The Hashemite Kingdom of Jordan

Wadi Rum Protected Area

A Proposal for Inclusion in the World Heritage List |UNESCO

January 2010

Table of Contents

Executive Summary

State Party

Hashemite Kingdom of Jordan

State, Province, Region

Aqaba Special Economic Zone

Name of the Nominated Property

Wadi Rum Protected Area

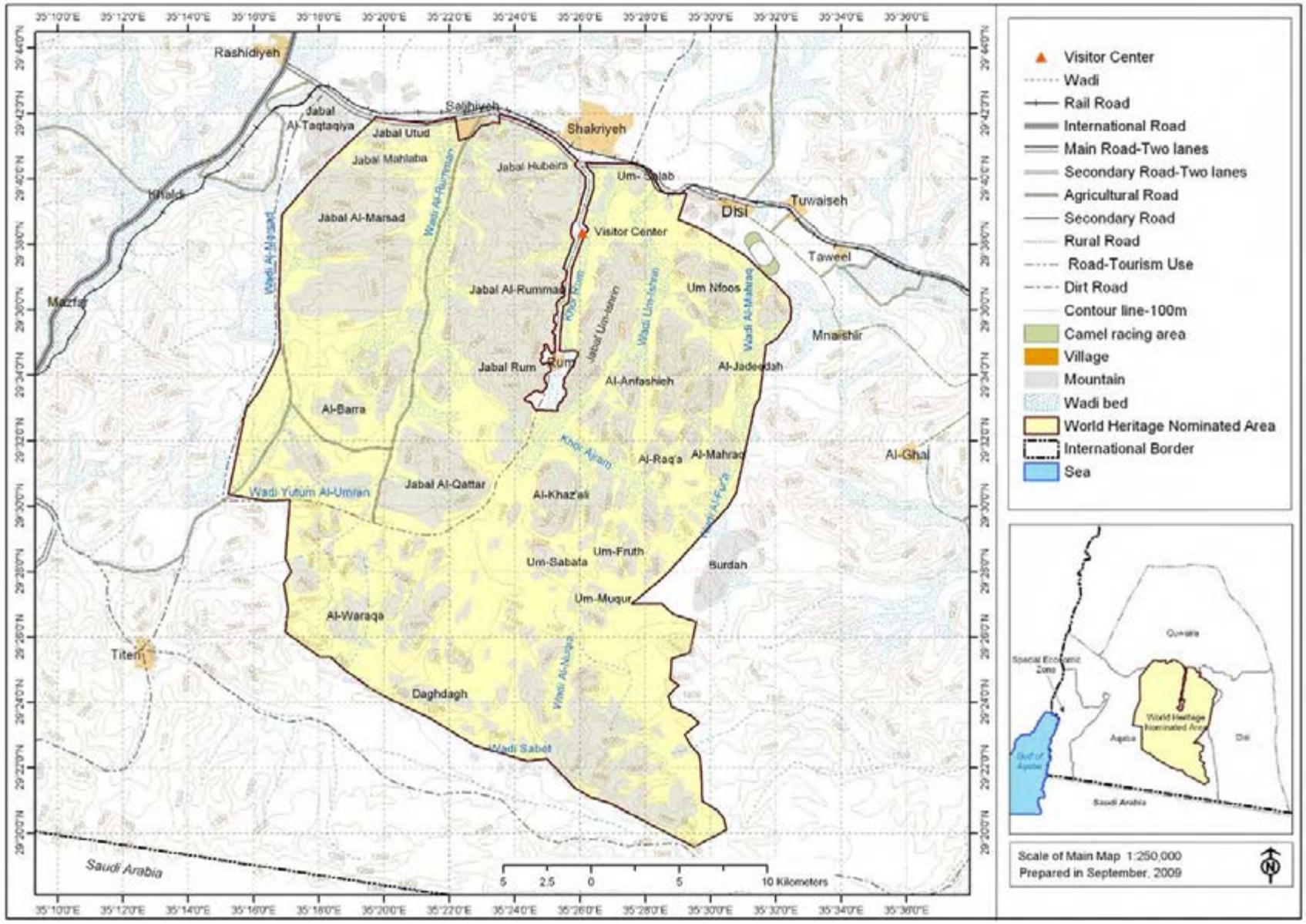
Geographic Coordinates to the Nearest Second

Central Management Station: N 29 38 22.60 E 35 26 02.32

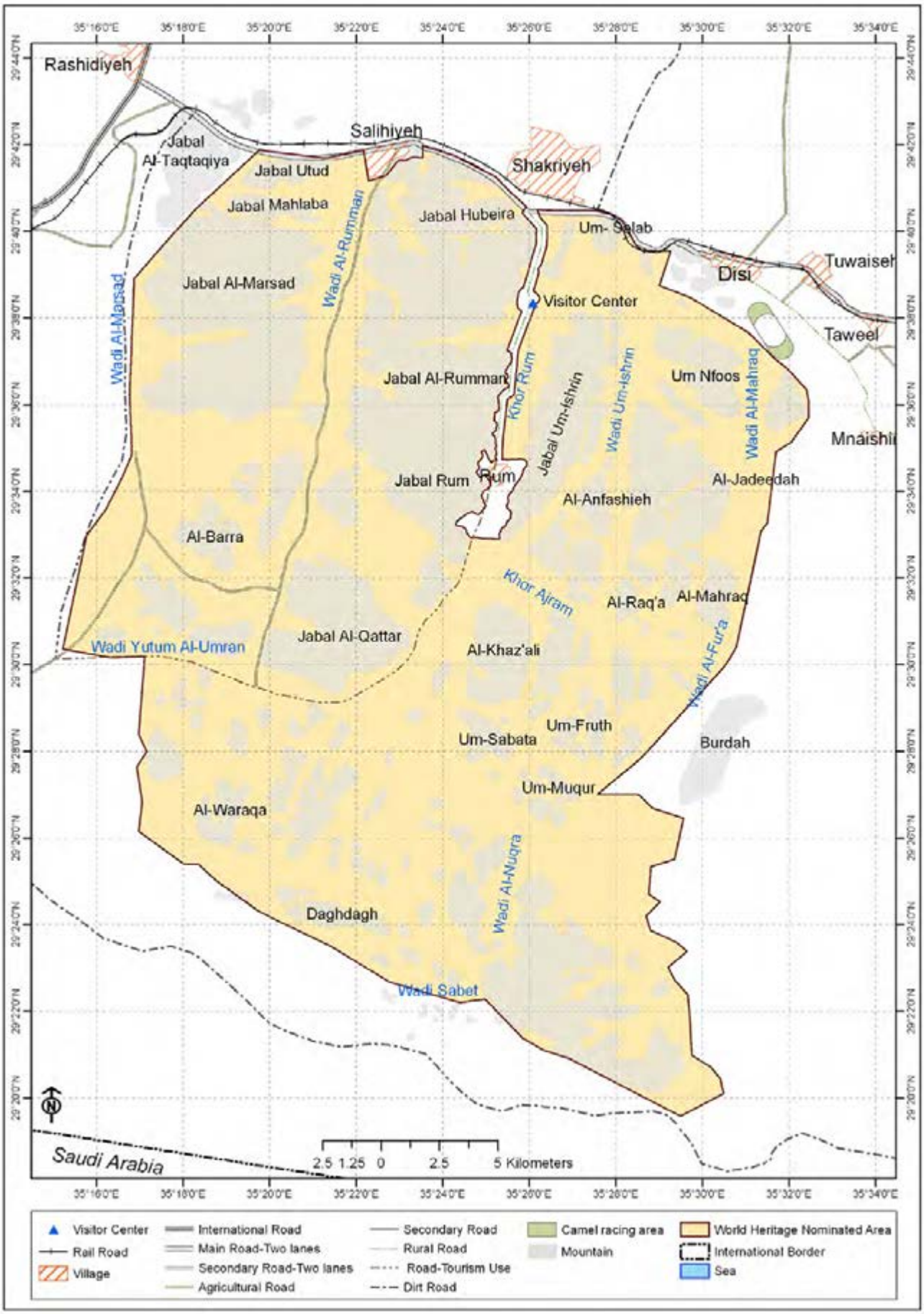
Textual Description of the Boundary of the Nominated Area

The Wadi Rum Protected Area is located in the southern part of Jordan and lies within the Aqaba Special Economic Zone which is part of the greater Aqaba Governorate, about 310 km south of Amman and about 60 km north east of the coastal city of Aqaba. It covers an area of 74,200 ha (seventy four thousand and two hundred hectares), out of which, 73,300 ha (seventy three thousand and three hundred hectares) are being nominated for world heritage status as mixed site for natural and cultural outstanding universal values. Wadi Rum Protected Area represents the largest protected area in Jordan and the Levant region, and covers almost one percent of the total surface area of the country. Wadi Rum Protected Area forms a major part of the Hisma desert of southern Jordan and northern Arabia, lying to the east of the Jordan Rift Valley and south of the steep escarpment of the central Jordanian plateau. The borders of the Protected Area extend from Qaa' Disi in the North-East to Jabal Al Fara'a in the South-East and to Wadi Sweibit in the South-West.

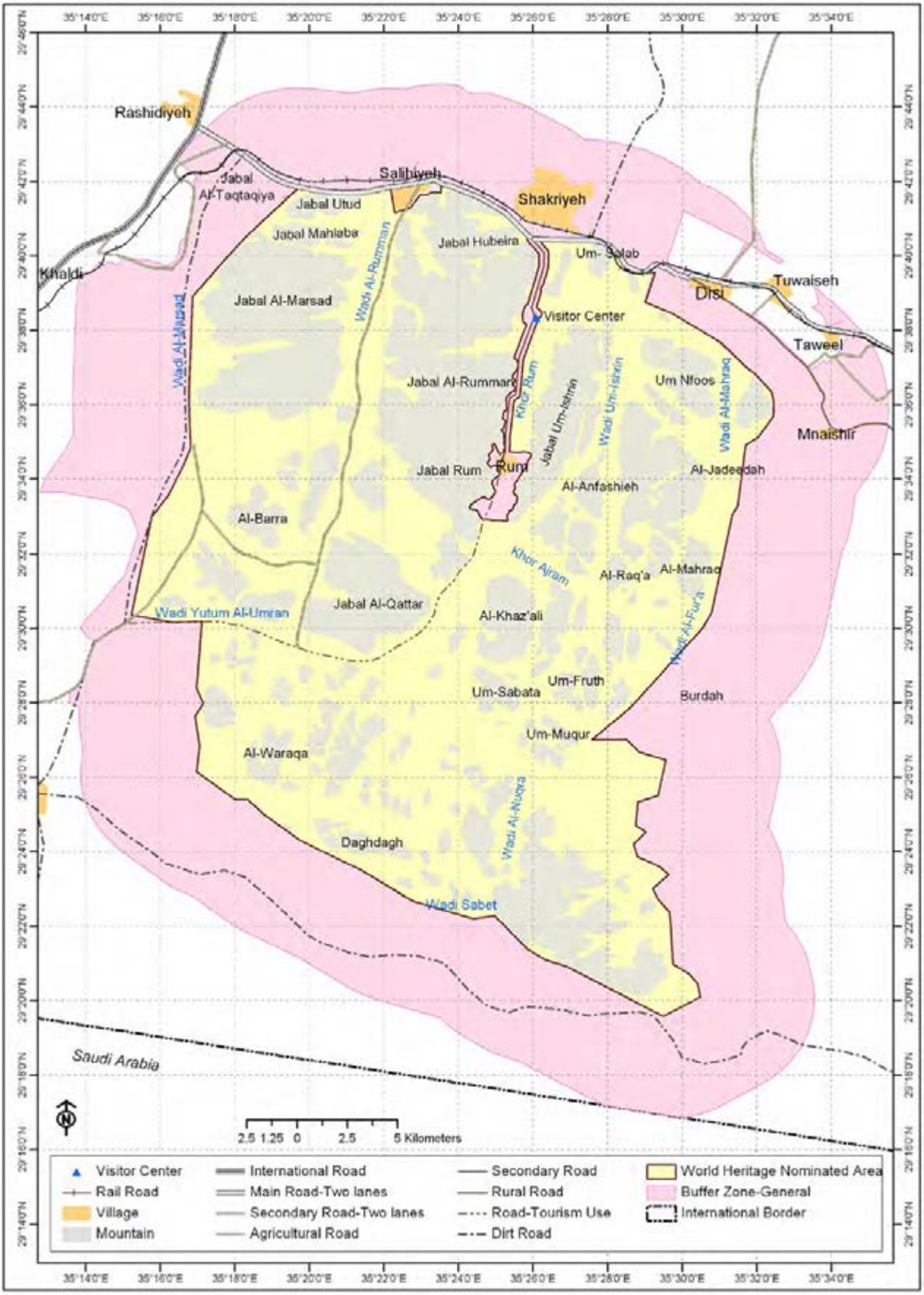
World Heritage Nominated Area – General Map, Topography



World Heritage Nominated Area – General Map



World Heritage Nominated Area – Map with Buffer Zone



Justification – Statement of Outstanding Universal Value

The Wadi Rum Protected Area is a mixed property composed of scenically stunning and tightly interwoven natural and cultural attributes in a lived-in desert environment.

The Area is the product of millions of years of geological processes, and thousands of years of interactions between humans and nature in a hostile desert environment. Wadi Rum is the iconic superlative exemplar of a highly varied desert landscape that is the result of the interplay between complex geological controls – both structural and lithological – and climatic influences that have fluctuated considerably over the long period that it has taken the landscape to evolve. Geology has been the ever-present artist; a sculptor playing with abundant possibilities of form, colour and texture.

Widespread petroglyphs and inscriptions eloquently attest to 12,000 years of human history and the very early development of alphabetical writing while on-going land use reflects a traditional but dynamic Bedouin culture. North-Arabian inscriptions have allowed scholars to identify Wadi Rum as a site specifically mentioned in the Qur'an (89: 7-8), the Holy Book for over one billion Muslims. This unique property satisfies all key requirements for an effective long term management and protection process that balances the visions and needs of a wide spectrum of stakeholders.

The property manifests outstanding universal values with respect to five separate, but fully complementary, World Heritage criteria. These can be summarized as: **(iii) exceptional testimony to a cultural tradition or civilization, (v) outstanding example of human interaction with the environment, (vi) association with literary works of universal significance, (vii) significant natural beauty and aesthetic importance, and (viii) significant geomorphic features.**

Criterion (iii): The Wadi Rum Protected Area bears a unique testimony to the practice of rock art and inscriptions that has been on-going for millennia. The combination of 25,000 petroglyphs with 20,000 rock inscriptions, and their continuity over a period of at least 12,000 years, sets Wadi Rum apart from other rock art and/or inscription sites. The petroglyphs, representing humans and animals, are engraved on boulders, stones, and cliff faces. They trace the evolution of human thought; the long-term patterns of pastoral, agricultural, and urban human activity in the Arabian Peninsula; and the environmental history of a distinct region that has evolved climatically from mildly humid to semi-arid. The engravings indicate an elaborate sense of aesthetics and a

pictorial culture. Numerous inscriptions in four different North-Arabian scripts testify to the very early emergence of alphabets from iconic representations, and widespread literacy among pastoral societies in the Arabian Peninsula. Thus, the open-air library that is Wadi Rum is a critical site for the study and understanding of the evolution of aesthetics, writing and literacy.

Criterion (v): The variety of landforms at Wadi Rum has played an essential role in fostering human settlement and, as a result, the development of sophisticated intellectual activity that is documented by abundant petroglyphs and rock inscriptions. This graphic testimony to diverse cultural traditions and civilizations over millennia is one of the world's richest sources of documentation. Nowhere else in the world can one find such a wealth of information that enables the study and understanding of the continuum of settled and mobile lifestyles in a desert landscape. Here is a record of resource use in this desert and mountain environment illustrating the adaptability and ingenuity of human communities who have made the most of scarce resources to sustain continuous presence after the climate became dryer in the Bronze Age (3rd millennium BC). This is why the significance of the Wadi Rum Protected Area goes far beyond its north-Arabian context as it represents a uniquely documented instance of human interaction with dry environments of relevance to other arid areas worldwide.

Criterion (vi): North-Arabian inscriptions have allowed scholars to identify Wadi Rum with Iram, where the tribe of 'Ad lived. The site and the tribe are mentioned in the Qur'an (89: 7-8), the Holy Book for over one billion Muslims. According to evidence derived from numerous inscriptions in various alphabets, ancient Iram and the tribe of 'Ad can only have been located in Wadi Rum. The Qu'ranic story of Iram, "the place of the columns", exemplifies divine punishment over a corrupt people. Allah left Iram buried under the sands of the desert, making Iram and 'Ad legends to be spoken of and an exemplary lesson of warning.

Criterion (vii): The aesthetic beauty of Wadi Rum is produced by an astonishing and iconic assemblage of landforms. The continuous uplift, tectonic faulting, weathering and erosion have transformed the mountains of Wadi Rum into a visual tableau of towers, pyramids, domes, narrow gorges, mushrooms, wide flat-bottom valleys called "Wadis", sand plains, and sand dunes. Soaring mountain peaks rise vertically from colourful sand plains and dunes. Summit shapes trace pillars, castles, domes and pyramids in the desert sky. Loose sands climb on the cliffs and fill wide wadis. Vertical cliffs with long vertical striations have been sculpted to produce rounded columns of coloured sandstones often featuring magnificent stone arches, inselbergs

and mushrooms. To eloquently express his overwhelming awe when he first entered Wadi Rum in 1916, T. E. Lawrence recorded this passage: "Our little caravan grew self conscious, and fell dead quiet, afraid and ashamed to flaunt its smallness in the presence of stupendous hills" (Seven Pillars of Wisdom, 1926: 342).

Criterion (viii): The Wadi Rum Protected Area holds an exceptional record of the intricate interactions between passive and active geological controls on the evolution of a uniquely diverse landscape within a true present-day desert setting. The present landscape derives from the interplay of changing environmental conditions, lithology, uplift, faulting, weathering and erosion over tens of millions of years and presents an unrivalled level of complexity and inter-dependence. Ongoing weathering and wind erosion sculpts the sandstone between the joints to produce long rounded sandstone columns rising to over 1800 metres asl. Flat-bottom valleys or "wadis", filled with shifting sands and occasional low dunes, are another unique landform that adds to the diversity of the landscape. A continuous line of mud flats (Qaa') lying at 800 metres asl run along the boundaries of the sand stone form a notable case of geomorphic contrast.

According to experts in desert landforms, Wadi Rum is the best place in the world to observe such high cliffs, extraordinary columns and niches, and the full sequence of rock falls of various types produced by weathering of the rock mass. While the landforms of this incredible setting are, without doubt a unique work of art, they also serve to help us interpret the geology as a basic conditioning element of the desert ecosystem. It reveals to us in its magnitude and subtleties the full story of Rum as told by nature.

Integrity and Authenticity: The Wadi Rum Protected Area is the largest protected area in Jordan and the Levant region. It was established in response to an IUCN report in 1979 that proposed a national network of protected areas to conserve the representative desert landforms and ecosystems along with their associated cultural values. Covering more than 72,000 ha, the Protected Area encompasses the finest examples of the target natural and cultural values and attributes that are the basis for the claim to outstanding universal value. The area includes the majority of the iconic sandstone landforms in Jordan and the wider Hisma desert, intermingled with their representative desert ecosystems, habitats and species along with their associated cultural values. The Protected Area also encompasses the majority of the rock art and inscriptions of the Hisma basin along with the historical testimonies demonstrating the long established interaction between man and his environment including the Qu'ranic evidence of record of Rum to be the place of the great tribe of Ad.

Governance and Management: the Wadi Rum Protected Area lies within the Boundaries of the Aqaba Special Economic Zone Authority; one of Jordan's strongest decentralised governance structures. The Protected Area satisfies all key requirements for effective long term management and protection of the area's outstanding universal values. The boundaries for the area were designated and delineated though a participatory process with stakeholders, which resulted in special legislation for Wadi Rum. A comprehensive management plan, also the result of a thoroughly participatory process, was developed for the area in 2003 and a full review is planned by the end of 2010. The Protected Area is managed by a competent, well equipped staff that has ample monitoring and enforcement capabilities, and is adequately backed by legal mandates and regulations.

The Management Plan review process will provide an opportunity to develop a strategic approach to the analysis and adoption of actions to deal with management issues requiring long term attention. These key issues include: (1) governance arrangements, (2) the impacts to desert ecosystems and aesthetics generated by the use of private vehicles to transport visitors to major attractions, (3) expansion of the Wadi Rum Village in response to natural growth, (4) diversification of the site's Management Committee to include a broader spectrum of stakeholders, and (5) transformation of Wadi Rum into a model zero carbon Protected Area.

Political Support: In his world renowned piercing vision, the late King Hussein of Jordan once said: "Wadi Rum is not for a human; it is for humanity". This demonstrates Jordan's long established understanding of the global significance of the Wadi Rum Protected Area and its commitment to conserve it and present it for the benefit of future generations. His successor, King Abdullah II, firmly follows on his father footsteps and considers the Wadi Rum Protected Area a national icon to be safeguarded as a common heritage of humanity.

Contact Information

Dr. Salim Al Mughrabi
Commissioner for Environment
Aqaba Special Economic Zone Authority

Address:

P.O. Box 2565
Aqaba 77110, Jordan
Tel: 962 (03) 209 1000
Fax: 962 (03) 209 1008
Mobile: 962 79 999 7212
Email: SMoghrabi@aseza.jo
Website ASEZA: www.aseza.jo
Website Wadi Rum: www.wadirum.jo

Section 1: Identification

1.a Country:

The Hashemite Kingdom of Jordan

1.b Region:

Aqaba Special Economic Zone

1.c Name of the Property:

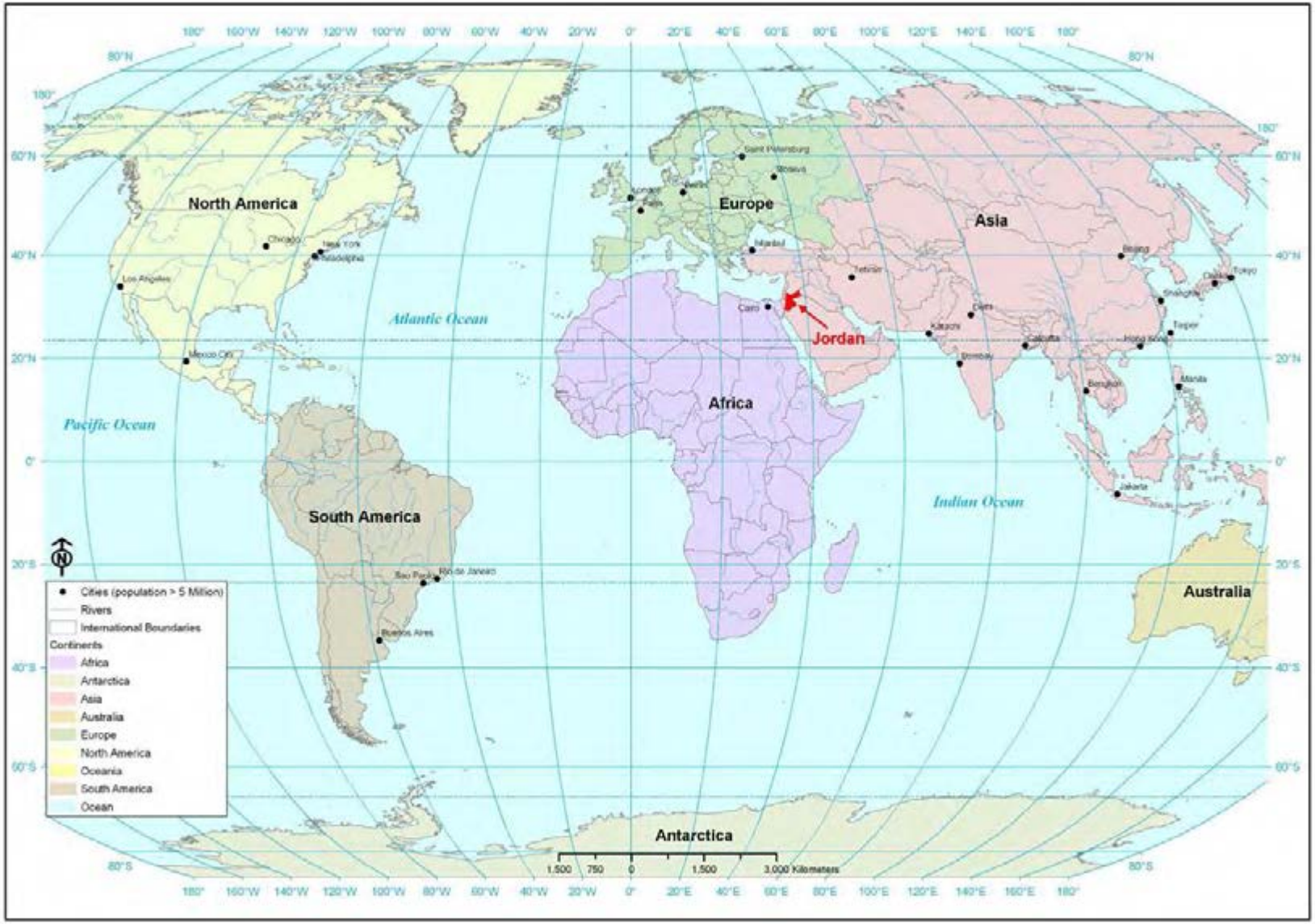
Wadi Rum Protected Area

1.d Geographical Coordinates:

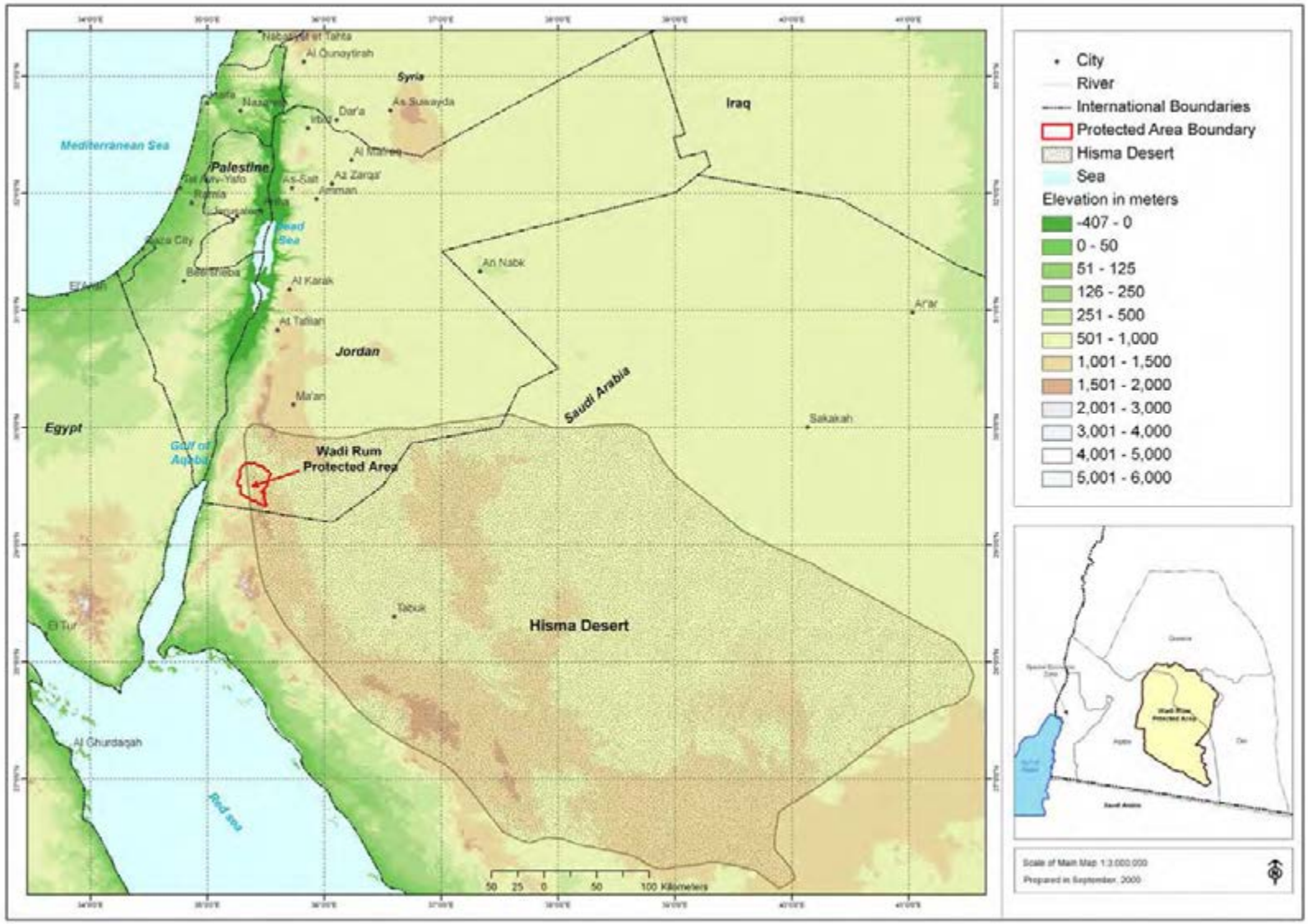
Central Management Station: N 29 38 22.60 E 35 26 02.32

1.e MAPs

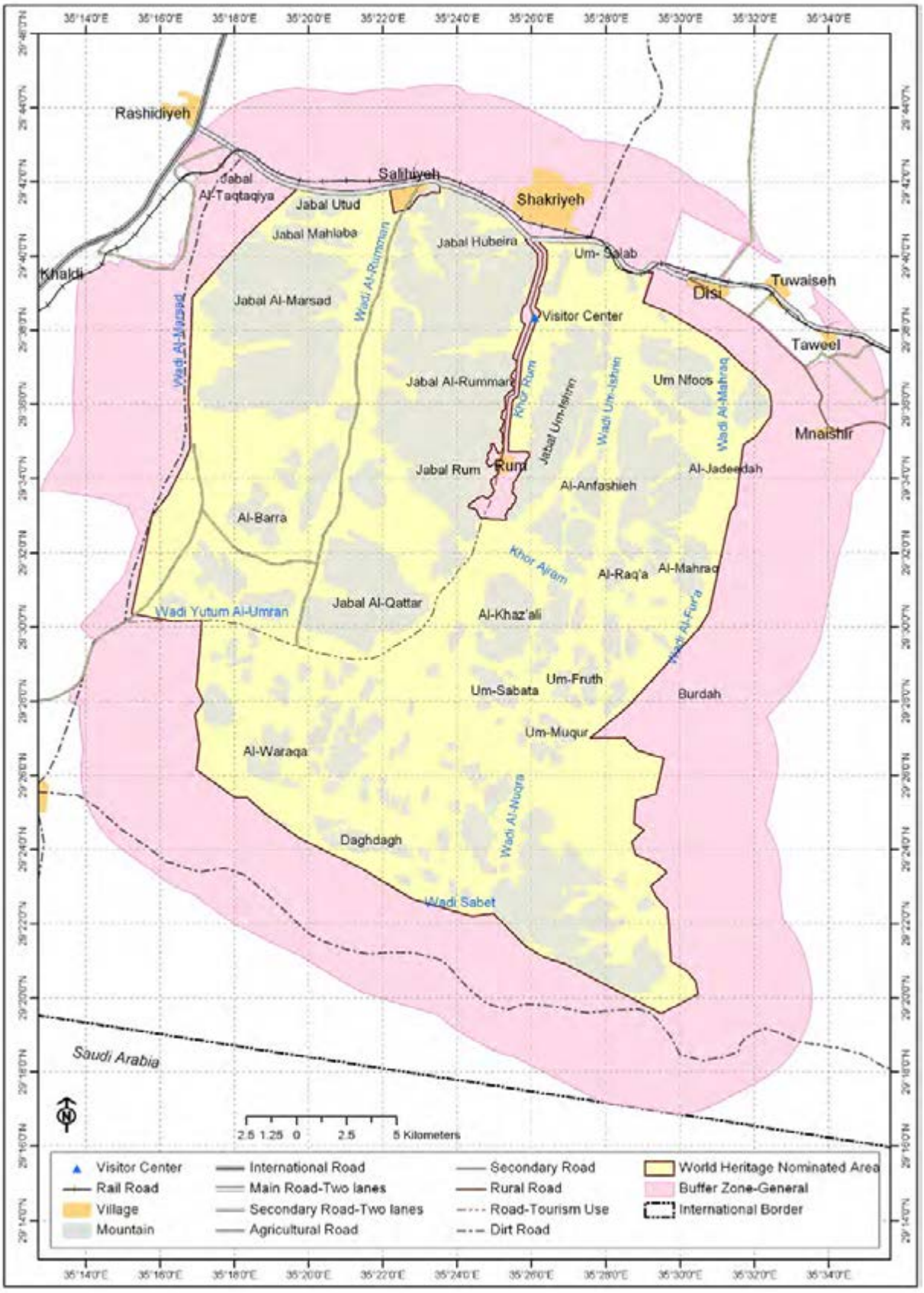
1- Jordan in the World Map



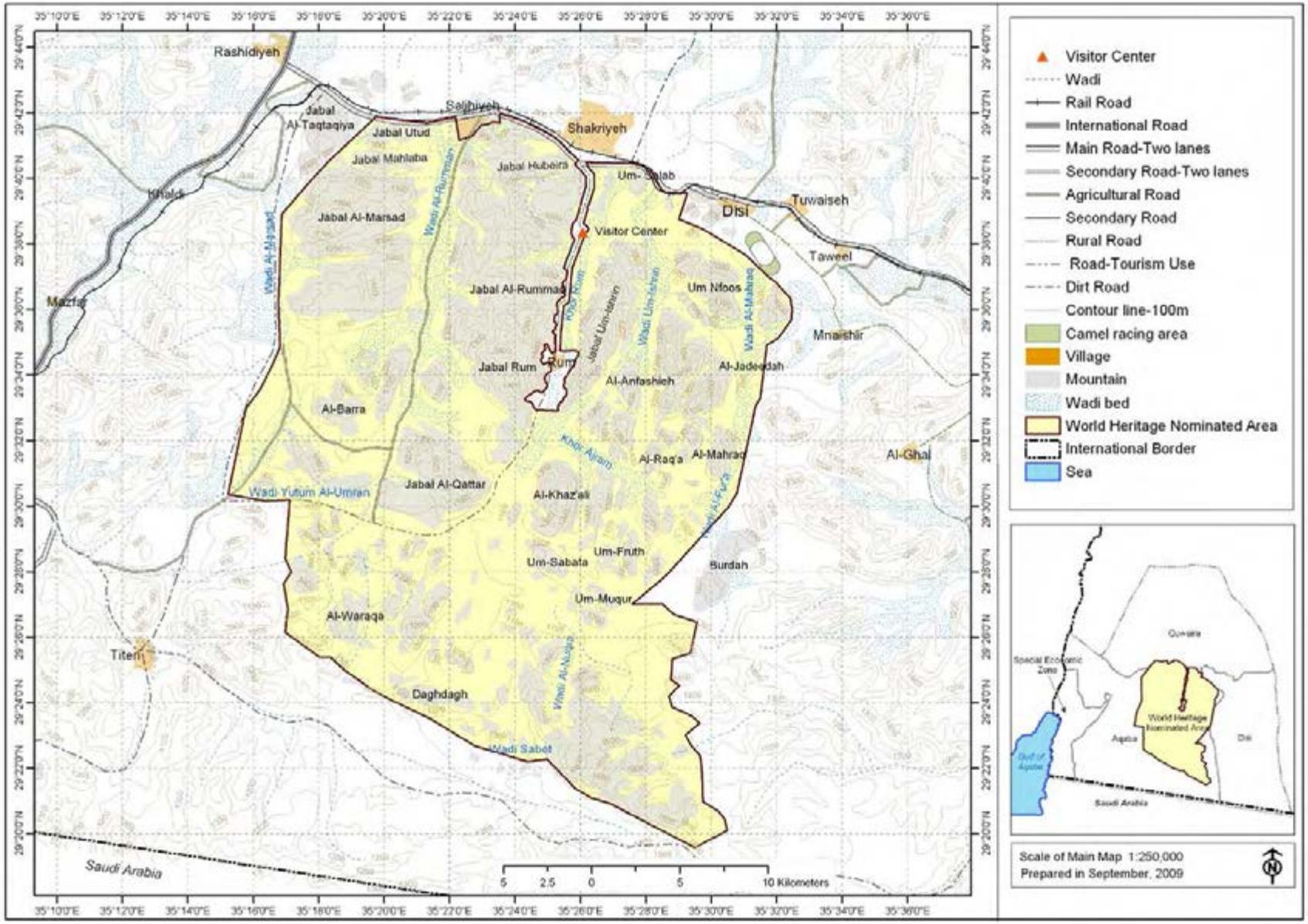
2- Wadi Rum in Jordan Map



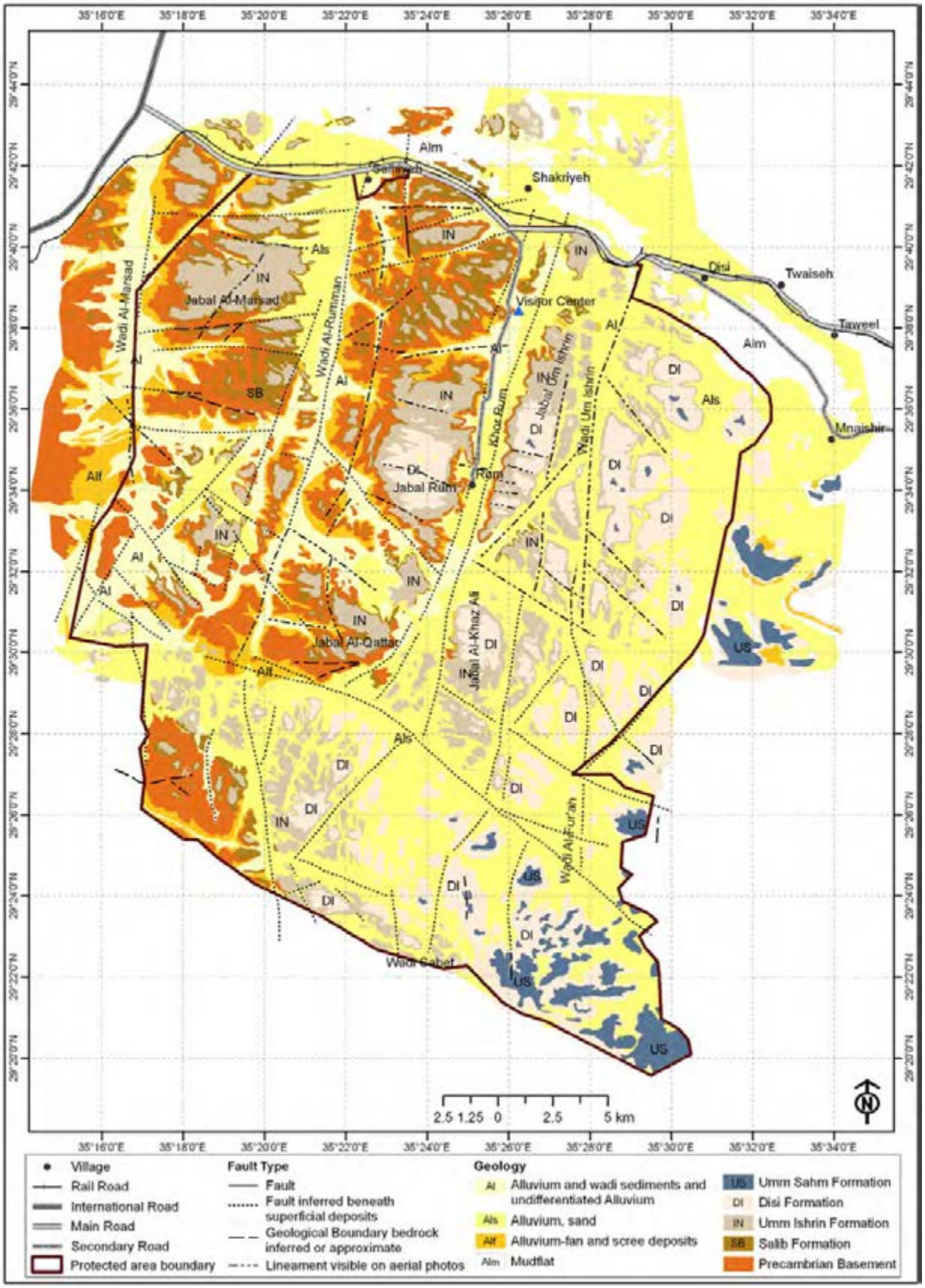
3- Wadi Rum Protected Area and Buffer Zone



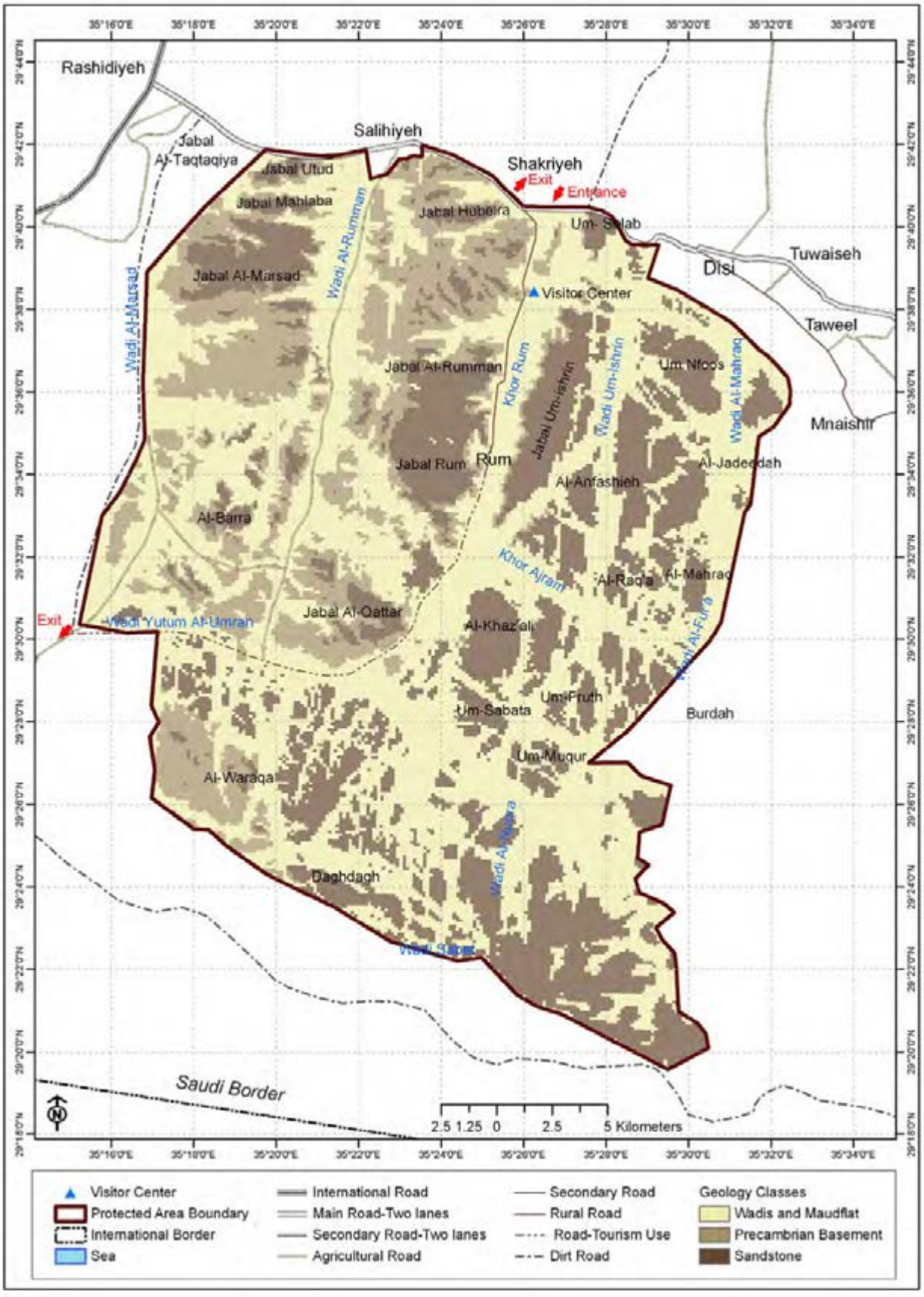
4- Wadi Rum Protected Area Map – Topography 1:250,000



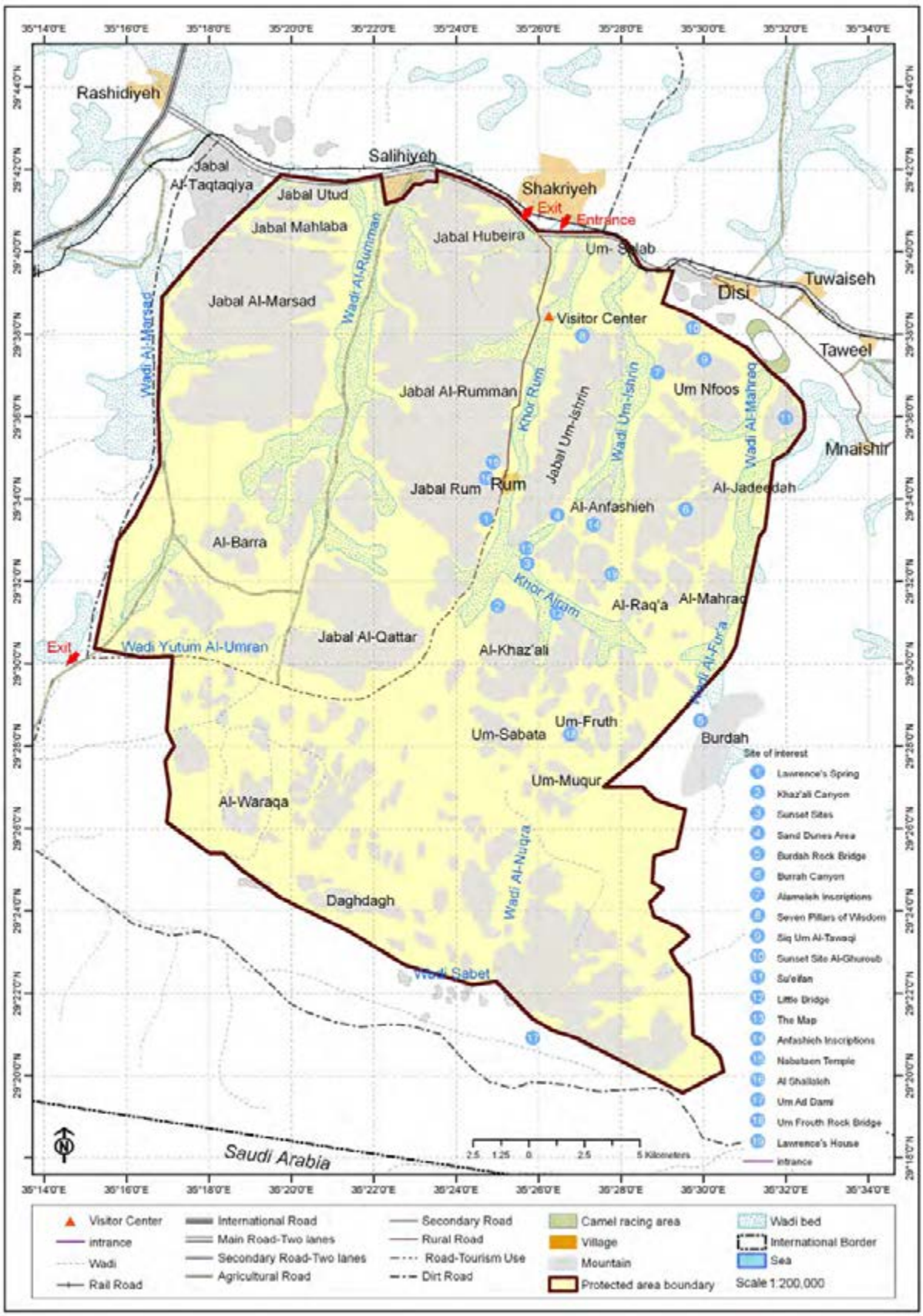
5- Wadi Rum Protected Area Map - Geology General



6- Wadi Rum Protected Area Map – Geology Classes



7- Wadi Rum Protected Area Map – Access Points



1.f Area of Nominated Wadi Rum Protected Area

Area	Size in hectares (ha)
Total Area of the Wadi Rum Protected Area	74,200 ha (Seventy Four Thousand and Two Hundred Hectares)
Total Area Nominated for World Heritage Status	73,300 ha (Seventy Three Thousand and Three Hundred Hectares)
Total Area of Buffer Zone	60,000 ha (Sixty Thousand Hectares)

Section 2: Description

2.a Description of Property

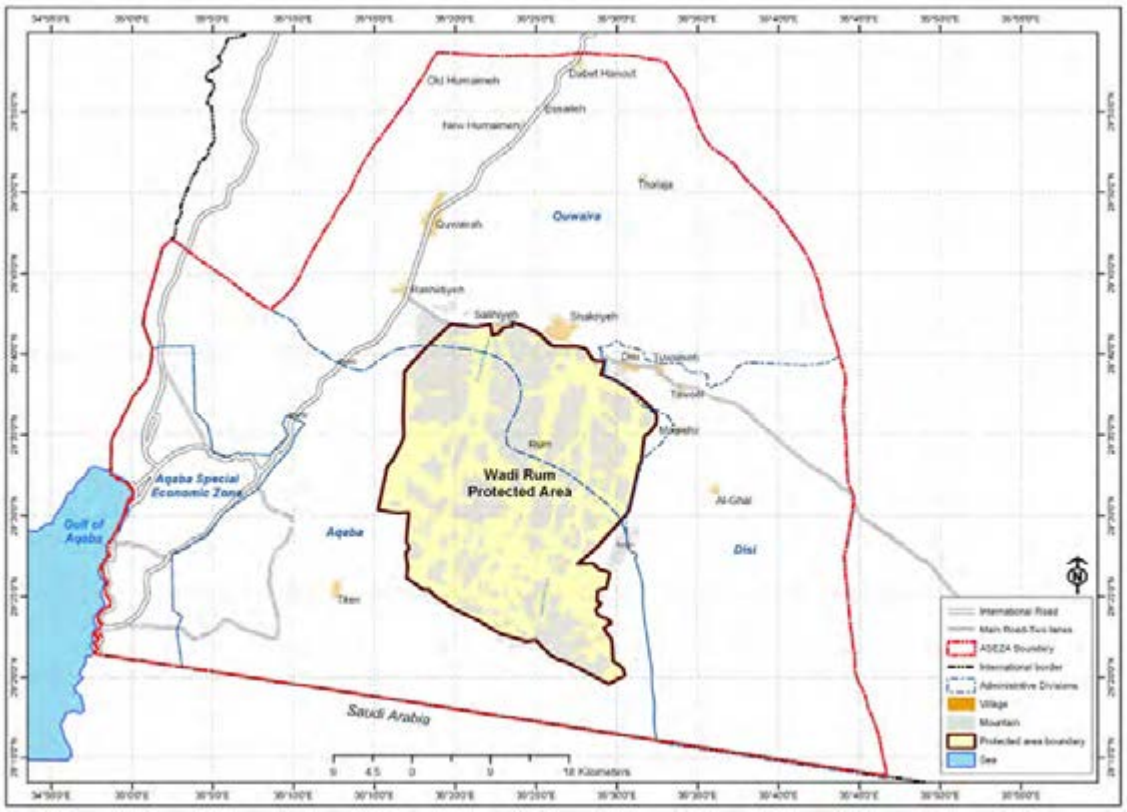
2.a.1 General Description

The Wadi Rum Protected Area is located in southern Jordan, about 290 km south of Amman and 60 km northeast of the coastal city of Aqaba. It covers an area of 72,000 ha – almost one percent of the country - making it the largest protected area in Jordan and the Levant region.

The Wadi Rum Protected Area forms a major part of the Hisma desert of southern Jordan and northern Arabia, lying to the east of the Jordan Rift Valley and south of the steep escarpment of the central Jordanian plateau.

The Hisma desert is mainly a Palaeozoic sandstone plateau or high desert. It is a distinctive feature of southern Jordan, with elevations up to 1,850 m, and extending southwards 150 km to Saudi Arabia.

Wadi Rum Protected Area within ASEZA Map

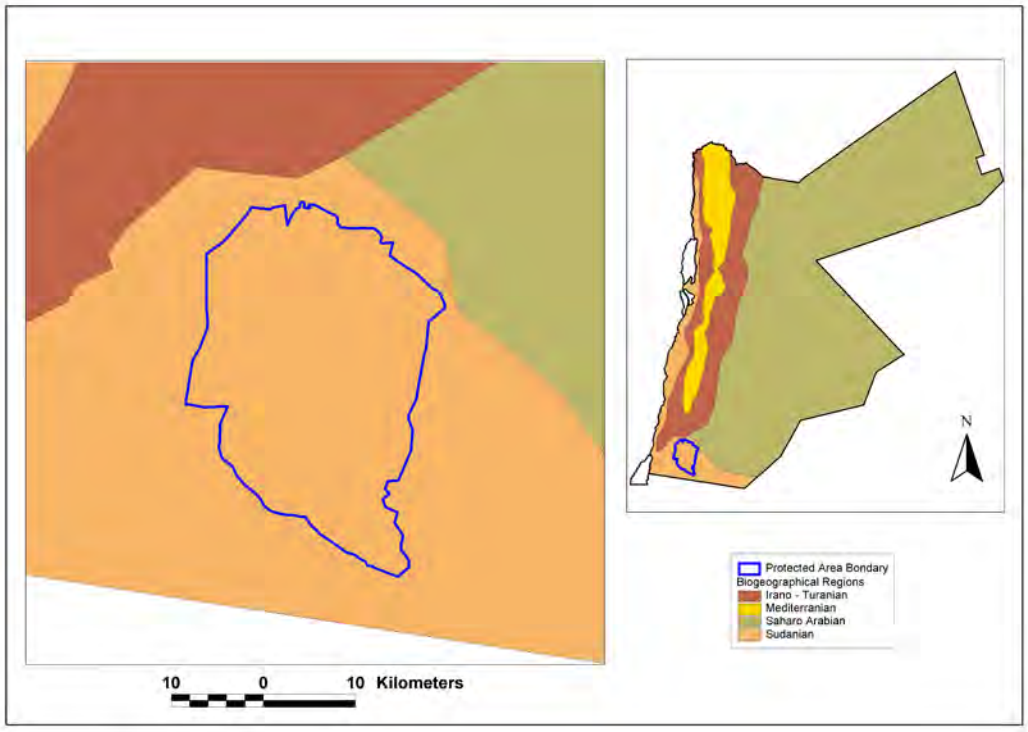


2.a.2 Climate

The Wadi Rum Protected Area has a typical true desert climate - hot and dry. It is dry throughout the year, although some precipitation may fall during the rainy season from October to April. During this period, Mediterranean cyclones drive clouds and rain to Jordan; however, the cyclones must be deep and intense in order to arrive to Wadi Rum. Long-term average annual rainfall is 75 mm, with a maximum of 100 mm; although during drought years, rainfall can be much less than 50 mm/year. Other than a few springs, no permanent running surface water is present in the area.

Wadi Rum Protected Area is hot in summer and cool to cold in winter. The relatively high relief makes the summer milder than the low land further west and southwest in areas such as Aqaba and Wadi Araba. Daily temperatures range in summer from 16 to 45°C, with a mean maximum of 34.6°C and a mean minimum of 19.3°C. In winter the range is –1.5°C to 31°C with a mean maximum of 14.6°C and a mean minimum of 4.6°C. Mean average humidity is 26% in June and 54% in February. Prevailing winds are northwesterly with an average speed of 2.3 knots/hour.

Wadi Rum Protected Area Map – Bio-geographical Regions



2.a.3 Geology

LITHOLOGY

Lithologically, the Wadi Rum Protected area is dominated by two main formations. The lowest and oldest of these is a basement complex of granitoid rocks of Precambrian age, on top of which is a great thickness of Early Palaeozoic quartz sandstones. These two formations are separated by an erosional boundary or unconformity created by the erosion and removal of rocks of intervening age. This represents an ancient granitic landscape that was buried by subsequent deposition of the sandstones.

Precambrian Granite Basement

This formation comprises various types of the larger granite family, including granite, granodiorite and quartz monzonite. It varies in colour from red to grey, and is intruded by several generations of green dolerite and pinkish microgranite dykes. These igneous rocks predominate in the western and south-western part of the Wadi Rum Protected Area. The age of the basement is uppermost Neoproterozoic; 630 – 540 Ma and is subdivided into two complexes: the older Aqaba Complex (630-600 Ma) and a younger Araba Complex (600-540 Ma). Both are further subdivided into suites and units. Within the Wadi Rum Protected Area, the Aqaba Complex predominates over the Araba Complex.

Towards the end of the Neoproterozoic and the early Cambrian, the basement was subjected to prolonged erosion producing the buried landscape which forms the base of the Early Paleozoic sandstone regime. This can be clearly seen in the north and center of the Protected Area, where sandstone mountain blocks are seen to have a distinctive granitoid base (e.g. Jabal Rum, Jabal Khaz'ali, Wadi Raman, and Wadi Marsad). The surface of the buried landscape dips gently to the SE and due to this trend, the granitoid outcrops decrease gradually south-eastwards under the sandstone cover until they disappear completely towards the eastern boundaries of the Protected Area. Locally, however, many NS trending faults along the Wadis have raised and re-exposed the granitoid basement.

Early Palaeozoic Sandstone Sequence

Regionally the granitoid basement is overlain by clastic sedimentary deposits in excess of 1,500 m in thickness subdivided into two groups, the Upper or **Khreim Group** – Ordovician-Early Silurian, and the Lower or **Rum Group** –

Cambrian-Early Ordovician. However, only the Rum Group crops out in the Wadi Rum Protected Area, where it is comprised entirely of quartz sandstone approximately 1,000 m thick and consists of four formations, each with its own characteristic color and morphology. In general, the sandstone sequence records a braided river depositional setting and represents a drainage system that flowed northwards into the shallow prehistoric Sea of Tethys. The shoreline could not have been far distant and within the sequence there is evidence of periodic inundation as indicated by marine fossils and trace fossils in the form of small-scale sedimentary structures. Larger scale structures include very well displayed cross bedding of various types, for example, pebbly large scale trough cross bedding, erosive base cross bedding, planar cross bedding and overturned or convoluted cross bedding. Fossil channels of various sizes are well displayed with quartz pebbles at the base of the cross bedding. Because the Wadi Rum Protected Area is a desert environment, outcrops are mostly bare rock with little plant or soil cover and offer 100% exposure. The nature of the landforms, dominated by vertical towers, also means that outcrops are commonly three dimensional which facilitates identification and documentation of the various types of sedimentary structure. In fact, Wadi Rum is a sedimentological paradise for the study of ancient braided river systems.

Formations within the Rum Sandstone Group

From oldest to youngest these are:

- The Salab Formation, Lower Cambrian.
- The Umm Ishrin formation, Middle-Upper Cambrian.
- The Disi Formation, Lower Ordovician.
- The Umm Sahm Formation, Lower Ordovician.

The Salab Formation is grainy sandstone some 40-60 m thick, and was deposited by rivers coming from the south and heading into the Tethys Ocean to the north. The upper end of this layer contains the oldest fossils of the Wadi Rum Protected Area – vertical tube shaped burrows of a marine worm called Skolithos which lived some 540 million years ago.

The **Umm Ishrin Formation** is medium cemented with prominent vertical joints. The length of a single joint can be followed vertically for more than 300 m. Thus, Umm Ishrin is characterized by spectacular towers of varying heights and width. This formation contains numerous and highly convoluted coloured bands, from rust red to yellow to almost pure white, caused by different levels of oxidation and composition of secondary iron minerals within the predominantly quartz sandstone. These so-called 'Liesegang

Rings' are not only visually striking, but also play an important role in the subsequent weathering of the rock, in that iron-poor or depleted areas tend to be less resistant to a range of weathering processes and are preferentially hollowed out, whereas iron-rich bands are more resistant to breakdown and form areas of positive relief. Colloquially these rocks are said to resemble either sliced red cabbage or marbled red meat.

The Disi Formation is relatively soft and the least cemented of the sandstone formations. It weathers into hemispherical or dome-like shapes and was deposited by meandering and intersecting rivers some 480 million years ago. The Disi Formation consists of glass-white sand that came from a different source than that of the red sand below, and is washed out of colour due to prevailing different climates. Disi sand is a sandstone that, when eroded, creates domes, often with rectangular geometric forms. The upper end of this layer contains some trace-fossils called *Cruziana*, which were created by an extinct marine animal called a trilobite. These fossils tell us that when the highest summits were deposited, Wadi Rum was covered by shallow waters of the Tethys Ocean.

The Umm Sahm Formation is well-indurated with closely-spaced jointing. It is characterized by pyramidal mountain tops which are usually present in a series of hump-like summits. Um Sahm is the most heavily eroded layer located on the highest summits of the Wadi Rum Mountains. It is of reddish to deep brown colour, similar to that at the base of Umm Ishrin. This layer contains some fossils and trace fossils, as it was deposited in a shallow marine environment near the shore, some 470 million years ago.

Fossils

The Rum sandstones contain no body or shelly fossils. This is in agreement with their fluvial depositional environment. However, there are scarce trace fossils of *Skolithos* and *Cruziana*, as mentioned above. Both groups of trace fossils indicate short-lived marine transgressions and the prevalence of on-shore marine environments like tidal sand flats. It is evident that these species thrived in the shallow water even as the shoreline covered the upper layers of sandstone. Just as *Skolithos* left behind the vertical shafts in which they once lived, trilobites left footsteps and traces of their daily under-water movement some 480-470 million years ago. These *Cruziana* traces can tell us when the animal was resting, digging, moving forward, or being stuck in the muddy sea bottom.

Also fossilized are great stretches of ripple marks, where the shallow Paleo Tethys waters covered the lower lands. These ripples have preserved in them

information on the direction of water flow, how calm or choppy the sea was, and the direction of prevailing winds on stormy days.

In short, the sandstones of Wadi Rum Protected Area exhibit super sedimentological exposures documenting the braided river environment.

TECTONICS AND LANDSCAPE EVOLUTION

Tectonics have and continue to play a seminal role in the evolution of the landscape that we now see in the Wadi Rum Protected Area. This goes right back to the uplift by the Najd Fault system following the placement of the plutonic and volcanic basement complex rocks around 550-540 Ma. This is thought to have triggered strong and prolonged erosion that created the landscape onto which the Rum Sandstones were deposited. Clearly, however, the tectonic activity that had greatest impact in terms of the present-day landscape occurred much later. Indeed one of the factors contributing to the uniqueness of Wadi Rum Protected Area is the on-going uplift and structural reconfiguration that continues to occur on an almost daily basis.

Late Neoproterozoic Uplift and Faulting

While folding is absent in Wadi Rum Protected Area, the effects of faulting are very conspicuous. Various episodes of uplift and erosion have also affected Wadi Rum to produce the present-day configuration. Because of this, Tertiary uplift is generally seen as the single, most important process in the formation of the high desert and mountain peaks of the Wadi Rum Protected Area.

Within this structural context it can therefore be argued that the evolution of the Wadi Rum landscape that we see today began in the Eocene some 30 Ma, when the area that is now Jordan was subjected to successive periods of intense geological uplift associated with the collision between the Arabian and Anatolian tectonic plates. This in turn was linked to preparations for the formation and opening of the Dead Sea Transform (DST). This resulted in the migration of the Tethys Ocean to the present-day Mediterranean. Since then, mountains on both sides of the DST have been rising and the floor of the DST subsiding. Consequently the entire Jordanian tableland was pushed upwards, exposing previously buried formations of consolidated sandstones and opening a complex grid of geological faults around 20 Ma that have facilitated extensive, distinctive and ongoing erosion.

Structural Controls on Landscape Morphology - the Role of Faulting

Despite the fact that presently there are no active faults in Wadi Rum Protected Area, the role that faults played in forming the iconic large-scale 'chequer-board' landscape character is fundamental. Faulting caused the straight Wadis and the rectangular mountain blocks. Also, successive NS faults were continuously throwing up the Precambrian basement granitoids opposite to the sandstone sequence. The oldest record for faulting is approximately 20 Ma - at the beginning of the formation of the DST.

Faults in Wadi Rum can be divided into two groups:

- Older NW-SE trending faults.
- Younger N-S trending faults.

NW-SE Faults. This fault zone marks the northern boundary of Wadi Rum Protected Area. It originates at the north-western corner of Wadi Rum and runs in a SE direction for more than 100 km into northern Saudi Arabia. The age of the zone is early Miocene, and seems to be contemporaneous with the formation of the DST or shortly before.

N-S Faults. Many faults within Wadi Rum follow this trend, with almost all of them running parallel to the DST trend. The major fault of this group is the Quweira Fault which marks the western boundary of the Protected Area. The other faults of this group are, at least partially, involved in the formation of the N-S trending Wadis such as Wadi Rum, Wadi Raman, and Wadi Marsad.

Fundamentals of Landscape Evolution

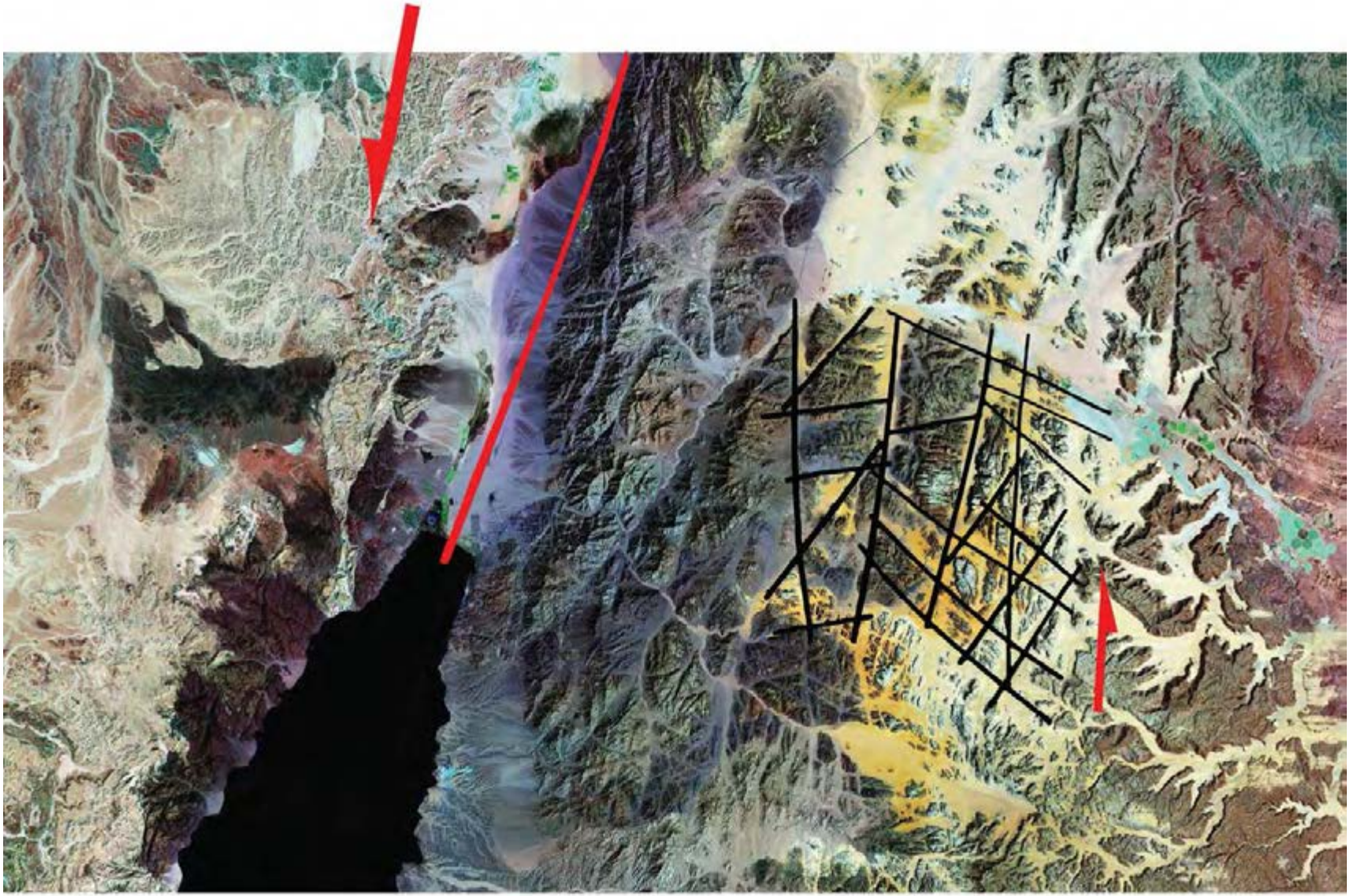
Concentrated erosion along fault lines has cut through an excess of 700 m of sandstone to create the iconic network of corridors and canyons that typify the Wadi Rum landscape. This also defined the often rectangular mountain blocks that comprise the other major landscape component of the Wadi Rum Protected Area. The area as a whole is still rising, and generally, the long-term average uplift of around 70 mm per 1000 years is greater than the rate at which the tops of the mountain blocks are being lowered. Relative relief within the area is therefore likely to increase over time, contrasting lateral erosion at the valley-floor level that is gradually widening the canyons. Over a geological timescale, this erosion will eventually consume the mountain blocks; until then, basal erosion is one of the key factors responsible for maintaining the characteristically vertical cliffs of Wadi Rum. Further, because it triggers the collapse of cliff sections, it is also responsible for producing much of the debris that ultimately supplies the sand flats and dune complexes that are so characteristic of the valley floors.

Clear evidence of the destruction of earlier mountain blocks is provided by the presence of numerous isolated small and large remnants of once larger massifs known as **Inselbergs** or 'Island hills' (Osborn and Duford 1981). These are widespread in the northern and southern parts of Wadi Rum Protected Area and are yellowish, reddish or whitish according to the rock formation present, or even red-brown in the Umm Ishrin Formation. These can be several tens of meters in height, with sculpted pinnacles throughout their thickness separated by spaces produced by weathering along intervening joint planes – as if these structures, described in the Qu'ran as 'columned', are planted in the loose sands.

Lateral erosion and maintenance of vertical cliffs is further aided by the configuration of the underlying geology, in that the boundary between the granitoid basement and the overlying sandstones occurs at the bottom of many cliffs, and forms a natural plane of weakness along which weathering and erosion can concentrate. A particularly important aspect of this is that groundwater percolating down through the permeable sandstones finds it difficult to pass through the less permeable basement complex and instead flows out as a series of important springs. Direct erosion by springs – so-called 'spring-sapping' – can lead to localised collapse of cliffs and is important because it can persist in one location, but on a wider scale diffuse seepage can have a very important role in promoting the weathering of the sandstones which so prevalent and important in shaping the landscape at many different scales. The precise nature of the weathering and the forms and

colours produced are strongly controlled by the nature of the rock in question. Granite, for example, in the absence of strong chemical weathering tends to be relatively resistant to weathering and generally retains sharp angular edges for long periods, providing Wadi Rum with a pedestal of rugged slopes that can reach almost 45 degrees. Because of their impermeability, granitoid rocks also tend to allow the development and retention of dark, oxidised crusts rich in iron. In contrast, the Um Ishrin Sandstone has numerous, well-defined joints that act as potential fracture planes and also allow rapid water percolation. The massive character of the intervening joint-bounded sandstone blocks are particularly prone to processes such as salt weathering which creates intricately shaped hollows and other ornaments Other sandstones, such as the whitish Disi Sandstone form domes with smooth curves, capping the mountains of Rum, topping them with a crown that often looks like the roofs of Ottoman mosques.

Wadi Rum Protected Area Map – Faults and Tectonics



2.a.4 Geomorphology

THE WADI RUM LANDSCAPE

Wadi Rum is a superlative exemplar of a highly varied desert landscape that is the result of the interplay between complex geological controls – both structural and lithological – and climatic influences that have fluctuated considerably over the long period that it has taken the landscape to evolve.

20 million years of ongoing landscape evolution have given Wadi Rum numerous inherited features (or memories) of past conditions, many of which are undergoing slow modification in response to processes driven by present-day conditions. At first glance any study of the landscape therefore reveals a number of anomalies that are at odds with the popular conception of desert landscapes as areas that have been shaped primarily by weathering that is driven solely by high temperatures and erosion that can only be accomplished by the wind.

The most obvious anomaly in the Wadi Rum landscape is that of a large, integrated system of river valleys in a present-day environment characterised by marked aridity. The explanation for this apparent incongruity is twofold. First, as is indicated by physical features such as effectively relict intermontane mudflats and the cultural evidence of previous habitation, there have been times in the past when the climate was more humid and rainfall more assured. Second, as shown by, for example, studies in the nearby Negev Desert (Schick 1977), floods do continue to occur – albeit infrequently. When they do happen, however, they can be particularly intense and are responsible for significant localised erosion and deposition.

It is this combination of variable, but effective fluvial erosion played out over a long timespan – together with permanent rejuvenation of the landscape through constant uplift and the structural control of numerous faults – that has driven the spectacular dissection of the Wadi Rum mountains into their characteristic rectangular blocks. This is especially evident in the northern and central parts of the Protected Area, where Wadi floors are on the order of 750 m asl. This creates a local relative relief difference that can exceed 1000 m to the mountain summits; a scale of landform development that is rarely encountered over such short distances anywhere else in the world. As a consequence of this combined uplift and dissection, Wadi Rum contains the country's first and second highest mountains, Jabal Um Addami and Jabal Rum reaching 1,853 m and 1,754 m respectively. Typically these mountains are highly colourful and range from grey-pink at the base (granitoids),

through the pale yellow (Salab Formation), red-pink-brown (Umm Ishrin Formation), snow white (Disi Formation), to the deep brown (Umm Sahm Formation).

Although long-term fluvial erosion is responsible for shaping the large scale character of the landscape, none of this would have been possible without the prior weakening of the rock and its preparation for erosion by the actions of a range of varied and ultimately very effective weathering processes. Indeed, at the scale of individual landforms within the overall landscape it is clear that these processes are responsible not only for weakening the rock and releasing material for removal, but are also fundamental in creating their distinctive morphologies and appearance. Central to these processes is, again, the counter-intuitive importance of water in what climatologists define as an arid region. One previously identified impact of the rainfall that does occur is the manner in which it infiltrates into the porous, and often well-jointed sandstone and feeds groundwater flow. This water can then emerge either as springs or at more diffuse seepage zones, especially at the boundary with the underlying granitic rocks. In a geomorphological sense, the importance of such flows is the way in which they contribute to the creation of a landscape that exhibits many surface characteristics redolent of those found within classic limestone karst terrains. Because of this it is common for many sandstone landscapes to be referred to as being 'pseudokarstic'.

The underlying similarity between karst and quartz sandstone landscapes is related to the importance of dissolution in both environments. In the case of hard, well-jointed limestones it is gradual dissolution of the rock itself. Whereas, in the case of typically quartz sandstones dissolution invariably involves the selective removal of the cements (iron, carbonate, amorphous silica) that hold the constituent quartz grains together. In both lithologies this can result in a hierarchy of landforms that are dominated by structural controls that concentrate solution along, for example, intrinsic joint systems. This typically results in block-like structures which, with continued erosion and downcutting, eventually produce distinctive pinnacles and columns. The most prominent of which within Wadi Rum are, of course the world renowned Seven Pillars of Wisdom. It is the recognition of these and other distinctive landforms, together with the processes responsible, that has driven the growing movement to identify a distinctive sandstone geomorphology on a par with the recognition normally accorded to karstic and granitic environments (e.g. Hartel et al. 2007, Young et al. 2009). Within this new classification Wadi Rum can lay pre-eminent claim to defining the arid end of the morphoclimatic spectrum for these landscapes. More than this, the vertical joints and columns produced by these processes are one of the essential aesthetic elements of the Wadi Rum Protected Area, and Rum is

most probably the 'columned' or 'elevated' place the Holy Qu'ran refers to as “Iram dhat al-'Imadd” (the elevated one or the one with lofty pillars) (Surat Al-Fajr, verse 7), a site of symbolic significance for over one billion Muslims.

Differences in the degree of cementation and patterns of jointing, coupled with weathering and erosion, produce characteristic surface morphologies, especially on mountain summits. Thus, the well-indurated, closely-spaced jointing of the Umm Sahm Formation is characterized by pyramidal mountain tops which are usually present in a series of hump-like summits. The Umm Ishrin formation is medium-cemented, but with prominent vertical joints. The length of a single joint can be followed vertically for more than 300 m. Thus, Umm Ishrin is characterized by spectacular towers of varying heights and width. The Disi Formation is rather soft and the least cemented. It weathers into hemispherical or dome-like shapes.

Within this dramatic and highly symbolic landscape is a range of individual but interlinked landform types. Each of these is significant and distinctive in its own right, but together they combine to give the area its distinctive character.

LANDFORMS OF WADI RUM

Vertical Cliffs

These cliffs, often in excess of several hundred metres in height, are characteristic of all faces of the mountain blocks and are generally related to point planes within the sandstones. As indicated earlier, their initial creation is related to basal erosion that leads to collapse of sections of the cliffs, and the efficient removal of the collapsed debris. This is aided by, but not restricted to, the zone of weakness at the foot of many cliffs related to the boundary between the basement rocks and the overlying sandstones. Often, the collapse is along lines of structural weakness related to joints or fault lines. In many instances, however, especially where the sandstones occur as thick, texturally homogeneous strata, internal stresses leading to collapse are resolved into curved failure planes within sandstone blocks. Evidence of this internal fracturing is provided by characteristic arcuate scars left on the cliff faces. Such surfaces also tend to be initially devoid of the typical iron coatings that are revealed by the toppling away of joint bounded blocks. Within this general model of cliff retreat other processes also play an important role, especially complex patterns of weathering on the cliff faces that create extremely distinctive surface topographies. Research into these features is globally important because of the light it has shed on the importance of biological processes in deserts.

Arguably, the most distinctive surface features of the vertical cliff faces are large black streaks that run down many of them, and curved coatings that run along the top of more resistant strata. Although many of the vertical streaks of blackened sandstone now stand proud of the adjacent cliff face, these areas were once ledges and channels over and along which water flowed as it ran down the cliffs. Over time the channels became hardened through the development of a surface coating that has protected them from the cavernous weathering that is eroding the areas of cliff between the former channels. Recent studies of these coatings by Goudie et al. (2002) and Viles and Goudie (2004) attributed the case hardening of sections of cliff face to 'iron and other solutions' precipitated by rainwash. Interestingly, they also identified an algal layer just below the case hardened surfaces and detailed analysis of the crusts found iron, manganese and calcium to be common constituents of the cements within the crusts and associated them in some crusts with the presence of cryptoendolithic biofilms containing cyanobacteria and fungi.

Between the black streaks the cliff faces are often consumed by a process of 'cavernous weathering' that typically hollows out the stone to form small pits (honeycomb weathering) or larger caverns (tafoni). There is ongoing discussion as to what controls the initiation and subsequent growth of cavernous hollows. Many are initiated in areas where groundwater seepage is concentrated, but elsewhere the seemingly random distribution might reflect localised variations in rock properties such as mineralogy and porosity that make an area more susceptible to weathering. In many cases initiation also involves the breaking through of a hardened outer crust that is typical of sandstones in arid environments, often associated with re-precipitated iron – either from within the stone or from dust that has landed on the surface. Once this surface is breached, weathering of the cavern can then open it out through the exploitation of an often weakened subsurface zone. Once initiated hollows will attract groundwater flow that could encourage the dissolution of inter-granular cements leading to granular disaggregation. Additionally, once a hollow forms it becomes a site in which salts derived from groundwater - from dew and/or from surface dust deposition - can concentrate, penetrate the stone and cause breakdown through repeated expansion and contraction within pore spaces. This illustrates two important points about weathering in arid environment such as Wadi Rum. First, that much of this weathering and the provision of debris is in fact accomplished by salt that is present in abundance in these environments. Second, because the weathering concentrates in shaded areas it indicates the importance of moisture and its retention as a control on weathering rather than the temperature extremes experienced on exposed rocks. The effectiveness of salt in rapidly weathering sandstone in this type of environment is dramatically

illustrated by the widespread destruction of dated Nabatean and later buildings and structures at nearby Petra as indicated by the detailed studies of researchers such as Paradise (1995, 2002, 2005). These studies have highlighted the importance of salts derived from rising groundwater and is reflected in the way that erosion and undermining of cliffs is concentrated near the base of slopes and buildings. Similar 'basal weathering' at the junctions between cliffs and wadi floors is a pervasive feature within the Wadi Rum Protected Area and demonstrates that undermining of the cliffs is not solely dependent on their coincidence with the discontinuity between the sandstones and underlying basement complex.

The combination of resistant ledges and streaks related to water flowing down the cliffs, interspersed by and undergoing destruction through active cavernous weathering symptomatic of arid conditions could provide further support for the contention that the landscape we see today is a product of the long-term variability of climate in this area

Cliff-foot Debris Slopes and Low Angle Ramps

The periodic collapse of cliff sections means that at any single time there will be numerous accumulations of rockfall debris in the cliff-foot zone. These have been studied in detail by Migon et al. (2005) who also linked them to the low-angle (< 10°) debris slopes that run down to adjacent wadi beds or playas. Characteristically they are masked by fine debris with occasional larger clasts, although they may be mantled by weathered boulders in their upper parts immediately after a fall, and are especially well displayed in the Ishrin Sandstone. Analysis of the debris accumulations and the cliffs above them suggests that most of the material is provided by catastrophic rockfalls. Once in place, however, the rockfall debris in most localities is subjected to efficient salt weathering and quickly disintegrates into easily transported fine-grained material which, redistributed by surface wash, builds the ramps. The uniqueness of the ramps arises from a combination of lithological and environmental factors, the former accounting for the high frequency of rockfalls, especially in the Ishrin sandstone, the latter being responsible for the efficacy of salt weathering and surface wash. As indicated earlier, this efficient weathering and removal is crucial to the preservation of the vertical cliffs and is what prevents them from burial beneath accumulated debris as they retreat.

The low angle ramps either below the steeper accumulations of rockfall debris or downslope of the cliffs themselves are redolent of the co-called 'pediments' described in the classical literature on arid zone geomorphology, particularly from the southwest of the USA. These low-angle, rock-cut slopes (often

mantled by a thin depositional veneer) are left behind as cliffs wear back by parallel retreat. Controversy persists as to their precise formation, but the key is the maintenance of a sharp break of slope between the pediment and the debris slope/cliff. One proposal that has resonance with Wadi Rum is that because slope angle is related to the size of debris that has to be transported across it, a sudden decrease in debris size downslope would be reflected in a sharp decrease in slope angle. This jump is especially evident in the sandstones of Wadi Rum, which tend to collapse as large boulders but break down directly into predominantly sand-sized by-products of in situ weathering. As such, it could be a further factor helping to determine and maintain the region defining flat floored U-shaped valley cross profiles of the Wadi Rum Protected Area.

Flat-bottomed Wadis, Sand Plains and Dunes

As indicated above, the Wadi Rum Protected Area comprises a large, integrated system of river valleys in a present-day environment characterised by marked aridity. Whilst being modified under current conditions, its origins lie in a past when effective precipitation was more abundant, especially within wetter periods during the Pleistocene. For example, Huckriede and Wiesamann described a 1,000-1,800 km2 fresh water lake in the Jafr Basin some 100 km to the NE at 27-25 ka. Abed et al., also described a 1,200 km2 fresh water lake in the Mudawwara area at the Saudi Arabian border some 80 km to the SE at around 70-135 Ka.

Wadis

In Landsat imagery, the majority of wadis are straight and aligned in a N-S direction and follow major fault lines; for example, Wadi Rum, Wadi Raman, and Wadi Marsad. A smaller number of wadis are also straight but extend NW-SE along faults running in this direction. Flat-bottomed wadis are broad and in many instances several hundred meters wide and filled with loose sand of various colours: white, brown, red, and orange. Average elevation of the sand plain surfaces is in excess of 750 m asl, and loose sand climbs up the vertical cliffs to form dunes of varying size.

Uniquely for mountain areas in Jordan the wadis of the Wadi Rum Protected Area are flat-bottomed and U-shaped, whereas in other mountain areas they are invariably V-shaped. Formation of the wide wadis may be explained by the slow but continuous parallel retreat of the cliff faces on both sides of the wadis due to the combination of weathering and basal sapping described above. This is accentuated by the geological discontinuity between the granitoid basement and overlying sandstones caused by the interaction of

minerals with moisture and/or sparse water resulting in the collapse of cliff faces.

The Wadis are widely blanketed with loose sand sheets and dunes of varying depth. The source of this sand is primarily the sandstone that forms the mountain blocks within the Wadi Rum Protected Area. Ongoing weathering, wind erosion, and the disintegration of collapsed blocks, would secure the vast quantities of sand needed to fill the wadis and form the sand dunes. This portrait of high, colourful mountain blocks surrounded by vibrant low wadis creates an almost Martian landscape.

Few if any coarse-grained rudites (blocks and boulders) persist at the foot of the mountain blocks where the loose sand predominates. Collapsed blocks and boulders may also be buried by loose climbing sand dunes.

Narrow Gorges (Siq)

These are developed along vertical joints and caused by water erosion, possibly when the area was more humid during the Holocene Optimum, Marine Isotope Stage 5 of the late Pleistocene or possibly other humid periods. These narrow gorges are especially present in the red-brown Umm Ishrin Formation which is characterized by prominent vertical joints, where one single joint can involve the entire thickness of the formation of more than 300 m. A siq forms when water runs through the joint for a period of time, widening the joint to produce the narrow gorge. The width of the gorge would depend on the amount and duration of the source of water. In Wadi Rum Protected Area, the finest example of a siq is that of Khaz'ali, located just south of Jabal Rum.

Sand Sheets, Plains and Dunes

Erosion of the Cambrian-Ordovician sandstone provides loose sand for the play of the wind. Sand dunes travel and rest at perfect locations as the vertical mountains channel winds through grand corridors.

Loose sand covers the wide Wadi floors and rises up the cliffs as climbing dunes. The areas covered by loose sand increase northwards and southwards even as the mountain blocks decrease, due to relatively stronger wind erosion. These sand sheets can be reddish, brown, and orange in colour where the Umm Ishrin Formation dominates, or whitish near the Disi Formation.

Intermontane Mud Flats (Qaa')

These are small, flat basins, of the order of one kilometre or so in width. They are usually greyish and consist of silt and clay particles. The northern boundary of Wadi Rum Protected Area runs along a line of these mud flats. This is the lowest lying land in the region at 800 m asl, and forms a local inland drainage basin, however, the Qaa' no longer hold standing water as they clearly did in the past.

British army officer and writer T. E. Lawrence, who stayed in Rum with the troops of the Great Arab Revolt on several occasions between 1916 and 1917, gave several powerful descriptions of the area in his world famous memoirs "Seven Pillars of Wisdom" (1926). In particular, he described one of the mud flats: "The camp was very beautiful, for behind us rose a cliff, perhaps four hundred feet in height, a deep red in the level sunset. Under our feet was spread a floor of buff-coloured mud, as hard and muffled as wood paving, flat like a lake for half a mile each way…" (p. 340).

Mushroom Rocks

Text book specimens of this phenomenon are present within Wadi Rum Protected Area, especially in the relatively soft Disi Formation. While wind erosion is responsible for the removal of loosened debris from around the stem of the mushroom, other processes are responsible for the initial weakening of material in the shade of the cap. Principal amongst these are moisture-related weathering processes, demonstrating the importance of feedbacks within shaded microenvironments.

Hydrology: the Ongoing Significance of Moisture

The irony in demonstrating the mystifying beauty of this desert landscape lies in the fact that water itself was, and still is, a secret of this desert's beauty. Water has played a major role in sculpting what we see today, and the unanticipated existence of water accentuates the majestic beauty of the landscape. The presence of water, harvested by the formidable porous sandstone formations and springing along the contact line with the dense granite base, has allowed fauna and flora to develop. These combined factors have fostered human presence since the Palaeolithic era. Even after the climate of the region became drier, pastoral nomads have supported their lifestyle using Wadi Rum's several perennial and seasonal springs.

In 'Seven Pillars of Wisdom', T. E. Lawrence writes: "From between these trees, in hidden crannies of the rock, issued strange cries; the echoes, turned into music, of the voices of the Arabs watering camels at the springs which there flowed out three hundred feet above ground. The rains, falling on the

grey domes of the hill-top, seemed to have soaked slowly into the porous rock; and my mind followed them, filtering inch by inch downward through those mountains of sandstone till they came against the impervious horizontal layer of the plinth, and ran along its top under pressure, in jets which burst out on the cliff-face at the junction of the two rocky layers." (1926: 342-343).

Annual rainfall is minimal, less than 100 mm / annum; however, the high mountain summits harvest enough of this rain to recharge their hidden springs. Wadi Rum Protected Area boasts the presence of two main springs – Ain Shallaaleh and Abu 'Aina – and over eleven smaller perennial springs which are generated from the line of contact between the permeable sandstones and the impermeable granite. The granite peneplain acts like a tray, sloping eastward to create the springs on the eastern side of the mountain. This line is similar to a crack in a big clay jar seeping water. Small oases have sprung up at the springs, protected and isolated as vertical natural gardens on steep shady elevations. Here grow trees and shrubs that add a splash of green to the mixture of brown, pink, red, and white colours of the mountains and sand dunes.
Regarding surface water, Wadi Rum Protected Area is located in two surface water basins: the Wadi Araba basin in the west and the Disi Basin in the south. The area generally does not have any large surface water bodies, even during the winter season. This is mainly because of the very low precipitation and because of the sandy nature of the area's soil, which causes direct loss of surface water.

However, Wadi Rum lies just west of one of the largest ground water basins in the country, the Southern Desert/Disi ground water basin. The salinity in the basin is one of the lowest in the country, making the water very suitable for drinking. However, most of the Protected Area has little ground water as the Precambrian granites are cropping out.

2.a.5 Mineral Resources

Despite the fact that Wadi Rum Protected Area was recently mapped at a scale of 1:50000 geological maps, no mineral or industrial rock resources of economic value were proved to exist here. The white Disi sandstone, which is an important source of raw materials for glass production and has been exploited commercially, crops out more than 20 km north of the Protected Area. At this northern locality, the reserves of the glass sand are infinite and easy and cheap to mine. Mining in the Protected Area is totally prohibited by regulation

2.a.6 Soil

Four major soil groups are present in Wadi Rum Protected Area:

- Torriorthent: This soil group covers about 20% of the Protected Area and it is represented in the lower part of the alluvial fans.
- Calcid: This soil group is present in the upper parts of the alluvial fans and covers about 25% of the Protected Area.
- Torripsamment: This soil group covers about half of the Protected Area, which is an indication for the dominance of sand alluvium in the area.
- Cambid: This soil group is found on the banks of the mudflats. It is barely represented in the Protected Area.

2.a.7 Aesthetic Importance

The best way to present this element of description is to quote again the words of T. E. Lawrence on Wadi Rum as documented in his 'Seven Pillars of Wisdom' (1926: 341): “We looked up on the left to a long wall of rock, sheering in like a thousand-foot wave towards the middle of the valley; whose other arc, to the right, was an opposing line of steep, red broken hills…The ascent became gentle, till the valley was a confined tilted plain.

"The hills on the right grew taller and sharper, a fair counterpart of the other side which straightened itself to one massive rampart of redness. They drew together until only two miles divided them: and then, towering gradually till their parallel parapets must have been a thousand feet above us, ran forward in an avenue for miles.

"They were not unbroken walls of rock, but were built sectionally, in crags like gigantic buildings, along the two sides of their street. Deep alleys, fifty feet across, divided the crags, whose planes were smoothed by the weather into huge apses and bays, and enriched with surface fretting and fracture, like design. Caverns high up on the precipice were round like windows: others near the foot gaped like doors.

"Dark stains ran down the shadowed front for hundreds of feet, like accidents of use. The cliffs were striated vertically, in their granular rock; whose main order stood on two hundred feet of broken stone deeper in colour and harder in texture. This plinth did not, like the sandstone, hang in folds like cloth; but chipped itself into loose courses of scree, horizontal as the footings of a wall. The crags were capped in nests of domes, less hotly red than the body of the hill; rather grey and shallow.

"They gave the finishing semblance of Byzantine architecture to this irresistible place: this processional way greater than imagination … our little caravan grew self conscious, and fell dead quiet, afraid and ashamed to flaunt its smallness in the presence of the stupendous hills."

2.a.8 Vegetation

Wadi Rum Protected Area lies within the Saharo-Sindian climate zone, with typical desert soils and, due to the long dry months and high temperature, sparse vegetation cover.

Altitudes play a major role in deciding the vegetation type in Wadi Rum as they influence the climatic conditions. Bearing in mind the fact that **temperature is reduced by 1 C per every 100 m increase in altitude, in Wadi** Rum, one can visualize the effect of the differences in temperature and precipitation between the mountain peaks and the bottom of the Wadis. This factor has noticeable influence on the vegetation types, and allows for Mediterranean non-forest vegetation types to exist on the mountain tops in the middle of the Saharo-Sindinan biome.

Wadi Rum Protected Area hosts three distinct vegetation types:

Sand Dune Vegetation Type

This vegetation type is only found in the Sudanian vegetation region, and Wadi Rum Protected Area is one of the best representatives for it - more than 60% of the total area of Protected Area is covered with this fragile vegetation type. Sand dune vegetation is made up of shrubs and bushes (sand dunes fixatives). The main species that characterize this type include *Haloxylon persicum, Retama raetam, Calligonum comosum, Neurada procumbens* and *Hammada scopiara.*

Acacia and Rocky Sudanian Vegetation Type

This vegetation type is limited to the rocky areas in Wadi Rum Protected Area. Sometimes it is found together with the Sand Dune vegetation type. The main species of this type that are present in the Protected Area include *Acacia raddiana, Anabasis articulata, Caralluma spp., Fagonia spp., Gymnocarpos decndrum* and *Helianthemum lippii.*

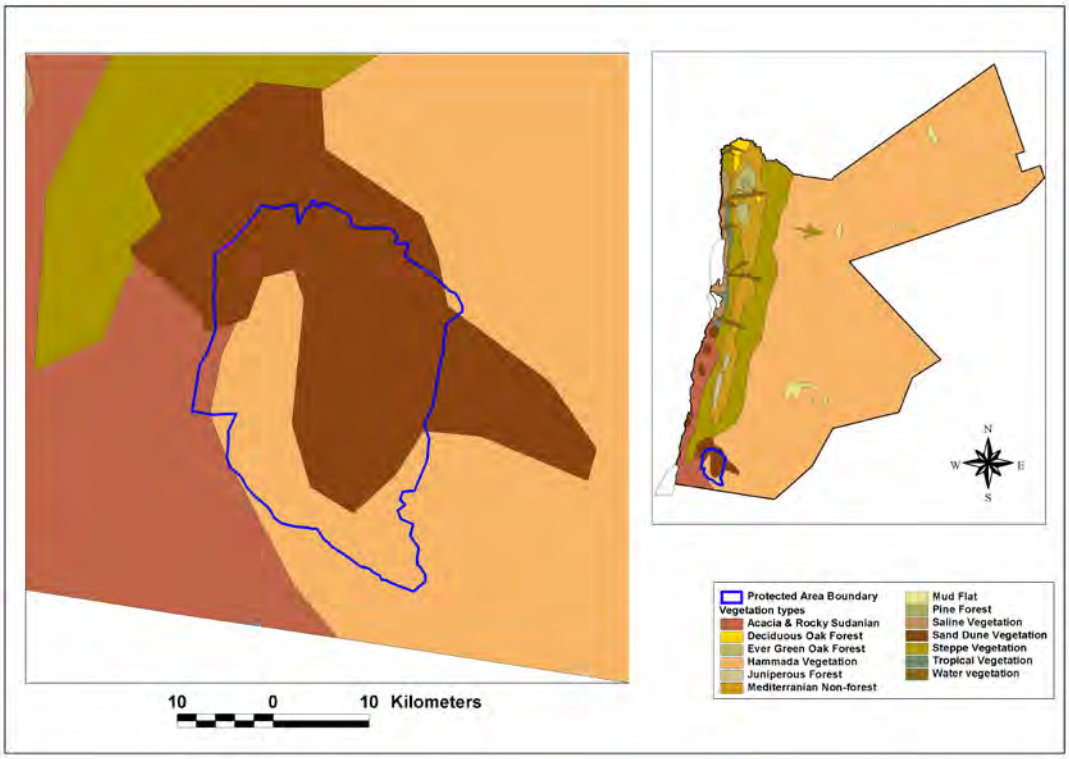
Hammada Vegetation Type

This vegetation type covers more than 70% of Jordan's surface area. Although this vegetation type is not dominant in Wadi Rum Protected Area, some of its components are present. The main species of this type that are present include *Anabasis articulata, Retama raetam, Tamarix spp., Achillea fragrantissima, Artemisia herba-alba* and *Zilla spinosa.*

The vegetation types are further defined into several vegetation communities:

- *Artemesia* steppes: These steppes abound in Irano-Turanian elements.
- Plateau vegetation: The aridity and the harsh conditions of Wadi Rum limited the spread of this type to form scattered communities.
- Sand stone vegetation: Characterizes the rocky environments along the gores and mountains of Wadi Rum.
- Detritus vegetation: Debris from alluvial cones or from compact sand which has accumulated as a consequence of winds can be found in Wadi Rum along the slopes of the mountains.
- Wadi vegetation: The most abundant vegetation type in Wadi Rum, it is mainly composed of *Haloxylon persicum*.
- Hygrophylous vegetation: This vegetation type is found around fresh water springs that occur in Wadi Rum.

Wadi Rum Protected Area Map – Vegetation Types



2.a.9 Species

FLORA

Wadi Rum Protected Area hosts a total of 158 species of plants belonging to 134 genera and 47 families.

Many of these plants are of conservation importance. There are at least 19 species that are rare, three of which extremely so, two that are endemic and two that are new to Jordan. Nine species are declining or restricted, and four more are endemic although not rare.

Species of other interest include 31 that are medicinal, 15 that are poisonous, 10 that are edible, five that are ornamental, seven that are a source of wood and 50 that are palatable to animals.

Two communities are of special importance in the Protected Area:

The arid Mediterranean forest of *Juniperus phoenica* in some of the high mountains of the Protected Area is considered to be a very important habitat because the Juniper trees are an isolated and old population in a Sudanian bio-geographical zone, where the climatic conditions do not normally favour the growth of Juniper.

The *Haloxylon persicum* communities, especially in the sand dune area, are considered an important habitat since they are particularly well developed and mature and act as fixatives for the sand dunes. This species also has enormous importance in Bedouin life as it is the main fodder for camels and a favourable source of fire wood.

FAUNA

Mammals

A total of 26 mammalian species have been recorded in Wadi Rum Protected Area. Several species have special conservation and ecological importance; six mammals are nationally endangered, two of these being globally vulnerable. Six more are nationally rare or vulnerable, and one is of medicinal importance.

Following is a breakdown of Wadi Rum's mammals:

Carnivores

Nine carnivorous species reside within Wadi Rum Protected Area.

- Five species are key species: grey wolf (*Canis lupus*), Blanford's fox (*Vulpes cana*), caracal (*Caracal caracal*), striped hyena (*Hyaena* hyaena), and wild cat (*Felis silvestris*).
- Three additional key species were present in the recent past, but are not currently recorded: sand cat (*Felis margarita*), Asiatic jackal (*Canis aureus*), and Arabian leopard (*Panthera Pareardus*).
- One species is common: red fox (Vulpes vulpes).

Ungulates

One ungulate species resides in Wadi Rum Protected Area, the Nubian Ibex (*Capra ibex nubiana*). The Protected Area is an ideal habitat for these creatures, as they prefer tough terrain which is difficult to be accessed by others, and the Rum Mountains offer Ibex with safe shelter and bedding areas.

The presence of two other species is suspected, but not confirmed, Dorcas gazelle (*Gazella dorcas*) and Goitered gazelle (*Gazella subgutturosa*).

Antelopes

In 2002, the Jordanian Royal Society for the Conservation of Nature (RSCN) began a reintroduction program for the Arabian Oryx (*Oryx leucoryx*) in Wadi Rum Protected Area. Presently, this program is being conducted in cooperation with the Environment Agency of Abu Dhabi, UAE. The project aims to release the Oryx back into their natural habitats while using the latest techniques of satellite tracking to monitor the ranging herds.

Small Mammals

Ten rodent species inhabit the lower elevations of the Protected Area. These belong to the families: *Gliridae*, *Muridea, Gerbillidae* and *Diplodidae*. Two species of bats belonging to the *Vespertilionidae* family also reside in Wadi Rum Protected Area. Also recorded are one species of hare belonging to the family *Lagomorpha*, and one species of hyrax belonging to the family *Hyracoide.*

Although none of the small mammal species are of global conservation status, Wadi Rum Protected Area is an important habitat for them on the national scale, especially regarding the Three toed jerboa *(Jaculus jaculus),* Evall's sand gerbil *(Meriones crassus),* Fat sand rat *(Psammomys obesus),* Cheesman's gerbil *(Gerbillus cheesmani),* and Rock hyrax *(Procavia capensis).*

Reptiles

Thirty four species of reptiles have been recorded in Wadi Rum Protected Area belonging to nine families: for snakes, *Colubridea, Viperidea* and *Leptotyphlopidae*; and for lizards, *Gekkonidea, Agamidae, Lacertidae, Scincidae, Chamaeleonidae* and *Varanidae*.

Although many of the reptile species may be considered of little concern globally, their Mediterranean populations are sometimes very threatened, such as in the case of *Stenodactylus doria, Eryx jaculus,*and *Cerastes gasperettii*. Some of the recorded species have an ecological importance to the Wadi Rum Protected Area such as the lizard *Phrynocephalus arabicus*. Another species to focus on is the large lizard *Varanus greseus* which was on the red data list of IUCN in 1994 and has an unknown status until now.

Also of interest; the skink *Ablepharus ruepellii* is known to occur in the Mediterranean region but has succeeded to adapt to live in the Sudanian region of Wadi Rum Protected Area. *Chamaeleo chameleon*, is normally restricted to the Mediterranean bio-climate and non-sandy habitats. The fact that it is found in the Protected Area means that it has also succeeded to adapt to the Sudanian region and soft sandy habitats.

Another notable lizard is *Lacerta lacerta* cf. *kulzeri*. This species is actually new to science and was discovered hiding in the deep and narrow siq of Khaz'ali in 2000.

Birds

Wadi Rum Protected Area has been identified as an Important Bird Area (IBA) based on the varied assemblage of desert and mountain birds it supports. These include several species of breeding and passage birds of prey, several species of wheatear, and Middle East restricted-range species such as sand partridge, Hume's tawny owl, Tristram's grackle and Sinai rosefinch. Wadi Rum itself is regularly visited by overseas birdwatchers as, until recently, it was the only site in Jordan where Verreaux's eagle could be seen easily.

Wadi Rum Protected Area is next to a "bottleneck" of one of the world's most important passages for migrating birds. Different species of raptors, in addition to storks and pelicans, take refuge here for resting and feeding. Sixteen migrant raptor species have been recorded using the area as a flyway during the autumn migration, in addition to three resident species.

A total of 119 bird species have been recorded in Wadi Rum Protected Area, of which, 34 are breeding or holding territory and 85 are passage migrants or winter visitors.

Many of the bird species recorded in the Protected Area are of global or national conservation importance: two are globally threatened, 15 are regionally threatened or declining, and nine are restricted totally or partially to the Middle East.

Macroinvertebrates

A total of 78 arthropod species have been recorded in Wadi Rum Protected Area. The largest representation is *Coleoptera* with 39 species. After that is *Arachnida* with 10 species, and 13 further families, each with six or fewer species.

2.a.10 Rock Art and Inscriptions

Geomorphology has played an essential role in fostering human settlement in Wadi Rum and allowing the development of sophisticated intellectual activity which is documented by petroglyphs (images engraved or painted on rocks), and rock epigraphy (engraved inscriptions) over a unique span of time. Wadi Rum is the site of one of the world's richest collections of rock art and epigraphy, going back to at least 10,000 BC and most probably before. This ensemble represents an open-air museum and library regrouping documents from the Prehistory to the present. It is the combination of petroglyphs with inscriptions, and the continuity of these traces, over a period that covers at least 13,000 millennia that set Wadi Rum apart from other major sites where rock art and/or epigraphy are present and that have been listed as World Heritage sites.

Over 25,000 petroglyphs, including early forms of pictographs, are located throughout the broader Wadi Rum area. Another 20,000 examples of epigraphical texts are found in the area. Petroglyphs and inscriptions were etched, engraved or pecked on stones or on the rock-faces of cliffs and hills. A more limited number were drawn using either charcoal or pigments (vegetal or ochre). Large boulders seem to have been the preferred supports, but otherwise cliff faces were chosen and the red sandstone that produces what is known as rock varnish was favoured over than the softer white sandstone (some example are also recorded on granite and basalt). These traces are rare testimonies in particular when writing becomes widespread and is associated with pictorial representations making this ensemble a priceless resource for the study of rock art - of the very early origin and development of writing in northern Arabia and the Middle East, and of pastoral communities, particularly nomads.

The extensive corpus of inscriptions in Wadi Rum was left behind by ancient and modern nomadic people. These inscriptions are found sharing the same space as rock art, overlaying older petroglyphs or in proximity to them. Often decipherable, the northern Arabian inscriptions are, at minimum, of a heuristic value for the interpretation of rock art. Most importantly, they show that drawing and writing were just as important a preoccupation for the ancient nomads as herding. These nomads used drawing and writing for the purpose of expressing their thoughts and emotions, for recording their commemorations, and for greeting. Writing and drawing were also associated with spirituality.

Starting in the 1930s, several epigraphical missions have surveyed the area (Savignac 1932 and 1935; Harding and Littman 1952; Harding 1971), with a systematic inventory undertaken by the Franco-Jordanian mission under S. Fares since 1996 covering North Arabian, Greek and Latin inscriptions (Farès 1997a, 1997b, 2001, 2004a, 2004b). On the other hand, the Italian scientific mission under E. Borzatti von Löwenstern has been surveying the area since 1978 with specific attention to rock art, pictograms, pictographs and ideograms (Borzatti 1998; 2005: 135-150). Current projects will continue to complete the inventory of these sites.

ROCK ART

The petroglyphs surveyed so far amount to over 25,000. They are densely concentrated in a relatively limited and coherent area that comprises Wadi Hafir, Wadi Sabit, Wadi Umm Sahm, Wadi Saladeh and Wadi Rum (at times spelled Ramm, Rumm or Iram by scholars) proper. Deeply pecked and at times darkly patinated petroglyphs depicting anthropomorphous and zoomorphic figures and abstract forms are, in their major part, in a very good state of conservation and protected from aeolian and hydraulic erosion by their orientation or their location under rock shelters. On the other hand, a number of early rock drawings and pictograms are sometimes faded.

In Wadi Rum, the practice of rock engraving extends without interruption throughout the Neolithic to the modern era. As always with rock art, dating is particularly challenging, especially when petroglyphs or drawings are not accompanied with script. However patina, techniques of execution, subjects and association with human settlements that can be dated help suggest a chronology. Some of the rock art, particularly of cattle, feet and abstract shapes, is dated by Borzatti von Löwenstern (1995) to the Neolithic and Chalcolithic periods based on patina analysis and the particular climatic conditions necessary for its development. But he also established the existence of an older stratum of rock art probably dating back to the final Pleistocene. This dating is consistent with the one carried out by Bednarik and Khan (2005) in other areas of the northern Arabian Peninsula using proven scientific methods and technologies. By analogy with dating suggested by scholars who have studied rock art in Kyrgyzstan - whose style appears to be close to that found in Wadi Rum - Farès (2006) suggests the Bronze Age for some of the rock drawings in Wadi Rum found near sites showing human occupation associated with agricultural activities. Elaborate scenes continue well into the modern era (20th Century) with depictions of recent warfare and portraits of Colonel T. E. Lawrence and of his fatal motorbike accident, and drawing or carving of modern objects.

Depictions belong to the world of pastoralists, although not always nomadic. Traces are concentrated along transhumance roads, water sources or human settlements. Important aspects of the cycle of human life - birth, hunting, warfare, worshiping (orants), and relationship with animals - are all part of this exceptional corpus. Through depiction of the fauna, rock engravings in Wadi Rum also document the evolution of the climate and of human domestication of animals (caprines, cattle, camels and even ostriches). Many of these drawings represent the large wild animals that once existed in the area and include species that have since become extinct or threatened, such as the Leopard and Arabian Oryx.

There are a several instances of representations of feet and hands (e.g. Jabal Khaz'ali, Jabal Um Ishrin and 'Areq 'Asegeh) and of orants which may have some religious connotations. There is clear evidence of an earlier sanctuary under the Nabataean temple at Rum (see below Section on History and Development) and coupled with the sanctuary at Risqeh (just south of the Protected Area), of uncertain date. There is no doubt that Wadi Rum had religious significance for many different people stretching back over the millennia.

Borzatti von Löwenstern (2005: 94-132) proposes the following thematic typology for rock art in the Wadi Rum area:

- Hunting scenes where the main game seem to be Oryx. Other hunted animal are: ostriches, gazelles, leopards, lions, wolves, hyenas, and eagles. Many scenes represent hunters with bows mounted on camels, or holding spears and mounted on horses. Hunting dogs (sloghi) are also frequent;
- Encounters between groups: collective fights or duels with a variety of weapons, including sticks, maces, daggers, etc; and raids where camels are involved;
- Animals, at times associated with human figures. Domesticated animals (horses, large numbers of camels often in association with men, dogs, cattle related to agricultural communities and dating from the 5th to 4th millennia B. C.), or wild animals (lions, leopards, wolves, foxes, birds, etc.);
- Human figures, isolated or in groups, including scenes of dance and of ritual practices (orants with both arms raised), erotic scenes and parturition;
- Feet and hands isolated on in combination with human or animal figures;
- Abstract or geographical motives in clusters or isolated (some identified as tribal marks).

Some of these themes, although constant over large periods of time, testify to changes in style of execution. This is the case, in particular for cattle and

orants. The most ancient ones (possibly dating from the 5th to 4th millennia B. C. and associated with human settlements before the area became drier in the Bronze Age) are larger in size, different in contours, and more sophisticated in execution.

Whereas scene types remain constant, details testify of the changing conditions affecting human communities: evolution of weaponry (bow, spear, shields, dagger, rifle, etc.), appearance and disappearance of some animals (domesticated or wild), introduction of new objects, in particular as of the beginning of the 20th Century (cars, trucks, electric lines, planes, etc.).

Early rock engravings in Wadi Rum show an elaborate aesthetic sense and pictorial culture, akin to that of the Sahara, Central Asia, Borneo or Australia. They are part of the common patrimony of archaic human communities. However, rock art in Wadi Rum stands as unique because of the continuity of its practice over an extremely long period of time linking the very distant past with present day human communities of the Arabian Peninsula. Most of all, the uniqueness of rock art in Wadi Rum derives from the presence of an extensive corpus of pre-Arabic scripts, usually existing side by side with pictorial petroglyphs or overlaying them.

From Pictograms to Alphabetical Script

Writing has generally been thought to have originated around 3500 BC in large urban centers controlled by empires, namely Mesopotamia and Egypt, developing over time from the use of pictographs, signs and symbols. New evidences from the Arabian Peninsula, including those found in Wadi Rum, point to the existence of independent, non urban foyers of development at a very early period. Bednarik and Khan provide a dating of between 3530-2120 years for two Thamudic inscriptions in the north of Saudi Arabia putting 'to rest some controversies concerning the early scripts in the Middle East' (Bednarik and Khan 2005: 64).

Findings in Wadi Rum provide the “missing link” between pictograms and early Thamudic script from which Arabic developed in stages. Based on a corpus of over 1,600 painted (mostly monochrome) standardized geometrical motifs surveyed in the broader Wadi Rum area, Borzatti von Löwenstern suggests the evolution of pictograms into pictographs then into ideogrammatic expression and alphabetical script, dating the early pictrographs to 5,000 to 4,000 BC (Borzatti von Löwenterns 1998; 2005: 133-151).

INSCRIPTIONS

The corpus of inscriptions in the Wadi Rum Protected Area and its buffer zone is of extreme importance for the history of writing and literacy. The thought of script and writing usually conjures the image of sedentary settlements and urbanism. Evidences from Wadi Rum and a limited number of other sites in northern Arabia testify that nomads played a role in the invention of writing, that the end of Prehistory came very early in the region, and that nomads figure prominently among the first literate people of the world. A clear indication of the literacy of the nomads is the huge number of inscriptions that the pastoral people left behind in the area of Wadi Rum, and a few examples of alphabet primers carved on rock faces.

Thamudic inscriptions are well written and show a good control over the technique used (i.e. pecked or incised on the rock, plus one rare example of a black painted text). A variety of styles suggests that these skills were perhaps widespread. Literacy might have been linked to the role of Rum as a major pre-Islamic religious centre. Less numerous South Arabian and non-Arabian (Greek and Latin) inscriptions are also found attesting to the role of the region for caravans, and as a trading and pilgrimage centre, and to the presence of imperial powers. Wadi Hafir, northeast of Disi has a particularly high concentration of petroglyphs and inscriptions.

Thamudic script spread out through northern Arabia, and from this developed the Lihyanite, Safaitic and Aramaic alphabetical writing systems. Eventually, Nabataean script developed from Aramaic, and Arabic from Nabatean. With the rise of Islam, Arabic spread all over the region. Locally in the Wadi Rum area, literacy and practice of inscriptions on rocks seem to have continued for a long time whereas Thamudic was being used contemporaneously with official scripts of the prevailing governments (e.g. Nabataean, Greek and Latin). One can presume that Thamudic script was the script of the common people while Nabataean and Greek were used for official and religious purposes. In the Islamic era, inscriptions in classical Arabic script near major water sources testify to caravans occasionally crossing the region. However the use of the Thamudic script is still attested well after the Islamisation of the region in the 7th Century. In one instance, two inscriptions in Arabic and Thamudic were found superimposed and dated from the 11th Century.

Typology of texts in north Arabian scripts:

- Dedicatory inscriptions and invocations to pre-Ismatic deities (such as the goddess ‘Allat). Those in Nabataean script are mostly found near the temple site at Rum, whereas others are in Thamudic script.

- Signatures recording personal names or genealogies associated with hunting or fighting scenes, most often in Thamudic;
- Personal names and genealogies in Thamudic and Arabic associated to water catchment and storage installations probably marking ownership;
- Some funerary inscriptions;
- Recent inscriptions recording names and genealogies in Arabic along hunting routes in the mountains;
- In more recent writings in Arabic script, authors express their love for young women and relate their amorous adventures.

QU'RANIC MENTION AND IMPORTANCE FOR ISLAM

The Holy Qu'ran, chapter 89 (Surat Al-Fajr), verse 6 to 13:

6: Have you not considered how your Lord dealt with ʾAd, 7: [With] Iram dhat al'Imadd [the elevated one or the one with lofty pillars], 8: The likes of which had never been created in the land? 9: And [with] Thamud, who carved out the rocks in the valley? 10: And [with] Pharaoh, owner of the stakes? - 11: [All of] whom oppressed within the lands 12: And increased therein the corruption. 13: So your Lord poured upon them a scourge of punishment.

From a religious point of view, the Qu'ranic story of Iram exemplifies divine punishment over the people of 'Ad corrupted by wealth and delights of the flesh. Classical Muslim commentators of the Holy Qu'ran refer to 'Ad as rebellious and arrogant people, outside of divine obedience, deniers of God's Messengers and rejectors of His Scriptures. Allah annihilated them, leaving Iram buried under the sands of the desert and making Iram and 'Ad legends to be spoken of and an exemplary lesson of warning.
The Qu'ranic story of Iram has given rise to one of the most popular tales in Islamic literature. It tells of a South Arabian Iram dhat al-'Imad, a marvelous city built by Shaddad bin 'Ad. Medieval Arab geographers have tried to fix its location, but seldom arrive at an agreement among themselves. In a much more elaborate form, the legend of the lost city of Iram is developed in the Thousand and One Nights (Nights 275-9) and has been reused in countless literary works to this day.

Qu'ranic Iram has been identified with various sites in Arabia, Yemen and Oman based on oral narratives and geographical analogies. However, the identification of Wadi Rum (or the valley of Ramm) with Iram and the tribe of 'Ad is the only one supported by numerous epigraphical Nabatean and Thamudic inscriptions, and therefore the only one based on sound scientific evidences. The first identification was made by French epigraphist Savignac in a 1932 article where he published a Nabatean inscription reading "May be

remembered Hayan, son of 'Abdallahi, son of Ibn 'Atmu, in front of Allat, the goddess of Iram, forever". The identification was recently confirmed by Zayadine and Farès based on a Thamudic inscription which they read as "By Ghawt, the son of Awslh, son of Tkm and he built the sanctuary of Lat, of al 'Ad (tribe)". Between the discovery of Savignac and that of Zayadine and Farès, several scholars have noted the recurrence of the tribal name 'Ad and the toponym Iram on inscriptions found in Wadi Rum.

In the Holy Qu'ran (89: 7-8) the city of 'Ad is called "Iram dhat al-'Imadd, the likes of which had never been created in the land". Dhat al'-Imadd has traditionally been translated as "of the pillars", but new interpretations by scholars of Arabic and North-Arabian languages suggest another translation: "of the high peaks", a reference to the outstanding elevated mountains of the region. However, the two translations are not mutually exclusive since the shape of many mountains in Wadi Rum recalls lofty pillars.

Another element reinforces the scientific identification of Rum with Qu'ranic Iram: the latter site is associated in the Qu'ran with the Thamud "who carved out the rocks in the valley". A vast part of the rock inscriptions in Wadi Rum are in the Thamudic alphabet, and the patronym Thamud is found recurrently. Thamudic script has been found in other areas of Arabia, however less densely and in none of the other sites that lay claim to being the site of Qu'ranic Iram.

HUMAN INTERACTION WITH AN ARID ENVIRONMENT

For thousands of years, Wadi Rum has naturally provided humans with water, food and shelter. This landscape hosts a wide variety of vegetation, shielded from the harsh desert climate – a good habitat for animals that humans can hunt, and where edible and medicinal plants can be collected. Changes in the composition and human use of the fauna from Prehistory to the contemporary era can be traced from the large number of drawings and petroglyphs.

Cattle lived in the region, either wild or bred, at a time when the climate was wetter. Wild mountain goats were hunted and domesticated. The gazelle, the Arabian Oryx, the ostrich and leopards were also hunted for their meat or their skin. The area saw the appearance of camels when they were already domesticated, and pastoral nomads have used the area for grazing and watering their herds for several millennia. At times, human communities have also practiced irrigated agriculture in Wadi beds, thanks to a sophisticated system of rainwater catchment (see below).

Nomadic communities are notoriously poor in material culture with the result that limited physical remains of activities can be recovered by archaeology. Together with rock art, ancient Arabian inscriptions give an authentic narrative of Bedouin life. Signs and writings represent indications on water sources, herding routes, animals to be hunted, threat posed by wild beasts, possible human dangers, important information regarding clans and families, the use and ownership of rangelands and water installations, etc.
In their writings, the nomads of Wadi Rum inscribed their deeds and resolutions, their hopes and inspirations, their prayers and supplications. Their petroglyphs and their inscriptions are brushstrokes painting a nomadic life centred on camping, herding and pasturing of animals, the importance of water, camel riding, raiding, hunting, kinship and tribal affiliation, and seasonal migration. They express their fears, sorrows and love, and they record their greetings and salutations, their sacrifices and prayers to be remembered, blessed, rewarded or heard by their deities.

Rock art, combined or not with inscriptions, gives us a great deal of information about the activities of Wadi Rum's inhabitants over time and the by-gone diversity of fauna. Hunting and fighting scenes tell us much about the weapons and tactics used by these nomads. The disappearance of cattle and the appearance of camels testify to adaptation to changing climatic conditions. Resilience of cultural patterns is indicated, for example, in the survival of the symbolism of the ibex, an animal which, until fairly recently, had been at the centre of various hunting rituals, and was also associated with some rogatory practices having to do with obtaining rain.

In the early Prehistory (Palaeolithic to Chalcolithic) human settlement was fostered by a wetter climate and more abundant sources of water. When climate became dryer during the Bronze Age, settlements were linked to the development of a technology for harvesting and storing water at a time when agriculture was already widely practiced. The development of a larger settlement at Rum (during the Antiquity, and again since the 1960s) is linked to the presence of central powers that have developed the area. However, even at times of permanent settlements, human communities have kept their mobility to make the best use of this arid landscape, either as foragers or as pastoralists. In Wadi Rum, mobility as a lifestyle is deeply imbedded in a particular landscape. It appears to have been a response to climatic constraints and opportunities offered by the geomorphology of the area, and has shown a remarkable persistence even when the development by central powers of a village at Rum provided an incentive to settle.

The history of human occupation in what is today the Wadi Rum Protected Area exemplifies the alternance and complementarity of mobile and settled

lifestyles over an extremely long period of time and helps us to understand the factors that underpin these relations. Such factors have been a combination of environmental constraints and of successive social, economic and political forces both external and internal (see below section 2.b History and Development). Responding and adapting to these forces, human communities have lived in caves and other rock shelters, in built settlements and in tents woven of animal hairs. Resource use has been based on a pattern of transhumance in which foraging, pastoralism and farming were interwoven within a complex subsistence strategy, and has evolved at times into elaborate settlements supported by agriculture and trading. Few areas at the lower and even higher altitudes have escaped human interference. Mountains have been used for hunting, collection of fire wood and plants, as pastures for livestock, as locations for elaborate water catchment systems (channels, cisterns, etc.). The site of the current village of Rum, below the largest perennial spring in the whole Hisma desert, has provided a focus for the economic and religious activities of the pastoral peoples who have lived in the region since Prehistory.

Successive communities of foragers, agriculturalist, pastoralists, and traders have left innumerable testimonies of their activities and lifestyle in the form of petroglyphs and inscriptions on the rocks or in archaeological sites. This makes Wadi Rum Protected Area a unique living testimony of human settlement and land use in an arid area for over 13,000 years.

2.a.11 Current Land Use and Exploitation of Natural Resources

Presently, Wadi Rum Protected Area is mainly used for tourism and pastoralism.

Tourism

The spectacular desert scenery of Wadi Rum is the primary interest of visitors, with secondary interests being Bedouin culture, archaeology, Lawrence of Arabia, "wilderness" and desert adventure. Standard activities for visitors are 4x4 tours, camel rides, hiking, camping, rock climbing and horse riding. The 4x4 tours are the most popular, with an estimated 85% of visitors using them. Special activities have been prohibited in the Protected Area including micro-light flying, ballooning and car rallying. More on these activities is present in the section of factors affecting management.

Livestock Grazing

The three types of livestock found within the Protected Area are the black "Baladi" goat, the black "Nejdi" sheep and the Arabian one-humped camel. These are favored over other types for their rugged nature and their suitability for grazing in desert areas.

The highest grazing activity is in the spring, decreasing in the other seasons. Wadi Raman and Wadi Marsad, in the western part of the Protected Area, face the highest pressure during the spring, while in other seasons the grazing pressure is concentrated more in the eastern parts. The highest grazing pressure from camels is during the spring and summer in the central part of the Protected Area, in Wadi Rum and Wadi Um Ishrin.

Total Numbers of Goats (1999)						
Counting Round	Area					
	Wadi Marsad	Wadi Raman	Wadi Rum	Wadi Um-'Ishrin	Wadi Um-Harraq	Um Muqour
Spring 1	1852	2590	913	306	0	90
Spring 2	1834	2435	962	297	91	225
Summer 1	461	185	317	280	0	175
Summer 2	815	587	958	135	172	280
Winter 1	225	558	611	268	35	101
Winter 2	118	225	481	200	75	332

Since the above count, there has been a reduction in livestock numbers in Rum Village and elsewhere, attributed partly to the development of the tourism economy and also to drought conditions. Since the late 1990s, capital

has mainly been invested in tourism rather than in livestock. Similarly, a reduction in the livestock numbers at Diseh, Mnaisheer, and Twail may be linked to the fact that villagers are relying on government/army pensions as a primary source of income. On the other hand, the number of camels, which had decreased considerably since the 1950s due to drought and the introduction of motor vehicles, is currently rising again to meet the needs of the tourism market and the development of camel races throughout the south of Jordan.

In addition to tourism, government jobs and agriculture, livestock grazing is growing ever smaller due to important factors such as:

- Local transformation towards urban settlement after services and infrastructure.
- The long drought periods with minimal rain fall and associated low land productivity.
- The increase in fodder prices and other animal husbandry related services.

Very few Bedouin participate in livestock production in the Protected Area as a commercial enterprise. Environmental conditions have been dramatically altered due to the extended drought beginning in the late 1950s to early 1960s in addition to high costs associated with store bought fodder. However, the actual value of the livestock is a form of security and provides basic food supplies when the tourism economy falters.

Nowadays the majority of shepherding is done by elderly women or hired hands. Due to the dramatic reduction in herd sizes and in the number of Bedouin families actively engaging in pastoralism, overgrazing appears to be of little consequence within the Protected Area. According to extensive interviews with pastoralists, most of the grazing occurs close to the villages with forays into the PA during the early spring to access new spring grass. These periods are short lived lasting approximately 2 – 4 weeks depending upon availability. Afterwards, shepherds return to established patterns within close proximity to village homes. Many of the older women keep herds of 2-5 head in enclosures within the village.

Today, we have no qualitative evidence on the impacts of grazing on the Protected Area's vegetation cover and flora and fauna as it requires long term monitoring to achieve concrete results and conclusions. Nonetheless, visual impact of grazing is easily spotted in heavily grazed areas as compared to the vegetation recovery witnessed in areas closed for grazing all year round such as the Oryx sanctuary.

Measures to control this activity include the Protected Area grazing scheme and the conservation zoning plan. According to the current zoning, the Protected Area is grazing free all year around. The program targeting the review of the Protected Area management plan will include a proposal for an in-depth monitoring program and intervention strategy to document and address the grazing activities.

Livestock Management

While the economic benefits of Bedouin livestock are questionable, the main owners continue to invest in livestock. They usually own their own tanker trucks and dams, and many owners provide veterinary care for their stock. Many households also have mobile fences used for special feeding and care of pregnant goats or kids, and herds are often divided and given different diets according to their special needs. This could be justified by the close linkage between the grazing activity and Bedouin lifestyle; livestock has always been more of a cultural component in Wadi Rum related to tribal status, power and pride rather than just a mere economic activity. Further, for the older women, nostalgia is a common denominator whereby small herds are kept for memory sake. Their attachment is deeply embedded in their inability to completely abandon the ways of the past.

Settlements and Villages

Formerly nomadic and living off pastoralism, Bedouins have settled in villages since the 1960s, with few families still living in tents year round or seasonally. Six main Bedouin tribes live inside or on the boundaries of the Wadi Rum Protected Area: the Zawayda in the area of Disi and adjacent villages; the Zalabya in and around Rum village; the Swelhiyyin in the villages of Salhiyya and Shakriyya; the 'Umran, Dbour, and Qudhman who have settled or graze their livestock on the margins of the Protected Area.

The current distribution of Bedouin villages in and around the Protected Area is related to water sources. Until the 1970s the only year-round water sources were the springs along the eastern face of Jabal Rum and they stimulated the development of the current village at Rum.

In the 1960s the Zawayda sheikh talked to Crown Prince Hassan, who felt compelled to sink wells for the tribe in the Disi area. By the mid-1980s pumps had been established at the sites of the five new villages: Disi, Tuweisi, Twail, Mnaisheer, and Al-Ghal. Today, many Zawayda call these villages home. The fact that the Zawayda have had virtually exclusive water rights at Disi, while

the Zalabya at Rum have benefited from the tourism income, was a source of envy and mutual distrust between both tribes until recently when all tribes were brought together under a unified visitors management system. The Swelhiyyin tribe has settled in the area more recently. They have established two new villages, Salhiyya and Shakriyya.

Rum Village

Rum Village lies within the Protected Area and is the only settlement inside its boundaries. Its community is part of a wider network of Bedouin tribes stretching as far as Aqaba and Saudi Arabia. The population of Rum Village is about 1,300 (according to recent information), made up of two tribes: the Zalabya tribe with over a hundred families, and the Swelhiyyin tribe with less than a dozen families.

To minimize the impact of the expansion of Rum Village on the Protected Area, the government of Jordan defined the village boundaries, restricting its area to 404 dunums (around 40 ha.). Construction is forbidden beyond these boundaries.

Rum village is a relatively new settlement established in the early 1960s adjacent to the fort built in 1934 for the Desert Police and below the main perennial spring. The village is rather small compared to average Jordanian villages and those existing around the Protected Area. During the last two decades, Rum village has developed rapidly in terms of size and population, a process justified by the relatively large average household size in addition to several other supporting factors:

- The general government policies related to settling Bedouins and supporting their services and development. In particular schools, the paved road and basic utilities;
- The establishment of the Wadi Rum Protected Area during the various stages of development;
- The rapid development of tourism activities in and around the Wadi Rum area since the mid-1980s;
- The gradual economic shift in the local economy from pastoral livelihood to modern tourism and services;
- The increasing levels of drought periods and the increasing prices of livestock husbandry.

In 1998, when the World Bank project commenced, a proposal to move the village away from the heart of the Protected Area was put forward by the

consulting agencies with the aim to avoid long term impact of the village's urban development on the area's values and potentials. The proposal was never realized due to local rejection and issues related to the impacts of the new proposed areas for the village relocation. It is worth mentioning that the Royal Society for the Conservation of Nature (RSCN) was not in favor of this option and was promoting an alternative to actively develop the village using an integrated approach in relation to its natural and cultural contexts.

At that time, the village was the centre of tourism management in the Protected Area but soon after the establishment of the visitor centre, it lost much of its role as the main access point and visitor distribution location.

The Aqaba Special Economic Zone Authority (ASEZA) developed a clear guide to urban expansion of the village and developed and endorsed an organizational structure for it based on the old 1989 one. The structure is currently under revision to respond to new developments and issues related to shortcomings of the previous one. One of the main suggestions is to have ASEZA and the local villages collectively agree on a "village wall" that will limit the uncontrolled development of the village while responding to urgent needs for structural expansions.

The current vision for the village is to basically develop it as a model rural village within the Protected Area and to develop it as an attraction in itself, capitalizing on the local cultural potentials and representations and utilizing the presence of several supporting destinations such as a local bed-and-breakfast, a village panorama (built around the fort), a village camp-site and guesthouse, the nearby archaeological sites of Abu Nkhaileh, the local handicrafts centres and several other associated activities.

Considering the ASEZA driven active management intervention, the village today does not represent a source of significant impact on the Protected Area. Nonetheless, the planned monitoring and enforcement program of its organizational structure and the anticipated high level of involvement of local residents in its implementation and development will form the minimal requirements for safeguarding the Protected Area against any possible future encroachment.

Nonetheless, the village is not included in the area nominated for the world heritage inscription. This is of vital importance as it aims at:

- Ensuring that the village does not represent a compromising element as it was established as a relatively new village before the establishment of the protected area.

- Ensuring the strict control of the village boundary line and any possible legal or illegal expansion by excluding it from any delineation ambiguities. The village wall against the nominated area boundary line is precisely established upfront to avoid any future misinterpretation of the village development in regard to the nominated property.

Allowing the village to be an integral part of the nominated area buffer zone, however, falling under a more extensive set of regulations and enforcement schemes being also part of the protected area proper.

In addition to Rum village there are other settlements outside the Protected Area:

Shakriyya Village

The residents of this village are from the Swelhiyyin tribe. The population is relatively well educated, and depends mostly on wage labour as their principle source of income. A very small number of them remain pastoral, herding goats and camels.

Disi and Tuweisa

These are the main villages of the Zawayda tribe. Government employment is the main economic activity of these villages, and agricultural jobs are ranked second, with Rum Agricultural Company as a major employer. For members of the tourism co-operative, tourism has also been providing an increasing supplementary income, particularly in the last five years. Tourism is recognized to be seasonal with high wages for a llimited amount of time.

Mnaisheer, Al-Ghal, and Twail

These villages are home to people of the Mazanah fraction, which was originally part of the Zawayda tribe. The people here acquired recognition of their land claims around the two government wells at Mnaisheer and Al-Ghal. Most of the population have government jobs.

Other Settlements

Three other tribes are found on the margins of the Protected Area: the ‘Umran, Dbour, and Qudhman. The ‘Umran and Dbour are Saudi Arabian Bedouins whose historical lands were part of the land deal between the Jordanian and Saudi Arabian governments in 1965. Both of these tribes are

very small and depend on trading and livestock, bringing it from Saudi Arabia and selling it in Jordan for a profit.

The very small Qudhman community lives in Rashidiyya village, with a few residents in Wadi Marsad at the western border of the Protected Area.

Firewood Collection

The Bedouin lifestyle historically depended upon the collection of firewood for cooking, heating, making coffee, etc. but since the late 1990s this has changed dramatically. Nowadays, villagers heat their homes and cook their meals with gas. Firewood is primarily used by individuals in the local tourism industry to prepare a meal or make tea over a desert fire..

This factor sheds some pressure on the Protected Area vegetation and flora diversity and consequently on the fauna populations and other cultural and aesthetic values. Measures to control this activity include the Protected Area conservation zoning plan. According to the current zoning plan 83% of the Protected Area is defined as a protection zone in which no wood collection is allowed. Bedouin do maintain that green wood collection was never part of their cultural past.

Water Catchment Systems

Numerous small to medium-size (rather than large) dams have been installed over millenia in and around the area that is today the Protected Area. These have served to collect winter runoff from the mountains for livestock and human consumption and for irrigated agriculture. Archaeological digs and surveys have revealed dams, reservoirs, sunken cisterns and associated water catchment systems going back at least to the north-Arabian occupation (starting 4th Century BC) with modern ones often set on the same sites. Water availability is a major concern in such an arid area, so catchment systems ensure significant water storage for local use during various times of the year depending on the availability of rain and the size of such structures.

This activity has little impact on the Protected Area and its values - to the contrary. To many visitors, these represent part of the ongoing cultural heritage of Wadi Rum and several important examples of them have been developed into visitor attractions as a part of the wider visitation program to the Protected Area. However from another point of view, the more recent construction materials (concrete and cement blocks) used for these structures are not always in harmony with the surrounding landscape, in addition to the possibility of left behind by-products of construction.

Sunken cisterns are another type of water storage system that allows fewer impurities into the water and reduces evaporation. They often meet domestic water requirements for individual households of encamped Bedouins. These are a part of the local traditional use of the Protected Area, considered fully in line with its conservation and promotion. Nonetheless, they present the same potential impacts as those of the concrete dams and reservoirs.

Brick Storage Chambers

These small storerooms are usually built into rock overhangs, providing cool shelter for the storage of many products for months or even years. Dairy products such as "Samn" and "Jameed" which are derivatives of milk can be stored there for a long time. The same applies here as for the two previous factors.

Agriculture

Agriculture has a very long history in the area with traces of olive farming dating back to the Bronze Age (3rd millennium BC) found at the site of Hudayb El-Rih in the Wadi Sabit. Due the low level of precipitation, dry agriculture has been impossible and farming was developed in connection with rainwater harvesting and conservation. Since Prehistory, wheat and barley for human consumption and as fodder for livestock have also been cultivated in Wadi beds near water storage areas.

Today however there is virtually no agriculture inside the Protected Area except for vegetable gardens and orchards in the village used for domestic consumption. Two olive orchards are still maintained in Wadi Sabit close to the Saudi border. However the cultivation of barley and wheat has totally stopped due to a succession of drought years that makes the investment in cereal farming no longer worthwhile. In addition, agriculture is prohibited under the regulations of the Protected Area except for existing olives orchards and for domestic gardens.

Mining

As stated in "mineral resources" above, no mineral or industrial rock resources are present within the Protected Area. The nearest mines are those of small scale white glass sand more than 20 km further north of the Protected Area. No mining activities presently take place or are planned in the Protected Area. Furthermore, the Protected Area by law prohibits any mining activities within its boundaries with no exceptions what so ever.

2.b History and Development

Natural History

Wadi Rum Protected Area is characterized throughout by a continuous record of part of the Earth's history extending from the lower Cambrian to the lower Ordovician. The role that time and history have played in the formation of Wadi Rum Protected Area is thoroughly highlighted in the above section entitled "Geology".

Human History and Development

Several scientific missions have turned their attention to human occupation in Wadi Rum throughout Prehistory to the late Antiquity, with conduction of archaeological surveys and excavations often in conjunction with surveys of the epigraphy. A summary of archaeological work up to 1999 is provided by Ruben and Nasser (1999).

Stages of Human Occupation

The present day arid and largely denuded aspect of Wadi Rum Protected Area belies how it must have looked in the past. Over the millennia of human occupation there have been many fluctuations in the climate, with cycles of arid and moist conditions, often with more rainfall than today. With very little extra rain the area could support far more vegetation and wildlife, as can be seen by the current difference between Wadi Rum and the slightly wetter limestone plateau just to the north.

Some 1.8 million years ago, the Wadi Rum area was probably a bridge for early human migration on the route between Africa and Asia. Permanent human occupation appears to have extended from the Upper Palaeolithic period (19,000 years ago) all the way to the Roman (2nd-7th Century AD) and Islamic periods to the present. The numerous archaeological sites from the **Palaeolithic** era (the most important being al-Kaaka in Wadi Umm Sahm), at a time when climate was wetter, suggest that the region was densely populated in settlements located near sources of water, vegetation and wild game. During early Prehistory there were large inland lakes, for instance at Qaa' Disi and Qaa' Um Salab (the northern borders of the Wadi Rum Protected Area). Around these lake shores a number of Palaeolithic (c. 1, 800,000-20,000 BC; e.g. during Marine Isotope Stage 5, 70-135 thousand years BP) and **Epi-palaeolithic** (c. 20,000 -8300 BC; e.g. during the Holocene Optimum around 8000 years BP.) sites have been found. Others have been

located in rock shelters and caves where flints have been found, and there must be many more sites that are now buried under the shifting sands of the wadis.

By the **Neolithic** period (8300-4500 BC), with the advent of agriculture and the domestication of animals, people were in a transitional state from hunting and gathering to living in houses in permanent or semi-permanent communities, whilst still making use of rock shelters and temporary camp sites. There are a small number of recorded Neolithic sites in the Wadi Rum Protected Area, the largest two being Abu Nukhaileh and Rways Salîm. These sites consist of groups of circular or rectangular houses that were probably inhabited by groups of semi-sedentary people exploiting the local wildlife and plants.

During the **Chalcolithic** (c.4500-3200 BC), at the time of the discovery of metals, namely copper; which was being mined in the not very distant Wadi Araba, large communities were settled in Rum where there is evidence of flints and pottery, usually associated with the stone structure foundations of settlements (Hudayb al-Rîh). Some of the many examples of rock art, particularly those depicting cattle, have been dated to Chalcolithic times that appears to have been a period of thriving human occupation and activities.

Climate became more arid during the **Bronze Age** (3rd millennium BC) yet settlement persisted now that human communities were supporting themselves through a combination of animal husbandry and agriculture. This lifestyle necessitated a new technology to catch now scarce rainwater and conserve it. Channels, dams and reservoirs started being built near mountain slopes and at the entrance of narrow valleys. The site of Hudayb El-Rih in the Wadi Sabit is one such settlement where very early traces of olive farming have been found. However, cattle are not present anymore on the rock drawings, pointing at shifts in husbandry towards animals (such as goats) more adapted to the dry climate.

There is not much archaeological evidence for the **Iron Age** (c.1200-539 BC) in the area, except for pottery found in Qweira, a few kilometres to the northwest of Wadi Rum Protected Area, and in Wadi Raman. Scholars have named this pottery style Midianite in reference to a people mentioned in the Bible. The scarcity of archaeological findings for that period might be due to lack of extensive excavations. However, most probably, it was a time during which permanent settlements were progressively abandoned in favour of a nomadic pastoral lifestyle, a process possibly inaugurated in the previous era. This shift is supported by Biblical accounts of the region from Exodus and Judges. The area of Wadi Rum (Aram in the Bible) appears to have been part

of Midian (possibly a tribal name), an area extending from the Jordanian highlands above Wadi Araba into the northwest of the Arabian Peninsula along the shores of the Gulf of Aqaba. The Midianites were said to be idolatre (i.e. polytheist), to have swift camels (camels were domesticated as of 2,000 BC) and seem to have formed a confederation of tribes, part of whom dwelt in cities and fortresses in the vicinity of Moab. Another part led a nomadic life, living in tents and herding heir livestock in a more distant region, such as Aram must have been.

Besides being used as a pastoral area, Wadi Rum was situated on one of the routes linking the coastal regions of the Arabian Peninsula with Egypt and the Levant across the Hisma desert. Along this route, frankincense and myrrh were transported from Arabia, whereas copper from the Wadi Araba region travelled in the other direction. This route became eventually used by the Nabataeans and was subsequently formalized by the Romans in the Via Nova Traiana.

As of the 4th Century BC, **north-Arabian tribes** lived in the region, probably the descendants of the so-called Midianites. This era inaugurated a period of intense inscriptions on the rocks mixed with drawings of animals and hunting and other scenes (see above section on Rock Art and Inscriptions). Although these people have generally been called Thamudenes, scholars today prefer to identify the inhabitants of Wadi Rum as Arabs, possibly 'Adites based on the recurrence of the tribal name 'Ad in inscriptions. They spoke a north-Arabian dialect which they wrote using the Thamudic script. These north-Arabians were mostly pastoral nomads breeding camels and goats, and practicing some irrigated agriculture to feed their livestock. Numerous Thamudic inscriptions were found near water catchment basins, dams and cisterns marking ownership.

Several stone circles with a larger stone standing in the middle, located in the foothills of Jebel Umm Ishrin and Jebel Rum and similar to well-studied structures found in the Sinai, appear to be pre-Islamic shrines. Together with inscriptions in different Arabian scripts, these structures attest that the valley of Rum had become a pilgrimage centre for different Arabian tribes of the region. It is possible that this role pre-dated the Antiquity by far. In any case, as we will explain in details below, it marked Wadi Rum as a major site where polytheism was practiced and whose destruction by Allah came to symbolize for Muslims the divine punishment incurred by corrupt people who refused the Revelation of Allah through his sent prophets.

The Nabataeans, another north-Arabian tribe that had progressively settled and established its main centre at Petra from the 4th Century BC, gradually

took control of the trade route linking the Arabian Peninsula to the Mediterranean. Wadi Rum became a Nabataean outpost on the route between Al-Higr (Meda'in Saleh) in today's Saudi Arabia, and Petra, two World Heritage sites. It was probably a settlement of some importance and is first mentioned as Iram by Cl. Ptolemaeus in his list of cities in Arabia Felix. (Aramava-Geogr., 6.7.27). The Nabatean presence is attested by several buildings including the remains of a temple to the pre-Islamic goddess Al-Lât (dated 32 AD), close to the modern village of Rum, and on numerous rock carvings of deities and inscriptions, such as the ones at the Al-Shallala spring above the village or near water channels, reservoirs and dams scattered in the surrounding mountains. Above the site are several natural springs. From these springs Nabataean aqueducts carried water down to two built cisterns. A second canal system came from another spring down through the temple hillside to the eastern complex and its baths. Inscriptions around the temple and at the springs were left by various workmen, Masons, sculptors and architects.

The Nabataean settlement represented a focus for commercial and religious activities and it is probable that pastoral tribes living in the area partially settled there permanently or seasonally. Other tribespeople, however, continued to live in and around the area practicing pastoralism and agriculture and using the Thamudic script to write on the mountains. The population of the region between the 1st Century BC and the 1st Century AD has been estimated at 20,000, well above the current number of inhabitants.

In **Roman and Byzantine times** (2nd–7th Century AD) Wadi Rum lost its role as a stopping place on the caravan route after much of the Arabian trade was diverted to Syria or started following maritime routes on the Red Sea. The settlement was abandoned but the pastoral population continued to live in the area, a presence attested to by numerous petroglyphs. Wadi Rum remained marginal to centres of power during the centuries of the **Islamic era**. Inscriptions in Arabic script near major water sources testify to caravans occasionally crossing the region. However human presence was limited to nomads who continued as before to practice pastoralism, some irrigated agriculture, and trade with settled communities on the Jordanian highlands and of the coastal area of the Red Sea.

T. E. Lawrence, who acted as British liaison officer with the troops of the Great Arab Revolt during **WWI**, was stunned by the impressive landscape of Wadi Rum and devoted to its description several pages of his famous literary and autobiographical account of the campaign “Seven Pillars of Wisdom”, first published in 1926. The Bedouin of the time; following in the desert

tradition, left graffiti on the rocks - drawings of tanks and men with rifles, and a unique depiction of Lawrence's death in a motorcycle accident

Quite naturally, in 1962 Wadi Rum provided the setting for most of David Lean's film *Lawrence of Arabia* based on T. E. Lawrence's memoirs. Modern mythologies, started at the time of the British Mandate over Jordan (1921 to 1946) that brought a small but regular number of adventurous European visitors to Wadi Rum, tend to overstate the Lawrence connection. Modern tourists, tour guides and rock climbers have renamed a number of sites in relations to Lawrence. Even if these identifications are not historically accurate, they have become part of the modern story and the magic of the Wadi Rum Protected Area.

The creation of **modern Jordan** in 1921 brought with it a new cycle of sedentarization: newly drawn borders with Saudi Arabia limited the movements of nomads, a fort of the Desert Police was built in Rum in 1934, a school for boys was established, and opportunities of employment in the armed forces created new focuses for the tribes. In the late 1960s, Bedouins in Rum started settling in growing numbers around the fort, whereas in Disi the digging of artesian wells was the major incentive for the creation of villages. Tourism is an added factor that has fostered settlement, yet because of the nature of this tourism, the desert areas remain largely used for a number of activities (camping, off road vehicles, camel and horse tours, hiking and rock-climbing) that cohabit with pastoralism in Rum and with agriculture in Disi.

Recent Conservation History

Conservation of the Wadi Rum Protected Area began **in 1979**, when the **IUCN/WWF Report** *on the Development of Wildlife Conservation in Jordan II: A Proposal for Wildlife Reserves in Jordan* recommended the establishment of a network of protected areas based on an evaluation of ecosystems and land types. The study recommended establishing protected areas in twelve different land types, and Wadi Rum was one of these the study recommended. The idea was "to protect and preserve a representative area of the Eastern Desert (Hisma) land type, together with its indigenous flora and fauna; and to preserve a large section of the scenic mountains of Rum".

In the 1980s and 1990s, six of the twelve sites proposed in the Report were formally gazetted, including Wadi Rum Protected Area with a preliminary area of 540 km (54,000 ha).

In 1991, the National Environmental Strategy for Jordan described the establishment of Wadi Rum Protected Area as having "top priority". Wadi

Rum was subsequently selected as one of the four sites in the Kingdom to receive financial and technical assistance through the World Bank Second Tourism Development Project.

In 1997, as part of the World Bank Funded second tourism project, the Royal Society for the Conservation of Nature (RSCN) became the party responsible for formulating and implementing a long-term management strategy for the Protected Area. It has been reasoned that by applying an integrated, participatory approach to site protection and tourism development, greater tourism benefits could be secured by the host community.

In 2002, based on the results of the baseline survey and management planning undertaken by RSCN and ASEZA, a cabinet decree endorsed an additional 18,000 ha. for inclusion in the Wadi Rum Protected Area for a total of 72,000 ha.

In 2003, the management of the Wadi Rum Protected Area shifted back from RSCN, to the Aqaba Special Economic Zone Authority (ASEZA), which is now the umbrella under which the Wadi Rum Protected Area is managed.

In 2009, a review of the 1979 IUCN report was concluded and a revised system for the national protected areas network was presented to the cabinet of minister's including Wadi Rum Protected Area. The cabinet endorsed the report and Wadi Rum's status as part of the protected areas network was confirmed.

Operational objectives for site conservation focus on: tourism development, habitat conservation, species conservation, cultural conservation, awareness and education, community work and outreach, and financial sustainability. More on this is in the management section.

Section 3: Justification for Inscription

3.a Criteria Under Which Inscription is Proposed

Natural Values

(viii) Be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;

Wadi Rum Protected Area presents an iconic assemblage of unique landforms forming an integrated desert landscape system; produced in an exceptional true desert environment. The area as it stands today is the result of interactions of lithology, uplift, faulting, weathering and erosion over millions of years that exists nowhere else with the same intensity.

The geology of the area is dominated by Cambrian and Ordovician sandstones which rest on older pre-Cambrian granite basement rocks. These form an exceptional record of Earth's history, illustrating a braided river depositional environment. Primary sedimentary structures are exceptionally exposed in three dimensions over tens of kilometres manifested in countless outcrops.

Historic and ongoing tectonic uplift, coupled with weathering and erosion, have sculpted the sandstones into characteristic mountain blocks and residual, isolated "island hills" or inselbergs. The overall shape of these owes much to the numerous fault lines that criss-cross the area.

Elongated vertical joints over 350 m in length slice through the faces of the mountains, creating vertical cliffs on each side of the mountain blocks. Ongoing weathering and wind erosion sculpts the sandstone between the joints to produce infinite variety of morphologies including the iconic columns or pillars with which the area is defined both scientifically and culturally.

Crucial to the maintenance of the vertical cliffs is active weathering and erosion at the junctions between cliffs and Wadi floors. Often this is associated with springs that form at the junction between the sandstone formations and the underlying granitoid basement complex. These are a critical feature of this region which has also allowed the presence of wildlife and humans in an otherwise uninhabitable desert region.

The verticality of the cliffs is accentuated by intervening flat-bottom wadis covered with shifting sands. Within the sand spreads are sporadic mud flats (Qaa') lying at 800 metres asl which testify to the occasional presence of rainfall and runoff which continues to occur regardless of the overall aridity of the region. In combination, these landforms underpin the exceptional natural value of the landscape.

(vii) Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;

The Wadi Rum Protected Area presents a world masterpiece of natural beauty and aesthetic importance.

Wandering through Wadi Rum Protected Area would transport you through a labyrinth of interesting elements of beauty such as narrow vertical gorges, arches and hanging cliffs. Giant wadis end abruptly at mud flats all forming the very unique combination of geological and geomorphological features which make the high desert of Wadi Rum Protected Area an outstanding site of beauty and magnificence.

The mountains and sands of Wadi Rum Protected Area are rippled with colour. It is typical to see alternating colours of pink, grey, yellow, red, orange, brown, white and deep brown depending on where you are located.

In the central and north-eastern sections of the Protected Area, rounded hats of snow white sandstone top the red-brown, vertical, mountains. Elsewhere, the sand stone formation is striped with beautiful colours dominated by rust-reds. In the west of the Protected Area, a major north-south fault line transforms the rounded, ribboned sandstone landscapes into sharp granite mountains with dramatic dark cross-dykes.

Wadi Rum Protected Area is an experience in altering your visual scale; its vertical elevations are so vast that they can re-format your sense of proportions, completely re-setting the visual calibrations between vertical and horizontal. Rum is definitely an experience and for many it can be a transformation.

<u>Cultural Values</u>

(iii) Bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared

The Wadi Rum Protected Area bears a unique testimony to the practice of rock art and rock inscription that has been on-going for millennia. This ensemble represents an open-air museum and library regrouping iconic and written documents from the Prehistory to the present. The combination of petroglyphs with rock epigraphy, and the continuity of these traces to the present set Wadi Rum apart from other major sites where rock art and/or epigraphy are present.

The over 25,000 petroglyphs and 20,000 of rock inscriptions in a limited and coherent area are exceptional documents to retrace the evolution of human thought and activities over at least 13,000 years, from the Upper Palaeolithic to this day. Furthermore, this ensemble allows us to understand the long-term patterns of human activities - pastoral and agricultural but also urban around the area - in the Arabian Peninsula, and to trace the environmental history of the area from a mildly humid to semi-arid climate.

The tens of thousands of petroglyphs – representing humans and animals - are engraved on boulders, stones or on the slopes of mountains. They reflect the highly developed and sophisticated intellectual and conceptual faculties of mankind in the Paleolithic era and are exceptional testimonies for the history of humanity.

Numerous early petroglyphs and inscriptions in North-Arabian scripts (Thamudic, Safaitic, Lihyanic and Nabatean) testify to the emergence of alphabets from iconic representations. Rock epigraphy attests to the development of alphabets and of widespread literacy in pastoral societies of the Arabian Peninsula may be as early as 3,500 BC. They are of extreme importance for the history of writing and literacy.

(v) To 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;

The history of human occupation in what is today the Wadi Rum Protected Area exemplifies the relationship between settled and mobile lifestyles in an environment with scarce resources over an extremely long period of time (from the Upper Palaeolithic 19,000 years ago to the present).

No other site in the world contains such a wealth of documentation over millennia that permits the understanding of the alternance and the continuum between settled and mobile lifestyles in a desert landscape. This is why the significance of the Wadi Rum Protected Area goes far beyond its north-

Arabian context as it represents a uniquely documented instance of human interaction with dry environments of relevance to other arid areas worldwide.

An astounding feature of resource use in this desert and mountain environment is the adaptability and ingenuity of human communities who have made the most of scarce resources to sustain continuous presence after the climate became dryer in the Bronze Age (3rd millennium BC). In particular, successive communities have developed a sophisticated system of rainwater catchment to support mobile animal husbandry and agriculture, with very early traces of olive farming. These installations are used to this day.

Not only is Wadi Rum Protected Area remarkably rich in traces left by communities of mobile and settled pastoralists and agriculturalists, it is also rich in documents attesting to the significance of the site of the current Rum village as a religious, trade and administrative centre for many different peoples stretching back over the millennia. These evidences attest to another remarkable feature of the human occupation in the Wadi Rum Protected Area: the complementarity between settled and mobile lifestyles that forces a reconsideration of traditional visions of the cycles of sedentarization and nomadism.

(vi) Be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.

North-Arabian inscriptions have allowed scholars to identify Wadi Rum with Iram, where the tribe of 'Ad lived. The site and the tribe are mentioned in the Qur'an (89: 7-8), the Holy Book for over one billion Muslims. The Qu'ranic story of Iram, “the place of the columns”, exemplifies divine punishment over a corrupt people. Allah left Iram buried under the sands of the desert, making Iram and 'Ad legends to be spoken of and an exemplary lesson of warning.

The Qur'anic story of Iram has given rise to one of the most popular tales in Islamic literature recalled in several works of major importance. It tells of a South Arabian Iram, a marvellous columned city built by Shaddad bin 'Ad. There has long been speculation as to its location, but the identification of Wadi Rum with Iram and the tribe of 'Ad is the only one supported by numerous epigraphical Nabatean and Thamudic inscriptions, and therefore the only one based on sound scientific evidence. It also matches the particular geomorphological features of the Wadi Rum Protected Area where the Sandstone Mountains were shaped into formidable natural columns.

3.b Proposed Statement of Outstanding Universal Value

The Wadi Rum Protected Area is a mixed property composed of scenically stunning and tightly interwoven natural and cultural attributes in a lived-in desert environment.

The Area is the product of millions of years of geological processes, and thousands of years of interactions between humans and nature in a hostile desert environment. Wadi Rum is the iconic superlative exemplar of a highly varied desert landscape that is the result of the interplay between complex geological controls – both structural and lithological – and climatic influences that have fluctuated considerably over the long period that it has taken the landscape to evolve. Geology has been the ever-present artist; a sculptor playing with abundant possibilities of form, colour and texture.

Widespread petroglyphs and inscriptions eloquently attest to 12,000 years of human history and the very early development of alphabetical writing while on-going land use reflects a traditional but dynamic Bedouin culture. North-Arabian inscriptions have allowed scholars to identify Wadi Rum as a site specifically mentioned in the Qur'an (89: 7-8), the Holy Book for over one billion Muslims. This unique property satisfies all key requirements for an effective long term management and protection process that balances the visions and needs of a wide spectrum of stakeholders.

The property manifests outstanding universal values with respect to five separate, but fully complementary, World Heritage criteria. These can be summarized as: **(iii) exceptional testimony to a cultural tradition or civilization, (v) outstanding example of human interaction with the environment, (vi) association with literary works of universal significance, (vii) significant natural beauty and aesthetic importance, and (viii) significant geomorphic features.**

Criterion (iii): The Wadi Rum Protected Area bears a unique testimony to the practice of rock art and inscriptions that has been on-going for millennia. The combination of 25,000 petroglyphs with 20,000 rock inscriptions, and their continuity over a period of at least 12,000 years, sets Wadi Rum apart from other rock art and/or inscription sites. The petroglyphs, representing humans and animals, are engraved on boulders, stones, and cliff faces. They trace the evolution of human thought; the long-term patterns of pastoral, agricultural, and urban human activity in the Arabian Peninsula; and the environmental history of a distinct region that has evolved climatically from mildly humid to semi-arid. The engravings indicate an elaborate sense of aesthetics and a

pictorial culture. Numerous inscriptions in four different North-Arabian scripts testify to the very early emergence of alphabets from iconic representations, and widespread literacy among pastoral societies in the Arabian Peninsula. Thus, the open-air library that is Wadi Rum is a critical site for the study and understanding of the evolution of aesthetics, writing and literacy.

Criterion (v): The variety of landforms at Wadi Rum has played an essential role in fostering human settlement and, as a result, the development of sophisticated intellectual activity that is documented by abundant petroglyphs and rock inscriptions. This graphic testimony to diverse cultural traditions and civilizations over millennia is one of the world's richest sources of documentation. Nowhere else in the world can one find such a wealth of information that enables the study and understanding of the continuum of settled and mobile lifestyles in a desert landscape. Here is a record of resource use in this desert and mountain environment illustrating the adaptability and ingenuity of human communities who have made the most of scarce resources to sustain continuous presence after the climate became dryer in the Bronze Age (3rd millennium BC). This is why the significance of the Wadi Rum Protected Area goes far beyond its north-Arabian context as it represents a uniquely documented instance of human interaction with dry environments of relevance to other arid areas worldwide.

Criterion (vi): North-Arabian inscriptions have allowed scholars to identify Wadi Rum with Iram, where the tribe of 'Ad lived. The site and the tribe are mentioned in the Qur'an (89: 7-8), the Holy Book for over one billion Muslims. According to evidence derived from numerous inscriptions in various alphabets, ancient Iram and the tribe of 'Ad can only have been located in Wadi Rum. The Qu'ranic story of Iram, "the place of the columns", exemplifies divine punishment over a corrupt people. Allah left Iram buried under the sands of the desert, making Iram and 'Ad legends to be spoken of and an exemplary lesson of warning.

Criterion (vii): The aesthetic beauty of Wadi Rum is produced by an astonishing and iconic assemblage of landforms. The continuous uplift, tectonic faulting, weathering and erosion have transformed the mountains of Wadi Rum into a visual tableau of towers, pyramids, domes, narrow gorges, mushrooms, wide flat-bottom valleys called "Wadis", sand plains, and sand dunes. Soaring mountain peaks rise vertically from colourful sand plains and dunes. Summit shapes trace pillars, castles, domes and pyramids in the desert sky. Loose sands climb on the cliffs and fill wide wadis. Vertical cliffs with long vertical striations have been sculpted to produce rounded columns of coloured sandstones often featuring magnificent stone arches, inselbergs

and mushrooms. To eloquently express his overwhelming awe when he first entered Wadi Rum in 1916, T. E. Lawrence recorded this passage: "Our little caravan grew self conscious, and fell dead quiet, afraid and ashamed to flaunt its smallness in the presence of stupendous hills" (Seven Pillars of Wisdom, 1926: 342).

Criterion (viii): The Wadi Rum Protected Area holds an exceptional record of the intricate interactions between passive and active geological controls on the evolution of a uniquely diverse landscape within a true present-day desert setting. The present landscape derives from the interplay of changing environmental conditions, lithology, uplift, faulting, weathering and erosion over tens of millions of years and presents an unrivalled level of complexity and inter-dependence. Ongoing weathering and wind erosion sculpts the sandstone between the joints to produce long rounded sandstone columns rising to over 1800 metres asl. Flat-bottom valleys or "wadis", filled with shifting sands and occasional low dunes, are another unique landform that adds to the diversity of the landscape. A continuous line of mud flats (Qaa') lying at 800 metres asl run along the boundaries of the sand stone form a notable case of geomorphic contrast.

According to experts in desert landforms, Wadi Rum is the best place in the world to observe such high cliffs, extraordinary columns and niches, and the full sequence of rock falls of various types produced by weathering of the rock mass. While the landforms of this incredible setting are, without doubt a unique work of art, they also serve to help us interpret the geology as a basic conditioning element of the desert ecosystem. It reveals to us in its magnitude and subtleties the full story of Rum as told by nature.

Integrity and Authenticity: The Wadi Rum Protected Area is the largest protected area in Jordan and the Levant region. It was established in response to an IUCN report in 1979 that proposed a national network of protected areas to conserve the representative desert landforms and ecosystems along with their associated cultural values. Covering more than 72,000 ha, the Protected Area encompasses the finest examples of the target natural and cultural values and attributes that are the basis for the claim to outstanding universal value. The area includes the majority of the iconic sandstone landforms in Jordan and the wider Hisma desert, intermingled with their representative desert ecosystems, habitats and species along with their associated cultural values. The Protected Area also encompasses the majority of the rock art and inscriptions of the Hisma basin along with the historical testimonies demonstrating the long established interaction between man and his environment including the Qu'ranic evidence of record of Rum to be the place of the great tribe of Ad.

Governance and Management: the Wadi Rum Protected Area lies within the Boundaries of the Aqaba Special Economic Zone Authority; one of Jordan's strongest decentralised governance structures. The Protected Area satisfies all key requirements for effective long term management and protection of the area's outstanding universal values. The boundaries for the area were designated and delineated though a participatory process with stakeholders, which resulted in special legislation for Wadi Rum. A comprehensive management plan, also the result of a thoroughly participatory process, was developed for the area in 2003 and a full review is planned by the end of 2010. The Protected Area is managed by a competent, well equipped staff that has ample monitoring and enforcement capabilities, and is adequately backed by legal mandates and regulations.

The Management Plan review process will provide an opportunity to develop a strategic approach to the analysis and adoption of actions to deal with management issues requiring long term attention. These key issues include (1) governance arrangements, (2) the impacts to desert ecosystems and aesthetics generated by the use of private vehicles to transport visitors to major attractions, (3) expansion of the Wadi Rum Village in response to natural growth, (4) diversification of the site's Management Committee to include a broader spectrum of stakeholders, and (5) transformation of Wadi Rum into a model zero carbon Protected Area.

Political Support: In his world renowned piercing vision, the late King Hussein of Jordan once said: "Wadi Rum is not for a human; it is for humanity". This demonstrates Jordan's long established understanding of the global significance of the Wadi Rum Protected Area and its commitment to conserve it and present it for the benefit of future generations. His successor, King Abdullah II, firmly follows on his father footsteps and considers the Wadi Rum Protected Area a national icon to be safeguarded as a common heritage of humanity.

3.c Comparative Analysis

The Wadi Rum Protected Area is proposed for nomination as a mixed natural and cultural site under criteria (iii), (v), (vi), (vii) and (viii).

Due to the number of criteria selected, the comparative analysis included herewith builds on comparing Wadi Rum to a series of other sites of mixed values, or of either natural of cultural value based on their relevance (see sets of values used for comparison below), be they inscribed on the World Heritage list or not. It is understood however that comparison between a mixed sites and sites whose values lie either in their natural or cultural features can only be partial.

The list of sites selected for comparison includes:

At the national level

For *mixed* natural and cultural values; (the remaining areas of the Hisma desert not included in the Wadi Rum Protected Area).

For *natural* values; (the Dana Biosphere Reserve and the Mujeb Nature Reserve).

World Heritage sites

Two World Heritage properties that are relevant because of their regional *cultural* context; (Petra in Jordan, and Al-Higr in Saudi Arabia).

One regional and one international World Heritage properties that share close *mixed* natural (sandstone formations) and cultural values (human cultures in an arid or changing environment); (the Tassili N'Ajjer in Algeria, and the Uluru-Kata Tjuta National Park in Australia).

One World Heritage site **(**Pyrenees - Mount Perdu, in France and Spain) which, although in a very different geographical context, shares a *mix* of natural (mountain environment) and cultural (pastoral societies) values also comparable with those of the Wadi Rum Protected Area.

One World Heritage property inscribed on account of its remarkable rock art (the Petroglyphs within the Archaeological Landscape of Tamgaly in Kazakhstan), out of several such sites inscribed on the World Heritage list,

because of comparable cultural contexts (pastoral societies and occupation to the present).

One World Heritage property inscribed on account of its remarkable *sandstone* geomorphological features (Purnululu National Park in Australia).

Other international sites of relevance

Three sites that are not inscribed on the World Heritage list but that present remarkable sandstone formations (Monument Valley and Canyonlands, both in the USA, and Danxia Landform of China, currently included on the Tentative List with nomination process in progress).

The set of values used for comparing Wadi Rum with other properties are:

- Iconic assemblage landforms forming an integrated desert landscape.
- Occurrence within a true desert ecosystem setting.
- Size of the land form assemblage.
- Size of the land form assemblage in the context of its geographic unit.
- Magnitude of manifestation of rock outcrops.
- Aesthetic significance - number of visitors.
- Aesthetic significance - world famous citations.
- Number of rock art and/or inscription within a geographical unit.
- Historical age and continuity of rock art and/or inscription.
- Site illustrating interaction of human communities with the natural environment.
- Affiliation of site to globally spread religious beliefs (as different from value to beliefs of local or indigenous peoples).
- Overall state of conservation of cultural and natural values.
- Geographic distribution (national, regional, global).

The following table summarises the results of the comparative analysis undertaken for Wadi Rum:

	Value	1	2	3	4	5	6	7	8	9	10	11	12	13
	Site													
National	Dana Biosphere Reserve	+	-	-	-	-	+	-	-	-	+	-	++	-
National	Mujeb Nature Reserve	+	-	-	+	+	+	-	-	-	-	-	+	-

	Remaining sand stone of Hisma desert	++	++	+	+	+	+	+	+	++	+	-	-	-
	Petra World Heritage Site	+	-	-	+	+	++	++	-	-	++	+	+	-
	Wadi Rum	++	++	+	++	++	++	++	++	++	++	++	+	-
Regional	Al Higr WHS – Saudi Arabia	-	-	-	-	-	-	+	+	+	++	-	++	+
	Tassili N'Ajjer – Algeria	+	++	++	++	+	+	+	++	++	++	-	++	+
	Wadi Rum	++	++	+	++	++	++	++	++	++	++	++	+	-
International	Petroglyphs of Tamgaly - Kazakhstan	-	-	-	-	+	-	-	++	++	++	-	++	++
	Uluru-Kata Tjuta National Park – Australia	+	-	++	+	+	++	+	-	-	++	-	++	++
	Pyrenees Mount Perdu France and Spain	+	-	+	+	++	++	++	-	-	++	-	+	++
	Purnululu National Park – Australia	+	+	++	+	+	+	++	-	-	-	-	++	++
	Danxia Landform – China	++	-	+	+	++	++	-	-	-	-	-	+	++
	Monument Valley – USA	++	+	++	+	+	++	++	-	-	-	-	-	++
	Canyonlands – USA	++	-	++	+	+	++	++	+	++	-	-	+	++
	Wadi Rum	++	++	+	++	++	++	++	++	++	++	++	+	-

Important Note: Marks in the table represent relevance of the site(s) against the set of values numbered from 1 to 13, with (-) being the lowest value and (++) representing the highest.

Comparative Narratives

Nationally

Wadi Rum is Jordan's prime protected area; it represents more than 60% of all natural protected land and sea in the county. No other protected area shares Wadi Rum's unique high desert setting and characteristic landforms. Two protected areas share natural values with Wadi Rum; the Dana Biosphere Reserve and Mujeb Nature Reserve, and have high national values for biodiversity and aesthetic importance. Some of these values are due to geomorphological formations including sandstone. Nonetheless, the proportion of representation of the landforms within these two reserves is not nearly comparable to that of Wadi Rum in terms of variety, magnitude, size, and general setting. On the other hand, Dana Biosphere Reserve and Mujeb Nature Reserve have little significance in terms of rock art, inscriptions, and archaeological remains, and no specific religious significance.

While the Wadi Rum Protected Area possesses all the key components of the Hisma desert land type, it is far from "typical" in terms of landscape. The dramatic, sheer-sided mountains are not characteristic Hisma landscapes. The latter largely consist of gently undulating gravel plains with occasional basins of sand. This is one of the characteristics that make Wadi Rum exceptional and unlike any other part of the Hisma desert in Jordan or Saudi Arabia. In terms of the cultural value of the Wadi Rum Protected Area, archaeological and epigraphical surveys undertaken in other areas of the Hisma desert (Jordan and Saudi Arabia) confirm that nowhere is there such a density of human traces in the form of rock art and inscriptions, or a settlement as important as Rum (Iram). This is because Rum was the main focus for human communities in the whole Hisma desert due to the presence of the largest perennial springs and outstanding outcrops, which were important for shade, wind and dust protection, and also contributed to mountain diversity.

Despite the above, Wadi Rum was compared to the areas surrounding the Protected Area. There, the assemblages of landforms are the only ones in the Hisma desert which share almost the same natural values with Wadi Rum. Considering the fact that a significant proportion of these areas is included in the Buffer Zone, it makes their significance vis-à-vis Wadi Rum more complementary than competitive.

On the cultural side, these areas also contain significant rock art and inscriptions, however, with one exception (Jabal Kharazeh), not with the same density as inside the Protected Area. This is again explained by the fact that the more areas are distant from the site of Rum settlement, the less densely

occupied they have been. It remains that Upper-Palaeolithic sites that have not been surveyed or excavated might be located on the shores of large mud-flats in these areas. Finally here; Jabal Kharazeh lies within the buffer zone.

Petra World Heritage Site is inscribed under criteria (i), (iii) and (iv) as a cultural site. The criteria over which to evaluate the significance of Petra (as built archaeological heritage) are markedly different from those over which to evaluate the Wadi Rum Protected Area (interaction of human communities with an arid environment, rock art and inscriptions). Petra exemplifies the urban development, and artistic and architectural achievements of one civilisation, the Nabataeans, whereas the Wadi Rum Protected Area exemplifies the durability, adaptability and creativity of human communities over millennia with the passage from foraging to agriculture, and the complementarity between mobile pastoral and settled lifestyles. In addition, if the shrine of Nabi Harun (Prophet Aaron) in Petra can be recognised as of some importance to the three monotheistic faiths, it has not been made a criterion for the inscription on the World Heritage list. It is one of several similar tombs of the Biblical and Qu'ranic prophets which are spread over the Levant and does not qualify as being of outstanding religious value. For its part, Wadi Rum enjoys a great advantage over all the above national sites in terms of religious significance due to its association to the Qu'ranic Iram and the meaning of this story for Muslims worldwide.

Regionally

Al Higr in Saudi Arabia can be best compared with Petra as another example of outstanding Nabataean architecture carved in sandstone. For the same reasons as Petra, its significance is limited to one civilisation and its natural features, though beautiful, do not compare with those of Wadi Rum. Al-Higr also possesses a large number of inscriptions that are of extraordinary value for linguistics study. More ancient rock art is not outstanding however. As is that case with Petra, Al-Higr should be seen as complementary with the Wadi Rum Protected Area in terms of human history and settlement patterns in the north of the Arabian Peninsula.

The Tassili N'Ajjer in the Algerian Sahara stands out as the World Heritage site most comparable to the Wadi Rum Protected Area in terms of natural and cultural values. That site has several key advantages over Wadi Rum in terms of size and geographic extent of its true desert landforms. It also includes one of the world's most important groupings of rock art and inscriptions with great historical and cultural significance. Nonetheless, Wadi Rum offers substantial global values when compared to those of the Tassili N'Ajjer. From the point of view of natural forms, Wadi Rum embraces much more intense

structures of the iconic landforms that rise higher above the highest magnitude of those in the Tassili N'Ajjer within a given unit of high desert setting. The intensity of Wadi Rum's landforms and their integrated nature along with their specific characteristics are more impressive than that of any other area in the Arab states region.

Culturally, and although there are no cave paintings in the Wadi Rum Protected Area, the latter enjoys the advantage of older and more continuous carved drawings, inscriptions and traces of human presence than those found in the Tassili N'Ajjer. In Wadi Rum, these are located within a much smaller geographical unit than the rock art of the Tassili N'Ajjer. Finally, Wadi Rum embraces the Qu'ranic relevance of Iram which reflects global religious significance absent in the Tassili N'Ajjer.

It is important to note that the inclusion of the Wadi Rum Protected Area in the World Heritage list does not undermine or is undermined by the importance of the Tassili N'Ajjer or other regional properties. To the contrary, it represents an effort of greater complementation for a region that is under-represented in the World Heritage list particularly in terms of natural and mixed sites attributes and characteristics.

Internationally

Of all the World Heritage sites inscribed as mixed sites under a combination of criteria iii, v, vi, vii and viii only a few contain global significance for representing assemblages of integrated landforms within a true desert setting along with their association with cultural significance related to human interaction with the environment in an arid area, and rock art and/or inscriptions. In addition, no other such site has a global religious significance, although several are important spiritual places for indigenous peoples.

Comparing Wadi Rum to these areas is not an easy task as Wadi Rum presents a very special setting mostly relevant to the regional biogeography, history and cultural heritage. It was decided to limit the rating of Wadi Rum against three sites with a combination of values that make the comparison with the Wadi Rum Protected Area at least partially relevant. Finally, one World Heritage property inscribed for its natural value was considered.

The petroglyphs within the Archaeological Landscape of Tamgaly (Kazakhstan) are inscribed under criterion (iii) as a dense and coherent group of some 5,000 petroglyphs, with sacred images, altars and cult areas. Together with their associated settlements and burial sites, they provide a substantial testimony to the lives and beliefs of pastoral peoples of the central Asian

steppes from the Bronze Age to the present day. In Tamgaly and in most other sites of rock art (such as Gobustan, Valcamonica, Matobo Hills) rock art is associated with archaeological sites, including of a religious nature. Some of these sites have been continuously inhabited from Prehistory to the present and in several cases they are still central for the religious traditions of living indigenous communities. In a similar way, the value of the Wadi Rum Protected Area lies not only in the artistic and creative nature of its rock art and inscriptions. In association with archaeological elements, petroglyphs and inscriptions are testimonies of the particular relationship human communities have continuously maintained since Prehistory with a changing environment in an arid mountain landscape. In addition, it is the continuity of the practice of using rocks for drawing or writing, and the importance of inscriptions for the history of writing, that makes Wadi Rum stand out among other comparable sites where the practice of rock art, although at times more sophisticated, is either attested within a more limited time-frame, or not associated with writing. Finally, the development and spread of Islam from within a cultural and geographical area to which pre-Islamic Iram belonged, and the significance of the Qu'ranic story associated with the site, transformed the religious importance of Rum from a local to a global one.

The Urulu-Kata Tjuta and Purnululu National Parks in Australia are vast areas of extended landforms, biodiversity and cultural significance. However these properties does not compare well with Wadi Rum when addressed under the above selected set of natural and cultural values. Wadi Rum embraces more intensity of high true desert with a magnitude of up to 1,000 m above the valley floors. Only half of that amount is evident in the case of Uluru and even lower in Purnululu. The variety of the landforms, their colours, and products are also added advantages for the Wadi Rum Protected Area. The interaction of human communities with their environment in Uluru and Purnululu on one hand and Wadi Rum's from the other are not comparable because of the difference in lifestyles between the communities of foragers who have lived in Uluru/Purnululu, and pastoral communities of the northern Arabian Peninsula. They are also not comparable because of vast differences in the development of human history and civilisation in Australia and the Near East. More specifically, the human culture associated to Uluru is extremely ancient but has not left traces such as inscriptions and built settlements. Moreover, Urulu is a major sacred site for some of Australia's Aboriginal communities, whereas Wadi Rum is significant for the Muslim community worldwide.

The Pyrenees - Mount Perdu (France and Spain) is vast mountain landscape and a rare mixed site comparable with Wadi Rum although its landforms, geographic and climatic contexts are markedly different. The rationale for the

comparison lies in its scenic beauty associated with a socio-economic structure that has its roots in the past and illustrates a pastoral mountain way of life that has become rare in Europe. Here, the two sites are compared more over their cultural attributes rather than their natural ones. Naturally, they partially lie under the same criteria, nevertheless in almost totally different climatic and geomorphic setting; hence they both represent valuable additions to world heritage under that criterion that are not comparable. The Wadi Rum Protected Area, for its cultural part, exemplifies the longevity of pastoral nomadism as a way of life in the arid environment of southern Jordan, a lifestyle that has also become rare in other arid areas of the Middle East and North Africa. Furthermore, unlike Mont Perdu, traces of human occupation and interaction with the natural environment in the Wadi Rum Protected Area are of much greater antiquity and of a different nature (rock art and inscriptions).

Outside the world heritage list, Monument Valley in the Arizona desert, the Canyonlands National Park in Utah, and the Danxia Landform of China were examined for comparison with the Wadi Rum Protected Areas.

Monument Valley and Canyonlands National Park are vast and spectacular and have an advantage over Wadi Rum in terms of extent. Nevertheless, Canyonlands, whilst an area of arid sandstone, differs markedly in that the sandstones are bedded and less massive producing characteristically V shaped valleys with steep slopes. On the other hand, whilst Monument Valley includes massive sandstones similar to Wadi Rum, it is in reality a plains landscape within which a limited number of isolated hills exist. These are iconic examples of mesas and buttes, but they are not comparable to the integrated landscape of Wadi Rum and lack the range and complexity of features.

Not unlike mixed sites in the World Heritage list, both represent a totally different cultural and historical context and do not compare well with Wadi Rum in terms of history and traces of human occupation, although Canyonlands has some rock art and is of spiritual value for the native Pueblo peoples.

Finally, the Danxia Landform of China is a remarkable sandstone formation that however does not possess iconic features as outstanding as those of the Wadi Rum Protected Area and is located in a different bio-geographic setting (humid area) which is not closely comparable to that of Wadi Rum.

3.d Integrity and Authenticity

Statement of Integrity

The Size of the Protected Area

Wadi Rum protected area is the largest protected area in Jordan. The original proposal of the area was part of the 1979 IUCN study on the national network for protected areas. The main justification at that time was the representation of the desert ecosystems and associated land forms (i.e. sandstone and granite).

The area established today includes all the areas which were proposed in the above mentioned report, considering that the area underwent major land use development and alterations. This is a clear indication not only of the great extent of resilience of such harsh landforms and ecosystems, but also the high level of political and institutional commitment of the government and people of Jordan to protect their key natural and cultural heritage areas.

Moreover, in 2002, the government of Jordan - based on the result of extensive research and analysis in and around the area - developed, endorsed and implemented a plan for the extension of the Protected Area to include more of its representative land forms, habitats and cultural values, resulting in a 18,000 ha increase in its size from 54,000 ha in 1997 to 72,000 ha in 2002.

The Protected Area in its present size comprises the largest representation of the targeted natural and cultural values and attributes respectively proposed to form the case for outstanding universal value. The Area includes more than 70% of the iconic sandstone landforms intermingled with their representative desert ecosystems, habitats and species along with associated cultural values presented by world class testimonies of ancient preserved rock art, inscriptions and archaeology to collectively form an outstanding case of integrated values of natural and cultural heritage.

The size of the property was used as one of the main evaluation criteria used for the designation of its protection and the development of the management plan. See Wadi Rum management plan.

The buffer zone of the protected area comprises an additional 56,300 ha of the same target land form and its associated natural and cultural values. As a result, the protected area proper and the buffer zone embrace almost all the targeted landforms, ecosystems and rock art, inscriptions and archaeology within Jordan resulting in the inclusion of more than one percent of the country within one single protected area.

The Boundaries

The protected area boundaries were described in the special legislation developed and endorsed for Wadi Rum. The Wadi Rum legislation was based on internationally recognised standards for the establishment and management of protected areas, and discussions with the various stakeholder groups. A map defining the boundaries of the sites is an integral part of the legal document produced. See Wadi Rum regulation no 24 for the year 2001.

Natural physical structures were used to define the boundaries of the Protected Area from its eastern, western and southern boundaries using main wadis and mountain ranges. As for the northern boundaries of the Protected Area, the main access road coming from the Aqaba main junction represents the approximate northern boundaries; it is supported by the use of non intrusive cone structures sensitive in colour and size to the Protected Area's values and compatible with local traditions and landforms to align the exact boundaries.

The boundaries are known to all citizens, government institutions as well as private sector and visitors. The local communities were heavily involved in the final definition and delineation of boundaries to ensure that no private lands or properties are included in the final demarcation. The names of the boundaries land marks all use local and traditional nomenclature to ensure the best levels possible for communication and information sharing. A system of road signage was also put in place to provide the basic guidelines of access and use, and to support visitors' orientation.

The Protected Area enforcement and monitoring scheme is one of the main means used for monitoring the boundaries and compliance related to access and use. The enforcement team uses its legal mandate and official regulation to support their dialogue with possible violators and trespassers.

High quality maps were developed and are available on site and included in all communication, promotional give-away materials.

It is important to note here that the Rum Village although being part of the Protected Area and lied within its boundaries, it is not being proposed as part of the world heritage nomination area (core zone). See nominated area map in executive summary and sections 1 and 4.

The Buffer Zone

The Protected Area lies within the wider geographical scope of the legally recognized ASEZA land use plan established under ASEZA law no 32 the year of 2000, and its associated regulations. The total area around Wadi Rum Protected Area which is subject to this law and set of regulations exceeds 300,000 ha. Due to the fact that not all these areas can be included in the buffer zone in practical terms, a decision was made by ASEZA following thorough discussions with stakeholders and analysis to include only 60,000 ha as a buffer zone for the Protected Area within its world heritage arrangement.

The size of the buffer zone was identified by mapping areas which lie within a five Km radius from the Protected Area boundaries and to include seven land use classifications as defined by the general land use plan of ASEZA as follows:

No.	Buffer Zone - Sub zones classification	Area (ha)
1	Agricultural area – future development	4,670
2	Tourism development area	7,545
3	Non-irrigated agriculture area	7,702
4	Tourism area – future development zone	13,353
5	No development zone	10,786
6	Rangeland zone	7,858
7	Sport tourism zone	6,647
8	Special Management zone	876
9	Non accessible areas	615
Total		60,000 ha (rounded)

The ASEZA regulations most relevant to the Wadi Rum Protected Area context are:
1- Regulation no 21 of 2001 – Environmental Protection
2- Regulation no 6 of 2001 – Development and Management
3- Regulation no 7 of 2001 – Sale and Lease of Land

The teams of ASEZA's various departments will ensure the effective enforcement of the buffer zone regulation as described in the above mentioned regulations to ensure full synergy between their conservation requirements and development opportunities all as part of a world heritage site.

Further under this heading, an agreement with the Ministry of tourism is currently being negotiated to handover the legal and enforcement mandates of the ministry to ASEZA as part of a delegative power of the Minister. This is going to be an instrumental step towards a more effective and comprehensive planning and monitoring program related to tourism development and management around the Protected Area; for it is the activity of most potential impacts and interaction with the Protected Area.

The Protected Areas faces no dramatic threats with respect to safeguarding the values included in the selected criteria for World Heritage Nomination. The above section demonstrates the strong level of effective management adopted for the area to ensure its long term sustainability.

Nonetheless, tourism activities represent a real concern for the well-being of the Protected Areas, especially with respect to criterion (vii). This is particularly true in relation to off road excursions and wilderness camping in terms of numbers and distribution within the resource use zone. ASEZA is very aware of the challenge exerted by these activities and has developed a clear emergency strategy – to be put in place and fully implemented by the end of 2010 - for ensuring the avoidance of long term impacts of visitation on the Protected Area through:

- Development of an agreed long term vision for Wadi Rum to fulfil its national and international obligations as a prime Protected Area and a potential World Heritage Site.
- Review and strengthening of the enforcement of its regulations.
- Review and endorsement of the new management plan.
- Enhancement of the scientific monitoring and evaluation.
- Endorsement and designation of the buffer zone.
- Enhancement of sound land use planning and enforcement around the Protected Area.
- Realization of the proposal for the Protected Area expansion.
- Introduction of electric or hybrid vehicles for 4x4 desert tours.

ASEZA, based on the recommendation of the UNESCO World Heritage Centre and its Advisory Bodies, is committed to expand, amend, and restructure the legal setting of the Protected Area and its buffer zone as suits

the requirements for world heritage sites and their effective establishment, management and sustainability.

Authenticity Statement
Status of Rock Art and Inscriptions

The more than 45,,000 examples of rock art and inscriptions concentrated in Wadi Rum are an open air library of images and writing, the authenticity of which has been proven by scientific research and corroborated by evidence found through excavations of nearby prehistoric and historic archaeological sites. These clearly document human presence and a continuity of cultural practices as foragers, agriculturalists, pastoralists, and traders over an extremely long period of time, linking the very distant past with the rich living heritage of present day communities of the Arabian Peninsula.

These extraordinary testimonials to sophisticated intellectual activity and livelihoods over a period of at least 12,000 years remain in their original setting, largely unaltered except for the effects of weathering. Modern graffiti have been added in a few of the more accessible sites, but this has decreased significantly since the establishment of the Protected Area, and no other intrusive elements have been introduced. Likewise, the Qu'ranic story of Iram, and its mention in the Thousand and One Nights, are authentic expressions of Islamic literature, and the identification of Wadi Rum as the site of Iram is supported by credible scientific evidence derived from numerous Nabatean and Thamudic inscriptions in the area.

Section 4: State of Conservation and Factors Affecting Management

4.a Present State of Conservation

The Wadi Rum Protected Area is the largest protected area in Jordan and the Levant region. Covering 74,200 hectares, it represents more than 60% of all terrestrial areas protected by Jordanian law. It is the best example of Protected Area Management in the country in terms of legal and regulatory systems, human and financial resource investment and participative management.

A national protected areas network review report developed and published by RSCN in 2009 using international guidelines adopted by IUCN for the assessment of protected area management effectiveness, confirmed that the conservation of Wadi Rum Protected Area from the date of the development of the first management plan has been satisfactory. Wadi Rum Protected Area marked 76 points out of 94, which clearly indicates improved levels of management effectiveness in relationship to various components of the Protected Area.

Nonetheless, the report highlighted several important areas for improvement and development especially in regard to effective visitor management and capacity building, all of which are planned to be integrated into the new management plan anticipated for 2011 to 2015. Issues identified as priorities for planning and interventions include:

- Devise a long term development strategy for Wadi Rum with an agreed shared long term vision.
- Update all baseline data (environmental, cultural, socio economic, land use, institutional).
- Review the legislative framework and regulations.
- Review the tourism development and visitors management plans.
- Review the conservation zoning plan.
- Review land use planning and management in the buffer zone.

Subsequent to the report, it has been suggested that as part of the revision of the management plan a commitment be made to converting Wadi Rum into a carbon-free protected area with all that implies for the re-development of the area's infrastructure.

4.b Factors affecting the Wadi Rum Protected Area

(i) Development Pressures (e.g. encroachment, adaptation, agriculture, mining)

Encroachment

The Wadi Rum Protected Area lies within the wider boundaries of the Aqaba Special Economic Zone which, in addition to the Wadi Rum regulations and bylaws, have developed and put in place a comprehensive land-use plan for the whole of the region falling under its jurisdiction. The land use plan is associated with several governing acts and by-laws governing land use around the Protected Area. These include urban organization, tourism development, agriculture development and environmental assurance. This arrangement is considered a primary vehicle for management of the buffer zone around the Protected Area. The new management plan for 2011-2015 will include measures to achieve full synergy and close coordination between the Wadi Rum Area Management Unit and other units in charge of land use management and control outside the Protected Area.

To date, there are no encroachments into the Protected Area from activities surrounding it. However, some activities are close to the Protected Area boundaries and will be fully addressed as mentioned above. This includes mainly tourism and agricultural activities as well as urban and infrastructure expansion and development.

Rum Village lies within the Protected Area and is the only settlement inside the boundaries. Its community is part of a wider network of Bedouin tribes stretching as far as Aqaba and Saudi Arabia. Nonetheless, and as mentioned before, the village is not included in the area nominated for the world heritage inscription. This is of vital importance as it aims at:

- Ensuring that the village does not represent a compromising element as it was established as a relatively new village before the establishment of the protected area.
- Ensuring the strict control of the village boundary line and any possible legal or illegal expansion by excluding it from any delineation ambiguities. The village wall against the nominated area boundary line is precisely established upfront to avoid any future misinterpretation of the village development in regard to the nominated property.

- Allowing the village to be an integral part of the nominated area buffer zone, however, falling under a more extensive set of regulations and enforcement schemes being also part of the protected area proper.

To minimize the impact of expansion of Rum Village on the Protected Area, the government of Jordan defined the village boundaries, restricting its area to 40.4 ha. All other settlements lie outside the Protected Area. Further, an integrated new village structure is currently under development for the village. The new structure is being fully developed based on the new vision for the area as a world heritage site. The structure will be developed in full participation of local and national stakeholders and will include an integrated set of environmental, socio economic and institutional components produced using a modern engineering practice fully aligned with international best practice and guidelines.

Considering the ASEZA driven active management intervention, the village today does not represent a source of significant impact on the Protected Area nor the nominated property; nonetheless, the planned monitoring and strcture and its associated enforcement program and the anticipated high level of involvement of local residents in their development and implementation will contribute significantly to safeguarding the Protected Area against any possible future encroachment or impacts.

In addition to Rum village there are other settlements outside the Protected Area; Shakriyya, Diseh and Tuweisah, Mnaisheer, Al-Ghal, and Twail, none of which present any threat of encroachment into the Protected Area.

Finally under this heading, there is only one stretch of paved road entering the Protected Area from its north east entrance to Rum village passing through the Protected Area headquarters and visitor centre. The full length of the road is around ten kilometres and no other roads or associated infrastructures are permitted or planned within the Protected Area. Here again, the visitor centre and paved road leading to the Rum village are excluded from the nominated world heritage property and fall under the same governance and management arrangements anticipated for the village.

Agriculture

There is virtually no agriculture inside the Protected Area. A few relict agriculture fields are evident but none of these are used anymore. A couple of olive groves in the distant Wadi Sabit are the only remaining areas still cultivated. The protected areas regulation prohibits the establishment of any new agriculture activities within the Protected Area with the exception of the household gardens in Rum village as part of its special arrangement.

Several fenced fields were scattered around the Protected Area. The current use of these fields is not entirely clear, although in the past they were used to farm barley. The investment in barley farming is no longer worthwhile due to a succession of drought years in addition to the restrictions of the Protected Area.

Mining

The Protected Area is located in the south of Jordan, which has significant mineral resources, although there is no specific study on the minerals that occur only in the Protected Area. The economically valuable minerals and rocks known to be present in the general area are quartz, feldspar and granite.

No mining activities take place or are planned nor will be allowed in the Protected Area because its importance for protection and visitation represent the guiding strategy adopted by the Government hence leading to prohibiting all mining permits or even exploration permits as clearly stated in the protected Area by-law.

(ii) Environmental pressures (e.g. pollution, climate change, desertification)

Pollution

Wadi Rum is considered very remote in relationship to main sources of pollution coming from large infrastructure projects, industry or urban centres. Nonetheless, low levels of air and soil pollution caused by agriculture and construction activities occur far around the Protected Area, particularity in the Diseh region but non of which represent any significant impact on the nominated property.

Natural and induced dust may occur in the spring each year for about 50 days, or by the effect of off-road driving vehicles used by local and visitors. The first is known as the Khamaseen dust that arrives to the Eastern Mediterranean from the North African Desert via the Mediterranean cyclones. Wadi Rum, in this case, is not different from other localities in the whole area.

Climate Change and Desertification

No concrete data is available on the impacts of climate change on the various environmental parameters in Wadi Rum. Experts' observations have included several reports on the low likelihood of the ability to measure such impacts on an area comprising a true desert ecosystem such as Wadi Rum. The same statement stands true in regard to the evidence and impact of desertification on the area, noting however that the area has been subject to a relatively long period of extreme drought during the last decade. Further specialised research and monitoring on both phenomena is to be fully addressed in the new Protected Area management plan.

Given the role that protected areas play as examples of sound resource management, the attention and publicity that is generated by World Heritage designation, and the on-going revision of the management plan, it is perceived a good time to consider commitment to management of the protected area as a carbon-free Protected Area. This is anticipated to have major implications for the conversion of current infrastructure, but the costs of this might be offset by the international funding available for climate change mitigation.

(iii) Natural disasters and risk preparedness (earthquakes, floods, fires, etc.)

The source of earthquakes in Jordan is the Dead Sea Transform (DST) which runs through the Gulf of Aqaba, Wadi Araba and the Dead Sea Basin some 40 km west and SW of the Wadi Rum Protected Area. The average slip rate of the Arabian Plate along the DST is 4.5-5 mm/year. This is too small a rate to cause major earthquakes with frequent recurrent periods. Wadi Araba is known to be aseismic or with low magnitude earthquakes, usually 5 or less on the Richter scale. However, the Gulf of Aqaba and the Dead Sea Basin are much more active and in the last decade some earthquakes of 6-7 magnitude on the Richter scale took place in the Gulf of Aqaba several 10s of kilometres away.

The last major earthquake took place some 30 km north of the Dead Sea (more than 250 km north of Wadi Rum Protected Area) in July 1927 with a magnitude of 6.25. As a result, Wadi Rum is not classified by seismologists as a risk zone.

No volcanoes or volcanic activities are reported in the area throughout the Phanerozoic Era (i.e. the last 500 Ma of the Earth’s history). However, there is a basaltic intrusion (dyke) extending in a NW-SE direction some 10 km north of the area along the Guwaira-Mudawwara fault zone. The age of this dyke is

around 20 Ma and seems to be associated with the onset of the DST activities in the area.

The area is too dry and the Wadis are too wide and numerous to support the formation of floods within the area even with torrential rain. No floods are reported or documented in Wadi Rum in the recent past. At certain rainy seasons, Wadi Al-Yutum, a major Wadi bordering Wadi Rum from the west, can have floods in its lower reaches near Aqaba city some 30 km to the west.

Fires are not anticipated in Wadi Rum. Most of the area is covered with sand sheets and dunes with very little vegetative cover. At certain localities, sparse and scattered shrubs, up to 50 cm high are present, but do not support fires. Consequently, neither natural nor man-made fire can take place within the Protected Area or adjacent areas hence presenting no risk factor at all.

Landslides of all types do not take place in the protected area. The lack of rain water, the maturity of the landforms and the absence of active tectonics are behind the non occurrence of landslides in the Wadi Rum Protected Area.

(iv) Visitor/Tourism pressures

Vehicles

A noticeable impact of tourism in Rum is the degradation of the desert landscape by vehicles. Visitors usually take a vehicle tour to the well-known sites and on peak days this can account for around 80 individual tours.

From Rum Village there are around 250 vehicles officially registered and running desert tours and with the vehicles from Diseh Cooperative, the Hashemite Fund, private sector operators and individual 4x4 owners, the fleet of vehicles exceeds 500.

Observations of driving habits in Wadi Rum revealed five main reasons for the excessive track proliferation: (1) soft sandy soils causing deep ruts in vehicle tracks, (2) dust clouds affecting vehicles driving in convoy, (3) time pressures on drivers, (4) competition between drivers, and (5) the use of inadequate 2-wheel drive vehicles.

In the 1999 interim visitor management plan, several measures were adopted to counteract vehicle damage, including the creation of a single track network between key visitor sites, the use of a grading machine to maintain a rut-free surface along the track network, the introduction of a vehicle spacing scheme and better training for drivers. Most of these measures have not been proven

very effective yet which makes the control of vehicle routes in the Protected Area is a top priority for management. The new management plan for the protected area will ensure that the total number of vehicle used for site visitation will be cut in half; more restrictions will be exerted on their distribution and simultaneously a visitors' experience development plan will provide models for alternative more friendly uses of visitors including the discussion on the carbon free arrangement.

Littering

While littering used to be widespread in the Protected Area in its development stage, the litter collection program has improved markedly with the development of the site ranger service, the municipal system and the employment of cleaners based in villages in and around the Protected Area.

A very strong awareness program has always been in place, but more is always needed to extend the process of targeting local inhabitants, visitors and tour operators.

Graffiti

A few of the sites with ancient rock inscriptions are showing signs of modern graffiti usually carved with sharp instruments or occasionally applied with paint. Some archaeologists argue that the ancient rock drawings are, in themselves, a form of graffiti and that modern graffiti will be valuable to the archaeologists of the future. However, the old drawings provide an important documentation of the life-style and resources of the people who once lived in the area and these are fully protected and are not to be damaged, effaced or confused by new carvings from people living outside. It is important to note that the problem has declined rapidly with development of enforcement through ranger patrols and awareness programs.

Camping

Camping itself does not damage the Protected Area but the servicing of campers does create unwanted impacts. The camping regulations and the enforcement program deal with most impacts, such as those caused by vehicle tracks to campsites, parking areas, and the disposal of solid and liquid waste. Solid wastes are transported to the village and safely disposed. Liquid wastes are allowed to percolate in the sand dunes. A comprehensive set of standards and regulations for campsites have been devised and are being applied in the licensing system. Specific areas have also been designated for permanent and semi-permanent sites to facilitate provision of tented accommodation and to

limit environmental impacts all falling in accordance with protected area management zoning scheme.

Climbing

Climbing is a minor activity but it has potential to cause damage, either by direst impact on the landscape or the disturbance to mountain wildlife (including cliff nesting birds) or by dislodging loose rocks and vegetation. Discarded or permanently fixed climbing equipment such as cams, slings and ropes can also be visually intrusive. A code of practice for climbers has been prepared by climbing experts and has been put in place and enforced since 2003.

Special events

Special events like ballooning, micro-light flying, car rallying, camel racing and marathons have been totally prohibited in the Protected Area. Nonetheless, they occur around the Protected Area and very rare incidents of encroachment have been recorded.

Carrying capacity

The approach to carrying capacity for the Protected Area has been to limit access to zones defined within the Protected Area zoning scheme. Under this scheme; 84% of the Protected Area is closed to visitor use – the protection zone. In the rest of the Protected Area the carrying capacity is linked to the number and distribution of services and activities. This was easily done for all visitor activities except the vehicle tours as no agreement on number limits was reached with the local communities and their respective cooperatives.

It has not been possible to reach agreement with local service providers to establish and enforce carrying capacity limits through voluntary user controls. . In response, the Protected Area Management Unit devotes substantial human and financial resources to obligatory management controls and monitoring of impacts. It is obvious, however, that this is one of the primary topics to be resolved by the new management plan for 2011-2015.

(v) Number of inhabitants within the Wadi Rum Protected Area and the buffer zone

There are six Bedouin tribes living inside or around the Protected Area: Zalabya, Zawayda, Swelhiyyin, ‘Umran Qudhman and Dbour. The majority of these communities are settled in villages, while only a limited number of

families change location throughout the year, moving with their livestock. According to studies conducted in the Protected Area, the latter demonstrate clear seasonal movement both within and outside of the Protected Area.

The Protected Area represents a major source of income for the local tribes in different forms. Some use it for tourism and others for livestock grazing or agricultural activities; as indicated in the table below.

It is very important to mention that these activities are not limited to the Protected Area only; almost all agriculture takes place outside the Protected Area, and tourism and grazing are well shared between inside and outside the Protected Area.

The following table is a profile of Rum village and other surrounding villages, and summarizes their main sources of income:

Settlement	Tribes	Household Numbers	Population	Location	Major Income
Salhiyya	Swelhiyyin	36	220	Buffer zone	E T
Shakriyya	Swelhiyyin	35	140	Buffer zone	ET
Rum	Zalabya Swelhiyyin	120 8	1100 35	Protected Area	T E EL
Disi	Zawayda	210	1550	Buffer zone	E AT
Tuweisi	Zawayda	105	650	Buffer zone	EAT
Mnaisheer	M'zana	40	280	Buffer zone	EAT
Ghal	M'zana	26	300	Buffer zone	EAT

A: Agriculture, T: Tourism, L: Livestock, E: Employment

Summary of numbers:

Area nominated:	1,135 inhabitants
Buffer zone:	3,120 inhabitants
Total:	4,255 inhabitants
Year:	2003

Section 5: Protection and Management

5.a Ownership

Two distinct systems of land tenure are applied to the land in and around the Protected Area - the official and the traditional systems.

Traditional Land Tenure

Traditional land tenure is based on the actual recognition of the historical rights to a piece of land (mainly its use) by other individuals or corporate groups, so the whole system depends on the mutually reciprocated recognition of claims. Challenges usually occur only over new areas of land where no precedence of use exists.

It is vital to note that customary (rather than traditional) land tenure in the area was mostly connected to grazing rights, not to ownership of the land. There is also customary ownership of water catchment and storage installations (but not of natural sources of water), and of cultivated areas, and claims to ownership of built properties (but not of unbuilt or uncultivated pieces of land).

According to the ASEZA plans, Wadi Rum Protected Area includes no legally recognized private lands. Nonetheless, further analysis and review of regulations by ASEZA is planned in regards to resource use rights resources, and ownership of water-related installations. These are part of the long established customary system and sometimes lead to conflicts with the Bedouin.

The traditional (customary) system of grazing rights practiced in Wadi Rum and elsewhere in pastoral areas of Jordan became enshrined in the Rangeland Law in 1971, allowing all individuals and corporate groups common access to (State-owned) land for pastoral purposes. Within the traditional (customary) system, temporary pastoral usage confers no long-term tenure to the user since the land is left unimproved. According to the same system, however, long-term use and development involving significant investment gives priority access rights to that user. The same applies to ownership in the case of agriculture and water-catchment and conservation installations, or built storage vaults.

Current Status of Ownership

All the Wadi Rum Protected Area is part of the ownership of the Government of Jordan, except the land of Rum village, which is privately owned and organised under ASEZA by laws. The land lies within the Aqaba Governorate, which is administered by the Aqaba Special Economic Zone Authority (ASEZA).

Nonetheless, the new management plan will address some critical issues related to recognition and understanding of the customary system of land tenure along with the assurance of synergy between the new ASEZA regulation and the previous rangeland law. This is important to ensure the long term stability and complementary implementation of all valid laws and systems within and around the Protected Area.

5.b Protective Designation

The Government of Jordan recognized the importance of Wadi Rum as early as **1978** when it approved the IUCN / WWF study, which identified twelve sites as potential nature reserves representing the unique habitats and ecosystems occurring in Jordan. Wadi Rum was one of the sites reviewed in this study and proposed as a nature reserve. (RSCN & IUCN / WWF project no: 1591, 1979 A proposal for wildlife reserves in Jordan).

In 1991, the National Environment Strategy for Jordan identified Wadi Rum as an important site, requiring urgent action to ensure its protection. (Ministry of Municipality of Rural Affairs and the Environment- Department of Environment. 1991. National Environment Strategy for Jordan.)

The Protected Area was designated as a Special Regulations Area in two phases; the first was on the15th of **November 1997** following a Cabinet decision. (Number: 27/11/3226). An area of 56,000 ha was designated in this phase. On the 24th of **January 2002** the Cabinet agreed to extend the Protected Area south by 180 km2. (Cabinet decision no: 224/11/1/986). The Special Regulations Area status applies in perpetuity.

In 1998, before the establishment of the Aqaba Regional Authority or ASEZA, the Ministry of Tourism and Antiquities – which was in charge of the main development project in Rum - delegated management of the Protected Area to the Royal Society for the Conservation of Nature in its capacity as the primary national agency responsible for the establishment and management of protected areas under the auspices of the Ministry of Environment (MoEnv). RSCN's intervention program was ratified under a five year contract with the World Bank Project.

In August 2000, ASEZA was established as a replacement for the Aqaba Regional Authority and supported by a framework of new legislation. This legislation enabled the government to endorse Wadi Rum Protected Area regulations in January 2001.

RSCN worked with ASEZA on the development of the Protected Area until **2003.** At that time, site management was handed over to the Wadi Rum Area Management Unit installed in ASEZA which still runs the Protected Area to date and is responsible for the implementation of the management plan prepared by RSCN, covering the period from 2003 – 2007 and later on extended to end of 2010; the anticipated time for the finalization of the development of the area's new management plan 2011-2015.

In 2001, the government of Jordan approved the Wadi Rum regulations and instructions accompanied by the establishment of a special fund called Wadi Rum Protected Area Development Fund with the aim to ensure the financial and institutional sustainability of the management program of the Protected Area. Currently, income from entrance fees and fines goes to the National Treasury and then reimbursed to ASEZA in the form of annual budget allocation. This situation id proposed to be changed to enable the Protected Area is to achieve more autonomy and sustainable finance for its operations.

In January 2002, a cabinet decision endorsed the proposal to extend the area of the Wadi Rum Protected Area from 540 Square Km to 720 Square Km. Thus, Wadi Rum became Jordan's largest protected area, as well as the largest in the Levant region.

The management of the Protected Area, the implementation of its management plan and the management of the development fund was handed over to a management committee established by ASEZA in 2002. Thus, it became the governance mechanism for the Protected Area with sole responsibility for overseeing the development of the area, the progress of its management program and the sharing of income generated by tourism and other development activities.

Other Designations

In 1999 the Wadi Rum Protected Area was identified as an Important Bird Area in the Middle East by Bird Life International. (Evans. M.I.1995. Important Bird Areas in the Middle East)

It was also reconfirmed as an Important Bird Area during the national review of bird sites, which was conducted in 2000 by RSCN.

Finally under this heading, in late 2008 the government of Jordan approved the revised National Protected Areas Network report prepared by the RSCN under the Ministry of Environment, and the Wadi Rum Protected Area was confirmed with its current legal status and boundaries.

5.c Means of Implementing Protective Measures

The implementation and enforcement of the regulatory framework for the Protected Area is the sole responsibility of the Wadi Rum Area Management Unit within ASEZA. It is based on site. The 82 person unit includes a fully equipped enforcement team (rangers) backed by legal enforcement status, both within the Protected Area and outside it in the buffer zone.

The Wadi Rum Management Unit is part of a larger team of specialized technicians and support staff, who are also backed with the similar legal powers to enforce regulation.

The full team is guided by the Protected Area zoning plan and its associated list of detailed regulations and activity code. The Protected Area team works closely with the local judicial system and transfers all violation reports directly to the local courts.

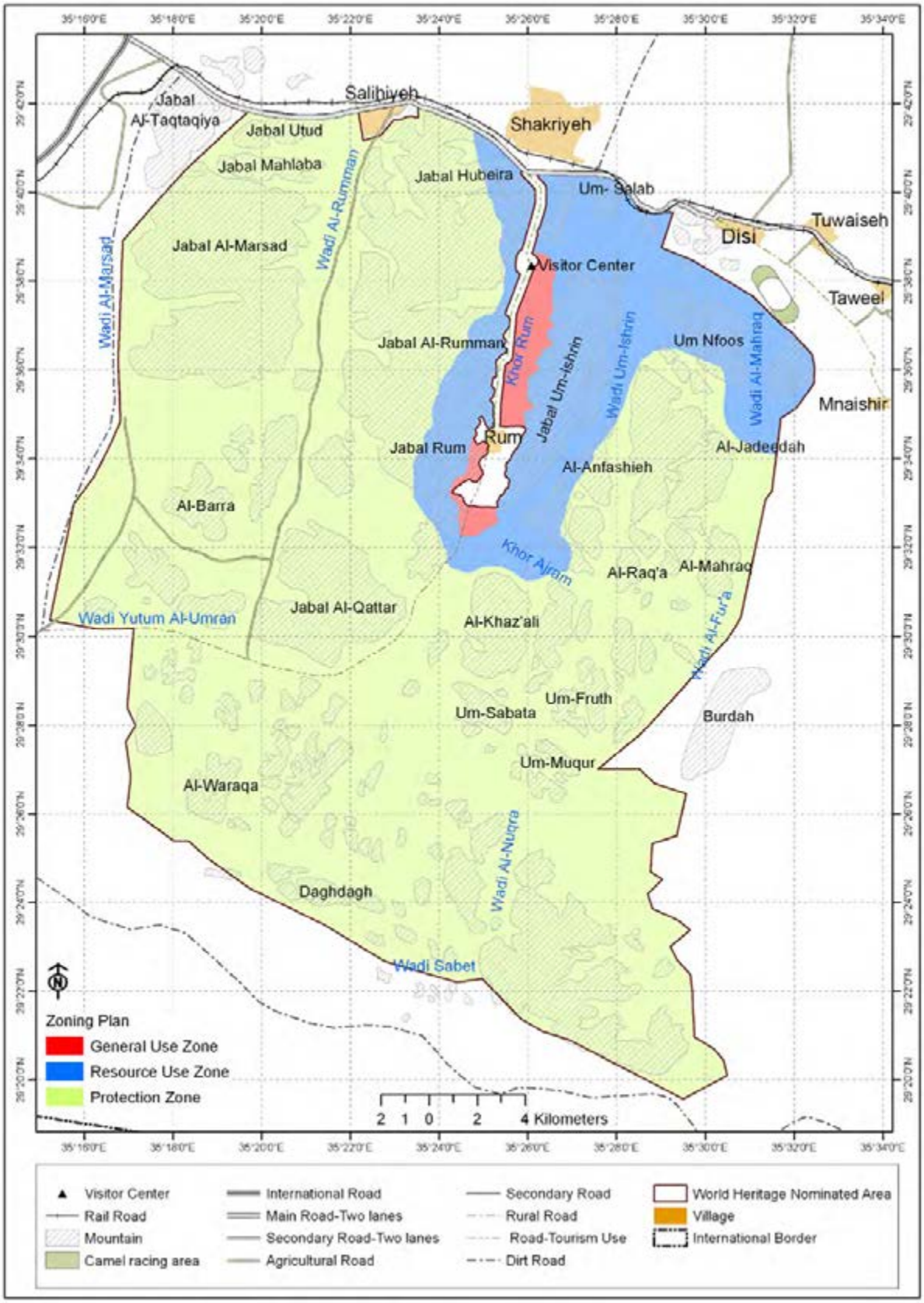
The zoning scheme for the Protected Area was developed through a participatory process in 2003 as part of the management plan; then was revised – based on strategic reviews, stakeholder inputs, and monitoring results – in 2009.

The following table summarises the areas and percentages of the three management zones within the protected area taking in consideration the area nominated for world heritage status and area excluded from it (i.e. visitor centre – Rum village strip).

No.	Zoning Classes	Area (ha)
1	Protection Zone	61,589 (84%)
2	Resources Use Zone	10,706 (15%)
3	General Use Zone	1,008 (1%)
Total		73,303ha (100%)

The scientific and technical approach used to develop the zoning scheme is a state of the art model using computer generated overlays that correspond to the baseline and monitoring data uploaded by the management team supported by the specialised GIS unit onsite and at RSCN. Annex 5 summarises the process of the development of the revised zoning scheme, its inputs and outputs.

Wadi Rum Protected Area Map – Management Zoning Scheme 2009



Other Legislative and Management Tools

One of the main vehicles for implementation of the regulatory framework for the Protected Area is the Site Management Committee, which was established in 2002 and represents a fully participative mechanism for management. It is the only one of its kind in Jordan and is fully delegated to oversee the Protected Area management and development program. The committee includes two permanent local community representatives.

The management team also coordinates with the other ASEZA inspection and monitoring teams, particularly in regard to enforcement of activities in the buffer zone.

It is also important to mention that the Wadi Rum area is governed by two national laws:

- The environment protection law no 52 of 2006 which was based on the temporary environmental protection law no. 1 of 1995 and its secondary act on natural reserves and national parks no. 29 of 2005.
- The law of the Department of Antiquities number 21 of 1988.

Both laws provide additional legal back stopping to any regulatory challenges and shortcoming whenever needed by the management and enforcement team of the protected area.

5.d Existing Plans Related to Region of Proposed Property

The primary plan guiding the management and development program of the Protected Area is the ASEZA land use plan, which covers the whole Governorate of Aqaba to which Wadi Rum Protected Area belongs. The land use plan, and its associated legal acts and bylaws regulating the various development activities taking place around the Protected Area, forms the basis for the legal designation and regulation of the buffer zone proposed around the Protected Area.

The land use plan includes regulations for all main activities taking place in the buffer zone, most importantly; urban development and organization; tourism investment licensing, monitoring and enforcement; agriculture expansion and development; land allocation and designation; municipal management and related services; and local social and economic development.

5.e Wadi Rum Protected Area Management Plan

The current management plan for the Protected Area was developed by the Royal Society for the Conservation of Nature in 2003 mandated by ASEZA to cover the period until 2007. A review programme was included in the Action Plan and a full review was planned to be undertaken during the final year.

The management plan used the accepted international format for management plans in accordance with IUCN guidelines and other renowned international institutions, however, some adjustments were made to accommodate the special needs of Wadi Rum and to account for recent developments in site management. The plan consisted of the following main sections:

Section one - Site Description

The section clarifies the basic information of the Protected Area and documents its description according to the following categories:

- Physical Context: includes information on site location, access points, map coverage, aerial photographic coverage, and photographic coverage.
- Land Tenure and Status: includes information about traditional land tenure, past status and interest, current status, and other designations.
- Land Use: includes information about tourism, interpretation use, educational use, research use, livestock grazing, agriculture, and settlements inside and around the Protected Area, mining, firewood collection, small concrete dams and reservoirs, sunken water cisterns, and brick storage chambers.
- Management: includes elaboration on the Second Tourism Development Project.
- Environmental Information: includes information on physical environment, climate, hydrology, geomorphology, geology, soil, and mineral resources.
- Biological Information: includes elaboration on bio-geographical regions and habitats, vegetation types, vegetation communities, flora and fauna.
- Cultural Information: includes description of Bedouin communities and archaeology.
- Description of ecological relationships.

Section Two: Evaluation of Features

The section presents an assessment of the conservation values of Wadi Rum Protected Area according to recognized international criteria as listed below:

- Size
- Diversity
- Naturalness
- Rarity
- Fragility
- Typicalness
- Recorded History
- Position in an Ecological Unit
- Intrinsic Appeal/ Landscape
- Public Access/ Use
- Education Use
- Interpretation and Awareness Raising
- Research
- Potential for Improvement of Ecological Values
- Factors Influencing Management
- Local Community participation

Section Three: Objectives, Outputs and Action Plan

The section states the objectives and expected results of the management of the Protected Area and presents an action plan to meet these objectives. The following is a summary of the main logical framework of the plan:

Principal objective

To develop appropriate and sustainable tourism within Wadi Rum Protected Area and conserve the site's significant natural and cultural values, while maximizing the economic returns to local communities and increasing their participation in management.

Operational objectives and outputs

1: Tourism Development

To continue and promote conservation oriented tourism development in accordance with the annexed tourism development plan.

Outputs

1.1: Well-implemented tourism development plan.

1.2: Comprehensive tourism procedures.

1.3: Updated tourism development plan.

2: Habitat Conservation
To conserve and, where necessary, restore the representative habitats of the Protected Area.
Outputs
2.1: Well-implemented zoning plan.
2.2: Well-implemented rangeland scheme.
2.3: Established graded track network, regularity maintained.
2.4: Well-implemented monitoring programme.
2.5: Detailed research programme applied to key management issues.
2.6: Completed baseline survey especially for the Protected Area extension.
2.7: Fully equipped lab to serve the research programme of the Protected Area.
2.8: Established metrological station in the Protected Area.
2.9: All relevant regulations effectively enforced.

3: Species conservation
To conserve viable populations of characteristic species in the Protected Area, with special emphasis on key and flagship species.
Outputs
3.1: Implemented system for regulating specimen collection.
3.2: Oryx herd released into the Protected Area and effectively monitored.
3.3: Husbandry of captive Oryx maintained to humane standards.
3.4: Prepared and Implemented conservation programme targeting ibex as a flagship species.
3.5: All relevant regulations effectively enforced.

4: Cultural Conservation
To prevent damage to all key archaeological sites, sites of rock art and inscriptions, and any others well visited by tourists.
Outputs
4.1: Visitors' management plan for priority archaeological, rock art, inscription sites.
4.2: An implemented monitoring programme to assess impact at each priority site.
4.3: Visitor information available on appropriate use of (rather: behaviour vis-à-vis) archaeological, rock art, inscription sites.

5: Local Lifestyles and Livelihoods
To encourage the perpetuation of the traditional Bedouin lifestyle where economically feasible and culturally acceptable.
Outputs
5.1: Bedouin traditions featured in tourism experiences.

5.2: Bedouin culture and tradition respected and facilitated through Protected Area management programmes.
5.3: Bedouin history and culture professionally documented and an archive created.

6: Awareness and Education
To develop an ongoing site-based education programme addressing the root causes of environmental issues in the Protected Area, targeted at schools in the Quweira district and other visiting schools.
Outputs
6.1: Existing education programme effectively implemented.
6.2: Well-trained local nature club supervisors in target schools.
6.3: Regular meeting of the local environmental education committee.
6.4: Education programme reviewed and evaluated.
6.5: Developed educational programme using the Internet centre.

7: Awareness Raising
To develop an ongoing awareness programme for all users and stakeholders of the protected area addressing the identified root causes of environmental problems and to generate support for, and appreciation for the Protected Area.
Outputs
7.1: Existing education and awareness strategy implemented.
7.2: Existing interpretation plan fully implemented.
7.3: Well-designed interpretation facilities within the visitors centre.
7.4: Local guides well qualified in interpretation and visitor management.
7.5: Production of regular newsletter of the Protected Area.

8: Community Involvement and Outreach
To continue to develop mechanisms for further community participation in the management of the Protected Area.
Outputs
8.1: Continuous local participation in the official management committee of the Protected Area.
8.2: Regular consultation with local communities over Protected Area development.
8.3: Local community working groups created for tourism development issues.

9: Income Generation
To continue to manage and develop income generation initiatives, which complement the management of the Protected Area and address local community needs.

Outputs
9.1: Continuous expansion of handcraft production.
9.2: Well-implemented marketing plan emphasizing the link with the Protected Area.

10: Legal and Institutional Arrangements
To continue developing management systems and procedures and building the capacity of the Protected Area team to be able to implement the site based management programmes.
Outputs
10.1: Well-trained team capable of implementation of Protected Area management plan.
10.2: Organizational structure reviewed and modified as required.
10.3: Management systems and procedures completed, documented and operational.

11: Institutional Coordination and Collaboration
To continue developing the mechanisms of coordination and communication with all institutions that have a direct relationship with the Protected Area management.
Outputs
11.1: Signed memorandum of understanding with all target institutions.
11.2: Regular coordination meetings with all target institutions.

12: Law Enforcement
To develop and implement a comprehensive enforcement plan that covers all the laws and regulations governing the use of the Protected Area.
Outputs
12.1: Existing enforcement plan effectively implemented.
12.2: Continuous liaison with the governor, Badia Police, Tourism Police and any other enforcement agencies to support the enforcement plan.
12.3: Voluntary scheme for community participation developed and promoted.

13: Buildings
To ensure that the visitor centre and any other Protected Area buildings are well maintained and functional at all times.
Outputs
13.1: Quality standards defined for maintenance and cleanliness.
13.2: A regular maintenance programme in place.
13.3: All buildings cleaned to appropriate standards.
13.4: Insurance premium for all Protected Area buildings and equipment renewed annually.

14: Vehicles and Equipment

To ensure that an adequate number of vehicles and other items of essential equipment are available for the effective management of the Protected Area.

Outputs

14.1: Procedures developed for proper use of cars and equipment.
14.2: Effective maintenance system for cars and other essential equipment.
14.3: Phased replacement of existing cars with models better suited to desert conditions.

15: Financial Sustainability

To develop systems that enable Protected Area revenue to be allocated directly to the on-site conservation programme and encourage financial sustainability.

Outputs

15.1: Effective fee collection system in place.
15.2: Well-implemented system for franchising onsite services.
15.3: Financial system efficient and operational.
15.4: Business plan prepared and implemented.

After the termination date of the first management plan in 2007, a decision was taken by ASEZA to extend the duration for the implementation of the management plan to the end of 2010 with the aims to:

- Take into account the validity of the plan until the new deadline.
- Ensure the plan's full implementation.
- Utilize the adaptability of the plan as a living document; this was done through the annual review of the plan as documented in the annual reports produced.

Between 2007 and 2010, the Protected Area was also guided by the ASEZA strategic plan 2007-2010 with a specific component addressing the Wadi Rum Protected Area. It is currently planned that the new (second) management plan for the Protected Area will be developed and finalized by the end of 2010.

The revision process of the current management plan was commenced in mid 2009 with the aim to prepare for the development and finalization of the new management plan to cover the period 2011-2015. The new management plan will follow the IUCN guidelines for protected area management planning and the ICOMOS guidelines for cultural sites. Further, if the world heritage nomination is successful, the new guidelines published by IUCN and ICOMOS on management of natural world heritage sites will also be adopted for the review process. Finally, the new management plan will include a

process for converting the area into a carbon-free protected area with all that implies for infrastructure re-development

To date, there have been several technical reports to review the level of implementation of the current management; a report was finalized to summarise the results of the thematic technical reviews and an electronic copy of the first draft is available in Arabic. Several strategic and preparatory workshops have been organized to re-visit the current logical framework of the management plan with the aim to re-assess the overall management goal and operational objectives of the Protected Area to set the basis for the new phase of management.

5.f Sources and Levels of Finance

The Wadi Rum Protected Area enjoys the highest levels of financial investment of all protected areas in Jordan. In addition to the direct investment provided by ASEZA for the area's operation and development, several other projects and programs also contribute substantially to the management program of the Area. This includes:

- The USAID funded SIYAHA project.
- The Abu Dhabi Environment Agency funded Arabian Oryx re-introduction project.
- A cluster of GEF small grant program funded projects.

The following table summarises the protected area budget in terms of expenditures and revenues for the years 2007-2008 as invested by ASEZA:

No	Budget item	Total 2007 (JD)	Total 2008 (JD)	Total 2009 (JD)
1-	Total operational budget – ASEZA	552,240	741,896	968,000
2-	Total capital budget – ASEZA	322,150	22,000	782,500
3-	Total capital budget – external support	77,800	00	470,000
4-	Annual grand total	952,190	763,896	2,220,500

The following table summarises the income/revenue account for the same years 2007 – 2009:

No.	Budget item	Total 2007 (JD)	Total 2008 (JD)	Total 2009 (JD)
1-	Total revenues/income – ASEZA	337,100	647,551	571,900
2-	Total revenue/income – external support	77,800	00	470,000
3-	Annual grand total	414,900	647,551	1,041,900

5.g Sources of Expertise and Training in Conservation and Management Techniques

The Protected Area received and has access to a wide array of training and capacity building programs in regard to conservation and management, tourism development, education and awareness raising, public participation, law enforcement and research and monitoring. These are available through the direct investments put in place on an annual basis by ASEZA through the allocation of significant funds to training and capacity building, but also come from the Area's extended list of supporters, partners and donors, namely:

- The Royal Society for the Conservation of Nature; with whom ASEZA signs an annual agreement geared at enhancing the site's teams' capacities in all disciplines related to conservation management and environmental monitoring.
- The USAID funded SIYAHA project; operational until 2013 and primarily leading training and capacity building programs related to tourism development, visitor management, product development, marketing and business planning.
- The Environmental Agency of Abu Dhabi funded Oryx reintroduction program; focusing on capacity building in relation to wildlife reintroduction programs and conservation management.
- The GEF small grants program; geared to capacity building for local associations involved in the local communities development initiatives such as small tourism related businesses, small scale sustainable agriculture development, local environmental rehabilitation initiatives, and handicraft development projects.
- Numerous research activities and initiatives; undertaken by national and international institutions particularly in the field of cultural heritage and anthropology. This includes the efforts of several foreign university or research institutions which fund archaeological and epigraphical missions inside the Protected Area through agreements and coordination with the Department of Antiquities.

5.h Visitor Facilities and Statistics

Visitors' Statistics

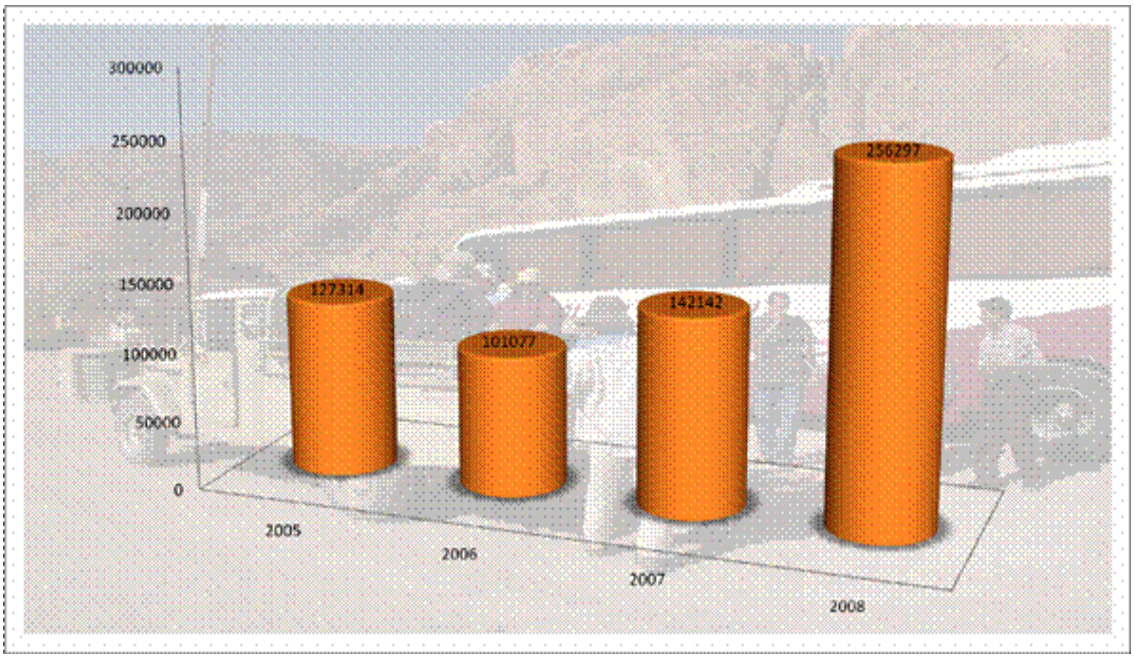
Visitor management is a primary program for the implementation of the Protected Area management plan. The sensitive development of sustainable tourism in the Protected Area has been one of the higher goals for effective management and long term development. One of the main plans prepared at the time of the development of the Protected Area management plan was the tourism development plan, which was by and large the most important document produced for the site management in 2003.

Today, visitation remains the primary land use activity in the Protected Area reflecting in a clear way the global status gained by Wadi Rum by a wide spectrum of visitors from a disciplinary and geographic points of view, which makes Wadi Rum world destination for nature and culture lovers and supporters.

The following table summarises the number of visitors received in 2008 along with their origins:

Month	Students/Jordan	Jordanian/ Residents	Non-Jordanian	Total Numbers
1	5	509	10683	
2	100	291	11606	
3	66	900	22100	
4	250	1300	32694	
5	242	3627	27393	
6	37	599	14016	
7	52	833	9966	
8	108	4391	16046	
9	0	203	18840	
10	225	1214	35228	
11	321	886	24936	
12	16	714	12900	
Total	1,422	15,467	239,408	256,297

The following diagram compares the total visitation of 2008 to the three previous years:



Visitor Facilities

The Visitor Centre

This is the main hub for visitor reception and distribution in the Protected Area. All visitors arriving at the Protected Area are required to enter at the visitor centre. The centre is a modern, well-designed complex established under the second tourism project, and was completed and officially opened in 2003. The centre includes all needed facilitates for visitor reception and distribution; including the main access gate, car park, interpretation centre, conference room, audio visual room, the offices of the Protected Area Management Unit, the ticketing offices, the local associations and products offices and outlets, rest rooms and a short panoramic walk, in addition to a staff accommodation building and research station. The complex also includes the offices of the Oryx reintroduction program.

The visitor centre represents one f the main investment put forth for Wadi Rum and greatly on the functions for awareness raising, education, stakeholders participation, scientific research all contributing the purpose of safeguarding the protected area, its sound management and long term sustainability for the benefit of future generations of Jordan and the world.

Rum Village

The overall vision for Rum village is to become a visitor attraction in its own right. The village has been the subject of several key development projects, targeting its infrastructure and services. The village includes a secondary

visitor reception point located at a guesthouse; a panoramic centre is being developed in and around the old military fort, a group of locally run bed and breakfast accommodations, a local handicrafts centre, a campsite, and numerous small shops and bazaars.

It is important to re-emphasize here that both and the visitor centre are not included in the nominated property for world heritage.

Campsites

The Protected Area visitors' management plan includes the development of a cluster of mobile and semi-permanent campsites within the resource use area. Today, there are around 28 licensed campsites in the Protected Area, which were developed using a prescribed set of guidelines and procedures. All are subject to a structured development program funded by the SIYAHA project, and fall under a specific monitoring program run by the Protected Area tourism and enforcement teams.

Signage

The Protected Area access points and entrance area are all supported by road signage systems which include basic information and regulations. The signage also provides the needed guidance for directions and distances to visitors approaching the Protected Area from Amman and Aqaba.

5.i Policies and Programmes Related to the Presentation and Promotion of the Property

There are three main regional and national programs relevant to the Wadi Rum Protected Area. The following is a summary of their scopes and their relevance to Wadi Rum.

ASEZA Strategic Plan

This is the primary ASEZA strategic document for the period 2007 – 2010. It includes a specific component on Wadi Rum based on its overall objectives and specificities. The strategic plan draws strategic direction to the Area through emphasizing its primary role in local economic development while safeguarding the natural and cultural heritage. The plan is also important as it formed the main reference document for the development and management of the Wadi Rum Protected Area during the period between 2007 and 2010 supplementary to the extended management plan 2003 – 2007, and will co-guide the development of the new management plan for the 2011-2015 period.

National Tourism Development Strategy
Ministry of Tourism and Department of Antiquities

The national tourism strategy is the guiding document for the period 2004-2010. The strategy identifies Wadi Rum as one of Jordan's prime tourism development areas. Despite the fact that this should mean more national attention and investment geared towards Rum, it also indicates a great need for well planned synergy and consideration of the site's limited capacity and sensitive cultural and natural heritage. The Wadi Rum Protected Area Management Unit and ASEZA realize the need to closely coordinate and collaborate with the Ministry of Tourism and its associated development agencies to ensure the development of a tourism model sensitive to Wadi Rum's special approaches, requirement and needs.

SIYAHA USAID Project

It is important to highlight that the main current tourism development initiative, the SIYAHA project funded by USAID, was guided by the tourism strategy to include Wadi Rum in its strategic and operational program until the end of 2013.

Ministry of Environment Strategy

The Ministry of Environment is the national agency responsible for environmental protection and sustainability. The Ministry and ASEZA are strategically linked and Wadi Rum is one of the main shared interest areas. The Ministry facilitated the inclusion of Wadi Rum in the UNESCO tentative list in its capacity as the chair of the national committee on Natural World Heritage and the inclusion of the Area in the protected areas effectiveness assessment undertaken by RSCN in 2008/2009. The strategic program of the Ministry includes several key actions specific to Wadi Rum including supporting the nomination under the world heritage list.

Oryx Reintroduction Project

This is relatively new initiative developed and signed between ASEZA and the Environment Agency of Abu Dhabi the United Arab Emirates through a contract to reintroduce the Arabian Oryx into the wilderness of the Wadi Rum Protected Area, which has a significant area of original Arabian Oryx habitat.

A total of one million Jordanian Dinars are allocated for the project's first three-year phase. The main expected outputs of the project's first phase are:

- Develop a Project Management Committee represented by project stakeholders, and chaired by ASEZA
- Identify an Arabian Oryx release site within Wadi Rum Protected Area
- Construct pre-release facilities
- Trans-locate animals to the pre-release facilities
- Animal monitoring and sound animal management before release
- Develop and implement marketing plan targeting national, regional and international conservation agencies
- Conduct release programme
- Conduct post release monitoring programme using latest technologies such as satellite and GSM monitoring techniques
- Integrate local communities in the release project
- Submit monthly and quarterly progress reports

5.j Staffing Levels

The organizational structure for the Protected Area was developed and approved by ASEZA and Wadi Rum Management Committee in 2003. The document is an evolving one and is subject to annual review and development. The table below summarises the staffing of the Protected Area in terms of positions and number as of 2009.

Position	No. of staff
Manger of the Protected Area	1
Head of nature conservation	1
Ecologist	1
Wildlife biologist	1
Head of rangers	1
Enforcement rangers	10
Oryx rangers	4
Cleaners	5
Tourism manager	1
Interpretation and marketing officers	2
Reception staff	2
Visitor centre guides	4
Cars rotation staff	8
Head of education and outreach	1
Education and outreach officers	3
Head of finance and administration	1
Accountant	1
Ticketing officers	4
Socio-economic officers	10
Visitor centre guards	4
Camel racing centre manager	1
Camel racing centre guards	4
Camel racing centre workers	2
Part-time staff – various positions	32
Total number of full-time staff	82
Total number of Part-time staff	32
Grand total number of staff	114

As seen in from the table above, the Protected Area includes a wide spectrum of professional and technical skills and competencies related to the main disciplines needed for its effective management. The Protected Area includes a number of the best conservation technicians in Jordan, with experiences ranging from 5 to 15 years in the field. This is particularly evident for the fields of visitor management, local community participation, conservation management, wildlife re-introduction programs, ecological research, socio economic research, local income generation projects, business management and management planning.

The Protected Area team are involved in the development and provision of many national and regional training and exchange programs organised in Wadi Rum or elsewhere. Key staff members are also involved in regional and international conferencing and events representing their experience in Wadi Rum and Jordan.

Section 6: Monitoring

6.a Key Indicators for Measuring State of Conservation

The Protected Area monitoring program is based on the monitoring program devised in the management plan. A separate document was produced for the Protected Area monitoring program using international guidelines and standards.

The overall objective of the monitoring program is to conserve and where necessary restore the representative habitats of the protected area while closely monitoring the impacts of key land use activities.

The monitoring program includes four main expected outcomes:

- Completed baseline survey especially for the Protected Area extension.
- Well-implemented monitoring programme.
- Detailed research programme applied to key management issues.
- Metrological station established in the Protected Area.

The monitoring program provides scientific advice on the overall conservation status of some of the key values included in this nomination file but requires restructuring considering the new adopted vision for the site under the World Heritage Program, particularly in regards to develop an advanced monitoring program for the status of the geomorphological sandstone landforms and landscapes as well as the rock art and inscriptions.

Further, it is important to note that the Protected Area was originally designated and managed for its desert ecosystem along with their habitats and species. It is foreseen that the new management plan will include an amended monitoring program geared towards the revised set of Protected Area values and attributes with particular emphasis on the protection and conservation of landforms and their associated habitats and species as well as the cultural values represented mainly by the rock art (epigraphy and inscriptions).

The monitoring program is supported by an advanced GIS system which allows for a cluster of computer generated modules which can provide the needed management decision support tools and applications.
As part of the monitoring plan, the following table summarises the monitoring programs geared towards key management issues:

Indicator	Periodicity	Location of Records
Sand dunes movements within the Protected Area – tourism impact	Annually	Wadi Rum research unit
Monitor the change in the vegetation communities within the Protected Area – multiple impacts	Seasonally	Wadi Rum research unit
Test seeds viability for main tree species	Seasonally	Wadi Rum research unit
Carry out the livestock counting	Three seasonal counts every two years	Wadi Rum research unit
Assess Bedouin tribes' movements	Bi-annually	Wadi Rum research unit
Effect of grazing on vegetation cover in the different zones	Annually	Wadi Rum research unit
Monitoring log for archaeological sites	Continuous	Wadi Rum research unit
The protected area effectiveness score	Every two years	RSCN

6.b Administrative Arrangements for Monitoring Wadi Rum Protected Area

The unit responsible for the follow up of the monitoring program is the Wadi Rum Protected Area research unit situated at the central management station:

Name of responsible officer:

Jamal Zaidaneen
Conservation Section Head
Wadi Rum Protected Area
Aqaba Special Economic Zone Authority
PO Box 2565
Aqaba 77110, Jordan.

Tel: ++962 3 2090600
Fax: ++962 3 2032586
Mobile telephone: 962 799444291

Email: jzaidaneen@yahoo.com
Website: http://www.wadirum.jo

6.c Results of Previous Reporting Exercises

The main reporting systems at the Wadi Rum Protected Area are:

1- The area's annual reports which are prepared and submitted to ASEZA at the end of each calendar year. The annual reports include a specific section on the monitoring program.

2- The annual monitoring reports prepared by RSCN under their bilateral agreement with ASEZA.

3- The management effectiveness evaluation report for protected area which by and large is the most comprehensive report.
It makes a detailed assessment at progress made in implementing the management plan as a whole, including the section on monitoring.

It is of importance to mention that the protected area monitoring program requires full review and restructuring as it enters into the implementation of the new management plan and the world heritage program.

Section 7: Documentation

7.a Image Inventory and Authorization Table

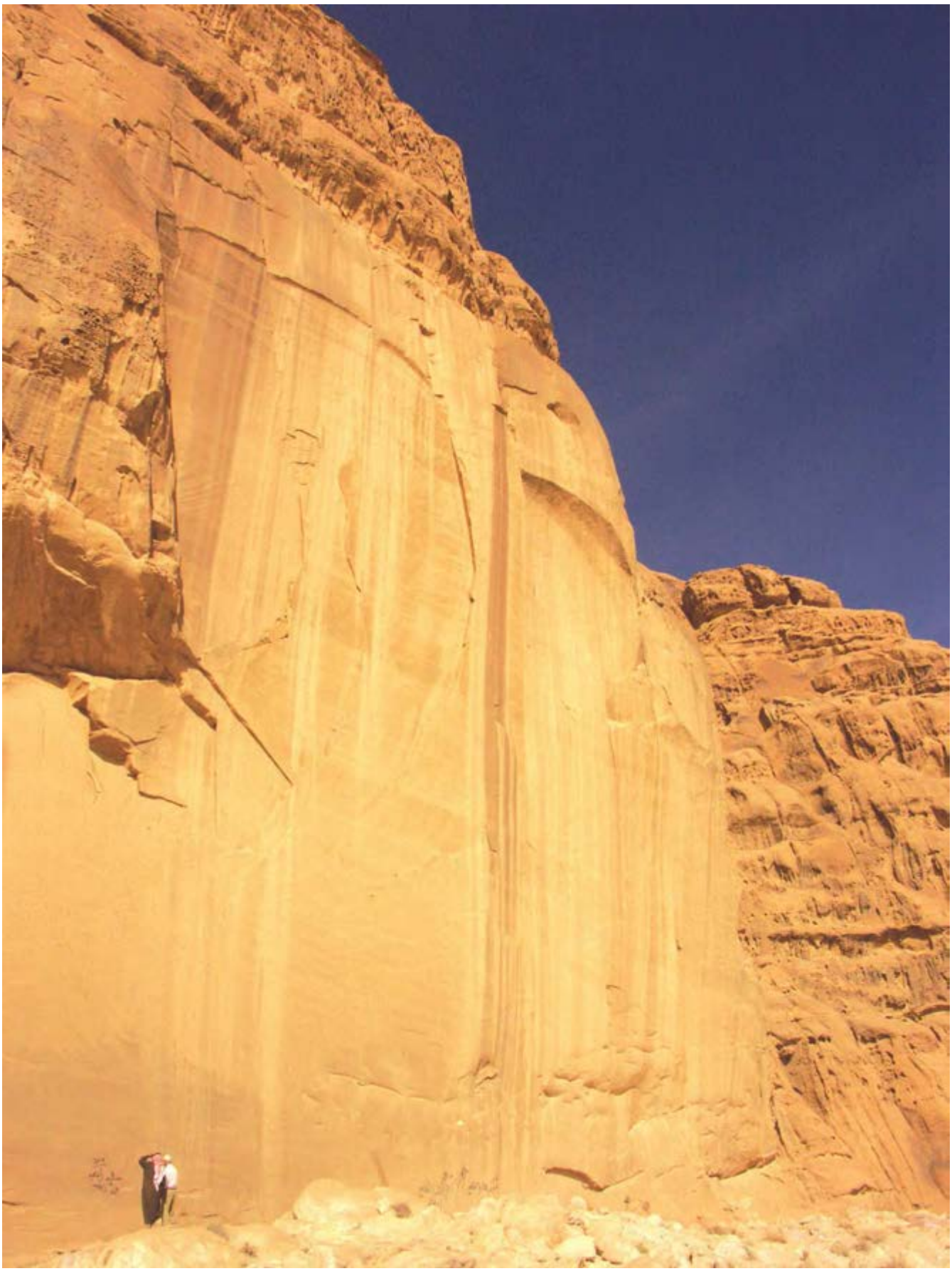
No.	Format	Caption	Date	Photographer	Copyright	Contact	Rights Cession
1-	Electronic	See title	NA	ASEZA	ASEZA	ASEZA	Ok
2-	"	"	NA	ASEZA	ASEZA	ASEZA	"
3-	"	"	"	"	"	"	"
4-	"	"	"	"	"	"	"
5-	"	"	"	"	"	"	"
6-	"	"	"	"	"	"	"
7-	"	"	"	"	"	"	"
8-	"	"	"	"	"	"	"
9-	"	"	"	"	"	"	"
10-	"	"	"	"	"	"	"
11-	"	"	"	RSCN	RSCN	RSCN	"
12-	"	"	"	"	"	"	"
13-	"	"	"	"	"	"	"
14-	"	"	"	"	"	"	"
15-	"	"	"	"	"	"	"

- See annex 5 for the set of selected photos
- See photos titles for captions details.
- Kindly see following respective letters of non exclusive cession of rights from ASEZA and RSCN.

1: Iconic Sandstone Landform – Jabal Khaz'ali

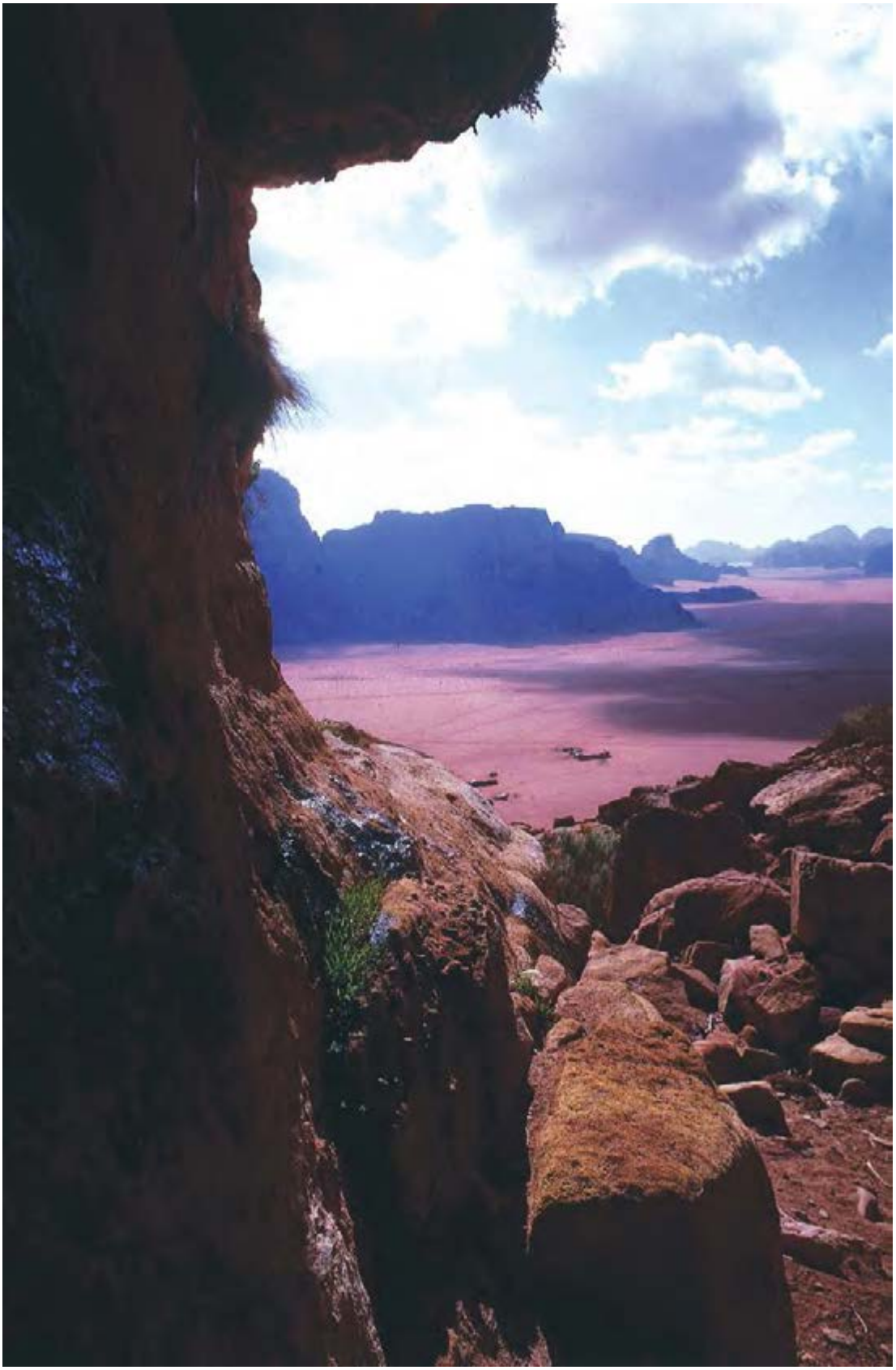
2: Panoramic view of Sandstone landform – Wadi Um Ishrin

3: Vertical Cliff – Wadi Um Ishrin



4: Panoramic View of Wadi Rum Protected Area from the Top of Jabal Rum

5: Flat-bottom Wadis – Wadi Rum



6: Mountain Inselbergs – Wadi Rum

7: Rock Mushrooms – Disi Region

8: Petroglyphs and Epigraphy 1

9: Petroglyphs 2

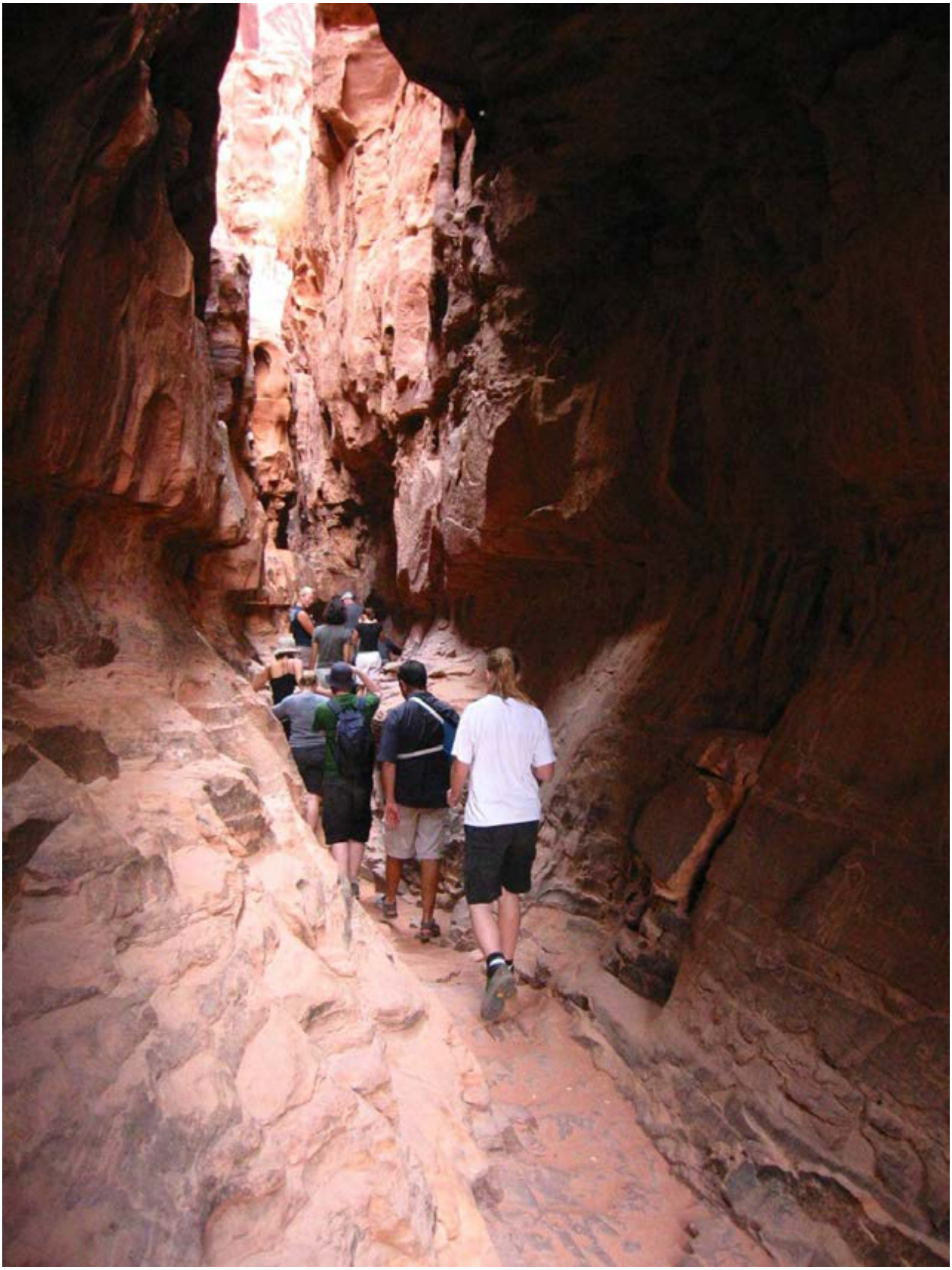
10: Mixed Rock Art Petroglyphs and Inscriptions 3

11: Petroglyphs 4

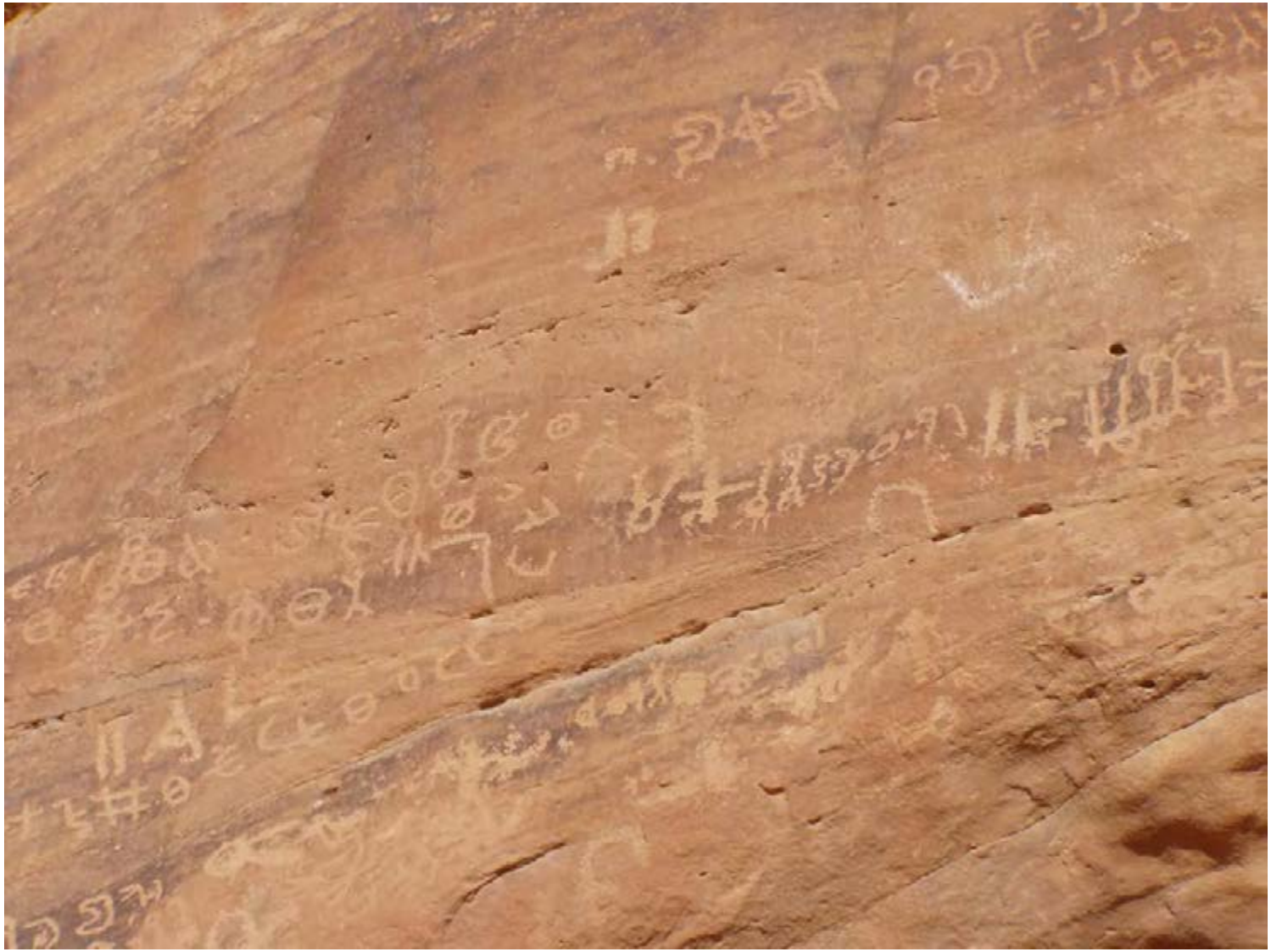
12: Camel in the desert of Wadi Rum – Barra Area

13: Seven Pillar of Wisdom Mountain

14: Mountain Gorge



15: Epigraphy



سلطة منطقة العقبة الاقتصادية الخاصة
AQABA SPECIAL ECONOMIC ZONE AUTHORITY

Ref: .... الرقم: ١٣
Date: .... التاريخ:
Dated: .... الموافق:

To: UNESCO World Heritage Program
Subject: Statement of Authorization of Non-Exclusive Cession of copy right

The Aqaba Special Economic Zone Authority (ASEZA); through this letter of authorization, grants UNESCO the nonexclusive and free of charge right to reproduce and use throughout the world the photos described in section 7a of the Wadi Rum Protected Area Nomination File.

ASEZA understands that the photos will be used by UNESCO to disseminate information on the sites inscribed under the World Heritage Convention in all ways adopted by the organization provided that all photos will be duly credited to ASEZA.

This is to also indemnify UNESCO, and to hold it harmless of any responsibility, for any damages resulting from any violation of the certification mentioned here.

Any differences or disputes which may arise from the exercise of the rights granted to UNESCO will be settled in a friendly way. Reference to courts or arbitration is excluded.

Akram Al Madadha

Deputy Chief Commissioner
Commissioner for Revenue and Customs
Aqaba Special Economic Zone Authority
Dr. Salim AL-MOGHRABI

ص.ب ٢٥٦٥ العقبة ٧٧١١٠ الأردن تلفون ٢٠٩١٠٠٠ ٣ ٩٦٢+ فاكس ٢٠٩١٠٥٦ ٣ ٩٦٢+
P.O.Box 2565 Aqaba 77110 Jordan Phone : +962 3 2091000 Fax : +962 3 2091056
URL : www.aqabazone.com E-mail: info@aseza.jo

Date : 27/9/2009
Ref : RS/31/945

To Whom It May Concern

The Royal Society for the Conservation of Nature (RSCN); through this letter of authorization, grants UNESCO the nonexclusive and free of charge right to reproduce and use throughout the world the photos described in section 7a of the Wadi Rum Protected Area Nomination File.

RSCN understands that the photos will be used by UNESCO to disseminate information on the sites inscribed under the World Heritage Convention in all ways adopted by the organization provided that all photos will be duly credited to RSCN.

This is to also indemnify UNESCO, and to hold it harmless of any responsibility, for any damages resulting from any violation of the certification mentioned here.

Any differences or disputes which may arise from the exercise of the rights granted to UNESCO will be settled in a friendly way. Reference to courts or arbitration is excluded.

Yehya Khaled

Director General
Royal Society for the Conservation of Nature

الجمعية الملكية
لحماية الطبيعة
RSCN

PO Box 1215
Jubaiha 11941
Amman, Jordan
Tel : 962 6 5337931/2
Fax: 962 6 5347411
E-mail: yehya.khaled@rscn.org.jo
Website: www.rscn.org.jo

7.b Text of Protective Designation, Management Plan and Other Relevant Plans

The attached annexes include the main following documents:

Annex 1: Wadi Rum Protected Area Regulation no 24 of 2001.
Annex 2: Wadi Rum Protected Area Management Plan 2003.
Annex 3: Wadi Rum Protected Area Visitors' Management Plan 2003.
Annex 4: Wadi Rum Protected Area Monitoring Program 2003.

7.c Form and date of most recent records or inventory of Wadi Rum Protected Area

The most recent complete records for the Protected Area inventory are those of 2003 which were developed upon the preparation of the Protected Area management plan. This includes: ecological baseline surveys (e.g. vegetation, birds, and carnivores), physical environment baselines surveys (e.g. geology, hydrology), land use baselines survey, cultural baseline surveys, tourism baseline survey, socio economic baseline survey, rangeland baseline survey and several others.

Many other and more recent records are dated 2008 and 2009. These include the annual reports, strategic plans, and Protected Area monitoring and effectiveness assessments.

Most records are kept at the protected area library in hard and electronic forms located at the main management station of the protected area.

Following is the list of main inventory sources:

- Raw, A, 1998. Wadi Rum Protected Area socio-economic survey.
- RSCN, 1999. The institutional review and recommendation for institutional strengthening of Rum Tourism Cooperative.
- RSCN, 1999. Wadi Rum Protected area Vegetation Survey.
- RSCN, 1999. Wadi Rum Protected Area Carnivores Survey.
- RSCN, 1999. Wadi Rum Protected Area Birds Survey.
- RSCN, 2000. Wadi Rum Protected Area Ungulates Survey.
- RSCN, 2000. Wadi Rum Protected Area Invertebrates Survey.
- RSCN, 2000. Wadi Rum Protected Area Reptiles Survey.
- RSCN, 2000. Wadi Rum Protected Area Small Mammals Survey.
- RSCN, 2000. Wadi Rum Protected Area Rangeland Survey.
- RSCN, 2001. Wadi Rum Protected Area Raptors Survey.
- RSCN, 2003. Wadi Rum Protected Area management plan.
- RSCN, 2003. Wadi Rum Protected Area monitoring program.
- RSCN, 2003. Wadi Rum Protected Area visitors management plan.
- RSCN, 2009. Jordan National Protected Area Network Report.
- RSCN, 2009. Jordan Protected Area Effectiveness Assessment Report.
- Ruben, I. and Nasser G. 1999 Review of the Archaeology of Wadi Rum Protected Area.

7.d Address where inventory, records and archives are held

I- Wadi Rum Protected Area

Mr. Jamal Zaidanein – Conservation Section Head
Aqaba Special Economic Zone Authority
P.O. Box 2565
Aqaba 77110, Jordan
Tel: 962 3 2090600
Fax: 962 3 2032586
Mobile: 962 799 444 291
Email: jzaidaneen@yahoo.com
Website: www.wadirum.jo

II- Royal society for the conservation of Nature

Mr. Nashat Hmaidan – Conservation Advisor
Royal Society for the Conservation of Nature
PO Box 1215
Jubaiha 11941
Amman, Jordan
Tel: 962 6 5337931/2
Fax: 962 6 5347411
Mobile: 962 796 877 297
E-mail: nashat@rscn.org.jo
Website: www.rscn.org.jo

Additional important contacts:

III- Department of Antiquities

Dr. Fawwaz Khraishah – Director General
Mr. Abdul Sa'meea' Abu Dayyah – Technical Advisor
Department of Antiquities
P.O. Box 88
Amman, Jordan
Tel: 962 6 460 3360
Fax: 962 6 461 5848
Mobile: 962 795 572 316
Email: doa@nic.net.jo; absami50@hotmail.com
Website: www.doa.jo

IV- Tourism

Mrs. Sahar Barari – Technical Advisor
Ministry of Tourism and Antiquities
3rd circle - Jabal Amman
Tel: 962 6 4603360
Fax: 962 6 4648465
Mobile: 962 777 512 921
E-mail: contacts@tourism.jo
Website: www.tourism.jo

7.e. Bibliography

I- Geology and Geomorphology

Abd Elahamid, G., 1990. Jabal Umm Ishrin sheet, 3049 II, 1:50,000 geological map series, 14, 76p. NRA, Amman.

Abdelhamid, G., Ibrahim, K., and Mortimer, C., 1994. The geology of Ayn Al Hashim, Jabal Al Mubarak, and Al Yamaniyya, map sheet 3048 I, 3048 IV, and 2948 I. 1:50,000 geological map series, 27, 57p. NRA, Amman.

Abed, A. M., Carbonel, P., Collin-Girard, J., Fontugne, M., Petit-Maire, N., Reyss,J. C., and Yasin, S., 2000. Un paléolac du dernier interglaciaire pléistocène dans l'extrème sud hyperaride de la Jordanie. Earth and Planetary Science, 330, 259-264.

Abed, A. M., 2000. Geology of Jordan. Jordanian Geological Association, Amman, pp. 870 (in Arabic).

Abed, A. M., Makhlouf, I., Amireh, B. and Khalil, B., 1993. Upper Ordovician glacial deposits in southern Jordan. Episodes, 16, 316-328.

Abed, A. M., Carbonel, P., Collin-Girard, J., Fontugne, M., Petit-Maire, N., Reyss, J. C., and Yasin, S., 1999. Un paléolac du dernier interglaciaire pléistocène dans l'extrème sud hyperaride de la Jordanie. Academy of Science Bull. Paris (in press).

Abu Ajamieh, M. M., 1989. Mineral Resourcs of Jordan. Natural Resources Authority, Amman, 149p.

Abu Ajamieh, M., Bender, F. and Eicher, R., 1988. Natural Resources in Jordan. Natural Resources Authority, Amman, 224p.

Al-Shanti, A. M., 1993. Geology of the Arabian Shield. King Abudu Aziz University Publishing Centre, Jedaah, Saudi Arabia, 196p (in Arabic).

Amireh, B. S., 1987. Sedimentological and petrological interplays of the Nubian series in Jordan with regards to paleogeography and diagenesis. Unpubl. Ph.D thesis, Braunschweig Tech. Univ., 232p.

Amireh, B. S. Schneider, W., & Abed, A. M., 1994. Diagenesis and burial history of the Cambrian-Cretaceous sandstone series in Jordan. N. Jb. Geol. Palaont. Mh., 192, 151-181.

Andrews, I. J., 1991. Paleozoic lithostratigraphy in the subsurface of Jordan. Subsurface Geology Bull., 2, NRA, Amman.75p.

Barberi, F., Capaldi, G., Casperini, F., Marinelli, G., Santacroce, R.., Scandone, R., Treuil, M., and Varet, J., 1979. Recent basaltic volcanism of Jordan and its implications on the geodynamic evolution of the Afro-Arabian Rift system. Atti Conv. Lincce, 47, 667-683.

Bender, F. 1968. Geologie von Jordanien. Borntraeger, Berlin, 230p.

Bender, F., 1974. Geology of Jordan, 196p. (Borntraeger, Berlin.

Beydoun, Z., 1993. Evolution of the northeastern Arabian Plate margin and shelf: Hydrocarbon habitat and conceptual future potential. Revue Institiut Francais Petrole, 48, 311-345.

Blake, G. S. & Ionides, M. G., 1939. Report on the water resources of Transjordan and their development, 372 p. Crown Agents for the Colonies, London.

Blanckenhorn, M., 1912. Kurzer abriss de geologie Palastinas zietsch rift. Deutsch Palastinas ver (mit Kart MaBtab 1: 700 000), 113-139.

Blanckenhorn, M., 1914. Syrien, Arabien, und Mesopotamien handbook. Geol. 5, Abt. 4.

Burdon, D. J., 1959. Handbook of the geology of Jordan, 82 pp. Government of the Hashimite Kingdom of Jordan, Amman.

COHMAP Members, 1988. Climatic changes of the last 18,000 years: observations and model simulations. Science, 241: 1043-1052.

El-Isa, Z., 1983, Seismic risk in Jordan. 1st. Jord. Geol. Conf. Amman. p. 523-541.

Galli, P., 1999. Active tectonics aling the Wadi Araba-Jordan Valley transform fault. Jour. Geophysical Research, 104, 2777-2796.

Goudie, A.S., Migon, P., Allison, R.J. and Rosser, N. 2002. Sandstone geomorphology of the Al-Quwayra area of south Jordan. Zeitschrift für Geomorphologie 46, 165–190.

Hartel, H. et al. (eds) 2007. Sandstone Landscapes, Academia, Prague.

Migon, P., Goudie, A. Allison, R. and Rosser, N. 2005. The origin and evolution of footslope ramps in the sandstone desert environment of south-west Jordan. Journal of Arid Environments, 60, 303-320.

Huckriede, R. and Wiesemann, G., 1968. Der jungpleistoz?ne Pluvial-See von El-Jafr und weitere Daten zum Quart?r Jordaniens. Geologica et Palaeontologia, 2: 73-95.

Hull, E., 1886. Memoirs of the geology and geography of Palestine. Survey of Western Palestine. London.

Jarrar, G. H., Baumann, A., and Wachendorf, H., 1983. Age determination in the Precambrian basement of the Wadi Araba area, southwast Jordan. Earth and Planetary Sci. Leters, 63, 292-304.

King, W. R., 1923. Cambrian fossils from the Dead Sea. Geol. Mag., 60, 504-514.

Lawrence, T. E., 1940. Seven Pillars of Wisdom. Jonathan Cape, London.

Lloyd, J. W., 1969. The hydrogeology of the southern desert of Jordan. UNDP/FAW 212, Technical Report No. 1, Rome.

McClure, H. A., 1976. Radiocarbon chronology of the late Quaternary lakes in the Arabian Desert. Nature, 263: 755-756.

McCourt and Khalil, K., 1990. The geology, geochemistry and tectonic setting of the granite and associated rocks in the Aqaba and Araba Complexes of southwest Jordan. Geol. Map. Div. Bull. 10. NRA, Amman, 96p.

Migon, P., Goudie, A. Allison, R. and Rosser, N. 2005. The origin and evolution of footslope ramps in the sandstone desert environment of south-west Jordan. Journal of Arid Environments, 60, 303-320.

Osborn, G. and J.M. Duford 1981. Geomorphological processes in the inselberg region of south-west Jordan. Palestine Exploration Quarterly January–June, 1–17.

Paradise, T.R. 1995. Sandstone weathering thresholds in Petra. Physical Geography 16, 205–222.

Paradise, T. R. 2002. Sandstone weathering and aspect in Petra, Jordan. Zeitschrift für geomorphologie 46, 1–17.

Paradise, T. R. 2005. Petra revisited: an examination of sandstone weathering research in Petra, Jordan. Geological Society of America, Special Paper 390, 39–50

Petit-Maire, N. and Guo, Z. T., 1997. Holocene paleoprecipitation over the present-day Sahara desert. In: Continental signals in paleomonsoon dynamics in Africa, Inter-Hemispheric Perspectives. SIWA Workshop, Paleomonsoon Project 33.

Picard, L., 1943. Structure and evolution of Palestine. Bulletin of the Geology Department, Hebrew University, Jerusalem 4, 1-135.

Powell, J., 1989. Stratigraphy and sedimentation of the Phanerozoic rocks in central and south Jordan, Part A: Ram and Khreim Groups. Geol. Map. Div. Bull. 11. NRA, Amman, 92p.

Powell, J., Moh'd, B. K. and Masri, A., 1994. Late Ordovician-Early Silurian glaciofluvial deposits preserved in paleovalleys in south Jordan. Sed. Geol., 89, 303-314.

Quennell, A. M., 1951. The geology and mineral rsorces of the (former) Transjordan. Colonial Geology and Mineral Resources, London, 2, 85-115.

Quennell, A.M., 1956, Tectonics of the Dead Sea Rift. 20th . Intern. Geol. Cong. Mexico. p. 385-403.

Quennell, A.M., 1983, Evolution of the Dead Sea Rift- A review. 1st Jord. Geol. Conf., p. 460-482.

Rabba, I., 1991. The geology of Al Quwayra area, map sheet 3049 I. 1:50,000 geological map series, 16, 50p. NRA, Amman.

Rushton, A., 1988. Preliminary report on some Cambrian fossils from Jordan. Brit. Geol. Surv. Tech. Rep. Strat. Ser. WH/88/63R, 2p.

Schick, A. 1977. A tentative sediment budget for an extremely arid watershed in the Souther Negev. In: D.O. Doehring (ed) Geomorphology in Arid Regions, Publications in Geomorphology, Fort Collins Colorado, pp. 139-164.

Selley, R. C., 1970. Ichnology of Palaeozoic sandstones in the southern desert of Jordan, a study of trace fossils in their sedimentologic context. In: Trace Fossils edited by T. P. Crimes and J. C. Harper. Geol. Jr. Spec. Publ. 3, p. 477-488.

Selley, R. C., 1972. Diagnosis of marine and non-marine environments from the Cambro-Ordovician sandstones of Jordan. Jour. Geol.Soc. London. 128, 135-150.

Smith, B.J. 2009. Weathering processes and forms. A. Abrahams and A. Parsons (ed.) Geomorphology of Desert Environments, 2nd Edition. Springer, Berlin, pp. 69-100.

Viles, H. A. and Goudie, A. H., 2004. Biofilms and case hardening on sandstones from Al-Quwayra, Jordan. Earth Surface Processes and Landforms, 29, 1473-1485.

Wolfart, R. R., 1968. Stratigraphie und fauna des Ober-Ordovixiums (Caradoc-Ashgill) und Unter Silurs Unter Llandovery)von Sud Jordanien. Geol. Jb., 85, 517-564.

Wray, R. A. L., 1997. A global review of solutional weathering forms on quartz sandstones. Earth Science Review, 42, 137-160.

Young, R.W., Wray, R.A.L. and Young, A.R.M. 2009. Sandstone Landforms, Cambridge University Press, Cambridge UK.

II- Culture

Achrati, A. (2006) “The story of the Arabian rock art: a Thamudic 'informant'”, Rock Art Research 23: 153-164.

Bednarik, R. G. (2000) “Rock Art Glossary”, Rock Art Research 17:147-155.

Bednarik, R. G. and Khan, M. (2005) “Scientific studies of Saudi Arabian rock art” Rock Art Research 22: 49-81.

R. Bocco and G. Chatelard (2001) “Comment peut-on être bédouin ? », in R. Bocco and G. Chatelard (eds.) Jordanie : le royaume frontière, Paris : Autrement, 60-77.

Borzatti von Lövenstern, E. (1982) “Sulle tecniche di incisione dell’arte rupestre in Giordania meridionale”, Studi Per L’Ecologia Del Quaternario 4, 109-115.

Borzatti von Lövenstern, E. (1984) “Pitture schematiche in ripari sotto roccia nel deserto della Giordania”, Studi Per L’Ecologia Del Quaternario 6, 71-79.

Borzatti von Lövenstern, E. (1986) “Figure umane incise sulle rocce nella Giordania Meridionale”, Studi Per L’Ecologia Del Quaternario 8, 127-134.

Borzatti von Lövenstern, E. (1996a) “Nuove incisioni parietali di figure umane nel deserto della Giordania meridionale”, Studi Per L’Ecologia Del Quaternario 18, 63-74.

Borzatti von Lövenstern, E. (1996b) “T.E. Lawrence nella documentazione rupestre die beduini del bacino di Isma” Studi Per L’Ecologia Del Quaternario 18, 101-6.

Borzatti von Lövenstern, E. (1997b) “Le armi dei beduini nelle incisioni rupestri del deserto della Giordania meridionale” Studi Per L’Ecologia Del Quaternario 19, 99-116.

Borzatti von Lövenstern, E. (1998) “Astrattismo e simbolismo ideogrammatico nella produzione rupestre calcolitica del bacino di Isma” Studi Per L’Ecologia Del Quaternario 20, 49-77.

Borzatti von Löwenstern, E. (2005) Quadri di Pietra. 8000 anni d'arte nel deserto, Bologna: Casa Editrice Nuova S1.

Borzatti Von Lövenstern, E. and Masseti, M. (1994) “Evidence of Epipalaeolihic art in Southern Jordan”, Studi per l'Ecologial del Quaternario (Periodico del Laboratorio di Ecologia del Quaternale Universita degli Studi di Firenze – Italia) 16: 27-35.

Borzatti Von Lövenstern, E. and Masseti, M. (1995) “Rock carving of cattle in the Hisma Bassin, Southern Jordan desert”, Studi per l'Ecologial del Quaternario (Periodico del Laboratorio di Ecologia del Quaternale Universita degli Studi di Firenze – Italia) 17: 65-78.

Boutros, N. and Chatelard, G. (2008) Today's Bedouin in Jordan, Amman: French Cultural Center.

Chatelard, G. (2000) “Utilisation contemporaine de l’espace et gestion des ressources dans la région du Wadi Ramm, Jordanie”, in Farès-Drappeau, S. and Zayadine, F. Mission franco-jordanienne au Wadi Ramm, Rapport d'activités 2000.

Chatelard, G. (2005a) “Desert tourism as a substitute for pastoralism? Tuareg in Algeria and Beduin in Jordan”, in D. Chatty (dir.) Nomadic Societies in the Middle East and North Africa: Entering the 21st Century, Handbook of Oriental Studies Series, Leiden: Brill, 710-736.

Chatelard, G. (2005b) “Tourism and representations: Of social change and power relations in Wadi Ramm, Southern Jordan”, in S. Latte Abdallah (ed.) Images aux frontières. Représentations et constructions sociales et politiques. Palestine, Jordanie 1948-2000, Beirut: IFPO, 194-251.

Farès, S. (1995) “L’inscription de type dédanite d’Abu al-Dibâ’/Wady Ramm, une nouvelle lecture”, Annual of the Department of Antiquities of Jordan (ADAJ) 39: 493-497.

Farès, S. (1997a) “Epigraphic survey in the Wâdi Iram, 1996” (Arabic) Annual of the Department of Antiquities of Jordan (ADAJ) 41: 37-44.

Farès, S. (1997b) “Wadi Ramm epigraphic survey”, American Journal of Archaeology 10: 496-497.

Farès, S. (1998) “Wadi Iram: un lieu du culte et de rassemblement des tribus arabes dans l’Antiquité. Les premiers résultats de la mission épigraphique 1997”, ARAM 8, 269-283.

Farès, S. (2001) “A preliminary report on the forth season of the Wâdi Iram epigraphical, geographical and archaeological survey”, Annual of the Department of Antiquities of Jordan (ADAJ) 45: 205-216.

Farès, S. (2003)“Remarques sur l’occupation humaine à Wadi Ramm”, Topoi 4: 427-429.

Farès, S. (2004a) “A preliminary report on the sixth season of the Wâdi Iram epigraphical, geographical and archaeological survey”, Annual of the Department of Antiquities of Jordan (ADAJ) 45: 350-375.

Farès, S. (2004b) “Compte-rendu de la mission franco-jordanienne 2004”, Munjazat, Department of Antiquities of Jordan.

Farès, S. (2006) “Les gravures rupestres de Jordanie du Sud et enquête sur les pratiques de chasse actuelles”, in Sidera, I. (ed.) La chasse. Pratiques sociales et symboliques, Paris : De Boccard.

Farès (2008) “La représentation de la main dans les gravures rupestres en Jordanie du Sud”, Journal of Epigraphy and Rock Drawings 2: 53-67.

Farès, S. and Zayadine, F. (1998) “Two North-Arabian inscriptions from the temple of Lât at Wady Iram”, Annual of the Department of Antiquities of Jordan (ADAJ) 42: 255-258.

Harding, G. L. (1971) An Index and Concordance for pre-Islamic Arabian Names and Inscriptions, Toronto.

Harding, G. L. and Littman, E. (1952) Some Thamudic inscriptions from the Hashemite Kingdom of Jordon , Leiden.

Inglis, B. (1988) “Incisioni di piedi e calzari sulle rocce del deserto della Giordania meridionale”, Studi Per L’Ecologia Del Quaternario 10, 67-92.

Glidden, H. W. (1939) “Koranic Iram, Legendary and Historical”, Bulletin of the American Schools of Oriental Research, 73: 13-15.

Howe, B. (1950) “Two Groups of Rock Engravings from the Hijaz”, Journal of Near Eastern Studies 9 (1) : 8-17.

Kirkbride, D. (1960) “Le temple nabatéen de Ramm”, Revue biblique 67: 65-92.

Rowe, A., L. Ra'ei and M. E. Zalabia (1998) "The Socio-Economic Organisation of
the Wadi Rum Reserve Population: Challenges and Opportunities for Conservation and Tourism Development", Unpublished Report, Royal Society for the Conservation of Nature, Amman.

Ruben, I. and Nasser, G. (1999). Review of the Archaeology of the Wadi Rum Protected Area, The Royal Society for the Conservation of Nature, Amman. http://www.wadirum.jo/Library/Rum%20Reports/archmenue.htm

Savignac, R. (1932) "Chronique : Notes de voyages. Le sanctuaire d'Allat à Iram", Revue biblique 41: 581-597.

Savignac, R. (1933) "Le sanctuaire d'Allat à Iram", Revue biblique 42: 405-422.

Savignac, R. (1934) "Le sanctuaire d'Allat à Iram, suite", Revue biblique 44: 572-589.

Savignac, R. and Horsfield, G. (1935) "Le temple de Ramm", Revue biblique 44: 245-278.

Tholbecq, L. (1998) "The Nabateo-Roman site of Wadi Ramm, a New Appraisal", Annual of the Department of Antiquities of Jordan (ADAJ) 42: 241-254.

Section 8: Contact Information of Responsible Authorities

8.a Preparer

Aqaba Economic Zone Authority
Commissioner of Environment Office

In cooperation with:

SIYAHA USAID Second Tourism Project

Nomination Project Team Leader

Tarek M. Abul Hawa
P.O Box 59 – Mahis, Jordan
Mobile: 962 799 050036
Email: tarekabulhawa@yahoo.com

SIYAHA USAID Project Coordinator

Mrs. Maysa Shahateet
Telephone: 962 6 520 0555
Mobile: 962 799 994442
Email: mshahateet@SIYAHA.org

National Technical Team

Dr. Abdul Kader Aabed – Geology Expert
Mobile: 962 777 490106
Email: aabed@ju.edu.jo

Dr. Mohammad Najjar – Archaeology Expert
Mobile: 962 799 888606
Email: m.najjar@joscapes.com

Eng. Mahmoud Bdour – Protected Areas Management Expert
Mobile: 962 796 288007
Email: mbdourrum@yahoo.com

Shaikh Mohammad Eid Zalabya – Local Culture Expert
Mobile: 962 796955577

Eng. Jamal Zaidaneen – Ecology Expert
Mobile: 962 799 444291
Email: jzaidaneen@yahoo.com

Mrs. Natalia Boulad – GIS Expert
Mobile: 962 799 029705
Email: natalia@rscn.org.jo

Mrs. Majd Abu Zaghlan – Technical Assistant
Mobile: 962 799 444281
Email: majdzaghlan@hotmail.com

International Technical Advisors

Prof. Bernard Smith – Desert Geomorphology Expert
School of Geography
Queen's University Belfast
Belfast, BT7 1NN, UK
Tel: 44 28 9097 5144
Fax: 44 28 9032 1280
Email: b.smith@qub.ac.uk

Prof. Saba Fares – North Arabian Epigraphy Expert
Université Nancy
Campus Lettres et Sciences Humaines
UFR - LCE - Etudes arabes
3 Place Godrefroy de Bouillon - BP 3397 - 54 015 NANCY Cedex
Tel.: 33 6 89 98 74 76
Email: saba.fares@univ-nancy2.fr

Dr Géraldine Chatelard – History and Anthropology Expert
Institut français du Proche-Orient (IFPO) - Amman
Tel: 962 6 4611171
Mobile: 962 795 370771
Email: gchatelard@yahoo.com

Mrs. Laura Strachan – Anthropology Expert
Theorice International Development Inc., Canada
Tel : 001 250 3340048
Mobile: 962 777 804271
Email: theorice.ceo@gmail.com

8.b Official Local Institution/Agency

Aqaba Special Economic Zone Authority
Wadi Rum Protected Area Management

Dr. Salim Al Mughrabi
Commissioner for Environment
Aqaba Special Economic Zone Authority

P.O. Box 2565
Aqaba 77110, Jordan
Tel: 962 (03) 209 1000
Fax: 962 (03) 209 1008
Mobile: 962 79 999 7212
Email: SMoghrabi@aseza.jo
Website ASEZA: www.aseza.jo
Website Wadi Rum: www.wadirum.jo

8.c Other Local Institutions

Ministry of Environment

Eng. Hussein Shahin – Director of Conservation
Mobile: 962 799 057415
Email: hussein_shhn@yahoo.com ; hussein.shahin@moenv.gov.jo
Website: www.moenv.gov.jo

Department of Antiquities

Dr. Fawwaz Khraishah – Director General
Mr. Abdul Sa'meea' Abu Dayyah – Technical Advisor
P.O. Box 88
Amman, Jordan
Tel: 962 6 460 3360
Fax: 962 6 461 5848
Mobile: 962 795 572 316
Email: doa@nic.net.jo; absami50@hotmail.com
Website: www.doa.jo

Ministry of Tourism and Antiquities

Mrs. Sahar Barari – Technical Advisor
3rd circle - Jabal Amman
Tel: 962 6 4603360
Fax: 962 6 4648465
Mobile: 962 777 512 921
E-mail: contacts@tourism.jo
Website: www.tourism.jo

Royal society for the conservation of Nature

Mr. Nashat Hmaidan – Conservation Advisor
PO Box 1215
Jubaiha 11941
Amman, Jordan
Tel: 962 6 5337931/2
Fax: 962 6 5347411
Mobile: 962 796 877 297
E-mail: nashat@rscn.org.jo
Website: www.rscn.org.jo

8.d Official Web Address

Aqaba Special Economic Zone Authority: www.aseza.jo
Wadi Rum Protected Area Directorate: www.wadirum.jo

Section 9: Signature on Behalf of the State Party

| Eng. Hazem Malhas |

| Minister of Environment |

| Hashemite Kingdom of Jordan |

| January 2010 |

Annexes

Important note: All annexes are attached are separate files documents

Annex 1: Wadi Rum Regulation
Annex 2: Management Plan
Annex 3: Visitors Management Plan
Annex 4: Monitoring Program
Annex 5: Zoning Scheme Summary 2009