Joint ICOMOS / World Heritage Centre Reactive Monitoring mission to Jordan
17 to 21 November 2006

Mission report

on World Heritage Sites of Um er-Rasas and Quseir Amra

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The mission was carried out by Mrs Angela Maria Ferroni, Archaeologist and Conservator, Ministry of Cultural Properties and Activities – Rome (Italy) and Mr Kerim Hendili, Arab State - WHC

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II - Report on Um er-Rasas

1. Executive summary

On the basis of the outcomes of the first reactive monitoring mission carried out in 2005 and the decision 30COM7B.51 of the World Heritage Committee, at its 30th session in July 2006 (see Annex 3), a joint monitoring mission took place to the World Heritage Site of Um er-Rasas (Jordan) from 17 to 21 November 2006.

The mission, carried out by Mrs Angela Maria Ferroni (ICOMOS) and Mr Kerim Hendili (WHC), aimed at assessing:
- the evolution of the situation at the site, since the last monitoring mission (2005), with particular reference to the protection, security, and conservation of the property;
- the progress made in drawing up management and conservation plans;
- the results of the consultation between the Department of Antiquities and the responsible persons in charge of the implementation of the European Commission funded project (EU project) in order to revise the latter and adapt it to the prevailing situation at the site.

The mission was based on a close collaboration with the Site Management Plan Team (SMP Team), with the support of the DG of the Department of Antiquities (DoA) and consisted in a dense preparatory meeting, a visit to the site and a deep debriefing in order to assess the overall situation and come out with the recommendations.

Having visited the Site and discussed with the SMP Team, the mission established the progress of the implementation of the management plan. The mission, however, observed that no measures had been taken by the State Party to face up to protection, security and conservation issues on the Site. Concerning the EU project progress, the mission could observe that it had been developing without taking into account the real needs of the WHS and that it could be better addressed by enhancing coordination amongst stakeholders.

2. Background

The site of Um er-Rasas became a World Heritage Property in 2004 (see Annex 1), the World Heritage Committee recognizing its outstanding universal value through the artistic and technical qualities of the mosaic floor of St. Stephen's church, the uniqueness and completeness of its styliletower and its strong association with monasticism and with the spread of monotheism in the whole region, including Islam.

In its decision 28COM14B.22, the World Heritage Committee also requested the State Party to elaborate and submit complete management and conservation plans and to organise two monitoring missions to review the progress of their implementation.

The first monitoring mission was carried out from 30 March to 3 April 2005 by ICOMOS. The outcomes of this mission were reported to the World Heritage Committee whose decision 29COM7b.41 (see Annex 2) reflected a concern as regards the development project foreseen within the framework of cooperation between the European Union and the State Party, as well as the progress in the elaboration and implementation of the management and conservation plans.
3. Objectives:

Owing to the request of the World Heritage Committee (Decision 30COM7B.51) the mission had to focus on the following main issues:

1) the urgent measures to be undertaken in order to resolve the security and conservation problems:
   - to assure the security of the persons working on the site and the visitors, as well as the most endangered components of the archaeological area (including the mosaics) by isolating the most dangerous zones (trenches, archaeological soundings, elements to be consolidated, etc.) using a temporary fence and adapted secure cover and consolidation materials
   - to stop the works at the site
   - to resolve the most urgent conservation problems and particularly the humidity threatening the mosaic floor of the St Stephen Church

2) the progress of the elaboration of the management plan including the definition of the future management structure and financial system:

At the date of the beginning of the mission, management and conservation plans were not yet submitted to the World Heritage Centre and ICOMOS.

3) the work progress of the EU project as regards the need to coordinate its objectives and work-plan to the above mentioned urgent measures:

The World Heritage Centre and ICOMOS received a copy of the EU project for the development of tourist activity at the site. This project foresees a detailed exploitation plan which doesn’t seem to take the current situation into consideration which is likely to seriously complicate the improvement of the general state of conservation of the property.

Other issues were raised, such as the clarification of the legal status of the different areas composing the site and its surroundings (also to address some threats like grazing). From the point of view of the World Heritage status of the site, the delimitation of the core and buffer zones appeared as one of the main points to clarify and focus on. The need for a good documentation also appeared as an important part of the process towards the elaboration of efficient management and conservation plans (see Annex 4).

4. Situation at the site

4.1 Level of protection of the site

Since the last monitoring mission, the situation of the WHS has not changed from the protection point of view. Fences have not been built and the boundaries of the property are still not clear. The lack of definition of the boundaries, especially on the spot, could lead to future problems in terms of impact from urban development (Figure 1). At present, modern buildings have a low impact on the archaeological ruins, but the presence of some disturbing villas -between the ancient settlement and the Stylite tower- has to be noticed.

Figure 1: Panoramic view from the road, at the entrance of the site (by authors)
There is no staff watching the site on a permanent basis; this situation in addition to the lack of fences makes theft, vandalism and illegal digs possible in several areas of the site. From this point of view the present situation, compared with that one observed in 2005, appears to be rather worse. Inside the Church of the Tabula, for instance, the stone relief *plutei* have been broken down by vandals (Figure 2) and the top of the underground cistern has been broken into pieces (Figure 3).

Everywhere illegal digs can be noted (Figure 4), earth and stones from which are dumped untidily in the few excavated monuments (Figure 5); such digs contribute to threaten further both the safeguard of ancient structures and the safety of visitors, increasing existing dangerous situation.

4.2 State of conservation of the archaeological area and decorative and structural elements

Concerning the state of conservation, we could notice that no interventions have been carried out to face up to the most urgent problems: the ancient ruins show more and more evidence of lack of maintenance and appropriate restoration works (Figure 6).

During the last visit, we also identified recent structural damages involving walls and pillars and could notice a worsening in the state of conservation of some mosaics and rare fragments of plasters. As a matter of fact, only the most important mosaics—in uncovered churches— are protected by means of temporary sand layers; however those solutions appear to be not sufficient to preserve adequately such floorings, especially because visitors keep taking sand off (by chance but also willingly).
Also mosaics in St. Stephen’s church show a worsening from the conservation point of view, because no measures have been taken to face up humidity problems. As a consequence an increase in salt efflorescence has been noticed, that can cause further chemical and mechanical damage (Figure 7).

![Figure 6: dangerous situation for some structures (by authors)](image)

![Figure 7: St. Stephen church, saline efflorescence of recent formation on mosaic flooring (by authors)](image)

4.3 Excavation works

A part from the most recent illegal digs and vandalism, that contribute to make the general situation worse, new archaeological excavations have been noticed on the spot (Figure 8), carried out badly and without specific strategy: soundings and trenches have been left open, without protection to structures and architectonical or decorative elements. Moreover abandoned pottery fragments are scattered everywhere (Figure 9). Earth mounds and stones have not been moved away from the archaeological areas, and it also increases the general lack of intelligibility of the site as a whole.

![Figure 8: New excavations (by authors)](image)

![Figure 9: fragments of pottery (by authors)](image)

4.4 Security issues

Although tourist flow is still limited, rubbish is dumped on all sides of archaeological area (Figure 10) and the few visitors climb and walk on the ancient structures because of the lack of physical barriers and specific paths (Figure 11). To date, no measures have been undertaken to assure the security of the persons working on the site and visitors. Furthermore, compared with the situation noticed in 2005, dangerous area have spread because of new unsafe opening of illegal digs and excavations and because of general decrease of structures’ stability.
4.5 Progress of the implementation of the management plan

A first draft of Management Plan for Um er-Rasas Site was presented to the Mission (see Annex 5): It has been carried out at the Department of Antiquities by a team constituted by Mr. Wolfgang Koellisch, conservation architect, as MP Project-Coordinator, and Mrs. Sabal Zaben, archaeologist, as responsible Manager for the MP.

The present draft of MP defines general strategies to protect and preserve the archaeological ruins based on the significance of the WH Site and according to the modern principles of conservation. It also points out the need to develop an appropriate specific strategy to prevent or reduce earthquake risk for cultural heritage and highlights the advisability of reducing excavation works, dedicating the efforts to conservative needs.

However the MP draft can not define specific actions to be carried out both in conservation and in archaeological investigation because of the lack of up-dated detailed archaeological surveys and comprehensive studies which should constitute the main management tools as a basis for developing specific projects and future monitoring activities.

A database for inventorying Um er-Rasas assets and objects of art was realized but it must be fulfilled and still integrated in the Geographical Information System of the DoA.

The draft deals also with the tourism development issue, recommending the need of an appropriate strategy - shared with the other government bodies and local community representatives- taking into account the protection and preservation of the WH Site as first priority.

At last the MP draft suggests a site management vision, defining the staff organisation and describing responsibilities and appropriate qualifications for the different components of proposed staff.

However, the draft shows evidence of the present lack of cooperation between the most important stakeholders involved within the WH Site and its Setting; furthermore it bears evidence of the weak position of the Department that, though it is responsible for the protection of Um er-Rasas, has neither adequate human resources nor sufficient funding to face at least the most urgent conservative and security problems.

In our opinion the present situation can make completing and implementing the Um er-Rasas management plan not feasible.
### 4.6 Development and promotion (European Commission funded project)

Concerning the European Commission Programme for the *Protection and Promotion of Cultural Heritage in the Hashemita Kingdom of Jordan*, the situation has considerably changed since the first ICOMOS mission to the Site.

At present the project seems to be evolving towards pure economic exploitation aspects, without taking into account the theoretical and methodological approach of the original programme which aimed at protecting and enhancing the cultural values of the WH Site, in view of a sustainable development of the Region. Therefore, only tourist services and new shelters are foreseen today (see *Annex 6*). For this reason lands for the building of the visitor centre have been purchased, while the other ones surrounding the archaeological site - which purchasing had been planned to protect the WH Site - are still private properties (Figure 12).

#### Figure 12: private land besides the Stylite Tower and between the two major archaeological areas of the site (by authors)

Furthermore the project seems to be in contrast with the present situation at the Site: apart from S. Stephen complex and a few churches, the archaeological area is a mass of ruins, which are more difficult to understand on account of ancient downfalls and heaps of earth and stones left over from
previous archaeological investigations and illegal digs (Figure 13). All the structures suffer from different kinds of decay and also those reconstructed in the past - by means of anastylosis works - could collapse in the event of an earthquake. Dangerous situations can be found everywhere (Figure 14).

Regarding some particular items of the EU project, we can notice that the new shelter to cover the S.Stephen complex has been planned without carrying out the necessary preventive microclimatic analyses and archaeological investigations and surveys of monuments and surrounding area. Moreover we can not agree with the shelter design since it could have a very disturbing impact on Um er-Rasas setting and - above all - would certainly cause a heat problem below, a “greenhouse effect”, because of the oversized foreseen glass panels (more than 14 square meters) (Figure 15).

Furthermore, also from the point of view of aesthetic presentation, the presence of transparent windows can lead to the problem of shadows falling across the mosaics.

In addition to it, those panels - as well as other material for the new buildings - should be imported from UK, which would imply future maintenance problems.

Figure 15: North elevation of the proposed structure to cover the churches complex, notably St Stephen’s church. The foreseen glass panels (in red) would affect the archaeological remains by creating a greenhouse effect (elevation extracted from drawing N° PLUDAR_129 – EU Project)

Concerning the planned rain water drainage system, it is not clear where and in which way the water could be removed from archaeological structures. Furthermore it could be able to protect mosaics from rainwater but not from rising humidity that is the most serious cause of damage to the ancient monument. We think that not enough in-depth investigations have been carried out to assess preliminarily the underground situation and find suitable solutions to this problem.

Last but not least, in such kind of situation (rising humidity-enclosure building- greenhouse effect exacerbating temperature and humidity fluctuations) the planned ventilation system could contribute to get worse the efflorescence phenomena on mosaics due to the cycles of crystallization and dissolution of soluble salts.

The new visitor centre, which seems to be too big (see Annex 7), has been planned before carrying out preventive archaeological soundings on the spot (to verify the possible presence of underground archaeological remains in the area where the building is foreseen) and without taking into account effective needs of the Site (i.e. archaeological storehouse, restoration laboratory, etc.).

At least it has to be noticed that, at present, the DoA is not really involved in the key issues of EU project: many operational solutions are assigned to the future contractor and advices concerning conservation methods are supposed to be provided by the Supervising Consultant of the project.

Considering the above mentioned issues and according to item 6. of the Decision 30COM7.B51 of the World Heritage Committee, the EU project should be revised on the basis of the identification and listing of the effective needs of the Site and on objectives and policies established in the management plan.
The management plan should identify strategies but also specific actions to protect and enhance the WH Site, defining different plans by sector, such as research, conservation, maintenance, presentation, enhancement, development plans, etc., meeting the interests of the different stakeholders (scientists, inhabitants, visitors, politicians, owners, etc.) and accommodating the possible conflicts. In fact, part of the problem appears to be the lack of coordination between the authorities and bodies involved, as well as the priority that seems to be given only to the tourist development of the Site.

5. Conclusions and recommendations:

With respect to the issues raised by the World Heritage Committee in its Decision 30 COM 7B, the mission observed the following:

“5. Recommends that the State Party concentrate its efforts on the implementation of priority measures, in close consultation with ICOMOS and the World Heritage Centre. These priority measures include:

a) Clearly identify the boundaries of the area(s) to be protected and fenced if necessary, even temporarily;”

With regard to protection of the Site no progress has been done since the last monitoring mission time: it is urgent that the exact boundary of the Um er-Rasas World Heritage Site and its buffer zone be identified on the spot, properties situation be clarified and archaeological area be fenced in order to ensure that the WH Site be adequately protected from potential urban encroachment, looting and illegal digs; with the same object in view it is imperative that present guardianship be strengthened. Also the state of maps and documentation has not changed, apart from the inventory data base realized by the MP team that has not still completed and should be integrated within the Geographical Information System of the Department. In addition to it the documentation centre at the DoA suffers from a lack of information which could be partly addressed by requesting the archaeological missions to systematically provide copies of the documentation work which their specialists realize.

“b) Address the security issues, notably by prohibiting access of visitors to potential dangerous areas and carrying out the necessary works to cover the trenches and archaeological soundings;

c) Isolate and preserve the most endangered and damaged archaeological and architectural components by establishing a temporary restricted plan of visit paths;”

No security measures have been yet taken to safeguard workers and tourists: neither physical barriers nor specific paths were provided. Trenches and soundings were not re-covered. Furthermore, compared with the situation noticed in 2005, dangerous area have spread because of new unsafe opening of illegal digs and excavations and because of general decrease of structures’ stability. In addition to it, the lack of an adequate guardian system lets tourists and local people free walk and climb up the ancient structures on the archaeological site.

“d) Preserve the mosaics with adequate temporary and protective materials (special geo-textile layers and draining sand layers);

e) Consolidate the most endangered architectural elements using temporary but secure structures;

f) Stop restoration works and reconstruction of collapsed elements;

g) Resolve, when possible, using simple and temporary solutions, the humidity problems, notably for the mosaic floor of the sheltered St. Stephen Church;”
With respect to the state of conservation the Mission could observed that damaged archaeological structures and decorative elements were not isolated or preserved with adequate and temporary measures. The lack of preventive interventions, combined with negative results of illegal digs and incorrect “archaeological” excavations, sometimes brought about a worsening in the state of conservation of ruins. Furthermore during the inspection the mission could observed recent, serious damage due to vandalism. Humidity problems were not faced up and mosaics in the St. Stephen Church show an increase of saline efflorescence damage.

“h) Define the future management structure and financial system, which will be adopted in the management plan for the site”.

A first draft of Management Plan for Um er-Rasas Site has been carrying out by a team within the Department of Antiquities. However, despite many efforts at the DoA, some constraints led to a delay in its submission to the World Heritage Centre. The main issue is related to the difficulties in having the authorities responsible for tourism development taking the current conservation situation at the site into consideration notably for a possible revision of the project financed by the EU. At the present different funds are not available to address the priority needs of the WH Site and also human resources within the DoA are not sufficient to face up the main problems. As regards the future management structure, the definition of the profile of the site manager, who will lead the whole management process, is a key issue for which the EU project doesn’t seem to be disposed to openly discuss with the DoA.

“6. Requests the State Party to engage, possibly with the support of the World Heritage Centre, in discussions in order to make sure that the European Commission funded project be redesigned so as to integrate the above mentioned priority measures and adapt its work-plan and schedule accordingly;”

The mission strengthened his opinion that many of the components of EU project are not adapted to the present situation of the Um er-Rasas archaeological site and they could affect the site instead of contributing to its promotion. Particularly from the technical point of view, several interventions foreseen by the project development might affect the archaeological elements and make their conservation more complicated and difficult. Furthermore the EU project appears to be directed only towards exploitation goals without taking into account the urgent conservation needs of the Site. As already requested by the World Heritage Committee all efforts have to be made to guarantee the adaptation of the project to the conservation and preservation constraints. There is an urgent need that discussions be engaged between the DoA and the responsible persons in charge of the EU project in order to redesign the project and better address available funds.

The mission would underline that, as described in the Operational Guidelines for the Implementation of the World Heritage Convention -par. 178 and 179-, a World Heritage property - as defined in Articles 1 and 2 of the Convention - can be inscribed on the List of World Heritage in Danger by the Committee in the cases of ascertained danger due to “serious deterioration of materials” and/or “serious deterioration of structure and/or ornamental features”, or potential danger because of “lack of conservation policy” and/or “threatening effects of regional planning projects”.

The Mission would accordingly stress the following recommendations:

6.1 General
• The central Administration ought to strengthen the Department of Antiquities in terms of human and financial resources, in order to face the site conservation and protection needs (see below).

• It should be useful soon establish a local management office to strengthen the protection and development activities on the Site.

• An agreement between all parties concerned by the protection and conservation of the site has to be reached as to include the EU project in the global strategy in terms of conservation and management of the site. It is important to make the decision makers at the EU and their representatives in Jordan understand that it is possible to develop a project at Um er-Rasas based on a close consultation with the DoA and the World Heritage Centre in order to identify the preliminary measures to be launched prior to any promotion initiative.

6.2 Protection of the Site

• The boundaries of WH Site an its buffer zone have to be exactly defined and identified on the spot to ensure that its outstanding universal significance is adequately protected.

• The archaeological site should be provided with updated topographic scale maps fixing the boundaries of WH Site and its buffer zone.

• The Ministry of Tourism and DoA should together address the issue of ownership relating to the lands composing the Um er-Rasas archaeological area and reflect the results of this study on a map, which also includes the core and buffer zones delimitation, in order to allow assessing the legal status of these areas and therefore their level of protection.

• The Ministry of Tourism and DoA has to improve and develop the protection system of the WH Site to control and regulate the access to it and to avoid looting and illegal digs.

• The site has to be fenced and provided with an efficient guarding system in order to protect the archaeological area from any kind of vandalism, theft or illegal excavation. Fences should be planned considering future visual impact on archaeological structures and surrounding landscape.

• The DoA should be strengthen the basic planning instruments, such as inventories and up-dated topographic and archaeological maps, supporting protection and conservation activities.

6.3 State of conservation of the Site

• Urgent works necessary to prevent collapsing have be carried out straightaway. The other pressing conservation problems (detaching plasters and mosaics, etc.) have to be solved at the same time, using temporary solutions and means in view of future suitable conservation works.

• The effects of the water (underground and rain) is a particular and urgent point to address and a system to manage this aspect should be envisaged as soon as possible, basic on specific studies.

• The site has to be provided with detailed plans in a scale suitable for the production of thematic maps on the state of conservation of the structures.

• The factors in decay affecting structures and decorative elements should be identified and different damage levels should be estimated; likewise procedures and materials, to be applied in the treatments, should be identified and tested in order to draw up a suitable comprehensive conservation plan for the site, identifying operations that have to be carried out and defining the work plan and time-table.
• After having brought back archaeological structures and architectonical and decorative elements to an acceptable state of conservation, a detailed maintenance procedure should be established and followed in a regular manner including preventive actions aimed at reducing the effects of deterioration factors.

• A specific monitoring system, aimed at assessing the results of adopted policies and strategies for the conservation and maintenance of the site should be considered in the Management plan.

6.4 Archaeological excavations

• The DoA has to obtain the necessary authority to stop any kind of excavation at the site in order to concentrate the future efforts on conservation. This authority should be recognized at highest level in order to avoid exceptional authorizations.

• Given the present situation possible archaeological excavations should be carried out only in case of conservation works and the contribution of archaeological mission should be re-directed to address the priorities of the site.

• It is advisable to ensure the protection of recently excavated structures by means of temporary solutions (as could be also the re-burial).

6.5 Security issues

• Security issues have to be addressed immediately. Since several parts of the site are representing a potential danger timely measures have to be taken: filling in or fencing the trenches, soundings and every hollows in the ground; erecting physical barriers; creating specific paths and also prohibiting access of visitors to the most dangerous areas (limiting access to the most fragile and unprotected areas can prevent also potentially damage activities by visitors, such as climbing and walking on the ancient structures).

• The establishment of a local management office as well as the strengthening of guardian system could also contribute towards ensuring the security of visitors by means of regular inspections

• The Ministry of Tourism, together with DoA, could attend to drafting and circulation of suitable codes of behaviour reflecting the OUV of the Site.

6.6 Site’s management

• In general the approach of the draft of Management Plan - drawn up by the team set up within the DoA - is considered sound and appropriate. However that plan has to be finalized identifying strategies but also specific actions to protect and enhance the WH Site, defining different plans by sector, such as research, conservation, maintenance, presentation, enhancement, development plans.

• The management plan has to assess what funds are required to ensure the implementation of the activities on the Site and it has to identify what sources, national and international, can provide the necessary financial resources.

• The management plan has and shared by all the authorities involved, including local community representatives, that have to work together in order to identify their interests and bring them together to a common “vision” for the site.

• All activities and projects concerning the site have to conform to the objectives and strategies defined within the management plan.
• The future management structure and its abilities have to be discussed at the level of the State Party, notably between the Ministry of Tourism and the Department of Antiquities.

• The State Party has to ensure the adequate financial resources for achieving the management objectives for the WH Site

6.7 EU project

• Concerning the EU project, on the grounds of the assessment of the general situation and of the state of conservation of the site, it is stressed that the initiative has to be reconsidered in the framework of a global conservation and management approach. The real needs to be addressed at Um er-Rasas are in fact different from those considered into that initiative (i.e. the lack of a proper and in-depth documentation and of detailed maps, the precarious state of structures, mortars and mosaics, the lack of a dedicate staff -guardians, archaeologists, restorers, surveyors, skilled workers-, the lack of funding for conservation and maintenance, etc.).

• It appears necessary to provide adequate –urgent- conservation and safety measures before working to increase tourist flows on the site.

• It is advisable to proceed with urgency to redesign the project, foreseeing -with the support of the World Heritage Centre- the involvement of a multidisciplinary team of experts. This would avoid implementing some components of the project which are not adequate notably in terms of conservation.

• Referring to the St. Stephen complex shelter, the existing shelter (unsuitable, not well built, damaged, etc.) has to be reconsidered but the new design foreseen in the project do not seem to be a suitable solution. Several technical reasons call for reconsidering the way this archaeological monument has to be protected. In particular it is stressed that a shelter correct project should be based on a) previous specific long-term climatic and micro-climatic analysis to establish the best conservation air condition inside enclosure building, b) detailed archaeological investigations and surveys of monument and surrounding area, c) environmental impact assessment to avoid a strong visual impact on the characteristic desert setting.

• It appears necessary a temporary suspension of EU project activity until a substantial revision of the plan is carried out.
II - Report on Quseir Amra

1. Brief presentation of the site

Quseir Amra is the best-known of the many fortress-residences that the Umayyad caliphs built in the desert for hunting and pleasure but also to maintain close contacts with the tribes of the region; it is located in present-day eastern Jordan, in a broad depression about 85 kilometres east of Amman, alongside the modern highway that links Amman to Azraq Oasis.

The castle was built in the early 8th by the caliph Walid I (705-715); however some scholars believe it may be the work of his uncle, Walid II (743-744). The complex comprised various buildings; nowadays the remains of Quseir Amra consist of a small country house and of the service water system linked to the baths, including a 40-meter-depth circular well, and remains of the water-lifting apparatus (Figure 16).

![Figure 16: The bath complex with the well and the water-lifting apparatus (by authors)](image)

Particularly, the country house is an austere limestone stone’s structure (Figure 17) including a reception hall, divided into three aisles by two arches covered with three barrel-vaults. The throne recess is an alcove facing the entrance, flanked by two small rooms. The adjacent bath complex, showing a strong Roman influence, consists of three small rooms: the first, covered by a barrel-vault might have been for disrobing (apodyterium); the second, cross-vaulted, corresponded to the moderately hot chamber (tepidarium); the third room, covered by a cupola, close to the furnace, served as the hot chamber (calidarium). A passage on the east side of calidarium opens to an unroofed enclosure that probably was a service room to the furnace (Figure 18).

![Figure 17: Lime stone’s structure (by authors)](image)

![Figure 18: Plan of the building including the bath complex (by authors from a panel entitled “The construction of the bath” - visitor centre’s exhibition room)](image)
The castle, considered thus one of the most important examples of early Islamic art and architecture, gains its fame from the decorated and figurative frescoes adorning its interior walls and ceilings. These paintings were re-discovered in 1898 by Alois Musil who recognized the artistic importance of Amra paintings, and made them known by means of the drawings produced by Mielich and published in 1907.

The extensive paintings display a rich and varied iconographic repertoire: the themes are most diversified and include hunting and bathing scenes, athletes, archers, musicians and dancers, as well as scenes related to pastoral life, historical scenes, mythological representations and panels depicting various trades and activities connected with construction work. The representations, which provide important information about the life style and the culture of an eighth-century Arab prince, reveal not only more than one artistic style to be found in the paintings at Quseir Amra, but also show that the Umayyad dynasty’s art linked with both the classical and Byzantine traditions which it had inherited, as well as with the contemporary cultural influences from the east.

The monument was declared a national property and a protected area by the Jordanian Antiquities Law in 1935. It is managed by the DoA.

2. Background

Quseir Amra was inscribed on the World Heritage List in 1985 on the basis of criteria (i), (iii), and (iv) by decision of the World Heritage Committee who recognized its outstanding universal value through the uniqueness of the paintings which extraordinarily witness to the Umayyad civilisation and the good conservation of the architectural complex that is a considerable example of the Umayyad desert castles.

Some years before the inscription on the WH List, a Spanish team from the National Museum of Madrid was commissioned by the Department of Antiquities to clean the paintings blackened because of the campfires of Bedouins and to consolidate the structures (see Annex 8). The work was carried out between 1971 and 1974. The Spanish team also made excavations in order to better understand the ancient water provision system, the palace and the castle and provided documentation on them.

In 1994, the Quseir Amra castle area was flooded because of heavy rains; the water level reached 70 cm above the floors and some frescoes were damaged by humidity.

After that event, special measures were taken to reduce risk of flooding, by means of sustainable works which did not change the setting characterising the desert castle.

At the end of 1996 a further restoration intervention was carried out on frescoes in the throne recess by a team of Spanish picture restorers (see Annex 9). This work revealed the presence of different pictorial additional touches probably related to previous unknown interventions.

In 1999, a project aimed at acquiring a full and accurate documentation of the complex and its paintings was completed by the French Institute of Archaeology for the Near East (IFAPO). The Institute also carried out the restoration of the noria and provided the bath’s rooms with new floorings. Furthermore IFAPO cooperated with the Jordanian Ministry of Tourism and Antiquities and the French Embassy in Amman to build and furnish the visitor centre that was built with a financial contribution from UNESCO.

In 2002, new scientific investigations were carried out by an Italian team from the Consiglio Nazionale delle Ricerche (CNR) together with the Università Internazionale dell’Arte di Firenze and the Istituto Superiore “Antonino De Stefano”. This study provided a final report on the state of conservation of the frescoes at Quseir Amra and a project to restore them (see Annex 10).

In 2003, a mission to Quseir Amra was carried out by Italian experts, on behalf of the World Heritage Centre, in order to evaluate a project concerning the building of a wastewater treatment plant in the
Al-Azraq area. Apart from the other negative effects, the experts pointed out the unsustainable location of the water treatment plant and recommended a new appropriate evaluation of the project to avoid risks of compromising the specific cultural landscape of the Azraq Region and its assets.

In spite all efforts made to face up to the precarious condition of the wall paintings, today frescoes suffer severe damage (Figures 19 and 20).

3. Executive summary

The mission, initially focused on the archaeological site of Um er-Rasas, was a good opportunity to also have a visit to Quseir Amra in order to update the available information concerning the management and the state of conservation of the site in general and of the mural paintings of the reception hall and the baths in particular.

The visit organized by the DoA and conducted by the SMP Team, revealed the general situation at the site in terms of management and the specific state of conservation of the mural paintings of the baths complex.

A visitor centre with basic facilities and services marks the entrance to the site and proposes an interesting room with explanatory panels and models describing the archaeological area with focus on the baths and their functioning.

The mission however could observe that paintings are in a bed condition and require urgent restoration works

4. Situation at the site

4.1 General observations

- At the level of the whole site, there are not major threats to deal with which makes the management of the area relatively easy. The visitor centre is an obliged step towards the visit of the site and this allows controlling the visit flows (Figure 21). The exhibition room providing information about the site and particularly the baths is very instructive and prepares the visitor for the continuation of the visit (Figure 22), using the quite well delimited paths.

- From the human resources point of view, there is a lack particularly for the maintenance and the protection of the baths complex. Indeed, the external side of this building suffers from a lack of maintenance which can affect the structure of the building on the long term. The protection of the mural paintings inside the complex is too limited and this is the main cause
of the critical state of conservation of the paintings which suffered and are still suffering from vandalism acts.

4.2 State of conservation of the paintings

With regard to the frescoes today, they are in a bad condition: writings and other scratches cut painted surfaces in almost all the rooms and other vandalism acts - probably blows with stones - can be seen on the upper parts of walls and vaults (Figure 19).

Vandalism is the most serious damage on paintings, but other factors also contribute towards making worse both the comprehension and the state of conservation of frescoes.

A lot of gaudy chromatic alterations and blackening, particularly evident on the arches and vaults in the reception hall and in the tepidarium, are due to two different factors: the deposit of black smoke on surfaces (Figure 23) and the degradation of the unsuitable fixative used during the past restoration (1971-1973). According to the report of recent investigations (2002), paintings, not correctly clean, were fixed at the end of the restoration with a product of synthesis identified as a synthetic resin (polyethylene/vinyl acetate). This material, in addition to its alteration, has also given rise to a waterproofing of the surface of plasters which has been causing condensation phenomena, detachments between plaster layers and falls of the original layer of colour (Figure 24).
In general, most of the recognisable works carried out in the past on painted plasters facing the walls and on structures of Quseir Amra were performed by using unsuitable materials and incompatible constructive techniques.

Cement stucco or neutral gluing was used to fill little and widespread pictorial gaps: apart from the strong aesthetic disturb (Figure 25), especially cement has produced the presence of soluble salts, causing further detachments and/or saline efflorescence on surfaces (Figure 26).

Figure 25: unsuitable reintegration (from aesthetic point of view) (by authors)

Soluble salts come also from the roofs: all the structure, in fact, was reinforced in the upper part, at extradoses base, with beams in reinforced concrete. Cracks on waterproofing layers on roofs allow rain water to penetrate and flow into walls solving soluble salts that crystallize under or on painting surfaces.

Figure 26: efflorescence decay (right picture: efflorescence and blackening) (by authors)

All these phenomena - vandalism, blackening, efflorescence - and also the inappropriate and debatable reintegration of losses contribute to make painted representations and decorations illegible. It means that the most important value of the WHS is seriously compromised (Figure 27).
5. Outcomes and recommendations

- The DoA should urgently consider the critical situation of the mural paintings by putting in place some necessary protection (guards who would ensure a permanent control outside and inside the complex, announcement to the visitors about possible prosecution in case of vandalism acts, etc.) and conservation measures.

- In particular, the following should be carried out:
  - identification and survey - on specific maps - of all degradation phenomena;
  - identification and evaluation of factors in decay affecting the frescoes;
  - general revision of waterproofing layers on roofs;
  - filling in of masonry joints with traditional lime mortar;
  - changing of window frames to better protect wall paintings from wind, rain and dust;
  - careful clean and consolidation treatments of painting surfaces (because of differences of methods given in the reports of Spanish team (1996) and in that one of Italian team (2002), we advise that further clean tests be carried out to verify the most appropriate method to be applied especially in order to remove the old layers of varnish, used in pictorial additional touches, and fixative products. Similar tests should be carried out also for consolidation treatments);
  - fine presentation intervention according to modern principles and criteria, particularly for the integration of lacunae. According to the Theory of Restoration of Cesari Brandi, that is at the roots of modern conservation methods “a lacuna in regard to a work of art is an interruption of the figurative pattern...it is inserted into the work of art as a foreign body... and perceived as a real figure to which the paintings provides a background. The most serious aspect in regard to a work of art is not what is missing but what is inserted inappropriately...The first one (principle) is that any integration must always be easily recognizable, but without interfering with the unity that one is trying to re-establish...It is necessary to reduce the prominent figure value taken on by the lacuna with respect to the real figure which is of course the work of art”
• In general, protective and fixative materials should be avoided.

• At the level of the site, the extension of the protected area could be envisaged in order to include the other Umayyad sites. This initiative could strengthen the outstanding value of the whole area despite some management implications.
IV - Annexes

1 – Decision 28COM14B.22 of the World Heritage Committee

2 – Decision 29COM7b.41of the World Heritage Committee

3 – Decision 30COM7B.51of the World Heritage Committee

4 – Map showing the delimitation of the archaeological areas of Um er-Rasas (extract from the draft Site Management Plan elaborated at DoA)

5 – Table of content of the Site Management Plan of Umm er Rasas, Jordan (Prepared by Sabal Zaben and Wolfgang Koellisch – DOA), September 2006

6 – EU Project – “Description of the works” from Vol. 3 Technical Specifications

7 – Visitor Centre – Ground floor plan (extract from the EU Project – MEDA Programme)

8 – Spanish archaeological commission - report of the works carried out in 1974

9 – Victor Medina Flórez - report of restoration works carried out on paintings in 1996

10 – Final report on the state of conservation of paintings and restoration project (2002)
1. **Inscribes** the site of Um er-Rasas (Kastrom Mefa'a), Jordan on the World Heritage List on the basis of cultural criteria (i), (iv) and (vi):

   **Criterion (i):** Um er-Rasas is a masterpiece of human creative genius given the artistic and technical qualities of the mosaic floor of St. Stephen's church.

   **Criterion (iv):** Um er-Rasas presents a unique and complete (therefore outstanding) example of sty lite towers.

   **Criterion (vi):** Um er-Rasas is strongly associated with monasticism and with the spread of monotheism in the whole region, including Islam.

2. **Requests** the State Party to submit to the World Heritage Centre its annual work plan for the first year following the inscription of the site, the complete management and conservation plans and to organise two monitoring missions to review the progress of the implementation of these plans;

3. **Further requests** the World Heritage Centre, in consultation with ICOMOS, to submit a report on these monitoring missions for the consideration of the Committee at its 29th and 30th sessions, in 2005 and 2006, respectively.
Annex 2: Decision 29COM7b.41 of the World Heritage Committee

The World Heritage Committee,


2. Having noted the additional information presented by the World Heritage Centre,

3. Recalling Decision *28 COM 14B.22* taken at its 28th session (Suzhou, 2004),

4. Commends the State Party of Jordan for the steps taken towards the establishment of management and conservation plans for the property;

5. Requests the State Party to provide the World Heritage Centre and ICOMOS, as soon as possible, with detailed information regarding the foreseen visitors centre, parking and shelter(s) prior to any decision making, as per paragraph 172 of the *Operational Guidelines*;

6. Requests the World Heritage Centre and ICOMOS to undertake the second foreseen joint monitoring mission, in close consultation with the State Party, and to report on such mission at its 30th session (Vilnius, 2006), notably as regards the progress made towards the establishment of an operational management plan and structure.
The World Heritage Committee,

1. Having examined Document WHC-06/30.COM/7B,

2. Recalling Decision 29 COM 7B.41, adopted at its 29th session (Durban, 2005),

3. Commends the State Party on its commitment for the protection and conservation of the World Heritage Property;

4. Notes that several unforeseen constraints led to delays in the elaboration and finalization of the management and conservation plans for the property;

5. Recommends that the State Party concentrate its efforts on the implementation of priority measures, in close consultation with ICOMOS and the World Heritage Centre. These priority measures include:
   a) Clearly identify the boundaries of the area(s) to be protected and fenced if necessary, even temporarily;
   b) Address the security issues, notably by prohibiting access of visitors to potential dangerous areas and carrying out the necessary works to cover the trenches and archaeological soundings;
   c) Isolate and preserve the most endangered and damaged archaeological and architectural components by establishing a temporary restricted plan of visit paths;
   d) Preserve the mosaics with adequate temporary and protective materials (special geotextile layers and draining sand layers);
   e) Consolidate the most endangered architectural elements using temporary but secure structures;
   f) Stop restoration works and reconstruction of collapsed elements;
   g) Resolve, when possible, using simple and temporary solutions, the humidity problems, notably for the mosaic floor of the sheltered St. Stephen Church;
   h) Define the future management structure and financial system, which will be adopted in the management plan for the site.

6. Requests the State Party to engage, possibly with the support of the World Heritage Centre, in discussions in order to make sure that the European Commission funded project be redesigned so as to integrate the above mentioned priority measures and adapt its work-plan and schedule accordingly;

7. Also requests the State Party to organize the second monitoring mission, to be carried out by ICOMOS and the World Heritage Centre, by 30 November 2006;

8. Further requests the State Party to submit, by 1 February 2007, a progress report on the recommendations made in points 5 and 6 above as well as on the elaboration of the draft of the management and conservation plans, for examination by the World Heritage Committee at its 31st session in 2007.
Annex 4: Map showing the delimitation of the archaeological areas of Um er-Rasas (extract from the draft Management Plan elaborated at DoA)
Site Management Plan

Umm er Rasas
Jordan

Prepared by
Sabal Zaben and Wolfgang Koellisch

September 2006
DOA Amman, Jordan

DRAFT
Abbreviations

DOA = Department of Antiquities
SMP = Site Management Plan
SMU = Site Management Unit
MOTA = Ministry of Tourism and Antiquities
JTB = Jordan Tourism Board
ICOMOS = International Council on Monuments and Sites
ICTC = International (scientific) Cultural Tourism Committee
GTZ = German Technical Cooperation (Deutsche Gesellschaft für Zusammenarbeit)
CIM = Centre for International Migration and Development Cooperation
FOA = Friends of Archaeology
PNT = Petra National Trust
WMF = World Monument Fund
WB = World Bank
KfW = Kreditanstalt für Wiederaufbau
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02. ICOMOS Charter - Principles for the analysis, conservation and structural restoration of architectural heritage
03. ICOMOS Charter - International Cultural Tourism
04. ICOMOS Charter for the protection and management of the archaeological heritage
05. ICOMOS The Venice Charter
06. Documentation and investigation report “The Stylite Tower of Umm er Rasas”
07. Visitors circulation and footpaths, PPCH-MOTA-EC Project
08. Signage to Umm er Rasas
09. Zone map Umm er Rasas, PPCH/MOTA design Component
10. Heritage at Risk, Umm er Rasas
11. The Umm er Rasas bibliography
12. Socio - Economic Component (PPCH/MOTA)
13. Information “Historic Plaster Umm er Rasas” (H.Pfund)
14. Malta declaration
15. Site Map
DESCRIPTION OF THE WORK

BACKGROUND TO THE WORK:
The overall objective of the project is to contribute to a greater awareness and understanding of the country's cultural heritage while improving the protection of some assets. Simultaneously it will aim to maximise, in a sustainable way, the benefit to Jordanians from the opportunities presented to the tourism sector and contribute significantly to its development in general. Therefore, the project indirectly intends to boost Jordan's economy and to generate employment opportunities through an increased number of tourists.

In order to allow the site to be used for tourism purposes, interventions are needed to:

- Provide a comfortable access from near roads;
- Provide information and basic facilities to visitors (rest space, toilets, bookstore, ticket booking, exhibition hall);
- Organize an historically and aesthetically satisfactory walk throughout the site;
- Make the walk safe for visitors;
- Guarantee the physical protection of the relics, both architectural remains and mosaics.

For such purpose, the Technical and Administrative Provision (DTAs) of the ‘Protection and Promotion of Cultural Heritage in the Hashemite Kingdom of Jordan’ has foreseen the funding of some basic work necessary to sustain the increase of the site’s tourism use. The works pre-identified in the DTAs were the following:

- Site area delimitation;
- Consolidation works for protection of the site remains;
- Shelters for the churches to protect the floor mosaics;
- Pedestrian paths;
- Access roads;
- Landscaping;
- Parking areas;
- Signs/panels for direction and information;
- Visitors’ centre;
- Infrastructure for services such as water, electricity and drainage.

THE WORKS:
The works generally comprise the following:

- Protection of the mosaics and all the archaeological remains within the World Heritage Site during the works.
- Restoration of the walls of the St Stephen's complex
- Construction of a shelter over the churches of St. Stephen and Bishop Sergius to protect the mosaics.
- Construction of a suspended walkway inside the shelter.
- Construction of a visitors centre to accommodate a ticketing office with craft shop, an exhibition space, administration offices, public toilets, store rooms, a laboratory and first aid facilities
- Construction of a visitor car park and service car park to the Visitor Centre with signage and drainage.
• Planting of landscaping with an irrigation system around the car park. The irrigation system will include a buried water storage tank.
• Construction of a footpath running through the site with information panels and signage to show the visitors the principle places of interest. Visitors will be directed along the path by signage and by roped areas for their safety.
• Construction of viewing platforms and shaded areas along the footpath.
• Construction of an access road to St Stephens complex with electrical supply.
• Demolition and reconstruction of the existing toilets near St Stephens Church.
• Construction of a path from St Stephens complex to the Stylite Tower.
• Construction of a similar shelter over the Church of the Lions.
• Construction of site works including installation of buried drainage, water supply pipework, power supply cables, external lighting and telephone services.
• Improvements to the road and construction of a car parking area for the Stylite tower.

The works include items to be supplied by specialist sub-contractors who will be expected to design, supply and install their products. The Contractor has to design the following items as part of the works.

• Detailed fabrication drawings of the St Stephen’s Shelter steelwork including the design of the connections.
• Design and installation of the sheet steel roof and wall covering with rainwater gutters, fascias and steel purlins.
• Detailed design of the shelter over the Church of the Lions in accordance with the aesthetic and structural form of the shelter over St Stephen’s complex.
• Specialist glazed walling systems for the shelters including window frames.
• Glass balustrades.
• Profiled steel roof sheeting to the shelters including fascias, gutters and rainwater down pipes.
• Lightweight solid wall of render on metal lath with channel supports.
• Security grille and gate around the entrance to Bishop Sergius church.
• Concrete mix design following tests for chlorides and sulphates to be carried out by the contractor.
• Road pavement design to be confirmed by contractor following insitu CBR tests which are to be carried out by the contractor.
• Detailed design of the mechanical and electrical works in accordance with the performance specification.
• Connection to the incoming electrical supply. The contractor is responsible for arranging the connection and coordination with the power company and installation of the power supply in accordance with single line diagram on PLDUAR/215. The contractor is responsible for making the connection in accordance with the power company requirements and shall obtain approval from the power company.
• Connection to the water supply and relocation of the water pipe buried away from the buildings and car parks.
• Connection to the telephone line and telephone distribution system.
• To locate any services crossing the Visitor Centre and Tower sites and relocate as necessary.
• The timber steps to cross obstacles on the visitor footpath.
• An access track shall be provided from St Stephens complex to the Tower as shown on drawing PLDUAR/101. The contractor shall grade the track and provide gravel where necessary for suitable for a small wheeled vehicle. The details shall be agreed with the Supervisor.
• Detailed design of new toilet block near St Stephens Church.
Annex 7: Visitor Centre – Ground floor plan (extract from the EU Project – MEDA Programme)
Annex 8: Spanish archaeological commission - report of the works carried out in 1974


During the month of November of 1974, the Spanish Archeological Commission of Technical Assistance to Jordan, has worked in this country unrolling their proposal plan approved by the General Direction of the International Technical Corporation of the Ministry of Foreign Affairs, of capital importance: the califal residence of Qasr’Amra and the named "Qaeya Palace" of the citadel of Amman.

The Mission was directed by the professor Mr. Martín Almagro Basch and was lefted after the channeling of the work under the technical direction of the architect Mr. Antonio Almagro Gómez and integrated by Mr. Jose Ignacio Merino, of the Photogrammetry Service and Photointerpretation of the Polytechnic University of Madrid, and Mr. Jose Ignacio Latorre, draughtsman and photographer.

I

Works realized in Qasr’Amra.

The works done in Qasr’Amra have been a continuation and complement of the one’s until now realized by the Spanish Mission, and it have been unrolled in two sights.

First of all excavations were initiated guided to complete the realized in the previously visit to the Mission and to clear up some points and sights of the monument and of the constructions that completed them.

With them the water provision system and desembogue of the
Palace and baths stayed totally determined and documented, verifying how the water reached to the alcove of the hall and how baths and alcove were desembogued to the dry wells made from a small distance of the building. Exactly so the existence of a room of the noria service settled by the exterior part of the rampart of the palace protection against the wadi was discovered.

In order to document the constructions affinities to the palace, excavations were effectuated in a near height, in which appeared remainders of the watch-tower, of square plant, which raised itself between the palace and the castle, which remainders are appreciate of the NO. of this.

Also in the proximity to the runway of the wadi, towards the south-west of the palace others remainders that while previously studies of the monument were affirmed, they resulted to concern to another system of water extraction composed of a well, a noria, a water deposit and water-trough with its conduction of drainage.

All these finds were conveniently documented with precise designs and abundant photographs, after of which were buried the exteriors conductions of the water as the opened drains for their locations resulted to be molestfuls and dangerous for the visitors and perturbers of the exterior vision of the monument.

In order to return its previous aspect to the monument, the hypocausts of the baths that were totally pregnant with land were cleaned inside, with exception of the already excavated part at the previous Mission's proceedings. It was also proceedued to excavate even its primitive floor, the room
of the oven’s service as so as the embouchure of this, being
recommended to the Antiquities Service the demolition of the
modern cistern constructed inside of this room.

The second aspect of the realized labour in 'Amra has
been exactly so complement and final of the labour that has
been taking ahead in the monument the Spanish Mission in their
consecutive works. After the powerful restoring of the pic-
toric decoration and the studies and commentaries of the mo-
ument, it was necessary to procedure to the consolidation of
its own structure.

Because of its own form and its special technical construc-
tive, a part of the building, with the transition of the time,
was being deformed threatening with ruining all the construc-
tion. Therefore, it has been necessary to consolidate the mo-
nument such as to attend some details that disfigurated and dis-
turbated its contemplation.

All these works have been taken ahead by the direction of
the architect Mr. Antonio Almagro Gorbea, according with the
project that by him was being previously redacted and presented
to the Jordan’s authorities. The works have been realized in
collaboration with the technicals, personal subaltern and the
day labourers of the antiquity Jordan’s Service.

The work of consolidation has consisted in the placement
of a concrete-set hoop at the tickness of the west ramparts of
the palace hall, in order to fortify such rampart and assure
the correctly counter-weight of the drift of the vault that
steadies over it.

By consequence of this counter-weight badly compensated
because of its oldness, the rampart was found collapsed with
a dangerous form and with several fissures, some of them of
great size; exactly so the vault had deformed itself chopp-
ing on the keystone and spandrel. Through mention fissures
the water had entered destroying a great part of the pictures.
It consisted then, in not only to cover mention fissures, but
to avoid its collapse that would have immerse the monument which
calculations proved that it could continue.

As previous operation to the intervention, a center was
builded, on a metallic structure base, that insured the inde-
formability of the vault during the works that were being re-
moveed on the largely of the vault while the work was unrolled.

For the construction of the hoop the work was made under
two phase in order to not weaken much part of support of the
vault.

Two row of stones were dismounted, which were previously
numbered, of the highest part of the rampart, as so as all the
interior forcement of itself which resulted not to have any
blight stone. By the time that this space were well cleaned,
all the thickness of the stones dismounted which surpassed
twelve or fifteen centimetre were cutten. Thanks to the num-
bering and to the maps realized previously as so as to the
numerous photographs documentation, the stones on their primitive
position were being restored. Before the stones reposition in
the space refill of the interior rampart were situated the
frame-works of the round iron of high resistance, necessary
for the hoop set. The stones were taken in with concrete that
were previously scratch on the exterior part of the connection
in order to allow the rejoint with the mortar-piece of calx in
which was added land of the desert to settle them. Once this
is established this way, the hoop box, with the frame-works inside,
was procedure to the concrete-set. With this was obtained as much as the stones of the exterior surface as the interior remained strongly adhered to the concrete’s beam.

Special difficulty was presented the bundle of the hoop at the north and south ramparts where the tympan of the vaults presented several ranges of stones on the row that must lodged the hoop.

It was necessary, with labour pacient, extirpating some stones perforating in others back baft, in opening the necessary concave to introduce the frame-work in it. Posteriorly the extirpated stones were replaced and the hole from the angle and from the window were concreted.

The bundles at the north and south rampart were settled right at the ranges of the window’s rabbet, being its section approximated of 25 x 25. The frame-work of all the hoop were divided in four parts by sectors allow its working set, organizing the rampart’s center and in the two angles.

After the concrete-set all the hoop were again rejoined, not only the extirpated stones but the crack that were internally refilled with concrete mortar.

With secondary labour of restoration the rejointments made with concrete, realized in an antiquite restoration were all pricked and which color enormously degenerated and disfigurated the monument. The joints were newly covered with mortar-piece of calx coloured with land.

Equally, to repair this previous bad realized restoration, they were substituted a series of small stones that covered a hole in the ramparts of the left base of the dooré palace by
two big stones more in tone with the primitive tackle.

Exactly so, we opened the small opening existent between the unloading arch and the door's lintel that was covered with concrete and stones and stones and that has been opened originally.

It was also demolished the modern ramps that closed the well's arches and the iron's entrance in order to give them back the primitive aspect.

In the well the perditions stones were replaced on the well-curb and wood pale were ordered to avoid people or animal from rolling to the well in the way that this was originally. It was also conveniently consolidated the mosaics filling in them the existings holes with concrete, in order to avoid its slow destruction.

With all these works, we think that the monument have been sufficiently consolidated and dignified. Not only a small reconstruction of the destroyed ramps of the oven's service room, has been made and it hasn't been again overlapped all the vault with a technical mortar of "opus signinum" that would water proof them in the form that they were originally. These works can be taking place, with the indications that has already been given to you, with the technicals and operators of the Antiquites Service. If by chance would be realizated on a further revision that the architect Mr. Almagro thinks to do.

With that, the labour that the Spanish Mission has realized in this important monument remains basically finished, being considered as an authentic result, not only from the technical point of view, but as an intermediate approximation and collaboration between Spain and Jordan and increase of
scientific prestige of our country in the international plain.

The publication that about this important piece of the art's history is being prepared in these moments will be a faithful exponent not only of the realized labour at the place, but of the methodical study that has been done of the monument.

II
Works in the Citadel of Amman.

While the works before mentioned in Qasr'Amra were unrolled it was started, always by the direction of the architect Mr. Almagro Gorbea, the first hold of contact with a new and future working place for the Spanish Archeological Mission in Jordan. The citadel of Amman because of its stratagical situation in the center of the city and for being an archeological valuable bed and a monumental place it offers to the Mission multiples and interesting possibilities of actuation always in collaboration with the Antiquities Jordan's Service.

With the commence of work in this place the denominates "Palace Omaysa" was elected, enormous construction of a great interest and which is encountered in enough of bad conditions of conservation. As a previous work to any posterior actuation it was necessary to procedure to a rigorous planimetric rising of the building, for which was integrated at the Mission two technicals of the Photogrammetry Service and Photointerpretation of the Polytechnic University of Madrid before mentioned.

The works made in this trip consisted therefore on a documentatation by the photogrammetry method of the monument that will now permit the restitution of all the necessary plans for any future actuation.

At the same time as the documentation was being procedured, with day-labours facilitated by the Antiquities Service the monument was being cleaned of garbage as so as arranging all the architectural elements fallen and that are necessary for a posterior restoration.

THE DIRECTOR OF THE SPANISH TECHNICAL MISSION IN THE RANGE OF THE ARCHEO-

THE ARCHITECT OF THE MONUMENT.
1 - 2 - 3 - 4 - 5. - Different views of the centering with which the vault supported itself during the works execution. Mention centering was being moved to the large of the centering according the work unrolled itself during November’s campaign of 1974.
8 - 9. View of the armatures of the first sector of the hoop while the rocks of the exterior rampart are restored, which were previously numbered.
10 - 11. - Views of the first sector of the hoop during the stage of putting the concrete in part already effectuated.
12 - 13. - View of the collocation of the armatures in the angle NO.
16 - 17. - Two general views of the hoop's preparation of the west sector.
18 - 19. - Two new views of the second sector before and during the construction of the hoop.
Informe de las pinturas murales de Qusayr' Amra.

LAS PINTURAS MURALES DE QUSAYR' AMRA (JORDANIA).

PRIMERA INTERVENCIÓN REALIZADA EN LA SALA DEL TRONO DESDE EL 15 DE OCTUBRE AL 15 DE DICIEMBRE DE 1996. ESTUDIO MATERIAL, ESTADO DE CONSERVACIÓN Y TRATAMIENTOS DESARROLLADOS

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En Granada a 30 de Noviembre de 1997.

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mismo, y que dadas las consecuencias el método empleado para la limpieza de mantenimiento del monumento es totalmente desaconsejable.

5. INTERVENCIÓN.

Esta primera intervención sobre las pinturas se llevó a cabo desde el 15 de Octubre hasta el 10 de Diciembre de 1996, fue realizada por un equipo de cinco LdOs. en Bellas artes de la especialidad de Restauración de Pintura bajo la Dirección de Víctor J. Medina Flórez.

La situación geográfica de la obra y la falta de disponibilidad de medios in situ, complica la planificación de una intervención global tanto a nivel de tiempo y personal como de materiales, lo cual requiere un cálculo lo más aproximado posible de lo que será la misma en todos los aspectos.

Por ello y como se indicó con anterioridad se seleccionó la zona del salón del trono por presentar toda la problemática que se daba en el monumento en diferentes zonas con la intención de hacer un cálculo más ajustado de lo que será la intervención completa de las pinturas.

Para hacer una localización de daños y tratamientos empleados, se clasificaron por zonas las pinturas del salón del trono. Para ello nos servimos de las líneas de enmarque de la decoración ya que está claramente compartimentada (gráfico de localización de zonas con código de colores). A cada zona le asignamos tres números,
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el primero corresponde a la estancia donde está ubicada la zona (en este caso nos referimos únicamente al salón del trono, pero en fases sucesivas se asignará un nuevo número a las diferentes estancias, Tepidarium, Caldarium, etc.), el segundo se refiere al paramento y el tercero a cada zona determinada dentro del paramento. Por ej. en la zona 1.2.4, el nº 1 corresponde al salón del trono, el 2 al paramento frontal de este salón (se empieza a numerar de izquierda a derecha) y el nº 4 corresponde a la zona concreta (el arco de enmarque decorado con perdices de este paramento). De este modo se pueden localizar fácilmente tanto la toma de muestras como las alteraciones y tratamientos.

A continuación se hizo un mapeo exhaustivo de alteraciones de la zona seleccionada para la intervención y posteriormente se realizaron pruebas de tratamientos en base a los resultados obtenidos en el estudio preliminar (gráficos de alteraciones de las distintas zonas).

Las pruebas de tratamiento se centraron en primer lugar en la limpieza, una vez encontrado el tratamiento más efectivo y de optimizar el método de aplicación del mismo, se inició el proceso propiamente dicho para realizar una valoración temporal y de este modo poder extrapolzar los resultados y calcular de forma aproximada lo que será la limpieza del conjunto.

Una vez acabada la limpieza de la zona seleccionada se repitió el proceso en la consolidación y sucesivamente en la reintegración matérica, en la fijación de la película pictórica, para finalizar con la reintegración cromática. No obstante durante el proceso de trabajo hubo que realizar variaciones en el tratamiento, al haber sido definido inicialmente en zonas localizadas.
5.1. TRATAMIENTOS.

5.1.1. LIMPIEZA.

Tratamientos de limpieza.

Como ya se ha apuntado la limpieza fue quizás el tratamiento más complejo de los llevados a cabo. Podemos diferenciar tres tipos de suciedad y por tanto tres tratamientos de limpieza diferentes.

En primer lugar se eliminaron los depósitos de polvo con brochas suaves, etc. fundamentalmente una limpieza mecánica muy superficial.

En un análisis más detallado de la pintura se pudo observar que la pintura estaba muy retocada. Normalmente estos repintes consistían en reforzar las líneas de contorno, a menudo con líneas negras mientras las originales eran rojas, también se habían reforzado algunos tonos cuando estos estaban muy perdidos o velados por los negros, como en el caso de la bóveda donde había muchos restos de humos que oscurecían el color y en ocasiones casi impedían la visión de las figuras (Fotografías 2, 4, 5, 14, 63 y 68).

Algunos de estos repintes estaban realizados sobre el fijativo aplicado en la restauración de 1971-74, de modo que la eliminación de dicho fijativo implicaba su eliminación.
Nos encontrábamos por un lado que la necesidad de eliminar el adhesivo superficial alterado era incuestionable ya que distorsionaba enormemente el color y además estaba produciendo tensiones mecánicas y serias alteraciones en el estrato pictórico, pero su eliminación en unas zonas sí y en otras no era implantable por la disonancia cromática que se produciría.

Por otra parte la eliminación de los repintes planteaba un problema de criterio ya que esta era la imagen que el público en general había tenido de las pinturas durante los últimos 25 años siendo mucho más completa que la que podría resultar, por lo que su eliminación podría ser polémica.

Esto nos llevó a plantear la limpieza de forma gradual, manteniendo en general durante una primera fase de aproximación todos los repintes de la restauración de 1971-74 y revisando los criterios durante el proceso de intervención.

Los resultados que íramos teniendo nos aportarían datos muy importantes. Así, durante la limpieza, se observó que en algunos casos debajo de los repintes había pintura original, se hicieron pequeñas catas y en los casos en que se comprobó la existencia de pintura debajo de los repintes estos se eliminaron, por ej. la túnica de la figura de la zona 1.2.1, o en el caso de los negros que cubrían los fondos de los arcos que encuadran los bustos de la parte alta de las paredes 1 y 3 (Fotografías 43, 44, 45, 46, 63, 68, 69 y 75).

Su eliminación nos obligaría a hacer una nueva fase de limpieza apurando más para igualar el tono general.
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Finalmente en las zonas donde no había nada debajo se dejaron los repintes. Este es el caso del fondo de la figura 1.3.4, que en la parte interior-derecha estaba repintada totalmente, se dejó ya que no había pintura original debajo (Fotografías 64 y 78).

Así pues partíamos de una situación inicial en la que, debido a la penetración del fijativo en el estrato pictórico y extremada delicadeza de este, nos planteábamos hacer primeramente una media limpieza del estrato superficial de acetato de polivinilo y goma laica, el cual estaba muy amarillento, microfracturado y alteraba enormemente la visión del color (Fotografías 11 y 65), y que además fijaba en algunas zonas los negros no eliminados en la limpieza de la restauración de los años setenta, sobre todo en las partes altas de los paramentos 1 y 3 del salón del trono (tras esta primera aproximación se procedería a limpiar los restos de humos carbonatados que cubrían estas zonas).

* Pruebas de limpieza realizadas para la eliminación de la capa pardamarilla: se hicieron en base a los resultados de los análisis de laboratorio.

1ª PRUEBA.

-Jabón neutro y agua destilada.

FORMA DE APLICACIÓN: Con hisopo.

*No da resultado más que para eliminar la suciedad superficial, la capa amarilla no se removiliza.
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2ª PRUEBA
-Acetato de Isoamillo
FORMA DE APLICACIÓN:
1.- con hisopo.
2.- en impaco con pulpa de celulosa (tiempos 8, 10, 15, 20 minutos)
3.- En gel, con carbopol y Carboximetil celulosa (6, 10, 15 minutos).
*No se obtuvieron resultados en ninguno de los tres casos.

3ª PRUEBA
-Acetato de Polivinilo
FORMA DE APLICACIÓN: Apliado en capa muy fina y sellando con film trasparente para evitar el secado (tiempos 5, 10, 15, 30 minutos). Se retiró con agua destilada y se repasó con hisopo impregnado de Acetato Isoamillo, procediendo posteriormente a su total eliminación con agua destilada.
*Los resultados fueron negativos ya que en tiempos cortos no removízaba la capa y en los largos la eliminación del APV era muy difícil.

4ª PRUEBA
-Carbonato de Amonio
FORMA DE APLICACIÓN:
1.- En disolución saturada aplicado con hisopo.
2.- En impaco con pasta de celulosa (Arbocel BC 1000) (tiempos 5, 10, 15 minutos).
3.- En gel con Carbopol (tiempo 5, 10 minutos).
4.- En gel con Carboximetil Celulosa (tiempo, 5, 10 minutos).
*Resultados muy negativos, la aplicación mediante impaco enrojece la película del fijativo y no ablanda la capa. Algunos componentes de la goma laca, sobre todo cuando esta no esta bien purificada, enrojecen en medio básico, probablemente es lo que ocurre en este caso.
5ª PRUEBA
- Alcohol etílico 40%, Acetona 40%, Agua destilada 20%.
FORMA DE APLICACIÓN: la mezcla se aplicó mediante hisopo y en impacos de 15 minutos.
   *Mueve algo la capa amarilla, pero el proceso es muy lento. Hay que insistir mucho lo que produce abrasión y además el rendimiento es muy bajo.

6ª PRUEBA
- Alcohol etílico en impacos (de 15 a 20 minutos según zonas).
   *En zonas muy endurecidas se llegaron a poner dos impacos seguidos de 15 minutos.
El tratamiento que da resultado, aunque en algunas zonas el mortero se ablanda.

7ª PRUEBA
Un tratamiento combinado en distintas fases consecutivas:
   1. Carbonato de Amonio aplicado con hisopo sobre la zona a tratar,
   *Hay que tener cuidado de no aplicar el Carbonato de Amonio en las zonas de grafitis y faltas antiguas, porque la goma laca enrojece y si penetra en la masa del mortero es muy difícil de eliminar.

   2. Impaco de alcohol etílico en pasta de celulosa (Arbocel BC 1000), dejar actuar 20 minutos, para evitar la evaporación colocar un film transparente fijado con carbometil celulosa.
   *Los resultados son buenos incluso en zonas muy endurecidas. Retirando con hisopo y bisturi se controla bien la limpieza, de modo que se pueden dejar las zonas de reimpresión y hacer una media limpieza, además al aplicar el carbonato de Amonio mediante hisopo la penetración es menor y no se produce el enrojecimiento.

Este será el tratamiento de limpieza seleccionado y aplicado finalmente en el salón del trono. Los resultados eran buenos y aunque los tiempos de permanencia de los impacacos variaron mucho según las zonas, la película amarilla se eliminaba en todas las zonas tratadas del salón.
En las pruebas realizadas en el salón principal también dio un resultado similar al bien éste era menos evidente, tal vez por haber un menor acumulación de fijativo en esta zona. Sin embargo en el tepidarium no funcionó, quizá la presencia de goma laca aquí fuera menor y la proporción de acetato de polivinilo mayor.

8ª PRUEBA

Como el alcohol ablandaba la película pictórica y el mortero, se pensó utilizar una mezcla de disolventes que fuera más volátil. Se sustituyó por una mezcla de tricloroetano y alcohol al 50%, tapando con film transparente para retrasar la evaporación. Los resultados fueron puros que en la prueba nº 7, por lo que se descartó su utilización.

Durante el proceso de limpieza se observaron zonas de limpieza desigual como el fig. 1.2.3. y parte inferior derecha del arco de las perdices, zona 1.2.4, aunque esta podría deberse al efecto de lavado y de la recristalización de sales que las filtraciones de agua de una grieta habían producido en la pintura (Fotografías 10 y 17).

Con el procedimiento antes descrito se retiró el fijativo aplicado en la restauración anterior, pero aún quedaba por limpiar el ennegrecimiento producido por los fuegos que durante años los beduinos hicieron en el interior de la sala, que afectaban fundamentalmente a la parte alta de la bóveda y que no habían sido eliminados en la restauración anterior (Fotografías 4, 40, 42, 66, etc.).

Hay que señalar que ninguna de las pruebas realizadas para su limpieza dio resultado cuando aún quedaban restos de aquel fijativo que los recubría, por lo que fue
preciso eliminar completamente esta capa y por tanto los repintes que sobre la misma se hicieron y que en este caso eran muy evidentes (Fotografías 63 y 68).

*Pruebas para la eliminación de restos de negros.

1ª PRUEBA.
Limpieza mecánica con lápiz de fibra de vidrio. El proceso era enormemente delicado ya que la película pictórica es muy delgada y frágil y la fibra de vidrio excesivamente agresiva.

2ª PRUEBA.
Con Carbonato de Amonio tampoco se obtuvieron resultados, ni empleado con hisopo ni en impactos.

3ªPRUEBA.
Como la capa de humo estaba muy carbonatada, se pensó finalmente en la utilización de un ácido orgánico.

El ácido seleccionado fue el EDTA, preparado en disolución al 5% y aplicado con hisopo de forma muy puntual, inmediatamente se eliminaba con agua destilada para que la penetración del ácido fuera mínima.

Hay que destacar que cuando se hacía rodar el hisopo mojado en la disolución de EDTA,

12Como se ha dicho con anterioridad en esta zona aparecían repintes generales sobre el estrato superficial de fijación aplicado en la restauración de los años 70. Estos repintes no se eliminaron en un primer momento ya que la densa acumulación de Hollín ocultaba cualquier posible resto de color original.

Haciendo catas se comprobó no solo la existencia de pintura original oculta por el estrato de humos carbonatados sino que además la densidad de los colores era buena, estando en ocasiones en mejores condiciones que las zonas visibles no cubiertas, como si la capa de negros hubiera servido de protección. Por tanto se procedió a la eliminación de los mismos.
los restos negros se iban haciendo transparentes, mientras que a los negros de la policromía no les ocurria esto, quedando claramente visibles las líneas de contorno originales. Era pues imprescindible rodoc el hisopo y no restregar, para que la película pictónica original no se vier afectada.

Los resultados fueron buenos ya que aunque el ácido hubiera podido resultar agresivo para los materiales constitutivos, el método de aplicación permitía controlar bastante su aplicación, aunque el proceso fue muy lento y laborioso. Las costras negras se retiraban con seguridad y sobre todo sin que el ácido penetrara prácticamente en la película pictónica ya que la aplicación se hizo de forma muy superficial, controlando los tiempos de aplicación de modo su permanencia fuese la mínima.

En la parte inferior del paramento 2, zona 1.2.5. (parte baja del califato) después de limpiar se observó que bajo lo que parecía una película pictónica ocre aparecían pequeños puntos de colores intensos, se hicieron algunas catas y se observó que debajo del color ocre había restos de pintura.

La limpieza dio como resultado la presencia de una decoración arquitectónica a base de arcos. Los tonos predominantes son el rojo y el azul intenso, esta zona aunque muy fragmentada tiene una gran riqueza de color.

En la parte derecha de esta misma zona durante el proceso de limpieza se definieron mejor las figuras de un hombre y una mujer desnudos (Fotografía 25). Aunque en un primer momento se pensó que podían tratarse de repintes, dado que los contornos aparecían reforzados en negro y que no se recogían en los dibujos que Mielich, durante el proceso de limpieza se pudo comprobar que sí eran originales.
La limpieza de esta zona 1.2.5. fue muy lenta ya que además del tratamiento de eliminación del fijativo de recubrimiento, posteriormente hubo que tratar con EDTA en disolución saturada, aplicándolo mediante hisopo en zonas puntuales y neutralizando inmediatamente. En ocasiones hubo que repasar con medios mecánicos.

Hay que destacar que durante el proceso de limpieza se detectan dos tipos de retoques muy diferentes. Por un lado los realizados sobre la película de fijación, con el mismo aglutinante que el empleado en la misma. Generalmente se ciñen al modelo original aunque con trazo menos fino, ej. collar figura masculina zona 1.3.4. (Fotografía 68) aunque en ocasiones no lo hacen, ej. brazo figura 1.3.2. en el que después de la limpieza se pudo comprobar que el contorno del brazo aunque esté confuso es diferente al del repinte (Fotografía 63, 77). En otras ocasiones cubren amplias zonas a modo de veladuras, como en los fondos de los arcos superiores Z-1.1.5, Z-1.1.7, Z-1.3.2 y Z-1.3.4 (Fotografías 66 y 67).

Por otra parte están los repintes realizados con una técnica diferente ya que no son solubles con el método de limpieza nº 7, empleado para la eliminación del fijativo. En este caso es necesario eliminarlos con EDTA, pero solo se hizo cuando debajo había pintura original, ej. arcos zona 1.2.5.
5.1.2. CONSOLIDACIÓN.

El proceso de consolidación estuvo condicionado por dos factores fundamentales, por un lado la enorme descohesión del mortero y por otro el problema de oquedades provocado por las filtraciones de las cubiertas. A esto hay que añadir la gran cantidad de lagunas, ya sean consecuencia de pérdidas provocadas por la degradación de los morteros ya sea de forma intencionada o por los abundantes grafitis y agresiones vandálicas.

Por otra parte la capa de fijativo aplicada superficialmente en la restauración anterior, al ser ésta prácticamente impermeable, ha podido contribuir a la degradación del mortero, de modo que al eliminarla, en todos los casos hubo que proteger la zona de inyección, ya fueran bordes ya fueran pequeñas lagunas. La protección se hizo con papel japones e Paraloid al 5%, proporcionando así una mayor resistencia en la zona a tratar (Fotografía 48).

En oquedades importantes, como en la zona circundante a la laguna grande del paramento 1, hubo que proteger de forma más consistente (Fotografía 49). Para ello se colocó una capa de papel japones fijada con Paraloid al 10% y una segunda de gasa aplicada con el mismo adhesivo, de este modo se conseguía un mayor resistencia a la manipulación durante los tratamientos de inyección.

Antes de iniciar el proceso de consolidación se hizo una fijación y sellado en alguna zona de bordes con mortero de cal y polvo de mármol para evitar que el consolidante empleado se saliera por los mismos;
Se hicieron pruebas de consolidación con diferentes productos y proporciones.

Para la consolidación de zonas con descohesión, se probó con Primal en porcentajes del 10 al 25 %, previamente se inyectó alcohol para mejorar la penetración. Los resultados en la mayoría de los casos eran buenos pero en la proporción del 20 % generalmente funcionó mejor, en cualquier caso los porcentajes variaron según los casos.

En las quebras, para ello se utilizó un mortero de inyección, Malta PLM-M, se emplearon en diferentes porcentajes, desde un 5 a un 50 %, la penetración era aceptable y la consolidación, aun en proporción muy diluida, daba resultado.

También se probó con mortero de cal y polvo de mármol con prinal. El efecto consolidante fue menor ya que no se disponía de un árido que proporcionara hidrulicidad al mortero, por lo que se descartó su empleo.

En ocasiones se inyectó prinal antes de proceder a la aplicación del mortero de relleno, ya que el enlucido estaba enormemente disgregado, por lo que había que dar cierta cohesión antes de inyectar el mortero de relleno concentrado.

El mortero de inyección se aplicó generalmente a un 20 % ya que en concentraciones mayores la penetración era muy difícil y en menores el efecto consolidante era insuficiente y el aporte de humedad era excesivo, lo cual incrementaba la movilización de las sales internas del muro; debiendo ser eliminadas aplicando
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Inpacos de celulosa con agua destilada. La composición de las mismas fue analizada con posterioridad, resultando ser cloruros, sales muy higroscópicas (Fotografía 50).

Los métodos de inyección fueron los habituales, pocillos, inyección con jeringas, etc. según la zona a tratar (Fotografía 48 y 72).

Se aprovecharon las lagunas y grafitis para hacer los orificios necesarios para la consolidación y desgraciadamente, dada la abundancia de los mismos, prácticamente no fue necesario abrir ninguno otro en zonas de policromía.

5.1.3. REINTEGRACIÓN.

Los criterios planteados en esta primera fase de la intervención no son los definitivos sino que se tomaron de forma provisional hasta ver los resultados en una zona más amplia del conjunto, por esto se tuvo muy en cuenta el criterio de reversibilidad y la facilidad de intervenir con posterioridad sobre los tratamientos realizados sin perjudicar a la obra.

Reintegración material

Los criterios de reintegración material fueron rellenar lagunas a bajo nivel, esta solución también permitiría, llegado el caso, que se pudiera reintegrar con morteros al mismo nivel que la pintura original.
Reintegración cromática.

En cuanto a la reintegración cromática, se decidió hacer una intervención muy discreta que no condicionara la posterior aplicación de un nuevo criterio de reintegración que pudiera ser definido una vez se tengan más datos del conjunto del monumento y de ensayar distintos tipos de solución, sobre reproducciones fotográficas utilizando reconstrucción informática, los resultados de este trabajo se expondrán al final de este informe (Fotografías 79, 80 y 81).

Por las razones anteriormente mencionadas la reintegración cromática en esta primera fase se limitó a la aplicación de unas tintas neutras que matizaran las faltas tanto de morteros como de película pictórica, cuyo color blanco dificultaba excesivamente la lectura de la obra.

Según los casos el método empleado fue diferente. En las lagunas de morteros reintegradas matéricamente se optó por una única tinta neutra general de un tono muy claro, que matizara en parte el blanco del mortero. Se seleccionó un color que entonaba con el color que presentaban las zonas de mortero original en las que se había perdido la película pictórica. El tono era muy bajo de forma que pudiera servir de base en sucesivas fases del trabajo y caso de optar en un futuro por una reintegración más ajustada sea cual sea solución adoptada finalmente.

En las lagunas de película pictórica, tanto si se deben al efecto de lavado de las goteras como si se deben a desgastes, se optó por una tinta de un color similar al circundante pero de un tono igualmente bajo.
La aplicación de las soluciones de reintegración definitiva que se proponen se ha elaborado a posteriori mediante tratamiento informático de imagen utilizando como ejemplo el paramento 2.

La primera solución propuesta es la aplicación de una tinta neutra de un tono más oscuro que el aplicado en esta primera fase. Aun resultando más neutra la reintegración esta solución tiene el problema de que dada la enorme cantidad de lagunas existentes se pierde la visión de conjunto de la composición, lo cual dificulta su interpretación. Esto es especialmente evidente en la figura del califa de difícil lectura por el gran número de lagunas existentes en esta zona (Fotografía 79).

La segunda solución sería utilizar dos tintas neutras, una más oscura y otra más clara, empleándolas en zonas de más o menos luminosidad, de forma que nos permita componer las líneas de dibujo mediante el contraste entre las dos, esta solución sin prestarse en ningún caso a confusión permitiría una mejor lectura de la obra (Fotografía 80).

La tercera solución sería reintegrar cromáticamente mediante un regatino ajustando el color en cada una de las lagunas completando la visión de la obra en los casos en que haya elementos para su recomposición. Este criterio aunque desde un punto de vista histórico es menos estricto, es respetuoso con él, facilitando la identificación de las zonas reintegradas sin ninguna duda. Además desde el punto de vista estético permitiría una mejor visión de la obra y por tanto un mejor comprensión de la misma (Fotografía 81).

En cualquier caso, y respetando siempre el que la reintegración deba ser claramente identificable, tanto en función de los resultados del trabajo realizado in situ
como de la experimentación sobre tratamiento de imágenes, creemos que en un futuro sería deseable tender a una reintegración que facilitara la lectura de la obra, en la línea de las dos últimas opciones, integrando así los restos de la decoración pictórica original y contrarrestando el peso que la cantidad de lagunas adquiere en la visión del conjunto.

Para decidirnos por cualquiera de ellas habría que valorar previamente si los restos de la composición pictórica existente, una vez finalizados los tratamientos de limpieza, aportan los datos suficientes para su recuperación.

MATERIALES SELECCIONADOS PARA LA REINTEGRACIÓN.

Reintegración material

Tanto para el sellado de los bordes de lagunas que hubo que hacer para evitar la salida del consolidante durante la consolidación como para el relleno de lagunas se utilizó un mortero de cal y arena.

Para determinar las proporciones de sus componentes se hicieron distintas pruebas comprobando la resistencia del mortero resultante tras su fraguado:

PRIMERA PRUEBA

En un primer momento la cal que se nos suministró era de muy baja calidad. Para reforzarla se añadió en un principio molta de inyección PLM-M, como conglomerante adicional, realizando distintas pruebas hasta determinar las proporciones de los componentes.
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Además, inicialmente, se pensó teñir ligeramente los morteros en masa con objeto de facilitar la identificación de las reposiciones a pesar de mantener en el material empleado unas características muy similares a las de los morteros originales y conseguir así además una entonación que sirviera de tinta neutra.

Para ello se hicieron distintas pruebas optando finalmente por añadir al mortero tierra del desierto previamente lavada y seleccionada según la granulometría, ya que el tono se integraba muy bien en el conjunto. Para garantizar que el color del mortero fuera siempre el mismo se pesaron los componentes.

Las proporciones empleadas fueron:
- 50 gr. cal *
- 50 gr. maíz
- 275 gr. arena
- 100 gr. tierra del Wadi

Este mortero equivalía a uno preparado en las proporciones:
- ¾ de cal *
- ¾ de maíz
- 1 de arena
- 1/2 de tierra del wadi.

* Aunque no pudo ser analizada al no disponer de medios, por su comportamiento en las pruebas, debía estar parcialmente carbonatada, por lo que funcionaba más como árido que como aglutinante.

SEGUNDA PRUEBA

A partir del 27 de Noviembre se nos suministró una cal de mejor calidad por lo cual al emplear esta en la preparación de los morteros resultaba innecesario reforzarlos con la maíz.
Informe de las pinturas murales de Qusayr' Amra.

de inyección por lo que la eliminamos de su composición. Tras hacer las pruebas de resistencia oportunas las proporciones empleadas fueron:

1 de cal  
1 de arena  
\( \frac{3}{5} \) de polvo de mármol  
130 gr de tierra del wadi

Este mortero se utilizó no solo para los bordes sino también para las pruebas de reintegración de lagunas. En este caso se observó tras el proceso de secado que la coloración no resultaba uniforme tal vez ocasionadas por acumulaciones desiguales de la tierra del wadi que podrían producirse al espatular los morteros, por lo que se descartó el método de tintar los morteros en masa.

TERCERA PRUEBA

A partir de este momento las lagunas se rellenan con un mortero de cal, arena y polvo de mármol a partes iguales, sin añadirle color.

La reintegración de lagunas que implicaba pérdidas de mortero se realizó a un nivel más bajo que el de la pintura original. La superficie se dejó texturada, repasando con fratas de madera con objeto de facilitar el agarre de una posible aplicación de un 2º mortero al nivel de la superficie pictórica una vez se definía el criterio final de reintegración.

El desnivel de la laguna y la diferencia de textura facilita en la actualidad la identificación de la reintegración.
Reintegración cromática

En cuanto a la reintegración cromática, los materiales empleados han sido diferentes según la pérdida afectase al mortero o solamente a la película pictórica.

En los dos casos como se ha dicho con anterioridad se dio un tono neutro muy bajo que suavizaría el contraste cromático.

En el mortero repuesto, en espera de una reintegración definitiva, la tinta neutra se aplicó a base de pigmentos aglutinados con Primal al 5%.

En cuanto a las zonas con pérdidas de película pictórica exclusivamente, fue necesario en algunos casos matizar el color del mortero original. El criterio general de reintegración en esta fase de intervención fue también entonar las faltas sin llegar a ajustar el color al máximo. En este caso se emplearon pigmentos aglutinados con goma arábiga preparada al 2%. Se seleccionó este aglutinante por su buena reversibilidad y por la compatibilidad que presenta con los materiales originales.

En ambos casos los pigmentos empleados fueron de la marca Wilson and Newton, por dar ésta mayor garantía en cuanto a la naturaleza química de su composición. Dentro de cada color se seleccionaron los de mayor permanencia.
5.1.4. FIJACIÓN DEL ESTRATO PICTÓRICO.

Finalmente fue necesario proteger o fijar el color, ya que estaba muy debilitado. La falta de cohesión del estrato pictórico así como el resultado de los tratamientos de eliminación de los fijativos empleados en la restauración anterior hacían que este presentara un aspecto reseco y una menor densidad cromática. Todo ello hacía necesario un tratamiento de fijación superficial que a su vez refrescaría igualmente el color de la pintura.

También en este caso se hicieron pruebas con diferentes productos:

1ª PRUEBA

Se utilizó una goma árabiga muy depurada preparada al 5% en agua destilada, por la buena compatibilidad que tiene con los materiales constitutivos y su reversibilidad. Los resultados visuales fueron buenos ya que no producía brillos y no alteraba las cualidades ópticas de la película pictórica. Pero se presenta el problema de su solubilidad en agua y la falta de protección que esto supone, por lo que se descartó su utilización, como capa de protección.

2ª PRUEBA

También se hicieron pruebas con Paraloid preparado en distintas concentraciones:
- Al 2% no se producían problemas de brillos pero el color no se refrescaba suficientemente.
- En sucesivas aplicaciones a la misma concentración daba brillos a la superficie
- Preparado con una mayor concentración, al 5%, el color se refrescaba en la primera aplicación pero las cualidades ópticas se veían alteradas sobre todo por el brillo.

3ª PRUEBA

Combinaición de los dos productos anteriormente empleados, tampoco se obtuvieron buenos resultados. Se aplicaron dando una primera capa de goma árabiga al 2% y una segunda
Informe de las pinturas murales de Qusayr’ Amra.

de Paraloid al 2%, para estabilizar al anterior, aplicadas en los dos casos con brocha. El tono no subía suficientemente, quedando un aspecto muy seco y apagado.

4ª PRUEBA
Silicato de Etilo al 60% aplicado con brocha. Las pruebas realizadas dieron los mejores resultados. El color se refrescaba mejor que con ningún producto y con una sola mano, aunque inicialmente aparecían algunos brillos, estos desaparecían una vez seco.

La fijación se realizó finalmente con silicato de etilo, después de terminar la reintegración con objeto de proteger esta también.

El resultado final, una vez seco completamente el silicato de etilo, no pudo observarse ya que se aplicó el último día y no pudimos comprobar su comportamiento completamente seco en toda la superficie tratada, si se pudo observar en las pruebas previas realizadas sobre zonas reducidas de la pintura.

5. EVALUACIÓN TEMPORAL

En transcurso de esta primera intervención se desarrollaron los tratamientos de una zona de 13,5 m² correspondientes al salón del trono. En la ejecución de los trabajos realizados participaron 5 personas durante dos meses, además del director del trabajo que permaneció los quince días iniciales y los 15 finales, realizando un total de 2490 horas. Descontando en total 10 días de descanso, tenemos 45 días netos de trabajo con una media de 10 horas por jornada y persona.

The restoration project of the frescoes of Qusayr Amra
Ref. No. 12/10/108
Date: 10/11/2005

Mr. Mounir G. Bouchemakki
Assistant Director-General for Culture
UNESCO, Paris

Dear Mr. Bouchemakki,

I am writing to you with regards to a recent report on the state of conservation of the frescoes of Qasr Amra, a Jordanian site on the list of World Heritage since 1985.

A field mission to Qasr Amra took place in 2002, and scientific investigations, followed by the final report (which we have just received), were prepared by a team from the Progetto Finalizzato Beni Culturali del Consiglio Nazionale delle Ricerche (CNR) together with the Università Internazionale dell’Arte di Firenze and the Istituto Superiore per le tecniche di conservazione dei beni culturali e dell’ambiente “Antonio De Stefano”. We are very concerned about the results of the study which claims that there is severe damage of the wall paintings, due to inorganic salts, as well as inappropriate conservation actions conducted by the application of synthetic fixative materials over the painting layers. These consolidants have created a barrier against the proper evaporation of humidity from the plaster layer below and have additionally caused some discoloration. The study concludes that urgent conservation measures should be carried out (attached is the report on the investigation on the state of conservation of frescoes at Qasr Amra, and the proposal for the restoration of the restoration at Qasr Amra). The proposed conservation plan forecasts a budget of 878,200 euro, 200,000 of which will be a contribution by CNR, UIA and ISAD.

We would greatly appreciate your consideration in providing any form of assistance, either by dispatching an expert mission to validate the results of the scientific report, or through funding assistance for the implementation of the adequate conservation works.

Please accept the assurances of my highest consideration.

Sincerely,

Dr. Fawwaz Al-Khraisleh
Director-General
cc. H.E. Minister of Tourism and Antiquities
cc. Prof. Giuseppe Claudio Infranca
The Safeguard of Cultural Heritage Project of the National Council of the Research (Progetto Finalizzato Beni Culturali del Consiglio Nazionale delle Ricerche) after the convention with the Department of Antiquities of Jordan, together with the International University of Art of Florence (Università Internazionale dell'Arte di Firenze) and with the Superior Institute for the Techniques of Conservation of Cultural Heritage and of the Environment "Antonino De Stefano" (Istituto Superiore per le tecniche di conservazione dei beni culturali e dell'ambiente "Antonino De Stefano"), prepared the following:

The restoration project of the frescos of Qusayr Amra
Project of restoration of the frescos at Qusayr Amra

of Guido Botticelli

After the first visit at Qusayr Amra at the end of November 2002 during which had been underlined the serious state of degrade of the mural paintings, and following the results of the first scientific analyses that the first diagnosis has confirmed done on the spot, today we can define in more concrete way the project of restoration that will allow us to operate in correct way for the recovery and the safeguard of this important pictorial cycle.

Pictorial technique

As it regards the pictorial technique, through the direct analysis and in base to the results of the chemical analyses, we can affirm that the paintings of Qusayr Amra result perform on a building support, preventively constituted by blocks of stone plastered and then covered by a layer of mortar and inactive (sand).

The used colors are constituted by earths and oxides, but an abundant use of particularly precious pigments has been found as the lapis lazuli, that allowed to get refined images, bright and of great suggestion.

In line of mosto the preparatory sketch and the first layouts of color result applied while it is wet, but the presence is not excluded of fixed organic as, milk, applied for instance, both to fix the colors and as protective ending. Chemical analyses have also individualized the presence of animal glue, that could have been used as medium for the layout of the lapis lazuli. The particular conditions microclimate of the building, besides, during the execution have favored a slow, but repeated process of carbonation that, mineralizing the organic legates, that increased the resilience of the colors.

Inside the placed used as both room it has been possible to individualize traces of plaster painting of fragments under the actual painting. In operational phase it will be of primary importance to analyze the situation reconstituting, through the detailed reading of the surfaces the history of this stupendous building.
State of maintenance

From a first general reading a distance from the opus, the paintings are found in discreet state of maintenance, if the low part is excluded (once painted up to earth: fake marbles) damaged by the rise humidity, but still worse damaged by writings, incisions and other vandal actions provoked by the man, that have caused the total loss of it.

Other interesting pictorial gaps the upper part, is due, with a lot of probability, infiltrations of water from the covers and to structural arrangements that has provoked the fall of the pictorial film. They are visible, besides, a lot of chromatic alterations due to deposits of black smoke that as antiscepticles are manifested stains. With a lot of probability the humidity of infiltration and of condensations (because in the adjacent rooms there were bathe) which favored in the time the solubility of the black smoke that has gone to fix on the pictorial plaster.

A degrade particularly evident it has been provoked in following the last intervention of restoration during which the paintings, not correctly clean, it has been fixed with a product of synthesis (Drinks: product used for the re-frame of the mobile paintings) that has provoked a waterproofing and a hardening of the superficial part of the pictorial plaster. Accordingly, the humidity contained in the masonry, not succeeding in evaporating on the surface, it has caused the micro-crack of the pictorial film and therefore a de-cohesion of the legates had already been jeopardizing for the time. The fixative, besides, is altered to grow dim and darkening the original color.

Always relatively to the preceding intervention of restoration, we have noticed that some gaps have been reinstated to "neutral" gluing some colored fabric with a greenish shade directly on the stone. This unusual methodological choice results overall incorrect and particularly ugly.
Proposal of conservative intervention

Before undertaking the intervention of restoration, with the aid of the scaffolding and therefore to bring closer vision it will owe a further analysis of the pictorial surface so that to deepen our knowledge on the pictorial technique and on the state of maintenance.

In this phase the portions of plaster will be individualized de-cohesion intervening with micro consolidations located in the zones to risk and using adhesive or cohesive (to establish in progress of work) that they don’t prevent the following phases of the restoration.

The following operation is constituted by cleaning performed through the collision with water ionized of the whole surface, previous interposition of a sheet of Japanese paper. This intervention will serve to convert the pictorial support the parts of color pulverized and dusty and to get a preliminary cleaning for the removal of the incoherent material deposited on the pictorial film (dusts).

After doing this the problem is set to remove the synthetic fixative (driers). It deals with a very delicate and difficult operation, in particular way whereas the de-cohesion of the plaster is strongly accentuated. In this case it is possible to perform a mineral pre-consolidation with hydroxide of barium: the barium, not reacting with the synthetic substances, goes to cohesion in stillle why the color of the plaster and the same plaster, facilitating the final cleaning and the consequent removal of the fixative applied in the last restoration.

This operation consists in the application on the pictorial surface of package of ammonium’s carbonate supported by pulp of cellulose. The ammonium’s carbonate, saturating of humidity the plaster, it will allow the fudge the organic substances introduced above the pictorial film and below the fixative. Subsequently, using an appropriate solvent, it will be possible to remove the synthetic fixative together with the dirty too much without an invasive mechanical action and without ruining the plaster by now saturated of water. The particular colors (thereby) sensitive to the carbonate of ammonium, the cleaning will be performed with bicarbonate of ammonium or resins to steric exchange. The times, the ways, the percentages of solvent, will be put in operational phase, after having performed small tests compared of cleaning.

To completed cleaning, the paintings will be soaked with water de-ionized preparing the support to the consolidation that will be performed with hydroxide of barium applied for diffusion to a package of pulp of cellulose supported by Japanese paper. The hydroxide of barium, carbonated inside the pictorial support, will go to recreate a cohesion material both of the color of the plaster that of the same plaster. This operation can be repeated in all that cases in which the de-cohesion results particularly a lot accentuated.
The following operations can be reassumed as following:
- consolidation of the pictorial plaster to the building support through micro fixative to points or with injections of plaster of mortar.
- Stucco of the deprived surfaces of the pictorial plaster,
- pictorial retouch for climax all the abrasions and the small lacks so that to make more good-byes and unitary the reading of the opera. The choice of the method for the pictorial reinstatement will be established after the cleaning and the stucco, in way of having the real situation together.

Maintenance

It is important after the intervention of restoration to individualize through a project of maintenance, the optimal conditions for the safeguard of these stupendous paintings.

A first intervention is that to avoid that the dust of the desert pushed by the wind penetrates inside the building going to deposit on the pictorial film for this it is possible to create some barriers with rooms of compensation before the entry of the building; these would also create automatically a climatic equilibrium in the environment in natural way avoiding apparatuses that in this case would not have a correct prosecution to all of this avoiding a continuous control of the covers, must be added in this way of the improper infiltrations of humidity, in over the elimination of the stucco in cement to the outside of the building replaced with mortar and sand which avoid infiltrations of humidity at the same time a best aesthetical presentation of the whole building.
Formality and times of carrying out of the restoration work

The formalities of carrying out of the restoration will be projected to develop in Jordan a complete and exhaustive knowledge of the thematic conservative of the restoration of the frescoes, so that is been able in continuity with the experience developed for Qasayr Amra a restoration that in the future can be continued by Jordanian workers. Accordingly we will form six restorers in this sector in order to guarantee continuity of intents for the restoration of the frescoes to the Jordan personnel.

The Italian restorers will guarantee this type of formation and they will prepare the young Jordanians to the techniques of cleaning, consolidation, protection and pictorial restoration with the most advanced technologies and in the respect of the scientific orientations of the maintenance.

It is supposed that the restoration can last around 24 months and the yard will be open to the activities of restoration and formation. At the end of this training it will be released by the Department of Antiquities of Jordan a certificate of share that will have value of specialization for the restoration of the frescoes, arranged with the Italian part.

Costs

The costs of the works and of the analysis for this restoration are in total for the all operation of the research. These operations and researches will be done with the new technology so as to turn back to the original fresco.

The costs are the following:

- Stratigraphic research (20 tests x 500 Euro) = Euro 10,000,00
- Analysis of the colours (12 colours x 600 Euro) = Euro 7,200,00
- Analysis of the plaster (4 tests x 250 Euro) = Euro 1,000,00
- Termovision (10 tests x 4000 Euro) = Euro 40,000,00
- Spectrometric (200 points x 280 Euro) = Euro 56,000,00
- Restoration of the painting surface:
  - 125 x 1,000 Euro = Euro 418,000,00
- Scientific consultants (5 x 20,000 Euro) = Euro 100,000,00
- Flight tickets (RM/AM/RM) n.30 x 500 Euro = Euro 150,000,00
- Pubbllication and video in Arabic and Italian = Euro 100,000,00

TOTAL Euro 878,200,00

Time

The restoration will be done in two years with a group of 4 restorers.

Formation

During the two years of the restoration works a stage will be organized with maximum 6 persons from Jordan and the Arabic Countries about the conservation of the fresco.

The theory and practic lessons will be done gratis by the Restorers of our Team, while the accommodation and food must be paid by the Department of Antiquities of Jordan.

Condition

The Department of Antiquities of Jordan will realize the bridge of the works in all the parts of the castle where it will effect the restoration.

Financial proposal

The CNR together with the UJA and the ISAD will participate in this project with a contribution of 200,000 Euro if the restoration works will done with our Team.

Ammcan, 22 may 2004

The Director of Project
(P频率, 希望同塞利奥拉法)
STATE OF CONSERVATION OF FRESCOES AT QASAR AMRA, AMMAN – JORDAN

S. Bianchini, U. Casellato, P.A. Vigato
ICIS – CNR Corso Stati Uniti, 4-35127 – PADOVA

Abstract

The state of conservation of the frescoes at Qasr Amra was investigated by means of integrated physico-chemical measurements, particularly optical and scanning electron microscopy, μ-infrared spectroscopy, mass spectrometry and X-ray powder diffraction. The frescoes appear severely damaged also owing to the presence of relevant amounts of different salts. These caused significant detachments of the pictorial layers. The materials used in the painting layer, in the preparation layer and in the wall plaster were characterized in order to clarify the pictorial technique. Furthermore, the nature and the degree of degradation of these materials were studied. Finally the materials employed in previous interventions were identified.

Keywords: wall paintings, state of conservation, salts formation, consolidants, binders.

Aim of the research

Integrated physico-chemical investigations were carried out on a series of fragments, sampled from the pictorial cycle at Qasr Amra, one of the most important "residence" of the Umayyad dynasty (750 A.D.) in Jordan. These paintings are very important, because they represent the point of junction and transition from the Roman and Byzantine figurative art to the Islamic non figurative one. The aim of the present study is to obtain information about the pictorial technique, to offer a preliminary scientific view of the state of conservation of these paintings, to ascertain the type and the extent of the degradation processes and to detect the materials used in previous interventions. The final goal is to offer scientific tools for a better understanding of this work of art and to set up a scientific aid and guide for a conscious intervention on this pictorial cycle, that appears severely damaged not only owing to natural decay processes.

Experimental

Materials

The solvents used for the extraction experiments (CH2Cl2, H2O, EtOH, Acetone) were purified according to literature.4

Sampling

Thirteen samples (Table 1) have been collected from the western and northern walls as reported in Figure 3. The sampling procedure deserved difficulty owing to the easy detachment and/or crumbling of the plaster.
Physico-chemical measurements

Optical Microscopy (OM)
The samples were observed as received and as cross-sections, obtained by inclusion of the samples in a polyester resin, polishing by SiC paper with a decreasing granularity (600, 2400, 1200/4000), using a Struers DAP-V instrument, followed by a final lapping of the surface in water.
The preliminary optical microscopy analyses were carried out on a Wild S-Leitz instrument. The photographic documentation was obtained with a Canon camera, using a corrective filter and a Kodak film. The observations on the cross-section were carried out on an Olympus microscope system with visible light and UV-lamp to evidence the organic layers.

Scanning electron microscope (SEM-EDS)
The cross sections, prepared for optical microscopy, were analysed also by SEM-EDS, after metallization by means of deposition of a graphite film. The electro-deposition was made with a BAELTIZER-MED 10 at a 10⁻⁷ mbar pressure. SEM investigations were carried out using a Philips XL-40 instrument equipped with an energy dispersion micro analytical system (EDAX-EDS)\[3\].

μFT-IR
These analyses were carried out on the samples crushed on a gold surface to study especially the binders. Extraction experiments, using different solvents (CH₂Cl₂, H₂O, EtOH, Acetone) and further deposition of some drops of the extracted fraction on a gold surface were carried out to study and identify better the organic components, evidenced by optical microscope with UV-lamp. The extracted fractions were observed through a microscope and studied by a Nicolet Magna 650 FT-IR Spectrometer and Spectra Tech microscope. The IRUG data bank was used for the identification of the material constituents of the samples.

X-ray diffraction (XRD)
These analyses, carried out on the powder of ground salts or milled plaster were performed on a Philips X'Pert PW3710 diffractometer, using Cu Kα radiation (40 kV, 30 mA), high-resolution graphite monochromator, rotating sample holder and proportional detector. Measurements were carried out in the range 5° < 2θ < 90° with a step of 0.02°; the ICDD data bank of standard X-ray powder spectra was used for phase identification\[5\]

Results and discussion\[4-8\]
All the samples have been examined as received and/or as cross-sections by integrated physico-chemical measurements, particularly optical and scanning electron microscopy, μFT-IR and where possible by X-ray powder diffraction in order to verify the pictorial technique, the state of conservation of the frescoes, the damages caused especially by chemically agents particularly salts, detachments, repaintings also in consequence of the materials employed in previous investigations and to propose an appropriate intervention project.
The correct identification of mineralogical phases by XRD or Mössbauer, often present in the employed pigments, is precluded by the low of available samples. Hence these phases have been proposed on the basis of the presence of typical metal ions.

Optical and SEM-EDS microscopies show in all the examined samples the inner wall plaster layer (a) is mainly composed by calcite. EDS, in fact, proved the presence almost exclusively of Ca together with a small amount of Si, mainly in the form of Quartz clusters.

Sample 1 is a fragment of plaster containing a green painted layer, detached especially for the characterization of the pictorial technique. The optical microscopy observation of the cross-section reveals the presence of seven different layers, whose characteristics are reported in Table 2 (Fig. 4).

SEM-EDS investigations add useful information for the identification of the matrix components of the different layers. The layer (b), 40-60 μm thick, is mainly composed by Ca (white lime). Owing to the small granulometry this can be classified as “intomachina”. The presence of P and roundish particles in the subsequent layer, 0.3 μm thick, testifies it can be classified as a bone black. The detection of Fe, Si and K in the yellow-green layer (c), ~10 μm thick, proves the green pigment is green earth (potassium and iron silicate) [5, 6]. Generally green earth contains Celadonite and Glauconite, the mean differences between these two phases being the presence of Mg in the latter. In the sample 1 Mg has been found; this proving the presence of Celadonite, although without excluding the presence of Glauconite.

The subsequent, 3 μm thick layer (d) contains the bone black, possibly used for a gesso. Optical microscopy analysis of layer (e), 10 μm thick, using UV lamp (Fig. 5) shows a remarkable fluorescence, owing to the presence of organic materials. Finally the presence of Fe, Si and a considerable amount of Ca in the layer (g) suggest that this layer is composed by green earth [7, 8] and lime plaster. Possibly this green earth contains only Glauconite, owing to the absence of Mg in the examined sample.

Furthermore the μFT-IR spectra of the fraction, extracted with CH₂Cl₂ (Fig. 6), resemble the spectrum of the aged 5 years aged BEVA (Fig 7), the synthetic resin poly(ethylene/vinyl-acetate). A comparison between the spectra of BEVA and 5 years aged BEVA, shows that the pattern is almost the same, with a relevant variation in the intensity of the bands. Thus by μFT-IR is possible to identify not only the synthetic materials used in the most recent restoration, but also to qualify their evolution caused by ageing processes. The same results have been obtained also for the other samples that show a remarkable fluorescence to the UV lamp. Furthermore μFT-IR spectra prove the presence of a considerable amount of BEVA in the samples 3, 4, 4a1, 4a2, 7, 8, 11 and 12. The pyrolysis of the sample 1, the subsequent derivatization in situ with hexacyanoferrato of the resulting products and their identification by gas chromatography-mass spectrometry (GC-MS) proves the presence of acrylic acid and aromatic molecules derived from copolymer BEVA.

Furthermore the presence of traces of carboxylic acids, of hexadecanenitrile and cholesterol together with their degradation products may be ascribed to the pyrolysis of egg yolk, used as original binder. The same results have been obtained with the samples 6 and 10.

Sample 2 was collected in order to study the soot formation on the surface of the low part of the wall. XRD Diffraconetometry on this salt efflorescence proves the presence of Sylvite and Halite, respectively a potassium and sodium chloride, and finally, Nitrate, a sodium nitrate (Fig. 8).
Sample 3 is a fragment of wall plaster containing a black painted layer, detached for the characterization of the pictorial technique. The observation of the cross-section by optical microscopy reveals the presence of four different layers, whose characteristics are reported in Table 3. The presence of roundish P-containing particles on the subsequent 1-20 μm thick layer (b) suggests the use of a bone black pigment. This white, 30-60 μm thick layer (c), mainly composed by Ca, almost exclusively contains calcite. The optical observation of the 15-30 μm thick layer (d), using UV lamp, shows a remarkable fluorescence, owing to the presence of organic materials.

In other fragments of the sample there are only two layers: wall plaster layer (a) and a layer (b) that, analysed by optical microscopy with UV lamp, shows a remarkable fluorescence, due to the presence of organic material. μFT-IR was carried out on the sample as received and on its surface in order to reveal the nature of the binders. Bands, probably attributable to proteinic groups have been detected at 2920 and 2851 cm⁻¹, but the presence of additional bands due to Silicate, Carbonate, Oxalate and Nitrate groups prevents an unambiguous identification of the binders (Figs. 9). The same results have been obtained also on the other samples (i.e., 4, 10).

Sample 4 is a fragment of wall plaster containing a blue painting layer. Optical microscopy reveals the presence of three different layers, whose characteristics are reported in Table 4. A SEM-EDS study of the wall plaster layer (a) shows the presence almost exclusively of Ca with a small amount of Si, mainly in the form of Quartz clusters. The detection of Na, Si, S and Al in the subsequent layer (b), 20-65 μm thick, proves the blue pigment is lapis lazuli and the presence of Ca proves the white pigment is calcite. The identification of lapis lazuli is also testified by the occurrence of a μFT-IR band at 2340 cm⁻¹, present in all the natural Asian ultramarine blue pigments.

Optical microscopy analysis of layer (c), 20-30 μm thick, with UV lamp, shows a remarkable fluorescence due to the presence of organic materials.

The sample 4a is a fragment of wall plaster containing a blue painted layer. The optical microscopy investigation reveals the fragment contains two different typologies, 4a1 and 4a2 which have been studied separately.

4a1 presents three different layers, whose characteristics are reported in Table 5. The presence of Na, Si, S and Al in the layer (b), 30-60 μm thick, proves the blue pigment is lapis lazuli and the presence of Ca proves the white pigment is calcite. Optical microscopy analysis of the layer (c), 10-20 μm thick, with UV lamp, shows a remarkable fluorescence due to the presence of organic materials. Again, as above reported for the samples 3 and 4, the μFT-IR spectra do not give a certain identification of the binders because of the presence of the additional bands of the Silicate, Calcite, Oxalate and Nitrate.

An optical microscopy study on the sample 4a2 reveals the presence of four different layers, whose characteristics are reported in Table 6 (Fig. 11). The detection of Ca, Al and Ti in the blue layer (d), 5-10 μm thick, proves the blue pigment is mainly cobalt blue while the white one is titanium dioxide. The presence of these two pigments, used in subsequent periods, and the presence of a pictorial layer, above the organic material layers, suggest that it must be a restoration material due to retouches.

Optical microscopy investigations on the sample 3, a fragment of wall plaster containing a green painted layer, reveal the presence of six different layers, whose characteristics are reported in Table 7.
The detection of Si, K, Fe and Ca in the layer (b), 20-30 μm thick, testifies it can be classified as green earth\(^6\)\(^,\)\(^7\) (potassium and iron silicate) with calcite (calcium carbonate). This green earth certainly contains Celadonite and Glaucocite, owing to the presence of Mg in the examined sample. The layer (c), 10-30 μm thick, is mainly composed by Ca is calcite\(^8\)\(^,\)\(^9\)\(^.\) According to SEM-EDS the grain (d) containing Si, K and Fe, can be classified as a green earth pigment\(^6\)\(^,\)\(^7\)\(^.\) The subsequential layer (e) contains red ochre\(^3\)\(^,\)\(^9\) and calcite\(^8\)\(^,\)\(^9\), as SEM-EDS investigations testify the presence of Fe and Ca. The very thin, 3 μm thick black layer (f) mainly contains Ca and Si. Probably this is a dirty deposit on this surface of the fresco.

The sample 6 is a fragment of wall plaster containing a red layer, detached from a painting representing a dog. On the basis of optical microscopy studies on the sample 6, three different layers were detected, whose characteristics are reported in Table 8.

The presence of Fe and Ca in the yellow-orange layer (b), 40-120 μm thick, testifies it can be classified as yellow ochre\(^8\)\(^,\)\(^9\) with calcite (calcium carbonate)\(^8\)\(^,\)\(^9\). In the layer (c), 20-70 μm thick, the presence almost exclusively of Fe, suggests that the red pigment is composed by yellow and red ochre\(^9\).

Sample 7 is a fragment classified by restorers as a wall plaster containing a clear-blue painted layer. On the contrary optical microscopy of a cross-section proves the sample is black. Furthermore optical microscopy observations of the cross-section reveal the presence of six different layers, whose characteristics are reported in Table 9.

The presence of Ca and Pb in the subsequential layer (b), 20-80 μm thick, testifies it can be classified as calcite\(^8\)\(^,\)\(^9\) and lead white layer\(^8\)\(^,\)\(^9\). The white layer (c), 5-10 μm thick, mainly containing Pb, proves that the white pigment is lead white\(^8\)\(^,\)\(^9\). The presence of P and roundish particles in the dark-brown layer (d), 5-30 μm thick, testifies that the black pigment is bone black\(^9\) and the presence of Pb testifies that the white pigment is lead white\(^8\)\(^,\)\(^9\). Optical microscopy analysis of layer (e), 5-10 μm thick, shows a remarkable fluorescence, owing to the presence of organic materials. The layer (f) is a very thin black layer (3 μm thick) that mainly contains Pb and a small amount of Ca. Probably this is a dirty layer on a surface of the frescoes.

Sample 8 is a fragment of plaster with a synthetic resin, (detached for the characterization of the synthetic resin). Optical microscopy observation of the cross-section proves the presence of three different layers, whose characteristics are reported in Table 10.

Salt efflorescences, grown on cement stecco, have been detected on sample 9. XRD Diffactometry proves the presence of Halite and Sylvite, respectively a sodium and potassium chloride in those salt efflorescences.

Sample 10 is a fragment of plaster containing a red painted layer. The optical microscopy observation of the cross-section reveals the presence of five different layers, whose characteristics are reported in Table 11. SEM observations reveal the presence of many crystals in the wall plaster layer (a) and EDS analyses testify the presence of sodium and potassium chloride. This observation is supported by XRD Diffactometry, that reveals the presence of Sylvite, Halite, Aragonite and Calcite. The layer (b), 10-30 μm thick, is mainly composed by Ca: the white pigment is calcite\(^8\)\(^,\)\(^9\). The presence of As and S in the subsequential layer, 10-20 μm thick, proves the presence of realgar (a red arsenic sulphide)\(^8\)\(^,\)\(^9\). The presence of Fe, Si and Ca in the clear yellow layer (d), 10-20 μm thick, proves the green pigment is green earth\(^6\)\(^,\)\(^7\) (potassium and iron silicate) mixed with calcite. The subsequential layer (e), 5-10 μm thick, contains only green earth\(^6\)\(^,\)\(^7\).
Sample 11 is a fragment of wall plaster containing a red layer. Optical microscopy observations of the cross-section reveal the presence of eight different layers, whose characteristics are reported in Table 12. The layer 20-80 μm thick (b), mainly containing Ca, is calcite [14, 15]. The presence of Fe in the subsequent layer, 5-10 μm thick, testifies it can be classified as a red ochre [16]. The optical microscopy study of the layer (d), 5-30 μm thick, using UV lamp, shows a remarkable fluorescence, owing to the presence of organic materials. In this layer it is possible to identify some red particles classified as red ochre [15], as they contain Fe as the major element. Owing to the presence of Fe in the red layer (f), 5-10 μm thick, red pigment can be classified as red ochre. The optical microscopy analysis of the layer (g), 5-20 μm thick, using UV lamp, shows a remarkable fluorescence, owing to the presence of organic materials. The layer (b) is a very thin black layer (3 μm thick) that mainly contains Si and a small amount of Ca. Probably this is a dirty deposit on this surface of the fresco.

Sample 12 is a fragment of plaster containing a rosacea painted layer. The optical microscopy observation of the cross-section reveals the presence of four different layers, whose characteristics are reported in Table 13. Also the layer (b), 10-40 μm thick, where the presence of Ca was detected, contains only calcite. The presence of Fe and Ca in the subsequent yellow-orange layer, 20-40 μm thick, testifies it contains a red ochre [15] mixed with calcite [4]. In this layer several lapis lazuli particles have been also detected. Optical microscopy analysis of layer (d), 10-20 μm thick, using UV lamp, shows a remarkable fluorescence, owing to the presence of organic materials.

Conclusion

The investigations, carried out on a series of fragments detached from the painted walls of the famous desert castle Qasr Amra-Jordan, allowed a satisfactory characterization of the pictorial technique and of the nature and the degree of degradation of the wall paintings.

The fragments have been sampled from the wall plaster, and from differently painted areas in order to ascertain the nature of the materials, particularly of the employed pigments and binders. The study of these fragments proved a severe degradation of the painted surface owing to salt efflorescences. The presence of remarkable amounts of inorganic salts, that cause a very severe damages, might be surprising. It must be considered, however, the presence of groundwater, testified by the presence of a well. Furthermore, historical testimonies report the existence, during the roman period, of a salt quarry in the neighbourhood.

Different pigments have been identified on the pictorial layers: the green areas of the samples 1 and 5 are constituted by green earth (iron-silicate), the black areas (sample 3) are constituted by blue black; lapis lazuli is the pigment detected inside the blue areas (sample 4 and 5). In the sample 3 as a layer, containing titanium white and cobalt blue were found. These pigments, not in use when the pictorial cycle was realized, must be considered as restoration materials due to retouches. The red pigment is mainly constituted by red ochre (sample 6 and 11) and resina (sample 10). Finally the rosacea was obtained by employing red ochre and some fragments of lapis lazuli (12). The sample 7, defined as fragments with a pale blue layer, does not contain any blue pigment.
Optical microscopy, using UV lamp, proved the presence of a consolidant layer almost in all the examined samples. In particular, the layers (e), (f), and (g) of the sample 11 show that a consolidation treatment, a retouch of the pictorial pigments, and a further final consolidation treatment were carried out.

μFT-IR spectroscopy was very useful for the identification of the used consolidant; the extraction with CHCl₃ from almost all the fragments gives rise to an organic fraction, identified as the synthetic resin poly(ethylene/vinyl-acetate).

Furthermore, μFT-IR was employed in the characterization of the binders; characteristic bonds due to the protein groups have been detected. Consequently, it is possible to suggest the presence of a protein binder. The type of binder was not identified unequivocally, owing to the presence, in their spectra, of additional bands of silicates, calcite oxalates, and nitrate. Also the infrared spectra of the extraction fractions are strongly dominated by the bands of the used consolidant, which masks the bands of the binder. Also, the IR spectra of the fraction, extracted with hot water, do not offer certain results. μFT-IR, carried out by ATR technique, on the surface of the fragments gave unsatisfactory results. On the basis of the μFT-IR data, it may be suggested that calcium white milk and/or animal glues were used as binders. Preliminary GC-MS studies suggest also the use of egg or yolks. We need, however, further information for an exhaustive identification of the binders used.

If we consider that many frescoes have been treated with organic polymers, it becomes immediately clear that we must prepare reference materials containing also a relevant amount of these synthetic resins, in order to set up adequate physico-chemical measurements capable to identify all the organic products, although present in very different amounts.

The pictorials cycle is severely damaged; inorganic salts, determined by XRD and SEM-EDS, have caused remarkable surface alterations. Especially on the lower part of the walls, calcite, potassium, and sodium sulphate and sodium nitrate have been detected. Close to a cement plaster, the use of cement should be severely forbidden for painting restoration. Sylvinite and Halite have been detected. Again, sylvite and halite have been detected inside the wall plaster, which is mainly composed by Aragonite and Calcite. Thus the natural degradation but also dangerous restoration interventions are the almost relevant causes of the very bad conservation state of this work of art.

The most appropriate actions guided by an appropriate and exhaustive scientific and petrography investigation, must be carried out very quickly; otherwise, this work of art, classified as a patrimony of the humanity by UNESCO, will be definitively lost.

The present work must be considered only as a preliminary contribution, that must considerably improved with additional studies covering the whole pictorial cycle, to the preparation of a satisfactory restoration proposal.

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