and Heritage Project (QIAH) in northern Qatar was carried out between November 1st 2010 and March 29th 2011.

The fieldwork was undertaken by the Department of Cross-Cultural and Regional Studies, University of Copenhagen in partnership with, and funded by, the Qatar Museums Authority. This report provides summaries of the main elements of the archaeological fieldwork carried out in 2010-2011, including substantial excavations in Al Zubarah and Freiha, rescue excavations in Ruwais/Khasuma, and extensive survey work at Islamic sites in various locations across the northern half of the peninsula of Qatar.

1.2 Project Background

Centring on the major political, cultural, and commercial settlement of Al Zubarah, which prospered in the later 18th and early 19th century CE, the University of Copenhagen was charged with investigating the Islamic era archaeology and heritage of northern Qatar in 2009. Since then the project has carried out three successful seasons of archaeological fieldwork.

Northern Qatar represents a remarkable region in which to study the emergence of economically, culturally and politically specialised settlements and communities during the early modern era in the Gulf. Al Zubarah is one of the most complete preserved cultural and commercial towns in the region, and holds key insights into the nature of urban societies in the Gulf, as seen through trade and economy, social life and status, and human lifeways. The site is embedded within a distinctive interrelated seascape and landscape, which consists of multiple coastal and inland settlements, wells, agricultural areas and temporary camps. Understanding the relationship between this rich historic landscape and urban settlement of Al Zubarah is a key aim of QIAH.

As part of this season, QIAH team members carried out excavations in five areas at Al Zubarah (see Section 2) and three areas in Freiha (see Section 3). In addition, the sites of Fuwairit, Qal'at Shuwail, Ain Mohammad and Ruwais/Khasuma were mapped. A survey along the coastline between Fuwairit and Ras Laffan was carried out, while Philip Macumber’s detailed geomorphological survey of northern Qatar was continued (see Section 4).

1.3 Aims and Objectives

The purpose of this section is to briefly outline the beginning of season objectives for each of the main areas of study in the 2010-2011 season. These are listed as bullet points for brevity and convenience.

1.3.1 Al Zubarah Excavation Point 1 (ZUEP01)

- To clarify the nature of Compound 2 by revealing its full extent and to gain a better understanding of its phasing and the function of its rooms
- To understand the chronology of Compound 2 in relation to other compounds in the excavation area and other earlier and later features
- To expose more of the Phase 6 occupation in ZUEP01, excavating a deep probe in the higher ground to the north where the best survival of a long stratigraphic sequence is most likely, in order to better understand the early occupation at Al Zubarah
• Determine whether there is a further alley or street to the north of Compound 2 to enable the further study of Al Zubarah’s street plan

1.3.2 Al Zubarah Excavation Point 2 (ZUEP02)
• To continue to expose the Phase 5 architecture across the site, bringing the entire area into phase with the east-west running roads in the north and south
• To expand the excavations northward to link ZUEP02 with the QMA ‘souq excavation area’ to establish stratigraphic continuity between the two
• To determine the size and function of the important courtyard building beneath the current Phase 3 and Phase 4 architecture in the main area of excavation

1.3.3 Al Zubarah Excavation Point 4 (ZUEP04)
• To continue the excavations in the fortified, palatial compound by exposing all of the southeastern courtyard area and adjacent rooms
• To obtain further data on the date and function of the compound and the individual rooms in the courtyard area
• To excavate a further sounding into the midden between the compound and the outer city wall to obtain additional evidence for dating, diet and lifeways, as well as trace further the character of the outer city wall

1.3.4 Al Zubarah Excavation Point 5 (ZUEP05)
• This new excavation area targeted the sizeable midden mound number 7 in the northern part of the site in order to sample and obtain material culture and other finds for the reconstruction of the inhabitants’ diet, trade links, patterns of consumption, lifestyle choices, and cultural traditions

1.3.5 Al Zubarah Excavation Point 6 (ZUEP06)
• ZUEP06 was a small sondage excavated through the stratigraphic deposits to the north of ZUEP01 to examine the deposits in an area of higher ground through the whole sequence of occupation.

1.3.6 Excavations in Freiha
• To complete excavations of the mosque (FREP01) launched last year and to detail its history of construction and use
• To open a large area in the core of the settlement west of the fort to understand the site’s occupation in terms of chronology, economy, cultural traditions and trade (FREP04)
• To test excavate a series of areas to the north and northeast of the core of the settlement to better understand the phasing of the site and the earlier occupations suspected to be present here

1.3.7 Regional Survey
• To complete the town plan of Al Zubarah following on from the 2009 work, in particular the 1980s and earlier 2000s excavation areas
• To map a series of sites in the surrounding hinterland of Al Zubarah including, but not limited
to, Qal’at Shuwail, Musaykah, Ain Mohammed, Al Khuwair, Qal’at Thaqab, Qal’at Rakayat, Khidaj, Al Nabaah, Jumayl, Qal’at Yusufiah, Shadiraya, Ghariya, and Ruwais. This will enable a more detailed understanding of the development of Al Zubarah’s hinterland.

- To conduct test excavations – where necessary – at selected sites to obtain securely stratified samples of material culture and associated finds to enable a dating profile for the surveyed sites
- To carry out a detailed geomorphological assessment of the landscape surrounding Fuwairit to better understand the site’s ecological and environmental setting and history
- To create the first ever map of Fuwairit by carrying out an intensive ground survey of the site
- To collect surface samples of ceramic and other finds
- To make a detailed assessment of the site’s preservation conditions

1.4 Methodology

1.4.1 Excavation

The project utilised the widely used single-context recording system (used in the previous season), which was adapted to the project’s specific needs. The system proved particularly useful for excavations in Al Zubarah, where complex urban stratigraphy was exposed across large open-areas. At times, however, the system was adapted to allow for excavation in somewhat more arbitrary levels, wherever sondages had to be excavated (e.g. ZUEP05 and Ruwais/Khasuma). In addition to using loci/contexts to distinguish particular features, architectural units or sediments, so-called “space sheets” were used to group related contexts together coherently. A common site grid aligned on the Qatar National Grid (QNG) was used, which was sub-divided into 5x5 metre squares. All single context and multi-context plans were drawn at 1:20 on Permatrace, which facilitated the subsequent scanning and digitization of site plans.

Samples were taken following a pre-designed scheme, on which basis deposits were sieved differentially according to their perceived interpretative importance. Botanical samples were likewise taken from significant sediment loci (midden deposits, floors, certain fills), and a minimum of 30 litres was taken per sample.

A more detailed overview of the methodology is provided in Richter (2011).

1.4.2 Survey

The project’s regional survey utilised a variety of techniques, from remote sensing using satellite photographs, historic aerial images, kite photography and current aerial photographs, to fieldwalking and site mapping using a Total Station and Global Positioning Systems.

These techniques were employed differently at various sites. Total Station surveys were carried out at a number of key sites in the region, including Fuwairit, to create complete maps of these sites. Fieldwalking was carried out to collect representative samples of material culture for dating purposes. A further fieldwalking survey was carried out along the east coast of Qatar between Fuwairit and Ras Laffan.

Aerial imagery analysis was used to detect sites, characterise them, map their extent and understand their change in preservation over time. For this a combination of aerial imagery and historic map regression was used. Finally, kite photography was used to create overview images of sites to enhance documentation.
1.5 SUMMARY

On the following pages we discuss the excavations in Al Zubarah and Freiha, the regional survey work at Fuwairit, Ruwais and other sites, as well as the rescue excavations carried out at Ruwais/Khasuma. The report also provides a summary of the important finds analysis and conservation work carried out during the field season.
Figure 1.1: Map of Al Zubarah showing the principal excavation areas
2. **Excavations in Al Zubarah**

2.1 **Al Zubarah Excavation Point 1 (ZUEP01)**

Lisa Yeomans

2.1.1 Introduction

Excavations in ZUEP01 during the 2010-2011 season focused on understanding four features: two compounds, a street providing access to one of these compounds, and an external area to the north of this street (Figure 2.1). These were all built during the expansion of the town and are thought to represent architecture from Phase 5 of the settlement’s occupation. During this phase the town was at its largest with blocks of courtyard houses organised around a street grid enclosed by the outer city wall. The main phase of settlement ends with the sacking of the town in 1811, and further archaeological evidence for this was found in ZUEP01. Rebuilding of the town and the construction of the inner city wall enclosing the smaller Phase 3 settlement took place thereafter, and some residual walls belonging to buildings that may date to this time frame were recorded and removed during the 2009-2010 season. In addition to the archaeological sequence dating from Phase 5, numerous features were excavated that suggest extensive earlier occupation either prior to the 1760s expansion or representing the initial occupation associated with their arrival. Here, we highlight some of the discoveries from the 2010-2011 season and provide an overview of the occupation sequence in ZUEP01.

![Figure 2.1: North-facing, overhead photo showing Compound 2 (centre), Compound 4 (centre-left), the street to the north that provide access into Compound 4, and the external space beyond north of the street](image-url)
2.1.2 Phase 6 Occupation

The Phase 5 architecture was built on a layer of mixed sand and cultural material. So far this has only been exposed below the southern end of Compound 4 and below the northern half of the courtyard of Compound 2 as well as below Sp.147 and Sp.166, where the Phase 5 occupation sequence was fully excavated (Figure 2.3). The sand itself has not yet been excavated, but it seals a number of earlier, as yet unexposed, features, which were visible in the sections of several pits excavated here. A number of cut features truncate the sand layer, although only a small number of these features have been excavated so far. These were rubbish pits, fire-pits and tannurs (Figure 2.2) indicating the extensive occupation that pre-dates the Phase 5 architecture. Spatially there is no particular distribution of these features, which may suggest that they were part of, or arranged with, temporary, ephemeral structures (e.g. tents or barasti). Exposure and excavation of a larger area of features dating to Phase 6 is necessary before a fuller interpretation of the nature and date of the occupation can be made.

![Figure 2.2: Pot (7372) reused as a tannur pre-dating the construction of Phase 5 architecture](image)

2.1.3 Phase 5 Settlement in ZUEP01

The expansion of Al Zubarah in Phase 5 is characterised by the construction of large compounds accessed from a network of streets. Many of the compounds excavated so far are typical courtyard houses representing the domestic structures of the wealthier segments of the town’s population. Compound 2 is an example of one of these structures with an internal open courtyard surrounded by domestic rooms of various functions, from latrines and washing areas, to cooking and sleeping areas. Access into the compound was from an east-west aligned laneway to the south, which also provided access into a larger courtyard house (Compound 1 excavated in the previous season). Compound 2 underwent minimal modification during its use with the occupation deposits accumulating from use in a recurrent and consistent manner. This differs from Compound 4 which was altered in its layout and function throughout.

Although only part of Compound 4 has been exposed, its original function focused, at least partially, on the production of dried dates and date syrup with two date presses or madbasat constructed during the original layout of the compound. Compound 4, perhaps significantly, was accessed from a different street to Compound 2. Access was from another east-west orien-
tated street north of the two compounds, with the street also providing access into an open area (Sp.190) where numerous temporary structures were erected over time. The urban layout, as demarcated by the access from streets, appears to be divided into zones with the excavations at ZUEP01 covering wealthier courtyard houses accessed from the southern street and production orientated and temporary structures accessed from the north. Although Compound 4 was initially associated with production activities, by its final occupation it had developed into a domestic courtyard house.

The external area to the north of the street also developed during Phase 5 with a curvilinear structure constructed in the northeast corner of the excavation area. This structure (Sp.191) would probably have been a small domestic arrangement providing a space to cook and sleep for an individual or small group of people. Eventually a more substantial roof requiring a large post was constructed in the structure and a stone-paved floor was laid. At the end of the Phase 5 occupation of Zubarah Sp.191 was terminated by fire.

Figure 2.3: Plan of Compound 2 showing Space numbers designated to rooms within the courtyard house
Compound 2 is trapezoidal in shape and contained within the area of two streets converging to the east (Figure 2.3). Although the overall shape of the compound is trapezoidal, the individual main rooms, built along the inside of the external walls, are rectangular allowing them to be easily roofed. On the west side of the compound this resulted in the overall curvature of the external wall with a change of angle where the internal wall dividing Sp.147 and Sp.142 is built into the external western wall. The layout of the courtyard house utilised an irregular plot of land whilst maintaining the regular shape of the main rooms. Walls were generally constructed from beach rock and gypsum stones with those needing to offer more structural stability constructed from aeolianite. The internal sides of the walls were all plastered and several rooms had a plaster surface laid over a stone paved make-up layer.

The main rooms of the compound consisted of a rectangular entrance passage (Sp.132) with bench features built into this eastern and northern ends. This entrance passage would have blocked the view into the compound from the street and provided an area for visitors to wait. To the east of this room, on the south side of the courtyard, was a long rectangular space (185) with a plastered surface. The north side of this space was open with the roof supported by a central column. This room would have provided a communal sitting area (liwân), a common feature of traditional Gulf architecture. Along the western side of the compound was a hammâm (Sp.151). The north side of the compound was occupied by a large room (Sp.150) which could be accessed from both the courtyard and Sp.147. This room had to be traversed to reach the smaller plastered room (Sp.142) in the northwest corner of the compound which may have functioned as sleeping quarters. It seems probable that Sp.147 was not covered allowing the breeze to cool down the plastered room Sp.155 through a wide, arched opening. A collapsed arch was recovered from here during the 2009-2010 season. The main cooking room in the compound was Sp.166 which is a small irregular-shaped room formed by the construction of the surrounding rectangular rooms. In the corner of the room a small area of the original floor surface impressed with a relief of matting survived (Figure 2.5). To the north of this was Sp.165 which was a very small room plastered on the inside with no means of access at ground level. There is evidence of a small second storey
accessed by steps built into the internal wall just outside the kitchen (Figure 2.6). This upper storey would have been supported by three pedestals of masonry found in the southwest corner of Sp.166 and in the northeast and northwest corners of Sp.151. It is possible that the upper storey consisted of a wooden superstructure or may have been a flat, open roof space. It is unlikely that there was a full range of second storey rooms, however.

Occupation within Compound 2 resulted in the accumulation of debris in the small cooking room
(Sp.166) as well as in the courtyard. A series of tannurs, fire-pits and hearths were excavated in this room although some cooking also took place in Sp.147 and the courtyard. A rubbish pit in Sp.166 produced an oil lamp discarded amongst the other rubbish (Figure 2.7). Towards the end of the occupation sequence in Compound 2 a large pit lined with stones, possibly used for bitumen processing, was dug into the courtyard. Modifications to the architecture of the courtyard house were limited to those used to reinforce its structural stability.

Figure 2.7: Oil lamp found in a rubbish pit in Sp. 166 from the occupation of Compound 2

**Compound 4**

As already mentioned, Compound 4 was initially constructed with two date-presses or madbasat for the production of date syrup (Figure 2.8, Figure 2.9). Aside from the two date-presses, a small room (Sp.195) provided a wash basin as well as cooking facilities. The rest of the exposed part of the compound was left open but a number of hearths, stake- and postholes represent several temporary shelters or lean-tos erected to provide shade whilst working in the outside space.

The first major change in Compound 4 marked a considerable shift in use of the area and involved the dismantling of the upper parts of the walls of Sp.195 to form a large open space, which was re-surfaced. The nature of the occupation in this phase was characterised by numerous post-holes, hearths, one tannur and large rubbish pits. The surfaces themselves are the result of finely laminated occupation spreads, trample and patches of laid-down surfaces that built-up during the use of the area. The postholes represent temporary structures that would not all have been in use at the same time. There was also evidence of bitumen processing and other skilled activities (Figure 2.10).

After the enclosed area of Compound 4 had been used for successive temporary structures, similar in nature to the occupation north of the street, the compound was transformed into a typical courtyard house. Numerous walls were built forming new rooms (Figure 2.11) and another wall was knocked down and rebuilt to align perpendicularly with the new walls. The view into the courtyard was blocked with the construction of a partial wall along the line of sight through the entrance into the compound. Thresholds in doorways were plastered and had sockets for wooden doors and one of the old date-presses was converted into a latrine. A room specifically designed for cooking was built (Figure 2.12) with a wide open entrance from the courtyard.
Figure 2.8: View into Compound 4 from the street showing the two date-presses in use during the early occupation of Compound 4

Figure 2.9: End of season plan of Compound 4, the street and Sp. 190 showing the date-presses Sp. 192 and Sp. 187 from the initial use of Compound 4
Figure 2.10: Circular hearth and flue [7218] before excavation showing the scorched edges along the entire feature which cuts an earlier wall.

Figure 2.11: Newly created Sp. 181 forming one of the suite of rooms when Compound 4 was modified into a courtyard house.
Presumably as the family occupying the courtyard house expanded or gained additional wealth, further rooms were added and at times subdivided into small rooms (Figure 2.13). There was no evidence of destruction by burning the end of the occupation of Compound 4. However, two large storage jars appear to have been abandoned and these were subsequently smashed in situ by the collapsing walls of the abandoned structure.

The street

Throughout Phase 5 the street (Sp.189) to the north of Compound 4 was re-surfaced repeatedly with the earliest surfaces still to be excavated. Occupation debris had been trampled into the surface of the street forming numerous thin laminations of debris. All deposits from the excavation of the street were 100% sieved recovering large assemblages of pottery and bone, along with numerous coins and other artefacts. The amount of waste that accumulated in the street is highlighted by the presence of articulated fish bones. A series of plastered gullies (Figure 2.14) built onto the external sides of the walls facing onto the street would have managed the flow of water running off the building after heavy rain.
Figure 2.13: The eastern series of rooms during the final occupation phase of Compound 4 showing Sp.146 in the foreground and Sp. 161 and Sp. 163 in the background.

Figure 2.14: Drain capping stones <1816> sealing drain in the street fed from a plastered gully
Open area to the north of the street

The occupation sequence to the north of the street remains to be fully excavated. The area is divided from the street by a low wall with a threshold close to the northern limit of excavation where the street navigates around Compound 4 (Figure 2.15). Numerous postholes cut the lowest surface reached during excavation, which would have resulted from a sequence of temporary structures. Following resurfacing, a number of tannurs were constructed perhaps indicating a slight shift in the temporary structures with the area exposed used as an external cooking space (Figure 2.16). In the north east of the area a curvilinear, un-plastered stone wall (enclosing Sp.191) was constructed. This is only partially visible within the limit of excavation and continues to the north and east beyond the excavation area. The western wall of the structure was robbed out, probably in Phase 3 when stones were needed for the construction of the Inner City Wall. Eventually a stone surface was laid and a large roof-support post was erected and held in place by a number of broken grind-stone fragments (Figure 2.17). Sp.191 remained in use for a while resulting in a number of surfaces and occupation debris spreads as well as hearths and a tannur within the room. Eventually, the occupation of Sp.191 ended when fire destroyed the structure. This fire resulted in the accumulation of a burnt deposit which was probably the remains of the roof that fell into the space when still alight as it also scorched the underlying surface. In section this burnt layer could be seen extending slightly beyond the wall of the structure, where it clearly sealed the final layer of street surface, indicating that the occupation of Sp.191 continued until the time when the street was abandoned. It seems possible, therefore, that the fire which destroyed structure Sp.191 was a result of the attack on the town in 1811, which terminated the occupation of the compounds and other structures built in Phase 5.

Figure 2.15: Access into the open area to the north of the street with the numerous post-holes and cuts for tannurs visible in Sp. 190
Figure 2.16: Tannurs (1822), (1825) and (1829) in Sp. 190

Figure 2.17: Structure Sp.191 showing the western wall removed by later robbing, and area of stone paving <1916>
2.1.4 Conclusions and potential for further work

The excavation of ZUEP01 in the 2010 to 2011 season has provided evidence from the occupation of the town during its main occupation phase (Phase 5). Large assemblages of pottery and bone, as well as numerous coins and other artefacts, provide dating evidence and information about the diet and status of these different groups, which will be analysed in due course. As most of the occupation sequence from Phase 5 of the settlement has been excavated at ZUEP01, the area now provides potential to examine the Phase 6 archaeological sequence over a much larger area. This will provide essential evidence allowing us to understand the earliest occupation of the site.
2.2 **Al Zubarah Excavation Point 2 (ZUEP02)**

*Michael House*

### 2.2.1 Introduction

Al Zubarah Excavation Point 2 (ZUEP02) is located inside the inner town wall of Al Zubarah slightly to the north of centre overlooking the beach about 50 m southeast of the QMA’s excavations of the area identified as the ‘*suq*’ (Figure 1.1 p. 5). Together with ZUEP01, this area has been the longest running excavation area in Al Zubarah and continues on from the previous season of work (see House 2011). As a result, most of the research aims remained the same with the overarching goal to try to gain a better understanding of the area and its function (either static or changing) throughout the development of Al Zubarah.

Last year’s discovery of a number of rooms with significant densities of broken ceramics strewn across their floors, suggested that they functioned as shop fronts (House 2011). This highlighted the possibility that at least some of the structures identified in ZUEP02 form part of the *suq* previously excavated by QMA. One additional aim this season was to verify this idea by extending the excavation area northward by 35 metre, linking it to the previous QMA *suq* excavation area.

Similar to ZUEP01, ZUEP02 preserves evidence for the most complete archaeological sequences of phases in Al Zubarah (Phase 1-5), showcasing the site’s development from the late 18th century to its abandonment in the early to mid 20th century. Apart from a few features in the newly opened northern extension, Phase 1 and Phase 2 were already completely excavated, recorded and removed during the previous season of excavation across ZUEP02.

The potential for exposing more of the *suq* area in ZUEP02 is of crucial importance for our understanding of Al Zubarah’s urban structure. *Suqs* and their attendant buildings and features were important hubs and centres of the urban life in many Gulf and Arab towns and cities. Given Al Zubarah’s history as a merchants and fishing port, excavations in the *suq* provide crucial pieces of information on the economic and social life of the settlement’s inhabitants. Understanding the relationship between ZUEP02 and the former *suq* excavation area to the north is, therefore, of prime importance. Below, the principal phases in ZUEP02 will be discussed in turn.

### 2.2.2 Phase 5

This Phase has been only partially exposed or excavated in the southern and central part of the excavation area. Excavations in the new northern extension and in the southwest of the excavation area have not reached this point (Figure 2.18).

The tops of walls, which appear to belong to Phase 5, have been partially exposed in the western part of the northern extension. These walls are largely north-south aligned and tacit observations suggest that they are in line with Phase 5 architecture exposed elsewhere in ZUEP02. Exposure and excavation of these structures in the northern extension will be a focus of future fieldwork.

Other than in the previously excavated parts of ZUEP02, as reported in House (2011), Phase 5 architecture and features were exposed in the north-eastern area. Here six rooms (Spaces 014, 015, 016, 024, 030 & 031) were revealed north of an east-west running alleyway (Space 003). Three of these rooms were already excavated during the previous season. To the south of this area there began to emerge a second large courtyard compound bounded to the north and south by roads. Four rooms and a corridor were excavated this season (Spaces 034, 035, 043 and 058), along with part of a fourth room located below the retained Phase 4 date press (Space 011). Three of the rooms were accessed only from a large central courtyard to the north. Prior to its blocking, the corridor (Space 035) linked three other spaces excavated last season (Spaces 025, 027, and 028) to a room as yet unexcavated to the north. Further excavations are necessary to fully expose this structure in plan, but the rooms thus far excavated provide an initial insight into the nature
Figure 2.18: Phase 5 Architecture
of this building. As is common across the site, and typical of the Phase 5 architecture, walls are rendered in gypsum or mud. The rooms appear to be partially dug into the natural, as gypsum plastered steps lead up from them into the courtyard to the north.

A large room (Space 045) was also excavated to the west, which was separated from the rooms to the east by the corridor (Space 035; Figure 2.19). Excavations in this room revealed a collapsed arched lying in the centre, the outside of which had been clad in plaster (Figure 2.20). Excavations down to the floor level produced a scattering of finds, which consisted of ceramics and the occasional coin. Particularly noteworthy was an oyster shell with a not fully developed pearl fused onto the shell. (Figures 2.21, 2.22). A discrete fireplace was also found in Space 058.

Collapse in all of the rooms appears to reflect natural decaying processes, suggesting that the buildings were left open and fell down gradually. A large spread of broken ceramics in Space 045 suggests the in situ destruction of one or two large (water) storage vessels, which suggests that the room may have been used as a storage room towards the end of its use-life (Figure 2.23). During the beginning of the abandonment Space 035, the north-south corridor was blocked at the southern end, making it in effect an additional, narrow room. Numerous fish bones discovered here suggest it may have been used for processing fish.

As parts of this building decayed, Space 034 was used as a dumping area for residue from a presumably not as yet further clarified manufacturing process (Figure 2.24). A vivid orange brown deposit was found in-filling this room. This deposit was previously determined to have a high iron content, when it was found to the north of Space 003 (see last year’s report). These related processes of decay, abandonment and dumping of material represent the last stage of Phase 05 excavated during this season in ZUEP02.

Figure 2.19: Phase 5 excavations looking SE, showing spaces 43, 68, 34, 35 and 45 (left to right)
Figure 2.20: Space 45 showing the collapsed spanning archway.

Figure 2.21: Oyster shell with fused pearl – found on the surface of Space 58
Figure 2.22: Oyster shell in-situ in the NE corner of Space 58

Figure 2.23: Crushed in-situ water storage jar on the floor of Space 45
2.2.3 Phase 4

Phase 4 was previously characterised as an ‘intermediate stage’ in the occupation of Al Zubarah. It follows on from the seeming abandonment and decay of Phase 5, which probably corresponds to the devastating effects of the 1811 attack on the town (Figure 2.25). This phase consists almost entirely of minute traces of settlement: postholes, stakeholes, ūmrūs and other fire places, single-course flimsy walls and patchy occupation floors. These mark what remains of ephemeral structures, such as tents or ḏārāstī in the settlement, which sometimes utilised parts of old, abandoned buildings. This picture was reinforced by the findings from this season’s excavations.

The earliest of these features were cut into the orange-brown industrial waste discussed above, but these were quite shallow and are likely truncated. The next group of features were contained beneath a widespread levelling deposit and occupation horizon. This levelling deposit was brought in immediately prior to the construction of the Phase 3 architecture. Cut features appear in distinct clusters throughout the excavation area, but they are difficult to define as individual structures. Many postholes and stakeholes appear to have a quite random spatial orientation; although windbreaks built using stone and stake/post-holes were identified. It is very difficult, if not impossible, to clearly delineate contiguous arrangements, as many of these features may relate to multiple episodes of tents or other ephemeral buildings being situated in this area (Figure 2.26).

Although Phase 4 does not represent a complete hiatus in the settlement sequence of ZUEP02, it shows that the effects of the 1811 attack were likely quite dramatic, with much of the earlier stone architecture being abandoned, left open, or being replaced by tents and windbreaks.
Figure 2.25: Phase 4 open area plan showing the numerous cut features, two temporary structures and the date processing room Space 11

Figure 2.26: Phase 4 - SE view of temporary structure marked by low-lying stone surrounds
2.2.4 Phase 3

The majority of the archaeology excavated during 2010-2011 in ZUEP02 was linked to Phase 3. Some architectural elements of this phase had already been removed during the 2009-2010 season, while new elements were added in the northern extension where additional Phase 3 architecture was found (Figure 2.27).

In the south-western part of the excavation area only one room (Space 029) was excavated, leaving the date storage room (Space 011) behind (Figure 2.28). The date storage room will be excavated and removed in the forthcoming season. Space 029 was constructed in much the same fashion as almost all the Phase 3 architecture. Walls were rubble-built, with a stone core faced with larger selected beach stones bound by a loose mid grey or yellowish brown sand-and-lime mortar. Floors all consisted of shell layers, which appeared burnt in places. A small sub-dividing wall was built following the initial use of the room, splitting the room into two small square-shaped rooms. The building’s main entrance was located to the west.

A large proportion of the Phase 3 architecture is located in the western part of ZUEP02 and most structures had already been recorded in the 2009-2010 season, only requiring removal to pursue the stratigraphy beneath. This included spaces 007, 008, 009, 010, 033, 022 and 023. The trend is again one of ‘piece meal’ architecture, which is characterised by the use of poorer building materials and less carefully applied construction techniques when compared to Phase 5. This is an impression that is concurrent across the excavations in Al Zubarah. The first rooms to be built in the western area were Space 007 and 009 to the north, adjacent to the east-west running road Space 003. An enclosure wall linking these two spaces and enclosing a more or less square shaped courtyard was then built. The enclosure wall does not survive in its entirety having been partially demolished in the south as the compound was expanded. This was likely coupled with the construction of the large enclosed Space 005 to the south.

This latest extension of the enclosure was directly linked to the construction of the additional Space 008 to the north. When the compound was extended eastwards, Space 002 became part of a ‘north wing’ of this enclosed area. This was followed by the construction of two small rooms (Spaces 010 and 033) located south and north of Space 007 respectively. To the west of Space 007 a further room was constructed (Space 023), which was then connected to Space 007 by the construction of a further small room (Space 022). Both were associated with internal and external shell surfaces that served as floors. Space 022 was constructed in a much more flimsy fashion than either Space 022 or Space 007 to the east. A hard metalled surface was removed in this space during the last season, which may reflect a regular, heavy-duty use of the room.

The area to the east of this compound outside Space 022 and 023 saw a considerable amount of activity. This is attested by two tannurs that were built in the open, but sheltered from the winds by existing walls. Additional fire pits and a dumping area consisting of ash, fauna and some ceramics were located around the larger of the two tannurs.

Returning to the compound itself, Space 009 saw a considerable amount of activity over its use-life. A southern doorway provided access to and from the enclosed yard (Figure 2.29), and it contains multiple floor levels which were cut by multiple, discreet pits, postholes and door socket/pivot holes. The constructional quality of this room can be considered as somewhat better than most of the other Phase 3 architecture, with more high-quality building material being used and more carefully applied wall rendering. Twenty cut features truncated the vast majority of the earliest floor level, which only survives at the eastern end of the room. Notable amongst the cut features were a row of three post holes that probably represent an internal sub-division of the room by a beam and palm frond construction. Several fire/hearth pits were found in the north and eastern parts of the room, in addition to one hearth-pit in the south-eastern corner.

These twenty features were sealed by a shell floor laid across the room. One dumping pit was cut
Figure 2.27: Phase 3 architectural plan
Figure 2.28: Eastern view of Space 29

Figure 2.29: Threshold in the southern wall of Space 09 allowing access to the courtyard
through the floor containing copious amounts of ash. One post hole near the southern doorway suggests that a new doorway may have been installed at this point. Two successive floors were then laid in the room, but only the latest of the two covered the whole extent of the room. Following the laying down of the first of these two later surfaces, another group of features that included post- and stakeholes were excavated, which may represent yet further subdivisions of this room. The last floor to be laid in this room produced evidence of only a single *tannur*.

Space 008 was a late addition to this compound in Phase 3 (Figure 2.30). It was built atop a levelling deposit covered by a mortar render. These were sealed beneath a floor, on top of which this room was built. Prior to construction three postholes, a larger pit and *tannur* indicate that this area saw some activity. A series of features – excavated in the last season – cut the remnants of the earlier floors in this room. Situated between Space 009 to the north and 007 to the south was the small room Space 033. This was a very ephemeral structure, which appears to have been heavily ‘robbed out’ with only a single course of stone remaining in place.

Space 010 was created in a similar process of construction as its counterpart to the north (Space 033) (Figure 2.31), with the insertion of a northeast-southwest running wall between the existing outer compound wall in the south and the southern wall of Space 007 to the north. Two small rectangular openings (vents?) were opened up above ground level in the western wall (Figure 2.32). A pit and an occupation floor were excavated inside this room, with access from the court-yard to the east. There is little understanding of the function of the two openings in the wall, but is likely that they provided some kind of ventilation for this area, as they are somewhat too small and too low above ground to act as windows.

Apart from the construction and activities attested in these rooms, investigations also targeted the courtyard area, where several Phase 3 features were excavated this season. These consist of series of pits, post- and stakeholes and *tannurs*. Many of the pits and fireplaces appear to be associated with domestic food preparation. Some of the stake- and postholes mark the locations of windbreaks and shelters. These features reflect considerable activity in the courtyard area, and were sealed beneath further occupation levels.

In the northern extension, further architecture belonging to Phase 3 was revealed and recorded, but not yet removed by the end of the season. While the Phase 5 architecture in this northern part appears to relate more closely to the *suq* previously excavated by QMA, the Phase 3 architecture here has a more random, domestic function. Like the predecessor buildings in this area, this architectural phase is also aligned north-south, although there appears to be somewhat greater deviation to this alignment. Eight rooms (Spaces 036, 037, 038, 039, 040, 041, 044, and 046) were revealed and documented. They form a single complex which is enclosed by a boundary wall around a courtyard. While the western limit falls within the excavation area, the eastern part is beyond the limit of excavation (Figure 2.33).

Three of the rooms (Spaces 037, 038 & 039) were constructed as part of one development, while Spaces 041 and 040 were built somewhat later. Space 044 was constructed even later than that. Space 037 appears to have been used as a storage room (Figure 2.34), as reflected by a wide range of ceramic sherd broken *in situ* and strewn across the floor of the room. Space 038 is a rectangular room which, on the other hand, appears to have functioned as a cooking area (Figure 2.35). A shell floor covered the entire internal surface of the room, while a wide range of domestic waste and material culture was strewn across the floor. A small fire pit/hearth was located against the eastern wall, which was backfilled and re-cut by a *tannur* pit. Two further pits and a posthole also cut this earliest floor. The room was then resurfaced with a compacted sand-silt floor, which reflects trampling. Two pits were cut into this floor, including one fire-pit and one proper *tannur*. 
Figure 2.30: Western view of Space 08

Figure 2.31: Eastern enclosing wall forming Space 10
Figure 2.32: Western wall of Space 10, showing the two inserted vents

Figure 2.33: Aerial overview of the Phase 3 architecture in the northern extension area
Figure 2.34: Space 37 storage room (Phase 3), in the northern extension

Figure 2.35: Space 38 cooking area, Phase 3 room in the northern extension
Space 039 was only partly exposed in plan, as it continues eastwards beyond the limit of excavation (Figure 2.36). The western part of the floor, which slopes down towards the centre of the room, was burnt. Two firepits and a single posthole were cut into this floor, filled by ashy deposits with inclusions of animal bone. This appears to be yet another instance of a food preparation/cooking space. However, the peculiar appearance of the floor suggests that the function may have been slightly different. It is possible that this may have been a fish curing or smoking room.

In the southwest corner of the compound Space 036 is a sub-rectangular room (Figure 2.37). The primary floor consists of a thick shell and sand floor, which produced a rich assemblage of material culture and associated finds. This appears to reflect a slow accumulation of occupational detritus combined with trampling. Three cut features (a firepit, tannur, and a posthole) truncated this floor. Once again, it appears that these rooms served broadly domestic functions.

The small room labelled Space 046 is located to the northeast of Space 036 and appears to have served as an entrance corridor or portico leading into Space 036. The internal space of this small room was covered by a trampled occupation surface, which contains a mixed assemblage of material culture, associated finds and charcoal inclusions. A single posthole and a firepit were cut in the southeast corner of the room. The latter was cut by a tannur, which re-used sherds from a storage vessel (Figure 2.38).

North and northwest of Space 039, two further rooms were constructed (Spaces 040 and 041) (Figure 2.39 [includes relationship with Space 044 and 039]). Neither could be fully exposed in plan. Due to the incomplete lateral exposure it is not fully ascertained that Space 040 is indeed a room – it may equally be a courtyard. Again, a sand and shell surface represents the floor surface, which was cut by two features (a pit and firepit – both of which are as yet unexcavated). A sand and shell surface was laid over this floor thereafter, although this was discontinuously spread across the area. Space 041 is a rectangular room in the northeast corner of the northern extension. Access from a space to the north (beyond the limit of excavation) exists, with a second possible entrance in the southern wall. This entrance appears to have been blocked up later on. Due to the construction of Space 044 to the south it is unlikely that this entrance was in use for very long. Space 044 is a small rectangular-shaped room which was one of the last additions to the building. The interior floor surface was virtually indistinguishable from the courtyard floor layers, and the function of this late addition room is as yet unclear.

The courtyard which is surrounded by this group of rooms (Space 042) is an irregularly shaped open space (Figure 2.40), which is characterised by the stepwise development of this compound. Survival of surfaces and floors in the courtyard is patchy and these patches are difficult to link across the entire space. Only one tannur so far is associated with the open courtyard, which was excavated to the west of Space 038.

The area between the compound of the northern extension and the rest of the previously excavated area of ZUEP02 to the south contains a surface deposit, which appears to have developed over a protracted period of time. It contains several burnt lenses, dumping areas, as well as copious amounts of fragmented material culture. Cutting this surface were several features, including a firepit and postholes, which may represent the remnants of a windbreak (Figure 2.41).

Following construction and occupation, Phase 3 architecture across ZUEP02 experiences a gradual decline. Material is dumped in what appears to now be disused buildings. Buildings were left open and decayed gradually, with little robbing of walls or reuse in evidence.
Figure 2.36: Space 39 small cooking room with ash floor and vents in the northern and eastern walls. Insert shows the vents in the west wall.

Figure 2.37: Space 36 – a later domestic addition to the compound - and Space 46 - a small entrance portico to the north allowing access to Space 36 - form the central courtyard.
Figure 2.38: Tannur located in the SE corner of Space 46 (entrance portico)

Figure 2.39: Architectural group including; Spaces 39, 40, 41 & 44 located in the NE corner of the Northern extension area.
Figure 2.40: SE view of the Courtyard Space 42 in the northern extension

Figure 2.41: Firepit and postholes forming a wind break located in an open area to the south of the compound.
Figure 2.42: Phase 2 architecture.
2.2.5 Phases 2 & 1

Evidence for these phases is ephemeral and was only encountered in the northern extension (having been excavated and removed in the southern main area during the previous season of excavation). It consists of some Phase 02 pitting into the rubble infill, as well as Phase 01 accumulation of aeolian silts and sands and some localised trampling (Figure 2.42).

2.2.6 Conclusion

Work in ZUEP02 made significant progress over the course of the 2010-2011 season, with much of the Phase 03 architecture removed in the southern part of the excavation area, and a link being created with the suq in the northern extension. Phase 5 architecture continued to be exposed and we are gaining a better understanding of the kind of structures that can be expected to be fully revealed in the future.

ZUEP02 continues to produce evidence for the most crucial phases of Al Zubarah’s occupation and, together with ZUEP01, is one of the few areas in which excavations have produced a full stratigraphic sequence detailing the history and development of the site. Nevertheless, excavations are at an intermediate stage in ZUEP02 and further work is required to complete the full exposure of Phase 5. Further progress on this will be made during the next season of excavation.

The emergent picture of the Phase 5 architecture appears to confirm that we are looking at a broadly commercially orientated group of spaces and buildings here. It seems that further excavations will reveal more of the suq, allowing us to link the present excavations with the previous QMA excavations stratigraphically. This will provide a fuller understanding of Al Zubarah’s economic and trade activities within a socio-political context. On the surface a look at some of the Phase 5 walls in ZUEP02, particularly in the southern area, suggest that we may be dealing with the footprint of a commercial warehouse in this area, which would work well with the idea of a larger market district. However, further excavations in the main area and in the northern extension have to be undertaken to clarify these issues.
2.3 Al Zubarah Excavation Point 4 (ZUEP04)

Tom Collie

2.3.1 Introduction

The site at Excavation Point 4 (hereafter ZUEP04) is located at the southern end of Al Zubarah (Figure 1.1, p. 5) and focused on a large compound enclosing rooms and courtyards surrounded by perimeter walls with corner towers. This was divided into eight separate areas around a centralised courtyard, which appears to have been circumnavigated by streets and passageways (Figure 2.43). The excavations from this season examined the entirety of one of the eight compound areas (hereafter named Precinct-Section 8), to determine its layout and function within the compound as a whole (Figure 2.44).

The archaeology revealed has been organised into the four phases previously established for ZUEP04 in season 2009-10. The oldest phase pertains to pre-construction activities and the natural geology. The following phase represents the construction of the building. The next phase relates to the occupation of the building including architectural renovations, dumped midden deposits and occupation deposits and features found within the internal rooms. The final phase includes materials from architectural dilapidation and degradation along with modern overburden deposits.

Figure 2.43: Plan of the Precinct Area
Figure 2.44: Post-excavation plan of excavated Precinct-Section 8
2.3.2 Phase 4: Pre-Construction and Natural Geology

Phase 4 details features and deposits that existed before the construction of the compound. Little evidence was found from this phase, purely because most remaining architecture was left in situ, which prevented any observations of the stratigraphy below. This differed from season 2009-10 where archaeological features, believed to pre-date the building construction, were discovered. Floor surfaces and walls were not excavated and therefore any features beneath were simply not seen. Natural geological deposits were evident in the sides of pits from the courtyards and in Space 3019. However glimpses through intrusive archaeological features were inadequate to make large scale conclusions about the nature of the geology prior to building construction. Further work would be needed here to gain greater insight regarding pre-construction activity.

2.3.3 Phases 3 & 2: Construction and Occupation

Descriptions of these important phases are combined in the present report. Ideas on general construction order and planning are described below followed by an account of architectural features and occupation deposits, categorised by architectural location (cardinal sides) and also by space number.

Precinct-Section 8 general parameters

Previous excavation revealed that both the corner tower and the westernmost north-south running precinct wall are contemporary features (Figure 2.44). Subsequently, the southernmost east-west running parameter wall joins the tower at foundation level. Two long, internal constructions further complement the external compound walls, forming a regular, square-shaped area. Together these four walls formed the architectural limits of Precinct-Section 8. The main northern and eastern walls measured 25 metre and 31.6 metre respectively. The outer precinct walls were longer and continued past the limit of excavation. The contiguous architectural units indicate that the compound in its entirety may originally have been organised into these set sections as opposed to being allowed to develop organically within the main walls. This clearly shows that the fortified compound was constructed as part of one overall event and was a carefully planned and organised structure.

Internal Wall Construction Order

Some observations of the architectural plan of Precinct-Section 8 can be made relating to the order of space construction. It seems that wall <4488>, partially uncovered in the excavation from 2009-10, forms part of an internal architectural line that stretches from southernmost outer precinct wall to join the northernmost perimeter wall (Figure 2.24). This internal line runs perpendicular to Precinct-Section 8’s southern and northern-most perimeter walls and is parallel to its eastern and western sides. It is instrumental in forming the basis for the precinct’s internal spaces and indeed governs the layout of the main courtyard Space 3012.

Both the northern and southern extents of this courtyard (Space 3012) are formed by lines of walls that run perpendicular to, and indeed butt against, the previously built western line. These southern and northern walls delineate rooms which skirt the edge of this part of the fortified compound. Most of the rooms on the southern side were excavated during the 2009-10 season (Richter 2011). Two more were revealed during this season. The northern side revealed merely three. After these sides were built the eastern rooms were constructed, which produced an additional entrance space. The eastern side holds another three rooms which includes a small space dominated by a large hammam. The western side is also subdivided into two smaller courtyard areas along with four room spaces.
The Western Side

In total, the western side included Spaces 3001, 3002, 3007, 3008, 3009 and 3020. Spaces 3001 and 3002 were excavated in season 2009-10 and work in these areas was continued. Two mini-courtyard areas (spaces 3002 and 3020) dominate the interior space of the western side. They appear in both the northern and southern areas and are separated by rooms 3007, 3008, and 3009. With the exception of Space 3009, all interior walls and floors hold no signs of rendered plaster. All walls were constructed using unevenly coursed roughly hewn beachstone (AG1-3 & BJ3, Hoffmann et al. 2011) and bound with a grey sandy mortar. Indeed, the northern mini-courtyard was covered in shell and sand, similar to the main courtyard space, suggesting that it was a similar outside space. Conversely, the southern mini-courtyard had a hard compact sandy silt surface. Space 3008 shared the same type of floor and indeed had no threshold step leading into the main area of 3002. It seems it was designed to be left open and maybe ventilated.

Space 3001

Architecture from Space 3001 was fully revealed in excavations from season 2009-10. Work this season focused only on the discrete features found lying at the base of the room. Excavation of these features, suspected to be tannurs, showed they were firepits. The intense ashy and charcoal fills suggests the presence of great heat and prolonged burning, especially since the archaeological strata below had changed in consistency and colour. Since they all truncated the same surface and were situated in one neat line, it is possible that they were operated simultaneously. If this was the case, it would indicate a serious demand for heat and for whatever was being heated (water/food). This supports the idea puported in the 2009-10 season that Space 3001 was some kind of kitchen, left open due to the intense heat, which was utilised by the rest of the precinct-section. Moreover, a view of the sides and base of these pits revealed that more burning activity had occurred in the layers stratigraphically beneath the floor surface. Further excavation will be needed here to discover the nature of these earlier burnt deposits.

Space 3002

Space 3002 was partially excavated in season 2009-10 and work continued here this season to reveal the room’s full extent. This space was revealed to have been truncated by multiple pits and postholes. The larger pits were believed to have been dug to gain access to the natural deposits to provide new material for interior floor surfaces. The purpose of postholes in the far north-western corner is unclear, but they bear resemblance to postholes in Space 3008 in both shape and extent. What is certain is that these pits scarred the floor surface of Space 3002 indiscriminately.

Two masonry features were revealed within this space. The first was a masonry plinth feature <4086> uncovered already in the 2009-10 season. The second feature was a block of beachstone, which butted the major staircase to the south and also main western wall. It was believed to be a small staircase leading to the wall’s top surface, although this seems strange when considering the presence of the larger staircase directly to the south. Further excavation will be needed here to fully determine this feature’s purpose.

The structural repair apparent in the eastern wall was re-examined and consequently redefined as a window cavity effectively linking spaces 3002 and 3004 (Figure 2.45). This was made from a grey plaster render laid into the beachstone wall. It was very similar to a feature in Space 3009. These windows were similar to those observed in another fort in the vicinity of Al Zubarah, namely Qal’at Al Thaqab. Although this fort has been restored, domestic living spaces near the front gate had both one door and one window looking out into a courtyard area. Examination of the plaster work in the far southern corner uncovered the remains of wood, possibly from the window frame.
Space 3007

Excavation herein produced three sequences of deposits. The latest sequence contained thin layers of sand and shell, which formed a floor surface containing the extant remains of a small black vial (Figure 2.46). Beneath this lay a second sequence of similar deposits forming a floor surface which was truncated by four small fire pits possibly created for some minor cooking activity.

The earliest sequence contains the original surface of the room along with a gypsum plastered waterbasin in the north-western corner. Its base is tilted slightly towards the northern wall and has a 0.2m hole cut in the corner which presumably provided drainage. Indeed, on the other side of the wall in Space 3020, there is evidence of a hollow in the ground surface hinting at the presence of a soak-away similar to that found outside space 3013.

The original room surface is unusual since, remarkably, it still held the presence and indentations of footprints and reed-matting from its initial use (Figure 2.47). The basin and the matted-floor resembled a poor mimic of the other, longer rooms, which contain plastered floors and hamams. Indeed, this space shares another similarity with Spaces 3018 and 3014, since it too displays evidence of sandy shell surfaces cut by fire pits. This small room therefore introduces the argument that the rougher undecorated rooms of the western and northern sides fulfilled a more utilitarian, less representational, function.

Space 3008

As mentioned previously, Space 3008 shares the same floor surface with mini courtyard Space 3002 and has no threshold, suggesting that it was an open space. The features associated with the floor surface include eight postholes and a beachstone structure situated in the south-eastern corner (Figure 2.44). The postholes were curious since they were situated along the western and
Figure 2.46: Black glass vial found in Space 3007

Figure 2.47: Footprint found in floor surface (4141) in Space 3007
northern interior sides of the room. Their form suggests that substantial posts were set inside but what they physically supported is uncertain. Their position in relation to the walls suggest that they may have had a structural purpose – possibly as supports for a canopy to provide shade. The beachstone feature in the south-eastern corner was interpreted as a low stone seat. However more investigation within this small room is needed to fully determine its function.

Space 3009

Room 3009 was very similar to Spaces 3003 and 3011 since it was completely devoid of occupation deposits. It differs from the surrounding spaces since its internal walls were plastered along with the floor. All decorative plaster features including the window in the north wall and the threshold, suggests that this big room may have fulfilled some important function on the western side. The window in the northern wall indicates that the room would have been filled with light in contrast to its neighbouring rooms 3007 and 3008, which were only illuminated through the doorways. The collapsed pillar lying inside (discussed in Phase 4) also pointed to a place of relative splendour.

Space 3009 is therefore an anomaly amongst a group of somewhat ‘bare’ rooms. It may have provided a focal point for those occupants functioning within the less luxurious spaces of the western side. This again introduces two levels in the condition of the interior rooms.

Space 3020

Excavations within the mini-courtyard space revealed a series of shell surfaces interwoven with occupation deposits and truncated by small pits. There were three sequences of deposits lying in the southern end of the courtyard, which became gradually more fragmentary and diffuse towards the north. The second sequence of hardened shell was notable in that it was truncated by a large pit filled with redeposited hearth material and contained two small coins. The first sequence consisted of a hardened silt surface, which was truncated by two small post holes. The earliest surface was left in situ and stretched from the southern end of Space 3020 through to the middle, whereupon it was covered by deposits from the northern end of the courtyard. These were patchy make-up layers for a courtyard surface and were interpreted as contemporary with the second sequence mentioned above. This hardened floor surface was an excellent archaeological horizon on which to stop work in 2010-2011 and resume work in the future, since it was distinct and well preserved.

The Southern Side

In total, the southern side included spaces 3003, 3004, 3005, 3010 and 3011. Only spaces 3010 and 3011 were excavated since the rest had been examined in season 2009-10 (see QIAH End of Season Report Stage 2, Season 1; 2011).

Spaces 3010 and 3011 displayed signs of high status domestic occupancy. Both rooms have plaster on their interior walls. Space 3011 has a plastered floor and two badly damaged niches set into both the eastern and western walls. The two rooms were separated by a plastered threshold step. They represent dignified internal domestic spaces, especially Space 3011, which was consciously separated from its northern neighbour by the well-constructed doorway.

Both spaces were bounded in the west by a large staircase. This has eight steps, which were built from beachstone, over-rendered with a hard brown sandy mortar, which is badly degraded. The staircase was cleverly constructed since it is supported by two buttresses, tied into the structure itself. This is combined with walls to the east to provide entranceways into Spaces 3011 and 3010 respectively (Figures 2.44, 2.48). The staircase provided access to an upper level, which explains the large quantities of collapsed rock and plaster-vaulting found from Phase 4. It also may explain the presence of the midden in Space 3021, which contains dumped deposits that ac-
cumulated at a point directly outside the precinct wall, as if they had been thrown from a space situated above 3010 and 3011.

Space 3010

Space 3010 was completely covered by a hard sandy shell surface, which then spread 10m north into the main courtyard. Since all major courtyard deposits were retained for future excavation, this shell layer was not fully uncovered. However, a few observations can be raised. Primarily, it bears striking resemblance to the shell deposits found in space 3004, which were revealed to run into the main courtyard. Like space 3004, these deposits indicate that space 3010 was a transitional room between an exterior to an interior area. Secondly, the entrance to this space showed no sign of thresholds or door frames. It was open to the exterior and was as wide as the entrance to space 3004. Moreover, collapsed archway material found at this access point (discussed in Phase 4) again indicates that this room was open to the elements. Space 3010 was therefore interpreted as a passageway through to clearly-defined interior spaces.
Space 3011

This room shares a distinct similarity with Space 3003, since it displays no signs of occupation. Clearly this room was used for functions that did not damage the floor surface and perhaps indicates that this room was used differently than others. The niches in the eastern and western walls, plus the fine plaster walls and the deliberate attempt at separating this space with a threshold step from the neighbouring room to the north, all point to the fact that this room was reserved for a specific purpose.

The Eastern Side

The eastern side includes Spaces 3013, 3014 and 3015. Their interiors were rendered with plaster and separated from the outside by plastered thresholds. They all formed neat interior rooms. The plaster floors from Spaces 3014 and 3015 seem badly damaged and degraded revealing the flag stone foundations beneath. Conversely, Space 3013 seemed well-preserved.

Space 3013

This room was unusual and differed from the other rooms in the precinct. Its western wall was not constructed from the typical roughly hewn beachstone that is so common elsewhere. Instead, it was constructed from aeolianite, a porous limestone (stone type FR1, see Hoffman et al, 2011) (Figure 2.49). The wall formed the western part of a gypsum-plastered hammam. It was the only wall in the entire excavation area where a distinctly different building material was used. It was

Figure 2.49: Hammam <4187> in Space 3013
probable that the wall was made deliberately thin simply because it aided the function of the washing facility itself. Drainage from the hammam into the nearby sinkhole would have been quicker and easier if material did not have to travel a long distance – the hammam therefore would have been built as near to the drain as possible. The feature spanned the entire western end of the small room. The hammam in the neighbouring room also drained into this and then fluid from both rooms ran under the thin limestone wall and into the nearby soak-away.

Other features within this space were therefore geared to the prime function of this room. A raised line of stone across the doorway effectively formed a recess and was believed to help keep water within the confines of Space 3013. No occupation deposits were found here. Only dilapidation material from Phase 1 was discovered crushed firmly onto the plaster floor surface. The contents of the hammam-drainage channels were excavated but no organic materials were found. This space seemed spotlessly clean, which either indicated its immaculate state while in use or the possibility that it was a wash-room. In view of the small size of the soak-away outside the wall to the west, it would seem likely that only liquids were channelled through the drainage system. Having a small sewage system within the confines of a finely decorated high-status domestic space seems impractical and unlikely.

**Space 3014**

There were plastered wall niches in this room’s eastern wall similar to those found in Space 3011. Additionally it contained a hammam in the far south-western corner, which drained through to Space 3013. Excavation revealed that it was repaired or at least re-plastered sometime after its original construction. This hammam appears to have been for washing, due to its size and location. The drainage channel was filled with a grey brown silty deposit mixed with demolition rubble from Phase 4. This was sampled for organic material.

There were two distinct occupation events in Space 3014. The first covered the entire room and lay beneath the dilapidation deposits from Phase 4. It consisted of loose coarse shelly sand that would have formed a fresh and clean interior floor space. The second event consisted of a previous shell layer with associated occupation deposits. This was interpreted as a floor surface which had laid down to provide a usable platform covering a previously dirtier surface below. However, unlike the shell from the first sequence, it was patchy and badly damaged. The re-plastering of the hammam seems contemporary with this layer, since there was evidence of shell mixed into the plaster render at the very base.

Underneath these occupation events was a plaster floor on which an event of small in situ burning was revealed. Scars, cracks and fissures in the plaster at the northern end of this room were blackened demarcating a fireplace. It is likely then that the constant use of the room created a demand to renew and replace the floor surface culminating in the shell surface events found above.

**Space 3015**

There were few signs of occupation within this room. Space 3015 had a scarred, degraded plaster floor with evidence of ingrained charcoal staining. Small, dark grey patches of sandy shell and charcoal lay in the southern part of this room, possibly hinting at the last remnants of a previous shell floor layer. However, as the layer is only 0.02m thick, this idea is tenuous. It is more likely that the occupation sat directly on the plaster floor. Indeed, the presence of a small tan-nur truncating the floor supports this theory. The tan-nur was filled with two ash deposits, which contained charcoal and fishbone. Another two small ashy deposits were found lying on top of the floor nearby. All deposits and features within this space pointed to direct use of the plaster floor, perhaps explaining its poor condition at the northern end.
**The Northern Side**

The northern side included Spaces 3017, 3018 and 3019. It was different since only one of its three rooms displays the high-quality plaster decoration that is common in both the eastern and southern wings.

Space 3017 and Space 3019 were two very small rooms that were not internally plastered. Space 3017 had an occupation surface of coarse gritty sand. There seemed to be no floor surface within the far western Space 3019 and features appeared to truncate natural geological sand and shell. Both rooms had large plastered thresholds and seemed entirely functional. They are markedly different to the lavish domestic settings of the other eastern and southern spaces. Their size and lack of decoration point to areas of storage or production, as opposed to domestic dwelling.

Space 3018 was more akin in size and function to those rooms revealed on the eastern side, specifically Space 3014. It had a deep threshold step which was constructed from beachstone and then covered in a plaster render. The plaster render clearly overlapped original plaster on the interior walls (especially evident on the eastern side) and also sat upon a lower layer of shell. It was clear then that this step was added to the precinct during occupancy, much like the plastered door posts in space 3017. It contains a large *hammam*, well-preserved plastered walls and a slightly scarred plaster floor. The inclusion of the these smaller rooms to the northern side introduces the idea that it fulfilled more functional roles than the south and the east. Like Space 3009 on the western side, Space 3018 seems to be the only northern room designated to some form of high-status living.

**Space 3017**

The stratigraphy found herein was distinctly different from the other interior spaces and consisted of three sequences of archaeological features and deposits. The first sequence lay directly beneath the dilapidation deposits of Phase 4 and contained large dumps of shelly sand containing large sherds of smashed black pot. Pottery from these deposits was also seen outside room 3017 in the central courtyard (see discussion for Space 3012) in a large shattered spread. Collectively, these deposits contained sherds from massive vessels that were believed to have sat in storage pits. They had been left lying shattered both inside and outside of Space 3017.

The second middle sequence contained two large pits that truncated an occupation surface. The two pits were very large and were both backfilled with material containing large sherds of black pot identical to those in the stratigraphy above. These pits had contained large vessels which were robbed out and then smashed.

The pits truncated an occupation surface comprised of trampled shell and rare small charcoal flecks. This was contemporary with a renovated doorway consisting of plastered doorpost settings and a plastered threshold, suggesting architectural repairs during occupancy. Similar activity was exemplified by threshold features in Space 3018. A further two surfaces were revealed below the threshold renovations. The earliest floor surface consisted of coarse compact sandy silt and was left preserved *in situ*. It had been truncated by an oval shaped pit containing a charcoal rich fill.

**Space 3018**

Space 3018 contained two sequences of clean shell with associated occupation debris. The first lay beneath the dilapidation deposits from Phase 1 and is contemporary with building additions made to the threshold step. The lowest sequence contained a layer of shell which covered the entire room and is believed to renew and replace the plaster floor below. It was truncated by two small fire pits. Below the shell, evidence of similar pits were seen scarring the plaster floor. The fires cut into the shell layer were placed in almost exactly the same positions as the original three, which scarred the plaster floor. It seemed these features had an established place in this room and...
were repositioned almost exactly even after a fresh layer of shell obscured their original positions.

Space 3018 shared many similarities with Space 3014. Both have hammams. Both have two series of shell floor surfaces. Both have evidence of interior small fireplaces. The main difference was that the plaster floor in Space 3018 was in a far better condition than that within Space 3014. These similarities may indicate that both spaces had similar functions where light was required and cleanliness was a necessity – perhaps this evidence points to a place of a reception room.

Space 3019

Features and deposits within this small room indicated the occurrence of intense cooking and burning activities. Excavation revealed three sequences of events dominated essentially by the presence of tannurs. The first sequence contained detritus from the dilapidation deposits of Phase 4 mixed with burnt, charcoal-filled deposits. This sequence effectively formed an interface layer between the occupation of Phase 2 and abandonment of Phase 1. Beneath this lay a second major occupation deposit which was truncated by four tannurs and covered in black, ashy deposits. The third sequence consisted of more pits and tannurs which directly truncated the natural geology.

The four tannurs all contained multiple fills of ash mixed with silty sand and charcoal (Figure 2.50). One tannur had particularly damp fill deposits suggesting that this feature extended down to the water table. Additionally, two further dumps of blackened ash and silt were found lying near the tops of these tannurs. They were interpreted as more clean-out from the ovens. These tannurs differed in depth, the largest measuring 0.51m and the smallest 0.24m deep. They were wider at the base than at the top, presumably to withhold heat within the vessel itself. Indeed, the fabric of the tannurs looked extremely robust and in some cases very thick. They truncated a deposit that was interpreted more as an occupation deposit, as opposed to a formal floor surface due to its consistency, compactness and finds content. It may have been formed by material cast-out from the tannurs and then compacted into the ground by constant use of the room.

![Figure 2.50: Tannurs cutting into occupation deposit (4208) in Space 3019](image-url)
The earliest sequence of deposits and features were revealed to directly truncate the natural geology below. They included another series of tannurs, fire pits and dumps of blackened ash (Figure 2.51). These were interpreted as the original cooking facilities that preceded those found in the second sequence. One pit was noticeable because it was the only feature within the room containing animal bone, including those from fish, sheep and goat along with the remains of egg shell.

Unsurprisingly the features from the first sequence all occurred in the western half of Space 3019 whereas the tannurs from the following stratigraphic sequence were housed on the opposite side. Clearly this room went through two phases of use. The first phase utilised the western and middle of the room, using both firepits and tannurs to cook food. The second phase utilised the eastern half of Space 3019, which had not been disturbed by previous activity.

The space appears to have been a central cooking zone which may have complemented the fire pits in Space 3001. The burning episodes in Space 3019 seem far more intense and untidy than those in Space 3001. This space provides more evidence for the use of the west and north-west zones of the structure as dedicated service-duties areas, as opposed to activities that involved non-domestic activities. The walls from this space were undecorated and the narrow threshold step implied that the room itself would have been very smoky and dark if all tannurs were in operation at once.

Entrances Space 3016 and the Main Courtyard Space 3012

Space 3016 represents the main entrance to this part of the fortified compound (Figure 2.44). This L-shaped space in the northeast led directly into the central courtyard. Facing an opposite wall upon entry, and reinforced by a short segment of wall that protruded slightly into the room from the south, direct view into the courtyard was effectively blocked. The actual doorway was formed in a gap between the north-south running architecture and was complemented by a plas-
tered threshold flanked either side by two plastered steps (Figure 2.52). Both these features have two obvious round hollows worn into the stone, which can be interpreted as door sockets. The remains of an arch were observed in section in the as yet unexcavated deposits filling the doorway and alley, suggesting that this was an arched entrance.

The main courtyard, Space 3012, dominated this part of the fortified compound, measuring 17m x 17m. The majority of the deposits within the main courtyard were left in situ for future excavation work. From the surface it appears that the courtyard’s ground surface was comprised of a number of spreads of fine grey yellow sand and minute shell. The extent of these deposits was difficult to determine since the distinction between them was very slight. However, there were differences suggesting that the surface was often renewed, with patches regularly added and old floors re-laid.

A square plastered basin/trough was revealed in the north-western corner of the main courtyard. It remained an enigma since its true function within the courtyard could not be fully determined. It appeared to be some form of drain or water-feature. It was filled with smashed pottery, very reminiscent in fabric to the tannurṣ in Space 3019 and also to the shattered ceramic spread lying outside Space 3017. It was also covered by compact ashy deposits. The feature’s close vicinity to Space 3019 and the ash trample covering suggests that the two are somehow associated. More excavation of this feature and the surrounding deposits is needed to fully determine its purpose. Its presence may indicate further features existing within the courtyard below the current limit of excavation.

Almost adjacent to the plastered basin was a large pit. Its steep sides and flat base, which sank below the present-day water-table, suggested at first this was some form of storage pit. Indeed, large sherds of a storage vessel were discovered in both upper and lower fills. However, since the pit was very close to the plaster basin, it may have been associated with it, perhaps to function...
as some form of soakaway. Indeed, excavation of the pit revealed the northern extent of another pit feature, this time lower down in the stratigraphic sequence and buried beneath the higher courtyard deposits. This suggests major excavations occurred in the courtyard area and may indicate the presence of large drainage sumps. The true function of all these pits will need further investigation in the future.

**Exterior Spaces 3021, 3022 and 3023**

Excavation outside the outer precinct walls was kept to minimum due to time constraints and resources. Space 3021 is located outside the southern precinct wall directly to the south of Space 3011 (Figure 2.44). Excavations here aimed to reveal and document the extent of midden deposits that had clearly accumulated against the outer wall, either from an outside influence or indeed from the process of casting out of materials from the precinct’s first floor. Since excavations from season 2009-10 had already focused on the midden near the main tower, excavations was swiftly abandoned. However, the deposits that were apparent bore a striking similarity to those found in Spaces 3000 and 3006 from season 2009-10. These were packed with shell and charcoal and were interpreted as surfaces from within the compound that had been discarded.

Spaces 3022 and 3023 were small exterior areas lying directly outside the outer western compound wall. These spaces were merely planned and not excavated. Two patches of charcoal and ash were noted in Space 3023 indicating that large fires had occurred.

![Figure 2.53: Ceiling fragments bearing indentations of reed and plant material from Space 3011](image-url)
2.3.4 Phase 1: Dilapidation

The final phase pertained to the dilapidation and collapse of the precinct building. Those layers interpreted as direct interfaces with the surviving occupation deposits were usually of mid grey sandy silt containing small fragments of plaster and pieces of beachstone from damaged walls. These deposits differed considerably from the layers of fallen rubble stratigraphically above, since they contained less massive stone and plasterwork. They were more compact and were interpreted as material that had naturally filtered down through the larger material over the last two to three hundred years.

In some spaces, the presence of small organic deposits bearing the indentations of reeds and other vegetation suggested the collapse of ceiling material (Figure 2.53). Spaces 3011, 3016 and 3018 all contained evidence of fallen organic ceiling material.

Collapsed arches and ceiling vaulting were also found in demolition deposits. The excavation of Space 3009 displayed the remains of a large rectangular pillar which had collapsed and fallen onto the plaster floor. Its presence strengthens the idea that Space 3009 was an important space within the western wing.

The remnants of two very large arches were revealed in Spaces 3010 and 3011. A collapsed arch was positioned fairly close to the entrance of Space 3010 and its massive curving structure may indicate the remnants of ceiling vaulting. Its huge size and position near the entrance of the main courtyard was reminiscent of the other archway found at the entrance of Space 3004 in season 2009-10. This served as more evidence to suggest that there was a permanently open entrance-way to Space 3010.

Other collapsed doorway features were found at the entrance between Space 3010 and 3011. The entranceway to the courtyard had two arches: one was revealed to have fallen immediately above the threshold of the entrance. The other fallen architectural piece residing within Space 3016 was a fallen lintel comprised of moulded plaster. This lay in the area where Space 3016 joined the central courtyard. The presence of these fallen arches marking the transition between interior and exterior spaces indicate demonstrate the differences in decoration between these zones.

The dilapidation of the fortified compound seen across in the excavation area did not occur at one specific point in time. Instead, the collapse occurred gradually over a period of some decades. Deposits within the main courtyard, Spaces 3002, 3012 and 3020 all displayed the accumulation of windblown sand that was deposited naturally and intermixed with general architectural detritus. It appears that the building, or at least this part of the fortified compound, was abandoned and left to decay naturally.

2.3.5 Conclusions

The excavations in ZUEP04 achieved their main objectives and revealed some fantastic archaeology, uncovering fourteen new interior and three new exterior spaces to complement the six already uncovered in the 2009-10 season. The excavations in this part of the fortified compound showed that it was orientated towards providing a more independent domestic facility rather than a purely fortified, military structure. The complex was likely a high-status domestic residence, enclosed within a large precinct wall separated from the remainder of Al Zubarah’s population.

The interior spaces were divided into two elements. The first are decorated, well-maintained rooms, which were residences, reception/dining rooms and hammams. The second were more utilitarian rooms, including kitchens, storage rooms, a madbasa room and other work areas.

This division is readily apparent in the architecture, where the rooms of both the southern and eastern sides were revealed to be lavishly decorated. Intricate moulded plaster adorned the walls, complemented by plaster niches for lamps or other objects. There were dedicated washing spaces with associated soakaways, entrances were adorned with decorative arches, and the floors were plastered, flat, and separated from the outside with obvious threshold steps. Conversely, the
spaces on the western side and to the north were geared towards fulfilling more functional roles, including cooking and storage. Floor surfaces were blackened by soot, badly covered by shell, gouged by pitting, while the walls remained deliberately unplastered.

The architectural construction of the precinct seems to have begun with the building of the outer walls and then the construction of the interior areas. The inside was divided by an architectural line running north/south, effectively forming the western side and also a base line onto which the northern and southern sides could be built. The eastern side was then completed, which also formed the entranceway. Beachstone was used for construction and exterior walls were made from a far better quality stone than those in the interior, being prominently constructed with beachstone-type AG3. This stone was an amalgamation of bivalves and gastropods embedded in a fine sandy matrix which is easily fragmented given significant force. This stone was used to build interior partitions where harder stone types such as beachstone-type AG1 and BJ3 were used to dress the exterior. Mudbrick or wood may have been used for coursing the higher level architecture which may explain the vast quantities of disintegrating rubble prevalent in Phase 4. The only difference seen in construction material was in the west wall of washroom 3013 and in the decorative arches placed over the entrances to Spaces 3004 and 3010.

Examination of the occupation surfaces within the rooms displayed there may have been at least two phases of occupation or at least two occasions where the residing occupants renewed the surfaces of their living spaces. Spaces 3018 and 3014 both had multiple layers of shell-renewal surfaces. This too was apparent in Space 3007 as well as 3004. They may have coincided with the surface deposits within room 3019. Renovations were also seen in the hammam of room 3014 and in the additions of threshold steps in Spaces 3017 and 3018. They may have even been coincidental with renovations made to the tower seen in Space 3000. Regardless of the number of times the spaces were renovated, the evidence suggests that the complex was occupied for a period of time long enough to warrant revitalization.

The excavations also clearly recovered signs of the precinct’s decline. There were tantalising glimpses of possible destruction and vandalism shown by the smashed ceramic spread outside of Space 3017 and by the burnt timber and collapsed ceiling material in Space 3011. Indeed the pitting of relatively late surfaces in the western wing displayed a possible disregard to the areas general upkeep and appearance. However, this evidence could just be representative of unlinked separate events. There is not a massive phase of deliberate destruction seen in the archaeology; rather, a deterioration, abandonment and then dilapidation.

Future work in this area will undoubtedly need to focus on the main courtyard area 3012 and the two side-courtyard Spaces 3002 and 3020. Excavation in these three spaces revealed underlying archaeological stratigraphy that will hopefully not only reveal the extent of buried architecture and features but also the function of those already uncovered. Tantalising evidence was also revealed at the northern extent of the site, where remnants of a possible entrance in the main western compound wall were discovered. It would be exciting to gauge the extent of the passageways that were believed to run parallel to the north and east walls and gain an understanding of how these and Precinct-Section 8 related physically to the other divisions of the compound. Whatever the scope for future work, the continued excavations at ZUEP04 will undoubtedly yield more engaging, monumental and exciting archaeology.
2.4 ZUBARAH EXCAVATION POINT 5 (ZUEP05)

Pernille Bangsgaard

2.4.1 Introduction

This report describes the results of the archaeological fieldwork carried out at ZUEP05 during the season from November to the end of December 2010. ZUEP05 is a new excavation area and is located immediately next to the main city wall of Zubarah (Phase 5), in the section between Outer Wall towers 9 and 10 (Figures 1.1 p. 5, 2.54).

The excavation investigated part of a large midden at Al Zubarah thought to belong to the main occupation Phase 5. The aim was to expand our knowledge of the everyday-use objects of Al Zubarah as the houses currently under excavation inside the settlement largely provide materials derived from secondary contexts. The houses generally appear to have been cleaned regularly, and at the time of abandonment, so few of these everyday objects have been found there. Evidence recovered from ZUEP05 adds to material excavated from another midden at ZUEP04 during the 2009-2010 season.

2.4.2 Background

The specific choice of midden was based on the aim of finding Phase 5 remains. This Phase is the time where Al Zubarah reached its maximum extent, and included the construction of the main outer town wall. It was therefore assumed that a location outside this city wall would ensure targeting deposits dating from the correct time frame. Middens belonging to one of the later occupation phases, where the extent of the city was significantly smaller, appear to be located closer to the occupation itself and thus lay within the area of the main town wall and not immediately outside of it. A final dating of the midden will, however, only be ascertained once datable finds from the midden have been analysed.

To sample the midden, a 12m x 2m trench was excavated into the mound. The trench extends in the west into the city proper, crosses the town wall (5005) and extends well into the centre of the midden. Because the town wall is included in the area, 2 metres to the west was not excavated as this would require the removal of the wall, thus leaving an actual area of excavation of approximately 2m x10m.

The midden as a whole is roughly oval in shape with an approximate diameter of 20 metres east-west and approximately 35 metres north-south. The central part of the midden rises approximately 2 metres above the surrounding landscape. The midden is also distinct from the surrounding yellow sand by its more brownish colour, and the ceramics and bone fragments visible on the surface. Part of the mound appears significantly compressed, probably due to the cars driving across the midden in an approximately north-south direction next to and parallel with the town wall. These tracks also cross the excavation area and the effect of such compression is clear. The deposits layers are here hard to distinguish from each other and the amount of finds in this area is significantly lower to what was found further to the east in the central area of the midden.

2.4.3 Excavation and stratigraphy

The midden is characterised by a fairly straightforward stratigraphy (Figures 2.55 to 2.57), but it includes multiple thin layers of deposits typically one to five cm thick. Some of these have a limited extent or simply merge with adjoining layers. A single deposit layer does not always extend across the entire east-west extent of the excavation area and it was therefore necessary to excavate these deposits in groups, as it proved difficult, and too time-consuming, to excavate each layer individually.
From the extent and morphology of these thin deposits it may be suggested that each represent a separate layer of detritus, possibly from a single event of dumping or from a very limited time period. If this is in fact the case then each locus in the main midden levels (two to four) represent a very limited time span that most likely cannot be separated chronologically, by the finds and ceramics analysis.

During excavation all removed soil was sieved in 3 mm sieves. It was possible to divide the 20 loci of ZUEP05 into six stratigraphic levels of use, described below.
Figure 2.56: Excavated northern profile through the midden

Figure 2.57: ZUEP05 - end of excavation
2.4.4 Level 6 (Loci 5019, 5005)

Layer 5019 is unexcavated at this time and as such represents the bottom of the ZUEP05 excavation area. The locus is visible as a hard and compacted surface to the east of the city wall. It butts against the wall and gradual slopes away to the west. The excavators could observe no finds or objects on the surface apart from charcoal flakes and weathered limestone fragments. This combination could suggest that we are dealing with the original surface of the area and as such the possibly top of an underlying natural deposits where the charcoal and limestone may represent remains from the construction of the city wall.

2.4.5 Blocking of the city wall (5020)

Two metres of the east side of the main city-wall were exposed. This small stretch of wall includes a later blocking made of random courses of beach stones held together by a gritty plaster (Figure 2.58). The blocking is located at the southern end of the excavation area and extends beyond the limit of excavation. It is likely that this later alteration to the city wall blocks an earlier passageway into the city. It is, however, not clear whether the opening represents a larger “proper” town gate or a small, and perhaps less permanent, access point. The location of this opening right in front of a large midden, which was deposited both before and after the blockade does perhaps indicate that a limited amount of traffic would have passed here. Only further excavation to the south of the present ZUEP05 excavation area can establish this with any certainty. The blocking event of a possible entrance into the city represents a convenient division of the midden refuse layers into Phases 4 and 5, but the general appearance of the layer do not deviate significantly from each other.

Based on the evidence outlined above, this phase of the midden deposits belongs to the main occupation of Zubarah, Phase 5, although probably the later part of this.
2.4.6 Level 5 (Loci 5011, 5013-5018)

The earlier of the two main use phases of the ZUEP05 area as a midden was labelled Level 5. The upper layers do not deviate significantly from those of the later Level 4, neither is there any sterile sand layer separating the two phases. Level 5 consists of thin layers of deposit in varying colour, generally extending across the entire area of the trench, although it can be difficult to follow each individual layer. The lower half of Level 5 is significantly more variable in range and general appearance. The north facing section suggests that there were initially three small mounds of refuse, which later deposition events then connected, filling out the entire area. The two final loci excavated this season (5017-5018) are only exposed in half of the original excavation area, as a 1m x 10m area was excavated further along the southern end of the trench. This tactic was chosen as a precaution due to the depth of the trench at this point, particularly in the eastern end.

Based on the evidence this phase of midden deposits probably belongs to the main occupation of Zubarah, Phase 5, as it is clearly later than the construction of the city wall, but also earlier than the blockade of the wall’s access point (5020). The analysis of the finds will, however, have to corroborate this before a final conclusion can be made.

2.4.7 Level 4 (Loci 5004, 5009-10)

This is the first of two main use levels of the ZUEP05 area as a midden (Figures 2.59, 2.60). In Level 4 the refuse layers extend across the entire excavation area from the city wall in east and into the centre of the midden. Judging by the number of layers and amount of deposits excavated here, the level also spans a longer time period than Level 3. There is no indication of any prolonged break of refuse disposal inside this level, which could potentially have been identified by thick layers of sterile sand.

The deposit layers vary in colour from a brownish-yellow to dark grey and black but generally consist of fine sand. All the midden loci have some inclusions and these include varying amounts
of white cone-shaped mollusc shells used for pavement inside the courtyards of the houses. The exact amount of inclusions appears to vary between individual loci, but this variation is significantly more pronounced in each locus due to the concentration of finds and objects in the eastern end of the excavation area.

The top layer (5004) is located immediately below the top-soil in the eastern half of the trench, and there is therefore some later contamination, evidenced by the occasional find of plastic. The remainder of this phase appears without any obvious traces of contamination. Included in Level 4 is an unmistakable floor surface located immediately next to the city-wall on the outer eastern side. The surface is clearly detectable for approximately 1 metre and then fades away into the surrounding softer midden layers.

This level of midden deposit likely belongs to the end of the main occupation of Al Zubarah (Phase 5).

2.4.8 Level 3 (Loci 5007-8)

Level 3 represents the latest use of the ZUEP05 area as a midden. The refuse layers are confined to the western half of the excavation, immediately east of the main city wall (5020) and they extend approximately four metres to the east, thus filling the area between the city-wall and the earlier midden deposits. The upper half must be assumed to include some later material as both loci contain the occasional find of plastic. Included among these refuse layers is also a hardened surface located at the top of (5008), likely the result of trampling or repeated use as a walkway.

Figure 2.61: (5003) showing ceramics scatter
2.4.9 Level 2 (Locus 5003)

Level 2 is located in the western half of the excavation area. To the west it is defined by the outside of the town wall and is visible approximately 3 metres further to the east. There are rare finds of ceramics (Figure 2.61) and bones in this locus, but also several fragments of worn plastic, suggesting that the layer is either contaminated or of a fairly modern date. The soil excavated here consists of multiple layers, which are different in character including colour, compactness, grain size and composition.

Locus (5003) does not represent a typical midden deposit. Instead this level includes multiple episodes of use. The brown layers of use include many flecks of charcoal and do in two cases include a hardened walking surface of a slightly lighter colour. These layers are separated by thin intervening yellow sand layers and also a few mixed refuse layers. In the lowest sub-levels of (5003) and in the actual transition from (5003) to (5008), a large concentration of at least three ceramic vessels was found. These vessels appear to have been broken here and sherds were found across an area of about 1.5m x 1m.

Figure 2.62: Wall 5006 seen from the side

2.4.10 Level 1 – (Loci 5002, 5006)

Level 1 is the very latest use level of the area, and apart from the topsoil from across the excavation it consists of the modern rubble-wall (5006) located in the west end of the area (Figure 2.62). The wall cuts across the excavation area from the north at a slight angle (north-northwest to south-southeast) and extends for about 2.5 metres. It is visible on the surface outside the excavation area and it continues further to the north for approximately 2.2 metres. The wall is flimsy and poorly constructed with only two layers of uncut stone of varied size, lain haphazardly on top of each other without any traces of mortar. The wall is clearly datable as a recent construction based on the discovery of half a Styrofoam cup and a piece of plastic sheet found underneath the wall and between the two layers of stone respectively. Based on the Styrofoam cup this phase can be included in the latest sporadic use of the area, Phase 1. The reasoning for dating the wall to this phase (post 1950s) is based on the Styrofoam as this material was only invented in 1954 by Ray McIntire for Dow Chemicals.
2.4.11 Bulk finds and field objects

The amount of finds in the excavation area is as extensive and varied, as had originally been hoped for. This was partly facilitated by sieving all soil in 3 mm sieves, resulting in a very high rate of finds recovery.

Eighty-three field objects have been registered from ZUEP05 and these include 27 coins, which derive from various loci, representing levels 4 to 2. Other field objects include worked bone, various beads, worked wood and several metal objects such as iron nails, and bronze rosette, pendants, buckles and rings.

The main bulk finds are the ceramics and the animal bones both of which represents substantial collections. The faunal remains have not been analysed to date, but the preliminary results from the ceramics analysis indicate that the midden collection includes a very wide and varied assemblage, thus covering a wide range of activities.

Aside from the extremely rich finds of ceramics, bones and other objects the midden also produced substantial amount of easily perishable organic material such as botanical remains, human and animal hair, wood, rope and various fragments of textile. Apart from the macro finds, the excavated soil also included high amounts of organic material particularly in the eastern end of the trench, the central part of the midden. Soil samples were therefore regularly taken during excavation and these samples represent each of the midden levels from context and all loci from 5004 to 5018.

2.4.12 Conclusion and Recommendation

The ZUEP05 excavation represents a substantial addition to our knowledge of Al Zubarah’s occupation. The initial analysis indicates that the aim of expanding our knowledge of the everyday use-objects of al Zubarah has been achieved. The majority of the results from this season are still pending, as these are based not on easily accessible architectural remains, but on the large collections of bulk finds and field objects, most of which require further analysis. These analyses should also be able to establish whether the dating of the midden deposit to Phase 5 is correct, but is already suggested by the stratigraphic relationship between midden and wall. Based on the promising results achieved this season at ZUEP05 it is recommended that further excavation should be carried out at an additional two or three middens at Al Zubarah. At the present only ZUEP05 and a medium size midden deposit next to the palatial compound in ZUEP04 have been excavated. The additional results could greatly enhance our knowledge of the refuse pattern of the town of Al Zubarah and would also facilitate an analysis of the variation in access to resources across the town and potentially also across the main phases of use.
2.5 Zubarah Excavation Point 6 (ZUEP06)

Kirk Roberts

A sondage (ZUEP06) measuring 5.2 x 5.2m was excavated through the stratigraphic sequence located on higher ground approximately 60m to the north of ZUEP01 (Figure 2.63). This demonstrated that the topography of the underlying geology, rather than longer occupation sequence, was the reason for a higher ground level in this part of the site. The earliest feature excavated was a stone-lined hearth sealed under a layer of windblown sand (Figure 2.64). Above the windblown sand were the remains of a probable metal-working area. This included a number of surfaces and post-holes with frequent remains of metalworking in the deposits. As this phase of the use of the area was destroyed by fire, it is a possibility that this occupation relates to the Phase 5 occupation of the city. The architecture was re-built and a sequence of surfaces (Figure 2.65), rubbish pits and occupation layers reflect the built-up of deposits through the use of the area in this phase. Again there was substantial evidence for an industrial use of the area and the surfaces may relate to the beach-stone walls visible on the ground surface in close proximity to the trench. It is therefore possible that this phase of use may date to Phase 3 of the settlement although further work would be needed to test this assumption. The evidence from ZUEP06 fits with the evidence from ZUEP01 of an area to the north of the wealthy courtyard houses (Compound 1 and Compound 2) which is a zone of industrial activity and temporary occupation, located in an area close to the souq to the west.
Figure 2.64: Hearth [7051] underlying clean windblown sand. As hearth was so close to the section it was excavated in reverse stratigraphic order.

Figure 2.65: Surface (1915) truncated by pits.
3. **EXCAVATIONS AT FREIHA**

Gareth Rees

3.1 **INTRODUCTION**

Four excavation points were investigated at the settlement of Freiha during the 2010-2011 season. The locations of these excavation areas were based on a total station survey and terrain modelling of the settlement, as well as trial excavations, carried out in the previous season of fieldwork (Figure 3.1). Excavations continued in FREP01 with the aim of understanding the methods of construction and phases of use of the beach front mosque. There was no further excavation in FREP02 or FREP03 this season, the deposits in these parts of the settlement having already been characterised. Instead, three new excavation areas were opened. FREP04 was located in an area highlighted by the survey as containing relatively well preserved structures surviving to a height of 0.5m or more. It was postulated that this area may have been the last to be occupied and so excavations aimed to characterise the architecture of the later buildings as well as investigate the possibility of early phases of structures below, providing a continuous stratigraphic sequence. An additional aim of this season was to investigate the ‘linear midden’ feature which appears to separate the zone of well preserved buildings to the south from those to the north and east; FREP05 was located in this area in order to evaluate the character and date of these deposits. Based on finds recovered from the walk-over survey and excavations in FREP03 in January 2010, both recovering pottery of a relatively early date, FREP06 was opened over a large deflated midden to the east. This aimed to recover datable material and artefacts that would provide information about the character and period of use of this, less well preserved, part of the settlement.

3.2 **FREIHA EXCAVATION POINT 1 (FREP01)**

3.2.1 **Introduction**

Excavations continued in FREP01 this season, the upper deposits having been removed previously. The excavations encompassed an area 30m² centred on a structure with several phases of stone walls aligned west-southwest – east-northeast (SW corner 182425 473280 QNG). Limited excavations were carried out outside of the building in order to investigate building techniques and to verify the existence of any external features. The previous season of fieldwork had uncovered three rows of column bases to the west and a courtyard that measured 18m (NNE\SSW) by 13m (WSW\ENE). The orientation and architectural layout of this building strongly suggested that it was a mosque, and excavations during the current phase of work have shown this to be correct. Only a small number of the architectural features were removed to preserve as much of the building structure as possible. Therefore, the earliest phases (5 and 4) were uncovered in sondages and not fully revealed in plan. However, it was evident that Phase 5 walls and surfaces directly overlay natural deposits. In the later phases the mosque was separated architecturally into three areas: the courtyard, the open iwan, and a prayer hall (Figure 3.2). The prayer hall was divided into two, presumably covered, iwans in Phase 5 which for clarity are referred to in the text as the eastern and western prayer hall; the western prayer hall being the iwan of the qibla.

3.2.2 **Phase 5**

The first phase of construction (walls 302, 522, 764, 727, 717) formed a building measuring 22m WSW – ENE and 17m NNW–SSE with a central mihrab in the qibla wall to the west-southwest (Figure 3.3). A mortar surface was laid in the courtyard whilst a fine plaster surface was laid in the prayer hall. Evidence of plaster in the mihrab and on the base of the exterior of the western and southern walls indicates that the building may have been plastered inside and out at this time.
Figure 3.1: Plan of surveyed features at Freiha showing excavated areas
Figure 3.2: FREP01 - aerial view
It was not possible to differentiate any internal dividing walls in this phase. A well was dug in the south east corner of the courtyard.

The mosque then appears to have been abandoned for a long period of time, in which the northern wall (522) collapsed and was robbed out, before 0.3m of silt accumulated over its foundation. This abandonment of the mosque does not appear to have been associated with a complete abandonment of the settlement since a large pit was dug during this period.

3.2.3 Phase 4

The northern wall was rebuilt (751 and 753), 2.25m to the north of the previous wall and on the same alignment forming a structure that measured 22m west-southwest - east-northeast x 18.6m NNW - SSE. No evidence for a divide between the prayer hall and the courtyard was uncovered in this phase. Two resurfacing episodes occurred in the western half of the building and externally to the north and south.

Another period of abandonment then occurred with surfaces in the Prayer hall and the courtyard covered by windblown sand and rubble and a thick rubble deposit accumulating in the centre of the building (later the open iwan). The Phase 4 northern wall may have collapsed once again at the end of this phase.

3.2.4 Phase 3

The entire extent of the prayer hall wall (712, 728=41, 48) and the northern courtyard wall (227) were rebuilt during this phase, each of these walls being founded on or over the remains of an earlier wall. Two surfaces were documented in the courtyard: the first appears to be the result of trampling, represented by a compacted sand surface; the second, later, surface was a hard mortar floor. The eastern prayer hall walls from this phase were built in foundation trenches dug into the rubble layer. The mosque may have been realigned at this time, with walls <227> and <712>...
The open iwan was divided from the main prayer hall by walls 757 and 767. These walls, built in a foundation trench dug into rubble (293), formed a wall across the entire width of the prayer hall with a door in the centre aligned with the qibla wall. To the north of the door in wall 757 a separate, internal, mihrab and minbar were constructed as part of this divide. The prayer hall was then divided again, into an eastern and western iwan. This divide was most likely spanned by arches with the central arch aligned on the axis of the rear mihrab. Postholes and stakeholes dug into the prayer hall surfaces may have held posts that were part of scaffolding for maintenance and alteration of the roof, lintels and columns.

The building then fell out of use for a third time with laminated windblown silts and mud-rubble deposits building up in the courtyard, in the prayer hall and outside the building. There was little evidence of roof collapse in the build up of these layers, but the central columns on bases 791 and 792 may have fallen completely, whilst 793 may have been badly eroded before the next period of use.

### 3.2.5 Phase 2

The external walls do not appear to have collapsed during the period of abandonment with only internal column bases being replaced. Column bases 56, 57, 58 and 59 were constructed on the courtyard-iwan dividing wall whilst the rear prayer hall column bases were replaced with smaller column bases. Some column bases were completely reconstructed, built in foundation pits dug through the remains of the preceding bases. This new location allowed a complete view of the mihrab and the newly built minbar. Remains of an arch, which would have spanned the qibla area at a height of c.1.96m above the surface, were also found (Figure 3.4).

Plaster surfaces were laid in the prayer hall and the open iwan and a thick beach shell surface was laid in the courtyard. Mortar surfaces were built to the north and south outside of the building. Postholes were dug in all areas of the mosque after the main period of use which may have been provided supports for temporary scaffolds and roof. It is also possible that these posts reflect the use of the abandoned mosque for temporary shelters (e.g. tents), for a short period of time.

There followed a period of major structural collapse with roofing material spread over the prayer hall. Silt and rubble accumulated in all parts of the building and over the external surfaces. The courtyard may have collapsed completely with rubble overlying it in places. The northern prayer hall and the northern segment of the qibla wall may have collapsed along with dividing wall 757/767.

### 3.2.6 Phase 1

Reconstruction in this phase reused a large amount of rubble, presumably from the previous phase of collapse. The northern prayer hall wall (42=49) and qibla wall 43 were built first, with two windows being added in to the north of the open iwan. The northern pier of the rear prayer hall divide was also built at this time. The eastern prayer hall wall was reconstructed with wall 757/767 (internal mihrab and minbar) being replaced by a more open arrangement of square windows, and flat lintels. Wall 47 was bonded into the northern prayer hall wall whilst 46 had been built in a ‘plug’ knocked through wall 728. This ‘plug’ was then covered externally by a red-
brown silt and cobble facing. Based on the rubble recovered from the upper layers, the mosque at this time may have consisted of arched colonnades at the front and rear with a colonnade with flat lintels between the open iwan and the prayer hall. The prayer hall was then resurfaced with a thick concreted plaster, which may have continued into the iwan. The resurfacing was closely associated with the plastering of all of the internal walls of the structure.

The courtyard wall (38, 39, 40) was constructed in a shallow mortar-filled foundation trench. An entrance was located in the centre of the wall, directly in line with the rear mihrab. Thick mortar surfaces were laid in the courtyard and externally on all sides of the mosque.

3.2.7 Discussion

The mosque in Freiha appears to have been used over an extended period of time with several episodes of abandonment leading to the collapse of the roof and many of the walls and columns. This regular abandonment of the building may indicate that the settlement was of reduced size or depopulated on several occasions. If there was a minaret, it is most likely to have been located to the north-east of the courtyard. The sections of a modern (post-1977) cut feature in this area show that the walls of the building in all phases were deeper in this area, indicating that they may have been supporting the weight of a tall structure. The rubble from the minaret may have been removed and used for building material elsewhere.

The northern walls of the building collapsed more than those to the south and this may be due to the prevailing north-westerly wind eroding mud-brick and plaster faster on the northern side of the structure. The mosque was extended by 2.25m to the north in Phase 4; this event may relate to an increase in the settlement’s population. A major reconstruction event occurred in Phase 3, when the entire prayer hall and northern courtyard wall were rebuilt on a different alignment from that of the previous phases, with a new mihrab being added. It is assumed that the previous southern and eastern courtyard walls were still in use at this time. The mosque in this phase was 18.6m wide and 22m in length and consisted of a courtyard, an open (probably colonnaded) iwan, and a covered prayer hall divided

Figure 3.4: Archway (161) collapsed over mihrab associated with column bases 51 ad 52
into two iwans each 2.60m wide by a row of four columns. The divide between the open iwan and the covered prayer hall was formed by a wall, including a mihrab and minbar. Access to the prayer hall was through an opening in this wall aligned with the rear mihrab. Adjustments to the alignment may have been made following improved measurements of the correct direction of the qibla wall.

The number of postholes located in and around the prayer hall may represent attempts to support the building’s roof during periods of disuse. It is not clear how long the disuse episodes lasted but laminations of windblown silt and eroded red-brown construction material (representing differing erosive processes during different seasons) imply that it was probably years rather than months. The people of Freiha appear to have been constantly battling the erosive forces of the wind, and possibly the sea, to keep their mosque standing.

Reconstruction in Phase 2 consisted primarily of columns, which may indicate a shorter period of abandonment with only minor internal collapse. The two rear central columns were completely rebuilt and a minbar was constructed to the north-northwest of the rear mihrab. These two columns may have supported much of the weight of the roof making them more susceptible to collapse during periods of abandonment. The columns in the prayer hall were spanned by arches (in excess of 1.96m high), although it is possible that a mismatching arch still existed to the south where the Phase 3 column and pier had not collapsed. New columns built at the front of the open iwan were also spanned by plastered arches (in excess of 2.10m high).

A piece of carbonised roofing material was recovered from the collapsed mud-rubble accumulated after this phase. This carbonised material is likely to represent the remains of palm matting laid over wooden beams in the roof. This would then have been covered by the mid-red silt construction material which was found in much of the collapse.

The southern and eastern courtyard walls had been covered with silt and rubble prior to the final use of the building. A thick silt build up covered by roof collapse in the prayer hall also attests to the extent of disrepair by this time. In the final phase of use very little new stone appears to have been sourced with much of the walls consisting of rubble blocks. As was the case during the previous extended periods of abandonment, the northern wall had also collapsed along with the prayer hall:iwan dividing wall. No minbar structures were found associated with this phase and those of previous phases were covered over by new plaster surfaces. The construction technique in this period appeared to be less careful than those of previous phases, however plastering of the entire internal space of the prayer hall and the open iwan along with high quality plaster surfaces may be an indication that the wealth of this later population was no less than previously.

3.3 Freiha Excavation Point 4 (FREP04)

3.3.1 Introduction

Excavations in FREP04, located 65m to the north of the mosque, aimed to investigate the character and date of some of the domestic structures in Freiha. This excavation area targeted buildings identified during the survey in January 2010 in an area, to the south of the linear midden, thought to have had the longest period of occupation. Many of the buildings identified during the survey appear to have consisted of several small rooms surrounding a courtyard measuring about 12m by 12m; the buildings located in FREP04 appeared to be particularly well preserved examples of these typical structures. This trench measured 25m north to south and 40m east to west (SW corner 182255 473370 QNG) and included the remains of four separate stone-built structures along with half of a midden mound c.20m in diameter in the NE corner. Removal of the windblown sand overburden revealed a complex series of rooms with multiple abutting walls. Excavations focused on two buildings in the centre of the area and the midden (Figure 3.5). A minimum of four phases of architecture were uncovered with a final phase of deposits representing midden dumping in the disused rooms.
3.3.2 Phase 5

Few features uncovered this season date to this period. Wall 516, surrounding an uninvestigated room, was the earliest wall uncovered but was built on top of midden material indicating that earlier occupation was present below. Several postholes, identified by a sondage in Space 14, pre-date wall 517 and may relate to occupation associated with wall 516.

3.3.3 Phase 4

Rectangular rooms Space 7 and Space 14 were constructed on different alignments in this phase. Both were constructed from a single wall and contained plastered features. The madbasa in Space 7 indicates that this room was used as a store room at one point in its history whilst the sump pits located in both rooms suggest that they may have been used as domestic kitchens (Figure 3.6). Quern stones and a large amount of pottery recovered from Space 7 support this idea.

A robber trench [699] identified to the south suggests that this period was a time of great investment in the settlement with large and substantial buildings being constructed. The construction of wall 514 may indicate that more rooms were present in this Phase, which were later dismantled.

3.3.4 Phase 3

Several walls survive from this phase that may once have been part of larger, complete rooms. Wall 332, 705, and 511 may have been partially dismantled in a later period, but their fragmentary presence gives an indication of the density of occupation at this time. Space 8 and Space 12 survived intact from this period. Space 8 was formed by a single wall abutting wall 705 and may have been contemporary with the primary use associated with wall 705. Later blocking of the doorway between these two rooms may be an indication that the room formed by 705 was in use.

Figure 3.5: FREP04 - aerial view
after Space 8 had been abandoned. Space 8 contained a shell-filled sump pit in the south-west corner (similar to Space 7), as well the remains of several storage vessels and bitumen coated pots.

Space 12 was a courtyard built on to the southern side of Space 14 (suggesting that Space 14 was still in use in this phase). A shell surface was laid and a tannur dug into it. Tannurs were also dug to the west of wall 705 at this time. Surfaces located to the east of Space 14 indicate that occupation continued to the east and that perhaps all of the material from these walls was also robbed out.

3.3.5 Phase 2
Spaces 9, 10, 13, 15 and 18 were all constructed in this phase. All of these rooms included parts of earlier phases of walls in their boundaries. Space 9 was constructed over robber trench [699], indicating that the building that may have stood here was removed (Figure 3.7). No features were located in Spaces 10 or 15 indicating that they may have been disused store rooms or domestic spaces. The quern stone located in Space 13 may indicate that processing was taking place in this area. Surfaces, a tannur and middens in the area south of Space 10 indicate that this area was also used for occupation and that its eastern wall may have been removed.

3.3.6 Phase 1
Activity at this time consisted primarily of the dumping of midden material in the abandoned buildings in this area. This suggests that settlement was still present nearby but had moved away from the buildings of FREP04.
3.3.7 Discussion

The sequence of occupation uncovered in FREP04 is indicative of recurrent occupations of these buildings characterised by periods of dilapidation and abandonment, as suggested by the lack of maintenance of walls (and probably roofs). Only Spaces 7, 14 and that to the south of Space 10 contained more than one period of use. These spaces appear to have been maintained more so than other buildings; a number of postholes associated with Spaces 7 and 14 may represent attempts to support the roofs during periods of absence. Occupation may have been based around these structures, which may have been used for domestic kitchen tasks and storage, with new rooms replacing those around them during each period of occupation. If this was the case then it would have been easiest to reuse fragments of older walls that were still standing and then use the fallen rubble to construct new walls. Midden deposits between some resurfacing and building phases are indicative of abandonment of this local area but not others around, whilst windblown sand build-up between some wall phases tends to indicate a more widespread depopulation.

A large amount of pottery and animal bone (both fish and mammal) was recovered from all of the spaces indicating that this area broadly speaking served had a domestic function. Fishing is likely to have been one of the main subsistence practices in the settlement and several diving weights were recovered. Several fragmentary and complete quern stones indicate that processing of grains or pulses may have taken place, and it is possible that these goods were imported in to the settlement; a large number of coins recovered, particularly from Space 14, is indicative of a population with trading contacts (this is supported by the findings of excavations in Qal'at Freiha in 2005).

It is not clear whether Freiha was abandoned for long periods, if domestic architecture was deliberately not maintained or if the population had constantly changing needs; but evidence from FREP04 indicates a sporadically thriving population with the means to build and rebuild regularly in the same place.
3.4 FREP05

During the survey of Freiha in early 2010, a difference in building preservation was noted, with buildings to the south generally surviving in a more complete state than most buildings to the north of the site, whilst those to the east survived only in the form of deflated pisé or mud brick footings. The buildings to the south were bounded by a bank of midden material, 250m north of the mosque, running northwest to southeast from the coast for 170m. This bank measured up to 20m wide and survived up to 0.8m above the ground surface, and was a likely location for the boundary of the later activity in the settlement. This bank was reused in the 1960s as a boundary and bulldozing along the course of the feature can be seen on aerial photographs from 1971 (QMA archive). No evidence of this boundary survives at present but the effects of bulldozing can be seen to the south-east of the bank, which continues as a track out to the modern road to the east.

Excavation point 5 (FREP05) targeted this midden bank to ascertain the presence or absence of a boundary wall for the settlement and to understand how these deposits accumulated. The excavation area measured 22m in length and 2m wide and was positioned perpendicular to the line of the mound (Figure 3.8). No boundary wall was found, but the remains of three structures were uncovered with associated tannūrs and refuse pits. These were covered by a thick layer of rubble and midden material when they had fallen out of use. This area may have been on the edge of the later, southern, occupation of the settlement, but the appearance of the boundary-like mound today may have been exacerbated by modern boundary construction in the 1960s.

The architecture uncovered in this trench appears to be closer in character to that uncovered in FREP03 (eastern area) than that in FREP04 (southern area). This may be due to the amount of stone refuse from the foundations that has left only partial evidence for these walls, but it may also be an indication that these buildings were part of an earlier phase of occupation at Freiha from which building material was removed to build new structures to the south.

Figure 3.8: FREP05 - facing south-west
3.5 FREP06

A sondage measuring 2m x 2m was excavated in a large, deflated, sub-circular midden mound to the east of the settlement. This mound, located 85m to the south-west of FREP03, measured 26m in diameter, and was associated with an area containing house platforms with robbed out walls. The deposits in this midden, the largest surviving feature of its kind in the settlement, were eroded by wind, suggesting that it was in use for a long period of time, but also that it was also not used for longer than many of the other middens in the settlement. Excavations aimed to ascertain whether this feature was in fact of an early date and if it was associated with the buildings located nearby.

The character of the deposits in FREP06 is indicative of regular phases of refuse deposition. Like many other middens in the settlement, this mound originated from dumping refuse in a disused building, which demonstrates that there are earlier phases of settlement before the midden deposition began. The dark ashy deposits, similar to those found in other midden deposits at the site, tended to be rich in artefacts especially ceramic and animal bone, and suggest domestic refuse dumping during a period of occupation (Figure 3.9). A friable red silt, composed of a material found in some wall bonding material and renders elsewhere at Freiha, found interlaced with these layers may have derived from render, mud walls or material from roof collapse in the surrounding buildings. If this was the case if would suggest that the red silt layers may be the result of cleaning after a period of abandonment, and partial structural collapse. This pattern of occupation is one also illustrated in the architecture of FREP04 and in the multiple abandonment layers uncovered in the mosque.

Figure 3.9: West-facing section of FREP06
3.6 Discussion

Several themes relating to the occupation of Freiha have become apparent through the excavations carried out in 2010 and 2011. The most dominant of these is a repeated pattern of abandonment and rebuilding. All of the trenches investigated thus far have demonstrated that the settlement is a complex palimpsest of occupation phases interspersed by periods of abandonment. This is something that can be seen most clearly in the remains of the mosque in FREP01. Here, five periods of construction, several on quite a significant scale, took place throughout the life of the building. Each of these phases of use was followed by a period of abandonment, whereby thick layers of windblown silt would accumulate along with debris from wall and roof collapse. The Phase 3 rebuild appears to represent a considerable investment of resources with the entire prayer hall being rebuilt on a different alignment, whilst Phases 2 and 1 represent significant architectural changes to the layout of the mosque; the returning population clearly had enough resources to rebuild this major structure in the same location each time.

The buildings in FREP04, originally thought to be cellular rooms laid out around a courtyard, in fact appear to have been a series of short lived stone-built room based around and abutting two older rectangular rooms. As in the mosque, it was these older rooms in which postholes were found indicating either an attempt to hold up the roof or the use of that area for temporary shelters or lean-tos, perhaps reusing the walls of abandoned buildings. The older rooms, Space 7 and Space 14, had multiple functions with madbasat, a sump pit, quern stones, kitchen waste in Space 7 and a sump pit, a plastered basin and multiple coins uncovered in Space 14.

Both in the mosque and in FREP04 the location remains constant and buildings are rebuilt, probably with rubble, in the same place, rather than moving elsewhere. It is possible that in both these areas some periods of occupation have gone undetected due to the tendency to build directly on to underlying deposits rather than in foundation trenches. The deposits uncovered in the midden (FREP06) to the east of the settlement also clearly illustrate a regular pattern of use with occupational midden deposits interspersed by structural material, possibly cleaned out from partially collapsed buildings. Structural evidence uncovered in FREP03, FREP05 and FREP06 tend to support a model of dynamic, organic occupation in Freiha with walls, rooms and courtyards added when necessary rather than on a set plan, but they also point towards a gradual migration of the settlement from north to south. This migration is illustrated by the large amount of stone masonry that survives to the south in contrast to the fragmentary walls seen to the east and north, and its final stages may be shown by the dumping of midden waste into the rooms in FREP04. It may be suggested that migration of building materials indicates a shrinking population, with people not returning to their houses, and the collapsed masonry eventually being reused in the core further south.

Inspite of these absences the economy of the settlement appears to have been relatively stable and may have involved import of unprocessed foods. Quern stones found in Spaces 7 and 15 may have been used to process grains or pulses, the provenance of which is not known. However, it is highly unlikely that they came from Freiha itself due to the lack of wells in the area (only one was identified by the survey). Coins were found in Space 14 and Space 17. Fishing weights as well as a large number of fish bones reveal the primary diet of people in the settlement, although this appears to have been supplemented by mammals as well as dates. This food appears to have been cooked in several different ways, with clay lined tannur uncovered in several areas (FREP04, FREP05 and FREP03), hearth-like installations in Space 17 and a large number of small shallow firepits in all areas that may represent only short term use.

The sequence of occupation in FREP04 is only just becoming clear and it appears that older structures lie to the east and south-east that may be associated with a robbed out foundation trench. Further excavations in this area would lead to a better understanding of the foundation of the settlement. The deep, wide foundation trench may indicate that there was an initial phase of architecture that was not as organic as the later buildings. Continued excavation down to this foundation phase may help to understand why the population first left and why the character and location of buildings changed so readily. One reason for a change in behaviour may have been
a change in economy, and further, more extensive excavations in FREP03 and FREP05 (which have already produced ceramics dated to the early 17th century) will not only elucidate on the morphology of the early settlement, but will provide data on diet and economy with which to contrast that which has been retrieved from later buildings in FREP04.
4. **REGIONAL SURVEY**

4.1 **INTRODUCTION**

The QIAH regional survey continued the project’s successful program of assessing and recording the archaeological heritage of northern Qatar begun the 2009-2010 season. The work consisted of multiple components:

- geomorphological, geoaethological and palaeohydrological survey of northern Qatar with a focus around the area of Fuwairit carried out by Dr Philip Macumber
- mapping/topographic survey of key Islamic era sites in northern Qatar with a particular focus on Fuwairit
- pedestrian survey along the coastline between Fuwairit and Ras Laffan
- Rescue excavations at Khasuma (Al Ruwais)

The aim of this survey work is to provide a wide ranging characterisation of the Al Zubarah hinterland, which played a pivotal role in the development of the settlement. Although it is generally acknowledged that hinterlands played an important role in the formation of towns and larger urban settlements, the exact economic and social relations between the town and the hinterland require detailed archaeological assessment by studying both the settlement and surrounding historic landscape in concert, rather than each in isolation. The survey accomplishes that by mapping key Islamic sites to understand their size, character and function, by surface collections of artefacts for dating and functional analysis, by conducting pedestrian survey to discover new sites, visiting known sites for record updating, and carrying out - where necessary - rescue excavations at threatened archaeological localities.

Previous work as part of this survey component of the Project has demonstrated that there was a close relationship between the town of Al Zubarah and its immediate and wider hinterland. Data suggests that there may have been a spike in site densities during the 18th century, which appears to be related to the emergence of Al Zubarah as a key regional centre. Many of these sites consist of small forts or fortified compounds that protect artisan wells and are often accompanied by additional buildings and settlements. Whether these sites appeared in the landscape as a reaction to Al Zubarah’s emergence (protecting existing water and land-use rights?) or whether they were built by Al Zubarah’s inhabitants to strategically take advantage of and protect key locales in the landscape is an as yet unresolved question and a key issue for the ongoing survey work and historical analysis.

The survey also acts as a wider heritage management tool by cross-checking sites listed on the Qatar National Historic Environment Record (QNHER) and evaluating their preservation status. As part of this work the survey naturally records sites belonging to all time periods and phases, not just those dating to the Islamic period.

A key part of the survey work has been the geoarchaeological, palaeoenvironmental and palaeohydrological study of Dr Phillip Macumber, whose studies over the course of the last three years has significantly changed our understanding of the hydrological characteristics and historic settlement patterns of northern Qatar. The link between the scarce water resources of northern Qatar and historic settlement continues to be a key concern, as the availability of consumable fresh water was a key constraint on the distribution of farms, camps, villages and towns.

This multi-faceted, multi-disciplinary approach to the understanding the historic landscape of northern Qatar has already produced, and continues to provide, an in-depth insight into the human-environmental relationships, the interaction between rural areas and urban sites, as well as the social, cultural and economic relations between differently constituted communities in northern Qatar in the Islamic period.
4.2 GEOMORPHOLOGY, HYDROLOGY AND OCCUPATION ACROSS NORTH-EASTERN QATAR

Phillip G. Macumber

4.2.1 Introduction

Central to any holistic archaeological study is the relationship between occupation and the natural environment – why people live where they do. This is especially the case in Qatar where low rainfall coupled with low relief results in the absence of fresh surface water. The only natural water source is from groundwater occurring in the Tertiary marine limestone aquifers, the Umm er-Rhaduma, the Rus, and closer to the coast the Dammam Formation which outcrops across much of Qatar. The deeper part of the aquifer system is brackish to saline, and freshwater in northern Qatar is limited to the upper parts of the aquifer, occurring as a freshwater lens. The freshwater is recharged locally, mostly during storm rainfall events during which run off and silt is concentrated in the many depressions scattered across the landscape. The depressions initially formed in response to solution of gypsum, leading to the development of collapse features in the limestone aquifers. The surface expression of the collapse structures are the rawdha which contain the better soils. With no surface water, the only alternative water source for occupation and settlement was groundwater, obtained from the many wells scattered across the country which are commonly associated with the rawdha. Without the groundwater there could be no settlement, and the history of settlement in Qatar is therefore reflected in the history and distribution of its wells.

In Season 1 (2009), the main emphasis of the hydrology and geomorphology study was placed on the landscape around Al Zubarah, which was strongly influenced by the mid-Holocene high sea level from 7,000 to 4,000 years ago during the Flandrian transgression. The sea transgressed as far inland as the eastern limits of the sabkha near Murayr (Macumber, 2009), depositing sediments at levels reaching 1-3 m above that of the present sea level. Sampling of the inner beach ridge was undertaken to provide a basis for better understanding the evolution of the landscape around Al-Zubarah.

The emphasis during Season 2 (2010) was to gain a broader understanding of the general relationship between occupation and the regional geomorphological/hydrological setting across northern Qatar. Attention was focused on the impact on the landscape by the earlier of the two high sea level phases at Qatar, coinciding with the penultimate interglacial period (Eemian – marine isotope sub stage 5e commencing about 140-130,000) and lasting to perhaps 115,000 years ago. During this period conditions were similar to today but perhaps warmer and certainly wetter. The Eemian finished about 115,000 years ago with rapid cooling.

Season 3 (2011) examines the relationship between landscape and occupation in north eastern Qatar from al-Jumayl to Fuwairit and its hinterland, with an emphasis on:

1. Geomorphology and geology of the Fuwairit-al-Ghariyah coastal area
2. The water supply for Fuwairit and al-Ghariyah and inland areas
3. The association of rawdha-playettes-trees-wells and occupation, exemplified by the ruins near Umm al-Kilab
4. Landscape and water along the NE coast of Qatar between Al Ruwais and al- Ghariyah
5. The inland area of northern Qatar was further investigated.
4.2.2 Geomorphology and geology of the Fuwairit - al-Ghariyah coastal area

The ruins of the towns of Fuwairit and al-Ghariyah are located on the north-eastern coast of Qatar about 50 km north of Doha and about 20 km east of Al Zubarah (Figure 4.1). They are two of a number of small coastal towns located across northern Qatar. Al-Ghariyah is located 6.5 km to the north of Fuwairit. Fuwairit lies in a gap between late Pleistocene aeolianite ridges fronting the coast, whereas al-Ghariyah is located between the more northerly of the two ridges and the sea.

Figure 4.1: Location of Fuwairit, N.E. Qatar

Geomorphology

Fuwairit was established on a narrow north-south trending spit-like promontory, attached to the mainland in the north (Figure 4.2). On its coastward side is a further sand spit, forming a barrier to the sea. The two are separated by a narrow tidal inlet, host to mangroves. A second narrow inlet occurs to the west of the town, where it is abuts higher ground formed from a combination of late Pleistocene shallow marine sediments and Eocene Dammam Formation dolomitic limestone (Figure 4.2). The town appears as a very low bumpy ridge of silty sand which partially masks the individual buildings (Figure 4.7), although they are readily distinguished on the satellite imagery (Figure 4.2).

Inland of Fuwairit there is a narrow sabkha developed at the bottom end of a small drainage line commencing on higher ground to the northwest, where it is associated with broad grassy rawdha flats (Figure 4.3, 4.4). The northern end of the town terminates against a small shallow stream channel emanating from the sabkha and separating the town from higher ground to the north, there formed across planated Eemian suite of marine sediments and the overlying aeolianites which form the Jabal Fuwairit. The base of the channel lies close to the water table and it only contains water in small saline pools where the groundwater outcrops. The sabkha is developed on Eemian marine sediments and is actively expanding by under-sapping its sides creating small scarps cut into the limestone and the marine sediments. The edges of the sabkha are commonly moist showing groundwater outflow mostly by capillarity.
Figure 4.2: Landscape in the immediate vicinity of Fuwairit

Figure 4.3: Locality map. The larger area around Fuwairit with that covered by Figure 4.2 and shown by the inset. Location of geological section lines ‘A-A’ and ‘B-B’ for figures 4.9 and 4.10
Figure 4.4: Relief and drainage pattern formed across the Dammam Formation with stream traces which broaden to form both rawda further inland, and sabkha closer to Fuwairit.

Figure 4.5: Fuwairit sand spit 1958

Figure 4.6: Fuwairit and sand spit 2010
There have been landscape changes at Fuwairit since the 1950s, with the enlargement of the sand spit lying to the east of the town, mostly during the 1970s and 1980s (Figures 4.5, 4.6). In the 1950s and 1960s, the spit was relatively narrow, but with a broad shallow sand bank developed offshore. The spit and sand bank gradually merged with the further development of small offshore bars. The mangroves were not present in 1958, when the area was a sandy tidal inlet. The present distinct tidal channel formed following establishment of the mangroves (Figures 4.7, 4.8).

Geology in the Fuwairit - al-Ghariyah region

A geological and topographic section showing the water table (line A-A -Figure 4.9) is shown passing from the coast at Fuwairit inland to a farm at Feleeha where there are a number of wells, which probably provided water for Fuwairit.

A second B-B section line (Figure 4.10) passes inland through Jabal Fuwairit, showing the more elevated hinterland against which the aeolianite accumulated. The aeolianites are underlain by beach and shallow marine sediments, from which they are derived by deflation. The underlying marine/beach sequences are best observed between Fuwairit and the Jabal, and to the south nearer al-Ghariyah. (see below).
Figure 4.9: SE-NW Geological (diagrammatic) and topographical section ‘A-A’ through Fuwairit

Figure 4.10: SE-NW Geological section line ‘B-B’ through Jabal Fuwairit
Dammam Formation and the al-Ghariyah Fault

The Eocene cryptocrystalline marine dolomitic limestone of the Dammam Formation, which forms the surface across much of northern and central Qatar, comes close to the coast in the vicinity of Jabal Fuwairit. It seems likely that the position of the aeolianite ridge forming the jabal was determined by the higher ground of outcropping Dammam Formation limestone, which rises to about 18 m above sea level further inland from the coast.

The Dammam Formation forms a coastward sloping plain, which close to the coast is overlain by the Fuwairit Formation consisting of shallow marine and beach sediments and aeolianites forming the jabal. The limestone has a steeper slope to the southeast, which has generated a number of small drainage lines associated with which are areas of rawdha in the upper areas and sabkha at the lowermost ends (Figure 4.11). The position of the high ground is in turn related to the al-Ghariyah Fault (Macumber, 2009), which crosses the coast between Fuwairit and Jabal Fuwairit (Figures 4.12, 4.13).

Figure 4.11: Geological map in the vicinity of Fuwairit. (Hunting 1980 courtesy of Neil Munro), note small drainage lines passing eastwards towards the sabkha and associated rawdha.
Figure 4.12: Location of the Ghariyah Fault between Fuwairit and al-Ghariyah and its representation to the south. The Eemian coastal terrace lies between the 0 and 6m contours.

Figure 4.13: Relief map of northern and central Qatar showing Al-Ghariyah Fault.
Shallow marine Fuwairit Formation

Littoral shallow marine and beach sequences were deposited around the Qatari coastline some 120-130,000 years ago during the last interglacial (oxygen isotope substage 5e - Eemian) when the sea reached levels about 6 m above that at present. As is the case elsewhere they are richly fossiliferous, the most common marine shells being small cerithid gastropods. This event was the earlier of the two most recent marine transgressions, corresponding to interglacial high sea levels, which inundated and sculptured the Qatari coastline.

At the height of the intervening glacial period, sea levels fell to be ca 120-130 m below the present between 18,000 and 15,000 yr BP. The following mid-Holocene (Flandrian) transgression saw sea levels peaking at 2.5 m to 3 m above present from between 7,000 and 4,000 years BP, with the regression commencing soon after, and continuing to about 1,000 yr BP. The period of the regression is based on radiocarbon dates from the excavated channel at al-Zubarah (Macumber, 2010, 2011).

The earlier Eemian marine transgression dates to about 117,000 to 130,000 years BP. At Fuwairit, Eemian littoral marine sediments outcrop in a narrow belt extending northwards beyond Jabal Fuwairit; they underlie the town. The extent of the Eemian transgression into NE Qatar is shown on the geological map by the darker orange unit (Figure 4.14). Overlying the shallow marine sediments are a thick sequence of aeolianites which reach a height of 20 m above sea level and form a 2.5 km long ridge parallel to the coast (Figures 4.16, 4.17). The aeolianite is the Al Wusayl Member of the Fuwairit Formation (Figure 4.16) which consists of a suite of shallow marine sediments and derived aeolianites (Williams and Walkden, 2001; 2002).

On the basis of the bedding within the aeolianites, it was determined that the wind direction of the Shamal at the time of deposition was from the north east, and therefore different from that of today where it comes from the north west. The initial transgression led to deposition of shallow marine deposits of the Futaisi and Dubb’iya Members and an aeolian Al Wusayl Member, each separated by a period of sub-aerial erosion (Figure 4.15). The Futaisi and Dubb’iya Members represent sea levels reaching 1.5-2 m and ca 6 m respectively above present sea level. These sediments are the source of the overlying aeolianite.

The shallow marine beach members of the Fuwairit Formation emerge from beneath the aeolianites to the south of Fuwairit and form the structural base on which the town has been built. Although deemed to be up to 6 m thick (Figure 4.15), the shallow-marine/beach sequence has been strongly wind deflated to form a flat surface whose elevation was dictated by the level of the underlying saline water table. This process, referred to as water table bevelling, is perhaps best seen at Ain Mohammad nearer al-Zubarah on the northwest coast of Qatar, where 3m high pedestals of Eemian beach and shallow marine sediments are preserved above the surrounding sabkha, the top of which is itself formed of marine sediments (Figure 4.18). Similarly, remnants of shallow marine sequences occur between Fuwairit and al-Ghariyah both as discrete pedestals and also forming a low ridge between the coast and sabkha/rawdha further inland (Figure 4.19).

Although somewhat obscured beneath the town of Fuwairit, the marine/beach members of the Fuwairit Formation show clearly in areas immediately to the west, where the sabkha impinges on a planated marine surface into which it has eroded small scarps (Figure 4.18, Figure 4.22). The micro-scarps appear to form from under-sapping by groundwater discharge, as the sabkha edge adjacent to the scarps may be quite moist, and small reeds may be present. The thin layer of Eemian sediments overlie a planated Dammam Formation surface (Figure 4.21), formed initially as a wave cut rock platform during the Eemian transgression (see Macumber 2009, 2010). Therefore while the micro-scarp may be cut entirely into the cemented marine/beach sediment, elsewhere the edges consist of a thin layer of marine sediment overlying planated Dammam Formation.
Legend

- Sabkha (saline coastal flats)
- Rawdha (colluvial and alluvial flats)
- Beach and shallow marine deposits (Eemian and Holocene)
- Al Wusayl Member of the Fuwayrit Formation – Eemian phase aeolianite
- Upper Dammam Formation dolomitic limestone – Middle Eocene
- Location of wells recorded on the geological map

Figure 4.14: Geological map of the Fuwairit area (Hunting, 1980)
Figure 4.15: Stratigraphy of the late Pleistocene Fuwairit Formation (from Macumber 2010, modified from Williams and Walken, 2002)

Figure 4.16: Aeolianite at Jabal Fuwairit
Figure 4.17: Aeolian cross-bedding at Jabal Fuwairit

Figure 4.18: Pleistocene shallow marine and beach sediments of the Dabb’iya Member with red-brown palaeo sabkha in the background, indicating the extent of deflation

Figure 4.19: One metre high remnant of pedestal of marine Fuwayrit Formation occurring to the east of al-Ghariyah
Figure 4.20: Dabb’iya Member of the Fuwairit Formation marking the edge of the sabkha (background) at Fuwairit

Figure 4.21: Shelly marine Fuwairit Formation overlying Damman Formation near Fuwairit

Figure 4.22: Eroded edges of the Fuwairit Formation at Fuwairit, at its junction with the sabkha
4.2.3 Water Supply for Fuwairit and al-Ghariyah

Like all northern Qatari towns, Fuwairit was entirely dependent on groundwater for its water supply. The town is one of a number scattered across northern Qatar between Al Zubarah and Fuwairit for which the groundwater derived from the calcareous (carbonate) facies of the Rus and Umm a’Rhaduma Formations limestone aquifer is the freshest in Qatar. (Figure 4.23). Elsewhere the aquifers are gypseous and the groundwater quality is poorer.

A number of wells appear on the geological map of Qatar (Hunting, 1980), and, although only a guide, the map shows them to be set back from the coast away from the influence of seawater intrusion. In addition three sites (marked as crosses) have been added to the map – two to the west of Fuwairit and one to the west of al-Ghariyah. One well located in an area of grassy rawdha close to an abandoned airstrip, appears to have been more recent (Figure 4.24), the other two are traditional sites and provided water to the respective nearby towns. In the case of both Fuwairit and al-Ghariyah the nearest wells appear to be located about 1.6 to 3.0 km inland of the towns. To the west of Fuwairit, wells are located at Feleeha where they are now associated with a modern day farm (Figure 4.26), those to the west of al-Garriyah are associated with ruins representing a number of buildings, a small cemetery and perhaps a small fort. In the latter case such features are a common characteristic associated with town supply bores occurring whereby the well field is some distance from the coastal town.

Figure 4.23: Relationship between freshwater and town distribution across northern Qatar
Figure 4.24: Well in rawdha with water within 2m of the surface - at airstrip 2.9km west of Fuwairit

Figure 4.25: Well distribution in the Fuwairit - al-Ghariyah area, inland of the sabkha
Figure 4.26: More recent and older infilled wells located at Feleeha about 1.6km west of Fuwairit

Figure 4.27: Hand-dug wells at ruins west of al-Ghariyah - ruins in background

Figure 4.28: Grassed rawdha with ruins near wells west of al-Ghariyah
More generally, a number of wells are marked on the geological map as occurring closer to the highway, often associated with towns such as al-Adhbar west of al-Ghariyah and Ain Sinan west of Fuwairit (Figure 4.25). It seems likely that these towns, as was the case with Murayr and Al Zubarah, existed as ‘twin-towns’ - one coastal and one inland – each providing different resources with fish from the coastal towns and water and perhaps agricultural produce from the corresponding non-coastal settlement.

The freshwater wells providing for the coastal towns are set well back from the coast away from the influence of modern saline seawater intrusion and that occurring beneath nearby sabkha, which are also underlain by saline water due to coastal groundwater discharge (Macumber, 2009, 2010). The supply wells are most commonly found in areas of rawdha where the freshwater lens may be recharged during heavier rainfall events (Figures 4.27, 4.28). Water tables are shallow (Figure 4.24). This is a common characteristic of wells located on the near coastal plain whether located on the Eemian terrace, or on the Dammam Formation.

Apart from permanent wells, in the Freehah - al-Ghariyah area, modern ‘water harvesting’ is/was carried out from scoop or dragline depressions excavated on the base of the rawdha where water collects during wetter events (Figure 4.29). Unlike the groundwater fed wells, they are essentially opportunistic, being filled only during and after major rainfall events.

A further method of water harvesting/storage was observed in the vicinity of several wells located near al-Adhbah, coastward of the highway adjacent to al-Ghariyah were small ponds/plots were located close to the larger well (Figure 4.30).

Figure 4.29: “Dragline” depressions in rawdha west of Fuwairit

Figure 4.30: Shallow wells shown on Geological Map east of al-Adhbah - the highway is in the background
This technique was also a feature in the area lying between al-Sidriyah and Umm al-Kilab (see below), where a number of roundish ponds were established on the bare rawdha, and the ponds filled during storm events. Across Qatar, interconnected rawdha provide the basis of a poorly connected drainage system, with shallow fluves. The system has considerable antiquity which reflects processes probably commencing in the late Tertiary period and especially active during the last interglacial period from 130,000-113,000 yr BP, when the climate was significantly wetter. However, because of the low relief and low rainfall, there is mostly only a small upper catchment to support the fluves, and internal drainage is the norm. The collection of water on the surface of some rawdha is enabled by the relatively low permeability of the varying thick silty clay deposits washed in from the surrounding higher ground, which commonly form the base of the rawdha, (Figure 4.32).

While the freshwater lens may largely represent sub-fossil water which infiltrated during the period between 9,000 to 6,000 yr BP, when the Inter-Tropical Convergence Zone migrated west across Arabia and northern Africa, modern day recharge to the freshwater lens also occurs from storm events. This is shown by the significant amounts of tritium recorded in the groundwater (Lloyd et al., 1981). The rawdha commonly show the deep wheel ruts of vehicles indicating wet conditions, during which the rawdha may be flooded to form very shallow lakes, as recorded by Dr Tobias Richter during the winter of 2011 from areas close to the ruins of Umm al-Qubur, situated about 5 km east of Furayhah (Figure 4.31).

While the rawdha may be cut virtually across the Dammam Limestone, elsewhere there is a significant deposit of reddish-brown silty clay derived from the surrounding limestone areas (Figure 4.32). Commonly, the silty clay floor has a finely developed pattern of anastomosing channels covering an area of a few hundred metres square, similar to that described from al-Sidriyah (Macumber, 2011). The individual channels may be deeply eroded to form an internally draining channel system across the rawdha floor (Figure 4.33).

The area is one of ‘patterned ground’, with the shallow water table exposed in a nearby dam/well. The drainage pattern formed by numerous small anastomosing channels referred to as playettes (Macumber, 1969; 2011) forms at the lowest parts of the landscape and is at times associated with medium to large trees (Figure 4.34, Figure 4.35). The trees indicate the presence of locally recharged shallow fresher water. The landscape of rawdha, trees and playettes is often one where hand dug wells occur, showing occupation (Figure 4.36).

The origins of the anastomosing pattern have been related to shallow water tables (Macumber (1969; 2011) arising in this instance from the occasional flooding of the rawdha, during which period the water tables rise rapidly towards the surface (cf Macumber, 1991). Conversely, as the temporary lake dries in response to evapoation and infiltration, inbank storage from the slightly higher areas of the rawdha floor and perhaps the adjacent limestone weep out, resulting in peripheral sourced drainage network flowing towards the lowest points in the rawdha, reinforcing any small channels developed across the lowermost rawdha floor. The infiltration process may be reinforced by the karstic nature of the limestone aquifer.

While the rawdha may be grassed or even treed, in other instances it is mostly bare other than scattered small bushes. In the vicinity of Umm al-Kilab, a number of oval to round ‘ponds’ or ‘plots’ have been established, which are deemed to be part of a modern water harvesting system which collects water during storm events. In such cases, the bare ground has been divided by small check banks into plots to pond water. In one instance a flume was observed on a short channel joining the plots (Figure 4.37 to Figure 4.39).

The relationship between bare rawdha, trees, wells and plots may be seen in Figure 4.40, 4.41 and in Figure 4.47 and its relationship with early occupation at Umm al-Kilab is discussed in Section 4.2.4.
Figure 4.31: Flooding of the rawdha in the vicinity of Umm al-Qubur (photo courtesy of Dr Tobias Richter)

Figure 4.32: Silty clay forming the floor of an area channelled rawdha at a well site to the west of al-Mafjar
Figure 4.33: Channels having a playette drainage pattern on the floor of a rawdha near Umm al-Kilab

Figure 4.34: Typical channelled playette drainage pattern (foreground) formed on the lowermost parts of the rawdha floor where the channels are commonly associated with trees - locality, al-Sidriyah
Figure 4.35: Light scattering of trees in rawdha near Umm al-Kilab indicating groundwater availability. The area surrounding the trees has a typical playette pattern.

Figure 4.36: Well near Umm al-Kilab
Figure 4.37: Plots on bare rawdha in the vicinity of Umm al-Kilab

Figure 4.38: Plots on bare rawdha in the vicinity of Umm al-Kilab

Figure 4.39: Plots on bare rawdha in the vicinity of Umm al-Kilab
Figure 4.40: The landscape association of rawdha, wells, channels, trees and occasionally plots in the vicinity of Umm al-Kilab

Figure 4.41: Bare rawdha floor with trees in the background indicating freshwater at a shallow depth
4.2.4 Early occupation and the rawdha landscape association

The rawdha landscape association described above is a setting highly favourable to occupation. The rawdha are extensive across Qatar (Figures 4.42; 4.43); however, there are limitations to settlement determined by groundwater salinity.

![Figure 4.42: Drainage pattern across northern Qatar (Eccleston et al. 1981)](image)

The presence of large trees and tree coppices provide a guide to both water presence and quality of the groundwater. Examples of inland settlements include the ruins at Umm al-Qubur (Figure 4.44, Figure 4.45) where occasional flooding guarantees the development and replenishment of the freshwater lens, Ghaf Makin (Figure 4.46), al-Sidriyah, and the earlier site at Umm al-Kilab. These settlements are located on the Dammam Limestone in contrast to the irrigation settlements closer to the coast at Qal‘at al-Thaqa’ab and al-Jiffarah which are situated on the upper parts of the Eemian terrace (Macumber, 2011).

![Figure 4.43: Coastal towns and inland localities and associated rawdha (geology from Hunting 1980)](image)
Figure 4.44: Ruins at Umm al-Qubur with trees and well in background

Figure 4.45: Well at Umm al-Qubur

Figure 4.46: Ruins at Ghaf Makin overlooking extensive rawdha
In a similar setting near Umm al-Kilab overlooking a nearby rawdha are linear ruins stretching along a distance of 400 m (Figure 4.47 to Figure 4.52). At the south western end, the ruins contain an elongated 30 m long rectangular structure with a number of rooms. Two further single detached structures were present at either end, and a number of others extending in a line for 400 m to the north east flanking the rawdha. Although over 6 km from the coast, gastrapod shells dominated by conus sp. were scattered throughout the village with a large number of shells forming part of a small mound at the north-eastern end (Figure 4.50). Included in the pottery from the village were a number of turquoise coloured sherds. Conus shells are known to be variously poisonous to humans and their toxin has no known antivenine. One species Conus magus has recently shown promise as a non-addictive pain reliever, more than 1000 times as powerful as morphine.

The ruins lies alongside a rawdha/wadi system which is eroded into an area of plateau lying between the 15 and 16 m contours.. The wadi passes westward towards the village of al-Sadriyah lying about 6 km away at an elevation about 10 m above sea level. There are several modern wells in the rawdha close to the village, these include a government observation well and a relatively new farm well. While the latter may have been in use for some short time, the sites of earlier wells in the rawdha present at the time of occupation of the village have been lost due to the silting of the rawdha under storm flood conditions. It is assumed that they would have been in the nearby rawdha, in the vicinity of the present wells, and perhaps in the playette area to the southwest (Figure 4.47)

Note the low areas to the south of the village where the hand-dug wells supplying water were probably established. On passing down-valley, the ancient town (now ruins) of al-Sidriyah is only 6 km away established at the head of a small embayment passing towards the coast (Macumber, 2010 and 2011). It is conceivable that a similar aged settlement existed on the route to the coast which emerged between Qal'at al-Thaqab and al Jumayl.

Figure 4.47: Distribution of modern and ancient features near Umm al-Kilab. Inset - 30m long rectangular structure with flanking structures at south-western end of the village
Figure 4.48: House structures near Umm al-Kilab (NE end of 400m long line)

Figure 4.49: Rectangular structure with rooms at SW end of settlement near Umm al-Kilab

Figure 4.50: *Conus* sp. shells amidst stones in a small heap from northeastern end of the ruins
Figure 4.51: 3D figure showing location of village (ruins) on edge of rawdha near Umm al-Kilab

Figure 4.52: Topography in the vicinity of linear ruins near Umm al-Kilab showing the site of al-Sidriyah to the west
4.2.5 Water and landscape along the northeast coast of Qatar between Al Ruwais and al-Ghariyah

In 2009 and 2010, the regional geohydrological survey was concentrated on northern Qatar, with an emphasis on the north-western coastline between Al Zubarah and Shamal. In 2011 more attention was paid to the north-eastern coast in the vicinity of Fuwairit, and extending northwards towards Al Ruwais. This region includes the areas around Fuwairit, al-Ghariyah and al Mafjar. The study centred on the rawdha and the wells known from the geological mapping such as that near the sports complex at Al Ruwais (Figure 4.54). In the course of the study a number of additional wells were added to the well distribution map.

The coastal setting for northeast Qatar is similar to that for northwest Qatar, in that there is strong representation of the high sea level impacts during which the two tier marine terrace landscape recorded for the northwest coastline also evolved. This is clearly seen at the coast where the high level wave cut platforms are exposed in coastal sections to the east of Al Ruwais.

The inland limits of the mid-late Holocene Flandrian transgression are shown by the 3 m contour (light grey areas in Figure 4.53), while that of the earlier Eemian transgression is approximately marked by the 6 m contour. As is the case elsewhere the Eemian terrace is formed of marine sediments (identified by cerithids and gypsite), and by planated Dammam Formation shore platform.
Figure 4.54: Well and structure near sports complex at Al Ruwais

Figure 4.55: Large well/dam intersecting the shallow water table, located to the east of Al Ruwais

Figure 4.56: Infilled well in small rawdha, west of Mafjar
Figure 4.57: 3-D topographic map of NE Qatar from al-Jumayl to Fuwairit with well distribution

Figure 4.58: Soils map of far northern Qatar showing the position of the sabkha (purple) and small rawdha (green) with which shallow wells are commonly associated. Map courtesy of Neil Munro
In general the 3 m contour marks the upper limits below which active sabkha are common. This was especially clear on passing southwards between al-Mafjar and al-Ghariyah where an extensive area of sabkha is shown in both the geological and soils mapping and on the 3-D topographic map (Figure 4.57) and the soils map (Figure 4.58). On the other hand a large number of shallow wells are located at elevations of between 4 and 6 m on the Eemian terrace.

One clear observation from the survey was the higher density of shallow hand-dug wells between Al Ruwais and al-Mafjar. Wells in this area were found in a number of small rawdha and commonly associated with large trees. As is the case elsewhere with the Eemian terrace, the water table lies at a shallow depth and appears as groundwater outcrop in shallow dam/wells (Figure 4.59, 4.60).

Perhaps the clearest indication of the location of wells relative to the coast comes from the 3-D topographic map (Figure 4.57) showing the coast from al-Jumayl to Fuwairit. Here the majority of wells are located in a zone commencing from about the 10 m contour interval to a position within about 1 km of the coast. The Eemian shoreline lies at or about the position of the 6 m contour, while the sabkha between Mafjar and al-Ghariyah is at elevation of 3 m or less. There are a number of wells on the Eemian coastal terrace, to the west of Mafjar and south of Ruwais, where the water table is shallow.

They are set sufficiently far back from the coast to avoid the problem of seawater intrusion. Between Al Ruwais and al-Mafjar, the wells (mostly now infilled) are commonly associated with small patches of rawdha, where trees are often present, dependant on shallow groundwater. In an area of small rawdha closer to al-Mafjar several wells occur in the vicinity of two small nearby cemeteries (shown as ‘c’ on Figure 4.58). Between al-Mafjar and al-Ghariyah, there is a large area of sabkha, with strongly undulating Dammam Formation bedrock and higher terrace sequences between the sabkha and the coast. However no wells were observed in the undulating area where the groundwater at a comparatively shallow depth is probably saline due to both seawater intrusion and the accumulation of salt beneath the sabkha. However, cairns (Figure 4.61) were observed on some of the higher ground in this area (marked as ‘m’ in Figure 4.58).

The nearest group of wells lies on a farm (‘f’ in Figure 4.5858), where walls and hand-dug wells suggest an earlier phase of settlement (Figure 4.59).

Cairns have been recorded from along the eastern coast of Qatar, at al-Khor and the proposed Aerospace City. At al-Khor, where there is Ubaid pottery, 16 cairn burials were recorded of which 6 were excavated. Dates from al-Khor were 6,290 +/- 100 BP, 6590 +/- 120 BP and 6,420 +/- 100 B.P (Inizan, 1988). A little to the south of al-Khor, at Aerospace City, a number of cairns are located on a 4–5 m high Eemian terrace protruding as a small peninsular into the former mid-Holocene sea (Macumber 2011). Like the al-Khor sites, they overlook the mid-Holocene high level shoreline, and are probably of similar age.
Figure 4.60: Infilled well with cerithids exposed in nearby sediment (inset) indicating that the site is developed on the Eemian marine terrace.

Figure 4.61: Cairns on higher ridges of Dammam Limestone between al-Mafjar and al-Ghariyah.
4.2.6 Conclusion-Discussion

A large number of wells are shown on the geological map of northern Qatar (Hunting 1980), and this was used as a basis to investigate the environmental setting in north-eastern Qatar between Al Ruwais and Fuwairit. In addition further study was carried out on the relationship between occupation and environment in the hinterland between al-Zubarah and Fuwairit.

There are a large number of shallow wells commonly associated with small rawdha scattered across north-eastern Qatar between Al Ruwais and Fuwairit. The largest distribution is between Al Ruwais and al-Mafjar, and inland of a large sabkha located between al-Mafjar and al-Ghariyah. The number of wells falls off to the south of al-Ghariyah reflecting the decline in small rawdha, but perhaps also reflecting the proximity of the water quality change from the fresher carbonate facies to the gypseous facies of the Rus limestone. Whatever the case, for the towns and their water supplies, the pattern is similar to that in the Al Zubarah region whereby coastal towns receive their water supply from wells located further inland. At al-Ghariyah and Fuwairit, small well-fields occur back from the coast, however the towns also appear to be ‘paired’ with larger settlements, as is the case of Adhbar and al-Ghariyah, and Ayn Shan and Fuwairit.

On the hinterland well away from the coast, there were fewer areas of rawdha but they were considerably larger. This was the case at Umm al-Qubur, and near Umm al-Kilab. The larger rawdha have larger local catchments, and flood during winter storm events. This leads to groundwater recharge. In a number of instances shallow fresh groundwater was implied by the presence of scattered large trees, and supported by the presence of wells, indicative of occupation.
4.3 REGIONAL SURVEY AND MAPPING

David Mackie and Daniel Eddisford

4.3.1 Mapping work at Al Zubarah

A ground survey of the remains at Al Zubarah (QNG 181064/469326) and its immediate hinterland was undertaken in 2009 by Richard Hugh Barnes (Figure 4.62). Initially, roughly scaled sketches of the site were drawn followed by a digital survey using a total station.

Each area has one control station established by resection from known existing fixed control points and the level is transferred from the fixed point using an automatic level. During this season previous excavation areas QMA1, QMA2, QMA3 and QMA4 were surveyed to provide wall plans for the conservators. These plans have allowed them to carry out a condition survey for each area. Previous excavation areas, ZUEP01, ZUEP02 and ZUEP04 were extended. A new area ZUEP05 was opened on a midden mound outside the outer city wall south of tower 9. A small sondage was excavated on the higher ground to the north of ZUPE01.

On excavation areas ZUEP01 and ZUEP04 additional control points were established for the laser scanning team to use.
4.3.2 Mapping of Shuwail

This site is situated c.1.1km east of Al Zubarah Fort (QNG 184076/469378) and is comprised of a small, ruined fort situated on the higher rocky ground within a large shallow irregularly shaped depression (Figure 4.63). The fort is a square structure with a round tower on its east corner and a rectangular tower on its west corner (Figure 4.64). The building measures c. 20 x 20m, with the entrance on the southeast side and includes two small buildings on the west side and one on the east side. Within the compound there are four rooms along the northwest wall with at least two along the southwest wall. The rectangular tower on the west corner still has remnants of the mud brick architecture surviving on a stone foundation.

Figure 4.63: Plan of the fort and settlement at Shuwail
This site was previously reported by Beatrice de Cardi in her Qatar Archaeological Report as site ‘13b Ain Al Shuwail’, where she describes an 18th to 19th century fort amid several ruined buildings. Beside the fort is a fine stone lined well 2m in diameter with water at a depth of 5.20m.

Located to the east about 200m close to the edges of the depression are another eight scattered ruined buildings (Figure 4.65). Another building is located on the northern edge of the depression with other possible buildings around the western edge of the depression.

The main settlement consists of twenty two dispersed buildings and is located 478m to the south of the fort close to three stone lined wells. The western well measures 4 x 4m and is surrounded by a circular eroded spoil heap. The central well is circular, approximately 4m in diameter and still contains water at a depth of 5m. It is likely that this is the well described by de Cardi. There is a denuded spoil heap around this well and it has two modern concrete water troughs adjacent to it with the remnants of a stone walled enclosure to the south east. The third well is located 75m to the south east of the central well and measures c. 5 x 5m surrounded by a large spoil heap.

To the north of the settlement and the wells within the depression are two sub circular cuts surrounded by large eroded spoil heaps with small eroded channels running into each. They are both unlined and appear to act as sumps rather than wells collecting and retaining water following rainfalls.

Within and around the edges of the depression are a number of temporary tent positions with one large cleared area to the north east bounded by low stone walls around a sand covered interior with a clay moulded hearth, drainage gullies, and clearance cairns (Figure 4.66). This is relatively recent as are the bulldozed spoil heaps and former tent positions to the south on the edge of the depression. This may be a former position of the existing sheep and goat farm to the west.
Figure 4.65: Ruined buildings at Shuwail

Figure 4.66: Temporary camp at Shuwail
4.3.3 Mapping of Ruwais

This site is comprised of two partly collapsed stone walled enclosures and associated wells located north of the Al Shamal sports ground (QNG 200414/485340). (Figure 4.67), Beatrice de Cardi makes no reference to this site in her Qatar Archaeological Report.

The northern enclosure is square in shape and measures c. 64 x 70m. The wall only survives to a height of one to four courses and is between 0.60m and 0.65m in width. Near the south east corner is a stone lined square well with the remains of a building on its northern side, the walls of which survive to a height of 1.23m and are 0.80m thick (Figure 4.68).

The southern enclosure is located c.130m to the south east and is sub square in shape and measures c.53 x 56m (Figure 4.69). The enclosure wall is constructed from large irregular undressed blocks of stone with an internal packing of mud and smaller stones. It is 0.70m in width at the base tapering up to 0.46m wide at the top, and survives in places to a height of 1.07m. Located on the western side is a partially collapsed disused stone lined well. To the northwest outside the enclosure is a small round concrete capped well which has been partially backfilled. Another disused square concrete capped well with a concrete water trough is situated on the north east corner of the enclosure.

Figure 4.67: The Ruwais enclosures with Al Shamal sports ground to the south
Figure 4.68: Northern enclosure at Ruwais

Figure 4.69: Southern enclosure at Ruwais
4.3.4 Mapping of Ain Mohammad

The abandoned settlement at Ain Mohammad is situated c. 4km northeast of Al Zubarah town (QNG 183897/472065). The settlement is defined by twenty relatively recent dispersed derelict buildings and a demolished mosque. Amongst these buildings are earlier ruined compounds, buildings and disused wells. Two walled cemeteries are situated to the northeast of the site. The centre of the site is comprised of a sub square walled enclosure with two later extensions to the north and south defined by reused oil drums surrounding a central well with a concrete cistern (Figure 4.70). Located to the northwest of this is a ruined square compound with a round tower on its southeast corner which is similar to the fort at Shuwaik to the south (Figure 4.72). To the southeast there is another ruined stone walled compound which has a tower on the northeast corner and the remnants of another possible tower on the southwest corner (Figure 4.71).

To the south of this structure is a collapsed stone lined well associated with a small walled enclosure. To the south west of this enclosure, adjacent to the access road to the military compound, is another concrete capped well and cistern. Another concrete and stone capped well is located to the east.

Located along the eastern edge of the site are nine small ruined structures and former temporary camp positions. Immediately to the south of the access that gives access to the military compound is another ruined small settlement, comprised of a linear group of collapsed stone buildings and enclosures with one standing building at the north western end. These buildings probably represent the southern extent of the settlement north of the road, but have been truncated by a modern road leading to a military installation further east. Since last year the northern edge of this site has been partially destroyed and covered by spoil excavated from a new service trench. Another two collapsed stone structures are situated to the southeast of this site.

Figure 4.70: Main enclosure, derelict buildings and cemetery at Ain Mohammad
Figure 4.71: Photograph of the southern compound at Ain Mohammad

Figure 4.72: Ruined northern compound at Ain Mohammad
4.3.5 Mapping of Fuwairit

Introduction

The site of Fuwairit survives as a series of poorly preserved and partially buried low walls. The topography of the site, along with all visible archaeological features was recorded by total station. A detailed digital terrain map of the site was produced, as well as an interpretive site plan and a 3D model of the site. The previously undocumented, fortified site of Zarqa was identified inland of Fuwairit, and would have been the costal site’s source of water as well as providing agricultural land. A photographic record of both sites was made, historical references were investigated, and aerial photos examined. The preliminary results of the survey are presented along with recommendations for further work in the area of Fuwairit, and measures to ensure the protection of the archaeological remains.

Site Location

The archaeological site of Fuwairit is located on the northeast coast of Qatar, centred on Qatar Nation Grid (QNG) reference 215295 475177 (Figure 4.73). The site is bounded to the north by Jabal Fuwairit and to the east by dense mangrove. Beyond the mangrove is a popular sandy beach, known as Fuwairit beach. To the west the site is bounded by an area of sabkha. The southern extent of the site lies on a sandy peninsula, and is bounded by an area of tidal mudflats and patchy mangrove.

The site of Fuwairit is a little over a kilometre long, with the main area of ruined architecture measuring c.750m long by 160m wide. To the north a wall extends c.500m along the coast to the foot of Jebel Fuwairit, enclosing a tidal area and beach frontage that may have acted as the settlement’s harbourage. To the west of the ruined architecture an area of associated midden dumps extend c.175m to the edge of the sabkha. Two walled cemeteries are also located on the edge of the sabkha.

Approximately 500m directly south of the archaeological site of Fuwairit lies the village of Fuwairit, which is largely abandoned with many buildings having fallen down or in an advance state of decay. The village consists of low demolished walls, partially ruined buildings including a mosque, as well as more recently constructed compounds that are still in use.

Inland from Fuwairit c.1.5km the site of Zarqa is centred on QNG 213843 474412. Adjacent to a small farm are the remains of a mosque, fort and a number of other ruined buildings. These represent a fortified site that would have provided the water and agricultural areas utilised by the former inhabitants of Fuwairit.

Historical background

Fuwairit is historically poorly documented and not shown on Carsten Niebuhr’s 1765 map of the Gulf region. According to oral tradition Fuwairit was the residence of the Al Thani family until they left for Bida in the mid 19th century after tribal conflicts.

Colebrook describes in 1820 “Phoerol” [Fuwairit] as being “to the East of Ras [cape] Reckan, the inhabitants removed to Bahrein, has no Khoor the coast on this side the cape, is bolder and may be approached by vessels within gunshot” (Rahman 2005, 3). A British maritime survey of the Arabian Gulf was conducted between 1820 and 1825, and makes mention that at “Affeeraat [Fuwairit] a few cattle and water may be procured” (Hughes Thomas 1985, 561).

In 1920, Fuwairit is described as a little walled town, with several towers, on the shore of a small khor (US Hydrographical Office 1920, 117) and an aerial photo from 1958 shows the site of old Fuwairit to be abandoned and in ruins. The site was by then replaced by the village of new Fuwairit located directly to the south.
Previous archaeological work

The area of Fuwairit was visited by Beatrice de Cardi as part of the British Archaeological Expedition in Qatar, undertaken between November 1973 and January 1974. Although no excavation was undertaken at Fuwairit, a summary of the site is included in the project’s gazetteer of finds.

The archaeological site of Fuwairit is described as a “large low site covering about 13 hectare, stands on a spit of sabkha jutting into the sea at the southern end of Jebel Fuwairit. The mound which represents individual houses shows that the town was well planned with building lines running parallel in an area of 860m x 170m. As at Al Zubarah some rubbish middens lay outside the town by the ‘fort’ and yielded pottery, glass bracelets and porcelain of eighteenth century date” (de Cardi 1978:190).

On Jebel Fuwairit a small scatter of 18th century pottery and a number of rock carvings similar to those on Jebel Jusasiyah was recorded by de Cardi (1978:190). The date and function of the rock carvings was not ascertained, although de Cardi suggests they may have been a gaming board. The carvings on the top of Jebel Fuwairit (QNHER 10627) consist of cupmarks and ‘boat’ depictions. A similar rosetta of cupmarks was recorded at the base of the Jebel, just north of the northern city wall (QNG 215106 476038).

Results - Fuwairit

From the Fuwairit survey data (Figure 4.74) a digital terrain model of the Fuwairit site was produced, this can both be represented as a contour map of the site (Figure 4.75) and used as the basis for an interpretive site plan of the buried architecture (Figure 4.76).
These compounds are rectangular in plan, measuring between c.15m and 40m across. The compounds generally consist of a large central courtyard, surrounded by a number of small rooms, measuring c.3m to 7m across. The architecture at Fuwairit closely parallels other coastal settlements in northern Qatar, such as those excavated at Al Zubarah and Freiha (Richter 2011). All the structures on the site are built of roughly finished beach rock, which is available within a few hundred metres of the site. Walls are constructed of two parallel rows of stone, sometimes with a packed core of smaller stones.
A possibly defensive wall was recorded as running east-west along the base of Jebel Fuwairit, then turning south and running to a small creek directly north of the main settlement. This wall encloses Fuwairit beach, and may have protected the site’s harbourage. The northern extent of the wall is almost entirely buried under sand dunes but appears to be well preserved, surviving to over 1.50m high. At its northeast extent a series of walls abut the southern face of the defensive wall, indicating there are structures directly inside the wall in this area. Possible structures are visible in this area on the 1958 aerial photograph of the site. The northern area has already been adversely impacted on by development, and this is one of the most threatened areas of the settlement.

The main domestic architecture at Fuwairit is located to the south of the creek on a narrow peninsula surrounded by tidal salt flats on all sides. The remnants of a defensive wall can be detected along the western side of the site, the northern extent of which is buried under later midden dumps.

The northern area of the site appears to have the mostly densely packed architecture. In this area the more irregularly shaped compounds may represent infilling between buildings as the settlement expanded. Groups of compounds can be identified, separated by narrow alleyways. The northwest area of the site lacks any obvious walls; however a series of low rectangular depressions may be the remains of more ephemeral wooden structures on the edge of the site.

An intriguing structure is located some distance to the west of the main area of architecture. Measuring 34. m by 28.50m, the building is constructed of beach rock in a similar manner to the rest of the site. However, the plan of the structure, with a double western wall, is clearly different from the domestic compounds seen across the rest of the site. This building is presumably the structure de Cardi identified as a ‘fort’ (1978:190) in her survey of the site. The building has midden material dumped against the outside of it, as de Cardi described. The plan of the structure does not suggest it is a fort, but probably a mosque. Its location with respect to the settlement would mirror that of some other mosques in villages in northern Qatar. As in Fuwarit, the mosques at Freiha and al-Ghuwair, for example, are the westernmost buildings in the settlements.

The central area of the site contains further domestic compounds, one of which is distinctly larger than the surrounding structures. It consists of two large courtyards that measure over 40m across, and ruined walls survive to almost 2 m high. This structure may also represent a domestic building; however, it is the largest compound on the site, and may have originally stood at least two stories high. This likely represents a fortified compound or fort within the settlement, which would have presumably been an important building.

A more open area in the centre of the site represents a marked change from the closely packed domestic architecture seen across other parts of Fuwairit. A series of alleyways lead into this area, and the poorly preserved remains of smaller structures are visible on the surface. It is likely this represents a suq area, an interpretation that is supported by the presence of rows of small rooms, possibly shops, visible on the 1958 aerial photograph of the site.

The southern area of the site also contains compounds, but they are less tightly packed, and appear to show less addition and alteration. The southern area of the site also has more midden dumping visible within the compounds, suggesting that this area may have fallen out of use earlier in the site history. Large mounds of midden material are also present along the western side of the site, extending out to the sabkha.

Several fish traps are visible directly to the south of the site (Figure 4.73). The early aerial photography suggests some of these are relatively recent constructions, dating to the last quarter of the 20th century. However, some are visible on the earliest aerial photography of the site and may be associated with earlier occupation at Fuwairit.

Results - Zarqa
Figure 4.75: Fuwairit contour map

Figure 4.76: Fuwairit site plan
About 1.5km inland to the west of Fuwairit, the site of Zarqa was identified, centred on QNG 213843 474412 (Figure 4.77). Adjacent to a small farm are a number of ruined buildings, representing a fortified site that may have provided the water and agricultural areas utilised by the inhabitants of Fuwairit. The QNHER lists one of these buildings (QNHER 10167) and the cemetery (QNHER 1068); however the site is incorrectly recorded as Feleeha.

The structures at Zarqa are built of unworked sub-angular pieces of limestone, a building material abundant nearby. The remains of a fort survive as a large mound of stone, measuring 26m across and 1.80m high, with deflated walls clearly visible on the surface. The fort is rectangular in plan, with a tower on each of its four corners. The fort, like all the structures on the site, has been heavily impacted by modern inhabitants. The southeast tower of the fort has already been largely destroyed by a mechanical excavator, as has part of the northern wall; it appears that the fort has been used as a convenient source of stone building material. In addition the western side of the fort is partially covered by modern dumps of building activities.

To the northwest of the fort a rectangular building measures 13m by 15m in plan. This structure is the only building on the site in which beach stone as well as limestone was utilised in construction. The building is divided roughly in half, and consists of an open courtyard to the east and a slightly smaller rectangular room to the west. The orientation and layout of this structure strongly suggest that it is a mosque. Similar to the fort this mosque is unprotected and is highly vulnerable to further disturbance.

There are a series of small buildings, measuring between 5m and 10m long, in the area to the south and west of the modern farm. These are all constructed of unworked limestone, and their function is not clear. Given the size of the fort and mosque there are relatively few other structures present, possibly suggesting much of the site was constructed of perishable material such as wood, or that the site was not intensively occupied and that the main bulk of the population in the area lived at Fuwairit. The original size of the site is also indicated by the presence of a cemetery measuring c.30m in diameter. The cemetery has been protected by a mound of dirt that has been pushed up to it by a mechanical excavator.

It is likely that the primary function of the Zarqa site would have been to provide water and ag-
Results - New Fuwairit

To the south of the archaeological site of Fuwairit the village of new Fuwairit is also largely in ruins (Figure 4.78). Constructed in the mid 20th century, it is not entirely clear if the site was ever entirely abandoned. Ruined walls of beach stone constructed compounds appear to be very similar to those surveyed to the north, and a contemporary date cannot cannot be ruled out.

Most of the buildings in new Fuwairit are constructed using a mixture of beach rock and cinder blocks (Figure 4.79). The buildings are roofed with a combination of wood, palm fronds and packed mud. The construction techniques observed here are likely to have direct parallels in the ruins of the earlier settlement.

Figure 4.78: Ruined compounds (foreground) in New Fuwairit looking southeast

Figure 4.79: Cinder block and beach rock construction
Surface Finds

A detailed, systematic surface collection of artefacts was not conducted at Fuwairit. Given the degree of midden dumping, modern activity and disturbance on the site it is unlikely that the surface distribution of artefacts accurately represents previous activity areas at the site. However, during the survey a number of surface finds that were in danger of being damaged or that could give strong dating evidence were collected. The locations of all the artefacts collected were recorded in three dimensions using a total station. In addition a brief overview of the surface pottery was undertaken, with the help of QIAH pottery expert, Agnieszka Bystron.

Surface pottery

Surface pottery observed on the Fuwairit site included bowls with manganese painted decoration and a yellow glaze of 16th to late 19th century date. Iranian Khunj wear bowls were present, with a similar date range. Chinese blue on white porcelain were present on the surface. In addition poor quality blue on white wear ware was noted, with crazed and blistered glaze, probably representing low quality local imitations of Chinese ceramics. One single sherd of block printed blue on white glazed porcelain dates to the 19th century. European semi porcelain from the site, of probable Dutch or English manufacture, dates to the late 18th or 19th century. Fragments of green glazed bowls were collected, although no diagnostic sherds were found. Large reduced wear ware vessels probably represent Julfar wearware, and date to the late 16th to 19th century. Collectively the surface pottery at Fuwairit appears to be very similar to the assemblages from the excavations at Zubarah and Freiha. Most of the surface pottery examined has a broad date range from the 16th century until the 19th century. However, certain pieces such as the European semi-porcelain suggest a later 18th or 19th century occupation. Surface pottery at Zarqa was significantly less common, reflecting the sparse and more spread out architecture. Here the surface pottery included sandy creamy wears wares and coarse tempered red brown domestic pottery.

Small finds

The surface finds from Fuwairit included several small, heavily corroded coins. In addition there were two more easily identified coins. An Indian Rupee dating to 1917 (SF4, Figure 4.80) and Chinese coin with a small square hole in the centre (SF9, Figure 4.81). A small padlock (SF7) has writing on one side of it, and will probably be able to be dated once it is fully cleaned. Two cartridge cases (SF8) appear to have been utilised as a stamp tool. One end of the casing has been shaped into a square pattern and may have been used to stamp decoration into the wet render on the buildings. Two stone artefacts were recovered from the surface of the site, both attesting to the importance of maritime activity. A small stone weight probably represents a net sinker; a fragment of a larger stone artefact with a hole through it is part of an anchor.
Conclusions and Recommendations

Maritime connections were essential to the inhabitants of the Qatar peninsula in the early modern period. The site of Fuwairit gave maritime access as well as being relatively defensible. This latter attribute was an essential requirement during a period when tribal rivalries in the region often resulted in violent conflict. The site of Fuwairit lacks on-site fresh water, and this need was met by the complimentary site of Zarqa. Located a short distance inland this site provided water and agricultural land to those living on the coast.

Both Fuwairit and Zarqa are threatened by development and damage from vehicular traffic, which are causing tangible losses on both sites. At Fuwairit the main site has been badly damaged by heavy vehicle traffic, in part due to its proximity to the popular recreation area of Fuwairit Beach. A modern structure on the northeast corner of the site has destroyed archaeological deposits, and the possibility of continued development of the beach would result in further losses. The site of Zarqa has been partially destroyed, either for the deliberate recovery of stone, or out of a lack of knowledge of its history and importance. The full extent of the site is unknown, due to the proximity of a modern farm.

In conclusion, the survey conducted in the Fuwairit area provides a basis from which to expand research of this region. Further research would include a survey of Zarqa, building recording at new New Fuwairit, and a series of excavations at the archaeological site of Fuwairit. The excavation and survey data from Fuwairit, along with oral histories would complement the ongoing research undertaken by the QIAH project in northern Qatar. The exploration and preservation of this area is important to understanding major social and political shifts in the recent history of Qatar and of the region. Excavation at Fuwairit would also allow the cultural heritage of the site to be presented to the public in situ, and allow future development of Fuwairit beach as an integrated recreational, cultural and environmental area.
4.3.6 Survey of the coastline between Fuwairit and Ras Laffan

Introduction

The coastal area of northeast Qatar, between Fuwairit and Ras Laffan industrial city, was examined in detail as part of QIAH’s regional survey (figure 4.82). Aerial photographs, Google Earth satellite imagery as well as data from surveys conducted by the British Archaeological Expedition in Qatar (de Cardi 1978) and Birmingham University (Beardmore et al. 2010) was utilised to locate archaeological sites in the area. The sites of Al Marrouna and Al Huwailah were mapped for the first time. An archaeological site at Al Jethay was recorded directly inland from Al Marrouna. Two smaller coastal sites were identified between Al Marrouna and Al Huwailah. This report presents a brief summary of the nature and location of these sites, as well as recommendations for their protection. All the sites identified were threatened with destruction, or had been adversely impacted on by recent development.

Figure 4.82: Location of the site discussed below
Al Marrouna (QNG 218328 470988)

According to Brucks 1829 (in Hughes Thomas 1985, 561) a settlement called Ras-ool-Maroona was at “lat. 26° o’ 50” N., and long. 51° 27’ 40” E”, clearly situated between al Huwailah and Fuwairit; however the author gives no further details of the site.

De Cardi mentions a site “five kilometres south of Fuwairit some buildings, very heavily sanded up, lie parallel to the coast just behind the beach. Mortared wall lines of large courtyarded houses stand up to 2.50m high. The site is very unusual in that the stone masonry is bonded with good lime mortar. No pottery was visible, but the site may be of eighteenth century date” (1978, 190).

The site of Al Marrouna has received little attention, in part no doubt due to the brief nature of the documentary references mentioned above. However, the remains of Al Marrouna were identified during the 2011 survey and found to consist of a substantial settlement, centred on QNG 218328 470988.

The archaeological site of Al Marrouna consists of a series of substantial walls constructed of beach rock, measuring 0.40-0.50m wide and possibly surviving up to 2m high. The site lies parallel to the coastline, and represents the remains of a relatively large settlement. The site has been partially destroyed by the construction of modern buildings (Figure 4.83). The surviving area of walls visible on the surface measures approximately 330m north-south and 150m east-west, but originally the site would have extended further to both the north and south. Recent development of the site has resulted in a significant proportion of the site being destroyed. The surviving areas of the site are threatened with imminent destruction, unless urgent measures to preserve them are undertaken.

The site is currently covered with low sand dunes, and rapid inundation by sand appears to have resulted in the structures on the site being unusually well preserved. Since the site is largely buried under sand it is difficult to identify from satellite imagery, and as a result it does not currently appear to be listed on the Qatar National Historic Environment Register (QNHER). The site contains a number of rectangular domestic compounds, consisting of central courtyards surrounded by smaller rooms. This architecture is typical of the 17th-19th century villages of the region, a date supported by the pottery sherds visible on the surface. In addition to the walls visible on the surface it is likely that midden dumps, possibly along with more ephemeral structures, extend to the west and are completely buried under the sand (Figure 4.84).

The unusual white mortar that caught de Cardi’s attention is visible on the exterior faces of many of the walls on the site. This “lime mortar” is in fact more likely to be dehydrated anhydrite (CaSO4), which occurs when gypsum is naturally dehydrated by being baked in the sun (Macumber pers. comm.; see also Macumber 2009: 18).
Figure 4.83: Extent of surviving archaeology at Al Marrouna

Figure 4.84: The site of Al Marrouna looking south
Al Jethay (QNG 217340 470482)

Approximately one kilometre inland from the coastal site of Al Marrouna is an area of earthworks and low buried walls, centred on QNG 217340 470482. This represents a second settlement, which would have presumably provided water and agricultural land to the coastal site of Al Marrouna. This pairing of coastal settlements and inland well sites is a pattern seen along the northern coastline of Qatar; for example the sites of Fuwairit and Zarqa directly to the north or Al Zubara and Murayr on the northwest coast. It is likely that the archaeological remains at al-Jethay are contemporary with Al Marrouna, and date broadly to the 17th to 19th century.

The site of Al Jethay was recorded from aerial imagery (Figure 4.85) as QNHER 10263; “a large area of former structures visible as earthworks, unknown date, with modern development occurring around and on top. Alignment appears to respect sabkha-former coastline.” However, the site appears to have been wrongly referred to as “Al Maroona” in the QNHER.

The structural remains cover an area of at least 200m by 150m. It is unclear from the brief examination of the site undertaken whether the remains represent domestic buildings, agricultural enclosures, or a combination of both. There is no immediate evidence of any defensive structures. While there is no evidence for backfilled in wells on the site the modern building constructed on the southern area of the remains has a functioning well. A large farm c.400m to the west also has access to water through wells.

As well as the ruined remains of the earlier occupation at Al Jethay, there are the standing remains of buildings, representing 20th century occupation (Figure 4.86). In addition there are modern structures on the site and to the west that are still in use.

Building and possible cemetery (QNG 218587 467351)

Between the sites of Al Marrouna and Al Huwailah is a large, gently curving bay, with a shallow reef extending some distance from the shoreline. Along this stretch of coastline two sites were identified, both consisting of the buried remains of what appear to be isolated structures.

Located approximately 450m inland, centred on QNG 218587 467351, a low mound measured 35.m across and survived to c.1.m high. Blocks of beach rock on top of the mound appear to be associated with a buried building. The mound and the area surrounding were covered with a relatively high concentration of pottery sherds. Many of the sherds were of 18th-19th century date; however, a sherd with fragments of turquoise glaze may suggest earlier activity.

In addition to these remains a second mound located c.100m to the east, centred on QNG 218686 467383, may represent a cemetery. The flat-topped mound measured 50m by 24m and c.1m high. Although poorly preserved, these deflated mounds of stone may have once been burial cairns. If this is a cemetery it suggests there may have been a larger settlement at this location at some point in the past.

Building (QNG 222382 465495)

Four kilometres to the east, at the other end of the bay, a second similar mound was centred on QNG 222382 465495. Located approximately 400m inland the mound measured c.20.m in diameter. Beach rock walls were visible on the surface, and the building was surrounded by a dense concentration of pottery sherds.

This site probably represents the remains of a building, with significant activity occurring in the immediate vicinity. The pottery suggests an occupation in the 18th-19th century. The function of the structure is unclear; although it is possible it was a watchtower, a small defensive structure, or merely a more mundane isolated domestic building
Figure 4.85: Satellite image of the structural remains at Al Jethay

Figure 4.86: Later structures at Al Jethay and earlier buried walls in the foreground
Al-Huwailah (QNG 224167 465677)

Historical background

In Major Colebrook’s Report on the Persian Gulf littoral of 10 September 1820 Al Huwailah is described as being “defended by a square Ghurry, containing good water, and is frequented by fishermen in the season. It was inhabited by a remnant of the once powerful tribe of Musellim (al-Musallam), now incorporated with the Utubis.” (Rahman 2005:3-4).

According to Brucks “Al Owahale (Huwallah) is a town…defended by a small square Ghuree, and is the principle place on the coast. It is inhabited by about four hundred and fifty of the Abookara tribe…It has few boats belonging to it, contains water, and has some supplies of cattle. The people are mostly employed as fishermen, or in coasting trade. This is one of the principle stations during the pearl fishery season” (Hughes Thomas 1985:560).

A century later a US navy survey of the coast of the Qatar peninsula reported on the same site. While the fort still stood to a considerable height, the site appears to have been abandoned. “Al Howeila (Huwallah), 6 miles northwest of Ras Laffan, is a small town, with a square fort some 30 feet high. Westward of the town is a small bay. The people were formally pearl fishers, but in 1887 the place was found deserted” (US Hydrographical Office 1920, 117).

Previous Archaeological Investigations

In 1973 Al-Huwailah was the subject of a two-day investigation by a team of archaeologists led by Beatrice de Cardi. The survey consisted of an aerial survey by helicopter, a brief walk-over of the site, and systematic pottery collections (Garlake 1978). The site was found to contain the stone-built foundations of “perhaps ten or twelve complexes, each consisting of four or five small separate rectangular rooms, grouped round compounds and not adjoining” (Garlake 1978, 173). A series of low earthworks formed a rectangle and “seems to reflect a rectilinear planning system, the buildings of which have now completely disappeared, or at least any remains of which are entirely covered in sand” (Garlake 1978, 173). These possible remnants of earlier occupation were covered by the town middens, measuring up to two meters high with “surfaces of wind-blown sand strewn with great numbers of potsherds and glistening from an abundance of oyster shells” (Garlake 1978, 173). The ceramics collected appeared to be “typical of an eighteenth-century trading centre of the Gulf” (Garlake 1978, 178).

In 1977 and 1978, the French Mission in Qatar conducted limited excavations at Al Huwailah, overseen by Claire Hardy-Guilbert and under the director Jacques Tixier. The excavations recorded a 32m by 32m rectangular fort with corner towers. The interior of the fort was comprised of a group of small rooms built adjacent to the exterior walls, with a central rectangular building. The walls were made of “quarry limestone and white coral stone or seastone, bound together with mortar” and “smearred with thick rosy-coloured plaster” while the floors were made of “lime-rich plaster” (Hardy-Guilbert 1980, 186). The pottery recovered from the excavation suggested a mid-19th century occupation at the fort. However, beneath the layers associated with the fort an ash layer contained glazed pottery that may have been of Iranian origin was found, thought to date to the 14th century.

Al Huwailah Today

Despite its position as the most important settlement in Qatar in the 18th century, and being the subject of two separate archaeological investigations, the location of the site of Al Huwailah had been forgotten over the last three decades. Although the site appears on numerous maps of the region, none are detailed enough to provide more than a generalised location. The QNHER has an entry for Lehwaila (10431) at QNG 221427 465904, however examination of this site showed it to be a modern structure.
De Cardi describes the location of the site as “an open and largely featureless stretch of shore on the north-east coast of Qatar. The coastline in this area, of which al-Huwailah is at the centre, faces due north, the only substantial part of the Qatar shoreline to do so. It is entirely unbroken, shallow shelving, sand beach unprotected by bays, headlands or fringing reefs …The visible remains of the town lie 400m. back from the shore on a bar or low ridge of sand that rises very slightly to a maximum height of 4m between the coast and extensive sabkha depressions running parallel to the coast and 2-3km behind it” (Garlake 1978: 180).

Early aerial photographs of the site (Garlake 1978: Plate XXIX; Hardy-Guilbert 1980: Fig.60) show the size of the site with well preserved buildings; however, they show no easily recognisable landmarks. These aerial photographs do show the coastal road curving inland to pass to the west of the fort at this point. Despite the construction of numerous new roads in this area over the last decade, the line of the old coastal road is still visible, and can be roughly aligned with these photographs. This location, at the very eastern end of the large bay described above, corresponds with more detailed map locations for the site.

From the descriptions of the location of the site, and the images described above the site of al Huwailah was successfully located at QNG 224167 465677. Sadly little of the site survives, having largely been destroyed by development over the past decade (Figure 4.87).

There is no longer any visible architecture remaining at Al Huwailah. The town and the fort were presumably destroyed by the construction of the large mosque and the mosque’s parking lot. The parking lot does not appear on the 2009 Google earth satellite imagery of the site, and this area appears to have been destroyed in the last two years. A pile of beach rock and pottery sherds to the west of the mosque attest to the destruction of this part of the site.

The western extent of the site has been heavily disturbed by mechanical excavators, and it seems unlikely any archaeological remains survive. A very large mound has been constructed on the eastern side of the site, which presumably has a military function (Figure 4.88). The construction of this feature has disturbed much of the site, and machine tracks radiating from the mound are clearly visible on the 2006 Google Earth satellite imagery of the area. In addition two small modern structures have been built on the southern edge of the site.

The central area of the site appears to be the least disturbed, and in this area the ground is covered with a dense scatter of 18th and 19th century pottery. A series of low mounds in this area of the site may be the earthworks recorded by Garlake (1978, 173). These earthworks were likely to be associated with an earlier phase of occupation, possibly the associated with the 14th century deposits recorded below the fort (Hardy-Guilbert 1980: 186).

**Ras Laffan**

Directly to the east of Al Huwailah, Ras Laffan industrial city covers an area of roughly 8.5 km by 12 km. Access to the site is restricted, and no survey was conducted in this area. The intensive development of this area implies that any archaeological remains are unlikely to have survived. No evidence of archaeological remains are visible on the satellite imagery from the area of Ras Laffan industrial city.
Figure 4.87: Extent of surviving archaeology at Huwailah

Figure 4.88: Al-Huwailah looking east
Conclusions and Recommendations

Several sites identified along the area of coastline between Fuwairit and Ras Laffan were examined, helping to build a more complete picture of the Qatar peninsula in the later Islamic period. All the sites identified have been adversely affected by recent development, or are imminently threatened with destruction.

Despite its historical and archaeological importance, Al Huwailah has been virtually destroyed over the last century, coming to near total obliteration in the last decade. Walls of the fort that stood almost 10m high in the early 20th century were reduced to a height of two meters by the 1970s and now are nearly invisible. Further rapid and unchecked development of the Qatari coastline may pose similar dangers for other sites in the area.

The sites of Al Marrouna, Al Jethay and Al Huwailah all require protection from further development. Any further development or construction on the sites should be halted. Land ownership needs to be ascertained to ensure the protection of these sites. Where appropriate the sites should be securely fenced and signposted. The isolated structures identified at QNG 218587 467351 and QNG 222382 465495 should also, at the very least, be clearly signposted as historic monuments.

At Al Huwailah an area of archaeological deposits measuring c.175m x 175m possibly survives in the centre of the site (see Figure 4.94). A detailed surface survey, including systematic pottery collection should be undertaken. Limited test pit excavation would allow the remains to be better evaluated. The aims of this work would be to assess the level of archaeological preservation, and the nature of the archaeological deposits present. It seems likely from the previous archaeological work undertaken on the site that it was occupied as early as the 14th century. If these early deposits survive they are of national significance, and would contribute greatly to the Islamic history of the region.

The sites of Al Jethay and Al Marrouna should both be surveyed in detail. A great deal of the site plan is visible on the surface, and much information could be gained in this manner. Limited surface collections of pottery would allow the more secure dating of these sites.
4.3.7 Survey and Rescue Excavations at Ruwais/Khasumah

Introduction

A program of archaeological assessment and excavation was conducted at the site of Khasumah near Ruwais in northern Qatar. The site consists of a series of substantial midden dumps, significant quantities of pottery as well as masonry walls. The site is threatened by the expansion of the town of Ruwais.

Three test pits were excavated through three separate midden dumps on the site. Additionally, two areas measuring c. 4.00m by 4.00m were scraped in an area where masonry could be seen on the surface. Finally, a brief walkover survey was conducted of the area to the south of the site. The test pits revealed a complex sequence of pottery-rich midden deposits, sealing earlier pits and wooden post-built structures. The area of the site that was scraped back revealed substantial walls belonging to a large building. This structure was built of roughly finished beach rock (faroush) and limestone blocks, with walls measuring up to 0.60m thick.

Directly inland of the site several deflated stone cairns were recorded and worked lithics were recovered.

Site Location

The site of Khasumah is located on the northern Qatar coast, approximately 0.5 km east of the present day town of Ruwais. The site measures at least 350m east - west and 100m north - south, running parallel to the present day coastline. The site consists of a series of substantial midden dumps, measuring up to 50m in diameter and surviving to 1.50m high. Significant quantities of pottery and masonry walls are visible on the surface.

The coastline consists of a sandy beach above a wave cut platform of beach rock. To the east a number of large fish traps are visible. A modern house and walled compound occupies the eastern end of the site. To the east of the walled compound a fence line encloses an area of undulating ground. To the southeast, approximately 300m from the site is a walled cemetery. The area to the south and to the west of the site is being developed as residential units; a series of concrete property markers across the site indicates that this development will engulf Khasūmah (Figure 4.89). To the south of the site an area of sabkha extends for c.800m, before rising several metres to a low stony raised beach, representing a relic early Holocene shoreline.

Research Background

Beatrice de Cardi visited Ruwais in the early 1970s and describes a site with masonry buildings and middens in the area of Ruwais/Khasumah. She believed the site to be occupied from at least the thirteenth century.

“About half a kilometre to the east of Ruwais the remains of buildings are grouped near the sandy beach together with a number of middens and ash-pits. Surface pottery included thirteenth-century wares, a fragment of celadon and glazed Persian wares of the eighteenth century. The site would appear to have been in occupation, possibly intermittently, at roughly the same periods as Yusufiyah [located 1 km to the west of Ruwais], i.e. the thirteenth to eighteenth century” (De Cardi 1978, 189).

Methodology

Three test pits were excavated, measuring 1.00m by 1.00m at their base. The pits were located along the length of the site, targeting three separate areas of midden dumping. In order to ensure safe working conditions, Trenches 2 and 3 measured 1.50m by 1.50m, as they
were excavated to a depth of 1.95 and 0.90m respectively. All trenches were excavated stratigraphically, using a single context recording system. The small excavation areas, combined with often homogenous midden deposits, meant the definition of separate contexts was at times difficult. In these instances contexts were set at 0.20m arbitrary intervals to provide stratigraphic control. A 50% sample of all deposits was dry sieved, with the remainder being hand sorted for finds. Thirty litre bulk flotation samples were taken from each deposit and charcoal samples were collected from the sections of the trenches.

An area of masonry was visible on the surface between Trenches 2 and 3. Here a 50mm-100mm layer of topsoil was removed to expose the underlying wall lines in plan. These were then planned, and tied into the Qatar National Grid (QNG), although no excavation was undertaken. A brief walkover survey of the area north of the site was conducted. Archaeological features and finds were identified and subsequently located using a handheld GPS and photographed.

Trench 1 (KHA01)

Natural sand (24), recorded at 2.08mOD, in Trench 1. Three small pits or postholes [20], [22] and [23] cut into natural sand (24). Extending beyond the limits of the trench in the NE corner cut [23] was not fully exposed, and measured 0.15m x 0.12m, with a depth of 0.08m. The fill (19) of the cut [23] was mid greyish brown, and possibly burnt (Figure 4.98). A C14 sample was taken from the fill matrix. Extending into the east-facing section of Trench 1 was a circular cut [22], measuring 0.71m N-S, and 0.21m E-W, with a depth of 0.12m. The fill (18) of cut [22] was again burned, and a C14 sample was collected. A third cut [20] extended into the southern section of the trench, measuring 0.38m N-S x 0.53m E-W, with a depth of 0.19m. As with the fill of the previous cuts, the fill (17) of cut [20] was burned, and a C14 sample was taken from the fill matrix.

Mid greyish brown silty sand (15) sealed these cut features, and contained burned stones, shells, fragments of glass bracelets, a coin, 18th century pottery, bone, glass, and metal. While the section contains a series of laminated deposits, these were difficult to ascertain in plan and the division between (15) and the previous locus (14) was hard to define. Grey brown midden deposit (14) contained similar finds and inclusions to (15). The boundary between the topsoil, locus (13) and underlying locus (14) was again
Trench 2 (KHA02)

The natural deposits, (27), in the base of Trench 2 consisted of yellow brown sandy silt, sealed by a thin 20-50mm thick layer of beach rock and rounded gravels, representing the remnants of a wave cut platform and associated beach deposits. The natural was cut by a sub-circular undercutting pit [26] (Figure 4.99), extending beyond the trench to the south and measuring 0.46m N-S and 0.52m E-W. The feature was not fully excavated, as the depth of the deposits made work unsafe. The mid brown silty sand fill (25) was excavated to a depth of 0.40m and contained a small amount of pottery and fishbone. A C14 sample was taken from fill (25).

Fill (25) was sealed by a laminated mid greyish brown midden deposits (21). Individual layers were hard to define in plan, but can be seen in section as the accumulation of many individual dumping events. This layer was sealed by similar midden layers, (16), (10), (9). These deposits varied slightly in colour, but contained similar find assemblages, including large unglazed pot sherds, frequent fish bone and burnt stone and occasional fragments of glass bracelet.

The upper layers of midden were considerably less sandy, containing more ash and dark brown silty material. The finds in the upper layers were less well preserved, with smaller pieces of pottery and bone present. Midden dumps (8) and (7) were the latest in the sequence recorded. Both deposits had animal burrows running through them. Deposit (7) was sealed by more compact ashy silty sand that contained frequent small, sub-angular gravels. This topsoil layer (6) was eroded, deflated and heavily intruded upon by animal and vehicular traffic.

Trench 3 (KHA03)

Mid yellowish grey natural beach sand (12) was recorded at a depth of 2.11mOD in Trench 3, corresponds roughly to the level of natural deposits found in Trenches 1 and 2. Overlaying this natural sand was a series of midden deposits. The first of these (11) was mid yellowish orange with fine lenses of mid brownish grey, and contained pottery and a fragment of a glass bracelet. This layer was sealed by mid yellowish grey midden (5), this deposit contained a small lens of burnt material, possibly a fire spot. This layer is sealed by further loose laminated ashy midden deposits (2), (3) and (4). All contained a similar assemblage of pottery and animal bone. The top soil (1) was again very disturbed by animal burrows and vehicle traffic.

Structural Remains

Two small areas were scraped back to expose part of a large masonry building. The area of the structure that was exposed measured over ten metre in length and 4.00m wide, although the building probably survives over a much larger area. The masonry was recorded as (29) and (30), and was sealed by 50-100mm of mixed mid grey brown topsoil (28).

The walls measured 0.50 to 0.60m thick and were constructed of a mixture of rough beach rock and limestone. The building was orientated east-west, running along the beach. The southeast corner was exposed, along with a row of small rooms along the southern extent of the structure, measuring c. 2.60m across. The building continued to the north and west, beyond the limits of the trench. It is likely that the building represents a large, walled residential compound. The midden deposits, similar to those excavated in Trench 1-3, appear to be deposited against the southern side of the structure and are probably contemporary with its occupation.

Possible cairns

Inland from the site c. 500m several heavily deflated stone cairns were recorded. A single cairn
was recorded at QNG 201317 486744 and a group of several smaller cairns were recorded at QNG 201111 486863. Built of unworked beach rock, the cairns measured 1.00-1.50m in diameter and survived to 0.10-0.20m high. These ephemeral features were poorly defined, and no artefacts or dating material was found in association with them. It is possible they represent burial cairns of a pre-Islamic date.

Lithic scatter:

To the south of the site the sabkha extends for c.800m, before rising several metres to a low stony rise, representing a relic early Holocene shoreline. A poor quality mid brown chert is present along this raised plateau in significant quantities. Several worked fragments of chert were identified, including two scrapers that were collected for further investigation. Both scrapers were retouched. The larger of the two scrapers has cortex present on one side.

Conclusions and Recommendations

The archaeological site of Ruwais/Khasuma is covered by extensive midden dumps, resulting from the disposal of domestic waste. A preliminary examination of pottery from the upper levels of Trench 3 identified creamy sandy wears, Julfar II painted pottery, Iranian Khunj wears, but almost no blue on white glazed pottery. Collectively the assemblage from the upper levels of midden in Trench 3 suggests a deposition date in the 18th - 19th century.

The site covers an area of c.400m², of which only 3.00m² has been excavated, representing a sample of 0.75% of the total site. In this small area earlier wooden post built structures and pits were identified in two of the three trenches excavated. At least one stone building was identified running parallel to the coastline, and it is likely that similar buried structures are present along the length of the site. The building was not excavated, and it is unclear whether it is of a contemporary date to the middens, or represents an earlier structure buried under the midden material.

It seems very likely that the site of Ruwais / Khasuma is the same location as the middens and buildings de Cardi identifies “about half a kilometre to the east of Ruwais” (1978, 189). De Cardi believed this site to be occupied, at least intermittently, from the thirteenth century onward. The structures on the site, the cemetery located to the southeast, and the substantial midden deposits, all indicate a relatively large and possibly long lived settlement. The presence of early, possibly prehistoric, archaeology directly inland of the site attests to the long human presence in this area.

The site is currently threatened with destruction as the area is being developed and incorporated into modern Ruwais. The site of Ruwais/Khasumah is clearly of significance and could represent one of the last surviving elements of Ruwais’ old historical fabric. Elsewhere in the Ruwais area this has been almost completely displaced by modern development. We recommend that the site is either protected, and current development plans adapted to reflect this, or alternatively fully excavated and recorded archaeologically prior to construction.
4.4 CONCLUSIONS

The diverse research carried out as part of the regional survey across northern Qatar produced a range of new insights into the historic landscape and rural archaeology of the region. It also created a detailed record of a number of key sites (Qal‘at Shuwayl, Ain Muhammed and Fuwairit) in northern Qatar that had hitherto only been preliminarily documented. Philip Macumber’s hydrological and geoarchaeological survey reinforced findings from previous seasons, documenting how closely related the availability of fresh water wells and rural settlements was.

An emerging theme is the relationship between numerous coastal sites that lack fresh water, and inland satellite settlements clustered around wells. Al Zubarah, with the hinterland sites of Qal‘at Murair, Qal‘at Shuwayl, Lisha and Helwan, certainly falls into this group, although this pattern is replicated at Freiha (Ain Mohammed), Fuwairit (Qal‘at Zarqa) and Jumayl (fort at the inland field system). These satellite sites, often associated with small fortified compounds or homesteads, provided a crucial resource infrastructure to these coastal settlements, protecting water sources, grazing areas for livestock and other agricultural activities (such as date plantation). The precise relationships between the coastal sites and these satellite communities, as well as the wider rural landscape, requires further, more detailed work, but the initial steps taken by QIAH as part of this season mark a decisive step forward in generating a better understanding of these relations and localities.
5. FINDS FROM THE 2010-2011 SEASON

The following report will give a brief summary of the bulk finds and samples and a more detailed description of some of the catalogued field objects.

5.1 THE BULK MATERIAL

Bulk finds are those that are recovered in large quantities during excavation and are bagged up by material and context to be studied by a relevant specialist. They include the following main material categories: ceramic sherds, animal bone, shell, glass, metal, bitumen and tabun. The glass finds include fragments from vessels, window glass and bracelets. The metal consists mostly of fittings such as nails, spikes, hinges, hooks etc.

The following are the total number of bags of each of these bulk materials recovered from Al Zubarah and Freiha. The quantities reflect the size of the two sites, with Al Zubarah being considerably larger than Freiha.

<table>
<thead>
<tr>
<th></th>
<th>Ceramic</th>
<th>Bone</th>
<th>Shell</th>
<th>Glass</th>
<th>Metal</th>
<th>Bitumen</th>
<th>Tannur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al Zubarah</td>
<td>702</td>
<td>576</td>
<td>61</td>
<td>167</td>
<td>296</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Freiha</td>
<td>273</td>
<td>150</td>
<td>92</td>
<td>45</td>
<td>55</td>
<td>54</td>
<td>2</td>
</tr>
</tbody>
</table>

The number of shells may seem to be rather low, given the coastal location of the sites, but it reflects to a large degree the recovery strategy. Small shells are found within much of the building material, both in wall and surface make-ups and so shells were only collected when a significant number were found together or if they were worked. The latter comprises mostly cowrie shells. This last season many oyster shells were found at Freiha which will hopefully prove to be evidence for the pearl diving industry. Bitumen was also collected when significant deposits were found, and the study of this material should prove fruitful as it occurs in many forms – coating the inside of and plugging holes in ceramic vessels, compact layers and lumps, and small rounded or bath-plug formed pieces.

The following table gives the individual bag total of bulk material by excavation area.

<table>
<thead>
<tr>
<th></th>
<th>Ceramic</th>
<th>Bone</th>
<th>Shell</th>
<th>Glass</th>
<th>Metal</th>
<th>Bitumen</th>
<th>Tannur</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZUEP01</td>
<td>251</td>
<td>215</td>
<td>21</td>
<td>37</td>
<td>90</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>ZUEP02</td>
<td>250</td>
<td>202</td>
<td>9</td>
<td>52</td>
<td>157</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>ZUEP04</td>
<td>162</td>
<td>117</td>
<td>17</td>
<td>21</td>
<td>19</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>ZUEP05</td>
<td>39</td>
<td>42</td>
<td>14</td>
<td>57</td>
<td>30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FREP01</td>
<td>85</td>
<td>29</td>
<td>12</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>FREP04</td>
<td>158</td>
<td>104</td>
<td>62</td>
<td>28</td>
<td>36</td>
<td>44</td>
<td>1</td>
</tr>
<tr>
<td>FREP05</td>
<td>24</td>
<td>12</td>
<td>11</td>
<td>5</td>
<td>8</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>FREP06</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
At Al Zubarah two brief observations can be made from the above figures: firstly the area ZUEP04 has noticeably less material than ZUEP01 and ZUEP02 despite being of similar size and likewise a domestic habitation. Further study and analysis of the finds will hopefully shed light on this, but one possibility is that ZUEP04 was cleared out before its abandonment whilst the other areas may have seen a gradual decline or a rapid desertion. ZUEP05 was expected to have less material being a small slot trench but given its size the area produced a high number of finds, a reflection of the nature of the deposit being one of the town’s middens. At Freiha the difference in find quantities again reflects the nature of the area being excavated. FREP01 as the town’s mosque is unlikely to produce as much material as the domestic building that is FREP04.

5.2 THE SAMPLES

The following are the number of soil samples taken within each area.

<table>
<thead>
<tr>
<th>ZUEP01</th>
<th>ZUEP02</th>
<th>ZUEP04</th>
<th>ZUEP05</th>
<th>FREP01</th>
<th>FREP04</th>
<th>FREP05</th>
<th>FREP06</th>
</tr>
</thead>
<tbody>
<tr>
<td>159</td>
<td>266</td>
<td>146</td>
<td>25</td>
<td>43</td>
<td>113</td>
<td>21</td>
<td>6</td>
</tr>
</tbody>
</table>

Once again the figures reflect the character of the excavation area. The notably high number from ZUEP02 is due to the large number of postholes in the open courtyard at different phases. A few other samples were taken where necessary, for example of building material such as mudbrick, carbon for dating purposes, charcoal for wood analysis and, from the midden ZUEP05, botanical samples and one sample of animal hair.

5.3 THE CATALOGUED FIELD OBJECTS

Field objects are finds that are considered important enough to separate out from any bulk category, for example coins, complete glass vessels, bracelets, stone tools and ceramic vessels. They are given an identification number in the field and their location is plotted. They are subsequently catalogued by the finds registrar.

A total of 575 objects were catalogued during the 2010/2011 field season. Of this number 13 are from Fuwairit, 128 from Freiha and 434 from Al Zubarah.

5.3.1 Material

The following 35 materials, listed alphabetically, are represented between the three sites:

- Amber, basalt, beach stone, bitumen, bone, carnelian, ceramic, coral, cork?, copper alloy, fabric, faience, flint/chert, glass, granite, haematite, iron, ivory, lead, limestone, pearl, plaster, plastic, quartz, quartzite, rope, rubber, sandstone, shell, silicified limestone, turquoise, unknown metal, unknown stone, styrofoam and wood.

Unsurprisingly, Al Zubarah has the most variety, with 31 types of material; Freiha has 22 whilst Fuwairit has just three. The four most common materials are copper alloy, glass, stone (of various types) and ceramic. Their totals are as follows: copper alloy – 300 objects, glass – 65, stone – 64, ceramic – 38. Of copper alloy about half are coins whilst the rest include fittings and attachments of various kinds, and jewellery. Glass objects mainly consist of bracelets, beads and vessels. The stone objects include hand-held tools, querns, weights, jewellery and building elements. The ceramic finds include vessels, shisha bowls, tobacco pipes, reused sherds and beads.

5.3.2 Object Type

The following object categories were recorded this season:

- Architectural elements: door-jamb, door-socket, door-spring, hinge-socket, window-jamb.
Commerces: coin.

Jewellery/Ornaments: bead, bezel, bracelet, button, earring, inlay, pendant, pin, pin/clasp, ring, toggle.

Metal Fittings: buckle, chain, disc, finial, fitting, hanging element, hinge, hook, nail, nail/tack, padlock, plate metal, ring link, rod, rosette, shaft, sheet metal, strip, wire/link.

Miscellaneous: small ball, bullet cartridge, game piece, pearl in a shell, plastic sheet, reused ceramic, rope, shot, spinning top, textile, worked bone, shell, coral and wood.

Smoking Utensils: shisha bowl, tobacco pipe.

Tools: blade, hammer-stone, knife, pestle, plumb bob, rotary hand quern, stopper, tweezers, weight.

Vessels: bottle, bowl, cup, jar, lamp, vessel.

The majority are found in quantities of less than 10. Those whose occurrence is greater include the following: weights x 17 of beach-stone, ceramic, copper alloy, granite, haematite, lead, limestone, plaster, sandstone and unknown stone; chains x 12 of iron and copper alloy; worked bone x 13; small balls x 18 of bitumen, ceramic, haematite, limestone; bracelets x 33 of copper alloy and glass; beads x 51 of amber, bone, carnelian, ceramic, coral, faience, glass, ivory, pearl, rubber, turquoise, unknown stone, and coins x 192 of copper alloy.

5.3.3 Specific Finds of Interest

Rotary Hand Querns

From Freiha in FREP04 seven rotary hand querns were recovered, including one intact upper grinding stone (cat. no. 69, locus 297). This quern is made of silicified limestone, a good choice for it contains many small shell inclusions which are self-sharpening to a degree as the surface is worn down.

Grinding face: diameter 36 cm, level to slightly concave, smooth, polished with visible striations. Upper face: diameter 32 cm, level, rough. Edge: thickness 5 – 6 cm, convex to oblique tapering into the upper face, rough. Central perforation: diameter 5.4 – 7.1 cm, wider at the grinding face to allow better dispersal of the substance being ground onto the grinding face. The surface is rough and has traces of iron colouring on the lower part, probably stains from an iron rynd. These are small perforated cross bars that fit into the perforation. The spindle that is fixed in the lower grinding stone passes through the rynd thus securing the upper stone during rotation. Vertical handle socket 3.1 x 2.3 cm that perforates the stone and is lined with bitumen, presumably used to fix the handle in place.

These querns are mainly used for grinding grain to produce flour, but can also be used to grind pulses to remove the shells. What is interesting is that some were found in a room that has a date press installation, raising the question of whether they were used in this process in some way. The future analysis of the environmental material from the soil samples plus research into the local agricultural system and possible importation of grain will enable a fuller understanding of their exact function.

Whilst some of the querns from FREP04 were just broken fragments, this complete upper stone appears to have been simply left when the building was abandoned and the occupants moved on elsewhere. A skeleton of a cat found in one corner, in the same locus (297), indicates that the room was no longer in use.
Diving Weights

Several diving weights have been found at Al Zubarah including a group of 14 from ZUEP02 last season and one from ZUEP01 (cat. no. 1026, locus 1735) this season. They are mostly sub-conical in shape, rounded/level on the base and top and with a lateral perforation through the upper body. Some have a distinct groove on the top. The dimension of the ZUEP01 example gives an indication of their size – length c.16 cm, width c.14 cm, thickness c.11 cm, perforation diameter c.3.5 cm. Weight 5231 grams. Most of these weights are made from haematite, a stone not local to Qatar. They are dark grey-black in colour with many small mica inclusions making them exceedingly eye-catching as they glitter and sparkle in water and sunlight. They are very heavy given their relatively small size and thereby perfect for their function. They would have been attached to the boat by a long rope which in turn would have been held by the pearl diver. A loop in the rope was made where the divers would place their feet before jumping into the water. The weight would then have carried them quickly to the required depth to look for the oyster shells.

The pearl diving industry is still within living memory and there are books with photographs and written accounts. In the souk in Doha one can find shops displaying diving weights, fishing nets, nose clips and even the tools used for weighing and trading the pearls. To find these weights in situ within a context of use adds a new dimension to this aspect of Qatar’s history. Further research will hopefully shed light on the source of the haematite, and on their manufacture. Other questions might be answered through ethnographic work with people who still remember the pearl divers – for example, were the weights personal possessions?

Worked Ivory

Two decorated objects of worked ivory are intriguing though their function is as yet not known; they may have been used in textile production or are possibly ornaments. One (cat. no. 523 locus 1428) from ZUEP01 is incomplete but this season a second intact example was found in FREP04 (cat. no. 146, locus 426). Both are roughly cylindrical in shape with a central vertical perforation and a second lateral perforation in one side. Both have incised decoration of rings around the circumference and small circles with central dots. The dimensions of the intact Freiha example are as follows: Height c.3.6 cm, diameter maximum c.3.7 cm, minimum c.3.1 cm, perforations – vertical, diameter maximum c.0.8 cm, minimum c.0.5 cm, lateral, diameter c.0.7 cm, weight 42 grams. The side perforation is drilled at an angle from the right and has distinct wear marks on its right edge. In addition there are patches of indented cross hatches on the upper part of the body. These various patterns are indicative of a possible textile function, as a whorl or bobbin perhaps, where something has been passed through the lateral hole repetitively and wound around the top of the object. A worked, broken shaft of mother of pearl was found protruding from the central vertical hole, length c.3.5 cm, width c.0.7 cm. It is this item, if broken off in situ that may indicate an ornamental use, as a hair or clothes pin for example.
6. **THE 2010-2011 SEASON: SUMMARY AND CONCLUSION**

6.1 **INTRODUCTION**

The 2010-2011 archaeological fieldwork season of the QIAH carried out a wide ranging and successful program of investigations across northern Qatar over the course of its five month season. These various fieldwork endeavours have provided a wealth of new data and insight into the Islamic heritage of northern Qatar, which will be briefly summarised here.

An emergent theme in dealing with the archaeology of northern Qatar is the increasing pressure posed by development and construction work across the region. Qatar’s fast paced development of national infra-structure, as well as a rapid rise in construction of housing areas, poses a challenge to efforts in mitigating their impact on the historic environment. Hence, QIAH carried out rescue excavations at one site this season, while expanding its program of archaeological survey to monitor existing and emergent threats to archaeological sites and historic buildings and places.

At the same time, the project continued its intensive program of research into the settlement of Al Zubarah and Freiha. The work here has begun to provide us with an ever more vivid picture of daily life, economy and trade in these early modern, historical sites. They provide unique perspectives on the life on Qatar’s northwest coast during from the 17th to the early 20th centuries.

6.2 **EXCAVATIONS AND SURVEYS IN AL ZUBARAH**

Following on from our initial 2009 survey of Al Zubarah, work was carried out this season to complete the plan of the settlement, including the extant previous excavation areas from the 1980s and 2000s. A newly discovered small settlement within the area of the Al Zubarah Archaeological Site perimeter fence was also fully mapped, as was an enclosure to the south of the southern screening wall. This work now provides us with a complete and up-to-date plan of the Al Zubarah Archaeological Site.

Excavations in ZUEP01 succeeded in fully excavating ‘Compound 2’, a courtyard house situated to the north of ‘Compound 1’. This building displayed a complex series of alterations and development, as parts of the house fell out of use, walls were realigned and an open yard established to the west. This shrunk Compound 2 to a much smaller size. The alleyway to the north of Compound 2 is similar in width and overall appearance to the east-west running alley between Compounds 1 and 2 in ZUEP01. These formed an integral part of a distinct, secluded neighbourhood. A building at the northern edge of ZUEP01, north of the alleyway, was at one point dismantled and a more temporary occupation established. These consisted of postholes, occupation floors and clay-lined hearths. Significant archaeological deposits were noted in the walls of pits and when the courtyard of Compound 2 was half-sectioned. These clearly belong to Phase 6 of the occupation of Al Zubarah. They appear to be more substantial than previously observed and warrant further excavations in ZUEP01 as part of the 2010-2011 season to better determine their function, date and distribution.

Excavations in ZUEP02 are at an intermediate stage at this point. It is fair to say that the excavations here are probably the most complex and time-consuming in the entire excavation area of Al Zubarah. This is because of the large area that was opened to fully expose structures in plan, the number of features and deposits encountered within the area, and the fact that ZUPE02 preserves evidence for the entire Al Zubarah sequence (Phases 6-1). Nevertheless, excavations have made significant progress during this season. The northern extension linking ZUEP02 with the former souk excavation area will in the next season allow us to tie in these two disparate elements and understand the development of the souk area holistically. Almost all of the Phase 3 architecture, and most of the Phase 4 archaeological features, have been dealt with and it is expected that a wider exposure of Phase 5 architecture across this excavation point can be achieved during the next season.
Work in ZUEP04 made significant progress over the course of the last season and achieved important results. Following on from the excavations in a small part of the fortified palatial compound in 2010, this year’s excavations exposed an entire courtyard area and adjacent rooms within Al Zubarah’s largest single building. Excavations of the courtyard area and individual rooms reinforced the impression gained from last year’s excavations that this building did not have a primarily militaristic or defensive function. The discovery of a madbasa (date press), hammams, a storage room, and a food preparation or kitchen area, showed that rooms in the building fulfilled some of the same functions as those found in the courtyard houses in ZUEP01. A staggered, blind entrance which provided access from alleys into the courtyard, which was found in this year’s excavations, furthermore shows that privacy was a concern for the inhabitants. This indicates the overall rather domestic character of this complex of rooms and courtyards. The palatial compound shares many features with similar buildings throughout urban sites in the Gulf. Its palatial character is nevertheless evident in the size, shape and positioning within the town. The palatial compound is the largest single building within Al Zubarah. Its towers and perimeter wall make as much a statement about status and importance of the occupants, as they are defensive. The building appears to have been constructed in tandem with the outer town wall and reinforced the defense of the town at this particular point. Nevertheless, on the inside it housed people who likely belonged to a large extended family group or clan, who very probably played an important role in the administration of Al Zubarah’s affairs and trade.

Excavations in ZUEP05 targeted one of the extra-mural middens of Al Zubarah. This is the second midden yet excavated in Al Zubarah – the first being located between the palatial compound and the outer town wall in ZUEP04 (excavated in early 2010). Excavations here documented the full depth of the stratigraphy of this midden and retrieved copious samples of ceramics, fauna, botanics and other items that will – once analysed – provide crucial insights into the diet, culture, economy and trade connections of Al Zubarah’s inhabitants. A small segment of the outer town wall was also revealed in the excavations, providing a further glimpse of its original construction techniques.

A recurrent question in the excavations at Al Zubarah has been to establish the age of the main settlement at Al Zubarah. Written sources have long suggested that the primary settlement was founded during the 1760s, but there is ambiguity whether this expanded a previously existing settlement or whether the major phase of occupation was stamped out of the ground from nothing. Ephemeral evidence for a pre-Phase 5 occupation in the form of post-holes and clay-ovens was found in both ZUEP01 and ZUEP04, but has so far not amounted to any substantial image of the pre-Phase 5 occupation. ZUEP06 was put in place to attempt to gain additional data on these earlier phases. Excavations in this area of high ground, however, proved somewhat inconclusive. Although evidence for dumping of production waste and multiple pits relating to possible industrial processes (such as bitumen processing) were documented, natural deposits were encountered relatively close to the modern ground surface. This appears to suggest that prior to settlement the Al Zubarah area was dominated by an undulating landscape consisting of bedrock and sand dunes. Further work with the material culture recovered from ZUEP06 is necessary to gain a better understanding of the time-depth documented in this excavation area.

Overall then, the phasing scheme suggested in QIAH’s previous End of Season report 2009-2010 (Richter and Walmsley 2011), has been confirmed by the excavations in 2010-2011. ZUEP01 and ZUEP02 are the only two areas which preserve the entire sequence, while other areas (ZUEP04 and ZUEP05) appear to preserve evidence for only some parts of this sequence (i.e. the earlier part). While excavations as part of this season have confirmed this phasing, we are still some way from understanding both the chronology and sub-division in more detail. Excavations in
ZUEP01 and ZUEP02 in particular have shown that these phases are coarse grained divisions. Each phase, in particular Phases 5 and 3, preserve multiple sub-phases that incorporate construction of architecture, occupation, refurbishment, re-occupation and abandonment.

**Excavations in Freiha**

The 2010-2011 season saw the first full five-month excavation at Freiha, building on the promising initial results from the 2009-2010 survey and small scale excavations. Work was concentrated on the supposedly later, central part of the settlement to the west and north west of the fort at Freiha. Here, the remains of a large mosque and an area containing the remains vernacular buildings were excavated.

The mosque underwent multiple phases of rebuilding and restructuring, interspersed with apparent abandonment and partial collapse. Presence of a minbar adjacent to the mihrab at one point during the sequence of mosque development highlights the similarities of this building with many other extant mosques in Qatar (for examples see al-Kholaifi 2006). Although the mosque was restructured and expanded it remained located at the same spot over the course of the occupation. This suggests that this area remained the focus of settlement for some time and that the restructuring and rebuilding of the mosque reflects the changing economic and social fortunes of the community at large.

Excavations in the central zone of the settlement in FREP04 revealed the remains of several linked courtyard houses of different size. In their simplest form they consist of a single room with an added perimeter courtyard wall. In general terms, they are smaller than the Al Zubarah courtyard houses and contain fewer rooms, probably reflecting fewer economic means. The excavations in FREP04 have revealed a multi-faceted sequence of construction, which begs further exploration in the forthcoming fieldwork season. We stand to learn a great deal from exploring the settlement’s core, so as to gain a complete stratigraphic sequence of the occupation.

One emergent theme from the work in Freiha is the cyclical nature of the occupation at the site. Episodes of construction and occupation are interspersed with abandonment, partial decay of buildings and reoccupation. This highlights the at times transitory nature of settlement at Freiha, perhaps fitting in first with the emergence of Al Zubarah as a major site and likely focal point in the landscape, followed by Al Zubarah’s partial abandonment and the reoccupation of Freiha. This forms part of an emergent, incredibly interesting story of the local settlement sequence.

6.3 **Surveys and Rescue Excavations in the Al Zubarah Hinterland**

The QIAH team carried out extensive survey work as part of the 2010-2011 field season, which included both field walking surveys, as well as topographic and mapping surveys. In addition, QIAH staff engaged in rescue archaeological work at the settlement of Khasuma near Al Ruwais.

Topographic mapping at archaeological sites – including Al Zubarah – is creating a lasting and detailed record of regional settlements. In addition to completing the town plan of Al Zubarah, key sites in the surrounding landscape were also mapped, including Qal’at Shuwayl, Ain Mohammed and sites near Ruwais. The largest topographic mapping work, however, was undertaken at Fuwairit, a major settlement on the east coast. Here, the entire settlement was surveyed generating a detailed topographic map of the site.

Fuwairit is an important site on the east coast of northern Qatar, occupying a narrow sand strip that is situated in a narrow, shallow bay. The survey of the site has shown that the layout of a complete 19th century village is preserved here. Individual buildings, alleys, at least one large compound and a mosque were identified from the detailed topographic data generated by the survey. This provides a detailed and thorough characterisation of the archaeological remains at the site, which now requires urgent attention to protect it from being damaged. Trackways pass the site nearby and vehicle traffic on the site is not uncommon. Fuwairit beach, situated to the
east of the site, is a popular weekend picnic and swimming spot, and the popularity of this beach is contributing to the further damage of the site by vehicle traffic.

Situated c. 1.5 km west inland from Fuwairit lies a small fort accompanied by some outbuildings, a mosque and a well. The small settlement of Az Zerqa appears to have functioned similarly to Ain Mohammad and Qal‘at Shuweyl did to Freiha and Al Zubarah: as a small fortified site protecting crucial fresh water sources. Similarly to Freiha and Al Zubarah (and Ruwaidah for that matter) fresh water is not available immediately at Fuwairit. Sources inland provide the only reliable supply of fresh water and therefore required protection. This pattern of a paired appearance of coastal village sites with inland, fortified satellite settlements is therefore characteristic of the northern Qatar peninsula settlement pattern during the 18th to 19th century.

Topographic surveys at Qal‘at Shuwayl and Ain Mohammad near Al Zubarah confirm this pattern. Both sites have small forts associated with wells, in addition to small settlements. The Shuwayl settlement appears to be smaller and somewhat more dispersed, whereas the Ain Mohammad settlement appears to be more concentrated around the two small forts. Recent road works and bulldozing in the area has truncated parts of this quite large site, which also contains evidence of more recent occupations in the form of breeze block buildings.

A field walking survey along the coastline between Fuwairit and Ras Laffan Industrial City was also carried out this season. This work aimed to characterise the occupation of this zone to gain an initial understanding of this particular region. This brief survey located a number of sites, some of which had hitherto not been recognised. The settlement of Al Marrouna, in particular, has to be highlighted. It is a today almost buried site, which has been heavily impacted and truncated by domestic compounds. This likely 18th - 19th century site requires some urgent attention, as it is reasonable to assume that it may soon be completely lost. The same survey also attempted to relocate the important site of Al Huwailah, once a prominent settlement on the east coast of Qatar. Sadly, the archaeological fieldwork confirmed that this settlement has been almost entirely lost due to modern development. The location of the fort and settlement of Al Huwailah are barren ground on the surface, although it cannot be completely excluded that there may be some sub-surface preservation of archaeology. Further investigations – perhaps using geophysical techniques – may be required to verify the presence of sub-surface archaeology here.

Lastly, the project carried out rescue excavations at one site to the immediate east of the modern settlement of Al Ruwais. Survey in the area had indicated the presence of four distinct midden mounds in a group along the shoreline here. Since this area is earmarked for development rescue excavations were carried out at this site to gain an insight into the character and chronology of settlement. The two excavated test units did not only produce some significant samples of material culture, fauna and other finds, but also produced evidence for at least one building buried beneath midden deposits. This site is therefore of some interest and importance and further work may well be required here.

Surveys and small scale excavations across northern Qatar are providing us with an ever better understanding of the settlement pattern and relationship between the environment and human land use. Macumber’s important geomorphological and hydrological research reinforced again the idea that well locations and their exploitability and reliability governed the settlement pattern during the medieval and post-medieval periods in northern Qatar. Further mapping of key sites and more extensive field walking in northern Qatar will provide us with an ever more detailed understanding of the region’s archaeology and heritage.
7. **BIBLIOGRAPHY**


    Hunting 1980 Qatar geological Map. Geology and Geophysics Ltd


Qatar Islamic Archaeology and Heritage Project

End of Season Report

2011-2012
1. **INTRODUCTION TO THE END OF SEASON REPORT, 2011-2012**

*Stephen McPhillips*

1.1 **QATAR ISLAMIC ARCHAEOLOGY AND HERITAGE PROJECT IN 2011-2012**

The Qatar Islamic Archaeology and Heritage Project (QIAH) was launched in 2008 at the initiative of their Excellencies Sheikha Al Mayassa Bint Hamad Bin Khalifa Al Thani, Chairperson of the Board of Trustees of the Qatar Museums Authority, and Sheikh Hassan Bin Mohammad Bin Ali Al Thani, Vice-Chairperson of the Board of Trustees of the Qatar Museum Authority (QMA). The project is run in collaboration between the QMA and the Institute for Cross-Cultural and Regional Studies at the University of Copenhagen. This collaborative project is under the co-direction of Professor Alan Walmsley (Archaeology), Professor Ingolf Theusen (Conservation and Heritage Management), Professor Morten Meldgaard (Environment) and Professor Jørgen Bæk Simensen (History). This report presents the results of archaeological excavations and survey in northern Qatar by QIAH in the 2011-2012 season (October 2011 to March 2012).

![Map of northern Qatar showing the QIAH archaeological sites and survey area](image)

Figure 1.1: Map of northern Qatar showing the QIAH archaeological sites and survey area
Figure 1.2: Plan of Zubarah showing QMA and ZUEP excavation areas
1.6 FINDS AND CONSERVATION (SECTION 6)

In an archaeological operation as wide-ranging as QIAH, the effective management of finds and data are critical. An introduction to the principal activities undertaken by the finds team is presented here, along with a short exposé on finds conservation work undertaken by the specialist team working at the Al Zubarah Research Station. This work has played a primary role in informing the National Museum of Qatar’s planned exhibitions which are scheduled to contain a significant component relating to Al Zubarah and the other archaeological sites investigated by QIAH.

1.7 ARCHIVAL MATERIAL RELATED TO LATER ISLAMIC AL ZUBARAH (SECTION 7)

Alongside archaeology, the investigation of historical sources is of major importance in building up a detailed picture of the past of northern Qatar. In this section, Hanne Nymann provides an overview of the major documentary source materials and archival collections available providing access to the Later Islamic history of Al Zubarah.

1.8 SPECIALIST REPORTS (APPENDICES)

A range of specialists have contributed their expertise to the QIAH project. Appended to this End of Season report are two reports dealing more closely with specific analyses carried out by members of the QIAH team in 2011-2012. These are Dr. Philip Macumber’s study of the impact of environmental disparity on human occupation in the Qatar peninsula, and Dr. Lisa Yeoman’s analysis of marine faunal material from the excavations at Al Zubarah. A list of further publications and reports is included.

Figure 1.3: Fish mandible from Lisa Yeomans’ typological series
2. **EXCAVATIONS IN AL ZUBARAH**

2.1 **AL ZUBARAH EXCAVATION POINT 1 (ZUEP01)**

*Lisa Yeomans*

2.1.1 Introduction

Excavations in ZUEP01 during the 2011-2012 season focused on providing a large exposure of the Phase 6 occupation with the intention of highlighting the density of features from this phase. To expose an area of the Phase 6 archaeology, whilst leaving complete Phase 5 courtyard houses for future display, this season’s work was limited to the area of Compound 4 and the area to the north (Figure 2.1). The excavation area was extended to the northwest, thereby fully revealing the partially exposed Space 188. The full excavation of the southern part of Compound 4 south revealed an extensive number of Phase 6 features resulting from repeated occupation. These include large rubbish pits, tannurs, hearths and postholes, with many of the features intercutting one another. The density was such that it was impossible to excavate all of the features and priority was given to pits rich in cultural material, intercutting sequences providing stratigraphic dating and features where C14 samples could be taken.

![Diagram of Compound 4 and Compound 2](image-url)

*Figure 2.1: Extent of area covered by 2011-2012 season (bounded by red line)*
Figure 2.2: Phase 6 features showing burnt postholes, postholes, pits, tannurs and hearths

Figure 2.3: Stacked pots found in ZUEP01
Figure 2.4: ZUEP01 - Phase 5, Compound 3
Figure 2.5: Illustration of cooking pot from Locus 7574 (Pot Ref 55)

Figure 2.6: Hearth surrounded by post holes in ZUEP01
Figure 2.7: Doorway leading to Space 187

Figure 2.8: Postholes interpreted as temporary support posts
Figure 2.9: Miniature ivory pot with lid (Locus 7540, Cat.1114)

Figure 2.10: Plaster lined drain and latrine in central courtyard of ZUEP01
Phase 5 Compound 4 A: Change in layout of domestic unit

In this phase the layout of the courtyard house was modified slightly, with Space 192 extended to the north and the room divided into two by a narrow partition wall. There were no associated changes within Space 188: this room continues to function as a latrine until the abandonment of the house. In Space 199 a spread of ceramic sherds lying on the surface probably represent a complete vessel left at the abandonment of the building, and subsequently broken by the collapse of the architecture.

Phase 5 Space 189/190 B: Occupation

Most of the deposits from this phase were excavated in 2010/2011. Based on the levels of the street deposits excavated last season and those from the extension of the trench to the west, two deposits have been assigned to this phase. Both layers were laminated sequences of occupation debris and laid deposits.

Phase 5 Space 189/190 A: Occupation

Further laminated street layers were assigned to this phase. At the western end of the exposed street the surface was truncated by a drain. This was lined with beach stones with sandy silt and areas of gypsum plaster used as mortar. The drain was capped with two flat stones covered and sealed with gypsum plaster. This plaster was also applied to wall and moulded into a recess in the wall to form a channel leading into the drain (Figure 2.11).
2.2 Al Zubarah Excavation Point 2 (ZUEP02)

Michael House

2.2.1 Introduction

Al Zubarah Excavation Point 2 (ZUEP02) is located inside the inner town wall, slightly to the north of centre overlooking the beach, 50m southeast of the QMA excavations of the area identified as a suq. Last season’s work saw a link, the Northern Extension, inserted between the suq excavations and the main open area excavations in ZUEP02. Excavations over the previous two seasons had identified a Phase 3 domestic compound similar in its piecemeal development to the compound in the main excavation area to the south. A continuation of the Phase 5 suq to the north (Figure 1.2) is currently being uncovered. The Phase 3 suq appears to have been smaller, reflecting the economic downturn directly related to the settlement shrinkage to the inner town wall identified in excavations at ZUEP01 (Figure 2.12).

Within the main excavation area to the west, the goal this season was to remove the remaining Phase 3 material and understand the complicated development of this large domestic compound, based mainly on the two distinct sub-phases of the central courtyard development. In the east

Figure 2.12: ZUEP02 Phase 5 Suq (North to right of image)
rooms (madbasas), each formed of two separate spaces and one containing the ridged plastered pressing channels divided by a low plastered wall from a smaller catchment room with a small pit designed to house a ceramic vessel to catch the syrup drained from the adjacent space (Figure 2.15).

The presence of these three large madbasas demonstrate that the function of the compound appears to be related to storage and production, rather than being a domestic compound, and likely has a direct link to the khan or suq located further to the north (QMA1). This is reinforced by the presence of several large storage vessels found as in situ abandonment deposits on the surfaces several of several spaces during all excavation seasons.

Located between two of these date processing rooms was a room of equal dimensions, the beaten earth floor/surface in a mix of sand and ash giving it a mid grey hue. Above this at the centre of the room was a combination of matting and matting impression formed in the vitrified (cemented) orange material (also found in other spaces in the excavation area). The matting covered an area 2.30m x 2.00m located roughly at the centre of the space, and the herringbone weave is clearly visible in the preserved remains (Figure 2.16).
Figure 2.15: ZUEP02 Madbassa and detail of catchment pit

Figure 2.16: Remains of matting in ZUEP02
Construction of the main compound occurs radially around the central courtyard. Access within the compound was restricted, with all of these spaces only accessible from the courtyard once access had been gained through the main western entrance hall (Space 59 - Figure 2.17). Later construction in the compound came in the form of two square additional wings abutting the extant western wall. The southern wing consisted of three spaces, a layout mirrored in the northern wing, however later still the northern wing was extended further to the west with at least two more spaces added and as yet unexcavated (see Figure 2.13).

In the Northern Extension

The removal of all of the Phase 3 architecture and some of the intermediate Phase 4 deposits has allowed a glimpse of the Phase 5 layout. At least 15 rooms/spaces are identifiable, laid out in two parallel north-south aligned groups, all or most appearing to have the hard grey plaster on the walls indicative of the Phase 5 architecture. The rooms include at least two ablation rooms, small cell-like structures separated from the main room with thin plastered screen walls. At present the full plan is not completely exposed (Figure 2.13).

Phase 5c - Post Occupation Abandonment and Demolition

This phase was represented by a series of large deposits filling the rooms and spaces discussed above (Phase 5a and Phase 5b). These deposits vary slightly: some are reminiscent of slow periods of degradation and decay whilst others seem more in keeping with systematic demolition and infilling, and not all the spaces have the same depositional sequence even between adjacent rooms. Most of the sequences end with a deposit of windblown sands filling the hollows formed at the centre of the rooms and spaces created by the demolition/collapse process. Several of the rooms contained articulated adult cat skeletons as in situ abandonment deposits on the floors or surfaces, most likely indicative of that space’s abandonment prior to collapse.

Figure 2.17: Entrance hall (Sp. 59) with ceramic spread and detail of preserved bitumen door frame
2.2.3 Phase 4 - Open Area Spaces 51 & 65

An intermediate phase, Phase 4, is constituted by a large open area with little or no stone architecture, but with a great deal of activity. Cut into the shell and sand surfaces were many tannurs, fire pits, post and driven stake holes. This is most likely indicative of temporary seasonal camps between the major architectural phases. The plan shows the distribution of features, which are present in numerous sub-phases (Figure 2.18).

Western Excavation Area

The earliest excavated deposit in the western area this season was the upper portion of aeolian sands filling the hollow between in the large eastern Phase 5 compound and the newly discovered phase 5 beach front structure in the Western Area (discussed above). The sand covered a substantial area (27.50m north-south x 12m E-W x 0.05 – 0.10m thick) but was mainly located above a space believed to be a north-south aligned street. The deposit links in with the eastern excavation area via rubble and plaster deposit which partly covered the sands. Dug into the sand were a series of cut features, mainly fire installations related to cooking, a couple of postholes and some irregular pitting likely associated with robbing of the phase 5 stone.

Figure 2.18: ZUEP02 Phase 4
Both sub-phases can be linked to external activity to the southeast, and both courtyards were the focus of domestic activity in the form of tannurs and their associated charcoal pits, postholes and larger stone lined pits cut for storage (Figure 2.23).

Northern extension

This has very complex stratigraphy owing to the very fluid nature of the Phase 3 development. New rooms and spaces were constructed that often encroached and changed the form of existing spaces, in particular the open courtyard (Space 42). Like the Phase 3 structures in the main excavation area, the structures in the Northern Extension developed in a piece-meal or ad hoc fashion unlike the formal structured layout seen in the Phase 5 architecture.

The Phase 3 buildings are still aligned roughly north-south, but with less regularity to their forms, and several are more on a NNE-SSW axis. The walls are constructed predominantly with angular beach stone and beach stone conglomerate, with occasional more exotic stone like dolomite and gypsum particularly around possible entrances and in thresholds.

All eight of the spaces and or rooms identified form a single complex enclosed with boundary walls forming a courtyard Space 42. The western limit of the compound falls within the excavation area, however the eastern limit is unknown as the rooms and walls continue to extend beyond the limit of excavation, some below the current location of the spoil heap.

The compound development is best viewed via the development and changes made in and around the form of the central courtyard Space 42, which includes and is linked to the construction of several new rooms - as such it has been divided into five development sub-phases (a-e).
Figure 2.20: Plan of ZUEP02 Phase 3

2.2.5 Conclusions and Recommendation

Future work should focus on the continued exposure and excavation of the soft deposits above the Phase 5 architecture, particularly in the courtyard storage compound where only three to four spaces remain unexcavated, and to gain a better understanding of the newly exposed Phase 5 structure in the Western Area.

In the Northern Extension the goal is to excavate of any Phase 4 material and removal of the fills within the exposed Phase 5 architecture in order to gain a better understanding of the suq, hopefully with some in situ floor deposits, and understand the link between the suq and the two southern storage compounds.
As noted earlier in this report, the nearby area of ZUEP01 has provided us with an extensive densely packed occupation Phase 6 comprised of a myriad of cut features not dissimilar to Phase 4 in ZUEP02 area. However a Phase 6 equivalent has not yet been seen within the ZUEP02 area and it would be of interest to see if it is represented here and if it has a similar density to that seen in ZUEP01 to the east. This could be done with some targeted trenches within the open spaces, the courtyards and streets providing a stratigraphic view of the depth of surfaces in these spaces as well as looking for earlier phase material culture, providing us with a more complete view of the site development.
2.3 Zubarah Excavation Point 4 (ZUEP04)

Tom Collie

2.3.1 Introduction

Excavation Point 4 (ZUEP04) is located at the southern end of Al Zubarah (see Figure 1.2). It focuses on a large compound enclosing rooms and courtyards supported by parameter walls with corner towers. This compound was divided into nine separate areas circumnavigated by streets and passageways (Figure 2.24).

Excavation work in season 2011/12 was extensive, and investigated the majority of the extant archaeology within the south western most compound section (hereafter named Precinct-Section 8, or PS8). It proved that the section was domestic accommodation for a family unit living in Zubarah during its earliest stages of development (see Figure 2.25). Work in season 2011/12 aimed therefore to continue this investigation and centred on three main objectives.

The first objective was to examine remaining deposits and architecture within the central courtyard area and unexcavated Space 3010. The second focused on an area to the north of PS8. The possibility of a northern corridor with an associated entrance to the outside compound area was highlighted from work in season 2010/11. With an extension of the site as a whole directly to the north, excavation therein would link interior deposits and dating evidence to

Figure 2.24: ZUEP04 - Plan showing precincts
those from the exterior. It would also illuminate methods of communication between compound sections and confirm whether they were linked internally. The third and last objective focused on the exterior area around the tower. Excavation of the south western exterior area would not only reveal the true extent of tower <4012> but also recover vast quantities of material dating evidence from the remaining midden deposits heaped against the architecture.

2.3.2 Objective 1

Space 3010
This small space contained layers of shell and silt forming surface layers that had been in constant use during the compound’s occupancy. Most deposits within this room spread north into the south-eastern area of the central courtyard. Whether this was a result of visitations to the ablution Space 3013 or the far southeastern Space 3011 is unknown. Certainly, Space 3010 was a transitional area between the exterior and the interior areas beyond. It is also similar to Space 3004 which shared a similar sequence of shell and occupation spilling out into the central courtyard. These rooms therefore could be classed as transitional spaces, neither exclusively interior nor exterior.

Figure 2.26: ZUEP04 - Drain not corresponding to the compound’s original construction
Space 3012

The excavation of Space 3012 was limited to an area focused outside both the southern and eastern wings of the compound (see Figure 2.25). This area stretched approximately 5m from the central courtyard walls and was strategically placed to facilitate the conservation process. Since only the southern and eastern ends of the courtyard were excavated, not all deposits observed and recorded from season 2010/2011 were examined and were therefore left for investigation in future seasons. Deposits within the courtyard were organised into five main sequences, each one representing a main courtyard surface which had been truncated by features such as post holes, soak-aways, simple pits and plastered drains. The presence of these sequences strengthened the idea that the compound was in constant use and underwent modification. This development not only extended to the cleaning of the shell surfaces and their subsequent replacement but also to the improvement of thresholds to Spaces 3002, 3014 and 3015. These sequences strengthened the idea that the ablution block was a later addition to PS8. The excavation of middle to later courtyard sequences demonstrated the existence of a cut that housed a drain not corresponding to the compound’s original construction (see Figure 2.26).

Space 3016

In Space 3016, further investigation indicated that the ground surface consisted of compact silt containing small tabular beach stone and weathered beach stone fragments (locus 4664). Excavation clearly displayed that the plaster door-post sockets at the doorway to Space 3016 were built on top of this deposit. It showed that the doorway was itself restored and reconstructed - the beach stone fragments present in the floor surface may have originated from this rebuild. Investigation of the threshold to Space 3016 revealed an earlier feature below the horizontal threshold (see Figure 2.25 and Figure 2.27). It is clear from this evidence that the threshold

![Figure 2.27: ZUEP04 - Earlier feature below the threshold](image-url)
Figure 2.28: ZUEP04 - View of northern area of excavation

Figure 2.29: ZUEP04 - Architectural feature <4813>
Figure 2.30: ZUEP04 - Excavation outside the compound and around tower <4012>

Figure 2.31: ZUEP04 - traces of temporary external structures
Figure 2.32: ZUEP04 -Buttressing of outer city wall
2.4 Al Zubarah Excavation Point 10 (ZUEP10)

Daniel Wheeler

2.4.1 Introduction

The principal aims for ZUEP10 were to:

- establish the depth of the Al Zubarah outer city wall, determine its construction method and remove all deposits later than its initial phase, allowing for continued preservation
- ascertain whether the small gateway within the wall to the north of Tower 8 was contemporary with its construction or added during earlier preservation work on the tower during the 1980s
- gain an idea of the function of the area around tower 8 and determine a rough dating spectrum based on the established Al Zubarah phasing

ZUEP10 revealed an unexpectedly dense sequence of archaeological deposits representing continued activity in this area throughout the main phases of Al Zubarah’s occupation and subsequent abandonment (see Figures 2.33 and 2.34). The earliest activity, represented by a number of postholes, pits and patchy surfaces, seems to be directly associated with the construction of the main city wall, with little or no evidence of any prior occupation. Once the wall was in place, the immediate vicinity appears to have been used mainly as a thoroughfare with trampled surfaces forming across the area. Soon after, the construction of a banquette walkway on the inner side of the city wall, turning the higher part of the wall into a defendable

Figure 2.33: ZUEP10 - Post-excavation plan
parapet which could be patrolled, and if necessary, fired from, seems to mark a transition in the area. This refortification, probably coinciding with increased tribal tensions around the turn of the 19th century begins, a period of increased activity and potentially semi-permanent occupation in the area. A number of laid surfaces cut by postholes suggest the possibility of barasti-style dwellings built against the lower wall complete with a nearby tannur installation set into the wall itself, and other evidence of cooking and domestic activity. Hereafter, this type of occupation becomes more sporadic and probably represents the period after the sacking of the city by forces from Muscat in 1811 and the town’s subsequent contraction behind the smaller, inner wall. Even after this shift, the presence of tannurs, small working surfaces and large concentrations of finds indicate that there was still activity in this area, suggesting that the outer wall and Tower 8 were still used sporadically as a lookout post and shelter. Eventually, as the town falls towards full abandonment, only a few opportunistic fire pits and hearths underlie the inevitable mix of collapsed wall and wind-blown sand. Cut into this wall tumble to the north of Tower 8, and filled with modern material, is an access-way attributable to the reconstruction team of the 1980s who clearly installed the small gateway in the wall to allow themselves easier entry to the inside of the city and the western side of the tower.
Figure 2.35: ZUEP10 - Postholes and quarry pits associated with the tower and wall

Figure 2.36: ZUEP10 - Banquette acting as a walkway against outer parapet wall
Figure 2.37: ZUEP10 - Tannur installation against banquette wall

Figure 2.38: ZUEP10 - Stakeholes supporting temporary structures
Figure 3.1: Freiha excavation points
Figure 3.2: Phase 6 Post built structures

Figure 3.3: FREP04 - Phase 4
Figure 3.4: FREP04 - Pisé remains of Space 32 during planning, facing northwest

Figure 3.5: FREP04 - Mud-brick footing, facing west
Figure 3.6: FREPO4 - Charcoal pit and tannurs

Figure 3.7: FREPO4 - Arrangement of anhydrite mortar pits in the southern area

Figure 3.8: FREPO4 - Plan of Phase 2
3.2.6 Phase 2: Stone-built structures I

Two rectangular rooms (Space 7 and Space 14), around which all subsequent occupation was based, were constructed in this phase (Figure 3.8). Space 7, contained a madbasa whilst Space 14 contained a plastered basin. A temporary structure was built to the west of Space 14 before the construction of a large courtyard to the south the rectangular room. A third stone-built room (Space 26), located to the north of Space 14, contained domestic activity in the form of fire pits, tannurs and lime-mortar making pits (Figure 3.9). Small cellular rooms, constructed from anhydrite rock walls, were uncovered to the west of the trench whilst a fourth stone-built wall was located to the far east. Although fire pits and tannurs were present in this phase they were considerably less prolific than had been the case in the previous phase. A large pit located to the north east may have been used to heat anhydrite and limestone to make mortar for bonding the stone walls of this phase (Figure 3.10).

Figure 3.9: FREP04 - Space 26, facing west
Figure 3.10: FREP04 - Large pit for making lime-mortar

Figure 3.11: FREP04 - Phase 1.1 and 1.2 architecture
3.2.7 Phase 1: Stone-built structures II

Phase 1.4 (Figure 3.11)

Several walls were constructed in this period, adding new rooms (Space 20, Space 15, Space 28) to the courtyard space south of Space 7 as well to the north of Space 14. Whilst these rooms did not contain many features, extensive external activity was taking place to the south and the north-east where multiple tannurs, fire pits, basins and occupation horizons were uncovered. To the north-east of the trench, four zones of domestic activity could be identified from the location of these features whilst postholes located between them may be indicative of animal pens. It is notable that domestic activity, probably in tents, was taking place away from the stone structures.

Phase 1.3

The courtyard of Space 7 was formalised into a trapezoidal space by the construction of stone walls to the south and east. These walls added several rooms (Space 13, Space 25, Space 81) to the complex and left entrances from the east and the south. The southern entrance appears to have been an area where midden material was dumped during this period. Space 28 is likely to have gone out of use and may have been deconstructed by this time. A substantial mud-brick and stone-built wall footing was constructed to the south east of the excavated area. This wall formed a rectangular room (Space 23) aligned NNW-SSE that was distinctly different in orientation and construction method from any of the others uncovered (Figure 3.12). It

Figure 3.12: FREP04 - Mud-brick footing, Space 23, facing west
Figure 3.13: FREP04 - Phase 1.3 and 1.4 architecture

Figure 3.14: FREP04 - Phase 1.3 courtyard, facing west
3.4 DISCUSSION

Evidence of the remains of settlement, in the form of house platforms, at the southern extent of Freiha suggests that the first period of occupation was more extensive than previously thought. This new area of settlement centres the domestic building activity in the area of the mosque and fort, suggesting that the latest occupation had shrunk back to a central core. The buildings encountered in FREP04 Phase 3 were similar in construction to those uncovered in FREP03 to the east, whilst those of FREP04 Phase 5 were similar to those found in FREP05 to the north. These comparisons along with the ceramic and radio carbon dating recovered from excavation and field walking will lead to a much closer chronology for the growth and abandonment of the settlement. The excavations in FREP04 have continued to uncovered a complex and dense occupation sequence. This began with post-built structures, followed by pisé and mud-brick permanent dwellings which were replaced, after a structural hiatus, by stone structures. The most extensive activity was most commonly found in external areas with internal spaces only containing a few features. This pattern may imply that the rooms tended to be used for storage or sleeping but not domestic activity.
4. EXCAVATIONS IN FUWAIRIT

4.1 FUWAIRIT EXCAVATION POINTS 1-20 (FUEP01-20)

Daniel Wheeler

4.1.1 Introduction
Excavations in Fuwairit during early 2012 were focused on recording archaeology revealed by a series of small interventions along the western edge of the main settlement (Figure 4.1). The primary objectives were to:

- Characterise the large building on the western edge of Fuwairit that appeared likely to be a town mosque.
- Provide a stratigraphic sequence through one of the large middens that flank the western side of the town and gather an assemblage of material culture for analysis and dating.
- Compare this assemblage of finds with those from others deflated middens in the area.
- Ascertaining if there is any evidence for a town wall running along the western edge of Fuwairit that has subsequently been buried beneath these middens.
- Investigate the large blank areas to the north-west of Fuwairit to establish if there is any archaeology present.

Figure 4.1: FUEP - Location of excavation points within Fuwairit
Figure 4.2: FUEP17 - Plan

Figure 4.3: FUEP16, 17 and 18 - mihrab extending from qibla wall
Figure 4.4: FUEP19 - Circular structure built atop midden

Figure 4.5: FUEP19 - Section through midden
everyday detritus. Each deposit was very rich in finds and material culture with an extremely large percentage of fish bone and shell. The main objective was to gather as much of this for later analysis as possible. Therefore, each context was sieved in its entirety through a 4mm mesh and a large unsieved sample was taken for flotation. A smaller sequence of samples through each individual lens within the northern extent was also taken for chemical analysis (Figure 4.5).
Figure 4.7: FUEP09 - Wall remnant
4.1.4 Deflated middens (FUEP01-09, FUEP20)
Investigations to the south of the mosque revealed a series of deposits spread from the line of deflated middens that flank the western edge of Fuwairit. These were typical midden dumps rich in everyday material culture. This arrangement of middens may mark the town boundary, being placed upon the outer wall of the settlement. A ridge seen in the south-west of the town, seemingly heads towards the mosque before disappearing in this area. Potential walls seen in FUEP07 and FUEP09 may be part of this boundary, the upper extents having been later robbed away (Figure 4.7).

4.1.5 North-western area (FUEP10-15)
From the surface, the area to the north-west of Fuwairit appears to be blank, with no evidence of any extant architecture. Investigations here proved however that there is a plethora of features cut into the natural beach sand indicating substantial activity. A number of pits with sterile fills is perhaps to be expected but the presence of postholes, fire-pits and a clay lined tannur perhaps suggest occupation in this area, on at least a short-term basis (Figure 4.8).
5. **REGIONAL SURVEY**

5.1 **GEODESIC SURVEY OF SITES IN THE AL ZUBARAH BUFFER ZONE**

*David Mackie*

![Map of sites surveyed in the hinterland of Al Zubarah in 2011-2012](image)

Figure 5.1: Sites surveyed in the hinterland of Al Zubarah in 2011-2012

5.1.1 **Introduction**

During the 2011-2012 season the mapping team has continued to undertake topographic surveys of sites within the hinterland of Al Zubarah. This season surveys were completed at Ain Mohammad, Musaikah, Helwan and Muhayriqat (Figure 5.1).

5.1.2 **Methodology**

The survey methodology remained the same as last season with regard to the surveying of features. Since wall lines are not always clearly defined on collapsed structures, the bottom of slope or collapse and the top of slope are surveyed. Where wall lines survive the wall face is surveyed, if the wall line is partially visible in plan and the centre line of the wall is surveyed. These lines with additional spot heights help if contouring is required at a later date while providing a realistic impression of the feature. Conjectured wall lines can be added post survey if required. This system allows both topographic, archaeological and other features to be surveyed.

Permanent survey control points were established on each of the sites with Qatar National Grid
Figure 5.2: Ain Mohammad (QNHER 10192)
(QNG) coordinates using a differential GPS. The surveys were carried out using a total station and differential GPS.

5.1.3 Ain Mohammad, QNHER 10192 (QNG 183897E/472065N)

The site is situated c.4km north-east of Al Zubarah town and is characterised by twenty scattered relatively recent derelict buildings and a demolished mosque, with two walled cemeteries situated to the northeast of the site (Figure 5.2). Among these buildings are at least two earlier ruined compounds, one still has upstanding walls and the internal layout is clearly defined with rooms arranged along the north and east sides of the compound. Another room is located on the western wall and there is a round tower on the south-west corner. To the north-east are the remnants of another compound, all that now remains is a small ruined building on the south-west corner and traces of the compound walls can be seen in the ground.

An aerial photograph from 1958 shows this compound with other internal buildings and at least three other structures to the north but these have since been demolished when the later present buildings were built. This western compound appears to be in a ruined state in 1958 (Figure 5.3).

![Figure 5.3: Western compound at Ain Mohammad](image-url)
Figure 5.4: Ain Mohammad - walled enclosure constructed on the rawdah with a central well, concrete cistern and troughs

Figure 5.5: Ain Mohammad - ruined heavily deflated stone-walled compound
settlement is aligned south-west to north-east and may have extended further to the north-east but has been truncated by the construction of the access road and by an easement running parallel to the existing Al Shamal road.

5.1.4 Musaikah

Three sites are situated c.7km south-east of Al Zubarah outside the boundary of the present farm at Musaikah (Figure 1.6). Although the interior of the farm has been intensively cultivated the remains of the Early Modern fort and some footings still survive on the eastern edge.

Musaikah A, QIAH 40 309, (QNG 187882.343E/467237.027N)

This site is situated on the south side of the present farm and is comprised of a linear group of ruined buildings constructed on platforms with associated compounds or courtyards along the south side, with another two on the northern side. The buildings are square and rectangular in shape some of which are further divided into two rooms. Although in a ruined state the platforms and rubble from the buildings still survive to a considerable height. Due to the collapsed rubble the walls are not always discernible; however, some of the wall alignments and platform edges suggest that there may be more than one phase to the site. The site is aligned south-west

Figure 5.7: Musaikah A
Figure 5.8: Plan of Musaikah B
north-west and may have once extended further north-east but has been truncated by the farm boundary wall. The site has a later cemetery (QIAH 40 310) located on the northern side (Figure 5.7).

*Musaikah B, QIAH 40 200, QNHER 10378, (QNG 188786.624E/467349.509N)*

The site lies on the western side of the present farm and consists of a linear group of four buildings, constructed on platforms aligned south-west to north-east. The two central buildings have one large room with two smaller rooms and share a compound or courtyard on the northern side, while the north-eastern building has an additional small courtyard on its south-east side. There are other small ancillary buildings, walls and four raised areas that look like natural features but some appear to have been levelled. To the north are the ruined remnants of an enclosure wall around an area of rawdah with a number of temporary camps positions (Figure 5.8). Beatrice de Cardi does not mention this site in her description of Musaikah and it is not known if this is contemporary with or later in date to the other sites.

*Musaikah C, QIAH 40 120, (QNG 188203.475E/467889.914N)*

The site is situated on the northern side of the farm boundary wall and is comprised of a linear group of 20 or more small structures aligned south-west to north east. Some are little more than raised platforms while others have fragments of wall and platform edges visible, but in general it is very hard to discern walls alignments within the rubble. The buildings are either square or

Figure 5.9: Plan of Musaikah C
Figure 5.10: Plan of Helwan
rectangular in shape, some being further subdivided into two rooms. Unlike Musaikah A there are no large enclosures although some of the structures appear to have a small associated courtyard. Among the buildings are a couple of very weathered middens. The site may have extended further to the south-west but has been truncated by the farm boundary wall (Figure 5.9).

5.1.5 Helwan, QNHER 3 (QNG 184578.350E/466078.276N)

The site is situated on the higher ground north-east of a large irregular area of rawdah, covers an area of 140m² and includes a number of ruined stone buildings and middens. Unlike the sites at Musaikah A and the ruined settlement at Ain Mohammad, where the buildings form a line with a courtyard on one side, at Helwan the buildings are concentrated and are comprised of a series of rooms surrounding a central courtyard. Parts of the site have been mechanically graded so that large areas are covered with levelled material obscuring the layout. Although obscured the larger compound on the south-west side may be a fort and other courtyard buildings can be inferred. There are two cemeteries, a walled one located to the south-west of the site with the other situated to the south of the site. Material from the middens is very similar to that from Al

Figure 5.11: Plan of Helwan and associated rawdah
Figure 5.12: Plan of Muhayriqat
5.2 REGIONAL SURVEY

Daniel Eddisford

5.2.1 Introduction

An archaeological survey of northern Qatar was conducted between November 2011 and March 2012. The survey area consisted of the northern tip of the country, north of the major highways linking the site of Al Zubarah to Ras Laffan (Figure 5.13).

The regional survey project aimed to record the historic environment of northern Qatar throughout its human occupation. The goals of the project were to build a better understanding of the history of the region; to create a robust dataset that could be used as the basis for further investigations; and finally to enable the better informed protection and preservation of the historic landscape by the QMA.

The survey recorded 363 sites within the survey area, although a significant proportion of these are modern features and disturbances. The data collected was entered into a specifically designed GIS database. Several possible prehistoric find spots were identified. A number of rock carving were recorded on coastal aeolianite outcrops, although the date of these carvings is unclear. A relatively large number of sites consist of distinctive linear arrangements of small rectangular

Figure 5.13: Area of the 2011-12 season survey
structures, all with an east-west or northeast-southwest alignment. The layout, architecture and surface finds at these sites all have clear similarities with the site of Murwab which is dated to the Early Islamic period (Guérin, and al-Naïmi 2009; Guérin and al-Naïmi 2010). Extensive evidence of later Islamic occupation was recorded, ranging roughly from the 16th century to the 19th century. A variety of different site types were identified including settlements, fortified structures, cemeteries, field systems, enclosures, wells and more ephemeral remains associated with nomadic Bedouin occupation in the area.

### 5.2.2 Methodology

**Phase 1: Ground truthing sites**

The initial phase of the regional survey consisted of ground-truthing possible sites identified from several sources. The main source of potential sites was the QNHER, a database of sites based on extensive examination of satellite and aerial photographic imagery (Breeze et al. 2011). Other potential sites that were ground-truthed include sites identified by previous archaeological surveys of the area (Kapel 1967, de Cardi 1978, Inizan 1978, Macumber 2011, Eddisford and Morgan 2011), as well as more informal observations made by team members.

A key aim of the survey was to cover a large area quickly, identifying and recording as many archaeological sites as possible. The level of recording undertaken reflected this goal; the aim being to locate each site in the landscape, briefly describe and document it, assess its age, and evaluate the potential of the site and the degree to which it is threatened. The minimum data
collected for each site consisted of a record of the site name; site location (QNG coordinates); site type; a site description and sketch plan; a provisional date for the site; the condition of the site; a risk assessment of the site; the geology, ground cover and land use of the area; at least one photo of the site. In addition surface artefacts were collected to assist in the dating of the sites identified.

Phase 2: Systematic field walking

A second phase of work consisted of a programme of systematic fieldwalking, intended to test the validity of the site distribution and range of site types that had been established. Six areas were targeted for more intensive survey (Figure 5.14). The fieldwalking methodology consisted of the systematic fieldwalking of one kilometre long transects, aligned to the Qatar National Grid. Each transect measured 100m wide and was walked by two team members. Each transect was sub-divided into ten segments, each 100m long, and the surface finds from each subdivision were collected separately.

5.2.3 Results

Prehistory

A limited amount of evidence of possible prehistoric activity was identified within the study area. Evidence of possible prehistoric activity consisted entirely of isolated surface finds of struck flint, with no evidence of structures of habitation identified. The raw material used for all the artefacts collected consist of a brown chert, which is found in some quantity on the surface at a number of locations within the survey area. The site of Helwan, although heavily disturbed by later Islamic occupation and modern irrigation, produced a number of struck stone artefacts, including a scraper with clear retouched edges (Figure 3, top left). Similar waste flakes and retouched flakes of brown low quality chert were recovered from Jabal Freiha.

Figure 5.15: Struck flint from Helwan (QNHER 3)
Figure 5.16: Distribution of early settlements and structures

Figure 5.17: Settlement QIAH40-276
Struck lithic flakes were occasional found along the coast close to the 3m contour, which represents a raised Neolithic shoreline. Some of these find spots represent sites identified by the French survey of the area in the late 1970s (Inizan 1978). These finds are mostly waste flakes, however a small lithic assemblage collected near Ruwais during the 2010-2011 season, site QIAH40-435, includes retouched scrapers.

*Early settlements and structures*

The regional survey identified a number of distinctive linear arrangements of small rectangular structures, all with an east-west or northeast-southwest alignment (Figure 5.16). In addition several isolated structures were identified that are also probably of a contemporary date.

The sites of Musaikah and al Nehayy were identified by an archaeological survey undertaken between 2005-2006 (Guérin and al-Na’imi 2009). Guérin identifies a number of structures at these sites, and notes that “the ceramics collected on the surface...provide samples similar to those of Abbasid [9th century CE] Murwab” (2009: 182). Three separate elements to the settlement of Musaikah were recorded by our more recent survey, Musaikah C, Musaikah A and Musaikah C. These correspond to the northern and southern element of the site described by Guérin and al-Na’imi (2009: 182) as well as a large, and apparently previously unknown, courtyard structure directly to the east of the present day farm (See Fig. 5.14). At al Nehayy a large rectangular multi-celled structure, QIAH40-144, potentially represents a khan. Two groups of smaller structures, QIAH40-153 and QIAH40-156, are probably domestic dwellings.

At least four northeast-southwest aligned rows of structures, QIAH40-194, QIAH40-276, QIAH40-277 and QIAH40-286 were recorded close to the site of Al Zubarah (Figures 5.17 and 5.18). These rows of buildings appear to be contemporary, and consist mainly small single cell structures.

*Figure 5.18: Aerial image of QIAH40-194*
Figure 5.19: Fuwairit, QIAH40-231, from the air

Figure 5.20: Umm Al Qubur
Figure 5.21: Walls of field system QIAH40-414

Figure 5.22: Walls of field system QIAH40-414
Field systems

Several field systems were identified, these varied in size but all consisted of units defined by low poorly preserved walls and associated wells. An extensive Field system at Umm Jassim, QIAH40-225, consists of a large number of fields and associated wells. A similar field system, QIAH40-414, at Muhayriqat consisted of a number of large rectangular fields, defined by ruined limestone walls (Figure 5.22).

Fortified sites

Fortified sites were often associated with wells, and are likely to have been used in part to protect water sources and associated agriculture. The sites of Qal’at Thaqab (QIAH40-143) and Qal’at Rakayat (QIAH40-219) have both been heavily restored relatively recently. The forts at Zarqa (QIAH40-438) on the northeast coast and Yusufiyah (QIAH40-167) on the northwest survive as ruins. The square fort at Qal’at Shwall (QIAH40-198) is associated with settlement QIAH40-196 and wells QIAH40-197. Most of the fort is constructed of limestone, however the larger northwest tower includes a heavily eroded mudbrick element; this tower survives to a height of 1.50m (Figure 5.23, refer to 2010-11 report for details).
Figure 5.24: Mud-brick tower near Makin

Figure 5.25: Possible animal enclosures QIAH40-105
Figure 5.26: Rock carving on Jebel Fuwairit

Figure 5.27: Circular structures QIAH40-383
Figure 5.28: Decorated ceramics from QIAH40-158 and QIAH40-309

Figure 5.29: Figure 17 sherds from QIAH40-434
6.1.3 Selection of objects for the National Museum of Qatar

The National Museum of Qatar requested an initial selection of objects for potential display in the new museum. This became one of the key priorities of the season. Objects were selected not simply for their aesthetic, visual impact but according to various display themes that could be used to tell different stories. By the end of the season 156 objects had been chosen from the different sites covering the topics of architecture, household, industry, diet, food storage, fresh water, commerce, trade, pearling, fishing, personal items, decorated objects and children. The majority were conserved, catalogued, drawn and photographed. A few still require full conservation and these will be the first priority in the following season. In October 2012 a further 46 objects were selected, including worked stone (anchors, diving weights), decorative architectural elements, large size ceramics and a collection of stone tools. In total, 202 objects have now been designated for the new National Museum of Qatar.

6.1.4 Conservation

Four conservators worked on three priority areas: Freiha coins, objects selected for the National Museum of Qatar, and beads. The latter was a specific project undertaken by Dr. Franca Cole, a specialist in this area, who conserved and catalogued 156 beads, including the natural pearl bead from Freiha, FREP04, Locus 1017, catalogue number 240, (Figure 6.1). It is an interesting example as it has bands of calcareous material resulting from discontinuous growth. These have been incorporated into the shaping of the bead however so that they form almost a decorative feature. This season also saw the full conservation of the pearl merchant’s box from Zubarah.

Another interesting object listed for the National Museum of Qatar is a copper alloy Jeton (counter) from Al Zubarah. It has a small perforation that obscures some of the markings, but careful conservation has revealed a sun, seven stars, crescent moon and the letters E. L. S. LAUER and RECHE R/N_FEN on the reverse and on the obverse a ship with the letters PLUS UL_ and I.L.S.L. Research so far indicates that the Lauer family were the last makers of jetons in Nuremberg, Bavaria, in the late 18th - early 19th century. Our jeton bears the initials of Ernst Ludwig Sigmund Lauer whilst the other word on the reverse is probably ‘Rechenpfen(ning)’ being German for jeton and on the obverse Plus Ul(tra) is probably the family motto (The Fitzwilliam Museum in Cambridge (UK) has a number of jetons in its collection that offer close parallels. Museum Accession Numbers: CM.2469-2003, CM.2471-2003, CM.2472-2003, CM.2473-2003. http://www.fitzmuseum.cam.ac.uk).

Figure 6.1: Pearl Bead FREP04, Locus 1017, Catalogue Number 240
Figure 6.2: Pearl Merchant’s chest

Figure 6.3: Copper alloy Jeton, ZUEP01 Locus 1116 number 323, L. Reverse R. Obverse
6.2 Preserving the Past - Challenges in Conservation

Anna Tjellidén and Marianne Schwartz (Moesgård Museum, Denmark)

6.2.1 Introduction

The 2011-2012 season saw a team of international conservators from Denmark, Greece and the United Kingdom working at the Al Zubarah Research Station and in the laboratory of the Qatar Museum of Islamic Art. Many different materials were taken care of, including objects in ceramic, ivory, bone, various metals, glass, stone and wood. All treatments were tailored to the needs of the individual object but there was frequently a need to minimize deterioration caused by salts in the soil due to the location near the sea. When salts crystallize within an object, cracks occur and, in the worst case, the entire surface detaches. A high proportion of artifacts needed desalination in order to slowly wash the salts out. If great care was not taken, the artifact would risk falling apart, owing to the only thing holding it together being the salt itself. An integral part of the conservation work this season included the packaging and storage of objects, both treated and untreated, in order to provide a stable storage environment.

6.2.2 Conservation Treatments

Ceramics

The surface of many decorated sherds were in danger of fragmentation and disintegration because of salts. In order to maintain the fragmented, glazed surface it was necessary to brush clean it dry, lacquer the surface and then desalinate it in distilled water. Subsequently a second lacquering/impregnation was introduced to hold the fragile ceramic together (Figure 6.4).

Figure 6.4: The deteriorated surface of manganese painted, alkaline glazed ware. Patterns are visible when introducing it to water or lacquer.
Ivory

The following is a summary of the delicate conservation treatment needed for a fragmented object of worked ivory suffering from extensive salt activity.

Surface salt crystals are removed mechanically, using a scalpel and bamboo skewer. Loose crystals are brushed away. The surface is swabbed with ethanol to remove loose, powdery deposits, before air-drying. Re-deposition of surface salt became visible after three days so it was decided desalination would be needed if item was to survive intact, as the flaky area of the base was determined to be held together by salts only. This was bound in place by adhering strips of blotting paper to solid areas of the base using HMG Paraloid B-72 adhesive, and covering the flaky surface with multiple strands of human hair (Figure 6.5).

Figure 6.5: Consolidation of ivory object FREP04/426, Catalogue No. 146
Internal armature was produced to prevent internal surface loss while desalinating, while allowing salt migration. Object cavity was lined with cling-film, then a cage structure of blotting paper strips was adhered inside the space using HMG Paraloid B-72 from a tube. This was allowed to harden, then was removed, and the cling-film cut away from the spaces. The armature was repositioned inside the cavity.

The remainder of the artefact was bound first with human hair, then corners and fragile areas were padded with blotting paper and the whole was bound together using bias-cut nylon netting strips knotted into position. This gave lightweight, solvent and water permeable compression to all surfaces of the artefact, while enabling free solvent and water movement. The object was next immersed in 96% ethanol for one hour, then distilled water was added in a combination of 85% ethanol and 15% water.

10% total volume of the solution discarded and 10% distilled water added three times daily for three days. The item was subsequently transferred to distilled water, removed, blotted with tissue to remove excess water, then immersed in 50:50 ethanol: water. After three hours, it was removed, blotted with tissues to remove excess solution, then immersed in 96% ethanol. Ethanol dewatering repeated three times daily for two days. The item was then moved to 50:50 acetone:ethanol solution for six hours then removed, blotted, and placed in pure acetone. Acetone washes were repeated three times. Item then transferred to 5% solution of paraloid B-72 in acetone. After twelve hours, 40% Paraloid-B-72 added to the original solution to produce a 10% solution. Left for twelve hours. Removed, dried in an acetone vapour environment for twelve hours, then left to dry in air for twelve hours. Surface wrappings are removed. The surface was swabbed with acetone to remove excess consolidant and re-deposited sediment, before being reconsolidated with 3% solution of Paraloid B-72 applied with a soft brush. This is then air dried. Fragments are adhered with Paraloid-B-72 (Object following conservation, Figure 6.6).

Figure 6.6: Ivory object after conservation, Catalogue No. 146, OD-6937
Figure 6.7: Working shot: coin prior to conservation

Figure 6.8: Working shot: bronze object prior to conservation

Figure 6.9: Lacquering the metals under vacuum
**Metal**

As bronzes are highly sensitive to salts in combination with fluctuating humidity, the surface of many objects was highly corroded (Figure 6.7 and Figure 6.8). The conservation of objects such as coins, jewelry and tools included mechanical cleaning under microscope using scalpel and ultrasonic dental chisel. Then lacquering with *Incro lacquer* was necessary in order to prevent the artefact from further corroding (Figure 6.9).

**Composite objects in wood, metal and organic materials**

A conservation project of high priority was the pearl merchant’s box carried out at the Museum of Islamic Art. After cleaning the wooden surface with its bronze decorative elements and remains of red dyed textile using brushes and tools, it was crucial to stabilize the box by slowly impregnating it with consolidant (Figure 6.10, and after conservation: Figure 6.2). For a detailed report on conservation of this object, see document QIAH-0101F002 “The Pearl Merchant’s Chest. Conservation report”, by K. Tsatsouli.

**Packaging and Storage**

The correct packing and storage is essential for object preservation. This season textile fragments were packed with the RP System with an oxygen scavenger and an oxygen eye in each Escall bag. Organics and fragile objects were packed with acid free tissue paper in boxes. Metals were stored with silica gel and humidity indicator cards and some were vacuum-packed. These step are necessary in order to prevent the excavated and untreated objects from deteriorating in the aggressive climate of Qatar. The conservators of following seasons will continue the professional care and knowledge necessary to preserve the past of Al Zubarah for future generations.
which occupation of Qatar occurred. The 7,000 year old Shagra site where a small fisherman's hut was excavated in the 1980s, fits into this pattern.

Figure 1 Locality map for selected towns across Qatar

1 Introduction - Potable water is the one essential requirement for settlement

Central to any holistic archaeological study is the relationship between occupation and the natural environment – why people live where they do. This is especially the case in Qatar where low rainfall coupled with low relief results in the absence of fresh surface water. The only natural water source is from groundwater occurring in the Tertiary marine limestone
Qatar between Fuwayrit and Al Zubarah (Figure 1), and, along the north western coast line, a zone of shallow wells (Figure 3) is distinguished by Lloyd et al., (1981).

Figure 2 Distribution of agriculture (from Dastane and Al-Faihani, 1980) and bore localities (Eccleston et al., 1981)

Figure 3 Northern Qatar with the zone of shallow wells and tritium content of groundwater (from Lloyd et al., 1981)
As occurs throughout much of the Gulf region, the major aquifers are located in lower to mid Tertiary marine sequences. These are principally the Umm er Rhaduma limestone and the overlying Rus limestone and anhydrites. The Dammam Formation forms the surface across much of Qatar (Figure 4).
Measurements made over the winter and spring periods in 1976 and 1977 show the development of recharge mounds developing both seasonally over spring, and after discrete storms (rainfall shown in the inserts at the top of graphs). The levels shown in Figure 6 represent water table height above sea level, showing more general rises of 3-4 m, and 3-4m after single events in the case of Rawdat Al Faras, which had only partially declined two weeks later. Superimposition of discrete rainfall events during wetter seasons may create significant temporal mounds beneath the rawdah. Such rises are capable of producing groundwater outcrop (surface water) wherever water tables are initially close to the surface. This may occur even with deeper groundwater tables in response to superimposed or prolonged rainfall events. It is considered that similar rises play a part in the development of the playette patterns seen across northern Qatar, with channels formed by water out-seeping from the sides of depressions (Figure 8). The presence of water at the surface in such instances is therefore not simply a ponding effect of rainfall and runoff, but is also a reflection of the rapid response of the water table to wet events. The rate of decline of the
Figure 9 Flooding of the rawdah in the vicinity of Umm al-Qubur (photos courtesy of Dr Tobias Richter)

Figure 10 Infilled well in small rawdah, west of Mafjar

Figure 11 Infilled well in the Muharaqit irrigation area, near Halwen
1.4 Groundwater and occupation

1.4.1 Impact of geology on groundwater quality across Qatar

The Qatar peninsula was formed by uplift along a N-S structure called the Qatar Arch (Figure 5). In northern Qatar, deposition of the Umm er Rhaduma and Rus Formations was strongly influenced by the Qatar Arch, resulting in two distinct facies – a calcareous facies straddling the structure and a gypseous facies on the flanks lateral to calcareous facies (Figure 18).

Figure 18  Relationship between the freshwater carbonate zone and town distribution across northern Qatar
While the different depositional environments have led to the two major facies, this distinction has been modified by post depositional anhydrite (CaSO₄) dissolution, causing the original carbonate-gypsum facies boundary to migrate southwards, where it is now seen as a "V" or fan shaped boundary with its apex in the vicinity of Rawdat Rashid in central Qatar. To the north, the Rus Formation is a predominantly carbonate facies with only residual deposits of inter-bedded gypsum. To the south, the Rus Formation is mostly gypseous (Figure 18 and Figure 19). The calcareous facies is largely absent from southern Qatar, although a narrow band occurs in the west, associated with the northwards trending Dukhan anticline passing southwards through Umm Bab towards Turayna (Figure 19). Because of the strong effect of the gypseous sediments on reducing groundwater water quality, Qatar is divided into two separate hydrogeological provinces: one in the north and the other in the south (Figure 19).

Figure 19  Litho-facies in the Rus Formation and hydrogeological provinces (Eccleston et al, 1981)
The distribution of farm pumping wells (hand dug and drilled) in Qatar within the extended carbonate line (Figure 20) clearly shows the fresher water distribution and hence the influence of the carbonate facies on groundwater quality across Qatar. There is a very low density of farm wells in southern Qatar compared with that in the north, and this difference echoes the asymmetric distribution of occupation of Qatar in the past, and hence gives an insight into its archaeology. The extended carbonate line is also shown in Figure 20.

Figure 20 Distribution of farm pumping wells across Qatar (Dept of Environment 2011)
1.4.2 Presence of a freshwater lens in the north

Despite very low rainfall, localized recharge via the rawdah has resulted in the development of a complex fresh groundwater lens within the calcareous facies of the aquifers across northern and central Qatar (Figure 21). The fresh water overlies more saline regional groundwater deeper in the Umm er Rhaduma aquifer. Elsewhere in Qatar to the south of the calcareous zone, the aquifer system is mostly gypseous and the groundwater is normally brackish to saline (Figure 31).

![Figure 21 Schematic cross-section across northern Qatar of the aquifers and the freshwater lens (from Lloyd et al, 1987)](image)

Groundwater recharges in the hinterland and flows coastward where it discharges into the saline sabkha system. On approaching the coast the depth to the water table shallows, as does the depth to which hand-dug wells were required to go. Settlements were therefore concentrated closer to the coast, and those directly on the coast like Al Zubarah and Fuwayrit, where intruded seawater precluded a direct water source, received their water from nearby inland settlements such as Murayr and Athbar respectively. In a broader sense, the influence of water table depth and salinity in determining the distribution of archaeological sites across Qatar is clearly seen in the case of the early Islamic linear sites found between Al Athbar in the east and Al Haddayah in the west. All were associated with nearby rawdah with ready access to shallow potable groundwater. By contrast, permanent occupation in southern Qatar where the water was largely brackish to saline is sparse, with relatively few modern day or ancient settlements.
significant fall in groundwater levels across Qatar. The decline starts just prior to 1958, and the groundwater levels of 1958 are taken as representing the pre-development situation across Qatar. It provides an approximate depth to water tables for which hand-dug wells were required to go. Amer et al (2008) show a five-fold increase in groundwater extractions since 1975.

Figure 22 Estimated rise in groundwater production across Qatar from 1958 to 1972 (FAO, 1974)

An approximation of the pre-development water table depth across all of Qatar may be obtained by taking the 1972 potentiometric surface (Figure 24) for all of Qatar and adding the amount that the water table fell between 1958 and 1972 (Figure 25), using the potentiometric head and decline figures provided in FAO (1974). The 1972 potentiometric surface shows two small (ca 4 m high) groundwater mounds - one in the north and one in the south.

Figure 23 The number of wells and the amount of groundwater extracted from 1975-2006 (data from Amer et al, 2008)
Three W-E coast to coast sections across Qatar show the potentiometric surface and hence the depth required to excavate a hand dug well to reach the water table - in the north through Ghuwairiyah (Figure 28 - locality Figure 1), in central Qatar through Doha (Figure 29), and in the south through Umm Said (Figure 30). In general, the depth to the water table increases markedly on passing southwards as the landscape elevation increases.

The depth to the water table is shallowest in near-coastal settings where the groundwater systems outflow, and are most readily tapped by shallow wells. This is the case with the towns around northern Qatar from Al Zubarah to Al Ghariyah, and readily seen at Al Zubarah where fresh water was obtained from a number of hand-dug wells located on the higher ground at Murayr. Further inland as the land surface rises, the depth to the water table concomitantly increases to a point where the groundwater was largely beyond practical reach by hand-dug wells. This was no longer was the case with to the introduction of modern drilling techniques.

Figure 27 Potentiometric surface in 1958 (m asl) across northern Qatar (Eccleston et al., 1981) overlaid on topography emphasizing the 30 m (red) and the 40m (green) contour
shown as being well inland of the coast this is the result of two factors. Firstly, there has been a significant inland intrusion of the seawater wedge as a consequence of the depletion of the freshwater lens in the post-development era with the rate of sea water ingress into the aquifer has been recorded as being as high as 1 km/yr in the north (Macumber, 2009). Secondly, much of the data comes from drilled bores rather than hand-dug wells and the bores are generally deeper, passing through and being screened in saline intervals below the thin freshwater lens in near-coastal settings.

Figure 32 Qatar relief and groundwater salinity (based on data from Dastane and Al-Faihani, 1980)
Figure 33 The 40 m contour and 3 m contour (blue) of Qatar showing highland depressions and the approximate extent of the transgression of the mid Holocene sea.
There were several different approaches to examining the relationship between water and occupation potential across different landscapes. One was to obtain perspective by re-examining the environmental and hydrological settings of a number of previously described sites in the south, starting with Shagra. The Shagra site in SE Qatar, perhaps best known for its fisherman's hut, is one of the earliest sites in Qatar. The Shagra site, excavated in 1982, provided an un-calibrated date of 7,520 ± 90 BP on marine shells (Inizan, 1988). Shagra was located in a depression on a Pleistocene strand line overlooking the sea during the phase of Holocene high sea levels. It now lies about 6 km inland from the Sealine Beach resort on the present coast. Priority in the 2012 field season was initially given to re-locating Shagra, as it was considered that this site may provide an understanding on the nature of early occupation (7,500-5000 yr BP) at a time when sea levels were higher and the southern coastline was strongly indented with large embayments.

2.1 Occupation in areas where there is little or no potable groundwater water

The above discussion is focused on the conditions required for settlement in Qatar; however there is strong evidence that people visited the less hospitable areas regularly, usually during
Figure 36 Ma'abar Depression, Al Wusta, Oman

Figure 37 W-E Section through the freshwater lens at the Ma'abar Depression, central Oman (diagrammatic)

Figure 38 Depth and thickness of the freshwater lens at the Ma'abar Depression, central Oman - diagrammatic
The surface of the Karanah Depression is markedly different in the north and south. In the north, the landscape is more stony with large areas of rocky broken surface, while in the south the base of the depression is a flatter, even surface. A number of bevelled surfaces form the edge of the depression. In both cases small sparsely treed depressions occur. A number of sparsely treed depressions were observed in the north; however ruins in the form of a two-room moderately recent structure were observed in one instance (Figure 40 and Figure 41).

Figure 39 The Karanah Depression (marked by 50 m contour) showing wells where high tritium content indicated significant groundwater recharge. Tritium values are shown in red as tritium units.
Approximate positions of numbered sites previously recorded by De Cardi (1973) are shown, one of which occurs in the northern-most area of the depression (site 38) and two others to the southeast, beyond the depression (site 33 and 34 - Figure 48). The rim of the depression is at about 50 m, while the deepest parts of the depression in the south lie at elevations of about 30 m, and in this respect they are at similar level to the low points in the Karanah Depression (29 m). The depression is not fully enclosed by the 40 m contour, while the 30 m contour passes unbroken across the outlet, suggesting that whatever drainage may have occurred in the past (or at present) is graded to that level. Evidence of incipient drainage probably following storms, in the form of eroded banks was present in places along the depression.
Figure 49 shows the Turayna Depression incised into a terrace-like surface developed between the 40 and 50 m contours with its base about 30 m. It is uncertain as to whether the terrace is a structural bench or an erosional feature. From Figure 30, it can be estimated that the depth of the water table under the pre-modern regime was about 25 m or more, which was probably beyond the depth of hand-dug wells. This may not have been the case during the latter part of the wetter period, between 6000-7000 years BP. Evidence of stream activity is seen in the incision of the wadi floor. Flow events reflected by the incision are likely to have also been recharge events into the limestone aquifer.

Towards the southern (lower) end, outlined by the 40 m contour, the depression narrows to a small neck prior to opening onto the plain. A number of features are present in the small
3.3.3 De Cardi Site 34. Al-Qusairah (Gusaurah)

De Cardi notes: The Danish Expedition had located a site on level ground behind a dune on which both flint implements, and pottery were noted and reference was made to a cairn nearby (Kapel, 1965, 155; 190.36, Site Q.62.8). An attempt was made to visit the area in order to check on the nature of the pottery but it proved impossible to find the site. Instead, several cairns and a camping-ground were noted in a large depression enclosed by relatively high rocky ridges. Stretches of abandoned cultivation occurred on patches of silt, and its sheltered position makes it likely that the area has been occupied from time to time for centuries although none of the surface pottery could be ascribed to a date prior to the seventeenth century – De Cardi 1973.

3.3.3.1 Landscape in the vicinity of De Cardi’s site 34 at Al-Qusairah

De Cardi’s site 34 lies down-basin of the Turayna Depression and a little to the south of Al-Qusairah, which in turn, lies near the junction of the main north-south track from Turayna and a track passing eastwards to San Ad Dhiban and San al Fuzaylan. The landscape in the vicinity of Al Qusairah and site 34 is rocky and broken (Figure 62) with large basins containing small grassed depressions. Unlike the rawdah in the north the depressions commonly have steep edges (Figure 62 and Figure 63). The broken nature of the region is probably in part a reflection of its proximity to the mouth of the Turayna Depression and perhaps from headward erosion by small coastward passing wadis. It may also reflect structural movements associated with a faulting system affecting the Turayna and Karanah basins. It is likely that the depressions would hold water for periods after heavy storms, and in one sandy depression a tiered cistern-like dam was constructed (Figure 64). It is notable that De Cardi records that in the Qusairah area there were stretches of abandoned cultivation, and it may have been occupied from time to time over centuries. Whether the Turayna Depression acts as a catchment area for surface and / or groundwater flow into the Qusairah district requires additional investigation.
The Shagra site (as does Trig Point G8) lies on a further strongly dissected ancient ENE-WSW beach ridge strand line further south (Figure 81).

![Image of the Shagra site on the shore of the mid-Holocene sea](image)

**Figure 79 Diagrammatic view of the Shagra site on the shore of the mid-Holocene sea**

A white terrace of marine sediments forms a pediment to the eroded strand line and this represents a boundary of rising ground to the north of the mid-Holocene (Flandrian) shoreline. The transgression created a number of similar marine embayments along the southeastern shoreline of Qatar. A simple topographic figure based on data from the NASA Shuttle Radar Topography Mission (SRTM) enables an view of the topography at the time except for the line of high peaks along the present coast to the south of Sealine Beach, which is the modern coastal dune system (Figure 79).

There are several views on the age of the Pleistocene strand lines. The traditional view based on sea level curves, is they may represent the second-last marine transgression to impact on Qatar, which occurred in the Eemian Period about 113-120,000 years ago (Macumber, 2011). An alternate, more recent view, is that the palaeo dunes and terraces commonly attributed to the Eemian period formed more recently, only 20-45,000 years ago (Wood 2011; Jerry Jameson pers. com.), and that their present elevated position reflects uplift along the southern margins of the Gulf. Vita-Finzi (1973) obtained a radiocarbon date a little further to the west of G8 on shells from the strandline of > 35,000 years, while Dr Jerry Jameson (pers com) has additional more recent dates. Whatever the case, during the time of the later Flandrian transgression from ca 7000 to 4000 yr. BP, the older Pleistocene strand line at the Shagra site
Figure 103  Topographic map with Al Haddayah linear village and nearby cairns

Figure 104 Vegetated depression to the south of Al Haddayah with feeder drainage lines

Figure 105  Small house at Al Haddayah overlooking a vegetated depression
The suitability of Wadi Fayshakh as an occasional water source and therefore a basis for visitations and perhaps occasional settlement was also observed at a locality lying about 2 km eastwards of the observation bore. This may have been the actual site of Fayshakh, as shown on the earlier maps. Here a small mosque and a number of nearby structures, including graves, occur on either side of the track to Jumayliyah.
cairns. Comparatively good quality pebbly chert was widespread across the area providing a ready source for artefacts (Figure 133). As is the case across much of Qatar small circular structures were noted at a number of locations, however the most prominent features were the ubiquitous cairns, concentrated both on the terrace (French site 25 - Figure 131 and Figure 135), and overlooking the northern and eastern edges of the depression (Figure 131, Figure 136 and Figure 137).

Figure 131  Sites observed in the area between Zughan Al Bahth and Al Kharsa - the numbered sites were taken from Inizan, 1988

Figure 132  Pebbly surface of the Acila terrace
Figure 138  Dukhan - Umm Bab - Al Kharsa area with the French and De Cardi sites

Figure 139  Arrowheads from the Al Da'asa site 46 (Smith 1988)
Al Zubarah Archaeological Site
Community Archaeology Program
QIAH Project UNESCO Phase One, Year One (2011-2012)

-Prepared by Dr. Iman Saca
Acknowledgments

Her Excellency
Sheikha Al Mayassa Bint Hamad Bin Khalifa Al Thani
Chairperson
Qatar Museums Authority

His Excellency
Sheikh Hassan Bin Mohammed Bin Ali Al Thani
Vice Chairman
Qatar Museums Authority
1. Introduction to Community Archaeology Program at Al Zubarah Archaeological Site

The field of Community Archaeology (which for the purposes of the QIAH Project involves education, outreach and oral history) aims at engaging and involving local communities in protecting, promoting, interpreting, as well as benefitting from the archaeological and heritage sites within their communities.

In 2009 the Qatar Museums Authority, jointly with the University of Copenhagen, launched the Qatar Islamic Archaeology and Heritage project (QIAH). From its inception, the QIAH Project included public outreach and education as an integral component of its work. Such community-based cooperation has brought clear and well-defined short and long term benefits to both the site and the project.

Working with local "communities" has both practical and ethical benefits for archaeologists and heritage specialists at Al Zubarah, no matter the definition of that community. Archaeologists and heritage specialists engage local communities and stakeholders to assist with interpreting, safeguarding and promoting the archaeological site. Such involvement gives the local communities a sense of pride, ownership and identity as they explore their own heritage. Specialists are also able to enrich their own research through the collaboration of, and involvement with, local communities in Qatar.

For archaeologists and heritage specialists, involving local communities in the “archaeological process” is not a matter of choice but a responsibility. By working with local communities, archaeologists and heritage specialists aim to protect, preserve and enrich the archaeological and cultural heritage of the area in the future. They hope to achieve this by creating a sense of shared history, cultural identity and cultural awareness. Engaged community archaeology promotes civic involvement and a better understanding of the values of archaeological and cultural heritage in Qatar.

In the longer term, the information researched, shared and gathered about Al Zubarah Archaeological Site in its cultural, historical and natural context will not only enrich the knowledge we have of the site and its associated material culture, but will help introduce the QIAH Project’s results to both national and international audiences. In doing so, the uniqueness of Al Zubarah Archaeological Site and the people of Qatar’s northwestern region will be revealed.
2. Aims and Objectives of the Program

The true success of an archaeological/heritage project (both during and post-excavation) depends on the understanding and support of the public and decision makers. Hence it is the role of archaeologists and others working in the field of heritage management to communicate their goals, results and recommendations honestly, clearly and effectively, as well as involve the community and decision makers in all aspects of the project.

There are three main aspects of the QIAH community archaeology work at Al Zubarah Archaeological Site: the first focuses on enriching our knowledge of the site, its history and the history of the northwestern region of Qatar by focusing on the accumulation of oral histories and traditions. The second is an active public awareness, education and outreach program focussing on various activities, both at the site and in Doha and Al Shamal. The third is to build knowledge and practice among QMA staff and other local professionals on issues of education, outreach and oral history.

To accomplish our objectives, the Al Zubarah Archaeological Site Community Archaeology is developed along five main trajectories:

1. **Coordinate and cooperate** with various governmental and non-governmental institutions, especially QMA, Qatar Foundation and Qatar University.
2. Focus on enriching knowledge of Al Zubarah by gathering, incorporating and **highlighting the rich oral history**, folklore and local traditions of the northwestern region and of Qatar as a whole.
3. Develop an active **comprehensive public awareness** and outreach program, to be carried out through various educational and hands-on activities on and off-site.
4. Use **archaeological heritage to serve Qatari society** in the fields of education, economy, culture, heritage, and to strengthen the national identity.
5. Use community archaeology as a vehicle to create a **well-trained and interested group of local professionals** that will carry on the mission of heritage preservation and heritage education.

2.1 Educational Outreach

The Al Zubarah Community Archaeology Program focuses on reaching out and working with schools and community centres, mainly in Doha and Al Shamal, to raise awareness of the site, its context and its importance. This is achieved through public lectures, presentations, site tours, museum visits, and practical hands-on experiences. A large number of activities are prepared for schools either during their visits to the site or when the education and outreach team visits the schools.

Other outreach efforts include producing booklets, brochures, temporary exhibits and various other activities to educate the general public and activate their interest in Al Zubarah and the archaeological heritage of Qatar.
2.2 Oral Histories Collection

The Al Zubarah Oral History program includes the gathering of oral histories, a process which involves the systematic collection of living people’s testimony about their own experiences and those of their ancestors, going as far back as their memory permits. The program focuses on tracing the lineages and histories of families; detailing documentation of village histories; tracing the movement of families from Al Shamal villages – including Al Zubarah – to Doha and Madinat Al Shamal; and gathering as much information as possible on divers and *tawaweesh* (traders) from their families. Understanding genealogies is an important part of this work and the lineages and histories of families of Qatari tribes, traders, *tawaweesh* and pearl divers have already been partially traced in the 2011-2012 QIAH work season [see Fig 2 & Fig 3 on p.4 - p.5].

The other aspect of the QIAH Oral History program is the gathering of oral traditions and folklore with a focus on verbal traditions, customs, beliefs, music and song, jokes, riddles, stories, legends, rhymes, proverbs, and language. This collection work also involves the creation of an audio and video registry of the interviews. Old photographs, historical documents and published research about the site and the region are all collected and used, and in the future information on boat building and pearling techniques and tools will also be gathered.

Through the gathered list of Al Shamal tribes, the QIAH team has been able to identify individuals that could contribute as interviewees to the oral history database. During the 2011-2012 season it has been possible to identify a list of Qatari individuals that were able to contribute to the collection work [see Fig 1]. Part of such work has also involved the gathering and acquisitions of documentation, written sources, historical photos and maps. Access to Sheik Hassan’s *Arab and Islamic Heritage Library* has enabled the enrichment of knowledge of the Al Shamal region and of the villages of the northwestern coast of Qatar, which include Al Zubarah.

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Fig 2: The tribes of Northern Qatar and their villages
Fig 3: List of names in Arabic for some villages in the North
3. QIAH Project UNESCO Phase One, Year One (2011-2012)
Community Archaeology Work

3.1 Educational Outreach

One of the first steps towards accomplishing the aims of the program has been ensuring coordination with the appropriate government and educational organisations. The QMA has been involved from its inception: the QIAH Project operates in close and regular coordination with the Director of Archaeology and Heritage, Dr Sultan Muheisen, who is also the QMA’s Senior Archaeology Advisor, and with Mr Faisal al-Naimi, who is Head of the QMA Archaeology Department and his team.

In an effort to coordinate Community Archaeology work with the appropriate governmental organisations related to education, an official letter of introduction from QMA was sent to the Supreme Council of Education (SCE) of Qatar, to introduce them to the work of the QIAH Project and inform them of its mission and goals, archaeology and heritage related activities, and the availability of the team to execute relevant activities either on-site or through schools visits.

A team from the QMA’s Department of Archaeology was trained to carry out presentations and educational activities in schools in Doha [see page 12], while at the same time a QIAH team member was responsible for giving visitors, both general visitors and students, a detailed tour of the site, as well as explaining the archaeological process [see page 11].

At first a list of all schools in Qatar was compiled by the staff at the Department of Archaeology [see Fig 4, p7]; all foreign and mustaqila schools (government-run schools) were listed according to village and region, detailing contact information for each [see Fig 5, p7]. These lists facilitated communication with the schools and helped the team plan current and future activities.

In Al Shamal, letters were sent to all schools explaining the nature of the activities taking place in Al Zubarah, and schools were also provided with a sample program for a site visit. The correspondence was then followed by regular visits and meetings with the heads of the Al Shamal schools, during which site visits and/or in-school activities were discussed and arranged.

To better understand how, and if, heritage and archaeology should be introduced to the children’s scholastic curricula in Qatar, and if so, what subjects would be covered, a team from QMA’s Archaeology Department gathered social studies textbooks currently used in government-run elementary, middle and high schools. The textbooks were reviewed with the intention of locating any information on archaeology, sites in Qatar, heritage education, and traditions of Qatar, among other similar subjects. Reviewing the school text books helped with an understanding of what is being taught in schools in Qatar and what is missing from the textbooks. This preliminary survey revealed a clear need for a comprehensive review.
### Fig 4: Official list of schools

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<td><a href="mailto:islam_eco@edu.qa">islam_eco@edu.qa</a></td>
<td>7094</td>
<td>1951</td>
<td>1</td>
</tr>
<tr>
<td>مدرسة السلام</td>
<td><a href="mailto:peace_eco@edu.qa">peace_eco@edu.qa</a></td>
<td>7094</td>
<td>1951</td>
<td>1</td>
</tr>
</tbody>
</table>

### Fig 5: Schools listed by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Name of School</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Doha</td>
<td>Doha Educational District</td>
</tr>
<tr>
<td>City of Al Waqifah</td>
<td>Waqifah Educational District</td>
</tr>
<tr>
<td>City of Al Khor</td>
<td>Al Khor Educational District</td>
</tr>
<tr>
<td>City of Al Daai'ah</td>
<td>Daai'ah Educational District</td>
</tr>
<tr>
<td>City of Al Salihiyah</td>
<td>Salihiyah Educational District</td>
</tr>
<tr>
<td>City of Al Rayyan</td>
<td>Rayyan Educational District</td>
</tr>
<tr>
<td>City of Al Thakhlah</td>
<td>Thakhlah Educational District</td>
</tr>
</tbody>
</table>

---

**Distribution of Schools by Region:**

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Doha</td>
<td>7</td>
</tr>
<tr>
<td>City of Al Waqifah</td>
<td>2</td>
</tr>
<tr>
<td>City of Al Khor</td>
<td>1</td>
</tr>
<tr>
<td>City of Al Daai'ah</td>
<td>1</td>
</tr>
<tr>
<td>City of Al Salihiyah</td>
<td>1</td>
</tr>
<tr>
<td>City of Al Rayyan</td>
<td>1</td>
</tr>
<tr>
<td>City of Al Thakhlah</td>
<td>1</td>
</tr>
</tbody>
</table>

**Notes:**

- **City of Doha:**
  - Al Waqifah Educational District
  - Al Daai'ah Educational District
  - Al Salihiyah Educational District
- **City of Al Waqifah:**
  - Educational District
- **City of Al Khor:**
  - Educational District
- **City of Al Daai'ah:**
  - Educational District
- **City of Al Salihiyah:**
  - Educational District
- **City of Al Rayyan:**
  - Educational District
- **City of Al Thakhlah:**
  - Educational District
of all the social studies textbooks as information on the archaeology and heritage of Qatar was rarely found in any of the reviewed textbooks. The ultimate goal is to provide schools with supplementary text information on Qatar sites, archaeology and heritage.

The team worked hard, both on and off-site, to prepare material for students and site visitors. To achieve this aim a large number of PowerPoint Presentations were prepared, targeting various issues, while materials and objects were selected for hands-on activities and show-and-tell sessions, so as to optimise student knowledge. Questionnaires and written activities were also created for students visiting the site, as were pottery conservation sessions off-site, and object sorting and cleaning activities on-site.

3.1.1 On-site and off-site activities

On site

A large number of activities were prepared and carried out by the QIAH team with the support of QMA’s Department of Archaeology. These aimed at enriching the visitors’ knowledge of the site and engaging them in archaeological processes. Various activities were conducted to highlight what archaeologists do and why. The work also focused on explaining the kind of material that can be found at an archaeological site, especially at Al Zubarah, and it how it is processed. One of the main aspects discussed during the site visits is the value of preserving the archaeological heritage of Al Zubarah and why this particular site is so important for Qatari people.

Based on the outreach and educational activities carried out in 2010-2011 and 2011-2012 by the QIAH Project, the number of students from schools in Doha and Al Shamal municipalities visiting Al Zubarah or participating in outreach workshops held at the schools has increased exponentially. Numbers grew from approximately 315 students over the 5 months period during the QIAH fieldwork season in 2010-2011, to approximately 1270 students (of which approximately 650 visited Al Zubarah Archaeological Site and 620 attended workshops on Al Zubarah in Doha) for the 2011-2012 season. The average number of people taking part in the various activities changes greatly according to the size of the school involved, but on average 30-40 students made up each visiting group. The figures for school visits and workshops are expected to increase further with the development of the QIAH outreach programs planned for the next three years.
Visits to *Al Zubarah Archaeological Site* are usually preceded by a letter sent to the school to prepare them for their visit [see Fig 7, p10]. Once students arrive at Al Zubarah, the QIAH on-site education officer, Mrs Nasreen Mohammed, accompanies them on their 2-3 hours site visit with the assistance of other archaeologists. An average visit includes:

- **Introductory talk** in front of the information pavilion to briefly introduce the group to the site, the QIAH Project and what their visit is going to include.
- **PowerPoint Presentation** prepared by the on-site education officer, introducing archaeology to the students and helping prepare them for the site visit.
- **Visit to Al Zubarah Fort**, including explanations of when and why the fort was built, as well as of the important architectural elements of the building. During the conservation process a conservator will discuss his area of work with the students.
- **A visit to the finds tent** to show the students where all the bones, pottery and sampled soil are stored. Here students hear from the finds officers about the value of these finds and the way they are processed.
- **Various objects from site** are displayed on the object table and an archaeologist explains to students what they are seeing, the importance of such finds, and the value of preserving them. Some objects can be handled by the students, which is an activity they generally really enjoy.
- **A visit to the flotation station.** The archaeologist responsible for the botanical remains at Al Zubarah explains how the flotation station works and why it is used. The importance of small faunal and botanical remains at an archaeological site is also explained to the visiting students and guests.
- **Pottery cleaning and sorting** is another hands-on activity that the students participate in during their visit to the site. Under the supervision of the archaeologists in charge of the finds, students engage in cleaning some of the pottery shards and learn how to sort material found at the site, and why archaeologists do it.
- **A mock excavation**, or the possibility to take part in the excavation process with the archaeologists, has been the highlight of the visiting students during the past two seasons of QIAH work at Al Zubarah. As this activity is very time-consuming, it requires lengthy preparations by the on-site team. This activity in particular should become an integral part of site visits and has the potential to become the main motivator for a school visit to Al Zubarah.
- **Students are also given the opportunity to participate in activities that involve drawing the fort, objects and other finds at the site.**
- **Short Q&A sessions** are also held regularly during site visits.
- **Last but not least, a detailed site tour** is given by the archaeologists on-site and the various areas of Al Zubarah are explained to the students.

It is important to note that activities carried out during each visit are modified on the basis of the age of the visiting group and their interests. Most schools are also encouraged to provide feedback by answering a questionnaire about their visit to the site, and they are asked how they can help promote and protect *Al Zubarah Archaeological Site*. 
Things to be kept in mind before undertaking an accompanied visit to Al Zubarah Archaeological Site

Important notice:

Teachers and accompanying parents are entirely responsible for the health and safety of their pupils while visiting Al Zubarah Archaeological Site (hereafter the Site). Teachers and accompanying parents must ensure the students behave in a responsible manner and follow instructions given to them by the group escort provided.

Your host is the Qatar Museums Authority, who has granted permission for your school group to visit the Site. At the Site you will be guided by members of the archaeology section of QMA and/or team members of the Qatar Islamic Archaeology and Heritage Project (hereafter the Project), a QMA initiative in partnership with the University of Copenhagen.

The site regulations below MUST be followed. Any infringement will result in the whole group being asked to leave the excavation area

1. Suitable clothing for the outdoors is required (light, comfortable); a lot of the activities occur outdoors.
2. Suitable footwear must be worn (trainers, walking boots are the best).
3. Protection from the sun and wind is necessary: a hat or head covering, sun glasses, sun block (sunscreen).
4. Plenty of water must be available (minimum 2 litres per person).
5. A responsible first-aider must accompany the group and bring a first aid kit with them (Project staff cannot render first aid).

All visitors need to comply with the following instructions

1. Vehicles must be parked at designated parking areas only. Driving on the Site is strictly prohibited.
2. Always look where you walk as the ground is uneven (and you may trip over).
3. No running.
4. No pushing or playing games.
5. Do not wander around by yourself – you must stay on designated paths unless otherwise advised by the group escort.
6. Do not pick up or remove any stones, pottery or any other objects that you may find on the Site.
7. Do not litter.
8. When visiting the site you may only enter an excavated area when permitted and always with an escort.
9. Visitors are permitted to take general photographs of the Site for personal use only. Detailed photographs of areas under excavation are not permitted. Photographs must not be used for anything other than personal use.
### Table: School Visits and Lecture Program

<table>
<thead>
<tr>
<th>Name of school</th>
<th>Date of visit</th>
<th>Number of visitors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>French school Lycee Bonapart</td>
<td>Feb 5-6-7</td>
<td>100 students</td>
<td>Hands on activities for 3 full days. Including site visit.</td>
</tr>
<tr>
<td>Cambridge school site visit</td>
<td>Feb 20th</td>
<td>15 students</td>
<td>On site activities.</td>
</tr>
<tr>
<td>Doha English Speaking school</td>
<td>Feb 27th</td>
<td>99 students</td>
<td>In-school presentation and pottery workshop.</td>
</tr>
<tr>
<td>Doha English Speaking school</td>
<td>Feb 29th</td>
<td>115 students, parents and teachers</td>
<td>Follow up school visit to site with all on site activities included in visit.</td>
</tr>
</tbody>
</table>

### Other schools

- Madrasat Maymouna Al-Eptidaiyah and did two presentations with a hands on component.

### Name of school               | Date of visit | Description |
| Qatar Foundation visit        | March 1st     | On site visit. |
| Doha Home Educators           | March 4th     | On site visit- full program. 12 family 33 children 13 parents. |
| Teachers Tour from various schools in Doha, organized by Mark Witherman | March 10th     | 36 teachers. Detailed tours and possible activities for their students. |
| QMA-PR office tour of site    | March 19th    | See the site and possible pr activities. |
| Al Duhail elementary school for boys | March 26th     | In school Pottery workshop and lecture. |
| Mesaieed International School | March 25th    | In school presentation. |

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**Fig 8:** Example of school visits and lecture program

**Photo 1:** Pre-visit talk in research station

**Photo 2:** Demonstrations at research centre

**Photo 3:** On site tour

**Photo 4:** On site tour

**Photo 5:** On site tour
Off-site

As with the on-site activities, off-site activities were prepared by a team of five women working in the Archaeology Department of QMA (Maysa al Kwary, Rima Nugnug, Hisa Malki, Siham al Mazrou’i, al Anoud al Mutaw’a) to promote Al Zubarah Archaeological Site and the value of archaeological heritage in Qatar. These activities targeted schools and students in Doha and its suburban areas. It became evident while preparing outreach and educational activities that many schools were either not prepared, or found it difficult to visit the site.

The Doha QMA team prepared various PowerPoint presentations and they were trained on how to present these to the students, what to focus on, and how to engage them. The team also prepared presentations to focus on what archaeology is and what archaeologists do. Mr Faisal al Naimi encouraged his team to participate and took part himself in some school activities. Five PowerPoint presentations were prepared by the team, with the main objectives of introducing students to the field of archaeology, what archaeologists do, Al Zubarah Archaeological Site and other archaeological and architectural sites in Qatar, and their importance and history.

Typical off-site activities which students took part in during the workshops, which were planned in collaboration with the QMA’s Archaeology department staff, include lectures, PowerPoint presentations, handling sample boxes of artefacts from Al Zubarah, lithics presentation, photo exhibits, a film showing, and an explanation of the use of archaeologists’ tools.
One of the highlights of schools visits during the last season of work was the pottery workshop organised as part of each school visit. After each presentation students were able to handle some object or check the tool kit of archaeologists. This was followed by a lively Q&A session. Afterwards students headed to a site prepared by each school for the pottery workshops. Rima Nugnug presented on her work with pottery in the QMA office and after her short presentation students gathered in groups to begin their work with the pots [see Photo 7, p12]. At the end of each workshop, participating students received promotional material to take home, such as hats and t-shirts.

It is important to note here that although all the members of the QMA Archaeology team participated regularly in school activities, Maysa al Kwary has been the main person responsible for arranging details for off-site school workshops.

An example of off-site activity

As part of the QIAH and QMA outreach and education activities, the staff of the Archaeology Department at QMA participated in the National Day Celebrations at Al-Nahdah independent School for girls on December 11-14 [see Photo 11 et al, p14].

The Archaeology Department’s activities were one on the main attractions during the 3 day celebrations.

Some of the main activities included:
- A large photo display of Qatar’s and the Gulf’s archaeological heritage sites. Maysa al Kuwary was involved in setting up the display and both the activities and the movie viewing tents. Ibrahim al Mansouri also helped with the set up.
- Pottery workshop: during the workshop, which was repeated every day for three consecutive days, students listened to a brief lecture on the origins of pottery, the significance of studying pottery and reconstruction methodologies. After the lecture a hands-on activity followed, which involved students restoring pots provided by the QMA office. More than 200 students participated in this activity. Rema Nugnug led the presentation with the help of Hissa Malki.
- Lithics workshop: Mr Faisal Al Na’imi presented information on stone tools, their production and what can be gained from their analysis to children and parents. He performed a live demonstration of flint knapping, the use of the bow and arrow and of other traditional hunting gear, which was extremely well received by the children.
- Presentation on the subject: what do archaeologists do at an archaeological site? This presentation was prepared by Al Anoud al Mutaw’a from the QMA’s Archaeology Department, who visited the site of Al Zubarah in 2010 and prepared a short film on her visit.
• Film on Al Zubarah: During the three days of the celebration a film on *Al Zubarah Archaeological Site* and Qatar was presented to students, teachers and parents. Dr Iman Saca of the QIAH Project gave a brief introduction to the site before the viewing. The film was continuously showing in one of the main tents at the school and was well received by the students, who asked numerous questions after the viewing.

The Team received a Thank you certificate, flowers and plaque for their participation.
Thank you letters and student reflections on their visit

Fig 9: Thank you letters and student reflections on their visit

Dear Dr. Iman,

I wanted to thank you for giving us the opportunity to visit the Zubarah Fort. It was an amazing experience and I learned a lot about the history of Qatar.

Sincerely,

[Name]

Zubarah Fort

Dear Miss Iman,

I am writing to tell you how much I enjoyed our visit to the Zubarah Fort. I really enjoyed learning about the history of Qatar and the role it played in the past.

Thank you for your time and effort in organizing this trip.

Sincerely,

[Name]
3.1.2 Work with Qatar University

After meeting with the Chair of the History Program at Qatar University and his faculty, a proposal for cooperation during the next excavation season between the QIAH Project (University of Copenhagen), the QMA, and the History Program of the Humanities Faculty of Qatar University was submitted to Qatar University. The proposal provided QU students with the opportunity to work in close contact with a large number of experts in the field of archaeology, heritage, oral history and conservation.

Three main issues were proposed:
- A special topics course to be offered at QU in the spring semester.
- Internship programs for QU students.
- An exchange program between Qatar University and Copenhagen University.

A detailed proposal was submitted to QU and it was suggested that in the 2013 season of QIAH fieldwork a more comprehensive discussion should take place with the QIAH Executive Director regarding the implementation of such cooperation.

Lecture at QU

An important outcome of the preliminary proposal for collaboration discussed above was a series of lectures given by professors working on Al Zubarah to both students at Qatar University and the general public. The lectures were well attended and students showed interest in collaborating with the QIAH Project during future work seasons. In particular, after one of the lectures, a discussion with students revealed deep interest in learning methodologies of Oral History research and working with the Community Archaeology Program conducting interviews and gathering data.

3.1.3 Dissemination

Sharing and disseminating information has been a focus of QIAH work during the 2011-2012 season. A commonly recognised problem has been the lack of awareness among the public, and especially the younger generation of Qataris, about the importance of their archaeological heritage.
The planned public education and awareness activities target at least three kinds of audiences: decision makers in private and public sectors; students at various education levels; Qatari communities, especially local communities in the Al Shamal area, as well as visitors to Al Zubarah and northwestern Qatar.

The two main desired outcomes of the medium and long-term outreach and educational efforts are to emphasise to all stakeholders the value of Qatari archaeological heritage and the need to protect and preserve it as a matter of national importance; and to engage and involve the larger local community in learning about, supporting and participating in the protection of Al Zubarah. It is hoped this latter outcome will also extend beyond Al Zubarah to the archaeological, architectural and cultural heritage of the northwestern region and of Qatar as a whole.

Building relationships and being in direct contact and communication with the people of Qatar, working with them and learning from them was the main objective of the Community Archaeology team in 2011-2012 and will remain so during future seasons. These relationships are the main source of information for the Community Archaeology Program in the QIAH Project.

General methods used for information dissemination include:

- Creation of educational programs and activities for schools, both Mustaqilah governmental and international elementary, middle and high schools. Students are the decision makers of the future and knowledge and familiarity with Qatari cultural heritage should be a crucial part of their education.

- Educational initiatives for universities, mainly focusing on archaeology, architecture, natural history and material science. The programs being offered by local academic institutions are a critical asset because they supply Qatar with well-qualified and highly skilled specialists. In future, these students will be full-time employees and specialists working within the relevant governmental agencies and institutions.

- Enhancing the Project’s visibility and contacts within cultural centres, especially those dealing with heritage issues and promoting cultural heritage preservation and education (e.g. Katara, Museum of Islamic Art, Mathaf Museum of Modern Art, National Museum) of Qatar, Souq Waqif, Education city, which were all approached this season).

- Literature and information created for dissemination to schools, site visitors, and the general public:
  - Booklets on the site, its history and archaeology
  - Brochures
  - Postcards
  - Information boards on-site, clearly positioned to guide visitors along a track
  - Information Pavilion with large visible educational boards located near the

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**Fig 11: Booklet**

![Booklet Image](image)

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Al Zubarah Fort, to welcome visitors and explain the site and fort in some detail

- **Al Zubarah Archaeological Site Website** (www.alzubraha.qa) and Facebook page (http://www.facebook.com/AlZubarah)
- Photo exhibit

### 3.1.4 Capacity building

Capacity building efforts are an integral part of the QIAH Project and are crucial to the creation of a Qatari group capable of working with confidence in the future and of encouraging civic involvement within the Qatari society. They are needed to promote a better understanding of the cultural, national, educational and economic values of the archaeological and cultural heritage sites in Qatar. The QIAH Project’s work with the Archaeology Department at QMA, as well as with QU students, is strongly geared towards training individuals and teams capable of carrying out education and outreach messages and activities. Five QMA employees are currently working with the Community Archaeology Program to prepare literature and presentations for schools in Qatar, as well as materials for hands-on activities and workshops.

Communication with Qatar University, aimed at attracting and recruiting students to work on issues related to archaeology, oral history, heritage education and community archaeology, is also ongoing. Short and long-term activities will be planned during the next work seasons with The Museum of Islamic Art and the National Museum of Qatar. These activities will require the establishment of relationships with museum personnel to work together and train personnel capable of carrying out specific community archaeology and oral history related activities. Cooperation with the Supreme Council of Education to create training workshops for teachers on themes of heritage education will also be essential.

One of the goals of the 2011-2012 season was introducing some of the QMA employees to the QIAH Community Archaeology Program, in the hope of creating a local team to collaborate on various aspect of community archaeology, especially education and outreach. This team is composed of staff from the Archaeology Department of QMA. Some of the accomplishments of this season in this regard are:

A team of 5 women from the QMA Archaeology Department (Maysa Al Kuwari, Rima Nugnug, Hisa al Malki, Siham Al Mazrou’i) started researching heritage education, archaeology and architecture of Qatar, archaeological preservation, and working on creating a photo exhibit for schools. They also prepared a number of lectures which were used in school presentations.

The QMA team prepared all the material required for hands-on activities, such as the very popular pottery workshops done in all schools visited during the 2011-2012 season. They also created a reference...
box for mock excavation activities, and put together a sample box of objects for students to handle during school visits.

Maysa Al Kuwari was given the responsibility of coordinating with local schools in Doha, the creation of a database of all visits, and the production of a report on QMA activities concerning education, outreach and school visits. (A 40 page report was produced and given to the Head of the QMA Archaeology Department, to Dr Sultan Muhesen and Dr Iman Saca).

Mr Mubarak Fadalah, the Al Zubarah Archaeological Site Deputy Site Manager, assisted in setting up the oral history interviews.

The Library of the Department of Archaeology of the QMA has been activated and many students from QU and other schools are able to visit the library for research purposes.

Much work has been done to acquire a large office space in the QMA Archaeology Office for the outreach and education program. Should it be successful, it will be the first time a space is dedicated to community archaeology activities in Doha.

3.2 Oral Histories Collection

3.2.1 Program of interviews, planning, and methodology

Aside from Educational Outreach, the other main aspect of the Al Zubarah Community Archaeology project is the collection of oral histories and oral traditions. Oral history brings depth to our understanding of the past by carrying us into recollections and testimonies at an individual level. Oral traditions are, in fact, non-written stories passed down from one generation to another, and kept alive in the memories of a people.

Both oral history and oral traditions enrich our knowledge of Al Zubarah and the surrounding sites by gathering, incorporating and highlighting the rich oral history, folklore, stories and local traditions of the northwestern region and of Qatar as a whole. Another goal of the QIAH Community Archaeology work is to place Al Zubarah and the abandoned villages closest to the site in a broader cultural, historical and natural context.

The process of interviewing started after researching details about the northern tribes of Qatar, as well as the basic history of the northern villages, including Al Zubarah. As mentioned earlier, a list of all the Al Shamal tribes, their internal divisions and their village affiliations was created. It became clear that each tribe has a Fakhd and a Badidah — branch and family – and lived in a specific village. For example, the Al Kubasi tribe lived in Khweir, Jumail, and Arish, while the Al Dasim branch of the tribe resided in Khweir.
Interviewees were selected on the basis of their knowledge of certain topics, their tribal affiliations, their village of residence before moving to Doha or Al Shamal, and their willingness to be interviewed [see Fig 13, p21].

The interviews took place in three main locations:
1. In the interviewee’s homes or farm.
2. On-site: these interviews involved going in the field and visiting the abandoned villages or fish traps with the interviewee.
3. In the majlis, an exclusively male gathering house or place of assembly. Dr Saca received a personal and rare invitation to visit and conduct interviews in these majalis (plural). The Majalis visited were mainly in Doha and its suburbs, but a few were located in Al Shamal.

The interviews focused on various issues, all aimed at a better understanding of the daily lives of the tribes of Al Shamal, their traditions and their recollections of life (including pearl fishing and trading) in the now completely abandoned villages. More specifically, interviews focused on the internal layout of abandoned villages, tribe or family identification, history of specific families and their connections to the villages, movement of families, northwestern coast fish traps, and water resource distribution and use.

3.2.2 Main results of interviews

The Tribes:

The QIAH team compiled a list of Al Shamal tribes, including the village of affiliation [see Fig 2, p4].

As has been previously mentioned, tribes have a Fakhd and a Badidah (branch and family) and they tended to live in a specific village. For example the Al Kubasi tribe that lived in Khweir, Jumail, and al Arish is divided into various branches and families. Below are examples of some of the branches and families:

- al Samkhan
- al Nfahi
- al Sloum
- al Rayej
- al Ayaysha
- al ’Ajaj
- al Eid
- Albu Jmizah
- al Hareb
### Fig 13: List of Interviewees

<table>
<thead>
<tr>
<th>Person name</th>
<th>Date</th>
<th>Location</th>
<th>Topic “in brief”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women folk of Mubarak Fadalah</td>
<td>Feb 12</td>
<td>The women’s majles</td>
<td>Information on women’s daily lives and activities. Included a field visit to collect the Kamal truffle.</td>
</tr>
<tr>
<td>Seif Al-Fadalah</td>
<td>Feb 13</td>
<td>Field visit to Matjar</td>
<td>The layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants. Water sources.</td>
</tr>
<tr>
<td>Husain al – Fadalah</td>
<td>Feb 13</td>
<td>Municipality of el Shamal</td>
<td>Follow up after June workshop. Asked about abandonment of villages, cleaning of sites, maps...etc</td>
</tr>
<tr>
<td>Khaled Al – Kubasi</td>
<td>Feb 15</td>
<td>Al Kubasi Majles in al shamal</td>
<td>Discussed the details of al kubasi tribe including the list of their branches, Their villages and information about al’arish.</td>
</tr>
<tr>
<td>Khalifa al Kubasi</td>
<td>Feb 16</td>
<td>On site in al Arish</td>
<td>The layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali Al Kubasi and his father</td>
<td>Feb 21</td>
<td>Um Qabrain</td>
<td>The water source and earlier town before the move to al Arish.</td>
</tr>
<tr>
<td>Khalifa Al Kubasi</td>
<td>Feb 21</td>
<td>His farm house in alshamal</td>
<td>Life in al arish, food sources and education</td>
</tr>
<tr>
<td>Grandfather Eid bin Selham</td>
<td>Feb 25</td>
<td>In his majles</td>
<td>An 80 year old gentleman. Meet with me even while using an oxygen tank to breath!!...met for 4 hours. Main topic – fish traps and the sea</td>
</tr>
<tr>
<td>Mohammed bin Issa bin sloum Al-Kubasi</td>
<td>March 7</td>
<td>Al Jamil -Al Shamal</td>
<td>Review the layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali Al Kubasi and his father Kahlifa</td>
<td>March 10</td>
<td>Fish traps of al shamal NW coast</td>
<td>A detailed tour of all fishtraps designation of owners, use, construction...etc.</td>
</tr>
<tr>
<td>Mohamed Saleh Ali al Fadalah</td>
<td>March 11</td>
<td>In his Doha Majlis</td>
<td>His life and war stories</td>
</tr>
<tr>
<td>Seif al Fadalah</td>
<td>March 13</td>
<td>Ruwais port- in al shamal</td>
<td>Fishing</td>
</tr>
<tr>
<td>Khaled Ali al Kubasi</td>
<td>March 13</td>
<td>UmmQabrain- al shamal</td>
<td>Review the layout of the town, a detailed description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Mohamed bin Issa bin Mohamed bin sloum al Kubasi</td>
<td>March 19</td>
<td>In his Doha Majlis</td>
<td>Poetry and his life in alshamal</td>
</tr>
<tr>
<td>Mohamed bin omr aldasim al kubasi</td>
<td>March 28</td>
<td>Site visit to Khwair</td>
<td>Village tour. description of life in the village including house to house tour of the site with names of inhabitants</td>
</tr>
<tr>
<td>Ali Shebib Manan’i</td>
<td>April 1</td>
<td>His Majlis in Abu Thlouf</td>
<td>Discussed his writings and the inhabitants of Abu thlouf wa al yusefiyah</td>
</tr>
<tr>
<td>Najla the wife of Mohamed bin omr aldasim al kubasi</td>
<td>April 2</td>
<td>Visit her in her home</td>
<td>Discuss women’s life, work, traditional food and games</td>
</tr>
</tbody>
</table>
The women of Al Shamal

The insights gathered from interviewing women in Qatar are usually very different from those of men. Dr Saca had the opportunity to meet with a few women in Al Shamal who are very active within their community and very involved in some of the main issues relating to their daily life, their relations with their families, household layout and room divisions, and relations between wives. Dr Saca received a special invitation to attend a private gathering of women called Fay al Duha in Al Shamal in 2013, in which elderly women share stories and knowledge of the past with each other and with the younger generation.

Some of the women interviewed include:
- Mrs. Kalthan – Umm Seif
- Mrs. Naflah
- Umm Nasser
- Naflah al Fadalah
- Mahra- al Fadalah
- Najla'Mohamed el Dasim

Headdress

There are different kinds of headdresses in Qatar that can be worn by women or girls and they have different names and functions:

*Al malfa*. When habitually worn by Qatari women living in the city, this headdress is made of light black cotton fabric. It is usually 2 metres long. The kind worn by Bedouin women is instead called *al smadah* and is made of a thicker black cotton fabric 4 metres long. The length and thickness of the headdress is necessary for better concealment, since Bedouin women do not wear an *'abaya* like city dwellers.

*Al batula [burka]*. The word is not of Arabic but of Persian origin. This kind of headdress is worn mainly by older Qatari women, above 50 years old, and by some younger girls. The *batula* face cover is also present in the UAE and Bahrain, and it is said that it is worn in all coastal cities of the Persian Gulf. Once the *batula* is worn, the woman should only take it off when she goes to bed. The *batula*’s length can vary; if short, it only covers the nose or the chin. The main parts of the *batula* are the fursa, a thick forehead piece for older women, thin for the young ones; the *qardah*, the opening for the eyes, and the *khad*, which covers the cheeks, nose and mouth area. The *sief* and *masater* are pieces of thin refined bamboo or *basjel* wood inserted in the *batula* just above the nose and on
the sides. The main purpose of these pieces of wood is to preserve the shape of the *batula*. The women interviewed highlighted that the production of the *batula* is the specialty of some women only. There is a special fabric imported from India or Iran, which is used to make the batula and nowadays women put tape on the inside of the headdress to prevent the blue color *nila* from rubbing on their faces.

*Al mulafa*. This headdress is made of heavy cotton fabric and is used by Bedouin women to wrap around their head, as well as their bodies.

*The abaya [bishet]*. Worn by Khaliiji women as well as Qatari women, this kind of black headdress is worn above the clothes and should be long enough the cover the ankles. There are many different kinds of *abayas* and each one is worn for specific occasions, times, seasons or for other reasons.

**Games played mainly by girls**

One of the women from Al Shamal, Najla’, explained that the *jadairah* is traditionally a girls’ game that she played with her friends in her village, al Jumail. She showed the team the one she had newly manufactured with her own hands in an effort to teach her grandchildren how to play. It is played with ten sea shells in each of the nine holes. The goal is to move them from one hole to another in a rotation.

**Food**

One of the other topics discussed by women during the interviews is the preparation of the traditional Qatari dishes. *Sh’itha, yeget, muhamarah, makhbous* are some of the foods that the women of the Al Shamal discussed at length, explaining the ingredients, how to cook them, and when they are eaten. For example, *yeget* is a yogurt based dish made of dried white yogurt-covered ghee and eaten with dates. It is served in the morning but is also taken on picnics.

Some of the interviews were conducted during truffle [*qama*] picking season, so Dr Saca joined in the truffle picking and learnt how to find them. The secret is to look for a plant called *raqruq* that would only grow close to the truffles [see Photo 15].

**The “Shell carpet”**

In Al Zubarah, archaeologists have been finding large amounts of shells scattered on the floors of excavated houses and wondered how all the shells ended up there, and for what purpose. From conversations with Najla’, one of the women interviewed, it became clear that this was common practice in all coastal villages.
In most instances a specific person was hired to go into the sea and gather the shells, which would then be distributed in the various houses, to be laid down in their courtyards.

This was done to make sure the courtyard looked clean all the time. It is, in fact, easy to clean it by sweeping or washing with water, and scorpions or other insects crawling on the floor would be more visible. Mrs Najla’ mentioned that when she and her sister used to go to the sea and collect shells to be scattered in their courtyard, they also caught fish in the fish traps (discussed in more detail below).

3.2.3 Village documentation – the people and their stories

Two months of visiting abandoned villages in the north of Qatar revealed the rich heritage of this area and the amount of information that can be gathered from the tribes who used to reside in these villages. Among the villages surveyed and researched are Arish, Al Jumail, Al Mafjar, Khweir, Umm Qabrain.

Interviewees were selected on the basis of their tribal affiliation in relation to the visited village. During each village tour an aerial map of the village was used to mark the building visited, as well as other important structures and complexes like wells, cemeteries, and rest areas [hotah].

The survey of abandoned villages focused on identifying the following issues, where possible:
- the tribe that lived in a specific village
- water sources, water reservoirs and distribution in the village
- buildings and their functions
- the owners/residents of a building
- household division
- schools
- movement between the village and the desert
- names of individuals with a prominent social role in the villages
- daily life
- fish traps
- relation to the sea – fishing/pearling/trade.

Arish – a village coming back to life

Al Arish Village is located on the northwestern coast of Qatar, just south of Khweir and north of Freiha [see Fig 14, p25]. The field visit to the town took place on February 16th 2012 and Dr Saca was accompanied by Khalifa bin Ali ‘bade al Nifahi al Kubasi and his son Hamad, Mubarak el Fadalah, and Khalid al Kubasi. Mr Khalifa is around 60 years old and his son Hamad in his thirties. The Al Kubasi family have resided in this village since 1920.
Fig 14: Location map of North West Qatar
<table>
<thead>
<tr>
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</thead>
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<td>(صاحب البيت)</td>
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<td>فضيلة على محمد بن صالح الفصالة</td>
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<td>17.</td>
<td>الشيخ/كبر القبيلة</td>
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<td>29.</td>
<td>عباسي بن مبارك بن خليفة الفصالة</td>
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</tbody>
</table>

Fig 15: Sample village survey sheet and map from the village of Al Mrafj
In order to have a better understanding of tribal genealogy it is useful at this point to briefly explain the name of the main interviewees from Arish:

- Khalifa (his name)
- bin Ali (the son of Ali - his father’s name)
- al 'bade (the *badidah* – “house/family name”)
- al Nifahi (the *fakhed* – tribal branch name)
- al Kubasi (the *Qabila* - tribal name)

A map obtained from Google earth was printed out and all the houses were numbered. The goal was to walk through the village and, whenever possible, record names of the owners of the houses and identify the structures by function (e.g. mosque, *majlis*, school, and water tank) [see Fig 15, p26].

Before the visit to Al Arish, Dr Saca was invited to visit Mr Khalifa’s Majlis to start the conversation and later head out to the site [see Photo 17, p29]. Mr Khalifa was a gracious host and was very interested in the QiAH Project’s work. Part of the conversation centred on the history of Arish, the various phases of habitation of the village, daily life when the village was fully inhabited, and when the village was abandoned. Mr Khalifa stated that there were two phases of residence/habitation there:

**The first habitation phase** (*al Nazla al Ulah*) was 1920-1937, during which there were predominantly eight families in Al Arish, consisting of:

1. Muhamed bin Khalifa bin Tokk
2. Khalifa bin Barghash
3. Mubarak bin Jasim bin Jasim
4. Abdullah bin Nasir bin Khalifa
5. Hashil bin Zayed
6. Abdullah bin Hashil

Mr Silham bin Eid al Kubasi acted as the “head man” during this phase of habitation of Al Arish, helping to manage the affairs of the village. This role continued until the second phase of habitation. For the residents of Arish fresh water was a serious concern, since their main source was Ain of Umm Qabrain, which was used exclusively during this habitation phase. The villagers used donkeys to deliver the water from the well to the village, which was 4km away from the village. Water was equally distributed to all.

It is important to note that during the first habitation phase the men worked as pearl divers and they were involved in the transport of lime (*jiss* and *froush*) and other materials to and from Bahrain.

**The second habitation phase** (*al Nazla al Thaniyah*) was 1951-1972, during which the rest of the Kubasi tribe moved to Al Arish. The spring of Umm Qrebah Ain was used as their fresh water source. The water was brought into the village by a *nashal* (a truck that transported water) and money was gathered from all the residences to keep the truck running and the water supply constant. The truck was driven by Khalifa bin
### Fig 16: Survey of Al Arish

<table>
<thead>
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<td>1.</td>
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<td>2.</td>
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<td>عضو بلدي من النزيلة</td>
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<td>4.</td>
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Dictionary note: everyone with no detailed last name belongs to the Nfaihi branch of al Kubasi tribe.
Ali and the money was calculated to suit the “social condition” of the residents. For example, women and family that were in financial difficulties would pay less than half of what a regular household would pay.

It is interesting to note that during the in-between years from 1938 to 1951 Arish was abandoned, and only two “homeless” individuals called Masud and al Hmadi resided in the village. During these years (1940-1951) the Kubasi tribe resided in Umm Qabreen, near their main water source.

According to Mr Khalifa, there is no information that mentions anyone residing in al Arish before 1920, and in 1972 all residents of al Arish where removed to Doha or Al Shamal.

Due to a lack of water the village had no agriculture and most of what the villagers consumed was imported from Saudi Arabia or Bahrain. The main imports were dates, sugar, coffee, and tea. Dates were also brought in from al Gharia and Khweir, other villages in northern Qatar, where dibs (date syrup) was produced in August or September for three months.

**Arish schools**

During the tour of Arish Mr Khalifa noted that learning was significant to the villagers. Throughout its history, Arish had two schools; the first and smaller school was built in 1953 and the house was rented from the sons of Mut’ab bin Jum’a- Khamis and Mohamed. The school had four students:

- Mr Khalifa bin Ali (the informant)
- Ghanem bin Abdullah
- Ghanem bin Mohamed
- Salem [Salum] name contraction indicated “slavery” origin.

The second and larger school was built by Khamis bin Mut’ab Bin Jum’a, who was commissioned by the government to build it in 1955-56, and it had 20 students. The students (of which a list with names and village affiliations was compiled) came from Al Arish, as well as Ain Mohammed, Leesha, and Khweir. Students were instructed up to the 4th grade by Mr Ibrahim Ibin Saleh, who was Palestinian.

Girls were not instructed in Al Arish, but they went to Khweir for their schooling. The mother of Ali, son of Mr Khalifa, studied in 1962 at the elementary school in Khweir.
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The Imams of al Arish

The *imams* are individuals that perform the call to prayer. In Arish, Sa’d bin Muhsen al-Murran al Kubasi was *imam from* 1956-1966, when he retired from old age. Rashid bin Mubarak al Danoun was also *imam and* Saleh Mohamed al Ansari, known as Zakaria, was the religious teacher (*mutawi*). Imam Rashid remained in his post until 1966, when he moved to al Shamal to remain the *mu’athen* until his death in 1971.

Poets of Al Arish

The Kubasi tribe appears to have counted a few poets among its members. The two mentioned by Mr Khalifa are Eid bin Selham and Abdullah bin Fayyad. They were both from the Sloum and the Simkhan branch of the Kubasi tribe. In a later interview with one of the famous Sloum poets, Mohammed bin Issa bin Al sloum Al-Kubasi, he discussed Nabati poetry, also called Bedouin poetry, which is a form of poetry written not in Fusha but in colloquial Arabic. Its main foci are love and stories of desert life. Some writers like Saad Al-Sowayan referred to Nabati poetry as the Oral Poetry of Arabia, as it is listened to, not read.

The Village of Umm Qabrain

The village of Umm Qabrain was where the main water source for the Al Kubasi tribe was located, as well as their residence from 1940 to 1951. It was also inhabited before the Al Zubarah war in 1937. On February 21st 2012 a group from Kubasi tribe (Khaled bin Muhsen bin Khalid el Muran al Nhai’i al Kubasi, Khalifa bin Ali al Nhai’i al Kubasi, Khaked Ali, Mubarak Fadalah and Ali bin Khalifa al Kubasi) accompanied the QIAH team to the site of Umm Qabrain [see Photo 19, p30].

Khaled Ali helped with locating houses on the map since he did some work on this site for personal interest. He provided pictures of some of the residences of Umm Qabrain, as well as the names of the individuals buried in the village cemetery. Mr Khalifa endeavoured to identify the houses, since the site is not well preserved [see Fig 17, p30].

The water well was clearly marked and the mosque was also identified. One of the houses belonged to Mohammed bin Ali Obaid al Nfaihi Al Kubasi, the first person in Qatar to receive a doctorate in psychology from the USA. The other location surveyed in Umm Qabrain was the cemetery. The interviewees mentioned a few individuals from the Al Kubasi tribe in Umm Qabrain who were buried there. Interestingly, the tribe continues to bury their dead in their ancestral village. Some of the individual buried in Umm Qabrain are:

- Mohamed bin Muhsen Dandun al Nfaihi al Kubasi
- Sheikha bint ‘Efah al Hajiree (from Kuwait)
- Rif’a bint Ghanem bin Touk al Kubasi
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**Fig 18:** Survey of Al Jumail

**Photo 20:** Mosque at Al Jumail

**Photo 21:** Mr Mohammed ibn Issa al Kubasi and Iman Saca in Al Jumail
**Al Jumail**

A short survey was conducted in Jumail by the QIAH team. Mr Mohammed ibn Issa al Kubasi, who is a very famous poet in Qatar, was the interviewee. Mr Mohammed lived in al Jumail until it was abandoned in 1972 [see Fig 18, p32].

Very often a house would have 2 independent sitting areas added to it. Both were mostly used by men. The *majlis* (with walls, roof and low windows) was used as a seating area in the winter and during daytime, while another space (*baraha* or *dekka*) with no roof and no walls was used for sitting outside at night, particularly after evening prayer.

The so-called sheik of Jumail inhabited a large house in the village and was mostly known as the *imam in* the village. It appears that the last *imam’s* who lived in Jumail was not actually from the region, but from Iran, and probably preached quite radical Shia Islamic doctrine, although this is still unclear at present (smoking *shisha/nargileh* for example was never really allowed in the village and was always perceived as *haram*, which it technically is according to the book, but this tradition tends to have been assimilated as part of local culture in most of the Gulf).

The mosque building appears to have been built or restored in 1964 and abandoned in 1972 [see Photo 20, p32]. It is not clear whether another mosque occupied the same place before, or whether there could have been another one elsewhere. The roof was ‘removed’ at a later date, probably indicating that when it started collapsing the villagers decided to remove the rest of the roof, in order to avoid debris falling all over the *iwans*. The existence of two *mirhabs* in the mosque is also unclear. Probably this is due to the fact that in summer it was too hot to pray inside the first *iwan*, so the inhabitants of Jumail decided to put up a second one, to pray outside during the summer months.

The fort of Jumail appears to have been abandoned already in 1816, when the Kubasi tribe arrived in the village for the first time. The walls are clearly visible and quite thick (ca. 1m), with large stones bases. The fort is located right in the centre of the village, next to the mosque.

The school was built in 1959 and abandoned in 1969, and is located a little outside the village, to allow pupils from the surrounding villages to access it more easily. The building contains 2 classrooms and a principal’s office.

The cemetery is still in use. Indeed all the Kubasi people who used to live in Jumail and their descendants are still buried here.

Agriculture in the mid-20th century was negatively perceived by the Qatari society, and farmers had a low status. Apparently most fathers would not allow their daughter to marry a farmer or a ‘planter’ (to use the Arabic slang word). People were not encouraged to plant seeds and produce oil due to the fact that once
importing became routine and water in the aquifer turned saline the farming activity gradually declined and people realised it had no future. Agriculture was no longer considered ‘modern’ and the few remaining farmers rapidly lost all support from the rest of their community.

The inhabitants of Jumail were semi-nomadic people, although the coastal villages were considered their permanent settlements. Men went herding inland for a few months a year and trading was carried out regularly. It took three days to reach Doha from Jumail on a donkey.

**Khweir village**

Mohamed bin Omar al Dasim al Kubasi was chosen as the interviewee for al Khweir because he is from the Dasim branch of the Kubasi tribe and they were the main residents of this village. He took the team around Al Khweir on March 28, 2012, identifying the houses in his village and the names of the residents as much as he could. Mr Mohamed was able to identify the mosque, the *majlis*, and the house of Hassan Abudul Rahman, the *mutawi* [religious teacher] of Khweir. He asked to return to the village with his wife, who resided in a large house in the village and remembered more about living there. Another tour of the village was scheduled with Mr Mohamed and his wife for the 2013 season.

Al Khweir or Khor Hassan, as it was originally called, is located on the northwestern coast of Qatar, just north of Arish [see Fig 14, p25]. According to Mr Mohamed, more than 70 families from the al Dasim branch of Al Kubasi tribe resided in Khweir. Their main source of income was pearl fishing and trading. Their main water source was located 5km southeast of the site. As mentioned earlier, water from certain springs was designated by tribal affiliation and this “division” was respected by all tribes. Al Thaqab was the *ain* designated for Al Dasim branch of the Kubasi tribe residing in Khweir. This *ain* was their main source of fresh water and in the earlier days they delivered it to the village via donkey. At a later time, water was carried by a water truck driven by a specific person from the village, whose job was to distribute water to the houses, or deposit it in the village reservoir. In this village, as in others, a specific person was assigned to monitor the water reservoir and grant supervised access to the villagers.
Fish Traps (Masaker) in NW Qatar

The northwest coast of Qatar is dotted with fish traps (masaker) and all the coastal villages visited and studied are linked to a number of them. These fish traps represented the main source of food and income for many of the villagers; they were well kept and well maintained for years. It has become apparent from preliminary fieldwork research on these fish traps that in the past both men and women owned them, and they both did the fishing.

After discussing the construction of fish traps with our interviewees, there appears to be two main types of fish traps: one is referred to as ma’mour, a fish trap built on the base of an older trap; the other is known as the bida’, a fish trap that is intentionally and newly constructed in a specific location where there was no previous fish trap. A third kind, very specific in terms of construction and location, was also mentioned and is referred to as yeder; this fish trap is mostly constructed in deeper waters and has extensions or arms protruding from it.

Ruined fish traps are called ghair ma’mour and their history is not too clear to many people, even to the interviewees living in Al Shamal. It is interesting to note that most of the fish traps near Freiha are considered masaker ghair ma’mourea. Even though these ruined fish traps were not maintained, they were used by many villages throughout history and since they were not designated to any tribe or individuals, they were used by all. More information on fish traps will be gathered from more fieldwork and a book the curator of the Library of Sheikh Hassan will acquire in 2013.

The construction of fish traps is not time consuming. All traps are made of porous and light black stones piled on top of one another and called froush. Fishing depends on the rotation of the earth and the movement of the tides, referred to in Arabic as madd and jazer. With the madd the fish comes into the trap and with the jazer, when the water recedes, the fish is trapped and subsequently collected by the villagers. In most of the visited villages and in between certain fish traps there are areas called bandar or marsa. These are areas where boats would dock to unload their goods. In order to reach the boast or ships Qatari people constructed sarouj, circular structures 4m in diameter and raised above water level, from which
You can load or unload cargo on the boats [see Photo 22, p36]. The traps can vary in size from a few metres to a few kilometres, and while some are constructed on the sea shore, others are built out in the sea. Those built in the sea are to be considered the earlier ones, according to Mr Khalifa.

**Fish traps Identification:**

Each fish trap was owned by a family and it could be named after the family or an individual, or it could be given a cultural or fun name. Men and women could own fish traps. The tribes who lived in the coastal villages were familiar with the names of the traps and their ownership, and they did not trespass on others’ fish traps. Ownership could also be transferred between families or individuals by purchase. In the early 70s the government of Qatar gave a monetary value to the fish traps and compensated the individuals who provided clear proof of ownership of these traps.

**Documented Masaker (fish traps):**

Fieldwork focused on gathering as much information as possible on the fish traps, past ownership, use and construction. Mr Khalifa Bin Ali al Eid al Nfaihi al Kubasi from the al Kubasi tribe took the team on a tour of all fish traps.

A list of Google maps were used to locate the fish traps on the northwestern coast of Qatar and fieldwork was conducted to identify these traps and gather basic information on them. During 2011-2012 it was only possible to identify fish traps from Al Zubarah to Khidaj village, located just south of Jumail. The data gathered relates to the masaker from the shores of Al Zubarah, Freiha, Arish, Khweir and Khidaj.

Al Zubarah fish traps are located around the island of Mjatelah, off the shores of Al Zubarah. There are four Al Zubarah fish traps and they are called Bu-hid, Al Rafi’, Al Yeryan, and the fourth is a nameless, ruined fish trap, possibly owned by Albin Ali.

Due to the low level of water it was possible to drive to the island by car for 3.5km on the water. This visit provided the team with basic information on the traps. It is interesting to note that not much information is known about the Al Zubarah fish traps that fall around the island of Mjatelah, due to the fact that these fish traps are considered to be the oldest in northwestern...
Fig 20: Al Arish fishtraps
Qatar. During the next season of QIAH work, Mr Khalifa will consult with some of his tribe's elders and try to provide more detailed information on these traps, so that a map to locate these traps can be drawn.

Below are two brief examples of the kind of data gathered about the Arish and Khidaj fish traps.

**Al Arish, from south to north:**
1. *Maskar Ji'dah* (Albin Ali) in ruins (the term used is *Ghair Ma'mour*).
2. *Maskar shridah*, constructed by Eid bin Silham. The trap has an older base, so it is considered a *ma'mour* fish trap.
3. *Maskar Mi'lay*, owned by a woman known as *Ya'idah*, who lived in Arish.
4. *Al Yaraf*, owned by Ali bin Mohamed bin Kafnah, is a *bida' maskar*.
5. *Maskar al E'bay* is a newly constructed *bida' trap*.

Both *Maskar Ji'dah* and *Mi'lay* were owned and/or used by Eid bin Said, the father of Silam bin Eid al Kubasi.

Looking at the map of this part of Arish [see Fig 20, p37] it is possible to clearly see the *bandar* or *marsa*, where the ships would dock to unload and load goods coming from Bahrain and India. The two *Sarouj* discussed above can also be seen on this map.

One interesting story shared by one of the interviewees during the fish trap visit of Al Arish highlights an important episode of the village's history. It is said that a tornado hit the village in 1924-23. Many residents of Al Arish died and numerous houses and tents were torn down. He also mentioned that many boats were ruined and a main source of income for the village was destroyed. According to the recollections of Mr Khalifa, this destruction occurred in a 30 minute period.

The example below pertains to the fish traps of Khidaj:
1. *Fshafish* is a large *maskar* going deep into the sea and used by Issa bin Khalifa al Kubasi.
2. *Al Yakoubi* fish trap (uncertain).
4. *Al Malay* fish trap. These were two separate fish traps later combined to become a larger one. This *maskar* is identified as a *ma'mour maskar* and is owned by a member of the Sloum family.

The above information is a brief of the work done in the 2011-2012 season. The work in the field and the data gathered proved to be of great value to the QIAH project's work. It enriched our knowledge of Al Zubarah, its hinterland, and the abandoned villages of the northwest coast of Qatar. It also established a level of acceptance and trust with the local community, especially the tribes of Al Shamal, and the respected elders of these tribes, men and women alike. It also became clear that the tribes of Al Shamal are keen on seeing their villages preserved and “activated”. These tribes, through their leaders or elders, and via general town hall meetings and workshops, should be involved in the decision making process regarding the future of the abandoned villages.
Library work and oral history

Sheikh Hassan Bin Mohammed Bin Ali Al-Thani, a prominent researcher who devoted his time to studying and documenting the history and culture of Arabia, in addition to a wider interest in culture, began collecting material in the early 1980s. In 2006, the library was annexed to the Qatar Foundation for Education, Science, and Community Development. For more information, go to http://www.qf.org.qa/community-development/protecting-qatar-heritage/the-heritage-library

During the 2011-2012 work season of the QIAH Project time was devoted to library research, in order to establish the historical context for the fieldwork in northwestern Qatar and in Al Zubarah. Dr Saca obtained access to Sheik Hassan’s Arab and Islamic Heritage Library in Doha, and the research carried out at this institution helped build the framework for the oral history fieldwork. Below is a list of some important sources the library contains on the history of Al Zubarah, the villages in the north of Qatar, as well as pearling and trading activities.

1. Bombay government records.
3. Lorimer, J.G., Gazetteer of the Persian Gulf, Oman and Central Arabia, 1908 and 1915. John Gordon Lorimer (1870-1914) was an official of the Indian Civil Service. Until 1970 the 6000 page Gazetteer on the history and geography of the Gulf region was considered a classified document.
4. Samuel Manestry and Jones Hartford, 1790. Reports on commerce of Arabia and Persia
5. سياك العسجد في أخبار أحمد نجل رزق الأسعد - المؤلف : عثمان بن سند البصري طبعة يمني 1315هـ

4.1 Educational Outreach

Since the beginning of this season, the Community Archaeology team focused on the creation of a multitude of public outreach and educational activities and programs. The main objective for the education and outreach program for the next three years is to continue the work started by the Community Archaeology Program during 2011-2012.

The focus of the 2013 season will be:

1. Formalising the relationship with the Supreme Council of Education via QMA, so as to organise both on-site and off-site school visits to Al Zubarah Archaeological Site.
2. Reassessing some of the new social sciences books and re-evaluating what is written in them about the archaeological and cultural heritage of Qatar (the first part of this literature survey was done in the 2011/2012 season).
3. Proposing to the SCE via QMA the creation of literature on Al Zubarah and other archaeological sites in Qatar, which could be taught or discussed in schools.
4. Consulting with teachers to design material to be introduced in the classroom regarding archaeological heritage and Qatari traditions.
5. The creation of literature in Arabic to be used during school visits to the site and during outreach activities. This will allow visitors to the site, the local community and Qatari students to be better informed and engaged. These publications will give a better understanding of the site and the importance of heritage preservation.
6. Continuing the training of a QMA team in the Department of Archaeology on various aspects of Community Archaeology, especially in relation to school education and outreach.
7. The use (via QMA) of the newly created website for Al Zubarah as a source of information on all Community Archaeology-related activities, including education, public outreach and oral history initiatives.
8. Continuing off-site activities for schools in Doha, such as mock excavations, lectures, PowerPoint presentations, sample archaeological finds for interactive display, pottery workshops, lithics presentations, and photo and film exhibits.
9. Continuing on-site tours and educational activities with a focus on Al Shamal schools, the ones nearest to Al Zubarah Archaeological Site.

Long term education and outreach goals:

1. Continue with the creation of literature in English and Arabic to be used in schools and in outreach activities and programs.
2. Work with the QIAH team responsible for setting up the visitor information centre at the Fort.
3. Create and update on-site educational panels, brochures, posters, postcards and other material to be distributed to the general public.
4. Continue organising workshops, public presentations, temporary exhibits, educational tours, hands-on activities for children of different ages.

5. Establish in collaboration with QMA and SCE a yearly training program for teachers on Al Zubarah and the Archaeological Heritage of Qatar.

6. Establish in collaboration with QMA and QTA a yearly training program for tour guides.

7. Create family oriented activities related to Al Zubarah, in an effort to reach out to the local community.

8. Work with education departments of Mathaf, the MIA and the National Museum of Qatar.

9. Coordinate with QMA's PR office, and enlist the support of the local media to disseminate the information on Al Zubarah and the archaeological heritage of Qatar.

10. Cooperate with and engage in Qatari cultural centres, Katara, Suq Waqif, the Qatar Foundation and universities, especially to organise joint activities and exhibitions related to Al Zubarah and the archaeological heritage of Qatar.

11. Support and be involved in, when permissible, the ongoing project that promotes the archaeology and the cultural heritage of Al Zubarah Archaeological Site.

12. Launch a series of ‘summer camp’ activities related to Al Zubarah Archaeological Site and Qatari natural and cultural heritage in general.

13. Establish a ‘traveling school bus’ to engage students in their schools with activities related to heritage and archaeology.

4.2 Oral Histories Collection

In 2011-2012 the QIAH Project started a strong Oral History initiative. The work achieved during the last season of fieldwork and the data gathered proved to be of significant value. It also established a level of acceptance and trust with the local community, especially the tribes of Al Shamal and their respected elders, both men and women alike. Although the 2011-2012 fieldwork season was short in terms of oral history work, the relationships that developed and the material that was gathered in a very short time provided significant knowledge about life in northwestern Qatar. The QIAH work should continue in future years with a few main objectives in mind:

1. Create a database to store the large variety of information gathered in the field, such as maps, photos, and videos.

2. Download and archive the audio and video collection gathered in 2011-2012, as well as digitise all maps used for identifying villages and fish traps.

3. Coordinate the work with the QMA’s department interested in this work and with the National Museum of Qatar.

4. Continue the fieldwork activities, such as meeting and interviewing Qatari people from the Al Shamal tribes to discuss issues related to the abandoned villages, Al Zubarah, pearl fishing, trading, daily life, water, genealogy, as well as other aspects related to their culture and history.

5. Explore in more detail tribal movement, land use, and the use of water and natural resources as key to tribal life in northern Qatar.
6. Focus on meeting with women who are considered “tradition keepers” in Qatar, especially through attending their Fay al Duha meetings.

7. Continue working with the men of the various tribes, especially on fish traps, tribal social structure, and other historical aspects of their villages.

8. Build on the strong relationships started with the History Department at Qatar University during 2011-2012. For the purpose of Community Archaeology initiatives, there is a clear and strong interest from some faculties and their students in participating in data gathering and conducting interviews, starting with their families. This is a very positive step that will help gather information on matters related to Al Zubarah Archaeological Site and its hinterland. At the same time, this involvement will help engage a group of Qatari students and their families in keeping their historical memory alive. In 2013 the QIAH team will work closely with QU to train, prepare and work with students to undertake the gathering of oral histories and traditions.

**Long term aims of the Oral History collection program:**

1. Continue the QIAH Project fieldwork and improve coordination with QMA and other Qatari institutions.

2. Work with QMA to create an online system to archive, update and make available to the public the gathered oral histories of Qatar.

3. Train QU students and QMA staff on basic oral history methodologies, so they can assist in the process of data gathering. To prepare the students, an oral history workshop will be conducted at the university with the involvement of QU teachers.

4. Involve school teachers – mainly middle and high school teachers – in the process of oral history and tradition gathering, in coordination with SCE. This will mainly be done through the preparation of a set of questions/issues which they will present to their students.

5. Create a mechanism to strengthen relations with the tribes of Al Shamal through town hall meeting, inviting them to Al Zubarah Archaeological Site, and involve them in various activities.

6. Involve the tribes of Al Shamal that have shown an interest in seeing their villages preserved and “enlivened” in the decision making process regarding the future of their former villages, through their leaders or elders, and through general town hall meetings and workshop.

7. Discuss with QMA the possibility of installing “Oral History Booths” at Al Zubarah or in certain venues throughout the city, allowing the general public to record their stories and recollections. These personal histories can then be reviewed by curators and, if deemed relevant, adapted and uploaded onto the website (provided permission is granted to use the material).

8. Organise, with the help of Al Shamal Municipality, a photo exhibit in Al Shamal on the ongoing work with the abandoned villages.

9. Based on the interest in Al Zubarah Archaeological Site shown by the media in 2011-2012, information on the “newest” discoveries at Al Zubarah should be sent to the media, newspapers and website, on a regular basis.

Gathering, incorporating and highlighting the rich oral history, folklore, stories and local traditions of the northwestern region of Qatar has proved to be an invaluable part of the mission of the QIAH Project. It
has become clear after carrying out some library research in 2012 that written information on the local history, traditions and culture of Qatar is scarce. The largest part of such information is preserved through the transmission of traditions and histories from one generation to the next in oral form. This is exemplified by the fact that on a couple of field visits interviewees asked if they could bring their grandchildren along with them, as they were very keen for them to listen to all the information they were giving, since such information is not recorded anywhere but in the memories of the elders of Qatar. There is therefore an immense wealth of oral histories and traditions in Qatar that should be documented and kept alive for future generations.
Acknowledgments:

H.E. Sheikha Al Mayassa Bint Hamad Bin Khalifa Al Thani
Chairperson of the Qatar Museums Authority

H.E. Sheikh Hassan Bin Mohammed Bin Ali Al Thani
Vice Chairperson of the Qatar Museums Authority

Sultan Muhesen - Senior Advisor, Director of Archaeology and Heritage - QMA, Faisal al-Naimi - Head of Archaeology Section - QMA, Adel al-Moslamani - Head of Restoration Section - QMA, Homam Zaim - Conservation Architect - QMA, Sami Eman - Restorer - QMA.


Conservation field team:
Mike Jastrzembski - master mason, Stefan Emmig - master stone mason, Thomas Knobloch - plaster specialist, Jörg Lohse - mason, Dominik Petzold - archaeologist, Christoph Thum - mud builder, Clemens Wardezki - stone mason, Jan Thiele - architect, Karl Woitke - engineer.
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**AL ZUBARAH ARCHAEOLOGICAL SITE**

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FOREWORD

The protection and preservation of Qatar’s heritage is of fundamental importance. At a time when our world is changing at an alarming rate we need to remain mindful of our past. For it is only through our understanding of the past that we can hope to improve our lives in the future.

This Handbook is about how we can protect, preserve and present the architectural remains of Al Zubarah. This is not only important for Qatari people but for people everywhere. The site provides us with a testimony of global trade and cosmo-political connections. The concepts and methods compiled here will provide the basis to preserve and maintain Al Zubarah’s remains, so that we may continue to visit and experience the site in its true form.

Prof. Dr. Sultan Muhesen
Senior Advisor
Director of Archaeology and Heritage
Qatar Museums Authority

Carsten Niebuhr’s map from 1765 mentioning “Gattar”.
INTRODUCTION

HOW TO USE THIS CONSERVATION HANDBOOK

Since we started work on the conservation concept for Al Zubarah Archaeological Site there has been a tendency to reduce the information to a simple “user friendly” manual. As soon as we started compiling all the material related to the conservation and protection of Al Zubarah, however, we realised that a simple manual would not have the capacity to cover everything. This Handbook brings together all the existing information on the site. This includes information from site reports and archive material. It also makes the information more easily accessible to people involved in the conservation process.

The collection phase of the data also made it clear that different groups are involved in the conservation process of Al Zubarah and each of these needs to be addressed. These are groups both within the Qatar Islamic Archaeology and Heritage Project (QIAH) and within the Qatar Museum Authority (QMA).

The Handbook provides guidelines for the conservation and consolidation of architectural remains at Al Zubarah Archaeological site. It will be modified and updated according to the evaluation of regular monitoring and the assessment of executed works, in coordination with the QMA, QIAH experts, the crafts persons, conservation architects and international consultants. Notably, the section on fiches techniques will be expanded over time, with input by conservation craft persons and restorers and their on-site experience.

The Handbook has been structured into four main parts:

PART 1 Basics:
compiles available information on (building) materials and its deterioration patterns, as well as environmental conditions. It also provides also general introductions to the regional architecture, building terminology, and references.

PART 2 Conservation Concept:
introduces to the conservation concept and explains general solutions with “do and don’t” case studies to provide guidelines for conservation supervisors.

PART 3 Conservation Manual:
contains fiches techniques detailing specific technical solutions for the conservation works presented in a simple and easy-to-understand manner designed for the craftsmen and the workers. The information and instructions presented in the fiches will help the workers in the execution of the work. However, a case-by-case decision on-site by the supervisor is always necessary.

PART 4 Appendices:
provides comprehensive additional information, reports, analyses, templates, and manuals as well as conservation schemes for specific areas at Al Zubarah Archaeological Site.

Moritz Kinzel
København, September 2012
I. PREFACE

The Preface outlines the scope of the Conservation Handbook. It introduces the concept of “conservation of ruins” and identifies the visionary strategy for all concerned parties. Part Two of the Handbook reviews the overall philosophic approach to the conservation of Al Zubarah, building upon the recent evolution of the conservation theory for earthen architecture.

I.1 Conservation Handbook

This Handbook is built upon a shared vision for the future of the site, which is the result of a common perception of both the archaeologists in charge of the excavation and the heritage and conservation teams. Input from laboratories, craftsmen and conservation architects are included to make the proposed strategy and the technical fiches realistic and technically sound.

The Handbook is a tool to guide the activities and direct the work on site, setting a series of principles and techniques that can be applied in a “mechanical” and “standard” way by technicians and workers.

It presents a series of “cases” and proposes, through simple “technical fiches”, practical solutions for the teams in charge of the conservation of the site. The effectiveness and the actual impact of these techniques on the site will be reviewed over time and the handbook will be regularly updated to take in these new techniques.

The manual aims to achieve a higher degree of uniformity in the solutions applied to the site and to avoid unsuitable, personal decisions by middle-qualified foremen and builders. It is expected that the handbook will play an important role in the coming years and it is hoped that it might become a scientific reference for the entire region, beyond Al Zubarah.
I.2 Conservation of Ruins

Preserving Al Zubarah Archaeological Site is a titanic and almost impossible task. Indeed, the very idea of “preserving the ruins” is in itself both a technically controversial issue and a technical nonsense as we aim at “freezing” the decay, which has no specific significance or value but is simply the result of a combination of natural and man-made decay over time. Traditional approaches to the conservation of ruins ranges from the “freezing” of existing ruins to the almost complete reconstruction of a site. Intermediate solutions range from the abstract “plan-like” reconstruction of walls to more “romantic” partial reconstructions of the ruins as “more stable ruins” or even as “more ruin-like ruins”.

Though the concept of “preserving ruins as ruins” has a romantic touch, it is likely one of the most challenging in 21st century conservation. Al Zubarah archaeological site becomes, therefore, an extraordinary opportunity not only to test state-of-the-art techniques and methodologies, but also to reconsider the actual sense and scope of conservation and restoration of ruins from a conceptual point of view.

Our endeavour is an attempt to slow the rate of decay in a particularly harsh climatic environment. Therefore, our activity cannot be perfect or everlasting. Before we begin, we need to fully understand why we want to do this work, what it implies and what aims we hope to achieve. Aside from the essential scientific issues related to the selection of the materials and building techniques to accomplish this task, we need to consider the full scope of this project and its aesthetic and theoretical implications.

What solution should be adopted for at Al Zubarah?
At the technical level, “conservation of ruins” strictly overlaps with the concept of “continuous maintenance” based upon a state-of-the-arts “monitoring” of the evolution of the site and of the vestiges. However, it is also more than that. Not only should we continuously remove dust and sand, clean and re-point, check and replace individual stones and preserve remaining plasters, but we should also fill in voids, partially reconstruct window sills and doorways, rebuild loose masonries, and replace entire rows of decayed stones with more resistant ones. We are not simply “conserving” and “maintaining” the remains but we are actually replacing, rebuilding and transforming the site. We are working at the edge of the traditional post Venice-Charter doctrine, not only on fragile remains, but also on a “fragile” scientific and theoretic ground.

What principles should direct our actions?
What projected result are we looking for in two, five or twenty years?
QIAH Project aims at achieving a certain level of coherence, clarity and sustainability in the conservation interventions. Original and restored colours, surfaces, masonries and plasters should be able to convey a clear and understandable message to visitors without leaving room for ambiguities and misinterpretations.

The QIAH team has set general principles for the project based notably on the driving concept that “we want to preserve Al Zubarah, not to rebuild it”, in order to offer visitors, specialists and laymen alike the image of an authentic archaeological site and not of a superficial, reconstructed heritage village.
In a recent British publication\(^3\) devoted to the conservation of ruins and archaeological sites, Giornata Rizzi, an Italian architect active in the conservation of archaeological sites in Europe and the Middle East, draws our attention to that:

“There is no such intervention that satisfies all the criteria of an abstract idea of ‘conservation correctness’, that is irreproachable from a theoretical and a technical point of view: each site has a different story, each calls for a specific approach. In conserving a ruin, it is impossible to be neutral. Experience teaches that, no matter how cautiously the work is designed, a conserved ruin always bears the traces of the interventions carried out. But if one cannot be neutral, one can at least try to be elegant and effective.”

Rizzi also underlines the importance of the preliminary activities to be carried out on a site before launching the conservation works. This can help us in defining the principles guiding our intervention. According to his vision, the architect in charge of the project should have a profound knowledge of the architectural body he sets to conserve, of its built form, history and of past interventions. He should have a perfect insight into its structural behaviour, a solid understanding of the materials and a deep comprehension of the mechanisms of decay active on the site. In the case of Al Zubarah these elements have been taken into consideration and high-quality scientific information has been collected and produced by the QIAH teams excavating on-site since 2009.

The comprehensive studies and analyses carried out in past seasons by the archaeological and the conservation units of the QIAH project – a large group of highly qualified archaeologists, architects, scientists and technicians – has allowed us to reach an in-depth knowledge of the history of the site and of its evolution, and a clear understanding of technical (material) and aesthetic characteristics of Al Zubarah at the height of its occupation.

Ongoing intensive archaeological research and excavations at the site have shed light upon the social, economic and ecological structure of Al Zubarah society in the late 18th and 19th centuries. Furthermore, excavations have uncovered previously unknown major architectural features and have recovered fragments of the wooden and gypsum decorative elements that composed the ornamentation of Zubarah’s mansions, forts and houses. These elements, carefully collected, stored and documented, offer us a vivid glimpse of everyday life in this pearl fishermen’s city.

The ambitious and comprehensive archaeological project launched by the Qatari authorities, with the scientific support of the University of Copenhagen, has allowed for a comprehensive survey of all archaeological sites along the Qatari northern coast and of the surviving traditional villages throughout the region, offering conservationists, archaeologists and visitors an invaluable comparative framework. Similarly, laboratory tests carried out in past seasons, and the tests carried out in situ on plasters and masonries, have enabled us to reach a good understanding of the physical, chemical and static issues typical of the ruins of the city of Al Zubarah.

Finally, the mechanisms of decay of the vestiges have also been investigated and understood, though more data on anhydride plasters and gypsum-based mortars still needs to be collected.

Likely, the only element partially missing in the vast documentation collected until now is the scientific analysis of the earlier conservation campaigns undertaken in Al Zubarah. This Preface explicitly deals with the subject, with the aim of identifying the theoretical framework of this earlier campaign and of assessing its actual impact on the physical remains.
I.3  Past Interventions in Al Zubarah

I.3.1 Historic Introduction

The ruins of Al Zubarah constitute not only the largest and most important Qatari archaeological site, but also the most complete and well-preserved pearl trading and diving town of the 18th-19th centuries. The site not only reflects the history of tribal migration in the Arabian Gulf (as it was founded by merchants arriving from Kuwait and Basra in the search for pearls), but also represents a unique mode of occupying a fragile desert ecosystem, which includes a particular system of water management.

During the mid to late 18th century, Al Zubarah was the Gulf’s most important trading hub, connecting the Indian Ocean with Arabia and western Asia. The site highlights how trade and exchange connected people from East and West economically, socially and culturally, making Al Zubarah a non-European, traditional form of settlement encapsulating unique anthropological and social historical themes. The different components of Al Zubarah’s urban plan show that the settlement was conceived and implemented from the outset. The layout of the town shows, therefore, both the sophistication of the planning principles, and the capacity of Al Zubarah’s rulers to control and direct the social and economic forces driving the town’s creation.

The site of Al Zubarah was mostly abandoned in the 19th century and it has been only briefly and partially reoccupied since then. The early abandonment of Al Zubarah at the beginning of the 20th century has helped to preserve the detailed urban layout of an 18th-19th century pearl fishing and trading town. Though some sectors were voluntarily destroyed in the 1970s (Qalat Murair), most of the decay within the area is the result of natural causes and of the restorations in the 1980s.

The site remained almost completely abandoned until the 1980s, when a major conservation campaign was launched. When considering the overall layout of the site, we should keep in mind that a significant percentage of what is currently visible at Al Zubarah is the result of that excavation campaign. These works were documented at the time by a publication3 in Arabic and by some colour photos (collected by QIAH), although unfortunately no complete record of the intervention has been kept.

I.3.2 The Cultural and Theoretical Framework of the 1980’s Campaign

The review of the large-scale works carried out in the 1980s underlines the strong impact of the theoretical choices that were made at the time. In order to define the new guidelines, we should not only focus on the mechanisms of decay of these earlier “restorations” but also identify the aims and implications of the conservation and presentation choices made at the time.

The team in charge of the works realised that it was impossible to uncover the ensemble of the city and opted for the definition of “priority areas”. Therefore, the campaign in the 1980s focused on the external city wall, which was extensively rebuilt with cement mortar and local stones, and on a series of punctual excavations, the so-called Northhouse (QMA2), the Suq area (QMA1), and the fortified Compound (QMA4).

3 Kholafi 1987
The 1980’s campaign did not aim at reconstructing archaeological remains and none of the remaining structures was rebuilt to the original roof level. Similarly, no interior was “completed” to offer a more complete image of what the buildings used to look like, and no new structures to favour the visit were added to the ruins, even though relatively heavy work took place and significant reconstructions of partially collapsed walls and vaults were carried out.

The driving concept of the conservation and presentation works was to present a regular plan of the ruined structures, to make the remains more easily “understandable” for the visitors. Therefore, original walls were “completed” with the addition of courses of stone to reach this abstract level, while higher standing walls were simply “capped” with a layer of hard impermeable cement-based mortar (upon which often was added a final course of stone capped with a more visually-neutral white cement mortar) to reach a regular level permitting the “reading” of the architecture.

The 1980’s project aimed at presenting Al Zubarah as an archaeological site and as a major consolidated ruin. The excavated areas were respectfully considered and treated to reach an abstract “plan-like” image underlining their “archaeological” significance and presenting them as “timeless” remains unearthed from the desert sand.
I.3.3 A Preliminary Assessment of the 1980’s Campaign

A scientific assessment of the 1980’s campaign underlines three major issues:

1) From many points of view, the driving concepts upon which the campaign was based were “modern” and coherent. The approach is notably at odds with plans that blur the line between “original” and “reconstruction”, aiming to transform archaeological sites into a pastiche “heritage” site.

2) Unfortunately, however, while the “theoretical” approach still seems scientifically correct (other tougher options for the presentation of the ruins might have been made), the quality of the technical work on the original masonries and plasters did not meet the same standards. The reliance upon strong modern building materials for mortars and masonries (cement capping and harder stones were regularly used for the added layers with a dramatic impact on the overall stability of the walls that were “restored”) on the one side, and an overall misunderstanding of the decay mechanisms of the original masonries after their excavation on the other, have led to a dramatically increased rate of decay not only of the additions in the 1980s, but also — and mainly — of the “original” parts of the structures.

3) The second major lesson to be learned from the 1980’s experience is that no single “once and for all” campaign can reach a long-lasting impact on such a vast and complex archaeological site. The evident decay of the areas “restored” in the 1980s has been further accelerated by the absence of regular maintenance at the site once the campaign was over. The 1980’s project lacked a long-term strategy and management guidelines and mechanisms for guaranteeing its sustainability.

Furthermore, the 1980’s campaign did not have a “vision” for the ensemble of the city. It focused solely on punctual elements, without proposing a comprehensive strategy for the entire site. Conservation works dealt exclusively with the areas that were uncovered and it never tackled the ensemble of the city. No comprehensive plan for conservation and presentation was ever drawn.

Simone Ricca, December 2012
Historic building stones
(mainly beach rock)

Aeolianite (mainly 1980s repairs)

“Original” historic wall and floor-plaster (anhydrite or lime-based)

1980s cement

Historic wall mortars

QIAH-repairs (stones)

new plaster (QIAH)
(at the moment lime-based)

new wall mortar (QIAH)

Plaster (surfaces) consolidated

(Quartz) sand
PART 1
BASICS
ENVIRONMENTAL CONDITIONS & STATE OF CONSERVATION
Introduction to Part 1

Part One of the Conservation Handbook compiles basic information on Al Zubarah Archaeological Site: its archaeology, environmental conditions, state of conservation, deterioration forms, and building materials.

The basic research upon which the conservation strategies and concepts are based are presented here. There is a brief introduction for each area of excavation and the main features of the site. The results of the analyses of climate data collected at Al Zubarah are presented, as well as some thoughts on salts in building materials. The illustrated glossaries are a work in progress. We hope to develop this further and to develop a tool to encompass building terms, building types, and building technologies.

Only through our knowledge of the basics can we formulate a conservation strategy that will be implemented in the field.
**AL ZUBARAH ARCHAEOLOGICAL SITE**

**BRIEF INTRODUCTION**

Al Zubarah Archaeological site covers an area of approximately 400ha. Situated on Qatar’s north-west coast, it includes the town, the harbour, a sea canal, two screening walls, Qal’at Murair and Al Zubarah fort, which was built in 1938.

The QIAH Project has launched archaeological investigations in five new major areas inside the town, carrying out a survey and excavations at Qal’at Murair, and an intense conservation program to preserve the exposed architectural remains. Excavations have revealed the well-preserved remains of courtyard houses, a souq, parts of a large, palatial compound and segments of the stone build town wall. The so-called excavation points (so far ZUEP01 to ZUEP12) covering some Living quarters with courtyard houses (ZUEP01), the suq and harbour area (ZUEP02), some brush huts so-called Barasti or Arish3 (ZUEP03), the palatial compound (ZUEP04), an midden area extra muros (EP05), and a walkway with other building structures along the town wall (tower 8/ ZUEP10).

Ceramics and coins found here attest to Al Zubarah’s far-reaching trade and economic links in the late 18th century, with artefacts from eastern Asia, Africa, Europe, and the entire Gulf region. Diving weights, Anchors, a pearl merchant’s box and other material culture illustrate the close connections between daily life in the settlement, sea trading and the pearl “industry”. These close associations between the inhabitants and maritime trade and commerce is further shown by the drawing of a dhow, found incised into the wall plaster in a room of a courtyard building (ZUEP01).

Al Zubarah is an outstanding example of an 18th-19th century pearl fishing and trading town. It is preserved in its entire urban layout with a clearly defined, pre-planned qibla-oriented town grid. Al Zubarah is the only place in the Gulf which still shows the complete layout and fabric of a settlement dating to this crucial and formative period in the region’s history.

In the town, at least four mosques have been discovered, as have four “fortified” structures. The largest of these is seen as a palatial compound. The commercial complex of the town including, a suq area, is situated next to the harbour zone of Al Zubarah and shows storage, warehouses, shops and production areas as well as a Khan-like building. South of this, near the sea line, remains of Barasti or Arish palm leaf huts, traditionally used by newly arrived inhabitants and pearl divers, have also been recorded.

Al Zubarah is the only known town in Qatar with a town wall. The 18th century town wall is around 2.5 km long and it has 23 towers. When the town shrunk after the 1811 bombardment a second town wall was erected encircling a much smaller area of 10ha.

It is striking that the buildings at Al Zubarah are predominantly stone built houses, requiring enormous efforts, economically, and on human resources. In other settlements in the Emirates the main components of the towns were primarily palm leaf architecture and only a minority of the buildings were made of stone.

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3 Piesik 2012
There was, however, one very important resource they were missing: water. The fortified settlement of Qal‘at Murair was built to protect and control the nearest wells and water recourse for Al Zubarah. It was linked with the town through a canal and two so-called screening walls, which might be part of a water supply system, overlaying partly the earlier canal. The canal seems to have served as a direct transport link to supply the ships in the harbour with water.

Building materials were mostly sourced locally. Beach rock and conglomerate stone were cut from the ground. Lime-stone (Dolomite) and Aleolite material was brought in from the plateau between Qal‘at Murair and Freiha. Anhydrite as well as gypsum was extracted from the sabkah or nearby outcrops along the former shoreline. Timber had to be imported. It is unclear so far how intense the hinterland was used for agricultural activities (e.g. date palms). For some of the streets, several layers of plaster floors have been discovered and suggest a regular maintenance of the street surfaces.

On the following pages each excavation area will be presented with overview images or plans. Some of the characteristic features appear in detail.
Excavation point 01 (ZUEP01): Living quarter with courtyard houses. In one of the houses a dhow was depicted in the wall plaster. This feature was documented carefully in different techniques. It was photographed, drawn, copied with a silicon moulding, scanned with a high-resolution scanner and with photogrammetric techniques. The courtyard houses show bended entrances, reception rooms (majlis), kitchen areas and an arcaded Ivan.
ZUEP02 - Commercial Centre (Souq)

Excavation point 02 (ZUEP02): The Commercial complex of Al Zubarah is situated next to the harbour zone and includes warehouses, storage, and shops. The warehouse incorporates some date presses (madbasah) and a courtyard. The warehouse has a straight entrance to allow direct access to the central courtyard. The room cells of the suq are built in two rows and extend from the earlier excavations (QMA1) to the recently exposed areas (ZUEP02).
Excavation of the Palace started in early 2010 and has so far exposed one of the nine main courtyards. Decorated plaster and elaborate room arrangements were discovered. The walls are predominantly built from beach rock rendered with an anhydrite-based plaster.
Town wall and Towers

1. Tower 8 and ZUEP10 (2012 before the consolidation).
2. Tower 7, collapsed outer wall face (2010).
3. Town wall at ZUEP04 (2012 after stabilisation).
4. Tower 18, seen from NE (2009).
QMA 1 - Commercial Centre “Suq”

QMA 2 - “North house”
QMA 3 - “Industrial Area”

QMA 4 - Fortified Compound
GENERAL ON-SITE CONDITIONS
A SHORT SUMMARY

Al Zubarah’s status as a historic site and an authentic representation of past cultural traditions is threatened by harsh environmental conditions. Erosion caused by the sea, salt efflorescence and crystallisation, wind, drastic change of temperature during the day and human activities are the main issues affecting the conservation of Al Zubarah.

High evaporation rates and the proximity of the sea result in a very high rate of air salinity. This is coupled with very high average of daily and annual temperature ranges, which can reach up to 55°Celsius during the summer months. Sampling and subsequent analysis of exposed mortar and gypsum building materials from Al Zubarah indicate very high salinity concentrations in both mortar and gypsum, which can reach >30% in the sand and soils on-site as well as approximately 15% in the wall structures. This high salinity content causes chemical reactions between the plaster and mortar, resulting in the disintegration of the structural integrity of walls.

Furthermore, strong winds from the north/northwest have undermined the foundations, resulting in structural collapse, while the erosion of wall gypsum plaster has caused the core building materials to fall apart. Heavy winter rains and a constant change of humidity during the day (averaging around 20% to 50%) also puts a lot of pressure on the building materials.

These natural environmental agents are difficult to mitigate against. In general, there is also a huge impact from wash-out and blow-out processes on the walls, e.g. the very soft beach-stones (type “Ag”) are in a very poor state. Erosion has left voids within the wall structures, as well as the disintegration of entire wall segments.

Most of the building materials were not chosen to perform under these environmental conditions: e.g. the soft beachrock was used inside walls and was protected by plaster. The same is true for the interior plasters.

Although the architecture at Al Zubarah can be seen as “stone architecture” it shares several characteristics with earthen architecture. The decay process of the so-called beachrock has more in common with the erosion of mud bricks than with the deterioration of building stones.
GENERAL ON-SITE CONDITIONS
A SHORT SUMMARY

- Temperatures between 5°C - 55°C
- Heavy winter rains
- Strong north/northwest winds
- Up to 30% salt in soil/sand
- Up to 16% salt in wall structures
- 20% - 50% changes in humidity during day

Diagram:
- Earth roof
- Al manghour mats
- Al Danshal (timber)
- Basjeel (bamboo strips)
- Anhydrite plaster
- Beachrock with soil/lime mortar
- Plaster floor laid on pavement
- Lime + anhydrite plasters (smooth)
- Window screen (gypsum grill)
- Anhydrite plaster ("hand tooling")
- Beachrock, disintegrated building materials
- Aeolian out-blow + pluvial out-wash
- Poor bonding of plaster to wall stones
- Crackling plaster
- Salty soil deposits
- Voids in wall structure
- Plaster showing various damages due to different sun intensity!
ENVIRONMENTAL CONDITIONS
CLIMATE DATA (MONITORING)

Fig. 1, 2, 3: Temperature/humidity data loggers at QMA2 in Al Zubarah town (D1, D2) and HAB54506 at Al Zubarah Fort (indoor).

Fig. 4: Positions of the temperature/humidity data loggers in Al Zubarah town (D1, D2, D4, D5, HAB54579), at the research station (D3), and in a building of the fort (HAB54506)
CLIMATE OF QATAR
IMPACT ON THE WEATHERING OF BUILDING MATERIALS

The climate of Qatar as described by the Encyclopaedia Britannica as follows:

“a notoriously unpleasant climate. Temperatures are high, though winters may be quite cool at the north-western extremities. Summer (June to September) is very hot with low rainfall. Daily maximum temperatures can reach easily 40°C or more. Winter is cooler with occasional rainfall. Spring and autumn are warm, mostly dry and pleasant, with maximum temperatures between 25°C and 35°C and cooler night temperatures between 15 and 22°C. The sparse rainfall occurs mainly as sharp downpours between November and April and is higher in the northeast. Humidity is high. The little cloud cover is more prevalent in winter than in summer. Thunderstorms and fog are rare, but dust storms and haze occur frequently in summer. The shamal, a wind that blows predominantly from a north-northwest direction during the summer, is seldom strong and rarely reaches gale force. Squalls and waterspouts are common in autumn, when winds sometimes reach speeds of 95 miles (150 km) per hour within as short a time as five minutes. Intense heating of the land adjacent to the coasts leads to gentle offshore winds in the mornings and strong onshore winds in the afternoons.”

Temperature and humidity data for Doha on the East coast of the peninsular is summarised in Fig. 5.

Temperature, humidity and wind all contribute to the weathering of building materials. A bigger range in temperature during the day will lead to an increase in thermal dilatation and, eventually, greater potential damage to the building through the development of cracks. Building materials with distinctly different thermal expansion coefficients (> 10-5/K) are particularly prone to damage. The heating of wall surfaces depends on the duration of direct sun exposure and the absolute temperature high. Therefore, the weathering of building materials through thermal dilatation primarily takes place during summer.
Humidity is a problem during the winter months, when it exceeds 74.6%, the value of deliquescence and the crystallisation of sodium chloride (at 20°C). The repeated crystallisation of sodium chloride in the pores of building materials eventually leads to a weakening of the fabric and, ultimately, to crumbling. The effect of repeated deliquescence and crystallisation of sodium chloride can be seen everywhere in Al Zubarah, where the debris of beach rock (especially type AG) accumulates up at the bottom of walls. Strong winds and sandstorms also contribute to the weathering of building materials by the transport of sand grains which act abrasively on the surfaces.

In order to gather detailed information on the climate of Al Zubarah, seven temperature/humidity data loggers were distributed over the town area, at the research station and inside a building of the fort (Fig.1 to 3). The localities are marked in Figure 4. The data loggers were distributed with respect to different geographical positions (close to the sea, more inland) and exposure situations (free exposure, protected position in a niche, wall crevice or under a stone, inside a building). One of the data loggers (D2) failed to record data over a longer period of time (more than several days). All data loggers are listed in Table 1 with their number, geographical position, exposure situation, and recording time.

Figure 6 shows that the data collected so far is fragmentary. However, the incomplete bell-shaped average temperature curve for 2011 is in agreement with the complete minimum and maximum temperature curves for Doha in Figure 5. Figure 7 shows the corresponding humidity curves.

<table>
<thead>
<tr>
<th>Number</th>
<th>Position</th>
<th>Exposure</th>
<th>Recording time</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>QMA 2</td>
<td>free (at top of a pole)</td>
<td>22.03. - 30.05.2012</td>
</tr>
<tr>
<td>D2</td>
<td>QMA 2</td>
<td>free (at bottom of a pole)</td>
<td>22.03. - 23.03.2012</td>
</tr>
<tr>
<td>D3</td>
<td>Research Station</td>
<td>free (west gable of workshop)</td>
<td>22.03. - 30.05.2012</td>
</tr>
<tr>
<td>D4</td>
<td>QMA 2</td>
<td>protected (in a wall crevice)</td>
<td>22.03. - 30.05.2012</td>
</tr>
<tr>
<td>D5</td>
<td>EP 04, tower 8</td>
<td>protected (under a stone)</td>
<td>22.03. - 30.05.2012</td>
</tr>
<tr>
<td>HAB0054679</td>
<td>QMA 2</td>
<td>protected</td>
<td>16.01. - 16.02.2011</td>
</tr>
<tr>
<td>HAB0054506</td>
<td>Al Zubarah Fort</td>
<td>protected (inside a room)</td>
<td>21.03. - 20.09.2011</td>
</tr>
</tbody>
</table>
A comparison of the curves shown in Figures 6 and 7 and Figures 8 and 9 shows that temperature and humidity are inversely correlated: humidity is low when the temperature is high and vice versa.

Figure 8 shows that the daily temperature maximum occurs between 12 and 13 hours, while the lowest temperatures occur in the time interval 24 to 3 hours. The temperature peaks are lower and broader for data loggers kept in protected positions (e.g. D4, D5). The maximum inland temperature (D3) is a little bit higher than the maximum temperature close to the sea (D1, D2). The recorded temperature data – although it’s not yet complete – enables a reasonable assessment of the daily and annual air temperature course. What is missing is surface temperature data for building stones and plasters to appraise the effect that thermal dilatation may have on them.

In Figure 9, the green horizontal line marks the deliquescence of sodium chloride. At 20°C and 74.6% relative humidity solid sodium chloride liquefies to a saturated brine. According to the humidity curve shown in Figure 9 this happens during the night hours when the temperature is close to the minimum. In the morning when the temperature rises and the humidity decreases and falls below the critical value of 74.6% sodium chloride crystallises again from the saturated brine. Deliquescence and crystallisation of sodium chloride takes place preferably in the colder winter period, as is shown in Figures 10 and 11.

It can be said that salt crystallisation is a weathering factor which is most active in the winter period, while thermal dilatation occurs predominantly during the summer. Our information about the impact of climate on the weathering of building materials at Al Zubarah will be improved with more data from well-positioned data loggers over the area. The evaluated data of the seven data loggers is presented in Tables and Figures in Appendix 8.

Robert Sobott, July 2012
Fig. 8: Temperature curves from data-logger D1 - D5 for the time period 22.03. - 23.03.2012

Fig. 9: Humidity curves from data-logger D1 - D5 for the time period 22.03. - 23.03.2012
Fig. 10: Temperature / Humidity curves from data-logger D5 for March 2012

Fig. 11: Temperature / Humidity curves from data-logger D5 for May 2012
WEATHERING PROCESSES UNDER THE ENVIRONMENTAL CONDITIONS AT AL ZUBARAH

The environmental conditions at Al Zubarah are determined by distinct daily changes in relative air humidity, frequent strong winds blowing mainly from northern directions, and the abundance of sodium chloride transported by sea water and wind. These three factors give rise to intensive physical and chemical weathering of building materials. Since they are unchangeable the consequences can only be mitigated by the choice of appropriate building materials and continuous maintenance.

Physical weathering processes
Physical weathering at Al Zubarah is mainly caused by wind erosion. Strong winds carrying sand particles act much the same way as industrial sand blasting. Soft and weakly consolidated building stones such as beachrocks are preferably affected and definitely need a protective plaster.

Thermal cracking of individual or composite building materials can be the consequence of two different processes. In the first case it is caused by weakening the bonds between the components of a building material by thermal stresses induced by anisotropic dilatation of the components on a microscopic scale due to repeated rapid and great temperature changes. An example for this process is the cracking of a boulder in the desert where daily air temperature differences up to 50°C are not uncommon.

In the second case, the composite structure of a building unit is disrupted by sheer stresses in the interface of building materials with distinctly different thermal dilatation coefficients. To become effective this process requires large temperature differences. A worst case example would be a thick, insulating render with a high thermal dilatation coefficient on a stone wall surface with moderate to low thermal expansion. Thermal cracking is supposed to play a subordinate role in the physical weathering of building materials at Al Zubarah. Although absolute temperatures can be very high, daily temperature changes are gradual and the difference in the morning and early afternoon temperature rarely exceeds 20°C.

No consideration must be given to the destructive effects of ice crystallisation in the pore space of fully water-saturated building materials.

1. Physico-chemical weathering
Physico-chemical weathering comprises the chemical reactions between water and water-soluble salts in the pore space of building materials and is effected by the pressure exerted by hydrating and crystallising salts on the pore walls. Therefore, it requires water and water-soluble salts which are both present at Al Zubarah in unlimited quantities.

Water sources are groundwater, condensed air humidity, and sea spray. Salts, mainly sodium chloride (halite), and to a smaller degree alkali earth sulphates (gypsum, epsomite, etc.), are derived from the sea water. The components of salts, positively charged cations and negatively charged simple or complex anions, are bonded by electrostatic forces in a crystal structure.
Salts are water-soluble when the hydration energy derived from the interaction of strongly polarised water molecules with the ions is greater than the bond energy between the ions. The interaction with water makes salts harmful to building materials because without water there would be no transport to, into, and in the building materials and no destructive reactions. Therefore the occurrence of salts is also always an indication of moisture in the masonry.

The combination of sulphate, carbonate, nitrate, chloride, phosphate, oxalate, and acetate anions with sodium, potassium, magnesium, calcium, and ammonium cations produced some fifty different salts which were identified in building materials. Apart from simple salts, which consist of one cation and anion there are double and triple salts, frequently with several molecules of crystal water. Very remarkable species are humberstonite, $K_3Na_7Mg_2(SO_4)_6(NO_3)_2\cdot6H_2O$, and thecotrichite, $Ca_2(CH_3COO)_3Cl(NO_3)_2\cdot7H_2O$. However, if only the ubiquitous salts are considered, only 11 species remain of which gypsum and thenardite are by far the most frequent. Together with halite these two salts play an important role in the physico-chemical weathering processes taking place at Al Zubarah.

Salt contents in building materials are recognisable either as white efflorescences or dark patches on the surface of building stones, renders, and mortars. The crystallisation of salts takes place when the relative humidity of the air is lower than the deliquescence relative humidity. Sodium chloride (deliquescence relative humidity 75.4%), for example, occurs as crystallised rock salt or halite at 20°C and 60% relative humidity, while under the same conditions solid nitrocalcite, $Ca(NO_3)_2\cdot4H_2O$, (deliquescence relative humidity 53.6%) takes up water from the air and dissolves. Salts with a very strong affinity to water practically never crystallise under ambient conditions and impart affected masonry a conspicuous dark colour.

2. Origin of salts

The formation of salts in building materials requires the presence of the cations and anions mentioned above. As a matter of fact, there are many possibilities as to how salts get into the stones and mortars of masonry. First of all, the building materials, stones and mortars, may contribute to the formation of salts. By the gradual decay of chemically less stable rock components, such as feldspars sodium and potassium, ions are set free, and the weathering of dolomitic rocks produces magnesium ions. The reaction of slaked lime (portlandite) and calcium silicate phases, the principal constituents of lime mortar and Portland cement, with water yields calcium ions which form low soluble compounds such as calcite and calcium silicate hydrates. Depending on the amount of $CO_2$ dissolved in water, calcite is partly dissolved again and therefore limestones and mortars are potential sources of calcium. If the raw material for burning lime contained appreciable amounts of dolomite then the mortar will contribute magnesium for the formation of magnesium salts.

The use of gypsum as binder introduced calcium and sulphate to the masonry, which may be mobilised by moisture. Some Portland cements contain distinct amounts of alkalis which are soluble and mobile in alkaline pore waters. Dry and wet deposition of the air pollutants $SO_2$ and $NO_x$ on building materials, in combination with catalytic oxidation sulphate and nitrate ions are formed. In the masonry they encounter a mix of cations and controlled by solubility combine with them to a variety of salts. Crystallisation of salts preferably takes place on limestone surfaces sheltered from the rain and leads to the growth of more or less thick and black gypsum crusts. However, these salt-forming processes are restricted to industrialised areas where energy is provided by fossil fuel power plants and densely populated areas with a lot of car traffic. Neither of these applies to the Al Zubarah region.
An important source of nitrates in masonry is the nitrification of organic matter by the nitrifying bacteria nitrosomonas and nitrobacter. High nitrate concentrations are quite common in the walls of horse and pig stables and, as a matter of fact, niter crusts were once a valued commodity for the production of gunpowder. Nitrates may occur in Al Zubarah where organic materials were stored and succumbed to bacterial degradation.

The high amount of sodium chloride in the building materials is derived from the sea water and like the other salts distributed in the masonry by capillary transport. The hygroscopic nitrates and chlorides are very mobile and migrate considerable distances from the spot of emplacement or formation.

Fig. 1 a Crystallisation of sodium chloride (halite) on sabkha at Zubarah.
3. Analytical methods for determining salt concentrations

There are a number of qualitative and quantitative methods for determining salt concentrations in building materials. For example, by licking a white crust on a building stone it is possible to distinguish magnesium sulphate hydrates (epsomite, hexahydrate) from sodium chloride by the characteristic bitter taste. However, the value of sensorial tests is very limited and reliable qualitative and quantitative analyses require greater effort with respect to methods and equipment.

3.1 Electrical conductivity measurements

Water-soluble salts can be extracted from building materials with distilled water. Positively charged cations (Na⁺, K⁺, Mg²⁺, Ca²⁺) and negatively charged anions (Cl⁻, NO₃⁻, HCO₃⁻, SO₄²⁻) are formed and conduct an electrical current. For diluted solutions there is a linear correlation between the electrical conductivity of the solution and the concentration of dissolved salts. The more salt the solution contains, the higher will be the electrical conductivity. A saturated and neutral calcium sulphate solution (~ 2 g CaSO₄ / 1000 cm³ at 20 °C) exhibits an electrical conductivity of about 2.3mS/cm. The electrical conductivity is related to the sum of dissolved ionic species but does not inform about the kind of dissolved salts. The measurement of electrical conductivity is well suited for the rapid and uncomplicated determination of total dissolved solids and, in combination with Merckoquant® test strips, even semi-quantitative analyses of sulphate, nitrate, chloride, calcium and potassium ions are possible.

Fig. 1 b Crystallisation of sodium chloride (halite) on wall render at Al Zubarah.
3.2 Quantitative chemical analysis (AAS, ICP-OES, IC)
The quantitative analysis of cations in the eluate of a building material is done by atomic absorption spectroscopy (AAS) or inductively coupled plasma/optical emission spectrometry (ICP-OES) while the anions are analysed by ion chromatography (IC). Conventionally, the contents of Na\(^+\), K\(^+\), Mg\(^{2+}\), Ca\(^{2+}\), SO\(_4\)\(^{2-}\), NO\(_3\)\(^-\), and Cl\(^-\) in the eluate are determined and recalculated to solid-related salt concentrations in percent. Ammonium and hydrogencarbonate ions are not included in the routine chemical analysis which is supplemented by the measurement of the electrical conductivity and pH. The determination of pH is especially necessary if the sample is a relatively young mortar which yields an eluate with a pH > 10. In this case an apparent excess of calcium ions which cannot be accounted for by sulphate, nitrate, and/or chloride contents in the sample is explained by the presence of hydroxil ions derived from the dissociation of portlandite.

The plausibility of the analytical result should be checked by an ion balance and the comparison of the measured and calculated electrical conductivity taking also the pH into consideration. The sum of the concentrations of anions in terms of ion equivalents should equal the total concentration of cations in terms of ion equivalents. If the solubility and deliquescence relative humidity are considered the ion balance allows a forecast of the crystallisation sequence of salts from the solution. The least soluble salts will crystallise first, and the most soluble last. The data from chemical analyses can also be used for a numerical simulation of brine crystallisation at a given temperature and relative humidity conditions (Steiger 2005). The computer program “ECOS” (Environmental Control for Salt Damage) can be applied for this purpose (Price 2000).

3.3 X-ray diffractometry
Salts are crystalline solids and can be identified by X-ray diffractometry. Since the wavelengths of X-rays are in the order of magnitude of the interplanar spacings in crystals, reflection and diffraction phenomena occur at the surface of irradiated crystals and produce a compound specific diffraction pattern. Evaluation of the diffractogram with Bragg’s equation turns diffraction angles into interplanar spacings (d values) which are listed for some ten thousand inorganic and organic substances. The identification is done by comparison of listed and measured d values. Individual constituents in salt mixtures can be identified if their concentration exceeds 1 mass%. Under favourable conditions, i.e. if the constituents have similar mass absorption coefficients and no preferred orientation of the crystallites in the sample, the peak intensities may be used for estimating approximate quantities.

4. Interaction of salts with building materials
The harm caused by salts to building materials is demonstrated by damages to paint coatings on render, which may become visible after several cycles of deliquescence and crystallisation. If the paint coating is barely permeable to the brine, salt does not crystallise on the paint coating but behind it and pushes it away from the render. Analogous to this process the harmful effects of salt crystallisation in the pore space of building stones can be imagined.

If the sum of volumes of crystallised salt and residual solution is greater than the volume of the supersaturated brine, a crystallisation pressure develops inside the pores provided they have been sealed off by crystallised salt. This process is comparable to the crystallisation of ice in a bottle completely filled with water which will burst because the ice has a greater volume than the water. As suggested by thermodynamical considerations and confirmed by experiments with alum, not only the expanding volume but also the growth of crystals in preferred crystallographical directions effects a pressure which is capable of disrupting the fabric of building materials. However, the quantitative contribution of the linear growth crystallisation pressure to the damage of build-
ing stones is difficult to assess because theoretical considerations do not completely agree with observations at buildings.

According to theoretical calculations, the crystallisation of halite from a twofold supersaturated solution effects a pressure almost twice as high as the crystallisation of thenardite under the same conditions. However, in cases where salt crystallisation plays a major role in damaging building stones it is mostly linked to sodium and/or magnesium sulphate and not to sodium chloride. The decay of building stones by salt crystallisation has been the subject of a number of dissertations (Hoffmann 1994, Weiss 1992). They confirm the hypothesis that salt crystallises with a pressure build-up from a constantly supplied brine due to the lower chemical potential in capillary pores first and will continue to crystallise in micropores when the pressure in the capillary pores has reached a level at which the chemical potential of the salt crystals in the capillary and micro pores is equal (Fitzner and Snethlage 1983). The magnitude of the resulting pressure depends on the absolute pore sizes and the pore size distribution. This capillary pressure model goes along with the observation that building stones with a maximum of the pore size distribution in the overlap interval of capillary and micro pores are specially prone to damage by salt crystallisation while building stones with a maximum in the macro pore interval are much more resistant.

Next to the crystallisation pressure, the hydration pressure of salts occurring with several molecules of water of hydration contributes greatly to the harmful interaction of building materials with salt.

By the uptake of waters some salts pass from a lower into a higher hydration stage with an increase in molar volume. This effect is especially distinct for sodium sulphate, where the uptake of water leads to the transformation of anhydrous thenardite to mirabilite with ten molecules of water accompanied by an increase of the molar volume by 310%. A second example is magnesium sulphate, which occurs in five different hydration stages: kieserite $\text{MgSO}_4 \cdot \text{H}_2\text{O}$, starkeyite $\text{Mg}_2\text{SO}_4 \cdot 4\text{H}_2\text{O}$, pentahydrite $\text{Mg}_2\text{SO}_4 \cdot 5\text{H}_2\text{O}$, hexahydrite $\text{Mg}_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$, and epsomite $\text{Mg}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}$. The increas-

Fig. 2a The phase diagram sodium sulphate – water with plotted data points from Fig. 2b.
In molar volume for the transformations of kieserite to starkeyite and hexahydrite to epsomite are 79% and 10%, respectively. Thenardite occurs very frequently in building materials.

**Figure 2a** shows the phase diagram sodium sulphate – water in which the univariant curve separating the thenardite from the mirabilite field defines the phase stabilities as a function of relative air humidity and temperature. For example, sodium sulphate is stable as mirabilite at 12.5°C and above 70% relative air humidity, while at this temperature magnesium sulphate already occurs in the highest hydration stage as epsomite at 32% relative air humidity.

If the crystallisation and/or hydration pressure exceed the tensile strength of a building material, cracks will develop. The mechanical failure of a building material will not take place at the first crystallisation process but will be the effect of periodically repeated events with a gradual decline in material strength.

As pointed out above, sodium chloride and calcium sulphate are abundant at Al Zubarah. Therefore the occurrence of halite and thenardite in building materials is not surprising at all. From the recordings of climate data at Al Zubarah it is evident that the conditions for the crystallisation and deliquescence of halite and the transformation of thenardite to mirabilite and vice versa are realised in the winter months, with peak humidities and temperature minima during the night hours **(Figure 2b)**.

A special case of interaction of salts with building materials is the so-called sulphate attack, a reaction of calcium sulphate with Portland cement components or reaction products to form ettringite and/or thaumasite. The reaction of gypsum with water and tricalcium aluminate, a component of ordinary Portland cements, leads to the formation of ettringite, while the reaction of calcium sulphate, calcium carbonate, and water with calcium silicate hydrate phases, the hydration products of Portland cement, results in the formation of thaumasite. The increase in molar volume of the product over the reactants is 62.4% for the ettringite reaction and 75.7% for the thaumasite

Fig. 2b: Temperature and relative air humidity data from 25.03.2012:12.00 to 28.03.2012:12.00.
reaction. Both reactions are harmful to building materials due to the volume increase. Laboratory tests with building materials from Al Zubarah have shown that there is a potential for ettringite and/or thaumasite formation. However, as the thaumasite reaction is favoured by low temperatures (T < 5 – 10 °C) which are uncommon in Qatar it is more likely that ettringite will be formed.

5. What can we do with salts in building materials
There is not so much we can do to suppress or stop the interactions of salts with building materials at Al Zubarah. We are restricted to mitigating harmful effects. A very simple but effective measure is the removal of salt efflorescences from wall surfaces with a brush. However, the brushed-off salts should not be discarded at the wall base but disposed of at a safe distance. The choice of binding materials which give sufficient strength to mortars to cope with the attack by crystallising and/or hydrating salts for at least several years will also help. As the salts are transported inside the walls from bottom to top by capillary forces it is recommended that we intercept the capillary rise of brines by a layer of impermeable building stones, such as the local dolomite at the wall base. However, this practice is only feasible when a wall requires a partial or total reconstruction. Finally, continuous maintenance of masonry and renders will prevent small damages from becoming larger, so as not to endanger the stability of an entire structure.

Robert Sobott, December 2012

6. References


CHARACTERISTIC WEATHERING AND DECAY ATTESTED AT AL ZUBARAH ARCHAEOLOGICAL SITE

Aeolian out-blow and Pluvial out-wash of loose mortar and debris material resulting in open joints, voids in wall structure, finally in instability and collapse of wall segments.

Erosion, decay and disintegration of single building materials components, e.g. for beachrock: Gastropods, molluscs, “sand”, salts, etc. Especially wall bases and zones where salt containing sand/soil- deposits are located resulting in heavy damages of beachrock (salt crystallisation zone!)

Bonding of plaster to wall stones often limited or lost

Plaster surfaces: powdery or cracked due to fluctuation of temperature and humidity as well as volume changes of sulphates and salt crystals. beachrock decay reminds of mud brick deterioration processes

Instability of wall structures, due to insensitive repairs

Loss of wall structures due to neglected maintenance
HISTORIC BUILDING MATERIALS
WEATHERING FORMS AND DETERIORATION PATTERN

Open joints (e.g. ZUEP04, wall 4010)

Eroded Beachrock (e.g. in QMA2)

Poor bonding of plaster to wall structure (e.g. QMA4:5c)

Voids in wall structures (e.g. QMA 4:4b)
GENERAL STATE OF CONSERVATION
IN EARLIER EXCAVATION AREAS

During the 1980s the first conservation measures took place following the archaeological excavations by QMA. The restoration work focused on the then excavated buildings (excavation areas QMA 1, 3 and 4) and on sections of the outer city wall (tower T6 to T10 and T15 to T16).

As part of these works, old wall stones were re-used to add courses to some walls to prevent further structural decay. Other walls, especially in area QMA 3, were more extensively reconstructed. In this restoration campaign traditional building and masonry techniques were used, however mortars were mainly cement-based, instead of local lime and gypsum-based mortars. In addition, most restored walls were capped with a cement coat. Lack of maintenance during the past twenty-five years and unsuitable materials has led to the substantial deterioration of the exposed walls. This earlier restoration project, which did not follow contemporary international standards, provides us with a useful reference tool. It offers invaluable data for the assessment of the decay rate of the exposed materials and a visual “proof” of the negative impact of cement-based mortars and cement capping on the walls.
GENERAL STATE OF CONSERVATION
EXAMPLES FROM QMA4 (FORTIFIED COMPOUND: ROOM 4)

State of conservation (QMA4) November 2009
STATE OF CONSERVATION: TOWN WALL
exposed segments

2009 - 2012
The town wall and its 23 towers were only exposed in two longer segments during the 1980s. The exposed parts of the wall as well as the towers were consolidated, re-built and partly reconstructed. Part of the exterior wall structure was completely re-built using cement mortar. The wall capping was also built with cement mortar. In some sections the dark grey portland cement layers are the only preserved element of the former wall structure, due to the extreme erosion of beachrock wall stones. Where joints are left open, voids can occur in the wall structure. Wall segments 6/7 to 9/10 show the greater impact of the strong north wind than do the exposed segments 16/17 to 18/19 in the southern part of the town.
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

COURTYARD HOUSES - 47
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Courtyard houses
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

Courtyard houses

A - Courtyard
B - Bended Entrance
C - Iwan or Majlis (Reception hall)
D - Kitchen area
E - Private Courtyard with an Iwan.
F - Storage Room
G - Multipurpose room
H - Stair to upper level (roof)
J - Alley
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

Traditional air ventilation systems

WIND CATCHER (Niches/Windows)
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

Mosque

Mosques:
1. Jumail Mosque; A - Mirhab & Minbar in Qibla wall, B - Prayer hall, C - Riwaq (?) / Portico, D - Courtyard (Sahar), E - Ablution-Room, F - Minaret, G - Entrances.
4. Minaret at Al Arish.
5. Historic Mosque at Freiha (dashed line in red indicates Qibla direction); Labels as above.
The **sug** is a commercial building complex characterised by rows of shop stalls in narrow alleys passable only for pedestrians and pack animals. Stores of the same industries are often grouped together. In general, shops, only a few metres wide, open onto the alley. They can have storage, warehouses and workshops out the back and upstairs.

At Al Zubarah’s **sug** (QMA1 / ZUEP02) **madbasas** are a common feature in the back of the shops. Roofs over the alleys of the sug, covered with wood and mats, protected pedestrians and goods. The rows of shops are complemented by warehouses and other commercial facilities, such as **khans**.
ILLUSTRATED GLOSSARY: BUILDING TYPES
TRADITIONAL BUILDINGS IN THE GULF REGION

Areech (Arish)
This was a summer house that would allow the weather to come in. It was constructed from palm tree fronds mainly without leaves and with wide spacing between the fronds of ground level up to 16 cm to allow the wind to penetrate. The roof could be slightly pitched or flat. Characteristically the entire front of the rectangular enclosure would be open. Areech buildings had no doors. Similar houses would be built up in the mountain areas for a single family to live in during their summer migrations to collect dates. This Areech (Arish) typology is still used in the Fujairah mountains as a summer house for families who continue the tradition of summer migration.

Barasti
English speakers often refer to any Arish building as a ‘Barasti hut’. What the people of Hatta call barasti, however, is a rectangular building with a flat roof and a doorway in the middle of the front wall, constructed from an Arish front, peeled of its leaves and put together in a pattern called sasabic, based on 16 cm by 10 cm spacing. Barasti buildings would always have hassir mats behind the Arish wall, where the air could not enter, and were sometimes used as ma'alis in the winter months. In some barasti interiors there was a small area designated as a bathroom (similar to khaimahs in the coastal and northern Emirates).

Khaimah
In all seven Emirates, the khaimah is a building with a pitched roof, used as a winter house and built totally from palm leaves woven tightly together in order not to allow cold wind or moisture to come through. In traditional khaimahs, including those of Hatta, the roof frame would always be constructed from a net of Arish fronds resting on a palm tree or chandelier timber beam. The roof was covered with hassir mats and occasionally bilawns before the final layer of daan mats was applied. The interior of a khaimah would have sand, gravel or hassir mats on the floor. Internal walls might be covered with hassir mats, depending on the availability of materials and the status of the family.

Kada
Mountain regions offer a diverse source of building materials, stone in particular. The walls in kada buildings were built from stone, covered by palm leaves. They were used for storage or as family houses. Apart from Hatta, kada houses are found in the Al Hajar Palace areas of Fujairah Emirate.

A typical house in Sharjah by Khalid Al Almari
1. Arish (summer house)
2. Khaimah (winter house)
3. Kitchen
4. Mails for men
5. Entry
6. Bathroom

from: Piesik 2012:87

Kale
Palm front (roof) net
with leaves inserted

Sarbal
Stones of covering palm leaf fronds, usually 60 cm x 60 cm

Hassir
60 cm x 60 cm mats

Habib
Coarse white vegetable fibers.

from: Piesik 2012:88

Palm leaf woven typologies in Hatta
Local names for some of the palm leaf patterns.

from: Piesik 2012:125
Tents

Al Zubarah Fort

Forts

Al Zubarah Fort

Al Thagab

Rakayat

battlement: a parapet having a regular alternation of merlons and crenels.

crenel

merlon

loophole

eyelet

gate
ILLUSTRATED GLOSSARY: BUILDING TERMS

ENGLISH

WINDOW

Wall plaster

Danshal timbers

Lintel

Frame

Shutter

Wall structure

Breast

Wall plaster with "hand tooling"

Head

Jamb

Breast

EXTERIOR
DECORATION PATTERNS & PROPORTIONS

<table>
<thead>
<tr>
<th>MERLONS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BRACKETS</td>
<td>![Bracket Images]</td>
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<tr>
<td>ARCHES</td>
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</tr>
<tr>
<td>VOIDS</td>
<td>![Void Images]</td>
</tr>
<tr>
<td>RECESSED PANELS</td>
<td>![Recessed Panel Images]</td>
</tr>
<tr>
<td>INCISED PANELS</td>
<td>![Incised Panel Images]</td>
</tr>
<tr>
<td>MOULDINGS</td>
<td>![Moulding Images]</td>
</tr>
<tr>
<td>DOORS</td>
<td>![Door Images]</td>
</tr>
<tr>
<td>WINDOWS</td>
<td>![Window Images]</td>
</tr>
</tbody>
</table>

after Yarwood & El-Masri 2006: Fig.2.4
ILLUSTRATED GLOSSARY: BUILDING TECHNOLOGY
ENGLISH

LIME or CEMENT MORTAR
MUD/EARTH
MANGHOUR
BASJEEL
DANSHAL

border line ("double"-line)
crown (of the wall)
wall top
cornice

Beach rock wall stones
finish
under coat
mortar
wall base

ledge
plaster-surface
"rough" surface (fiche 3.5.3)

panel
plaster-surface
"smooth" surface (fiche 3.5.1)

wall face
core (wall structure)
ILLUSTRATED GLOSSARY: BUILDING MATERIALS

1 - (Quartz) sand
2 - Al Danshal timber from East Africa
3 - Basjeel, bamboo strips (from India)
4 - Daoun, Palm leaf mats (from the Emirates)
5 - Manghour matting
6 - Soil/ Earth / Mud
7 - Plaster materials (Lime [A] & Gypsum [B]-based)
ILLUSTRATED GLOSSARY: BUILDING MATERIAL - Rock types

ENGLISH

Table 1: Characteristic macroscopic features of the building stones

<table>
<thead>
<tr>
<th>Rock type</th>
<th>Colour</th>
<th>Macroscopically visible components</th>
<th>Hardness</th>
<th>Diagnostic features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beachrock</td>
<td>light yellow grey to whitish</td>
<td>bivalves, gastropods</td>
<td>friable</td>
<td></td>
</tr>
<tr>
<td>Conglomerate</td>
<td>mixed colours of rock constituents</td>
<td>bivalves, gastropods, dolomite fragments</td>
<td>- components</td>
<td></td>
</tr>
<tr>
<td>Aeolianite</td>
<td>light yellow - medium grain size, bedding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dolomitic limestone</td>
<td>fresh surface grey</td>
<td>- very hard density, fine grain size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gypsum</td>
<td>yellow grey to whitish</td>
<td>- soft scratchable with finger nail</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4: The principal rock types in the walls of Al Zubarah.

1: Beachrock AG (mollusc rudstone); 2: Beachrock BJ (gastropod rudstone); 3: Conglomerate (KA or LA); 4: Aeolianite FR; 5: Dolomitic limestone BL; 6: Gypsum rock BE

For an identification scheme see fiche 2.2, 6.1 or Appendix 1
ICOMOS (ed.)
## GLOSSARY: DETERIORATION PATTERNS

**ENGLISH, German**

### ALTERATION
Modification of the material that does not necessarily imply a worsening of its characteristics from the point of view of conservation. For instance, a reversible coating applied on a stone may be considered as an alteration.

### MATERIALVERÄNDERUNG
Veränderung der Materialeigenschaften, die nicht notwendigerweise eine Verschlechterung des Zustands unter dem Gesichtspunkt der Konservierung bedeutet. Ein reversibler Überzug auf einem Gestein kann zum Beispiel als eine Materialveränderung betrachtet werden.

### DAMAGE
Human perception of the loss of value due to decay.

### SCHADEN
Menschliche Wahrnehmung des Wertverlusts durch Verfall.

### DECAY
Any chemical or physical modification of the intrinsic stone properties leading to a loss of value or to the impairment of use.

### ZERFALL / VERFALL
Jede chemische oder physikalische Veränderung der Gesteinseigenschaften, die zu einem Wertverlust oder einer Einschränkung der Gebrauchsfähigkeit führt.

### DEGRADATION
Decline in condition, quality, or functional capacity.

### ABBAU / VERSCHLECHTERUNG
Negative Veränderung des Gesamtzustands, der Qualität oder Funktionalität.

### DETERIORATION
Process of making or becoming worse or lower in quality, value, character, etc.; depreciation.

### ZERSTÖRUNG / SCHÄDIGUNG
Prozess, welcher die Verschlechterung des Materialzustands, die Minderung der Qualität oder des Werts oder des Materialcharakters verursacht oder der Prozess der Verschlechterung/des Zerfalls selbst.

### WEATHERING
Any chemical or mechanical process by which stones exposed to the weather undergo changes in character and deteriorate.

### VERWITTERUNG
Jeder chemische oder mechanische Prozess, durch den Gesteine, die der Witterung im Freien ausgesetzt sind, Veränderungen ihrer Eigenschaften erfahren und zerfallen.

---

ICOMOS (ed.)

ILLUSTRATED GLOSSARY: DETERIORATION PATTERNS
ENGLISH, German

**ALTERATION, MATERIALVERÄNDERUNG**

Common alteration of architectural mouldings by algae.

Materialveränderung von Architekturprofilen durch Algen.


**DAMAGE, SCHADEN**

Damage to the lower part of a sandstone grave slab resulting in loss of value.

Einen Wertverlust verursachender Schaden am unteren Teil einer Grabplatte aus Sandstein.


**DECAY, ZERFALL, VERFALL**

Limestone relief showing advanced decay.

Kalksteinrelief im Zustand fortgeschrittenen Verfalls.

France, Caen, Eglise Saint-Pierre, 2006. Head ca. 10 cm, LRMM / V. Vergès-Belmin

**DEGRADATION, ABBAU, VERSCHLECHTERUNG**

Degradation of red sandstone masonry due to defective rainwater gutter behind parapet.

Verschlechterung/Minderung des Erscheinungsbildes eines roten Sandsteinmauerwerks durch schadhafte Regenrinne oberhalb des Gesimses.


**DETERIORATION, ZERSTÖRUNG, SCHÄDIGUNG**

Deterioration of a Carboniferous sandstone masonry.

Schädigung eines Mauerwerks aus Karbonsandstein.


**WEATHERING, VERWITTERUNG**

Weathering of a Lewisian Gneiss monolith resulting from long term exposure to the elements.

Verwitterung eines Monoliths aus Lewisian Gneis durch lange Klimaexposition.


ICOMOS (ed.)
GENERAL ACTION PLAN: CONSERVATION SCHEME

1. BASICS (PART 1)
   a) Decay processes, deterioration of building materials, climate conditions, state of conservation.

   b) Recording & Monitoring (3D-Laser scanning, photo, sketch, drawing, text, Inventory), Documentation, includes mapping, etc.

   c) Analyses, assessment and evaluation of structural conditions.
2. PLANNING (PART 2)

d) Planning of measures according to assessment of state of conservation. Plan sketches to discuss strategies. Concept development; Selection and test of materials. Definition of conservation scheme and technical solutions (Fiches techniques)

3. IMPLEMENTATION (PART 3)

e) Fiches Techniques as step by step instructions; listing of needed materials, tools, required staff, premises, climate conditions etc.

4. DECAY PROCESS

f) Decay and deterioration of materials caused by natural and human agency. Restart of process (see Part 1).
REFERENCES

Ashurst, John (ed.)
2006 Conservation of Ruins. London : BH.

Ashurst, John und Asi Shalom

Brandi, Cesare

Cramer, Johannes
1984 Handbuch der Bauaufnahme. Stuttgart : DVA.

Dostal, Walter
1983 The traditional Architecture of Ras al-Khaimah. TAVO B:54. Wiesbaden: Ludwig Reichart

Hassler, Uta & Nerdinger, Winfried (Hrsg.)

Hawker, Ronald

Hubel, Achim

ICCOM (eds.)

ICCOMOS (eds.)

Jameson, John H. (Hrsg.)

Kersten, Thomas und Mechelke, Klaus

al-Kholafi, Mohammed Jassim
2006 The Traditional Architecture in Qatar; (2nd edition); Doha: National Council for Culture, Arts and Heritage.

King, Geoffrey

Kinne, Andreas

Koepf, Hans
Meskouris, Konstantin, Klaus-G. Hinzen, Christoph Butenweg, Michael Mistler

Müller, Joachim

Nerdinger, W.

Niebuhr, Carsten

Piesik, Sandra

Pütt, Karin

Pütt, K. & Adolph, K.

Ragette, Friedrich
1974 Architecture in Lebanon. Beirut: AUB.

Rainer, R.
1977 Anonymes Bauen im Iran, Graz: Akademische Verlagsanstalt.

Richter, Tobias, Paul Wordsworth & Alan Walmsley

Scharabi, Mohammed

Seidl, Ernst (ed.)

Sobott, Robert

Thuesen, Ingolf & Kinzel, Moritz

Walmsley, Alan

Wirth, Eugen

Yardwood, John & El-Masri, Souhail
PART 2
CONSERVATION CONCEPT
PRESERVATION OF RUINS
REALISING ARCHITECTURE
CONSERVATION CONCEPT
GENERAL PRINCIPLES

INTRODUCTION

The excavations at Al Zubarah are among the largest ongoing excavations in the world. The research and excavation programme started in 2009 has taken into consideration the issue of the conservation of the uncovered vestiges and of the archaeological finds since the beginning of the operations on the field.

While an important series of analyses and tests on building material was carried out during the first years to determine a preliminary strategy of intervention, QMA and QIAH realised that a comprehensive concept capable of dealing with the extraordinarily complex issues conservationists have to confront in Al Zubarah was needed.

In order to design such a strategy, a seminar, gathering a panel of international experts in archaeological conservation, was organised in Doha between 29 November and 2 December 2011. This first meeting will be followed by similar seminars in the coming years and the panel of experts is meant to become an “international committee” for the preservation of Al Zubarah, advising the QIAH project and reviewing the results achieved on site.

The involvement of international experts and the scientific discussions into the ongoing works are a proof of the QIAH commitment and are in full compliance with the state-of-the-art approaches to conservation and site management outlined in the UNESCO Nomination File and Management Plan.

A COMPREHENSIVE STRATEGY: CONCEPTS AND DRIVING PRINCIPLES

The conservation of an entire city buried under the sand of the Qatari desert, in one of the most challenging climates of the world and set in an extremely salty natural environment, imposes the definition of clear principles to direct the intervention. These principles should be translated into flexible technical solutions capable of adapting to the results of the ongoing excavations, studies and experiments.

The QIAH Team in charge of the conservation of Al Zubarah has followed a step-by-step approach in order to adapt the interventions to the data being collected and to the results of the archaeological excavations. The conservation activities carried out in Al Zubarah Archaeological Site can be divided into three successive phases, each one building upon the previous one.

Phase 1
Data collection: analysis of the building materials and techniques, review of the climatic and physical conditions on site, tests and preliminary interventions on the built structures.

Phase 2
Design of a conservation strategy based upon the use of lime mortars. On the basis of the scientific data collected in phase 1, the team has defined a set of solutions and a series of building materials and techniques adapted to Al Zubarah. Particular emphasis has been put on the use of local sands and soil, and on the analysis of the tooling and building techniques used in the past.
Phase 3
While continually implementing the principles of Phase 2, the conservation team will further explore the possibilities related to the use of anhydrate mortars and plasters. Laboratory exams, on-site tests and visits to other archaeological sites in the region will allow us to design more “sustainable” building materials that may withstand the extreme climatic conditions of the present-day ruined city of Al Zubarah.

The Manual details the solutions of Phase 2, constituting a coherent conservation strategy for the site. These solutions might be modified according to the development of Phase 3 in further updated versions of this document.

The methodological approach followed during the first two years of the campaigns for the conservation of Al Zubarah was driven by the will to “improve” the materials found on the site. It was mainly based upon laboratory analyses, with the emphasis put on chemical and physical data, to design new improved mortars and masonry solutions. Such an approach implied that non-traditional materials (white cement, hydraulic limes, clean salt-free quartz-sands) be used to “freeze” the situation and reduce the disruptive impact of salt crystallisation on both mortars and stones.

The laboratory analyses carried out in this preliminary phase have enabled us to get a clear picture of the characteristics of the stones and mortar used by Zubarah’s builders and to make a precise classification of the building materials used in Al Zubarah (cf. Appendix 1 and 2).

With the unfurling of the project, the focus has moved towards a different vision, a sustainable approach based upon the driving principle that new added elements should always be “weaker” and “less resistant” to the original ones (even when the original masonries were made of extremely poor quality stones) and that limited reconstructions are actually necessary for the preservation of the fragile vestiges, an approach implying regular reconstruction/maintenance interventions need to be realised on the site by a technical team, to be financed by the State of Qatar on a long-term basis.

Sustainability in the case of Al Zubarah means three distinct and complementary issues:

1) The development of an administrative and management system capable of guaranteeing the long-term commitment of the State of Qatar and the regular allocation of financial and human resources for the site preservation.

2) The development of national capacities in the fields of archaeology and heritage through capacity-building programmes and the development of new academic institutions and structures.

3) A sustainable approach to technical conservation on the field.

This last point implies that the materials and the techniques used for the preservation of the site are, as far as possible, produced in the region and that local building traditions are integrated in the overall approach to conservation and restoration. Consequently, mostly traditional and/or local materials should be used for the restoration and conservation of Al Zubarah town, while “modern” techniques and materials are generally avoided.

Such an approach has become more and more frequent in architectural and archaeological conservation in the last twenty years. The 1964 Venice Charter, which remains one of the main cultural and intellectual references for the scientific community of conservationists, affirmed that:
“the conservation and restoration of monuments must have recourse to all the sciences and techniques which can contribute to the study and safeguarding of the architectural heritage (art. 2)” and that:

“where traditional techniques prove inadequate, the consolidation of a monument can be achieved by the use of any modem technique for conservation and construction, the efficacy of which has been shown by scientific data and proved by experience (art. 10).”

However, more recent views pay more attention to material contiguity and affinity, and to technological and static compatibility between old and restored elements.

This new sensitivity has lead to the development of a rich technical literature devoted to the re-discovery of traditional constructive know-how and local technical specificities, and to a less dogmatic vision of the necessary distinction between original and restored elements.

The very concept of sacrificial layer and the idea that integrations might be required for the consolidation of the structures (because we want them to continue working according to the static system originally conceived) are the coherent consequence of these new theoretical developments. Such an approach seems particularly meaningful when conservation concerns archaeological sites and ruins, and, possibly, even more so when these ruins are made of particularly fragile or perishable materials. Indeed, the still “fragile” theory developed for the conservation of earthen architecture partially contradicts many assumptions set in the 1960s that were essentially conceived for stone and firebrick structures within the Western World.

Al Zubarah, which is neither a medieval European city nor a classic Roman ruin, and is mostly composed of extremely fragile stones and mortars whose load-bearing and weather-withstanding capacities closely resemble mud brick and adobe structures, provides us with a perfect opportunity to put these contemporary concepts into practice, rather than a mechanical application of the Venice Charter.

If sustainability is the key, and contemporary solutions adopted for earthen architecture and ruins are used as a meaningful technical reference, then the conservation of the city of Al Zubarah should be developed accordingly.
TECHNICAL PRINCIPLES

The concept presented above is not based upon a theoretical vision detached from reality, but is actually grounded on a detailed analysis of the situation on the field and on the assessment of the characteristics of the building materials and technologies found on site.

At Al Zubarah, substantial parts of the original gypsum-based (anhydrite) mortars and plasters have been preserved, notwithstanding the extremely difficult climatic conditions. While laboratory tests seemed to prove the overall incapacity of anhydrite mortars to resist the prevailing climatic conditions, the visual analysis has forced us to question why laboratory test have proven so negative.

Likely, the laboratory data did not take into consideration the fact that the original local materials present a series of “impurities” that positively influence the capacity of the gypsum to withstand the site conditions. Layers of clay within the rocks, particles of lime, traces of coal, shells and other elements — but possibly also the temperature and the length of the cooking process to obtain the gypsum from the stones — have all produced a relatively high-quality material, based upon traditional knowledge accumulated over time by local masons.

The visual analysis of the masonry seems to confirm that where the building stones and the salt presence could not be improved, the local masons tried to achieve higher resistance with more sophisticated mortars and plasters.

This statement, which needs scientific verification, is one of the starting points for the identification of the “principle” directing the overall conservation of the site. Acknowledging the quality of traditional materials and building techniques, however, does not imply that no modifications are necessary to confront the particularly difficult conditions of the site, leaving room for the scientific research of new solutions.

Research on building materials and laboratory tests can and should continue to provide valuable new information and to control the overall quality of the work implemented on site. Instead
of designing new solutions and materials, however, tests will aim to “reproduce” the original materials and will attempt to identify the technological methods used to produce them.

Similarly, masonry tests will analyse the original tooling and finishing techniques the inhabitants of Al Zubarah used in their houses. They will attempt to reproduce them as accurately as possible to achieve visual, technical, chemical, mechanical and physical homogeneity with the original materials.

At the practical level, it has been agreed that the conservation interventions will be based on lime-based mortars, while new research will be launched to verify the impact of different sands, rocks and cooking techniques in the preparation of the gypsum-based mortars and plasters similar, to those originally used in the city.

The important studies already completed by the technical team on site during Phase 1, and the data produced by the laboratories, coupled with the sustainable approach described above, have allowed us to design very satisfactory lime-based mortars and plasters and to identify the best constructive and tooling techniques to treat the ruined walls of the site. The techniques and building materials to be used in the different areas of the city are presented in detail in the technical fiches of this Conservation Handbook [see Part 3].

In keeping with the principle announced above, the finishing proposed for the restored surfaces is based on the careful analysis of the traditional techniques and on the identification of the different solutions the builders adopted, according to the functions of the buildings.

The exterior plaster of the palace tower, for instance, might share similar chemical/physical data with the internal plasters, but presents a different finishing made with different tools for a different function. The visual analysis of the inner plasters of the rooms next to the date presses — likely used as simple storage areas and not as residential units — shows that the plaster received a much rougher treatment where the traces of the trowel used by the masons has not been erased to achieve a “perfect” result that was not needed by the function.
According to the vision outlined above, the conservation of Al Zubarah as an 18th century Gulf city with unique qualities and characteristics is based upon the precise recording and understanding of its technical and architectural elements. From a theoretical point of view, this approach, far from "falsifying" the vestiges, actually aims at preserving the ensemble of ruins not only in their material elements but also in their technical, static and almost "spiritual" essence.

TECHNICAL SOLUTIONS

The original houses and palaces of Al Zubarah were very likely entirely plastered and lime-washed, both internally and externally, and their walls were covered by roofs and terraces protecting them from direct sunlight, rain and wind erosion. The strategic principle to avoid reconstructions and to preserve the site as a ruin implies that no roof is to be created and that the vestiges of the walls remain exposed to the harsh desert and marine environment. In their current state, the masonries are not able to withstand the extreme climatic conditions of the site, and should therefore be protected by a plaster acting as a "sacrificial layer" destined to decay and collapse.

The conservation strategy developed by the QIAH heritage team, and validated by the recommendations of the international seminar on the conservation of Al Zubarah held in December 2011, requests that the ensemble of the ruined walls be covered with a layer of plaster. This solution would have a significant visual impact and would radically modify the overall image of the site. The QIAH team and all the workers and supervisors on the site will have to have a clear understanding of the theoretical and technical implications of this "radical" choice. It is also essential that any new plaster be applied in a way that is compatible with an archaeological site.

When it is agreed that a protective plaster is to be applied to the original vestiges, we will need to develop a better mix and improved building techniques. The external plaster will be subject to much stronger stresses than the original plaster, which is why we are looking to make use of lime-based mortars and plasters as a coating material. The conservation team has begun to develop a series of lime-based "mixes", taking into consideration not only the purely "scientific" data con-
Concerning their physical and chemical characteristics, but also the availability of the materials, their cost, colour and visual impact on the site. The proposed mortar mixes also have good physical and mechanical qualities and acceptable colour shades.

The team has also designed a set of building techniques to be applied in different areas of the site. The Technical Fiches of the handbook detail these in a clear and simple way. They have defined the “constructive” method to be applied in Al Zubarah, to highlight the difference between the “capping” and the faces of the walls so the site can remain true to its archaeological heritage.

At the practical level, the solution adopted:
• stresses the importance of the overall image of the wall after the conservation is completed;
• achieves an architecturally significant shape for the ruined walls;
• differentiates walls from capping;
• achieves an “irregular” profile for the wall and for the plaster;
• shows the thickness of the plaster with the support of a “sharp” line;
• underlines the difference between the faces and the capping with a different finishing of the plaster;
• reduces the impact of straight corners by “softening” vertical angles with rounded curves;
• avoids covering entirely the last course of stones of the walls with new plaster to favour the visual differentiation between wall and capping.

More research is needed to achieve an even more compatible mix and a more sustainable building material (that does not require the importation of hydraulic lime from Germany), if they are to reproduce an anhydrite mortar similar to the one found in the original plasters of Al Zubarah. In the coming years new solutions, based on the development of high-quality anhydrate mortars and plasters, will be tested and included in upcoming versions of this Conservation Handbook.

Simone Ricca 2012.

Consolidation of 1980s Restoration in QMA2: Taking off cement capping; Consolidation of wall structure, and re-shaping of wall top (2011/2012).
CONCEPT DEVELOPMENT AND IMPROVEMENT

In order to develop a conservation concept, the state of conservation of the exposed architectural remains was documented and analysed. Building materials, e.g. plaster, mortars, and building stones were examined in the lab (see Appendices). On site the decay processes were studied. This diagnosis showed that the predominantly used beachrock has to be covered in order to minimise and reduce decay and disintegration processes, due to the presence of Halite in the beachrock.

The analysis of building materials and soil samples showed also that salts played a major role in the environment. To ensure at least a considerable time frame for conservation and maintenance activities, a sulphate resistant lime (Otterbein NHL) was chosen to execute first works. At the palace (ZUEP04) wall 4010 was covered with a render. The render protects the stone surfaces and preserves the existing situation. No additions were made. Architectural elements were left as they were found and not rebuilt or repaired. Wall face and wall top were executed in the same way and no differentiation was implicated.

This concept works from a technical point of view, to a point, but it does not fulfil our desire to show the remains of an 18th century town and its architecture. Preserving the excavation status makes it, in several instances, impossible to understand the architectural context as well as its character. The indifferent handling of wall surfaces makes it difficult to read the remains as walls with a wall face and a ruined wall top.

An analysis of the 1980’s restoration work made it clear that one of the main failures of the works was the non re-plastering of wall faces. The beachrock building stones, as stated before, were of poor quality and were still exposed to the harsh environmental conditions, e.g. strong winds, and were not protected by a layer of plaster, as they were when the houses were built. This resulted in the disintegration of building material components, e.g. gastropods and sand particles, followed by the collapse of wall parts.

Under these conditions, the only suitable solution is to cover the beachrock wall stones with a plaster or mortar. This ensures that the decay process caused by Halite and other minerals is slowed considerably and aeolian erosion is minimised. Although the architectural remains can be described as stone architecture, they show all the decay characteristics of earthen architecture. Taking this into consideration, the re-building of architectural elements using traditional techniques and materials seems to be the only natural course of action, to preserve the architectural remains and to protect the integrity of the town of Al Zubarah. It is hoped that we can reproduce the new plaster surfaces as closely as possible to the historic remains. The continuous monitoring, observation and evaluation of works, damage and decay processes will improve over time, as will our methods, techniques and materials.
THE RESPONSE EVOLVES IN TIME, TO ALWAYS FIT THE CONTEXT BETTER

THE SITE LOOKS ALIKE, BUT **RESPONSES DIFFER** ON EACH SITE, BASED ON THE INITIAL ASSESSMENT (technical, social, economic, environmental, etc.)
CONSERVATION TESTS IN FALL 2009

1ST TEST: soil mortar

First mortar tests at Al Zubarah in November 2009: Soil mortar mix with the soil from the site.
CONSERVATION WORK in SPRING 2011

1ST APPROACH: protective lime slurry

To protect and stabilise the fragile wall structures built with beach rock a lime slurry is applied to the wall. No substantial rebuilding took place only water pockets were filled with smaller stones to eliminate these.

Wall top and wall face were treated the same way. Only a slightly different mortar mix was used. But surface followed the stone shapes as an protective layer. No plaster surfaces were reestablished.
COMPARISON OF CONCEPTS


“Preserving and Protecting only”

- Lime slurry covering wall stones
- No differentiation between wall face and wall top
- No additions
- No levelling of uneven wall surfaces
- Lime slurry differs in colour and structure to the historic plaster surfaces.
- Based on conservation concepts for stone architecture.

2. Conservation concept (since 2011/2012)

“Preserving remains, making the architecture understandable”

- Re-plastering/ Resurfacing of wall faces (to protect building stones)
- Clear differentiation between wall face and wall top with a “double” line stating the wall plaster and a rough wall top surface.
- Surface treatment and appearance of new plaster material (at the moment lime based) close to the historic ones to generate a homogeneous “image”.
- Structural rebuilding
- Rebuilding of architectural elements, e.g. wall faces, niches, ledges, and doorways.
- Consolidation of historic plasters: Stabilising surfaces, cementing cracks and border lines, filling of voids and fixing of loose parts. Re-attaching of loose or fallen larger plaster fragments.
- Strategy takes the earthen architecture character of the decay processes into consideration.
- Additions are seen as a sacrificial layer.
- Use of traditional techniques and materials when possible and suitable.
GENERAL PRINCIPLES
AND CONSERVATION CONCEPT

- Wall top capping with “rough” surface (fiche 3.5.3)
- Structural rebuilding (fiches 3.3 and 3.4)
- Re-pointed joints (fiches 3.1 to 3.3)
- Consolidated historic wall plaster (fiche 4)
- Historic wall plaster
- Repair (fiche 4)
- Remove soil and sand deposits
- Beachrock wall stones

- Sharp “double” plaster line
- Rough surface on wall top showing wall structure
- Blocked door with rough surfaces
- Edged corners
GENERAL PRINCIPLES
CHARACTERISTIC SITUATIONS AND PROPOSED SOLUTIONS

SITUATION 1

loose building debris

Original wall plaster

Deteriorated Beachrock

Sand / Soil deposits contain up to 30% salts

1. Remove of loose particles
2. pre-fixing of loose stones
3. Insert (new) mortar
4. Add Render/plaster in layers
5. check for waterpockets on walltop

Sharp edge (double line)

Consolidated plaster
Remove deposits

Surface run-off water management
GENERAL PRINCIPLES
CHARACTERISTIC SITUATIONS AND PROPOSED SOLUTIONS

SITUATION 2

- Open joint caused by aeolian and pluvial processes
- Deteriorated Beachrock
- Wall plaster lost bonding to wall structure
- Voids
- Sand / Soil deposits contain up to 30 % salts
- Building debris deposits

e.g. ZUEP01, Space 102: 604

- Structural additions
- Sharp edge (double line)
- Consolidated plaster
- Re-pointed joints
- Repair
  - according to situation:
    - sloping surface or
    - compacted horizontal surface
- Re-bonding plaster
GENERAL PRINCIPLES
CHARACTERISTIC SITUATIONS AND PROPOSED SOLUTIONS

SITUATION 3

Deteriorated Beachrock

Open joint caused by aeolian and pluvial processes

Voids

“Open joints” + eroded beachrock wall stones

Sand deposits

ARCHAEOLOGICAL DEPOSITS

e.g. ZUEP04, Space 3001: 4010

Additional wall stones to make the wall more visual on a case to case basis

Sharp edge (double line)

Re-pointing of joints
Re-plastering to protect beachrock

protective sand layer
GENERAL PRINCIPLES
AND CONSERVATION CONCEPTS

The following principles were developed for Al Zubarah Archaeological Site, for the conservation of architectural remains:

The conservation work respects the authenticity of the archaeological remains and contexts as well as the integrity of the site and its features. The urban fabric of Al Zubarah has to be protected to ensure its integrity.

The architecture of Al Zubarah resembles characteristics of stone and earthen architecture. This is not only true for its construction but in the nature of its decay.

No major reconstruction should take place but structural rebuilding is necessary in several cases to ensure the stability of the wall structures, to protect the soft and fragile wall stones and to maintain the integrity of the overall town plan.

Plaster surfaces should resemble historic surfaces in appearance as far as possible.

Three different tooling are attested:
1. rough surface with traces of hand tooling;
2. surface with traces of trowel tooling;
3. smoother surface with only a few traces of tooling.

The aim is to create a closed, more unified surface instead of accentuating differences. Differences will appear naturally, according to the soils and sand used in the mortar. This reflects the variety of plasters and mortars in the archaeological record. At the moment a hydrated lime produced in Qatar is used as binder, but in future we hope to replace the lime with anhydrite for the plasters. As long as the production of anhydrite is not developed further we will use the Qatari lime, which is performing well.

Areas not foreseen for presentation will be backfilled permanently. Temporary backfill of excavation areas will take place when no immediate conservation and consolidation work can be carried out or excavation work is not finished. Backfill should be done properly and should consider surface run-off water management.

Newly added materials (plaster and mortar) should be less hard and slightly weaker – or of same strength – than the “original” material.

To protect the fragile vestiges on site only limited and controlled access will be given to visitors. Clearly marked and partially raised walkways will allow visitors to explore the site but only in the areas open to the public. Permanent guards will ensure the rules set out for Al Zubarah Archaeological Site will be followed. To limit the impact of vehicle traffic, one vehicle track for visitors leading to an interim parking zone and one service track for ongoing works on site were established in 2011/2012.

Regular monitoring will help us to develop the above mentioned conservation strategies further.
QIAH- Tests:
A - very smooth, dense surface, almost no tooling visible
B - rough surface with traces of hand tooling
Bb - same as A & B, but with desert sand aggregate
C - washed surface with traces of trowel tooling
D - Archaeological Record: Hand-tooling, tower EP04
In the conservation of architectural remains at Al Zubarah, several historic and modern mortars and plasters were analysed, tested and optimised to correlate with the historic settings and to withstand the extreme environmental conditions on site (see Appendix 2). These requirements often seem incompatible. However, the following mortars performed well in fulfilled these requirements:

1. close to historic appearance;
2. use of local materials (when possible);
3. performs well under environmental conditions;
4. same strength and/or slightly softer than original plasters.

Two mixtures were based on locally produced hydrated lime. Two others are based on German Natural Hydraulic Lime Otterbein Hydradur. The cement (which should be tricalciumaluminate (C3A)-free) content is meant to stabilise the mortar before the carbonation process of the lime is finalised. In a mid- to long-term perspective, there is a plan to reproduce anhydrite mortars, as they were widely used at Al Zubarah when it was built.

**Wall mortar No. 1.2**
1 part NHL (Otterbein Hydradur) + 3 parts Quartz sand (0-8 mm); Ratio 1:3

**Wall mortar No. 1.51**
2,5 parts Lime (hydrated lime) + 1 part white cement + 12 parts Quartz sand; Ratio 1:3,4

**Wall plaster No. 1.55**
3,5 parts Lime (hydrated lime) + 1,5 parts cement + 3 parts Quartz sand + 6 parts sieved “Zubarah soil” + 6 parts “desert sand” (reddish in colour); Ratio 1:3.

**Wall plaster No. 1.56**
1 part NHL (Otterbein Hydradur) + 1,5 parts “desert” sand + 1,5 parts Quartz sand (0-3 mm); Ratio 1:3

**Note:** NHL should be used in the context with historic (gypsum-based) plasters; hydrated lime in combination with white cement should only be used were no gypsum-based plasters are preserved, due a possible reaction between the tricalciumaluminate (C3A) and the gypsum, which can result in the further disintegration of building materials.

Sharp “double” line defining wall face and wall top (example ZUEP04:4010)
CONSERVATION CONCEPT FOR EARLIER EXCAVATED AREAS

**STATE of 1980s REPAIRS**

- Cement capping
- Aeolianite (Sand/Lime stone)
- Beachrock, deteriorated
- Blown- & washed-out joints
- Loss of bonding between plaster & wall structure
- Voids
- Fragile plasters need consolidation

**CONSOLIDATION of 1980s REPAIRS**

- Take-off Cement Capping
- Add or remove stones to re-shape wall top
- Sharp plaster edge (double line)
- Fill-in mortar into wall structure
- Re-bonding of loose plaster fragments
- Consolidated Plaster
- Protective layer of sand
- Replace damaged stones

Legend:
- Historic Building Stones (mainly beachrock)
- Aeolianite (1980s repairs)
- "Original" wall and floor plaster (anhydrite + lime-based)
- 1980s cement
- Historic wall mortars
- QIAH-repair (stones)
- new plaster (QIAH) (at the moment lime-based)
- new wall mortar (QIAH)
- Plaster consolidation
- Sand
CONSERVATION CONCEPT:
TOWN WALL with exposed walkway, e.g. TOWER 8 / EP10

Section of wall segment North of tower 8

Re-plastering:
“Rough” surface with traces of hand tooling; sharp edge (double-line) between wall top and wall face; edged corners
Conservation Concept: TOWN WALL
for segments exposed in 1980s

TOWN WALL
CURRENT SITUATION

Wall collapse
Sand deposits with high salt content
former Walkway
1980s Cement mortar
1980s Cement capping
Blown- & Washed-out Joints
eroded Wall stones
Sand & Soil deposits
heavily damaged (deteriorated) Beachrock

TOWN WALL
GENERAL CONSERVATION CONCEPT

Taking-off cement capping
Re-shaping wall top ("re-ruined")
Re-plastering; Rough surface with traces of hand tooling; clear sharp, double lined edge
Re-pointing of joints
Addition of stones due to structural needs
Exchange of damaged Beachrocks
Removal of Sand & Soil deposits
Quartz-sand fill, compacted horizontally or slightly sloping away from wall basis

VAR. 1
Conservation Concept: TOWN WALL
for segments exposed in 1980s and by QIAH

- Re-pointing of joints
- Re-shaping of wall top
- Re-plastering, with rough surface and ledge
- Re-plastering, hand tooling
- Exchange of damaged Beachrocks
- Re-buried walkway
- Sand deposits stay

VAR. 2

Town wall segment 8/9 with re-shaped crown in March 2012 (VAR. 1).

Town wall segment at tower 4012 (ZUEP04) in March 2012 (VAR. 2).
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

NICHES

Niches are a common feature throughout Zubarah’s architecture. Situated above a plaster panel/socle, centred, or in regular intervals on the walls. Due to the state of conservation it cannot be stated if some of the niches exposed in the house walls are linked to wind catchers. Some niches seem to have had plaster decorations and decorated frames. Some were obviously arched, but no complete niches have so far been found.

Niches can serve several different functions, such as to:

1. keep things in
2. place a lamp onto it
3. point to Qibla direction
4. catch wind and direct it into the building.

A) Restored example from Saudi Arabia (S. Ricca, 2008)
B) Historic example from Lamu /Somalia (S. Moriset 2009).
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

WINDOWS

Windows are a common feature at Al Zubarah. The construction has an elaborated design. In several cases the window has a plaster frame on the exterior encircling a mashrabiya – Gypsum grill. In some cases (as shown here), there is a wooden frame on the interior where a shutter would be placed to regulate light and air flow. Often additional wall openings for air circulation were situated above the window. Windows are generally situated close to the floor for people sitting on floor mats.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

DOOR REVEALS

BEST PRACTICE GUIDELINES

- AVOID plaster lines on different levels
- AVOID odd arrangements
- AVOID tilted geometry

DO

- Keep it simple.
- Make the doorway recognisable.
- Stabilise fragile parts.
- Discuss detail on a case-by-case basis.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

CORNERS

BEST PRACTICE GUIDELINES

• AVOID plaster lines on different levels
• AVOID odd arrangements and forms.
• AVOID artificial lines
• AVOID too extreme amplitudes

DO

• Create logical plaster connections.
• Connect wall faces and plaster lines, where possible.
• Keep levels straight.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES
PLASTER LEDGE / PANEL

BEST PRACTICE GUIDELINES

Plaster panels and related ledges should be reconstructed where possible and where archaeological evidence is given. The reconstruction of these features will help to show the historic proportions, character and function of the rooms.

If no information is available **NO** reconstructions should take place. For interior plaster surfaces a “smooth” surface treatment with some traces of trowel tooling is recommended to reach a homogeneous image.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

**PLASTER LINE** DEFINING BORDERS BETWEEN WALL FACE AND WALL TOP

**BEST PRACTICE GUIDELINES**

**AVOID**
- plaster lines joining on different levels.
- illogical arrangements and forms.
- artificial lines: do not follow every stone outline with the plaster line: keep it natural
- do not make the line too wide: max. 3 to 4 cm

**DO**
- Create logical plaster connections.
- Try to keep levels straight and try to even out height differences.
- Keep the line running naturally.
- Do not follow every single stone outline.
- Keep the width of plaster line between 2 to 4 cm.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

STAIRS

The conservation solution for stairs and steps should be planned on a case-by-case basis. Stairs should be completed (Figs. 2 and 3) and stairwell walls should be rebuilt in keeping with the archaeological and architectural context (Figs. 3 and 5). Where a partly destroyed step can be understood as a step (Figs. 1 and 2), only the remains should be consolidated and conserved.

To stabilise, preserve, and consolidate historic plaster in situ, it might be necessary to complete a step or plaster surface (Fig. 4).
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

DATE PRESS

Over time the dates begin to release a sweet juice, and are “pressed” by the weight from sacks above.

The juice (dibs) runs down the plastered gullies to one end of the madbasa, into a main gully running the length of the press.

A pot tuned below floor level collects the dibs which is then ladled out and used for food.

Cut away diagram of a madbasa (date press) excavated at the palace in Al Zubarah (A. Pantos)
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES
BENCHES AND PLATFORMS

Surfaces of benches or platforms should be done with a smooth surface and a sharp plaster edge. NO double line! e.g. platforms in the Palace (ZUEP04). Same is true for benches, e.g. the reconstructed benches in QMA2.

Platform in EP04 (2012 consolidation)

Bench in QMA2 (1980s reconstruction)
Hamams are common features throughout the settlement. Raised 10 to 30 cm above the floor level the platform shows a very smooth plaster surface. The Hamman installation drains through a sewer into an external, underground-placed sewage tank. Some hamams are showing elaborated plaster decorations (e.g. in ZUEP01 [A]), others are kept very basic and simple (e.g. in ZUEP04 [B to D]).
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES

FLOORS

Historic (anhydrite) plaster floor at the palace; (03/2010).

Pavement made of conglomerate stone slabs; This kind of pavement can also be found under the plaster floors as an underbed (03/2010).

Cleaned floors should be covered by mesh or geotextile before a layer of fine sieved soil or better quartzsand is placed on. The layer of sand should be around 5 cm.
CONSERVATION CONCEPT FOR ARCHITECTURAL FEATURES
BACKFILL AND PROTECTION OF SECTIONS & WALLS

Backfilling features and trenches

Protection of excavation trench sections
MONITORING STATE OF CONSERVATION USING 3D-LASER SCANNING
**MONITORING STATE OF CONSERVATION USING 3D-LASER SCANNING**

In addition to the traditional inventory and photographic record, 3D laser scanning provides fantastic possibilities for monitoring changes and decay patterns over time. Comparing scans by overlays allows us to visualise consolidation measures, e.g. structural rebuilding, but also the decay of building materials as well as the effectiveness of conservation measures. The study and analysis of this documentation will allow us to develop maintenance cycles and to revise the conservation materials and techniques we apply.

In contrast to traditional recording techniques, 3D laser scans allow us to look at the recorded structures in 3D, not simply as two dimensional images or a plan. Defects caused by weathering, thermal expansion and salt crystallisation can be followed and documented in great detail to provide additional information on the environmental conditions at Al Zubarah Archaeological Site.

**MONITORING STATE OF CONSERVATION MAPPING OF DEFECTS**

Defects, deterioration patterns and weathering of materials should be mapped and recorded before conservation and consolidation measures take place to help define the methods and materials we use as well as allowing us to discuss the extent of the measures that are needed. The recording should be executed by an expert or skilled person (restorer, conservator, crafts-person). It can be done on hand drawings, photoplans and/or plan generated out of scan point clouds.

Defects and the state of conservation in general should be documented at least with photographs (with and without scale) before, during and after a conservation measure has taken place. The documentation has to be added and linked to the Inventory database (conservation log) as soon as possible to make sure that no data is lost. The mapping of defects and deterioration patterns helps us to identify patterns over time, to define conservation methods and materials and to define the necessary workforce required to preserve the remains.
CONSERVATION MANUAL (PART 3) OVERVIEW: WHERE TO APPLY WHICH *FICHE TECHNIQUE*
CONSERVATION MANUAL (PART 3) OVERVIEW: WHERE TO APPLY WHICH FICHE TECHNIQUE
LIST OF FICHES

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   3.2 Wall foundations
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   3.5 Plaster works
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**Conservation Handbook for Al Zubarah Archaeological Site - PART 3**
Edited by Moritz Kinzel with contributions by Simone Ricca, Paul Hofmann and Robert Sobott.

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Department of Cross-Cultural and Regional Studies - ToRS
University of Copenhagen and the Qatar Museums Authority - Al Zubarah Archaeological Site.
HEALTH & SAFETY INSTRUCTIONS
FOR AL ZUBARAH ARCHAEOLOGICAL SITE

Field of application: general
AMBULANCE (Police & Fire) dial 999

Personal Security

• Wear security boots.

• Always wear gloves and glasses when you are working with lime and stones, to avoid injuries (see Fig. 1).

• Wear appropriate clothing.

In order to protect yourself against the harsh climate:

• Drink plenty of water throughout the day (Fig. 2),
• wear sun-cream with a high UV filter (Fig. 3).
PROTECTION OF BUILDING MATERIALS

Make sure that you have

1. a secure storage and mixing areas; clear and well organised (see figure at the bottom),

2. separated the materials,

3. placed the water tanks on secure platforms to avoid cracks in the bottom.

Materials (especially Lime, Gypsum and Sand) should be covered with fabric to avoid direct sunlight. (pictures on the right: Sand bags covered with plastic fabric and building materials stored in house).
Adjunctioned building elements should be protected, e.g. Floors, Doorways, etc. to avoid damages during the work process.

**Building up protective layers:** protective fabric, e.g. Mesh (Fig.1), 5 cm Sand layer (Fig.2) for walkway planks have to be added accordingly (Fig.3 & 6). In addition doorways, thresholds, recesses etc. have to be protected separately (Fig. 4 -6).
HEALTH & SAFETY INSTRUCTIONS
FOR AL ZUBARAH ARCHAEOLOGICAL SITE

SAFE & SECURE HANDLING OF TOOLS

Safe and secure handling of power tools:
1. clear cable routing
2. clear power distribution
3. Read instructions for Mixers, Drills, Hoovers, Compressors, Generators, etc. prior to their use in field.

Tools and vehicles should be treated gently.
DO NOT risk damages or losses.

Stay with vehicles on the marked tracks (ask for the latest update of the track map distributed by the site manager).
DO NOT drive, never ever, into the Sabkha!
AVOID crossing archaeological features as much as possible!
Be aware of archaeological features outside the town wall of Zubarah (e.g. cementery, screening walls and saline areas)!

How to deal with archaeological finds and architectural remains in general?

When you find archaeological objects please contact an archaeologist and/or your project coordinator.
Do not move or touch finds!
Take a photograph and ask for advice.....(see telephone list at ZRS)

Field of application: general
AMBULANCE (Police & Fire) dial 999
FIELD OF APPLICATION: general

STONE MATERIAL
for Replacements, structural rebuilding and reconstructions:
KA, LA, BL, LO, AG3 according to Appendix 1 classification of building stones

BINDER
Natural hydraulic Lime (hL)
White cement (wC)
Hydrated lime (wLh)

ADDITIVES
Quartz sand 0-10; sieved on the spot to ca. 0-4
"Zubarah" Soil, sieved on the spot to ca. 0-4
"Desert" sand, ca. 0-2

Desert sand (ds)
Quartz sand 0-10 (qs10)
Quartz sand, sieved to 0-2 (qs2)
Soil from Zubarah, sieved to 0-2 (so2)
In the conservation of architectural remains at Al Zubarah, several historic and modern mortars and plasters were analysed, tested and optimised to correlate with the historic settings and to withstand the extreme environmental conditions on site. These requirements often seem incompatible.

However, the following mortars performed well in fulfilled these requirements:

1. close to historic appearance;
2. use of local materials (when possible);
3. performs well under environmental conditions;
4. same strength and/or slightly softer than original plasters.

Two mixtures were based on locally produced hydrated lime. Two others are based on German Natural Hydraulic Lime Otterbein Hydradur. The cement (which should be tricalciumaluminate (C3A)-free) content is meant to stabilise the mortar before the carbonation process of the lime is finalised. In a mid- to long-term perspective, there is a plan to reproduce anhydrite mortars, as they were widely used at Al Zubarah when it was built.

**Wall mortar No. 1.2**
1 part NHL (Otterbein Hydradur) + 3 parts Quartz sand (0-8 mm); Ratio 1:3

**Wall mortar No. 1.51**
2,5 parts Lime (hydrated lime) + 1 part white cement + 12 parts Quartz sand; Ratio 1: 3,4

**Wall plaster No. 1.55**
3,5 parts Lime (hydrated lime) + 1,5 parts cement + 3 parts Quartz sand + 6 parts sieved “Zubarah soil” + 6 parts “desert sand” (reddish in colour); Ratio 1:3.

**Wall plaster No. 1.56**
1 part NHL (Otterbein Hydradur) + 1,5 parts “desert” sand + 1,5 parts Quartz sand (0-3 mm); Ratio 1:4

**Note:** NHL should be used in the context with historic (gypsum-based) plasters; hydrated lime in combination with white cement should only be used were no gypsum-based plasters are preserved, due a possible reaction between the tricalciumaluminate (C3A) and the gypsum, which can result in the further disintegration of building materials.
BUILDING MATERIALS
AT AL Zubarah

LIME

ANHYDRITE

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Formula</th>
<th>Lime (CaO)</th>
<th>Sulfur Trioxide (SO₃)</th>
<th>Water of Crystallization (H₂O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gypsum</td>
<td>CaSO₄•2H₂O</td>
<td>32.6</td>
<td>46.5</td>
<td>20.9</td>
</tr>
<tr>
<td>Anhydrite</td>
<td>CaSO₄</td>
<td>41.2</td>
<td>58.8</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Mineralogy

Gypsum forms monoclinic crystals with a perfect {010} cleavage and distinct cleavages along {100} and {101}. It is distinguishable from anhydrite by its lower Mohs hardness (2.0 versus 3.5) and specific gravity (2.24 versus. 2.97 g/cm²). Pure gypsum is colorless, but may be tinted yellow, red, and brown because of the presence of impurities. Twinning is common along {100}, forming “swallowtail twins.” Gypsum is relatively soluble in fresh water (about 0.2 g/100 g H₂O) and is easily dissolved or eroded in conditions of high humidity or rainfall. Anhydrite forms orthorhombic crystals with perfect cleavages along {100} and {010} and a good cleavage along {001}. Anhydrite has a Mohs hardness of 3.5 and a specific gravity of 2.97 g/cm². Pure anhydrite is colorless, but the color is variable from colorless to dark gray (Sharpe & Cork 2006:519-540).

Sabkha Evaporites

Sabkha is an Arabic term referring to a coastal tidal flat. Numerous geological studies in the 1960 and 1970s examined the formation of gypsum and anhydrite minerals along the Trucial Coast region of the Persian Gulf (e.g., Kinsman 1966, 1969; Butler 1970). These deposits are characterized by a distinctive suite of sediments, including lagoonal limestone, intertidal algal mat limestone and nodular gypsum, and anhydrite-bearing, fine-grained terrigenous or calcareous sediments. Gypsum and anhydrite form by precipitation of supersaturated brine in the pore space of the tidal-flat sediments. Nodular gypsum and anhydrite are the most common forms, but large poikilitic selenite crystals may also form (Sharpe & Cork 2006).
BUILDING MATERIALS
AT AL ZUBARAH

IDENTIFICATION SCHEME FOR BUILDING STONES ATTESTED AT AL ZUBARAH

Fossils recognisable?

Yes

No

Mixture of rock fragments and fossil debris (clam shells)

Scratchable with fingernail

Fossil debris consisting almost entirely of gastropods

Conglomerate KA

Gypcrete BL

Micro-crystalline fabric withuggy porosity, grey to white colour

Beachrock AG

Beachrock BJ

Dolomite BI

Aeolianite FR
CONSOLIDATION OF WALLS
AT AL ZUBARAH TOWN

Field of Application: general
PERSONNEL: Skilled craftsperson with trained workforce
TOOLS: Brushes, Industrial hoover, spatulae, trowel, bucket, sponge, water pump, mason hammer, etc.
MATERIALS: Water, Otterbein NHL5, Quartz sand
Fiches: 3; 3.1; 3.2; 3.3; 3.4; 3.5 (3.5.1, 3.5.2, 3.5.3, 3.5.4)

Tower (4012) at palace before consolidation (2011)  Tower (4012) at palace after consolidation (2012)
Window at palace before consolidation (01/2012)  Window at palace after consolidation (03/2012)
Doorway at palace before consolidation (01/2012)  Doorway at palace after consolidation (03/2012)
FICHE No.3

CONSOLIDATION OF WALLS
RELATED TO HOUSES

Palace (ZUEP04: wall 4091)
State of Conservation December 2011

Remove debris (industrial hoover)
Prefixing of loose stones

Palace (ZUEP04: wall 4091)
Concept for consolidation February 2012
FICHE No.3

CONSOLIDATION OF WALLS RELATED TO HOUSES

SITUATION 1

- Sand / Soil deposits contain up to 30% salts
- Building debris deposits
- Deteriorated Beachrock
- Wall plaster lost bonding to wall structure
- Open joint caused by aeolian and pluvial processes

1. Remove of loose particles
2. Pre-fixing of loose stones
3. Insert (new) mortar
4. Add Render/plaster in layers
5. Check for water pockets on walltop

- Consolidated plaster
- Remove of deposits
- Surface run-off water management

SITUATION 2

- Open joint caused by aeolian and pluvial processes
- Deteriorated Beachrock
- Wall plaster lost bonding to wall structure
- Voids
- Sand / Soil deposits contain up to 30% salts

- Structural additions
- Sharp edge (double line)
- Consolidated plaster
- Re-pointed joints
- Re-bonding of plaster

Repair according to situation:
- Sloping surface or compacted horizontal surface

E.g. ZUEP01, Space 102: 604
CONSOLIDATION OF WALLS
TOWN WALL without exposed walkway

**TOWNWALL CURRENT SITUATION**
- Wall collapse
- Sand deposits with high salt content
- Forward Walkway
- 1980s Cement mortar
- 1980s Cement capping
- Blown- & Washed-out Joints
- Eroded Wall stones
- Sand & Soil deposits
- Heavily damaged (deteriorated) Beachrock

**TOWNWALL GENERAL CONSERVATION CONCEPT**
- Taking-off cement capping
- Re-shaping wall top ("re-ruined")
- Re-plastering: Rough surface with traces of hand tooling; clear sharp, double-lined edge
- Re-pointing of joints
- Addition of stones due to structural needs
- Exchange of damaged Beachrocks
- Removal of Sand & Soil deposits
- Quartz-sand fill, compacted horizontally or slightly sloping away from wall basis
- "Re-buried" Walkway
- Sand deposits will stay
CONSOLIDATION OF WALLS
PREPARATIONS & INITIAL WORKS

Field of Application: general
PREMISE: Work of Fiche 6 has been executed and documentation is finalised
PERSONNEL: surveyor, skilled craftsperson
TOOLS: hammer, chisel, pick, brush, hoover, trowel
MATERIALS:

Before work can take place, the walls that are being considered for consolidation work have to be recorded and registered in the building inventory (see Fiche No.6 – Monitoring and State of Conservation record). When the documentation is finalised the following procedures should be followed:

1. Hammer out and remove 1980s cement capping

2. Hammer out and remove cement mortar remains in joints.
3. Expose, strip off and clean collapsed building parts.

4. Remove loose materials and clean with an industrial hoover.
5. Pre-select stone material according to quality and (possibly) field of application.

6. Pre-watering of wall stones before mortar is inserted.
CONSOLIDATION OF WALLS

NOTES
1. Selection of the suitable stone material [KA (1), LA (2), BL(3)].
2. Work at unstable wall parts in manageable segments to avoid collapse.
3. Excavate wall basis down to 20 cm under the current surface level (Fig.4).
4. Insert vertical stoneslabs (KA or LA) into the trench from ca. 20 cm to 5 cm above ground.
   Stones set in quartz sand (Fig.5 to 7). Exterior of Wall structure to be consolidated and com-
   pacted.
5. Production of needed amounts of mortar mixture (Fig.8).
6. Wall structure: Build-up of interior wall structure with mortar and inserted BL-stone-lumbs as
   well as smaller stones (Fig.9).
7. Building up wall structure with mortar and BL-stones up to 25 cm above ground level. Re-
   pointing of joints (Fig.10 - 12).
8. Re-pointing of joints at the wall foundation with mortar no.1.2 (Fig.12)
9. Protect your work segment for at least 12 hours against wind and sun (Fig.13).
   Keep the mortar moist during this period!

FIELD OF APPLICATION: Only where NO floors were recorded in the archaeological findings.
DO NOT perform when historic wall plaster is preserved on floor level or a historic floor has
been recorded.

PREMISE: Work of Fiche 3.1 has been executed and finalised
PERSONNEL: skilled craftsperson with workmen
TOOLS:
MATERIALS: KA, LA, BL, qS
Mortar No. 1.2
CONSOLIDATION OF WALLS

4 5 6

7 8

9 10
CONSOLIDATION OF WALLS
FOUNDATIONS (MAINLY TOWN WALL)

cross-section through consolidated town wall
CONSOLIDATION OF WALLS
1. Selection of suitable stone material (LO, FR, AG3; Fig. 1 to 3).
2. Preparation of necessary amounts of relevant mortar mixture (Fig.4).
3. Securing and stabilising “open” wall structure by ejecting mortar into voids and caverns (Fig.5).
4. Securing and stabilisation of partly collapsed wall segments by structural re-building; Keep an eye on the joint configuration and the height of courses! (Fig.6)
5. Rebuilding of recognisable shapes by repositioning of stones.
   Note stone cubatures and joint courses! (Fig. 7 & 8)
6. Re-pointing of joints up close under the stone surface (Fig. 9).
   Keep it moist during this period.
7. Protect area of work for at least 12 hours against wind and sun (Fig. 10).

DEFINITION:
IF THE ADDITION OF MATERIALS (STONE & MORTAR) GOES BEYOND THE ATTESTED SHAPE OF A STILL RECOGNISABLE WALL STRUCTURE, IT CAN NO LONGER BE CALLED “STRUCTURAL REBUILDING” OR “STABILISATION”. IT HAS TO BE CALLED “RECONSTRUCTION” INSTEAD.
CONSOLIDATION OF WALLS
STRUCTURAL REBUILDING

Mortars
- Use mortar No. 1.2 at walls with remains of historic plasters.
- Use mortar No. 1.51 ONLY at walls WITHOUT plaster remains!
CONSOLIDATION OF WALLS
STRUCTURAL REBUILDING
FICHE No.3.4
CONSOLIDATION OF WALLS
RECONSTRUCTION

FIELD OF APPLICATION: general, but only according to detailed planning!
PREMISE: Work of Fiche 3.1 and 3.3 has been executed and finalised
PERSONNEL: skilled craftsman with workmen
TOOLS:
MATERIALS: LO, FR, AG3
Mortar No. 1.2 (at walls with remains of historic plasters)
Mortar No. 1.51 (ONLY at walls WITHOUT plaster remains!)

1. Selection of suitable stone material (Fig. 1 to 3).
2. Preparation of needed amounts of mortar mixtures (Fig.4).
3. preliminary dry-setting of wall stones of the area to be reconstructed; selection of stone cubature (Fig. 5).
4. After moistening of the wall structure and selected stones, build up prepared areas (Fig.6).
5. Raise wall-tops to ensure good surface-run off of water (e.g. rainfall). Set stones in mortar and re-pointing of joints (Fig.7 & 8).
6. Reconstruction and shaping of building features, e.g. steps, door recess according to approved planning documents (Fig.9, 10 and 11).
7. Protect your work segment at least for 12 hours against sun and wind (Fig.12). Keep it moist and re-moist it in regular intervals!

DEFINITION:
IF THE ADDITION OF MATERIALS (STONES & MORTAR) GOES BEYOND THE ATTESTED SHAPE OF A STILL RECOGNISABLE WALL STRUCTURE, IT CAN NO LONGER BE CALLED “STRUCTURAL REBUILDING” OR “STABILISATION”. IT HAS TO BE CALLED “RECONSTRUCTION” INSTEAD.

1 2 3
CONSOLIDATION OF WALLS
RECONSTRUCTION
CONSOLIDATION OF WALLS
RECONSTRUCTION

TOWER 8 / ZUEP10
TOWNWALL
CONSERVATION CONCEPT

Remove Flat stone capping + add wall stones to re-shape wall top

Re-plastered walkway surface (“smooth”)

Sharp edge ("double" line)

Re-render/plaster:
“Rough” surface with traces of hand tooling

Structural Re-building

Backfill: compacted layers when possible sloping surface away from the wall base

1 m
1. Preparation and production of needed plaster mix (Fig.1)

2. **First application**: Even out irregularities, but follow the general form, keeping general unevenness. Plaster mortar should be inserted without smoothing. After ca. 2-3 hours scratch off peaks. This plaster layer can be 1 to 5 cm thick. Shrinkage cracks will appear. Design details have to prepared and pre-shaped in this phase. Cover plaster with fabric! (Fig. 2, 3 & 4).

3. **Second application**: after approx. 6 -24 hours. The underground (1st application) can be partly dried. Pre-watering of wall segment. Apply plaster mortar and strip it off. Don't smoothen it. Plaster mortar application should not be more than 3 cm. There could still appear some shrinkage cracks. Design details have to be shaped. Plaster has to be covered with fabric (Fig. 5, 6, 7, 8 & 9).

4. **Third application**: after approx. 2 - 4 hours. 2nd application should be solid and not mouldable with the thumb. Apply plaster material with trowel and smoothen surface with a small trowel in vertical segments. Some visual traces of trowel tooling are desired (see [Fiche No. 3.5.1](#)). Plaster mortar should be applied in layers of max.1.5 cm thickness. Design details should be shaped and completed by now. Cover plaster with fabric! (Fig.10, 11, 12 & 13).

5. Protect your work segment for at least 12 hours against sun and wind! Cover the surfaces with fabric (Fig. 14). Keep the plaster humid. (Fig.15).

**NOTE**: Applied wall plaster should cover approx. 10 cm of the wall top to create an area which forms a ledge once the wall capping is applied (see [Fiche No. 3.5.3](#))! Salt crystallized on the surface should be brushed off after 40 to 50 hours!
CONSOLIDATION OF WALLS
PLASTER
FICHE No.3.5

CONSOLIDATION OF WALLS
PLASTER
CONSOLIDATION OF WALLS
PLASTER

NOTES
1. After approx. 30mins. to 1.5hours the mortar should be not mouldable by thumb pressure.
2. Expose, carefully, quartz particles at the surface with sponge and water. Avoid sponge traces.
3. Afterwards, smooth surface with a small trowel. Traces of trowel tooling can stay visible.
4. Steps 2 and 3 (sponge/small trowel treatment) has to repeated over approx. 4hours with short breaks of approx. 15 to 45mins.
5. Surface should be kept humid over the entire work period.
6. Mortar has to be covered in between.
CONSOLIDATION OF WALLS
PLASTER DESIGN “Smooth surface”
FICHE No.3.5.2

CONSOLIDATION OF WALLS
PLASTER DESIGN “Hand tooling”

FIELD OF APPLICATION: in general on “exterior” wall faces at the palace, the town wall and towers (Check archaeological record!).

PREMISE: Work of Fiches 3.5 is executed!

PERSONNEL: skilled crafts-person with workmen
TOOLS: Trowel, sponge, water-sprayer
MATERIALS:
Mortar No. 1.55 (ONLY at walls WITHOUT plaster remains!)  
Mortar No. 1.56 (at walls WITH historic plaster remains)

Follows immediately after Fiche No. 3.5!
Mortar can still be mouldable by thumb pressure.

1. Treatment of mortar surface with gloves, hessian or linen-bales to create traces of hand tooling.
2. The surface appearance suggests that the plaster was applied entirely by hand.
3. Surface has to be kept humid during the entire work period.
4. Mortar should be covered with fabric in between.

3. Der Oberfläche ist über den gesamten Zeitraum genügend Feuchtigkeit anzubieten.
4. Mörtel mit Folie zwischendurch abdecken.
1. Building up of mortar layers

2. Applying final render by hand with gloves...

3. Final appearance with “tools”.
1. after 30 mins. to 1.5 hours the mortar should be not be mouldable by the thumb anymore.
2. Exposure of quartz particles at the surface by trowel, sponge and water; repeat procedure if necessary (Fig. 1 to 3).
3. This procedure applies a rough but regular appearance to the mortar surface (Fig.5).
4. Surfaces should be kept humid during the entire work period. (Fig.4)
5. Mortar should be covered with fabric in between the work steps.

---

1. nach ca. 30 min. bis 1,5 Stunden sollte der Mörtel auf Daumendruck nicht mehr formbar sein.
3. Der Mörtel erhält so ein rauhes aber gleichmäßiges Erscheinungsbild.
4. Der Oberfläche ist über den gesamten Zeitraum genügend Feuchtigkeit anzubieten.
5. Mörtel mit Folie zwischenendurch abdecken.
CONSOLIDATION OF WALLS
PLASTER DESIGN “Rough surface”
FIELD OF APPLICATION: general when cracks appear on plaster surfaces

PREMISE:

PERSONNEL: skilled craftsperson with workmen

TOOLS: Trowel, sponge, water-sprayer

MATERIALS:
Mortar No. 1.55 (ONLY at walls WITHOUT plaster remains!)
Mortar No. 1.56 (at walls WITH historic plaster remains)

1. Open surface cracks with trowel and clean the area with brush.
2. Water plaster / mortar and mix amounts of mortar required.
3. Fill opened crack with mortar.
4. Adjust mortar to surrounding surface.
CONsolidation & Stabilisation of Historic Plasters & Surfaces

Field of application: general
Climate conditions:
Premise: Performance before Fiche No. 3.5!

Personnel: experienced conservator/restorer with trained assistant
Tools: Brushes, Industrial hoover, spatulae, trowel, bucket, sponge, water-spray
Materials: Water, acryl-dispersion, Lime, Sand

Before consolidation took place (ZUEP02)

Immediately after the consolidation took place.
CONSOLIDATION
OF HISTORIC PLASTER SURFACES

Consolidation of Plaster surfaces
see Fiche No. 4.1

Fixing of loose plaster parts
see Fiche No. 4.2

Cementing of Cracks
see Fiche No. 4.3
Introduction
The historic plasters have an enormous complexity and range of preservation. This work should be executed and supervised by a conservator/Dipl.-Restorer experienced in conservation in the context of archeological field work.

Conservation works
Before the conservation works, all extremely deformed and loose fragments of the wall plaster, as well as debris materials, need to be carefully removed using an industrial hoover.
To fill gaps, cracks, and voids a specially composed mortar is used, which is based on 1 part lime, Acryl-dispersion (2%), and 4 parts „desert sand“.

1. Preparation and mixing of Consolidation liquids (Acryl-dispersion SF016 7% in Water) (fig. is missing).

2. Cleaning of plaster surfaces with brushes and hoover (Fig.2).

3. regular application of consolidation liquid onto the plaster surface (Fig.3 & 4).

4. repeat point 3 after 5 to 10 minutes according to absorbency of plaster subsurface. However additional application should be executed wet in wet (Fig.6).
FICHE No.4.1

CONSOLIDATION
OF HISTORIC PLASTER SURFACES

NOTE: AIM OF MEASURE IS TO STABILISE THE HISTORIC PLASTER SURFACES TO REDUCE WEATHERING EFFECTS. DUE TO THE HIGH SALINITY INSIDE THE MORTARS AND WALL STRUCTURES THE DETERIORATION CANNOT BE STOPPED COMPLETELY.
FIELD OF APPLICATION: general
Climate conditions: Avoid direct sun (max. 28°C) and too strong winds (max. 5Bft)
PREMISE: Fiche No. 4.1 has to be executed before!
PERSONNEL: One or two skilled restorer
TOOLS: Brushes, Industrial hoover, spatulae, trowel, bucket, sponge, drill, saw
MATERIALS: Water, acryl-dispersion, fibre glas rods
EXTRA: Avoid direct sun and too strong winds

A - Securing detached plaster by needling
1. Prepare anchor material (fiberglass rods D 4-8 mm), define drilling range, quantity and length of needling and deployed anchors (Fig. 1).
2. Drilling holes with 2mm wider diameter than desired anchor material; make sure that the holes are pointing in different directions, but drilled slightly diagonally downward (Fig. 2)
3. Cleaning of the dowel hole and prewetting (Fig. 3)
4. Glue/Fixing of dowel rods. Glue: here Lime-Acryl milk (Fig.4)
5. Closure of the dowel holes with mortar (see Fiche 4.3), (Fig.5)
B - Re-attaching broken plaster parts by needling

6. Recover and securing fragments, Cleaning of fragments (Fig.6)
7. Mapping, sorting, and reconstruction of the original position (Fig.7).
8. Bonding of the fragments as required (Fig.8)
9. Preparation of needling (as described in paragraph A), (Fig.9)
10. Re-attachment and bonding of fragments in its historical position (Fig. 10 & 11).
11. Seal dowel holes and joints with mortar (Fig.12)
CONSOLIDATION OF PLASTER
CEMENTING OF CRACKS AND LOOSE PLASTER PARTS

FIELD OF APPLICATION: general
CLIMATE CONDITIONS: Avoid direct sun (max. 28°C) and too strong winds (max. 5Bft)

PREMISE: Fiche No. 4.1 has to be executed before!

PERSONNEL: One or two skilled restorer
TOOLS: Brushes, Industrial hoover, spatulae, trowel, bucket, sponge
MATERIALS: Water, Acryl-dispersion, Repair plaster (1RT wLh, 4 RT ds, 2%SF016 in water)

1. Cleaning of plaster borders with brush, hoover and lancettes (Fig. 1 & 2)
2. Mixing of repair plaster (1RT wLh, 4 RT ds, 2%SF016 in water) in an amount that can be used within 1 hour (Fig. 3)
3. Application of repair plaster after pre-watering to the level of the historic plaster surface: closing of holes and cracks, bridging areas to be prepared for later replastering (Fig. 4 to 6).
4. After 10 to 13 min.: Secondary- treatment with sponge, Exposure of granulation, smoothing and cleaning of plaster borders (Fig.7).
5. Protect your area of work for at least 12 hours against wind and sun (Fig.8). Keep it humid during period.

NOTE: Aim of measure is to stabilise the plaster surfaces with completing the historic plaster; including filling of holes, gaps and cracks. Border line between historic remains and additional replastering (see Fiche No. 3.5) has to be defined with the responsible conservation architect in forehand.
CONSOLIDATION OF PLASTER
CEMENTING OF CRACKS AND LOOSE PLASTER PARTS
FIELD OF APPLICATION: general
Climate conditions: Avoid to heavy winds.
PREMISE: Work is finished for the season or it was decided to backfill
PERSONNEL: Trained workmen under supervision
TOOLS: Sieve, Wheelbarrows, Shovel, Brush, Stomper
MATERIALS: Sieved soil and/or quartz sand and sand bags, mesh/membrane, Hessian
EXTRA: Protect yourself against dust and fine sand particles during the work.

GENERAL GUIDELINES

Damage to architectural and archaeological remains should be avoided in general. Damage to the fragile vestiges should be minimised by the following preventive measures:

1. Careful handling of tools, especially wheelbarrows to avoid scratches and colour marks on historic plaster surfaces or door reveals.
2. Preventive covering of architectural/archaeological features
3. Clearly marking closed areas with restricted access.
4. Cover plaster floor with mesh and sand layer. Use planks for working tracks.

FICHE 5.1 BACKFILL (TEMPORARY AND PERMANENT)
FICHE 5.2 STABILISATION AND PROTECTION
FICHE No.5
PROTECTION
OF ARCHITECTURAL AND ARCHAEOLOGICAL REMAINS

NOTES
FIELD OF APPLICATION: general
Climate conditions: avoid too strong winds

PREMISE:
PERSONNEL: Supervisor, trained labour
TOOLS: Wheelbarrow, shovel, stomper, cutter, etc.
MATERIALS: sieved soil or quartz sand, sand bags (size depends on context), Membrane (Geotextile/Tyvek), Hessian or Mesh,

EXTRA:

TEMPORARY BACKFILL will take place in areas with ongoing archaeological investigations or when consolidation work cannot take place immediately after the archaeological record is done.

The backfill should always be carried out in a way that can be easily taken out or removed again for work to continue. In principle, the temporary backfill should be carried out as carefully as a permanent one, but with the premise that archaeological/architectural remains should be protected until conservation work can take place. Therefore only sieved material or quartz sand should be used.

No stone or beachrock lumps as well as wall plaster chunks should be in the backfill material. Walls should be covered first with a membrane, mesh or hessian fabric before and bags placed along the wall structures to protect against collapse.

Backfill should be done high enough to cover wall faces and wall tops. Avoid water pools in the backfill area. Try to create a sloping surface away from the walls and wall base.

DO NOT
use unsieved soil from the spoil heaps mixed with stone material

DO
only use sieved soil or quartz sand for backfill
PERMANENT BACKFILL will take place when areas or features will not be presented to the public. Backfill should be done carefully to avoid collapse of building structures and trench profiles. Layers should be compacted. In the beginning, horizontally laid sand/soil layers should be built up. Finally, some sloping should be implemented to ensure a quick run-off of surface water away from wall foundations.

More fragile archaeological features have to be stabilised and covered separately beforehand. This has to be discussed and agreed upon with the responsible archaeologist / conservation coordinator.
Protect features and building elements against human impact. Door recesses should be protected with sandbags and fragile walls or profiles should be stabilised accordingly. Sandbags can also be used to limit access to specific areas, e.g. stairs or rooms. Using Sandbags is an easy and simple solution. For several reasons (UV-protection, aesthetics) bags made of plastic fabric should be covered with hessian or comparable materials. To fill sandbags only, sieved soil should be used to avoid damage caused by stones inside the sandbag.

If you have to remove a temporary stabilisation by sandbags, be careful to avoid damage to the protected walls and features. Additional protective measures may be necessary once the sandbags are removed.
To protect the walls or trench borders/profiles, the following preventive measures should be used: 1. Cover the remains/profiles with mesh/membrane or hessian. 2. Place sandbags in front of the segment to protect and stabilise. 3. The sandbags should be covered with hessian to provide protection against UV-sunlight. 4. Keep the hessian in position with stones placed on top and bottom.
FIELD OF APPLICATION: general, in regular intervals
related Fiches:
Fiche 6.1 State of conservation Record
Fiche 6.2 Record of Climate Data
Fiche 6.3 (Conservation) Site Journal
Fiche 6.4 Indicators and Periodicity

MONITORING has to be done in regular intervals. For details see defined indicators and interval recommendations in the Management Plan for ASAZ (Chapter 11, Tab.5 -p.75; Summary on Fiche 6.4).

WORK STEPS:
1) Photograph, Analog Data sheet (entry into digital inventory data base)
2) Mapping of Damages etc. on plan, photos, scan...
3) 3D-Laserscan and interpolation with earlier scans to show changes, interventions, etc.
4) Analyses of monitoring data and preparation of state of conservation report
5) Development of priority list for conservation measures and repairs according to monitoring record analyses.
The state of conservation should be recorded before conservation measures take place. The actual state should be also documented after the conservation measure has taken place. Then monitoring should take place on a regular basis according to the recommended interval mentioned in the inventory database. Regular monitoring helps to identify threats to the remains and to initiate maintenance work to protect the fragile vestiges (see also Appendix 10).
The state of conservation record at AZAS is kept in an Inventory Database (Microsoft Office 2010 Access-based). Data record should be supervised by conservation architects or restorers and executed by trained/skilled staff, using photographs, 3D-laserscans and written comments and/or analyses of defects. On the basis of the 3D-laserscans and images plans should be produced to map the damages and deterioration patterns. Overlays of 3D-laserscans can be used to document structural changes and conservation measures. Manual recording should be digitalized.

(see also APPENDIX 9.5 and APPENDIX 10)
IDENTIFICATION SCHEME FOR BUILDING STONES
with colour code for mapping

- Fossils recognisable?
  - Yes
    - Mixture of rock fragments and fossil debris (clam shells)
      - Yes
        - Conglomerate KA
      - No
        - Fossil debris consisting almost entirely of gastropods
          - No
            - Beachrock AG
          - Yes
            - Beachrock BJ
  - No
    - Scratchable with fingernail
      - Yes
        - Gypcrete BL
      - No
        - Micro-crystalline fabric with nubby porosity, grey to white colour
          - Yes
            - Dolomite BI
          - No
            - Aeolianite FR
At Al Zubarah several data loggers are installed permanently (for locations see map below). The recorded data has to be downloaded from the single devices regularly, at intervals of three to six months. Data should be uploaded to the project server immediately.

Data loggers have to be reset according to the technical manual, before they are placed back. At the same time the batteries should be checked. **Make sure that the batteries are replaced in time!**

Temperature/humidity data loggers at QMA2 in Al Zubarah town (D1, D2) and HAB54506 at Al Zubarah Fort.

Fig. 8: Positions of the temperature/humidity data loggers in Al Zubarah town (D1, D2, D4, D5, HAB54579), at the research station (D3), and in a building of the fort (HAB54506)
MONITORING
Site journal - How to record your work

1. Keep a record of your work
2. Weather conditions: note temperature, wind intensity, and general conditions; whether it is cloudy, sunny, dusty, humid.
3. Who is working: Names of colleagues and workmen (numbers)
4. What are the activities and programme.
5. List any events: visits, injuries, etc.
6. Photo documentation of work: at least one image in the morning (before the work starts), one before the main breaks and one at the end of the work day.
7. Save images to the database with a description (Meta data)!
8. Type in the site journal data and save the report as a pdf (see templates in Appendix 9; especially 9.3 and 9.4).
AL ZUBARAH ARCHAEOLOGICAL SITE
CONSERVATION SITE JOURNAL
DAILY REPORT
QIAH-01-02-HE-9000
SITE VISIT from Monday [Day]; 17.9.2012 [Date]; 13:00 [Time]

SKETCH / COMMENTS

Assessment should be done by experts when the season starts to execute repairs.

Wall 4012 - loss of historic plaster due to salt crystallization. Wall 4010 - cracks in new wall plaster (sacrificial layer).

Photo of current situation

additional information, sketches or images explaining the work or specific features, conditions, events, etc.
MONITORING
Site journal - Examples from 2012

Day and Date
Climate data from weather broadcast
Materials in stock. Follow up to order materials in time. Proposed amounts needed for planned measure.

Note on needed materials
Note on staffing and tasks
Area of work marked in sketch plan; Note on planned tasks
Area of work

Reference: APPENDIX 9.4
MONITORING
Site journal - Examples from 2012

Day and Date
Climate data from weather broadcast
Materials in stock. Follow up to order materials in time. Proposed amounts needed for planned measure.

General notes

Note on staffing and tasks

Area of work marked in sketch plan; Note on planned tasks

Area of work

Reference: APPENDIX 9.4
### FICHE No.6.4

**MONITORING INDICATORS and PERIODICITY**

*Defined in AZAS-Management Plan*

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Periodicity</th>
<th>Location of Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental parameters in Al Zubarah (Temperature, humidity, rain, wind)</td>
<td>Daily records (Data Logger) Record should be downloaded regular after 3 to 6 months</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Natural changes in north-western Qatar especially within the Buffer Zone (satellite pictures – landscape scale)</td>
<td>Once a year /every second year or by notice</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Infrastructural changes in north-western Qatar (Zubarah Hinterland) especially within the Buffer Zone</td>
<td>Once a year /every second year, or by notice</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>No. of visitors (of the Visitors Centre)</td>
<td>Daily record (by Guards at the Site entrance and/or at Al Zubarah Fort, for template see Conservation Handbook Appenix 9.1)</td>
<td>Handed in monthly in double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Visitor experience (quality assessment of a visit to Al Zubarah)</td>
<td>Once or twice a year</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>State of conservation in earlier QMA excavation areas (Photos, drawings, reports, 3D-scanning, etc.)</td>
<td>Once a year or every third year (according to interval recommendation in last monitoring). For Inventory categories and record sheets see Conservation Handbook Fiche 6 (6.1 to 6.4) and Appendices 9 &amp; 10</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH); Digital Inventory data base</td>
</tr>
<tr>
<td>State of conservation in new QIAH excavation areas (Photos, drawings, reports, 3D-scanning, etc.)</td>
<td>Once a year or every third year (according to interval recommendation in last monitoring). For Inventory categories and record sheets see Conservation Handbook Fiche 6 (6.1 to 6.4) and Appendices 9 &amp; 10</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH); Digital Inventory data base</td>
</tr>
<tr>
<td>State of conservation of not excavated structures (Photos, drawings, reports, 3D-scanning, etc.)</td>
<td>General report every third year (according to interval recommendation in last monitoring). For Inventory categories and record sheets see Conservation Handbook Fiche 6 (6.1 to 6.4) and Appendix 9 &amp; 10.</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH); Digital Inventory data base</td>
</tr>
<tr>
<td>Damages caused by visitors</td>
<td>Daily, weekly or monthly report (check particularly after the weekends) see Template Appendix 9.2</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Damages caused by high tides</td>
<td>after observed high tides and each third year</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Damages caused by heavy rain</td>
<td>after (observed) heavy rainfalls</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
<tr>
<td>Damages to infrastructure (walkways, panels, etc.)</td>
<td>Daily, weekly and monthly reports (by Guards and on-site personnel). Check daily by guards. Report only when damages appear! For Report use Template in Conservation Handbook Appendix 9.2</td>
<td>Double copy to be kept at the QMA and Site Management Office (until 2019 with the QIAH)</td>
</tr>
</tbody>
</table>

PART 4
APPENDIXES
TO CONSERVATION HANDBOOK
for Al Zubarah Archaeological Site
LIST OF APPENDIXES

APPENDIX 1 Classification of Building stones - March 2011 (revised 12/2012)
APPENDIX 2 Mortars & Plasters tested - March 2012
APPENDIX 3 Analyses of Building Materials - June 2011
APPENDIX 5 On Mortars - Feb. 2011
APPENDIX 6 Analyses of Mortar Samples - Dec. 2011
APPENDIX 7 X-Ray diffraction and chemical analysis of samples - March 2010
APPENDIX 8 Climate Data Record - July 2012
APPENDIX 9 Templates and Forms
APPENDIX 10 Manual Architectural Recording
APPENDIX 11 Manual Touristic Assessment for Heritage Sites
APPENDIX 12 Conservation schemes

Conservation Handbook for Al Zubarah Archaeological Site - PART 4
Edited by Moritz Kinzel with contributions by Simone Ricca, Paul Hofmann and Robert Sobott.
ISBN XXX XXXX XXXXX X

Carsten Niebuhr Centre for Multicultural Heritage - Materiality in Islamic Research Initiative
Department of Cross-Cultural and Regional Studies - ToRS
University of Copenhagen and the Qatar Museums Authority - Al Zubarah Archaeological Site.
APPENDIX 1
CLASSIFICATION OF BUILDING STONES
AT AL ZUBARAH / QATAR

R. Sobott, M. Kinzel and P. Hofmann
March 2011, revised version December 2012
IDENTIFICATION SCHEME FOR BUILDING STONES ATTESTED AT AL ZUBARAH
with colour code for mapping

1. Fossils recognisable?
   - Yes
     - Mixture of rock fragments and fossil debris (clam shells)
       - No
         - Fossil debris consisting almost entirely of gastropods
           - No
             - Beachrock AG
           - Yes
             - Beachrock BJ
       - Yes
         - Conglomerate KA
   - No
     - Scratchable with fingernail
       - Yes
         - Gypcrete BL
           - No
             - micro-crystalline fabric with vuggy porosity, grey to white colour
           - Yes
             - Dolomite BI
       - No
         - Aeolianite FR
Classification of building stones
Sobott/Kinzel/Hofmann

Petrographic type: Beachrock (mollusc grain- to rudstone)

Code: AG
Varieties: AG 1, AG 2, AG 3

Mapping colour

<table>
<thead>
<tr>
<th>Characteristic features</th>
</tr>
</thead>
<tbody>
<tr>
<td>General description:</td>
</tr>
<tr>
<td>Colour:</td>
</tr>
<tr>
<td>Petrophysical properties:</td>
</tr>
<tr>
<td>Weathering characteristics:</td>
</tr>
<tr>
<td>Bedding:</td>
</tr>
<tr>
<td>Occurrence in wall structures:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appearance in wall structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG 1</td>
</tr>
<tr>
<td>AG 2</td>
</tr>
<tr>
<td>AG 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mineral composition</th>
<th>Thin section photographs (pore space is coloured blue)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium calcite I</td>
<td></td>
</tr>
<tr>
<td>Magnesium calcite II</td>
<td></td>
</tr>
<tr>
<td>Aragonite</td>
<td></td>
</tr>
<tr>
<td>Dolomite</td>
<td></td>
</tr>
<tr>
<td>Quartz</td>
<td></td>
</tr>
<tr>
<td>Feldspars (Halite)</td>
<td></td>
</tr>
<tr>
<td>*) determined by X-ray diffraction and thin section microscopy</td>
<td></td>
</tr>
</tbody>
</table>
Classification of building stones  
Sobott/Kinzel/Hofmann

<table>
<thead>
<tr>
<th>Petrographic type</th>
<th>Beachrock (gastropod grain- to rudstone)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>BJ</td>
</tr>
<tr>
<td>Varieties</td>
<td>BJ 1, BJ 2, BJ 3</td>
</tr>
</tbody>
</table>

**Mapping colour**

**Characteristic features**

- **General description:** friable interstratification of variably thick gastropod rich beds and carbonate sand beds; non-carbonate particles include quartz and feldspar grains; low compressive strength; very porous fabric; BJ 1 and BJ 3 are more or less thick gastropod rich or carbonate sand beds, respectively; BJ 2 is an interstratification of gastropod rich and carbonate sand beds.

- **Colour:** yellow grey; gastropod rich beds are a little bit darker than carbonate sand beds.

- **Petrophysical properties:** porosity: \(\sim 30\) Vol.\%, bulk density: \(\sim 1,56\) g/cm\(^3\), ultrasonic velocity: 3.8 km/s.

- **Weathering characteristics:** disintegrates to carbonate sand and gastropods which pile up at the base of walls.

- **Bedding:** not recognisable in BJ 1, weak in BJ 3, and distinct in BJ 2.

- **Occurrence in wall structures:** generally less frequent than AG, but locally abundant.

**Appearance in wall structure**

- **BJ 1**
- **BJ 2**
- **BJ 3**

**Mineral composition**

- Magnesium calcite I
- Magnesium calcite II
- Aragonite
- Dolomite
- Quartz
- Feldspars
- (Halite)

*\(^{1}\)* determined by X-ray diffraction and thin section microscopy.

**Thin section photographs** (pore space is coloured blue)

- [Pore space coloured blue]
Classification of building stones
Sobott/Kinzel/Hofmann

Petrographic type: Peloidal grainstone
(Aeolianite)

Code: FR

Varieties:

Mapping colour

---

Characteristic features

General description: grain-supported, very porous fabric of biogenic detritus (forams, bryozoa, peloids) Cemented by granular calcite; homogeneous particle size distribution; maximum at 200 µm, medium compressive strength

Colour: light yellow

Petrophysical properties: porosity: ~40 Vol.%, bulk density: ~1.63 g/cm3, ultrasonic velocity: 3.1 km/s

Weathering characteristics: good weathering resistance, best building stone of the Al Zubarah area

Bedding: hardly recognisable

Occurrence in wall structures: preferably in more important buildings, e.g. in walls of mosques; more frequent in Freiha than in Al Zubarah, because of greater proximity to the quarries

Appearance in wall structure

---

Mineral composition *:
Calcite
Dolomite
Plagioclase
Quartz
Mg calcite II

Thin section photographs (pore space is coloured blue)

* determined by X-ray diffraction and thin section microscopy
Classification of building stones
Sobott/Kinzel/Hofmann

Petrographic type: Dolomite
Code: BL

Varieties:

Mapping colour

---

Characteristic features

General description: microcrystalline fabric of dolomite crystals; contains vugs which range in size from less than a millimetre to several centimetres; very high compressive strength due to dense fabric of interlocked dolomite crystals; no visible porosity

Colour: grey to white with yellowish tint

Petrophysical properties: porosity: <10 Vol.%, bulk density: 2.55 g/cm³, ultrasonic velocity: 4.9 km/s

Weathering characteristics: very good weathering resistance

Bedding: not existent

Occurrence in wall structures: seldomly used in original masonry; more frequent in repair work

---

Appearance in wall structure

---

Mineral composition +) determined by X-ray diffraction and thin section microscopy

<table>
<thead>
<tr>
<th>Mineral composition +)</th>
<th>Thin section photographs (pore space is coloured blue)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolomite Quartz</td>
<td>![Thin section photograph]</td>
</tr>
</tbody>
</table>

+) determined by X-ray diffraction and thin section microscopy
Classification of building stones
Sobott/Kinzel/Hofmann

**Petrographic type:** Conglomerate

**Code:** KA

**Varieties:**

**Mapping colour:**

---

**Characteristic features**

**General description:** mixture of dolomite fragments and fossil debris (bivalves and gastropods) on a well cemented basal layer

**Colour:** yellow grey

**Petrophysical properties:**

**Weathering characteristics:** good resistance to weathering due to good cementation of components

**Bedding:** clearly marked by basal layer; rarely more than 2 or 3 layers

**Occurrence in wall structures:** locally abundant

---

**Appearance in wall structure**

---

**Mineral composition \(^{(*)}\):**

- Dolomite
- Mg calcite
- Aragonite
- Calcite
- Quartz

\(^{(*)}\) determined by X-ray diffraction and thin section microscopy

**Thin section photographs** (pore space is coloured blue)
Classification of building stones  
Sobott/Kinzel/Hofmann

Petrographic type: Gypcrete  
( evaporitic mudstone with rock fragments )
Code: BE

Varieties:

Mapping colour:

Characteristic features:

General description:  porous crypto-crystalline gypsum matrix with rock and mineral fragments and little fossil debris; low compressive strength due to the porous structure and low hardness of gypsum
Colour: light yellow grey to white
Petrophysical properties: porosity: ~39 Vol.%, bulk density: 1.5 g/cm³, ultrasonic velocity: 2.5 km/s
Weathering characteristics: good weathering resistance
Bedding: not recognisable
Occurrence in wall structures: less frequent

Appearance in wall structure:

Mineral composition *)

<table>
<thead>
<tr>
<th>Gypsum</th>
<th>Dolomite</th>
<th>Mg calcite</th>
<th>Aragonite</th>
<th>Quartz</th>
<th>Feldspar</th>
</tr>
</thead>
</table>

*) determined by X-ray diffraction and thin section microscopy

Thin section photographs (pore space is coloured blue)
5 (Hydraulic) lime-based mortars

(Hydraulic) lime-based mortars were obviously used for earlier repair work at the forts of Al Zubarah and Al Rakayat. The corresponding X-ray diffractograms are marked by strong diffraction peaks for quartz (aggregate) and calcite (binder). Usually the aggregate contains not only quartz but also feldspar (K feldspar and/or plagioclase). Additional diffraction peaks attributed to gypsum or dolomite are derived from a contamination of the sample with adhering rock fragments. Especially the phase association of quartz and feldspar(s) is diagnostic for sand as aggregate which is usually added to (hydraulic) lime mortars.

The typical fabric of the (hydraulic) lime mortar to be observed in a thin section under a polarising light microscope consists of a more or less close packing of aggregate grains (mostly quartz and feldspar) with a filling of the interstices by calcite (figure 14). Depending on the grain shape and grain size distribution of the aggregate particles packings with pore volumes between 25 and 50 % corresponding to binder/aggregate ratios of 1:3 to 1:1 are observed. The shape of the sand grains reveals whether the sand comes from a sand pit or was produced by crushing silicate rock material. Rounded shapes are typical for natural sand grains transported by water or wind over long distances while angular shapes point either to artificially crushed rock material or rock debris transported over very short distances.
<table>
<thead>
<tr>
<th>Data Logger</th>
<th>Location:</th>
<th>Al Zubarah Fort inside room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial number:</td>
<td>53243</td>
<td>equivalent to 179 days and 13,05 hours</td>
</tr>
<tr>
<td>Sampling interval:</td>
<td>4.85 min</td>
<td></td>
</tr>
<tr>
<td>Start of data recording:</td>
<td>21.03.2011 11:15:06</td>
<td></td>
</tr>
<tr>
<td>Maximum Temperature:</td>
<td>37.2</td>
<td>Minimum Humidity:</td>
</tr>
<tr>
<td>Minimum Temperature:</td>
<td>21.0</td>
<td>Minimum Humidity:</td>
</tr>
<tr>
<td>Av. Temperature March:</td>
<td>22.9</td>
<td>Av. Humidity March:</td>
</tr>
<tr>
<td>Av. Temperature April:</td>
<td>26.2</td>
<td>Av. Humidity April:</td>
</tr>
<tr>
<td>Av. Temperature May:</td>
<td>31.7</td>
<td>Av. Humidity May:</td>
</tr>
<tr>
<td>Av. Temperature June:</td>
<td>33.7</td>
<td>Av. Humidity June:</td>
</tr>
<tr>
<td>Av. Temperature July:</td>
<td>35.4</td>
<td>Av. Humidity July:</td>
</tr>
<tr>
<td>Av. Temperature August:</td>
<td>36.2</td>
<td>Av. Humidity August:</td>
</tr>
<tr>
<td>Av. Temperature September:</td>
<td>34.7</td>
<td>Av. Humidity September:</td>
</tr>
</tbody>
</table>

![Graph showing temperature and humidity data](image)
APPENDIX 9
LIST OF TEMPLATES and FORMS

9.1 Visitor Log Sheet
9.2 Damage Report
9.3 Site Journal
9.4 Site Journal VAR. 2011/2012
9.5 Record sheet for fractures in mortars
9.6 Record sheet for Architectural Documentation
## QMA AL ZUBARAH ARCHAEOLOGICAL SITE VISITOR LOG SHEET

**SITE:**
- Al Zubarah town
- Al Zubarah Fort

### MONTH / YEAR:

<table>
<thead>
<tr>
<th>S.N.</th>
<th>DATE</th>
<th>NO. OF VEHICLES</th>
<th>NO. OF CHILDREN</th>
<th>NO. OF MALES</th>
<th>NO. OF FEMALES</th>
<th>TOTAL OF VISITORS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**REPORTED BY:**

Staff No.
APPENDIX 9.2 DAMAGE REPORT

AL ZUBARAH ARCHAEOLOGICAL SITE
REPORT ON DAMAGES

DATE:

REPORTED BY

LOCATION:

DESCRIPTION OF DAMAGE (where, what, caused by, etc.)

IMAGES
## Daily Report

**QIAH-01-02-HE-9**

**SITE VISIT from** [Day]; [Date]; [Time]

**WEATHER:**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ATTENDEES** (incl. workmen, craftpersons, etc.)

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**LOCATION:**

<table>
<thead>
<tr>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**MEASURES, ACTIVITIES, WORK**

(Planned for the day, as well as executed)

<table>
<thead>
<tr>
<th>Drawing/Doc</th>
<th>Related</th>
<th>Content</th>
<th>Date</th>
<th>Handled over to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**INADEQUACIES** (defects, cracks, detaching, etc.)

<table>
<thead>
<tr>
<th>Inadequacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**INSTRUCTIONS**

<table>
<thead>
<tr>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Fractures in mortars and concrete

Shape (linear, curved, reticulate):

Width (< 1mm, > 1mm):

Depth (< 5mm, > 5mm):

Frequency (singular, multiple):

Location (affected part of construction):

Mortar composition (especially water/cement ratio, aggregate size distribution):

Constructive details (thickness of mortar layer, reinforcement, connection to other parts of the construction, possibly with entirely different properties):

Date of origin of cracks after curing:

Remarks (temperature/humidity conditions during curing process, exceptional events during or after the execution of work):

Photo documentation:

Main reasons for cracking: shrinkage, stress-induced failure
## QIAH - HERITAGE

### SITE:

### STRUCTURE:

**DATE:**

**SEASON:** Phase 1 Season1

### Related STRUCTURES:

### Related ROOMS:

### Related WALLS:

### Related FEATURES:

### FUNCTION

- Compound
- Domestic unit
- Mosque
- School
- Public space
- Sitting area (baraha)
- Commercial unit
- Shops/souq
- Storage
- Stable
- Workshop
- Unknown/Other

### General Description

### Plan / Sketch

### SIZE

**Length:**

**Width:**

### PERIOD

- 2009 movie rebuilding
- Late occupations (cement)
- Main occupations
- Early occupations
- Other occupations

### CONDITION

- Excellent
- Good
- Moderate
- Poor
- Unknown

### RISK ASSESSMENT

- HIGH PRIORITY
- MEDIUM PRIORITY
- LOW PRIORITY

### PHOTO Numbers:

### CONSERVATION INTEREST

- HIGH
- MEDIUM
- LOW

Ref.: Appendix 10: Manual for Architectural recording.
### QIAH - HERITAGE

**SITE:**

**ROOM:**

**DATE:**

**SEASON:** Phase 1 Season1

<table>
<thead>
<tr>
<th>RELATED STRUCTURE:</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related ROOMS:</td>
<td>□ Courtyard</td>
</tr>
<tr>
<td></td>
<td>□ Domestic unit</td>
</tr>
<tr>
<td></td>
<td>□ Hammam / WC</td>
</tr>
<tr>
<td></td>
<td>□ Storage</td>
</tr>
<tr>
<td></td>
<td>□ Kitchen</td>
</tr>
<tr>
<td></td>
<td>□ Shed</td>
</tr>
<tr>
<td></td>
<td>□ Prayer room / Iwan</td>
</tr>
<tr>
<td></td>
<td>□ Mihrab</td>
</tr>
<tr>
<td></td>
<td>□ Minaret</td>
</tr>
<tr>
<td></td>
<td>□ Sitting area (baraha)</td>
</tr>
<tr>
<td></td>
<td>□ Ablution room</td>
</tr>
<tr>
<td></td>
<td>□ Workshop</td>
</tr>
<tr>
<td></td>
<td>□ Unknown/Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATED WALLS:</th>
<th>RELATED FEATURES:</th>
</tr>
</thead>
</table>

| RELATIONS | GENERAL DESCRIPTION | PLAN / SKETCH |

<table>
<thead>
<tr>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length:</td>
</tr>
<tr>
<td>Width:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>CONDITION</th>
<th>RISK ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 2009 movie rebuilding</td>
<td>□ Excellent</td>
<td>□ HIGH PRIORITY</td>
</tr>
<tr>
<td>□ Late occupations (cement)</td>
<td>□ Good</td>
<td></td>
</tr>
<tr>
<td>□ Main occupations</td>
<td>□ Moderate</td>
<td></td>
</tr>
<tr>
<td>□ Early occupations</td>
<td>□ Poor</td>
<td></td>
</tr>
<tr>
<td>□ Other occupations</td>
<td>□ Unknown</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FLOOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Anhydrite/ Gypsum</td>
</tr>
<tr>
<td>□ Mud</td>
</tr>
<tr>
<td>□ Soil</td>
</tr>
<tr>
<td>□ Shells</td>
</tr>
<tr>
<td>□ Cement</td>
</tr>
<tr>
<td>□ Fine cement finish</td>
</tr>
<tr>
<td>□ Other</td>
</tr>
<tr>
<td>□ Unknown</td>
</tr>
<tr>
<td>□ Excellent</td>
</tr>
<tr>
<td>□ Good</td>
</tr>
<tr>
<td>□ Moderate</td>
</tr>
<tr>
<td>□ Poor</td>
</tr>
<tr>
<td>□ Unknown</td>
</tr>
<tr>
<td>□ Cracks in floor surface</td>
</tr>
<tr>
<td>□ Loose floor surface</td>
</tr>
<tr>
<td>□ Collapsed stones</td>
</tr>
<tr>
<td>□ Collapsed plaster</td>
</tr>
<tr>
<td>□ Blown-in sand deposits</td>
</tr>
<tr>
<td>□ Litter / bushes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CEILING</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Round beams</td>
</tr>
<tr>
<td>□ Rectangular beams</td>
</tr>
<tr>
<td>□ Planks</td>
</tr>
<tr>
<td>□ Bamboo</td>
</tr>
<tr>
<td>□ Woven mats</td>
</tr>
<tr>
<td>□ Mud covering</td>
</tr>
<tr>
<td>□ Unknown – not visible</td>
</tr>
<tr>
<td>□ No ceiling / roof</td>
</tr>
<tr>
<td>□ Excellent</td>
</tr>
<tr>
<td>□ Good</td>
</tr>
<tr>
<td>□ Moderate</td>
</tr>
<tr>
<td>□ Poor</td>
</tr>
<tr>
<td>□ Unknown</td>
</tr>
<tr>
<td>□ Insect frass on beams</td>
</tr>
<tr>
<td>□ Rot damage on beams</td>
</tr>
<tr>
<td>□ Broken beams</td>
</tr>
<tr>
<td>□ Partly collapsed roof</td>
</tr>
<tr>
<td>□ Collapsed roof – visible on floor</td>
</tr>
</tbody>
</table>

**PHOTO Numbers:**

Ref.: Appendix 10: Manual for Architectural recording.
## General Description

**SITE:** QIAH - HERITAGE  
**DATE:**  
**SEASON:** Phase 1 Season 1  
**WALL:**

### Related STRUCTURE:

- [ ] Type:  
- [ ] Size:  
- [ ] Description:

### Related ROOMS:

### Related WALLS:

### Related FEATURES:

### OPENINGS

- [ ]
- [ ]
- [ ]

### GENERAL

- [ ] Length:
- [ ] Width:
- [ ] Height inside:
- [ ] Height outside:

### PERIOD

- [ ] 2009 movie rebuilding  
- [ ] Late occupations (cement)  
- [ ] Main occupations  
- [ ] Early occupations  
- [ ] Other occupations

### CONDITION

- [ ] Excellent  
- [ ] Good  
- [ ] Moderate  
- [ ] Poor  
- [ ] Unknown

### RISK ASSESSMENT

- [ ] HIGH PRIORITY  
- [ ] MEDIUM PRIORITY  
- [ ] LOW PRIORITY

### COMPOSITION

- **Stones**
  - Beachrock AG  
  - Beachrock BJ  
  - Beachrock LO  
  - Gypsum BE  
  - Dolomite BL  
  - Fossiliferous limestone  
  - Aeolinanite FR  
  - Conglomerate  
  - Coral  
  - Concrete blocks (old)  
  - Concrete blocks (new)  
  - Unknown  
  - Predominant:  

- **Mortar**
  - Mud fine grain  
  - Mud coarse grain  
  - Cement  
  - Not visible  
  - Unknown  
  - Predominant:

- **Plaster**
  - Anhydrite/Gypsum  
  - Mud, fine grain  
  - Mud, coarse grain  
  - Mud slurrying  
  - Cement  
  - Fine cement finish  
  - Other  
  - Unknown  
  - Predominant:

### DAMAGES

- [ ] Cracks in wall  
- [ ] Voids in wall  
- [ ] Eroded stones  
- [ ] Blown out/eroded joints  
- [ ] Partly collapsed  
- [ ] Collapsed  
- [ ] Plaster fragmented  
- [ ] Detached plaster  
- [ ] Cracks in plaster  
- [ ] Voils in plaster  
- [ ] Plaster eroded/washed off  
- [ ] Blow-in sand deposits  
- [ ] Graffiti

### PHOTO Numbers:

Ref.: Appendix 10: Manual for Architectural recording.
### QIAH - HERITAGE

<table>
<thead>
<tr>
<th>SITE: FEATURE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE: SEASON: Phase 1 Season1</td>
</tr>
</tbody>
</table>

#### RELATED STRUCTURES:

- Pillar
- Terrace
- Terrace & pillars
- Stairs
- Fireplace/hearth
- Bench
- Basin
- Water tank
- Water well
- Mihrab
- Minbar
- Timber structure
- Portal
- Unknown/Other

#### FUNCTION

#### RELATED ROOMS:

#### RELATED WALLS:

#### RELATED FEATURES:

#### GENERAL DESCRIPTION

<table>
<thead>
<tr>
<th>PLAN / SKETCH</th>
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<tbody>
<tr>
<td>Length: Width: Height:</td>
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</tbody>
</table>

#### PERIOD

- 2009 movie rebuilding
- Late occupations (cement)
- Main occupations
- Early occupations
- Other occupations

#### CONDITION

- Excellent
- Good
- Moderate
- Poor
- Unknown

#### RISK ASSESSMENT

- HIGH PRIORITY
- MEDIUM PRIORITY
- LOW PRIORITY

#### COMPOSITION

<table>
<thead>
<tr>
<th>STONES</th>
<th>MORTAR</th>
<th>PLASTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beachrock AG</td>
<td>Beachrock BJ</td>
<td>Beachrock LO</td>
</tr>
<tr>
<td>Gypsum BE</td>
<td>Dolomite BL</td>
<td>Fossiliferous limestone</td>
</tr>
<tr>
<td>Anhydrite/Gypsum</td>
<td>Anhydrite/Gypsum</td>
<td>Anhydrite/Gypsum</td>
</tr>
<tr>
<td>Mud fine grain</td>
<td>Mud coarse grain</td>
<td>Mud fine grain</td>
</tr>
<tr>
<td>Cement</td>
<td>Not visible</td>
<td>Mud, fine grain</td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>Mud, coarse grain</td>
</tr>
<tr>
<td>Predominant:</td>
<td>Predominant:</td>
<td>Predominant:</td>
</tr>
</tbody>
</table>

#### DAMAGES

<table>
<thead>
<tr>
<th>COLLAPSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collapsed</td>
</tr>
<tr>
<td>Partly collapsed</td>
</tr>
<tr>
<td>Cracks in feature</td>
</tr>
<tr>
<td>Eroded stones</td>
</tr>
<tr>
<td>Blown out/eroded joints</td>
</tr>
<tr>
<td>Blow-in sand deposits</td>
</tr>
<tr>
<td>Plaster fragmented</td>
</tr>
<tr>
<td>Detached plaster</td>
</tr>
<tr>
<td>Cracks in plaster</td>
</tr>
<tr>
<td>Eroded plaster</td>
</tr>
<tr>
<td>Plaster eroded/washed off</td>
</tr>
<tr>
<td>Graffiti</td>
</tr>
<tr>
<td>Litter/bushes</td>
</tr>
</tbody>
</table>

PHOTO Numbers:

Ref.: Appendix 10: Manual for Architectural recording.
INTRODUCTION
An Access database provides detailed information on the building materials and the structural condition of the architecture in Al Jumail. The database has a hierarchic composition. Four forms dedicated to structures, rooms, walls and features contain similarly structured sets of data describing spatial relations, functions, size, building period, condition, risk assessment and conservation interest of every structural element.

<table>
<thead>
<tr>
<th>STRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relations</td>
</tr>
<tr>
<td>Function</td>
</tr>
<tr>
<td>Plan/ Sketch</td>
</tr>
<tr>
<td>General Description</td>
</tr>
<tr>
<td>Size</td>
</tr>
<tr>
<td>Period</td>
</tr>
<tr>
<td>Condition</td>
</tr>
<tr>
<td>Risk Assessment</td>
</tr>
<tr>
<td>Conservation Interest</td>
</tr>
<tr>
<td>Photo numbers</td>
</tr>
</tbody>
</table>
## ROOM

### Relations
- Related STRUCTURES, ROOMS, WALLS and FEATURES

### Function
- See appendix 1
- Ablution room, Courtyard, Domestic unit, Hammam/WC, Kitchen, Mihrab, Minaret, Prayer room/Iwan, Shed, Shelter, Sitting area/Baraha/Dekka, Sitting area/Majlis, Storage, Workshop, Other/Unknown

### Plan/Sketch
- Drawing produced during the survey or by detailed measurements

### General Description
- Information on the form of the room and on the spatial connections and relations of its elements (e.g. openings) to each other, succession of the building phases. Additional comments and remarks

### Size
- Length, Width, Surface area
- Information on the measurements and surface area of the room

### Period
- See appendix 2
- 21st century
- 20th century
- Pre-20th century

### Condition
- The condition assessment concerns the general impression of the room as whole. The structural condition of the majority of the walls, floor and ceiling is taken into account
- Excellent: Complete structure, with no OR few cracks in the covering plaster
- Good: Structure collapsed to slight extent OR small voids and/or cracks (width under 1cm) in the stonework
- Moderate: Partly collapsed structure OR extensive voids and/or cracks (width over 1 cm) in the stonework; critical structural damages
- Poor: Extensively collapsed structure, mostly rubble
- Unknown: Predominantly non visible or inaccessible structures

### Risk Assessment
- High priority: High structures (more than 1,50m) of poor condition
- Medium priority: Structures of about 1,50m height, in moderate or poor condition
- Low priority: Stable walls and harmless rubble

### Floor composition
- See Appendix 3
- Anhydrite, Lime, Mud, Soil, Shells, Cement, Fine cement finish, Other/Unknown

### Floor condition
- Applies only to floors with screed topping (anhydrite, lime or cement). Floors made of shells, mud or soil are always ranged as “good”
- Excellent: No OR few superficial cracks in the screed topping
- Good: Cracks in the plaster, small, flat voids in the screed topping
<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Extensive voids and cracks in the screed topping, thick fragments of screed missing</td>
</tr>
<tr>
<td>Poor</td>
<td>Screed topping missing on extensive area of the floor, deep voids in the floor</td>
</tr>
<tr>
<td>Unknown</td>
<td>Non visible</td>
</tr>
</tbody>
</table>

### Floor damages

<table>
<thead>
<tr>
<th>Damage Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracks in floor</td>
<td>Cracks in the screed topping</td>
</tr>
<tr>
<td>surface</td>
<td>Parts of the screed topping are missing</td>
</tr>
<tr>
<td>Voids in floor</td>
<td>Screed topping is detached, shows voids, it is easy to remove screed layers without tools</td>
</tr>
<tr>
<td>surface</td>
<td>Stones fallen from the walls of the room, covering the floor surface</td>
</tr>
<tr>
<td>Loose floor surface</td>
<td>Detached plaster fallen from the walls of the room, covering the floor</td>
</tr>
<tr>
<td>Collapsed stones</td>
<td>Sand blown in by the wind, covering the floor surface</td>
</tr>
<tr>
<td>Collapsed plaster</td>
<td>Litter deposits or litter blown in by the wind; plants growing, damaging floor surface</td>
</tr>
<tr>
<td>Blown-in sand</td>
<td>The roofs are usually composed of round, rectangular beams or planks supporting splitted bamboo stems and woven mats. The top covering consists of mud layer and sometimes small gravel.</td>
</tr>
<tr>
<td>deposits</td>
<td>No ceiling/roof</td>
</tr>
<tr>
<td>Litter/bushes</td>
<td>CHOICE: Al Jumail, S40 - mosque. Cracks on the steps leading to the courtyard of the mosque.</td>
</tr>
</tbody>
</table>

Al Jumail, S40 - mosque. Cracks on the steps leading to the courtyard of the mosque

No Photo

Al Jumail, S40 - mosque. Fragments of plaster, stones, blown-in sand deposits and litter visible on the floor

Al Jumail, S40, Roof of round beams, bamboo, woven mats and mud covering
### Ceiling condition

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>Covering complete, no structural damage</td>
</tr>
<tr>
<td>Good</td>
<td>Mud covering complete, little insect damage on the beams</td>
</tr>
<tr>
<td>Moderate</td>
<td>Damage by insects and/or fungi, ceiling strongly deformed</td>
</tr>
<tr>
<td>Poor</td>
<td>Extensive damage by insects and/or fungi, ceiling partly collapsed</td>
</tr>
<tr>
<td>Unknown</td>
<td>Construction not accessible for investigation</td>
</tr>
</tbody>
</table>

### WALL

#### Relations
- Related STRUCTURES, ROOMS, WALLS and FEATURES

#### Openings
- **Type, Size, Description**
  - Type: Door, window, ventilation opening
  - Size: Width, Height
  - Description: Lintel construction, window frame, condition, comments

#### Plan/Sketch
- Drawing produced during survey or by detailed measurements

#### General Description
- Information on the spatial arrangement of the openings. Indication of the succession of the building phases. Comments and remarks

#### Size
- Length, Width, Height
  - Information on the maximal measurements of the wall. As the height of the wall may differ in the related rooms or between the room and the façade, both values have to be given

#### Period
- See appendix 2
  - 21st century
  - 20th century
  - Pre-20th century

#### Condition
- **Excellent** Complete, with no OR few cracks in the covering plaster
- **Good** Collapsed to slight extent OR small voids and/or cracks (width under 1cm) in the stonework
- **Moderate** Partly collapsed structure OR extensive voids and/or cracks (width over 1 cm) in the stonework; critical structural damages
- **Poor** Extensively collapsed structure, mostly rubble
- **Unknown** Predominantly non visible or inaccessible structures

#### Risk Assessment
- **High priority** High structures (more than 1,50m) of poor condition
- **Medium priority** Structures of about 1,50m height, in moderate or poor condition
- **Low priority** Stable walls and harmless rubble
### Damages

<table>
<thead>
<tr>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracks in wall</td>
<td>Cracks, reaching deep inside of the stonework’s structure</td>
</tr>
<tr>
<td>Voids in wall</td>
<td>Stones broken off the wall, leaving voids in the stonework</td>
</tr>
<tr>
<td>Eroded stones</td>
<td>Surface of stones eroded by the influence of wind, salts and moisture</td>
</tr>
<tr>
<td>Blown out/eroded joints</td>
<td>Stones in place, mortar of the joints eroded by the influence of wind,</td>
</tr>
<tr>
<td></td>
<td>salts and moisture</td>
</tr>
<tr>
<td>Partly collapsed</td>
<td>Wall partly collapsed, still standing parts allow the insight in the</td>
</tr>
<tr>
<td></td>
<td>construction and the identification of the openings</td>
</tr>
<tr>
<td>Collapsed</td>
<td>Wall entirely collapsed, remains recognizable as rubble</td>
</tr>
<tr>
<td>Plaster fragmented</td>
<td>Deep cracks in plaster</td>
</tr>
<tr>
<td>Detached plaster</td>
<td>Plaster loosened from the wall, easy to remove without tools</td>
</tr>
<tr>
<td>Cracks in plaster</td>
<td>Superficial, “hair-thin” cracks in plaster, no structural damage</td>
</tr>
<tr>
<td>Voids in plaster</td>
<td>Fragments of plaster missing, fallen off the wall</td>
</tr>
<tr>
<td>Plaster eroded/washed off</td>
<td>Layers of plaster eroded by the influence of wind, salts and moisture</td>
</tr>
<tr>
<td>Blown-in sand deposits</td>
<td>Sand deposits in the eroded joints and voids of the stonework</td>
</tr>
<tr>
<td>Graffiti</td>
<td>Ornaments or text scratched or painted on plaster</td>
</tr>
</tbody>
</table>

### Photo numbers

| Photo numbers                                      | All DNG-Photo # displaying the wall                                     |

### FEATURE

<table>
<thead>
<tr>
<th>Relations</th>
<th>Related STRUCTURES, ROOMS, WALLS and FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>See appendix 1</td>
</tr>
<tr>
<td></td>
<td>Basin, Bench, Fireplace/Hearth, Mihrab, Minbar, Niche/Shelves, Pillar,</td>
</tr>
<tr>
<td></td>
<td>Terrace, Terrace&amp;Pillars, Timber structure, Portal, Staircase or Steps,</td>
</tr>
<tr>
<td></td>
<td>Water tank, Water well, Other/Unknown</td>
</tr>
<tr>
<td>Plan/Sketch</td>
<td>Drawing produced during a survey or by detailed measurements</td>
</tr>
<tr>
<td>General Description</td>
<td>Information on the form of the feature, indication of building phases,</td>
</tr>
<tr>
<td></td>
<td>comment and remarks</td>
</tr>
<tr>
<td>Size</td>
<td>Information on the outer measurements of the feature</td>
</tr>
<tr>
<td>Length, Width, Height</td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>21st century</td>
</tr>
<tr>
<td></td>
<td>20th century</td>
</tr>
<tr>
<td></td>
<td>Pre-20th century</td>
</tr>
</tbody>
</table>

| Condition       | Excellent                      | Complete, with no OR few cracks in the covering plaster |
|                | Good                           | Collapsed to slight extent OR small voids and/or cracks (width under 1cm) in the stonework |
|                | Moderate                       | Partly collapsed structure OR extensive voids and/or cracks (width over 1 cm) in the stonework; critical structural damages |
|                | Poor                           | Extensively collapsed structure, mostly rubble |
|                | Unknown                        | Predominantly non visible or inaccessible structures |

| Risk Assessment | High priority                  | High structures of poor condition |
|                | Medium priority                | Structures of about 1,50m height, in moderate or poor condition |
|                | Low priority                   | Stable walls and harmless rubble |

| Damages                     | Cracks in feature              | Cracks, reaching deep inside of the stonework |
|                            | Voids in feature               | Stones broken off the wall, leaving voids in the stonework |
|                            | Eroded stones                  | Surface of stones eroded by the influence of wind, salts and moisture |
|                            | Blown out/eroded joints        | Stones in place, mortar of the joints eroded by the influence of wind, salts and moisture |
|                            | Partly collapsed               | Feature partly collapsed, still standing parts allow the insight in the construction and the identification of the openings |
|                            | Collapsed                      | Feature entirely collapsed, remains recognizable only as rubble |
|                            | Plaster fragmented             | Deep cracks in plaster |
|                            | Detached plaster               | Plaster loosened from the underground, easy to remove without tools |
|                            | Cracks in plaster              | Superficial,"hair-thin" cracks in plaster, no structural damage |
|                            | Voids in plaster               | Fragments of plaster missing, fallen off the underground |
|                            | Plaster eroded/washed off      | Layers of plaster eroded by the influence of wind, salts and moisture |
|                            | Blown-in sand deposits         | Sand deposits in the eroded joints and voids of the stonework or sand deposits inside of the feature |

| Photo numbers             | All DNG-Photo # displaying the feature |
## Appendix 1 - FUNCTIONS

### STRUCTURES, ROOMS

<table>
<thead>
<tr>
<th>ROOM TYPE</th>
<th>DESCRIPTION</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ablution room</strong></td>
<td>Room for ritual purification, adjusted or located close to the mosque and provided with water (well, tank, water tap) and a washing basins</td>
<td><img src="JU_S40" alt="Ablution room" /></td>
</tr>
<tr>
<td><strong>Commercial unit</strong></td>
<td>Workshop, production building or shop, working space</td>
<td>No Photo</td>
</tr>
<tr>
<td><strong>Compound</strong></td>
<td>Series of buildings interconnected and/or adjusted to each other, arranged around a courtyard</td>
<td><img src="JU_S58" alt="Compound" /></td>
</tr>
<tr>
<td><strong>Courtyard</strong></td>
<td>Space inside of a building or compound, surrounded by walls, without a covering</td>
<td>Photo: See <a href="#">Compound</a> or <a href="#">School</a></td>
</tr>
<tr>
<td><strong>Domestic unit</strong></td>
<td>Compound or single building for dwelling purpose</td>
<td>Photo: See <a href="#">Compound</a></td>
</tr>
<tr>
<td><strong>Hammam / WC</strong></td>
<td>Restroom; mostly a part of a domestic unit separated by a wall, provided with small basin and drainage opening</td>
<td><img src="JU_S15" alt="Hammam / WC" /></td>
</tr>
<tr>
<td><strong>Kitchen</strong></td>
<td>Room for food preparation</td>
<td>No Photo</td>
</tr>
<tr>
<td><strong>Mosque</strong></td>
<td>Building of worship for followers of Islam</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Minaret</strong></td>
<td>Distinctive architectural feature of mosques, generally a tall spire, usually free standing and taller than any associated structure. Minarets are used for the call to prayer</td>
<td></td>
</tr>
<tr>
<td><strong>Mihrab</strong></td>
<td>Small room in the wall of a mosque that indicates the qibla - the direction of the Kaaba in Mecca and hence the direction that Muslims should face when praying</td>
<td></td>
</tr>
<tr>
<td><strong>Prayer room / Iwan</strong></td>
<td>Rectangular hall or space in the mosque, walled on three sides, with one end entirely open, used for prayer. The prayer room is oriented to the direction on Kaaba in Mecca by the mihrab</td>
<td></td>
</tr>
<tr>
<td><strong>Public space</strong></td>
<td>Open space (square or street), outside of the private domestic units</td>
<td></td>
</tr>
<tr>
<td><strong>School</strong></td>
<td>Structure explicitly dedicated for educational purposes provided with classrooms and teachers room</td>
<td></td>
</tr>
<tr>
<td><strong>Shed</strong></td>
<td>Simple, one storey building, may be used as storage or workshop</td>
<td></td>
</tr>
<tr>
<td><strong>Shelter</strong></td>
<td>Simple structure or building that provides cover</td>
<td></td>
</tr>
<tr>
<td><strong>Shops/Souq</strong></td>
<td>Shop or assembly of shops (souq)</td>
<td></td>
</tr>
</tbody>
</table>
### Sitting area: Majlis

Public / semi-public gathering space in form of a free standing, single-room building. Majlis lay in a free, public space and are not adjusted to other buildings or compounds. The Majlis appear mostly as ensemble along with a Baraha/Dekka.

### Sitting area: Baraha/Dekka

Public / semi-public gathering space in form of a free standing flat platform. Baraha/Dekka lay in a free, public space and are not adjusted to other buildings or compounds. Sometimes the Majlis has an open terrace adjusted to it. In this case there is no other Baraha/Dekka that would go with this kind of Majlis.

### Stable

Building for keeping of livestock

No Photo

### Storage

Building for storage of goods

No Photo

### Workshop

Room or building that provides space and tools for production of goods

No Photo

### Features

#### Basin

Kind of sink or bowl to contain water for cleaning hands and other minor ablutions

#### Bench

Small structure for sitting
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fireplace / hearth</strong></td>
<td>Structure designed to contain a fire for heating and for cooking</td>
</tr>
<tr>
<td><strong>Mihrab</strong></td>
<td>Niche in the wall of a mosque that indicates the qibla - the direction of the Kaaba in and hence the direction that Muslims should face when praying</td>
</tr>
<tr>
<td><strong>Minbar</strong></td>
<td>Pulpit in the mosque close to the mihrab, where the imam (prayer leader) stands to deliver sermons or where the speaker sits and lectures</td>
</tr>
<tr>
<td><strong>Niche / Shelves</strong></td>
<td>Setback in the wall, in connection with the window opening or providing space for shelves</td>
</tr>
<tr>
<td><strong>Terrace</strong></td>
<td>Raised flat platform connected to a building</td>
</tr>
<tr>
<td><strong>Pillar</strong></td>
<td>Free standing feature supporting a covering, square in the cross-section</td>
</tr>
<tr>
<td><strong>Terrace &amp; Pillars</strong></td>
<td>Raised flat platform connected to a building, pillars with covering</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Portal</td>
<td>Representative doorway</td>
</tr>
<tr>
<td>Staircase or steps</td>
<td>Internal or external stairs</td>
</tr>
<tr>
<td>Timber structure</td>
<td>Ruined timber shelters found in the courtyards of the compounds</td>
</tr>
<tr>
<td>Water tank</td>
<td>Building or container constructed for water retention</td>
</tr>
<tr>
<td>Water well</td>
<td>Artificial excavation, hole or structure for the purpose of withdrawing water</td>
</tr>
</tbody>
</table>
Appendix 2 - PERIODS

21st century
Constructions erected for a movie set in 2009 – walls of stone or cement blocks, mud/earth mortar of coarse grain and high amount of gravel, covered with mud slurry and/or shoddy plaster. Very often the proportion of mortar exceeds the proportion of stones in the stonework. Some parts of the structures may consist of provisional constructions made of wood, textile tissue and gypsum - e.g. portals or shelves.

20th century
Constructions characterized by use of cement as mortar and/or plaster, walls mostly covered with additional anhydrite plaster finish, sometimes also with mud slurry.

Two different modes of cement use:
- Cement used as mortar AND plaster for constructions made of cement blocks or for stone masonry in buildings of particular use - the mosque, the school and some of the water tanks.
- Cement used ONLY as plaster. The walls being constructed of stones and mud mortar, the wall faces are consolidated by the layer of cement plastering. This kind of construction applies for ordinary domestic buildings. Courtyard walls are covered with cement OR lime based renders.

Pre-20th century
Constructions built of stones and mud mortar, extensively ruined.
## Appendix 3 - BUILDING MATERIALS

### STONES

<table>
<thead>
<tr>
<th>Stone</th>
<th>Colour</th>
<th>Solidity</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beachrock AG</td>
<td>White to beige</td>
<td>Very friable/brittle, loose components</td>
<td>Fine grained, high content of shells and gastropods, rough surface</td>
</tr>
<tr>
<td>Beachrock BJ</td>
<td>Grey to light reddish</td>
<td>Soft to medium hard</td>
<td>Recognizable stratification - gastropods and fine-grained sandy matrix, uniform ingredients, rough surface</td>
</tr>
<tr>
<td>Beachrock LO</td>
<td>Reddish to brown, grey</td>
<td>Medium to very hard</td>
<td>Rough surface, numerous cavities (holes), few gastropods and shells</td>
</tr>
<tr>
<td>Gypsum BE</td>
<td>Yellow grey to white or bright grey</td>
<td>Soft to medium hard (scratchable with fingernail)</td>
<td>Fine grained, no shells or gastropods, little holes, recognizable stratification and horizontal splits</td>
</tr>
<tr>
<td>Rock Type</td>
<td>Colour</td>
<td>Solidity</td>
<td>Characteristics</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Dolomite BL</td>
<td>Beige, yellowish, reddish, bluish grey</td>
<td>Very hard</td>
<td>No shells or gastropods, very fine matrix, fine and polish surface, larger pieces with holes</td>
</tr>
<tr>
<td>Fossiliferous limestone</td>
<td>White to bright beige</td>
<td>Hard</td>
<td>A limestone that contains obvious fossils - normally shells, cavities</td>
</tr>
<tr>
<td>Aeolianite FR</td>
<td>Beige</td>
<td>Fairly hard</td>
<td>Medium grained, even surface, no shells or gastropods, homogenous, looks similar to sandstone</td>
</tr>
<tr>
<td>Conglomerate</td>
<td>Beige, grey</td>
<td>Very hard</td>
<td>Mix of dolomite fragments and shells, extremely rough surface</td>
</tr>
<tr>
<td>Coral</td>
<td>Brownish</td>
<td>Hard</td>
<td>Very rough surface, sharp edges, small cavities of organic origin</td>
</tr>
</tbody>
</table>
### Concrete Block

**Concrete Block (old)**

- **Colour:** Brown, grey
- **Solidity:** Two qualities: hard and soft (falls apart when touched)
- **Characteristics:** Both types with a high proportion of small shells. Size: 20/20/40 cm, walls of about 3 cm thickness surround two square hollow spaces

**Concrete Block (new)**

- **Colour:** Grey-blue
- **Solidity:** Very hard
- **Characteristics:** No shells, round aggregate grains, porous. Size: 20/20/40 cm, walls of about 3 cm thickness surround two square hollow spaces

### Mortars

#### Mud, Fine Grain

- **Colour:** Light brown to brown
- **Solidity:** Very soft
- **Characteristics:** Fine, extremely brittle and susceptible to wind erosion, joins stones in the cores of historic walls of stone masonry.

#### Mud, Coarse Grain

- **Colour:** Brown
- **Solidity:** Soft
- **Characteristics:** High proportion of coarse aggregate, size reaching small gravel. In the stonework the proportion of the mortar often exceeds the proportion of stones
Cement

**Colour:** Grey, bluish-grey  
**Solidity:** Very hard  
**Characteristics:** Very fine aggregate, depending on the application technique smooth or rough surface

---

**PLASTERS (RENDELS)**

**Anhydrite**

**Colour:** White  
**Solidity:** Soft  
**Characteristics:** Fine, smooth surface, often applied as finish layer to cement plaster

**Mud, Fine Grain**

**Colour:** Light Brown  
**Solidity:** Medium  
**Characteristics:** Relatively fine, fairly rough surface; mostly found on the wall faces of the buildings erected in 2009

**Mud Slurrying**

**Colour:** Brown  
**Solidity:** Medium  
**Characteristics:** Thin layer, applied like paint to the white anhydrite or cement plasters

---

Al Jumail, courtyard walls in the village erected partly in 2009. Left: top of the wall made of stones with earth mortar, no plastering at all. Right: the fine, thin layer of mud plaster covering the rounded wall.
**Lime**  
*Color:* Yellow grey  
*Solidity:* Hard  
*Characteristics:* Loose packing of aggregate grains stabilized by calcite cement and pores in between the matrix-forming particles. The pores have about the same size as the matrix particles and add up to 40 – 45 volume percent porosity. Often applied to the courtyard walls.

**Cement**  
*Colour:* Grey  
*Solidity:* Very Hard  
*Characteristics:* Fairly rough surface, very often scratched (wavy lines) to increase the support for the following finish layer.

**Fine Cement Finish**  
*Colour:* Grey to dark grey  
*Solidity:* Very Hard  
*Characteristics:* Very fine, polished, smooth surface, applied to lime or cement plaster.
SCREEN SHOTS of INVENTORY DATABASE for ARCHITECTURAL RECORDING

The start when you enter the database.

Structure registry. Just the basic information.

Structure record, with no information. The grey boxes with a small black arrow pointing down are scroll downs with different options.

The grey 'things' such as 'Enter Room Record', 'PDF' etc., are buttons leading you to the next step, or showing the pdf file, refresh the page etc.
Structure record, example. You can click on the blue links and see the photos.

Room record, floor. No information.

Room record, ceiling. No information.
SCREEN SHOTS of INVENTORY DATABASE for ARCHITECTURAL RECORDING

Relations.

Photo record.
Manual for the Touristic Assessment of Heritage Sites in NW Qatar

ASSESSMENT OBJECTIVE: Collect information about heritage sites in order to assess their touristic potential.

The QIAH Project has already surveyed the entire region in 2012. The data collected is mostly archaeological and this new documentation intends to expand on the existing record by adding a series of indicators measuring the inherent value of each site from a touristic perspective. These new sets of indicators are divided into 2 main categories:

- Cultural and Environmental Landscape
- Infrastructural Capacities

In order to measure the touristic potential for a given site, all indicators are attributed a specific value according to their importance. Combining the recorded values will set an overall score for each site.

COLLECTION OF INFORMATION: The documentation sheet is divided into 4 sections:

- Site Identification details (predefined indicators)
- Main Category 1: Landscape
- Main Category 2: Infrastructure
- Future Work Proposal (optional)

SITE IDENTIFICATION
(all these indicators have been defined by the QIAH Regional Survey 2012)

- QNHER # Number assigned to each site in Qatar, Qatar National Heritage and Environment Record
- Site Name Informal name the site is referred to by the local population - if known
- Site Period Defined by the regional survey (Neolithic, Early Islamic, 18th century, etc)
- Site Type Defined by the regional survey (Settlements, water source, agricultural field, etc)
- Related sites Sites located in the same vicinity and as well as contemporary

LANDSCAPE INTEGRITY ASSESSMENT

CULTURAL Landscape

Architectural remains/ruins
- High: standing ruins with occasional complete structural remains
- Med: visible architecture amongst ruins
- Low: very limited and unattractive visible remains

Archaeological activity
- H: the site is being investigated or has been comprehensively documented
- M: the site has partly been researched (excavation, survey, geology)
- L: the site has never been explored

ENVIRONMENTAL Landscape

Vegetation
- H: presence of a number of trees and/or mangrove and/or grass
- M: scarce presence of trees and/or mangrove and/or grass
- L: dry desert with disseminated low bushes only

Wildlife
- H: repeated sightings of multiple animals (e.g. multiple birds, wild mammal species OR large flocks OR colorful insects)
- M: occasional presence of some visually interesting animal species (see the above)
- L: rare occurrence of visible animal presence

Nearby Intrusive Structure
- H: No structure visible in the immediate vicinity of the site
- M: Very limited structures visible in the vicinity of the site
- L: Presence of large structures in the direct vicinity of the site

Site Pollution
- H: No visible pollution in the immediate vicinity of the site
- M: Presence of trash within the site
- L: Continuous overflow of large amount of trash within the site vicinity
INFRASTRUCTURE ASSESSMENT

Traditional Structure
- H: Presence of traditional structure that could potentially be re-used
- M: Presence of traditional structure but badly preserved or inappropriate for re-use
- L: No presence of traditional structure

Modern Structure
- H: No modern structures but space available to accommodate new structures
- M: Presence of modern structure and space available to accommodate new structures
- L: No structure and very limited space for any new constructions

Accessibility
- H: Direct road access to the site
- M: Track access under 15 mins drive from the main road
- L: No track access to the site or over 15 mins drive from the main road

Parking
- H: Presence of a parking space
- M: No parking but space to accommodate a parking place
- L: Limited or no space available to accommodate a parking place

Guard’s cabin
- H: Opportunity for the re-use of a traditional structure to put up a housing for the guard
- M: No traditional structure available for re-use but space to put up a modern or traditional structure
- L: Limited or no space available for any structure that could be used as guard’s office/housing

Toilets
- H: Toilets available on the site
- M: No toilets available but opportunity to re-use a traditional structure for toilet purpose
- L: Limited or no toilet space available or new construction opportunity only

Shelters
- H: Presence of features (either natural or traditional building) that could be re-used as shelters to sit/rest/picnic
- M: Limited features available for re-use but space to put up new features
- L: Very limited space available for any feature that could be used as shelters

Walking path/hike track
- H: Presence of a trail/path in the site and/or connecting the site to other sites in the vicinity
- M: No trail/path available for re-use but space to put up a new trail/path
- L: Very limited space available to put up any trail/path

Waste
- H: Presence of garbage cans on the site and of a nearby skip
- M: No garbage cans but presence of a nearby skip
- L: No garbage cans and no skip available in the site vicinity

PROPOSITION FOR FUTURE HERITAGE WORK
(optional)
APPENDIX 12 Conservation Schemes
12.1 Town wall (segments exposed in 1980s)
12.2 Town wall segments exposed by QIAH
12.3 Fortified Compound QMA 4
12.4 Palace EPO4 (in prep.)
The outer town wall of Al Zubarah was excavated partly in the 1980s. The remains were consolidated then and capped with a flat cement layer. Over the past thirty years huge amounts of soil and sand deposit had accumulated on the exterior and the exposed wall segments were heavily effected by the harsh environmental conditions. When the QIAH-Project was initiated in 2009 it was decided to remove the accumulated deposits to make the town wall more visual for visitors and to gain a better understanding of its structural conditions. Based on the initial record of the state of conservation the conservation concept for the town wall was developed.
CONSOLIDATION OF EXTERIOR/OUTER WALL SEGMENT

1. **Documentation** of State of Conservation / **Planning** of Measures
2. **Consolidation** outer wall face (Fiche 3; Fiche 3.1)
   a) Re-placement of damaged wall stones
   b) Inserting new wall stones and new socle zone: up right standing conglomerate (La) stone slab and one course dolomite (Bl) to avoid damages caused by salt crystallisation (Fiche 3.2).
3. **Re-pointing** of joints (Fiche 3.3)
4. **Take-off of cement capping** (1980s) (Fiche 3.1)
5. **Re-shaping of wall tops** with additional wall stones (case to case basis) (Fiche 3.3 / 3.4)
6. **Re-plastering** of the “outer” wall segment: a) Wall faces with “hand tooling” (Fiche 3.5.2); b) Wall top with “Rough” surface (Fiche 3.5.3).
7. **Sharp edge line** defines wall face and wall top. “Double” line showing thickness of plaster (Fiche 3.5).
8. Not exposed walkways should be kept uncovered or will be covered again with a soil/sand layer after works at outer wall segment are finalised (Fiche 5; 5.1, and 5.2).
9. Produce **report** on executed measures to be stored with the Inventory data base.
10. Regular **monitoring** after the measure take place to initiate repairs when needed.
GENERAL CONSERVATION CONCEPT

CURRENT SITUATION

Wall collapse

Sand deposits with high salt content

former Walkway

1980s Cement mortar

1980s Cement capping

Blown- & Washed-out Joints

eroded Wall stones

Sand & Soil deposits

heavily damaged (deteriorated) Beachrock

GENERAL CONSERVATION CONCEPT

Taking-off cement capping
Re-shaping wall top ("re-ruined")

Re-plastering: Rough surface with traces of hand tooling; clear sharp, double lined edge

Re-pointing of joints

Addition of stones due to structural needs

Exchange of damaged Beachrocks

Removal of Sand & Soil deposits

Quartz-sand fill, compacted horizontally or slightly sloping away from wall basis

"Re-buried" Walkway

Sand deposits will stay
PROPOSED WORK for 2013:

Cleaning of wall segments.
Re-plastering of segment 8/9 including towers 8 and 9.

Consolidation of wall segment 17/18,
State of Conservation Record: Nov. 2009
(Photograph-Survey), planned for spring 2013

Works should follow *fiches techniques.*
The fiches needed for the proposed work are highlighted in **bold.**

---

**Fiche No. 1 Health & Safety instructions**
**Fiche No. 2 Building materials**
2.1 Materials to use for consolidation work

**Fiche No. 3 Wall consolidation**
3.1 Preparation and initial works
3.2 Wall foundations
3.3 Structural rebuilding
3.4 Reconstruction
3.5 Plaster works
3.5.1 Smooth surface
3.5.2 Hand tooling
3.5.3 Rough surface
3.5.4 Repairs

**Fiche No. 4 Consolidation and Stabilisation of Plasters**
4.1 Consolidation of plaster surfaces
4.2 Fixing of loose plaster pieces/parts
4.3 Cementing of cracks
4.4 Notes

**Fiche No. 5 Protection of architectural remains**
General guideline
5.1 Backfill
5.2 Stabilisation & Protection

**Fiche No. 6 Monitoring**
6.1 State of Conservation
6.2 Climate data
6.3 Monitoring (Site journal)
6.4 Indicators and Periodicity
GENERAL CONSERVATION CONCEPT

Town wall segment at tower 4012 (ZUEP04) in March 2012 (VAR. 2).
CONSERVATION CONCEPT:
TOWN WALL with exposed walkway, e.g. TOWER 8 / EP10

CURRENT SITUATION - January 2012

Section of wall segment North of tower 8

Wall base:
Soft Beachrock is in a poor state;
Deterioration & Disintegration of
Beachrock components!

Re-plastering:
"Rough" surface (wall top) and with traces of hand
tooling (wall face); sharp edge (double-line) be-
tween wall top and wall face; edged corners
PROPOSED WORK for 2013:

Cleaning of area
Stabilisation and Protection of walls endangered to collapse

Consolidation of walls and wall plasters in Rooms R.004, R.005, R.006, R.007, and R.008.

State of Conservation Record: Nov. 2009 (Photo-Survey) and April 2012 (3D-Laserscan).

Works should follow *fiches techniques.* The fiches needed for the proposed work are are highlighted in *bold.*
**APP.12.3 CONSERVATION SCHEME**  
**FORTIFIED COMPOUND QMA4**

## CASE STUDY QMA4_R.004

<table>
<thead>
<tr>
<th><strong>Al Zubarah</strong></th>
<th><strong>Inventory - State of Preservation</strong></th>
<th><strong>November</strong></th>
<th><strong>2009</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>QMA 4</td>
<td>Fortified Compound</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R.004</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Description** (2009)

- **Measurements:** 6.80m x 3.10m, 21.08m².
- **Context:** Connected with R.005 and R.009.
- **Features:** Blocked door to exterior area in the west (street?); Niche in wall a.
- **Floor:** Covered by deposits of blow-in sand and disintegrated building materials (beach rock components as well as sand).
- **Relatively high concentration of salt.**
- **Fragile plaster remains at wall c and d which will be difficult to keep.**

**Consolidation/Conservation suggestions**

**Proposal 2012:** Consolidation of walls, including re-pointing of joints and replacing of wall stones at the wall base if necessary. Taking off cement capping and re-shaping of wall tops. Re-plastering with smooth surface showing some traces of trowel tooling. Removal of deposits down to floor level and protection of floor according to manual.
State of Conservation - R.004_wall a

<table>
<thead>
<tr>
<th>Al Zubarah</th>
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</thead>
<tbody>
<tr>
<td>QMA 4</td>
<td>Fortified Compound</td>
<td>Date: 18.11.2009</td>
</tr>
<tr>
<td>R.004</td>
<td>Wall a</td>
<td></td>
</tr>
</tbody>
</table>

**Wall a**

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niche: b:82cm, t:48cm, UK 1,25m</td>
</tr>
<tr>
<td>Anhydrite plaster in lower part of the wall preserved. Hard cement capping, cement mortar between beach rock stones.</td>
</tr>
<tr>
<td>Voids, gaps, holes, out-blow, wash-out in wall structure.</td>
</tr>
<tr>
<td>At wall base blow-in sand deposits and wash-out accumulations of building material debris.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consolidation/Conservation suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012: Remove deposits in front of wall base;</td>
</tr>
<tr>
<td>Remove cement capping and mortar;</td>
</tr>
<tr>
<td>Consolidation of historic plaster remains;</td>
</tr>
<tr>
<td>consolidation of wall structure; Re-shaping wall top and re-plastering according to manual</td>
</tr>
</tbody>
</table>
## Al Zubarah

### Inventory - State of Preservation

<table>
<thead>
<tr>
<th>QMA 4</th>
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<tbody>
<tr>
<td>R.004</td>
<td>Wall b</td>
<td></td>
</tr>
</tbody>
</table>

### Description

Cement coat on wall top: Crackling. Beach stone (Ag) is badly preserved, mostly eroded and effected by out-blow and wash-out processes. Blocked door in northern half of the wall. The door reveal on both sides shows well preserved plaster remains! Massive wash-out-, blow-in-deposits at wall bottom of sand and disintegrated building material components. Only in southern corner some “original” plaster fragments preserved.

### Consolidation/Conservation suggestions

2012: Removal of deposits down to floor level; Removal of cement capping and render; consolidation of wall structure; re-shaping of wall top - capturing door reveal of blocked door; Re-plastering according to scheme.
State of Conservation - R.004_wall c

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<tr>
<td>R.004</td>
<td>Wall c</td>
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</tr>
</tbody>
</table>

Wall c

**Description**

- Cement coat on wall top and upper 1/3 of wall face is crackling.
- Beach stone material is in a very poor state and heavily effected by aeolian and fluvial erosion processes. Wall structure starts to collapse.
- Massive deposits of disintegrated building material debris at wall base.
- In lower half of the wall historic plaster fragments preserved.
- It is unclear if the wall opening is a result of the 1980s excavation and consolidation work or if it is a historical context.

**Consolidation/Conservation suggestions**

- 2012: Removal of deposits; Sorting of wall stones and plaster remains; Removal of cement capping and render; Removal of cement coating on wall structure; Consolidation of historic plaster remains; Re-plastering.
**State of Conservation - R.004_wall d**

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<p>| <strong>Wall d</strong> |</p>
<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th><strong>Consolidation/Conservation suggestions</strong></th>
</tr>
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<tbody>
<tr>
<td>Beach stone-wall with mud/soil-, anhydrite- &amp; cement-mortar. Cement coating, in lower parts also historic plaster fragments are preserved. Substantial plaster remains in door reveal and in front of the wall. Beach stone is in a poor state especially at the wall base. Heavily weathered wall stones. Deposits of disintegrated building material debris and blown-in soil/sand. Wall opening (door) to R.005. Missing stones. Voids in the wall structure.</td>
<td>2012: Remove deposits, Collect fallen plaster remains; Remove cement capping and render; Consolidation of wall structure and plaster remains (mainly at the door); Re-shaping of wall top and re-plastering.</td>
</tr>
</tbody>
</table>
PROPOSED MEASURES and CONSERVATION CONCEPT - R.004_wall a

Design & Conservation principles
PROPOSED MEASURES and CONSERVATION CONCEPT - R.004_wall b

QMA 4_R.004 wall b; proposed conservation works

Design principles
Comparable situation in the Palace (ZUEP04) after consolidation and re-plastering. Historic plaster remains were consolidated and integrated in the plaster surface.
PROPOSED MEASURES and CONSERVATION CONCEPT - R.004_wall d

- Remove cement capping and plaster (fiche 3.1)
- Re-shaping of wall top (fiche 3.4)
- Consolidation of historic plaster remains (fiche 4)
- Consolidation of wall and re-plastering with smooth surface (fiche 5.3 to 5.5.1)
- Remove deposits down to floor level, protect floor (fiche 3.1 and 5)
- Remove cement capping and mortar material (fiche 3.1)
- Re-shaping and re-plastering with a rough surface (3.3 to 3.5 and 3.5.3)
- Missing stones
- Cracked, voids, gaps
- Beach stone eroded
- Wash-out deposits of beach stone materials
- Consolidation of plaster fragments (if possible) (fiche 4)
- Different mortars
- Cement coating
- Removal of deposits down to plaster floor, protection of floor with membrane and sand (fiche 5)
PROPOSED WORK for 2013:

De-backfill and removal of stabilisation material along walls etc. to prepare further excavation, documentation and initial consolidation work.

Re-plastering of walls initially consolidated in 2012

Consolidation of walls and wall plasters

State of Conservation Record: March 2011 (Photo-Survey & 3D-Laserscan); December 2011/January 2012 (Photo survey prior to work); April 2012 (3D-Laserscan).

Works should follow *fiches techniques*. The fiches needed for the proposed work are are highlighted in **bold**.
CASE STUDY: Palace ZUEP04_Space 3018

Consolidation example space 3005

Consolidation example ZUEP04
PROPOSED MEASURES and CONSERVATION CONCEPT - Space 3018_wall a (4473)
Wall 4476, state of conservation, February 27th, 2012

Wall 4476, mapped materials and planned measures
PROPOSED MEASURES and CONSERVATION CONCEPT - Space 3018_wall c (4480/4475)
Wall 4481, state of conservation, February 27th, 2012

Wall 4481, mapped materials and planned measures
PROPOSED MEASURES and CONSERVATION CONCEPT - Space 3018

Consolidation of walls:
- re-pointing & replastering (fiche 3.3/3.5)
- smooth surface (fiche 3.5.1)
- wall tops (fiche 3.4)
- with rough surface (fiche 3.5.3)

- smooth surface (fiche 3.3.1)
- structural rebuilding
- protective layer
- consolidation of historic plaster (fiche 4)

removal of deposits down to floor level:
- protection of floor with membrane
- and quartz sand (fiches 3.1.5)