QUṢAYR ‘AMRA WORLD HERITAGE SITE: PRELIMINARY REPORT ON DOCUMENTATION, CONSERVATION AND SITE MANAGEMENT ACTIVITIES IN 2010 - 2012

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Introduction

Three investigation and conservation seasons at Quṣayr ‘Amra World Heritage Site took place in 2011-2012: the first from 17 March to 28 May 2011, the second from 3 October to 3 December 2011 and the third from 15 April to 26 June 2012. The Project is a partnership between the Department of Antiquities of Jordan (DoA), the Higher Institute for Conservation and Restoration of Rome (Istituto Superiore per la Conservazione ed il Restauro, ISCR) and the World Monuments Fund (WMF) [2]. Expert conservators trained at the Istituto Superiore per la Conservazione ed il Restauro in Rome (ISCR) took part in the work alongside staff and workers of the DoA and WMF representatives and consultants[3].

Background

The Umayyad Castle of Quṣayr ‘Amra is one of four World Heritage sites in Jordan. It was added to the UNESCO World Heritage List in 1985. The site, located approximately 80km east of ‘Ammān, along the highway to Azraq (**Fig. 1**), was documented for the first time by Alois Musil in 1898, who returned there in 1902 with the painter Alphons Mielich in order to copy the paintings that he had seen in his first visit. The resulting publication (Musil 1907) is still an important reference today given the decay that has partly obscured some of the scenes. Unfortunately some of the decay was caused by Musil and Mielich themselves, who admitted to having used chemicals to clean the paintings from layers of black soot (the result of fires lit inside by local *bedouin*). Moreover Musil and Mielich detached some of the paintings, causing further damage in the process. A complete figure and other fragments are today at the Pergamon Museum in Berlin, after they were sold by Mielich without Musil’s agreement. Other fragments are apparently lost, while others were inadvertently destroyed during detachment (Vibert-Guigue and Bisheh 2007: pl. 14).

Subsequently the site was visited and photographed by a number of travelers. The establishment of the Department of Antiquities in 1928

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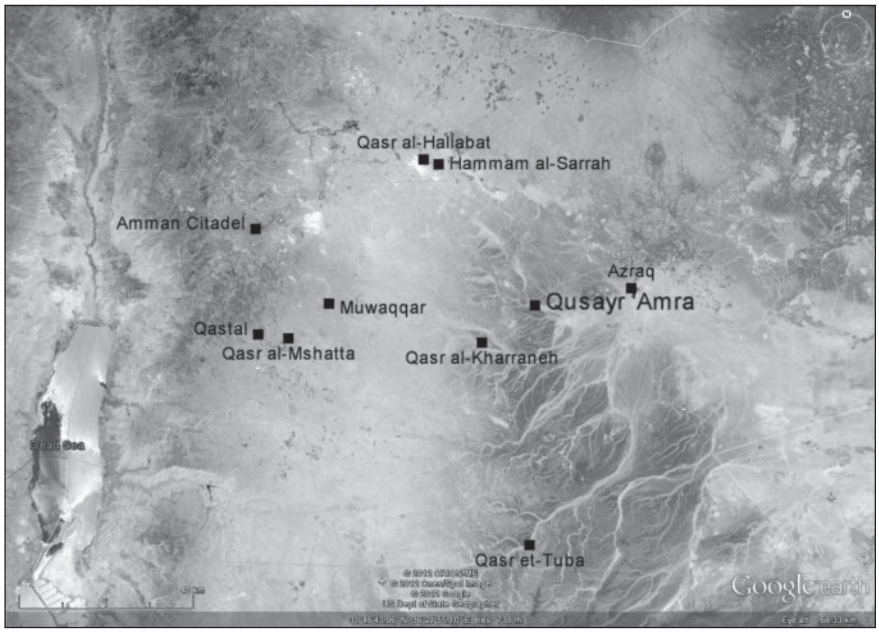
2. ISCR is the oldest and most prestigious institution in Italy dedicated to the conservation of cultural heritage monuments. WMF is a not-for-profit institution dedicated to the protection and conservation of cultural heritage worldwide. Project Managers are Dr Giovanna De Palma (Archaeology), Carlo Birozzi (Engineering), Asma Shhaltoug and Dr Gaetano Palumbo. Operations Managers are Maria Carolina Gaetani and Marie-José Mano.
3. We wish to thank HE the Minister of Tourism and Antiquities, Mr Nayef al-Fayez, Dr Ghazi Bisheh, former and present Directors General of the Department Antiquities Dr Ziad al-Sa‘ad and Mr Fares al-Hmoud, for encouragement and assistance throughout the project. Ignacio Arce, José Luis Lerma and Ignacio Moscoso have contributed technical expertise to the documentation components of the project. Wisam Esaid, Romel Gharib, Jihad Haroun, Husam Hijazeen, Mohamed al-Khatib, Ahmed Lash (DoA) and Hussein Khirfan (Ministry of Tourism and Antiquities) contributed expertise to the conservation project and the site management planning component. This article is dedicated to the memory of Dr Fawwaz al-Khraysheh, former Director General of the Department of Antiquities, who made this project possible, and Luigi De Cesaris, who made available his profound knowledge of conservation techniques to the project.



1. Location of Quṣayr 'Amra and other Umayyad sites mentioned in the text.

contributed to the early protection of the site. Various conservation interventions followed, not all of them properly documented, until a Spanish project under the direction of Martìn Almagro was conducted there between 1971 and 1974, with a second intervention in 1979 (Almagro *et al*. 2005). Work on-site included the archaeological documentation of the site and its surrounding structures, consolidation of both the western wall of the main hall (using a reinforced concrete beam) and the vault of the western aisle, and the cleaning, consolidation and – in several areas – repainting of figures in order to enhance scarcely visible features. Both the repainting and the application of layers of shellac as a protective substance over the restored paintings were not documented, and were unknown to the scientific community.

It was only when Claude Vibert-Guigue started an exhaustive (1989-1997) documentation of the paintings at the request of the Department of Antiquities that this intervention was recognized (Vibert-Guigue 1994). However, the exact composition of the materials applied remained unknown.

The Spanish intervention made the site better known to the world and one of the major tourist attractions in Jordan. In 1985 the site was added, along with Petra, to the UNESCO World Heritage List. More undocumented work on the structure, both exterior and interior, was executed between the end of the 1980s and the beginnings of the next decade. Between 1989 and 1997 a Franco-Jordanian project was implemented, consisting of a detailed, 1:1 documentation of all paintings. Following a disastrous flood in 1994, the Institut Français d'Archéologie au Proche-Orient (IFAPO) financed and implemented a series of flood risk reduction and water management interventions between 1995 and 1996[4]. These consisted of the excavation and reconstruction of a wall to protect the site from floods, reconstruction of the ancient *sāqiyya* (Ar. "well") that in antiquity served the baths on site and constructions of berms to redirect the waters of Wādī al-Buṭum away from the site during episodes of rain and flooding (Bisheh *et al*. 1997). IFAPO also contributed to the construction of the visitor center and limestone paving of the main hall, throne room and *apodyterium* (dressing room of the baths), while the *tepidarium* and *caldarium* rooms were provided with a wooden passage (here the ancient floor is lost, leaving the *suspensurae* and lower floor level visible) (Morin and Vibert-Guigue 2000).

In 2007 the DoA sent a request for assistance to the WMF, as the conditions of the monument seemed to be deteriorating, especially with regard to the important cycle of mural paintings conserved in its interior. WMF listed the site

4. Project financed by the French Embassy in Jordan and the DoA.

on its 2008 Watch list and provided, through the Robert Wilson Challenge to Conserve Our Heritage, a first grant to be matched by other organizations. The Italian Ministry of Culture stepped in by providing a grant in 2009. In 2010 a first sampling season took place, in order to study the composition of mortars outside and inside, as well as those of the paint layers inside. This sampling work was accompanied by site condition assessments, collection of background literature and discussions with scholars and researchers that had worked on the monument in the past. At that time the team also started contacting institutions worldwide with photographic collections that could contain early images of the site in order to track the evolution of interventions where reports and publications could not supply adequate information.

In October 2010 a Memorandum of Understanding was signed between the stakeholders, after a definition of the project's scope and initial budget.

In January 2011, two training courses took place in ʻAmmān, the first for workers and masons, covering techniques of lime mortar production and application, and the second for conservators, covering cleaning techniques for mural paintings. It was however decided that only trained conservators would work on the mural paintings, given the complexity of their conditions. The precise date of the paintings and their manufacturing technology remained partially uncertain, and the whole picture was further complicated by the substantial restorations that the painted complex had undergone in the past.

The training course was followed, in early February 2011, by a workshop which represented an important occasion for the exchange of information and experience between Jordanian, Spanish, French and Italian experts, who had carried out studies and interventions on the monument in the past.

The three field seasons conducted in spring 2011, autumn 2011 and spring 2012 were attended by numerous conservators, and involved Jordanian professionals working on ancient plasters and stone. The latter consisted of four rotating groups, each consisting of three DoA staff. A similar arrangement for DoA workers focused on the exterior walls and allowed many of the people trained in January to gain hands-on experience at the site.

Previous Documentation and Creation of a Project Archive

One of the aims of the Project is to collect published and unpublished documentation about the site in order to create a repository of this information at the Department of Antiquities, since a complete archive does not exist anywhere. On the basis of previous studies and information available through publications, the team was able to contact a number of institutions holding photographic collections and other archival material. The response was overwhelming, since most of the archives which were contacted responded favorably by sending digital copies of their holdings, often allowing free use of the material for research purposes. Collaborations were established with the École Normale Supérieure and CNRS in France[5], the Institut Français du Proche-Orient (IFPO) in Jordan, the Spanish Archaeological mission in Jordan, the Pergamon Museum and Rathgen laboratories in Berlin, Germany, as well as with a number of institutions holding early images of Quṣayr ʻAmra which have generously made these historic photographs available for study. These include the Academic Society of Alois Musil (ASAM) in Prague, the Gertrude Bell archive in Newcastle, the Creswell archive at the Ashmolean Museum, Oxford, the Lankester-Harding archive at the Department of Antiquities of Jordan, the Jaussen and Savignac archive at the École Biblique, Jerusalem, the Horsfield archive at University College London, the Laboratory of Archaeology at the University of Granada, Spain, the Rockefeller Museum in Jerusalem and the Aerial Photographic Archive for Archaeology in the Middle East (APAAME) at the University of Western Australia. Other institutions and private individuals were contacted and they may be able to provide yet more previously unknown information on the site.

5. More than 10,000 pictures, thousands of drawings, documents and archives were collected during the Franco-Jordanian project. The 2007 joint publication (DoA / IFPO) presents one part of the work. Claude Vibert-Guigue's PhD (Sorbonne 1997) helped to gather information about the building, its state of conservation and a first historical background of the paintings' alterations.

Building Features: Exterior

The building is a lodge and bath house characterized by a main rectangular hall, divided into three aisles of the same width (**Fig. 2**). The barrel vaults covering them are underpinned by two large, slightly pointed arches. The central aisle ends in a smaller area leading to two apsidal rooms. To the left of the entrance, the main hall leads to a small bath house consisting of three small rooms: the *apodyterium*, the *tepidarium* and the *caldarium*. The *caldarium* is roofed by a dome resting on pendentives. The hot air coming from the nearby boiler room could circulate in the hypocausts and terracotta tubes underneath the plaster, heating the *caldarium* and *tepidarium* rooms.

Perimeter walls are made with stone blocks and a rubble core (**Fig. 3**). The structure is similar to others of the same period, such as Ḥammām as-Sarāḥ in the vicinity of Qaṣr al-Ḥallabāt. In the lower part, ashlars are alternated with small flat horizontal stones so as to make the setting beds regular. Similar walls were also found at Qaṣr al-Kharrānah and the ʻAmmān Citadel mosque. The internal part of the wall is made of rubble of the same stone, randomly bedded in a gray and friable mortar mixed with ash. The masonry is about 75cm thick, ensuring appropriate strength. Neither the large, slightly pointed arches separating the two aisles in the main hall nor the central aisle in the same hall have any buttresses.

The external wall color is homogeneous owing to a thin, ochre, ‘earthy’ patina resulting from the desert wind; this covers even the lowest portions of mortar. Investigation of samples confirmed *in situ* observations. Surface brushing revealed the genuine, more grayish color of the stones and mortars.

2. General view of the site.

The rear facade of the monument shows traces of plaster covering the stones. Large portions are visible near the mortar joints where they can more easily adhere to the underlying layers. The surface of this mortar is treated with regular herringbone-patterned signs, clearly aimed at improving the adherence of the final plaster layer (**Fig. 4**). The plaster also displays large gravel particles, which were applied to its surface with the palm of the hand in order to increase the ‘grip’ of the thinner, final layers of finishing plaster. However, the entire outer plaster layer and most of the preparatory layers are lost.

At Qaṣr al-Kharrānah, only 13 kilometers away, fragments likewise confirm the outer plastering of this building.

Mortars are still strong and can be broken without crumbling. They are composed of lime with a number of aggregates in different proportions:

(1) Bright red, sometimes grayish-brown *coc-*

3. Wall section of the praefurnium showing the construction technique.

4. Original mortar found on the exterior of the monument.

ciopesto;

(2) Flint grains of different colors (whitish, gray, brown, reddish), always characterized by chipping edges and conchoidal fractures;
(3) Alluvial sand made of carbonate stone grains of different color and type. Stereo microscope analysis found calcareous fossiliferous micritics (with foraminifera), flint limestone and possibly marl limestone. Their color ranges from whitish to light gray and from light brown to yellowish and orange;
(4) Calcite and hydrous iron oxides (calcareous limonitic 'crusts');
(5) White calcium carbonate grains, probably – on the basis of a positive HCl 2N microchemical test result – carbonated lime 'lumps' (*bottaccioli*) or carbonated slaked lime aggregates with 'inert' function, used in accordance with a Byzantine technique;
(6) Black, opaque, fibrous grains, *viz*. charcoal and ash fragments;
(7) Plant fibers.

Considering the large amount of calcareous aggregate, the weight ratio between binder and aggregate can be estimated at around 1:3.

Most of *cocciopesto* and plant fibers can be found in the surface finishing layers, while charcoal and ash are more common in the ones below.

Water-resistance in the extrados of the vaults is guaranteed only by plasterwork. As the roof does not have gutters, water is drained by sloping the spaces between the barrel vaults towards the southern side. The vaults are made of quadrangular stone ashlars. On top of them, four mortar layers were applied. The lowest, just above the stone core of the vaults, is made of lime mortar, ash and a thin inert charge of different color, serving as bedding for flat stone fragments. This layer was probably used to control the roughness of the vault's exterior core. Three other layers, with decreasing granularity, were placed on top of the one just described. The second mortar layer, with a similar composition to the lowest, is about 1.5cm thick. On its surface, various grits ranging in size from 1 to 4cm were applied. Several roundish areas created by hand pressure can be observed. Grit applied in this way supported the third layer of mortar, thereby increasing its 'grip'. This layer is typically 2.5cm thick and includes diverse aggregates (roundish stones, flint and *cocciopesto* fragments) ranging in size from 0.5mm to 5mm. It also contains smaller particles invisible to the naked eye. The fourth, finishing layer was applied to make the lower one more uniform. It is just 1-1.5mm thick, white and full of lime putty (*grassello*) and vegetable fibers, still identifiable in surface traces. The original appearance must have been very smooth and compact, to judge by those areas where the mortar still remains intact.

Some important elements of the masonry, such as the lintel and jambs of the entrance door, are made of basalt, which can be found in Azraq,

5. Mortar loss at the base of the walls (before intervention).

25 kilometers to the east.

State of Conservation: Exterior

The monument's state of conservation showed some worrying problems concerning the masonry. First, flooding (including an episode as recently as 1994) seems to have caused the loss, in parts almost total, of the original bedding mortar and the mortar inside the core of the masonry in the lower 60-70cm of the walls (**Fig. 5**).

The surfaces of the walls showed widespread filling between the ashlars performed using cement mortars during previous restoration works. This cement, besides being aesthetically unpleasant, may have contributed to increased salt content, which is sometimes visible as efflorescence in the lower parts of the walls.

The ashlars of the exterior wall, made of light yellow sedimentary stone, appeared to be in overall good conditions. Some of them, because of their geological nature combined with the effect of atmospheric agents, show signs of de-cohesion and de-adhesion of the constituent material, mainly near the most exposed and micro-exfoliated areas. There are also macroscopic fissures in the ashlars, along with micro-fissures and de-cohesive areas. This may be the result of both pressure and – in the lower parts – rising damp. On the southern and northern walls, ashlars that were removed in the past or are otherwise missing have exposed the cement core walls to rainwater infiltration, which has caused loss of mortar within the masonry. All along the perimeter of the monument, graffiti are visible on the wall, even at a considerable height.

6. Condition of the extrados of the vaults (before intervention).

The extrados of the vaults were in worrying condition, owing to the loss of the original mortar layers. This has exposed the rubble core and allowed water to penetrate deep into the vaults, affecting the painted surfaces inside (**Fig. 6**).

The dome of the *caldarium* was heavily integrated in the early 1990s using cement mortar, which is in very good condition and unaffected by the serious damage afflicting the original mortar.

As on the other vaults, here too the top mortar layer has disappeared; the surface looks eroded and fragmented because of bio-deteriorating agents, as well as the effects of wind and diurnal variations in temperature. As can be seen from old photographs, most of the plaster on the dome was lost, leaving the masonry exposed.

The mortar layers on top of the vaults of the main hall are in different states of preservation. The most exposed, *viz*. the eastern, has lost almost all of the three mortar layers and the stones placed right upon the structure were in plain view, so the risk of infiltration to the paintings was very high.

The west wall is about 30cm out of plumb. While the lateral thrust of the three vaults is resisted by the east wall adjoining the thermal bath, the west wall is freestanding and not buttressed. The size of the shear wall supporting the last vault is clearly insufficient to resist thrust. The movement of the wall caused serious longitudinal damage along the higher part of the vault, visible from both inside and outside. Spanish conservators and architects during the 1971-1975 seasons tried to solve the problem by installing a reinforced concrete beam in the wall by the last two rows of stones. The beam runs along the orthogonal facades up to the windows.

On the inside, the damage was filled and covered with yellow paint. On the outside, the intervention was more complex and may not have been carried out at the same time. The gap on the extrados was covered with tar paper and filled with roughly smoothed concrete mortar, with no attempt to connect it with the ancient mortar. In the 1990s, more filling was carried out. The eastern vault differed from the other two on account of the lack of the second layer, which in the other two vaults is the layer with the presence of grits to increase its 'grip'. This may be evidence for damage to the second layer in antiquity, which might have been replaced by mortar of the third layer during repair works.

The monument is provided with rectangular windows in the higher part of the main body, situated in the centering which closes the barrel vault, and several circular openings about 20cm in diameter. Some of them have a brick pipe, occasionally round, but more often rectangular in section. Others have less regular openings, perhaps owing to the loss of the internal pipe. Sometime in the last 30 or 40 years, glass was set in circular iron frames on the outside of the building to prevent water from entering. Many of these covers were broken, missing or had lost adhesion and allowed water to penetrate. On the inside, streaks and large eroded areas suggest that the glass had been missing for a long time or that fillings were not waterproof.

The original windows are lost; the monument had 10 wooden window frames (plus four iron frames in the *caldarium* dome). These were very damaged, simply left open or with broken glass, thereby allowing the ingress of water and pests into the building. Bird droppings and water stains are visible on the interior paint layers under every window.

Conservation Intervention: Exterior

Before the intervention started, chemical and physical analyses were carried out in order to verify the composition of the mortar and the aggregates, as well as the granularity curve. Observation of the exterior walls allowed for the detection of homogeneous mortars. It was immediately clear – and subsequently confirmed by analyses – that the whole building is covered with the clay dust typical of this part of the desert; it is easily carried by the wind and raised by sudden 'dust devils' that occur at certain times of the year. The bedding and facing mortar is not the typical yellow-pinkish color of clay, but white-grayish as often happens to lime putty (*grassello*) mortars. The use of ash and coal as an additive or inert material makes this color more intense. The clay on the masonry became embedded in it and it is not easily removable except by use of mechanical brushes. The choice of mortar color was highly influenced by this observation.

During the second season, the mortars of Qaṣr al-Kharrānah were also investigated, in view of this site's physical proximity to Quṣayr ʻAmra, as well as its similar age and construction techniques. Unexpectedly, these investigations revealed the use of gypsum, which was never found at ʻAmra. Although building techniques concerning the arches and vaults were completely different from those used for the bath, some masonry features appeared to be similar. On the contrary, the use of gypsum as a binder is something new.

Biological deterioration of mortars was analyzed in order to identify the most effective biocide. Mild polishing was used to remove sandy particulate from surfaces; areas affected by biodeterioration were treated with Preventol R80 3% in deionized water, applied in three phases with seven-day gap between one treatment and next.

Conservation was aimed at performing the minimum intervention required to guarantee the stability of the structure and conservation of *in situ* mortars and plasters.

So far as possible, the new mortars and aggregates used comply with the existing ones.

Similarly, attempts were made to ensure that the intervention was both identifiable and documented with photographs and drawings. The state of conservation dictated reintegration of missing plaster fillings and covering mortar layers.

All mortars used consisted of slaked lime putty matured for more than six months. DoA experts turned quicklime into slaked lime in barrels next to the work yard. The first stage of the intervention implied the choice of aggregates and mortar color. White sand, yellow sand, *wadi* sand and *cocciopesto* were used. A warmer tone was preferred to the original grayish color of

mortars, since it was closer to the wind-deposited clay that covered the whole building.

Cocciopesto-based hydraulic mortars were used for deep consolidation. Granularity analysis on ancient mortars allowed compatible mortars to be worked out. Nevertheless, with the aim of integrating ancient mortars exposed to the elements for centuries, several attempts were necessary until a suitable color mixture was found.

A three part / volume dry mixture must be mixed with one part / volume of slaked lime putty, with the addition of sufficient water to make the mixture soft as a dense cream. The modern intervention was limited to a lower level compared to the original, so as to be clearly perceptible.

Surface treatment of the intervention was subject to careful treatment in order to harmonize it with the original, now eroded by atmospheric agents; the wet mortar was therefore brushed with soft brushes. An application of water mixed with desert clay completed finishing. The mortars were designed to have a mechanical resistance similar to that of the existing ones.

The first interventions on the exterior of the monument were conducted on the lower sections of the walls, which have been affected by the loss of the bedding and core mortar. Gaps and holes were filled with stone chips up to 60-70cm above ground level. The filling was divided in two distinct operations: one aimed at re-establishing the building's compliance with static safety requirements, the other at protecting the surfaces from future deterioration. Consequently, we examined different mortars characterized by the presence of a lime binder.

DoA technicians prepared a sufficient quantity of lime putty (*grassello*) from quicklime produced in a nearby plant. In total, fourteen tests were carried out in order to achieve a mortar capable of meeting the mechanical and aesthetic requirements of this type of conservation work. The prepared mortars were tested on the eastern wall to verify their mechanical and aesthetic features. A hydraulic mortar (*grassello*, grit, *cocciopesto* and yellow sand; binder to charge ratio = 1:3) was used internally, in order to ensure its 'grip' in an unventilated environment. Once the walls were secured against possible collapse and the ashlars were replaced in their original positions, a surface mortar complying with the specific conservation and aesthetic requirements was applied.

The intervention on the exterior of the building followed a number of phases:

(1) Removal of Portland cement used in previous restoration work and of stones used to fill in gaps;
(2) Removal of dust and earthy deposits from surfaces using paintbrushes and medium- to hard-bristled brushes;
(3) Where necessary, the surface was roughened using a mortar made of inert and hydraulic charges of different granularity (binder to charge ratio = 1:3; *grassello*, sand, grit and *cocciopesto*). Stones of different sizes were soaked in water and used to fill the gaps in the core wall. This allowed the restoration of cohesion within the masonry;
(4) Missing ashlars were replaced by natural stones found nearby, with the intention of restoring a complete view of the surfaces without the 'interference' of missing parts. In order to underline the presence of non-

7. Building exterior (before intervention).

8. Building exterior (after intervention).

original ashlars, the perimeter filling was done slightly under the surface level;

(5) In the same way, the finishing mortar used for the gaps between ashlars (binder to charge ratio = 1:3; *grassello*, sand, grit and volcanic sand) was applied slightly under the surface level to make the conservation intervention identifiable.

The final smoothing of the surfaces was aimed at easing the flow of rainwater to the ground.

We paid particular attention to avoid depressions where dampness and roughness might create the right conditions for future deterioration (**Figs. 7 and 8**).

The upper layers of mortar in the *praefurnium* vault were missing, leaving the surface exposed to atmospheric agents. Moderate signs of de-adhesion were noticeable between the layers of mortar and between them and the masonry support. The grey-green-black color of bio-deteriorating agents was clearly visible near the areas most exposed to dampness. Furthermore, the old restoration cement looked cracked, allowing water infiltration. Here the old restorations were removed and new lime mortar layers applied.

During the study aimed at understanding the building phases of the vaults, we were also able to observe different types of mortars used in previous restoration works. Five types of recent restoration mortars were identified and classified:

(M1) Brown mortar (possibly because of earthy impurities); rich in aggregates and poor in binders, it does not seem to contain cement and is probably the oldest;

(M2) Grey cement mortar made of large size aggregates of different granularity;

(M3) Grey cement mortar made of white small aggregates; it was mainly used to seal and fix the glass covers on the vaults' openings;

(M4) Grey cement used to fill the edges of the different layers of original mortar; rich in soil particles;

(M5) Grey cement mortar made of aggregates of different granularity; similar to mortar M2 but containing finer aggregates.

Surface plaster layers displaying de-adhesion problems were initially re-attached using a ready mixed low-salt mortar (Ledan TB1).

Cement fillings from previous restoration works were removed, because of the greater hardness of their constituent material compared to that of the original surfaces. In this way, pre-existing mortars did not suffer further damage. Fissures in the cement mortar of the *caldarium* and *tepidarium* dome were then filled with lime putty (*grassello*) mortar, desalinated cement (with properties consistent with the conservation intervention) and sand (1 part *grassello*, ¼ part white cement, 2 parts yellow sand, 1 part red sand and ¼ part black sand).

Cement surfaces on the *caldarium* dome, which could not be removed because of their hardness, were slightly coated with water and sandy dust to harmonize the surface color and remove the 'spotted' effect of the exterior surface of the dome.

A spreading test of the mortar was run in the 2011 spring season on the *praefurnium* vault, which had completely lost the top two layers of original mortar. This small-scale test allowed the procedure for work to be conducted on the three upper vaults during the subsequent autumn season to be defined.

At the same time, a group of conservators

9. Eastern vault (before intervention).

10. Eastern vault (after intervention).

focused on the roofs. On the barrel vaults, cement layers from previous restorations were mechanically removed with hammer, scalpel and angle grinder with diamond cutting discs. Gaps were filled with mortars similar to the existing ones. A sacrificial layer was constructed in order to protect the original mortars, which are widely cracked and have become fragile over time. During each working day, mortar was spread over approximately 9m^2. For some of the surfaces, final smoothing was necessary to allow rainwater to drain to the ground. To slow down erosion caused by atmospheric agents such as wind and sand, low and rough areas where water could accumulate were eliminated (**Figs. 9 and 10**).

Consolidation of detached layers of plaster was tested in the alcoves next to the bath. Once the edges of gaps were filled, lime-based grout was injected. However, this type of intervention was stopped because of the large amount of mortar absorbed and the impossibility of controlling leakage from internal fissures adjacent to painted decoration.

Consolidation of the longitudinal gap in the vault with concrete, done during the Spanish intervention of the 1970s was found to be quite drastic. Once the first layer was removed and tar paper identified, cement and water repellent were carefully cleaned off. The tar had made concrete consolidation ineffective and could allow water seepage. The concrete was gradually removed and replaced with a new lime-based mortar mixed with rubble. Afterwards, it was leveled off with finishing mortar.

Throughout the autumn season, windows were replaced with similar wooden structures. The broken shutters could be opened but not controlled, so they were replaced with fixed shutters to prevent animals from entering the building.

Each one of the barrel vaults of the main hall originally had eight openings defined by a rectangular-section ceramic tube (*ca.* 6-8cm per side). The tube was inserted into the masonry, probably to let fresh air in and steam out. The original openings were sealed by glass in circular metal frames, now rusted. These were replaced with rounded glass caps in order to avoid water accumulation and were installed without metal support to prevent the glass from breaking because of metal expansion. Four openings on the west side of the west vault were completely sealed with cement mortar and were re-opened.

The Interior

The best description and documentation of the monument and its decorative elements is the work conducted by the Franco-Jordanian team, directed by Claude Vibert-Guigue under the supervision of Dr Ghazi Bisheh, between 1989 and 1997 (Vibert-Guigue and Bisheh 2007).

The monument is characterized by 350m^2 of mural paintings that almost entirely cover the interior surfaces. These paintings are extraordinary and unique in their style and representations. Although mural paintings existed at other Umayyad sites, Quṣayr ʻAmra is the only one where the paintings are legible and largely preserved. They depict court scenes and leisure activities, (including a caliph or prince on his throne with other kings of his time [e.g. the Byzantine emperor, King Roderic of Spain and the Sasanian emperor Chosroe]), hunting scenes with dogs, representations of bathing scenes, dancing women and craftsmen at work. The dome of the *caldarium* illustrates constellations and zodiac signs, and is the earliest known representation of the zodiac on a non-flat surface. The wall paintings represent the transition between Byzantine culture and the new Islamic era, and are also heavily influenced by Sasanian art and iconography. Finally, two rooms are decorated with floor mosaics, embellished by the use of glass *tesserae*[6]. This section is focuses specifically on the work conducted on one of the panels of the main (reception) hall.

Reception Hall

The entrance hall of the monument is a rectangular room with a north - south major axis of three aisles separated by two slightly segmental arches (**Fig. 11**). Rectangular windows are located in the northern, eastern and southern sides. The pictorial decoration of the aisle is principally divided into three bands at different heights:

(1) The lower one, up to a height of 2.1m above the main floor, is homogeneously painted on the three walls and the arch springer, and de-

6. For further details on the decoration of the monument and its interpretation (see Musil 1907; Fowden 2004; Almagro *et al*. 2005; Vibert-Guigue and Bisheh 2007).

11. Main hall.

picts geometric-patterned imitation marble;
(2) The central one, between 2m (on the eastern and western sides) and 3m (on the southern side) high, contains the main figurative representations. The sides of the arch are decorated with ornamental patterns; along the eastern and western sides, the paintings reach the spring of the vault and beyond;
(3) The upper decoration covers the vaults; on the northern and southern sides, the lunettes are separated by a central window.

Western Aisle: Southern Wall Paintings

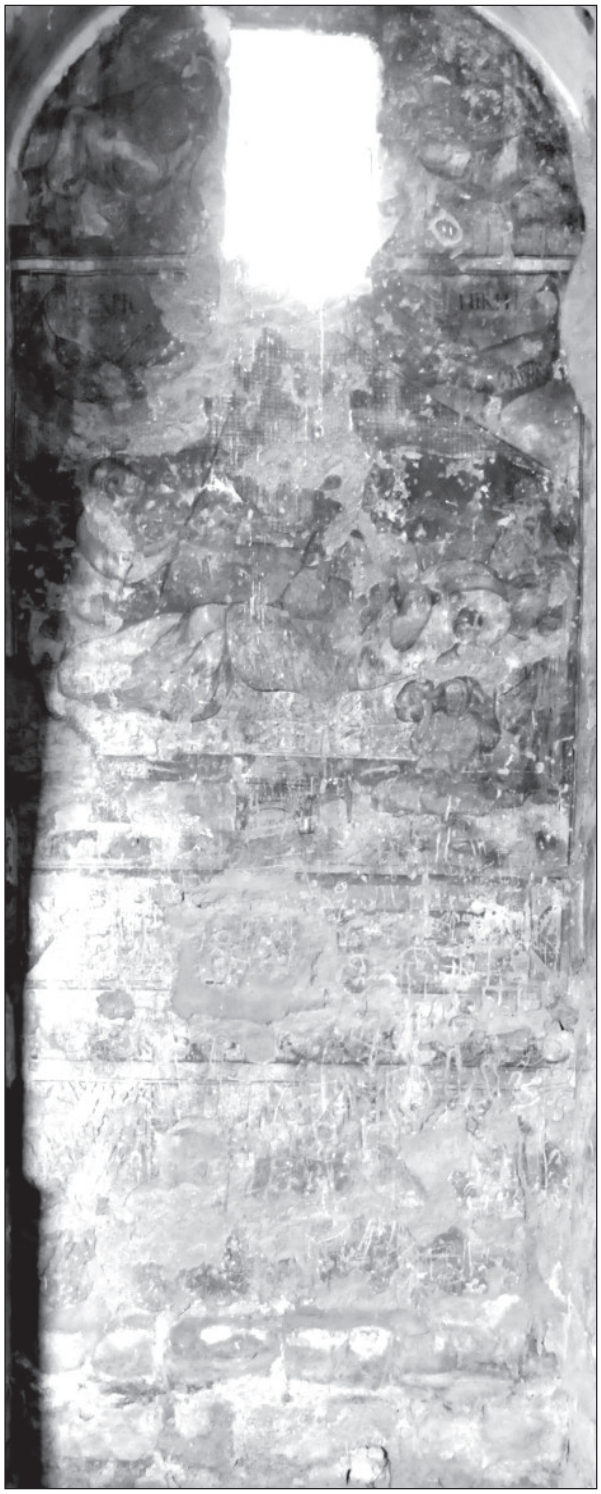
Following analysis of source documents, observation of the pictorial cycles and the results of the first scientific analyses, the southern wall paintings of the reception hall's western aisle were found to be affected by a number of issues and problems representative of other parts of the monument, especially concerning the use of unusual conservation techniques and materials in past conservation projects.

The bibliographic collection in our possession, consultation of historical and technical articles and information gathered from DoA archives lacked any description of the interventions performed on Quṣayr ʻAmra's painted walls.

Regarding the area under investigation, it was necessary to verify the historical and scientific data taking into account the present condition of the mural paintings. The decoration on the investigated wall is divided in four bands (the below description is based on what could be seen before conservation) (**Fig. 12**):

(1) In the area just above the window, there is a Kufic inscription inscribed in a rectangle whose meaning was, before this conservation, undecipherable. On both sides of the window, two human figures, perhaps allegoric, filled the space with three-quarter views. The figure on the right joins his fingers around his knees, whilst the one on the left leans his back against the edge of the window opening;
(2) The main scene of the composition portrays a central figure laying on a sofa, protected by a curtain or a net, and four lateral figures, one to the left and three to the right. Above the curtain / net, there is a representation of two peacocks under two Greek inscriptions: *APA* (Ara) and *NIKH* (Nike).

The characters are portrayed in the act of making different gestures. The veiled figure sitting in the foreground on the right seems to hold the elbow of the character at the back with his / her left hand. He / she holds a scroll or the cloth of the garment at chest-level in his / her right hand. A medium-sized *lacuna* prevents the correct reading of the position of the background figure with a covered head, whose hand (with a raised forefinger) and deep blue garment are visible. These figures have been interpreted as children; Fowden (2004: 184-185) added that one of them may be al-Hakam, designated heir of Caliph al-Walid II, and the other his half-brother ʻUthman. The figure



12. South wall of the west aisle (before intervention).

standing behind the other two at the back of the sofa represents a man wearing a garment, cloak and sandals. He is in the act of making a gesture with one hand whilst holding a baton. Fowden (2004: 185) interprets this figure as a representation of Caliph al-Walid II.

To the left of the central figure, a woman holding a pole seems to support the net above the central figure. The latter is represented at a larger size than the others and rests on a bed or sofa, with the torso and head upright. This figure was interpreted as representing a woman, perhaps the mother of Walid II's heir, according to Fowden's interpretation (2004: 184-185).

On the ground in front of the central figure, a brazier is represented in perspective;

(3) Immediately below the figurative scene is another inscription set inside a *tabula ansata* with dark outlines. Before conservation, its meaning was undecipherable, but a *basmala* type of inscription has been proposed by Imbert (1996);

(4) The decoration on the lower band with imitation marbles and stylized plant patterns connects the southern wall with the other pictorial cycles of the Reception Hall[7].

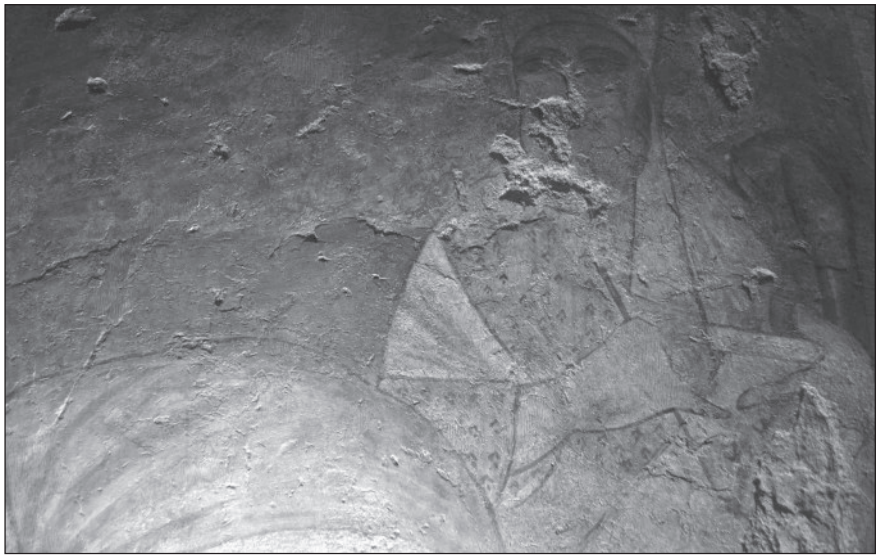
Execution

The painted wall is made of squared local limestone ashlars installed using an interstitial mortar. The mortar is composed of siliceous inert materials of different granularity and color, and slaked lime. Often, the mortar is also used to level off the roughness of the wall and make it smooth enough for the last layer to be spread. In addition, in some areas (lower part of the wall; splay of the window) grit of different granularity and color was scattered on fresh mortar to prevent it from shrinking when drying, as well as to improve the 'grip' for the next layer.

At the bottom of the wall, 4cm thick fragments of bedding mortar from the skirting marble slabs can be observed. Marble slabs covered the whole aisle to a height of 50cm; a few fragments remain in the throne room. Slab slots are still visible on the floor. The plaster, without further preparatory layers, was applied directly on the stone and consists mainly of plant fibers, slaked

7. Imitation marbles were recognized as such during Vibert-Guigue's documentation work, although Musil had interpreted them as representations of suspended hangings.

8. Analyses were performed by the Higher Institute for Conservation and Restoration in Rome (Istituto Superiore per la Conservazione ed il Restauro) and the Diagnostic Laboratory for Conservation and Restoration of the Vatican Museums. Four different spreading phases were identified.



13. An example of 'pontata' visible in center of image.

lime and an organic protein binder[8]. About one centimeter thick, it has an intense white color and quite a smooth surface although some unevenness can be detected.

Raking light inspection has revealed successive plaster spreading phases ('*pontate*') from top to bottom (**Fig. 13**).

The upper '*pontata*' is divided in two '*giornate*', the left overlapping the right. By and large, this wall was clearly plastered before the vault and side walls.

In some localized areas, mortar was probably added in order to correct unevenness. Signs of presumably hurried and non-homogeneous work are visible on smooth surfaces close to rougher and irregular areas. Plaster smoothing seems more accurate in the lower part, intentionally simulating marble. No traces of direct or indirect incisions were found. The preparatory drawings, which outline figures and major decorations, are orange-red colored.

Another element of the pictorial technique is represented by the preparatory drawing performed directly on the rendering, which can be glimpsed in *lacunae* in the painted layer.

Wide traces of red and yellow colors can be noticed near the lateral figures' garments and can be assigned to this preparatory phase.

The sequence of pictorial levels appears to be complex. A first drawing of the figurative scheme may have been traced when the preparatory layer was still drying. This could have allowed cohesion between pigments and plaster. Blue backgrounds especially can be assigned to this phase.

This first level was followed by a series of pictorial layers performed using binder. In this phase, the characters' complexion and probably hair – now missing – as well as other pictorial details were completed. These include white circles and highlights on the folds of the main character's garment, the furnishing, the peacocks' plumage and the Kufic Arabic inscription at the top of the lunette.

In particular, the *tabula ansata* shows two different phases of blue paint. For the first, *fresco* technique was used. For the second, a thicker layer was applied to dry walls where the binder had caused cracking (*cretto*). On this surface, ochre letters were outlined in red and lined up with a blue horizontal line painted in relief on their upper edges.

The double spreading of blue paint is also noticeable on the main character's foot and shows a micro-*cretto* on the first layer applied directly on plaster. The palette that was chosen reveals extensive use of precious pigments such as lapis lazuli, which was spread on the background even when it was to be covered by more layers of paint. According to analysis of pigments, elements such as lead and arsenic (white lead and orpiment), natrojarosite, calcium hydroxide (*bianco Sangiovanni*), ochre, lapis lazuli, minium and cinnabar are part of a complex and variegated palette of natural and

synthetic pigments, some of which may have been hard or very expensive to obtain[9].

State of Conservation

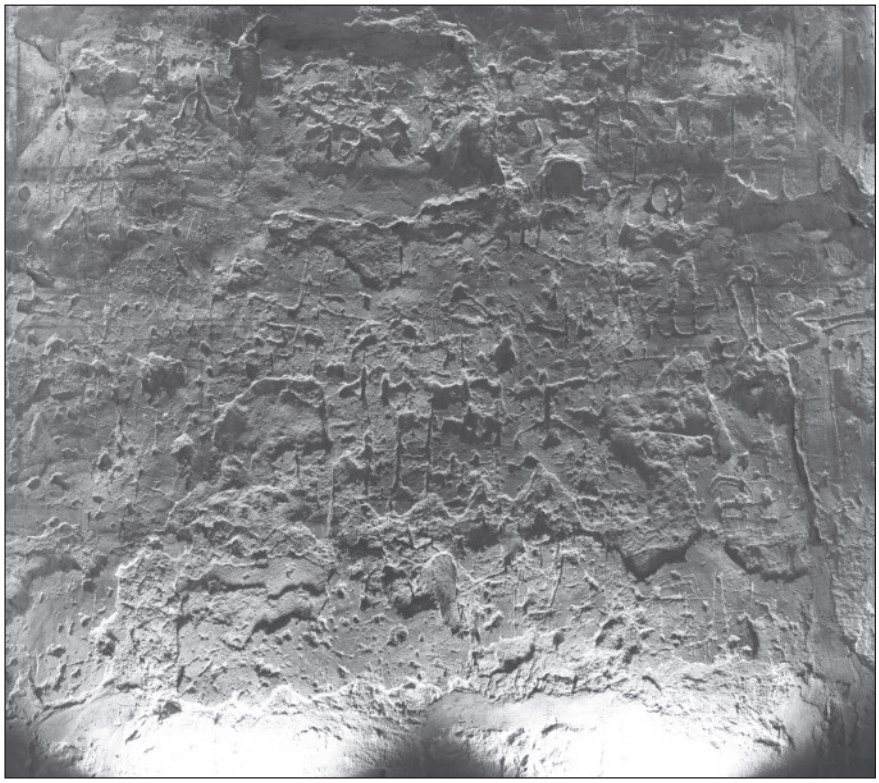
The state of conservation and its history concurred remarkably to alter the original look of the mural paintings within the monument. The fortunes of their conservation can be partly retraced using reports, notes, and photographs. The constant use of the area as a shelter by local tribes and its remote location has led to the loss of large portions of plaster. This was the result of incisions and graffiti, which affected not only the lower part of the walls, but also the upper area. In some cases delicate details, such as the characters' faces, were severely damaged (**Fig.14**).

Since the rediscovery of the monument in the late 19th century, surface cleaning efforts – even though not always appropriately performed – have allowed better visibility on the one hand, while accelerating the deterioration of constituent materials on the other. A large portion of the pictorial film applied on dry plaster (*secco* technique) has been lost because of aggressive cleaning methods, which totally depleted the binders and damaged the plaster on most exposed areas. As a consequence, surfaces appear to be more opaque than they probably were, and widely incomplete.

Lead-based pigments have undergone major alteration, turning from white to dark grey tones. These include the hand and part of face of the central figure, some characters' faces and ornamental elements of the lozenge-patterned blanket. Some of the substances used to perform aggressive cleaning in the past, may have favored the alteration and change of some original pigments.

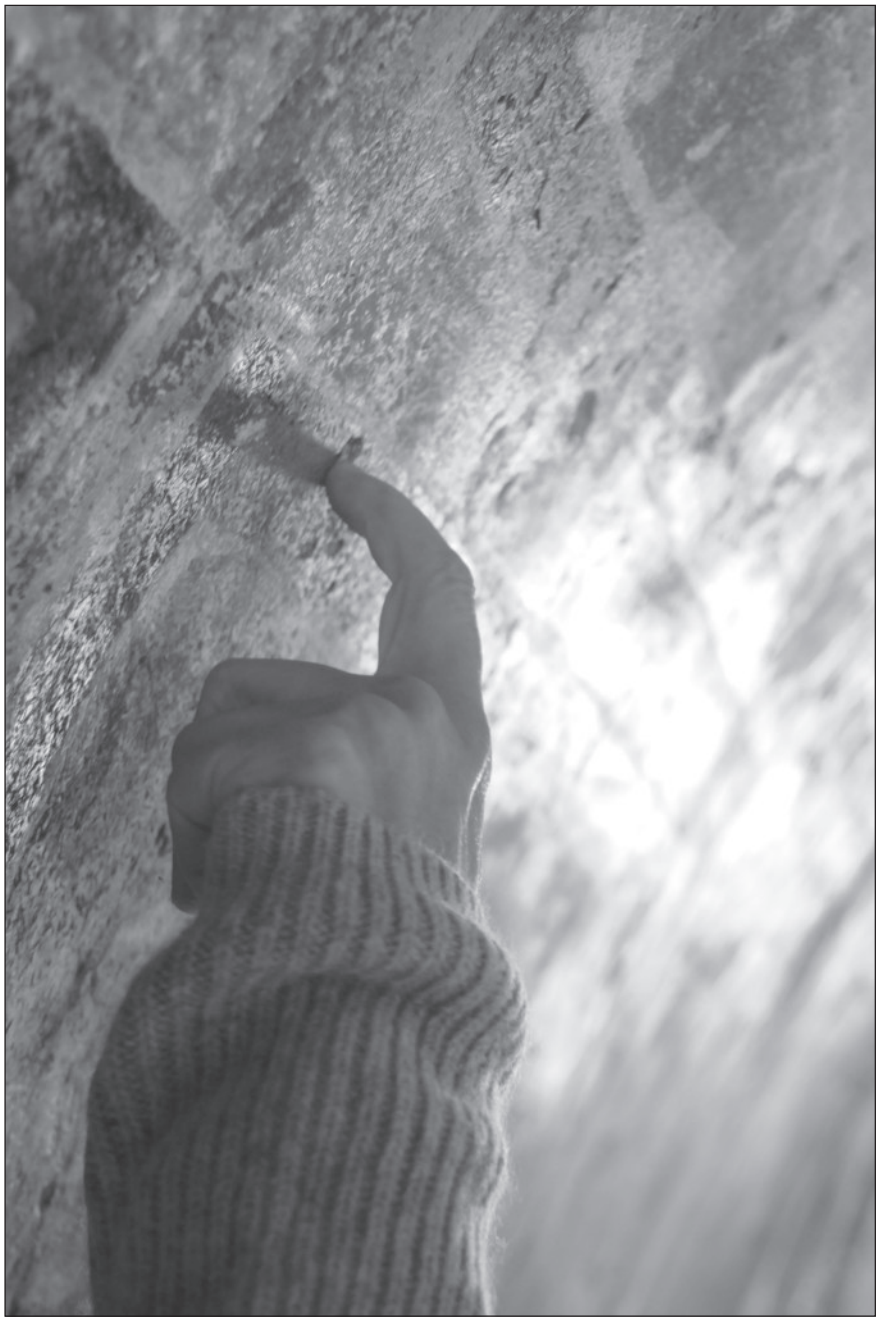
Furthermore, the lack of adequate closure has allowed desert dust and birds to enter the building and cause deterioration, as testified by traces of carbonate and oxalate concretions caused by water percolation, combined with animal droppings identified below the windows. These concretions are combined with extensive soot residues and yellow substances.

In the mid 1970s, the monument was subject to an extensive restoration intervention aimed at preserving the masonry and plaster and, at the same time, reintegrating the paintings. At



14. Graffiti and incisions visible with raking light.

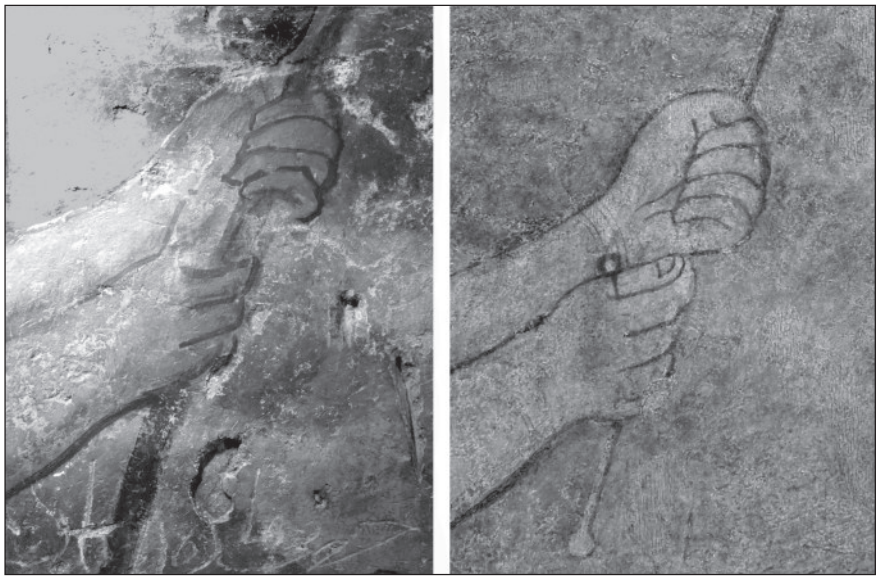
9. Analysis performed by ISCR and the Diagnostic Laboratory for Conservation and Restoration of the Vatican Museums.



15. Shiny effects of shellac applied on the surface.

that time, the gap between the west and south walls was filled with rubble and cement mortar. Detachments of the preparatory layer from the masonry (de-adhesion) were secured with vinyl resin. The edges of the widest *lacunae*, or the *lacunae* themselves, were sealed with cotton soaked in that same resin – without applying any other filling – and covered with a yellowish tempera which, in some case, was applied on exposed stone walls and also onto parts of the original pictorial layer.

After partial cleaning, the paintings throughout the building (with very few exceptions) were covered with a layer of natural resin (shellac) (**Fig. 15**). This substance, more suitable for use on furniture than for protecting mural paintings, must have been applied in order to modify the refractive index of fading colors, made irreversibly opaque by previous interventions. At the time it was applied, the shellac was more transparent, but over the last forty years it has acquired a strong amber tint, worsened by several



16. An example of repainting from the 1970s intervention (left) and the original found underneath (right).

layers of atmospheric fine particles owing – in part – to tourism. In addition, the shellac layer is now showing signs of contraction, causing the pictorial layer underneath to lift. This shellac layer has extensive repaintings (**Fig.16**) in non water-soluble color in some of the *lacunae*. Traces of an older brown shellac layer, a residue of previous interventions, were also found.

Large traces of soot residues and particles (silico-aluminates) found in saline concretions of a different nature, which were never removed, prevented the correct reading of some original details of the composition. Therefore, the aim of the reintegration by the Spanish team was to outline with dark colors the characters and other figurative elements still visible.

Some parts of the drapery, zoomorphic elements (peacocks) and geometric / decorative patterns (squaring; tent) were repainted more freely.

Natural and man-made causes affected the pictorial film, typically scratching and whitening the surface. Some figurative details of the characters' profiles disappeared or fell off. Countless *lacunae* can be found in the whole pictorial layer (lapis blue background) or parts of it.

Therefore, when the present project began, the paintings of the south wall were scarcely visible, their colors were severely altered and iconography was affected by the interpretation given by the Spanish conservators.

Large *lacunae* extending down to the masonry are found throughout this panel. A large *lacuna* extends from the net painted above the central figure, halves its face and affects the chest, part of the hand holding the pipe and the lozenge-patterned blanket. Many small *lacunae* are widespread on the surface.

Being easily accessible, the lower band of the paintings with its faux marble decoration is the most affected by widespread and deep scratches. The pictorial film and plaster also show intentional damage such as graffiti and incisions. The detachment of mortar from the walls caused large *lacunae* reaching the lower part, once covered with marble slabs. There are also traces of burning and black inscriptions.

Even the faux marble area was subject to interventions during the restoration work in the 1970s. Rough repainting of the geometric patterns and veins are visible under the yellow shellac layer.

In the lower band, moderate adhesion faults were detected between the rougher layer of mortar, the bedding mortar of the marble slabs and the masonry. There are also saline concretions.

In the upper band, medium and large detachment areas were identified between the preparatory render coat and the wall structure.

Some stylized images of animals and symbols carved by *bedouin* living in the *bādiyyah* are of historic and palaeographic interest (Betts 2001). These were classified and analyzed, but at the same time threaten the preservation of paintings as graffiti represent a discontinuity in the plaster and weaken it.

In addition to those detected by Vibert-Guigue's investigations, further small-sized losses of plaster were found. Medium-extent cohesion faults in the layers of rendering were noticed, in particular along the perimeter of *lacunae*, together with several cracks and fissures. Widespread abrasions and losses of the pictorial film due to previous inappropriate cleaning interventions were detected.

Previous Interventions

The reconstruction of the paintings' conservation history was deemed particularly significant to define the criteria for the new intervention. Methods and materials used over time were investigated, as were their effects on the paintings and their possible role in the deterioration process.

For this reason, all of the restoration works carried out from 1898 (the time of Musil's first visit) to 1996 (the most recent intervention, performed in compliance with modern standards) were assessed.

Historical documents, restoration reports, published photographic materials and unpublished archive pictures supplied by many institutions were examined. The enthusiastic response of several institutions to our requests for documentation bears witness to the keen interest of many scholars and professionals in this monument.

The most important interventions affecting the appearance of the paintings were those of Alois Musil and the Spanish group guided by Martìn Almagro in the early 1970s.

The state of the paintings at the time of their discovery can be determined from drawings by the Austrian painter A.F. Mielich and from descriptions of the state of preservation of the paintings 'discovered' by Alois Musil (1907) in 1898. Unfortunately, the publication does not include the pictures that the author claims to have taken and the description of the restoration techniques used is limited to generic information.

Musil claims that he cleaned the paintings, which were then mainly covered with soot owing to use of the monument by *bedouin*, with soda and soap and, subsequently, with a mix of Venetian turpentine, gasoline and alcohol.

Probably as a result of this aggressive first cleaning, whitening signs appeared, hindering the reading of the paintings. Allegedly, Musil redefined the figures' outlines and brightened the colors in order to improve the reading of the pictorial text. This may be the reason for the most ancient shellac traces forming the first layers overlapping the original pictorial film.

This is also confirmed by observation and direct comparison between Mielich's drawings[10] and the pictorial surfaces. We noticed that the painted areas copied on the drawings are very close to the original. Some details, such as the figures to the right of the main figure on the sofa, were depicted just by outlining the images, while large areas - which were probably still covered by soot stains and / or have subsequently become readable as a result of cleaning, were reproduced on the paintings with a homogeneous grey color.

Following Musil's intervention, roughly fifty-five years passed until we find more systematic documentation. Nevertheless, photographs taken by travelers and scholars in the intervening period have been found in several libraries and archives, and are an important contribution to research. In 1962, Ettinghausen took pictures that are important evidence of the paintings' condition before the Spanish work.

About a decade later, Professor Almagro and his team of Spanish restorers carried out structural interventions along the western wall of the western aisle, carrying out restoration work on the paintings inside the monument between 1971 and 1973, and again between 1978 and 1979. No photographic evidence has been found of the state of preservation encountered during the restoration works of the early 1970s, except for an unpublished report of a performed intervention mentioning the painting in a 'neutral colour' of the *lacunae* and plaster. This is still visible, although the color has a yellow-greenish hue. The comparison with Ettinghausen's documentation, where the *lacunae* do not appear to be filled with cotton, allows us to conclude that the use of such material and the overlapping colors and shellac should all to be attributed to the Spanish team's interventions.

The reason why the Spanish team went for such a vast reconstructive intervention may

10. Drawings were done partly *in situ* and partly in Vienna from pictures, since he stayed on-site for only 12 days.

have been linked to the effects of the aggressive cleaning carried out at the beginning of the 20th century using inadequate methods. The Spanish team must have restored paintings seriously affected by the previous cleaning, on which Musil and Mielich had applied unifying and brightening agents, perhaps the older shellac identified in our analyses. Furthermore, soot from fires lit inside the monument must have been redeposited on the surfaces before it was declared a protected cultural site.

Diagnostic Analyses

Diagnostic analyses aimed to describe the essential features of the paintings' constituent materials, the alterations they underwent over time, and the chemical and physical composition of the substances applied during past restoration work (which may have interacted with the pictorial film). Analyses were conducted using the following tools: SEM microscopy, EDS analysis, FTIR analysis and GS / SM analysis.

Conservation Intervention: Interior

Graphic Documentation

The painted surface was graphically documented by means of themed maps detailing execution technique, state of preservation, previous interventions and the present intervention on the southern wall and lower band of the western wall.

Claude Vibert-Guigue's drawings made between 1987 and 1992, and published in 2007, were used as a graphic base. Their high quality, accuracy and wealth of detail allowed the state of the surfaces in 1987-1992 and their current state to be compared. High resolution photographs supplemented Vibert-Guigue's drawings.

Photographic Documentation and Remote Sensing

Before, during and after the restoration, an accurate photographic report of the surface conditions, different phases of the intervention and training activity throughout this whole period was conducted. UV and IR photography was also carried out, showing details poorly visible or not visible at all to the naked eye.

A thermographic survey of the entire complex was conducted by Dr José Luis Lerma (Universidad Politécnica de Valencia) in February 2011, in order to visualize thermal discontinuities in the walls of the building. The survey allowed the visualization of the composition of the walls hidden beneath the paint layers and the identification of areas which may indicate the presence of voids or of possible water infiltration. Dr Ignacio Arce (Director, Spanish Archaeological Mission in Jordan) contributed to the project high-resolution photography, orthophotography of exterior elevations and 3D reconstructions of some of the interior spaces. Finally, the DoA conducted a new topographic survey, mapping the entire complex, and also carried out a laser scan of the main building in order to produce an accurate 3D model of the site to be used in future phases of the conservation project, as well as for presentation and education purposes.

Environmental monitoring has been carried out since 2010, following the installation of sensors throughout the building, in order to measure variations in temperature and relative humidity within the structure. These measurements are especially useful now, following the installation of new windows and covers that have effectively 'sealed' the building. Comparing data with the measurements during the year before the installation of the new windows will help us to understand the effect of this intervention on the stability of the environment inside the building.

Collection of Marble Fragments

Many stone pieces, along with pottery fragments, were discovered on the plateau in front of Quṣayr ʿAmra. Given their proximity to the building, it is safe to assume that they were originally from inside it. A grid was laid out with GPS, allowing the exact location of recovered fragments to be recorded. No excavation was carried out; fragments were simply collected on the surface.

Because of the patina adhering to these fragments, it was difficult to recover any information about them or possible traces of previous intervention. After careful dry removal of incoherent deposits with soft brushes, an ammonium salt solution was used for cleaning.

The removal of concretions allowed different marbles to be identified, *viz*. (1) fine-grained, uniform white marble, (2) gray-veined marble

17. Marble fragments collected outside the monument.

and (3) stratified discontinuous fragments similar to *cipollino* marble.

Investigation of execution techniques allowed fragments of mural and floor coverings to be distinguished on the basis of thickness, cramp signs, rounded moldings, carved edges and toothed chisel signs (**Fig. 17**). It was also possible to make a tentative identification of the back face of the slabs, through the presence of original mortar residuals. A number of fragments also showed point, ruler and caliper signs indicating that the slabs, once installed, were prepared for incision or fretwork, or for the application of *tesserae* or inlays.

A recording form was designed for the description of the fragments, now grouped and stored in containers along with the pottery finds. Some of them were subject to cleaning with the above-mentioned methods and separated on the basis of thickness, in order to be numbered, examined and catalogued.

Conservation Intervention

The cleaning operations were complex and carried out in phases, primarily because of the presence of the shellac layer. This substance becomes irreversible with ageing and its removal required progressive treatments and particular care, in order to respect the original pictorial layer.

Before cleaning, Portland cement filling the joints was mechanically removed where necessary.

As the very stiff and non-transpiring cotton that filled the *lacunae* had weakened the plaster, its removal required particular care. The cotton was softened with a mixture of demineralized water, acetone and ethanol, paying attention not to affect the painted surface. Once the cotton surface layer had softened, it was cut away small pieces at a time. This operation was repeated until it was completely removed. Where removal might have damaged the painting, cotton gauze soaked in acrylic resin solution was applied to the pictorial layer (**Fig. 18**). This allowed the safe removal of cotton and ensured adhesion of the detached areas. Afterward, the gauze was taken off with organic solvents and complete removal of the acrylic resin was verified under raking light.

At the end of this operation, the borders were consolidated and filled with a weak mortar made of 2.5 parts inert materials to 1 part binder.

Adhesion faults between the plaster and ma-

18. Careful cleaning of the mural paintings.

19. Injection of mortar to consolidate the base of the painted layers.

sonry were restored using a low-pressure injection[11] of low-salt, ready-mixed hydraulic mortar (**Fig. 19**). Emulsion acrylic resin was used to reattach small-size detachments and adhesion faults on the pictorial film. Before and after the cleaning, the painted surface underwent pH and electrical conductivity measurements.

The cleaning consisted of removing over-applied substances: shellac, repaintings, older shellac traces and a grey-brown layer of organic nature.

Shellac was made soluble and completely removed using a mix of organic solvents included in the solubility area of natural and synthetic resins. Solutions were thickened with gel[12] in order to allow better control of cleaning, extend the time exposure, improve the contact surface, limit solvent penetration and delay its evaporation.

The grey-brown layer of organic nature was removed using the same pH 6 gel chelating buffered solution. Furthermore, carbonate and oxalate concretions and soot stains were reduced by applying a chelating buffer solution using different time exposures.

Afterwards, the surface was treated with a Japanese paper compress soaked in 10 % pH 6 ammonium citrate and covered with the same agent in carbopol for a 5 minute exposure time. The choice of pH of the saline solution was dictated by the exclusive interest in its chelating properties. The surface was then carefully washed with deionized water. After cleaning, electrical conductivity tests and pH measurements were carried out to verify the complete removal of the saline solution.

Treatment of the *Lacunae* and Pictorial Reintegration

The reintegration of the pictorial text was

11. Ledan TB1 by TecnoEdileToscana: low-soluble salt, ready-mixed, hydraulic mortar.
12. Gel solvents used for cleaning are composed as follows (for each 100ml of solution): 55ml benzyl alcohol, 35ml isopropyl alcohol and 10ml Ligroin, added to the gel prepared with 1gm Carbopol, 9ml Ethomeen C25 and 1ml Ethomeen C12; 70% benzyl alcohol, 30% isopropyl alcohol. Carbopols are polyacrylic acids neutralized by Ethomeen C25 and C12, turning into salts with gel properties. Carbopol Ultrez 21 turns water into gel with no need for neutralization.

aimed at re-establishing its formal and chromatic features for correct legibility.

The pictorial reintegration is a critical action. The decision to integrate a pictorial text depends on its state of preservation and the damage it has sustained. The aim is to reconstruct logical threads of the image enabling its comprehension, legibility and potential unity, without erasing or hiding its conservation history.

There is a subtle balance between aesthetic requests and historical accuracy. The methods in use and their legitimacy are clearly expressed by Cesare Brandi (2005), founder of ISCR (previously ICR). The integration aims to reduce the visual disturbance caused by *lacunae* and unhomogeneous parts of the surface, considering the needs of both aesthetic and philological interpretation. Furthermore it must be recognizable and reversible. Materials must have the following characteristics: reversibility, transparency, chemical / physical stability of pigments and binders, and minimal alteration as a result of ageing.

Pictorial film losses and preparatory layer abrasions were treated with a light transparent watercolor glaze to reduce optical interference. The color shade chosen followed the original. The color intensity of *graffito* engravings of historical interest was softened using watercolor glazes.

Lacunae Selected for Reintegration

After long consideration following Cesare Brandi's theories and with the agreement with of the project management team, restorable *lacunae* were identified by means of careful examination of their pictorial composition in order to legitimize the intervention.

After cleaning, *lacunae* in preparatory layers that could be reintegrated (because the reconstruction would not be hypothetical) were filled to surface level using aerial mortar (binder to charge ratio 1:4) and then reintegrated using *tratteggio* (a hatching technique) (**Fig. 20**). This technique was first used by ISCR conservators and has been codified by Cesare Brandi (Bentivoglio and Oteri 2005). Small *lacunae* in the preparatory layers were filled. The deepest ones were filled with a first layer of mortar consisting of 2 parts chalky white sand (passing through a 2mm mesh, but retained on a 0.5mm mesh), 1 part volcanic black sand (passing through a 2mm mesh) and 1 part slaked lime. The final layer of mortar, spread at the same level as the painted layer, is made of 3 parts chalky white sand (passing through a 0.5mm mesh) and 1 part slaked lime. Filling was performed selectively so as not to erase historical incisions or to exceed reintegration of the most severely damaged areas, in particular on the lower part of the wall. Fragments of the letters preserved in the *tabula ansata* were studied by means of a relief drawing at 1:1 scale. Since filling was considered legitimate, according to Project epigrapher Frédéric Imbert's instructions, very small *lacunae* were restored so as to ensure continuity in the reading of the epigraph. Restoration could have been extended to larger areas, yet it was limited in order to preserve the historical value of the artwork.

Lacunae not Selected for Reintegration

In case of *lacunae* that were impossible to integrate because the reintegration would have been hypothetical, the stone and original interstitial mortar were cleaned. *Lacunae* in the original interstitial mortar and stone unevenness were fixed with a mortar consisting of 5 parts siliceous sand (passing through a 0.5mm mesh), 1 part white lime powder (passing through a 0.5mm mesh), 1.5 parts black volcanic powder (passing through a 0.5mm mesh), ½ part grit from the *wadi* (retained on a 0.5mm mesh) and slaked lime. The charge to binder ratio was 2.5:1.

This composition was selected after a number of tests on samples, with the aim of ensuring that it was distinguishable at close range from the original mortar.

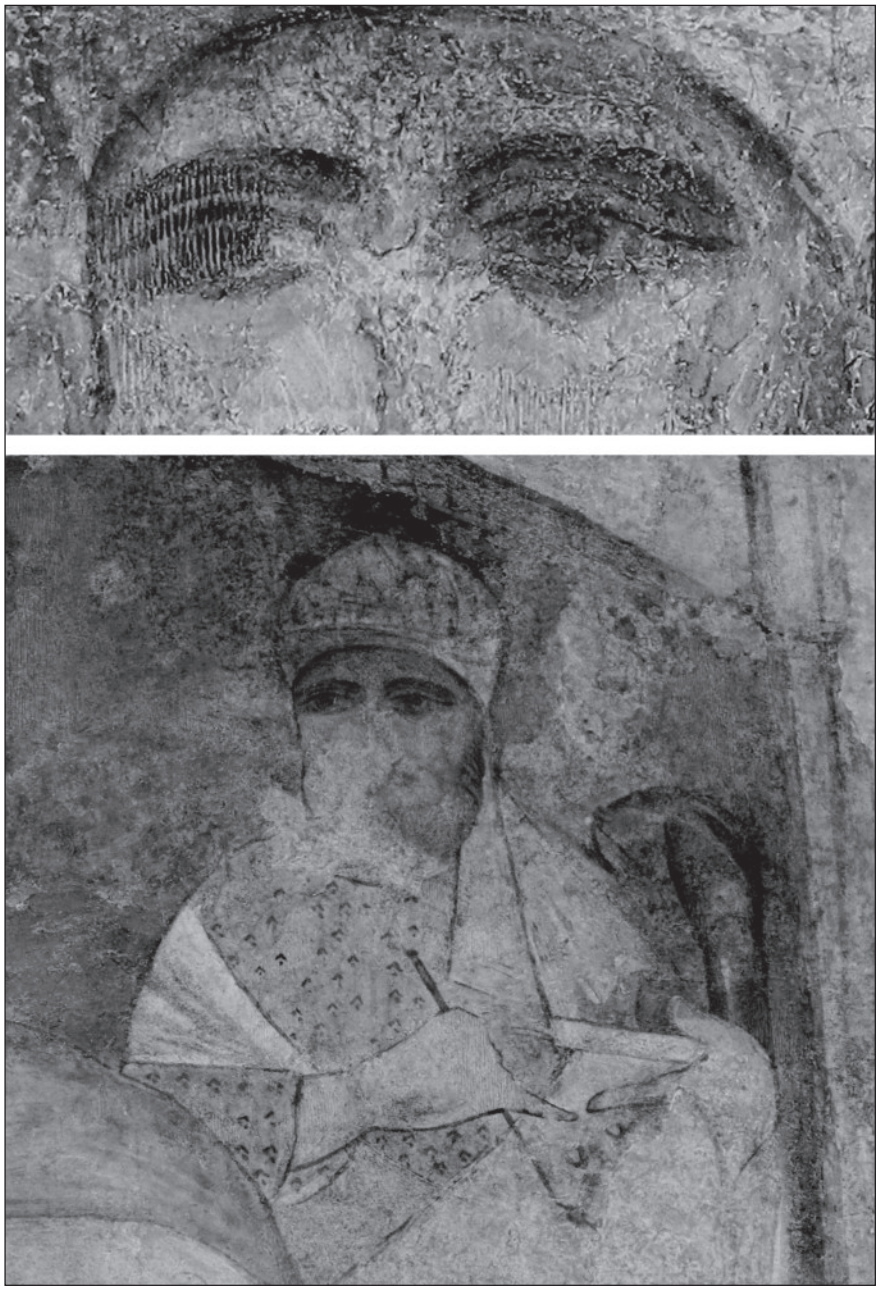
Change in Iconography

Lunettes: Human Figures

The iconography of the two figures in the lunettes besides the window has changed completely after the cleaning intervention (**Figs. 21 and 22**).

Before intervention, one of the arms of the figure on the left, joining his knee to his face, was extraordinarily long. The other, leaning against his hip, was out of proportion.

In the same manner, the garments outlined an unintelligible leg position. Repainting, removal and cleaning revealed a left arm more in



20. An example of tratteggio used to improve the visibility of detail.

21. Lunette (before conservation).

22. Lunette (after conservation).

23. Detail of left character with inscription.

proportion with the rest of the body. One of the sleeves follows the elbow profile and is raised from the figure's chest, while the right arm (completely misunderstood by the previous intervention) is in reality bent, supporting the head of the figure.

The legs, once crossed, are now close together and both feet are visible, though fragmented (**Fig. 23**).

The change in iconography is also clear on the right side of the lunette. The original scene showed a figure joining his fingers around his knees, with one arm in the foreground and the other hidden behind his chest but outlined by the sleeve.

This interpretation was proved to be wrong when cleaning revealed an arm bent behind the figure's head, which rests over a pillow that was invisible before intervention (**Fig. 24**). Feet were also discovered, one of which was completely illegible before the intervention.

The two characters – usually considered as allegoric figures – provided us with two more unexpected (given the state of conservation of the painting) details, *viz*. two Greek inscriptions painted on dry plaster (*secco* technique) upon the blue background.

The I and C (possibly O) letters are legible on the left side, with ONAC on the right side. This latter discovery suggests the character's

24. Detail of 'Jonah's' head with inscription.

possible identification as the prophet Jonah. This hypothesis is confirmed by several representations of the prophet lying under a tree that God miraculously provided for him as a shelter after he succeeded in converting the inhabitants of the city of Nineveh[13]. The image of Jonah sleeping under a tree with his arm bent behind his head was known from the 2nd century and is often depicted on Christian sarcophagi, mosaic decorations and catacomb mural paintings, both in the Roman area and its provinces (Milburn 1988: 62-64)[14]. Moreover, the fact that at least the character on the right is male has been confirmed by the discovery of traces of a beard.

The curve of the lunette is further marked by representations of trees, foliage and flowers.

25. Upper inscription (before conservation).

13. Book of Jonah, Chapter 4, Verses 5-6: "So Jonah went out of the city, and sat on the east side of the city, and there made him a booth, and sat under it in the shadow, till he might see what would become of the city. And the LORD God prepared a gourd, and made it to come up over Jonah, that it might be a shadow over his head, to deliver him from his grief. So Jonah was exceeding glad of the gourd." The story is also mentioned in the Qur'an, in Sura 37 (as-Sâffât), 146: "And we caused to grow, over him, a spreading plant of the gourd kind".
14. Cf. for example, a floor mosaic in Aquileia, wall paintings in the catacombs of Via Latina and Saint Callistus in Rome, sarcophagi in Saint Maria Antiqua in Rome, and the Vatican Museums, Vatican City.

The tree may have a more direct significance in the interpretation of the right figure as Jonah, as mentioned above.

Dedicatory Inscription at the Top of the Lunette

At the top of the lunette, above the window, an inscription was detected but was illegible owing to the conservation condition of the wall (**Fig. 25**).

During previous restoration, following the usual treatment with shellac, this area was repainted but only a few letters were revealed, while the rest of them and the text as a whole remained obscure. The frame around the inscription, outlined in black, was identified as a repainting and removed during the autumn 2011 season.

By cleaning this area under Imbert's supervision, three lines of text consisting of half-preserved words were identified (**Fig. 26**). Their white / light yellow color is similar to the pigment used for the Greek inscriptions relating to the two characters painted at the sides of the window. The epigraph was clearly painted upon the blue background and foliage (barely visible) during the last phase of decorative work in this area.

The loss of pictorial film left clear marks and allowed the almost complete identification of the missing letters. The words are in Kufic script, without diacritical marks. This, and the poor state of preservation of some letters make reading and interpretation quite difficult. A preliminary reading by F. Imbert is as follows:

(1) *O God, make al-Walīd b. Yazīd virtuous the way you did with your*
(2) *pious servants! Surround him with the freshness of mercy, O Lord of the worlds*
(3) *and for your community, eternal ... the religion the day of ... all the ...*

26. Upper inscription (after conservation).

Line 1: *Ṣalāḥiyya* Ṣalāḥ("goodness"; "rightness") could also be *ṣāliḥāt* ("the good works and deeds"). This line is based on the repetition of the Arabic root *ṢLḤ* (*aṣliḥ* […] *ṣalāhiyya* Ṣalāḥ). In fact, the presence of the article is strange. At the end of the line, the letter *dāl* of '*ibād* ("servants") is not present. This is exactly what Jaussen and Savignac saw in 1909 (Jaussen and Savignac 1922: 99, fig. 18, n. 4).

Line 2: The second word is problematic: there is only one round letter after the article *al-* and this could not be read as *mufliḥīn* ("lucky"; "fortunate") without the letter *mīm*. On the first photographs taken during the cleaning itself, there is a little tip appearing on the top of the round letter, like the drawing of a *ṣāḍ* in little proportions: it could be possible to read *ṣāliḥīn* ("pious") in old *scriptio defectiva*. The following expression looks strange, but the shape of the letters is quite clear: *aḥīṭ-hi bi-bard raḥma* ("surround him with the freshness of mercy"). In Arabic grammar, we should have *aḥiṭ* and not *aḥīṭ* and the verb is commonly followed by the Arabic particle *bi-*[15]. At the end of the line, the word *walī* (lord) is preceded by the vocative *yā'* in *scriptio defectiva*.

Line 3: *Li-ummati-ka* is clear ("for your community"). The word after it could be read as the Arabic root *Khuld* ("eternity"), but the letter *lām* seems too short. Other readings are possible as *jund* ("army") or *jayyid* ("good") but the meaning is not guaranteed. The last part of the line is not readable; we can only recognise letters with no clear meaning.

The Walid's inscription is not an official inscription. It has been painted in a place where it was quite invisible to the visitors, away from ground level. It is possible that this inscription is 'private', being an invocation to God in favour of a man called al-Walīd b. Yazīd. It is painted with close attention to its execution, but with smaller dimensions than the letters of the *tabula ansata*. The text of al-Walid had without any doubt a propitiatory value: to attract God's grace towards the prince al-Walid. The mention of the name of al-Walīd b. Yazīd helps us to date the

15. The invocation *Allāhumma adhiq-nā bard ʿafwi-ka* is well known in Islam: "O God make us taste the freshness of your forgiveness".

inscription to the Umayyad period.

The text is not a construction text. It does not help us to date the building of the bathhouse of Quṣayr ʻAmra or the paintings[16]. The only historical element in the whole inscription is the name, which consists of a single *isim* (surname) and *nasab* (name of the father) and is not followed by any mention of the titles of the caliph. Such titles are well known and are repeated on a number of epigraphic texts mentioning the Umayyad caliphs[17], e.g. ʻ*abid d-allah* ("the servant of God") and *amīr al-mu'minīn* ("prince of the believers").

At our present state of knowledge, which is still tentative, we should not attempt to provide a fixed date for this epigraphic text. In fact, the clear mention of al-Walid in the inscription does not provide a date for the paintings during the reign of caliph al-Walid II (743-744 AD). This leads us to believe that the text refers to prince al-Walīd b. Yazīd, during the long reign of Hisham b. Abd el-Malik and before his accession to the throne. This hypothesis may date the text, but not necessarily the building, to the years of Hisham's reign, between 723 and 743 AD. This interpretation would accord with the previously proposed reading of the inscriptions painted over the representation of the person seated on the throne on the back wall of the throne room, which mentions a "crown prince of the Muslim men and women" (*waliy* ʻ*ahid al-muslimīn wal-muslimāt*). It also agrees with the text found in the eastern aisle, which mentions a prince[18]. The cleaning of this latter text will be of fundamental importance, as it may then be possible to demonstrate conclusively that Quṣayr ʻAmra belonged to prince al-Walīd b. Yazīd.

Peacocks and Inscriptions

The tail of the peacock on the right was clearly subject to formal transformation and had been incorrectly interpreted by previous interventions (**Figs. 27 and 28**). A fragment of plaster just under the windowsill suggests that the symmetrical peacocks' tails would have converged on the centre of the composition, parallel to the upper corner of the drapery. After cleaning, the peacock on the left revealed a bent wing, hidden by background repainting in light blue. Traces of preparatory drawings for the feet of both peacocks also appeared, but these were painted in a different position during the intervention carried out in the 1970s.

A localized cleaning test was run on the APA inscription, in order to confirm the correct interpretation of the legible letters. The final A turned out to be an I and a C, supporting the hypothesis that the complete inscription was origi-

27. Right peacock and Nike inscription (before conservation).

28. Right peacock and Nike inscription (after conservation).

16. Such an inscription is found on the paintings of the Christian church of Mar Mûsa in Syria where we read: *Khal(l)aṣ al-muṣawwa(i)r* […] ("the painting is over").
17. See the Muwaqqar capital in ʻAmmān Museum, with the title belonging to Yazid, his father.
18. *Allāhumma bārik ʿalā al-amīr* [...] "O God, bless the prince…". The reading that we propose was made on the basis of photographs and sketches made by C. Vibert-Guigue.

nally XAPIC (Kharis) (Fowden 2004: 191-193; Vibert-Guigue and Bisheh 2007: pl. 26).

Wall Intermediate Band: Central Scene

The main scene of the composition portrays a central figure lying on a sofa, sheltered by a tent. Other figures stand at his side. Two peacocks and Greek inscriptions complete the scene. More accurate cleaning partly clarified its iconography.

The central figure, considered female by previous scholars, turned out to be a male with a beard. Presumably, it is a portrait of the man who commissioned the building, now supposed to be Walid II, perhaps – in view of the short (14 months) duration of his reign – when he still was a prince. Unfortunately, the figure's face is severely damaged and large, deep *lacunae* reach the stone underneath. After cleaning, the pipe held in his right hand turned out to be thinner.

On the left, a female character (possibly a slave girl) was previously interpreted as holding a pole up inside the tent. Removal of repainting from the tent above the central figure's head showed a *flabellum* decorated with peacock's feathers being waved by the woman. Over the *flabellum*, the lower edge of the tent above the characters' heads is bordered by a piece of deep blue sky.

The pictorial film of the *flabellum* pole appears to be very incomplete, even though its mark is visible on the lapis lazuli background. Repainting during the 1970s intervention lengthened the pole and hid its original head. The hair of the maidservant holding the *flabellum* appeared to be similar to that of the two women painted under the arch of the eastern aisle. It can be seen where the most superficial pictorial layers have fallen, leaving a typical mark on the blue background. The preparatory drawing of the hands – strengthened by previous repainting – is now visible as it was originally. After cleaning, fragments of pink pictorial film to the left of the bed leg were identified as belonging to the lower edge of maidservant's dress.

Beneath the altered repainting, the tent revealed weaving rich in details. The tent is made of a square-patterned weave, crossed by diagonals from left to right and from top to bottom. On careful observation, the weaving turned out to consist of two different units. These are both formed by black rectangles containing a number of smaller red ones. The vertical lines of the tent converge on the central top, which is unfortunately lost.

Cleaning revealed some preservation of the blanket. It is rich in legible details, but unfortunately most of their original three-dimensional tones have been lost[19]. The heavy outlines were removed and replaced by thinner ones. The original decoration consists of an orange background, upon which lozenges with white, upwards-pointing arrows were painted. Some of the arrows have been blackened by alteration of the original color and are no longer visible from a distance. This detail adds information to the classification of the textile materials represented in the pictorial cycle. Hitherto, only the blue details of the blanket had been considered. The edges of the lozenges are alternatively decorated with blue and white elements.

Cleaning the main character's legs, a blue garment decorated with white circles and little inverted 'v' decorations was discovered. The legs are quite three-dimensional and cast a shadow on the mattress below, giving the image an unexpected naturalistic perspective. The left foot – which had been interpreted in a different manner by the repainting – is now plainly visible and well proportioned. Many decorative details of the mattress have been lost, yet blue areas are still visible at the lower edge of the blanket and by the foot.

Complete cleaning of the two characters to the left of the central figure was also carried out. They seem to be male figures, pointing their right hands at the central character in a specific gesture. Because of a medium-sized *lacuna*, it is difficult to understand the rear figure's attitude. This character is wearing a Phrygian headdress and his raised forefinger and deep blue garment are still clearly visible. The character on the right in the central scene, behind them, had been interpreted as a man standing and almost joining his hands on his chest, with half-open fingers. Cleaning has revealed the real position of the

19. All types of textile materials represented in the pictorial cycle were identified in Vibert-Guigue and Bisheh 2007: pls 148 -149. The ornamental pattern of the blanket is shown in picture 9.

29. Central panel (after conservation).

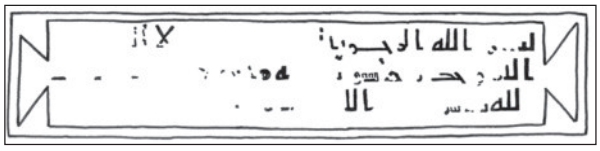
hands: he holds a stylus in his right hand and is using it to write symbols – perhaps letters – on the open scroll in his left hand. Just by his left hand, a round object – probably an inkpot – has been exposed. His garment has rich decoration, similar to that of other characters (**Fig. 29**).

Inscription in the Tabula Ansata

The *tabula ansata* is located between the main figurative scene and the band decorated with wheels and plants. It is rectangular and framed by perspective dentils. The *tabula ansata* was never repainted during the previous interventions, even though a thick shellac layer hindered its full understanding. Cleaning has clarified the initial part of the first two lines and revealed many fragments of the letters on the rest of the *tabula*. Its conservation status has been badly jeopardized and prevents complete reconstruction of the text, even though fragments seem to coincide with the letters of the *bismmallāh* formula (**Fig. 30**). A tentative translation made by F. Imbert is as follows:

(1) *In the name of God, the most gracious, the most merciful. There is no god except*
(2) *God, unique and with no associates...*
(3) *God ... God ...*

This is the most prestigious inscription in the bathhouse. It was facing the entrance door and we can imagine that this large, painted, monumental inscription was one of the first things to be seen by visitors entering the building. This inscription, visible from afar, was a reminder to visitors that they were entering an Islamic building belonging to a Muslim ruler.



30. Copy of the surviving tabula ansata inscription.

The text consists of traditional Islamic formulas, commonly found in Arabic inscriptions of the Umayyad period (661-750), cf. the example from Samakh in Palestine, south of Tiberias (Sharon 1966: 367-372). The identification of some letters at the beginning of Line 1 helped us to put forward a translation, despite the bad condition of the inscription. The only word that can be read without difficulty is the name of God (*Allāh*), which is repeated at least three times in the text. We are able to read the word *ar-Raḥmān* (the Merciful) but only have the definite article of *al-Raḥīm* (the Compassionate). This expression, according to the well-known formula, is followed by the *shahādah*, the Muslim declaration of belief, in two parts. The first part, *lā ilāha illāl lāh* ("there is no god but God") could be identified at the end of the first line (only a *lām-alif* letter and an isolated *alif* and *lām*) and the beginning of the second line, where we find the word *Allāh*. After this we find the declaration of oneness of God. From the word *waḥdahu*, we only have the *wāw* and *ḥā'*, and a part of final *dāl*. Also, it is possible to read the first letters of the expression *lā sharīka lahu* ("no associate"), *viz*. a *lam-alif*, then a *shīn* and a final *rā'*. The rest of the text is unreadable. We assume that the legible part was followed by the expression of the acceptance of the Muhammad as God's prophet but we can't be sure. This epigraphic text was perhaps ended with a date, which is often found in this type of official inscription.

The inscription in the *tabula ansata* is nothing more than a monumental inscription dating to the Umayyad period; the most important thing about it is that it is painted and not engraved. Very few inscriptions of this type are known in the Islamic world. One of the few examples known was found on the wall of the audience hall of the bathhouse of Ḥammām as-Sarāḥ, some kilometres from Quṣayr ʻAmra, close to the Umayyad palace of Ḥallabāt (Imbert forthcoming). Both are painted texts located in the same part of the audience hall, in front of the

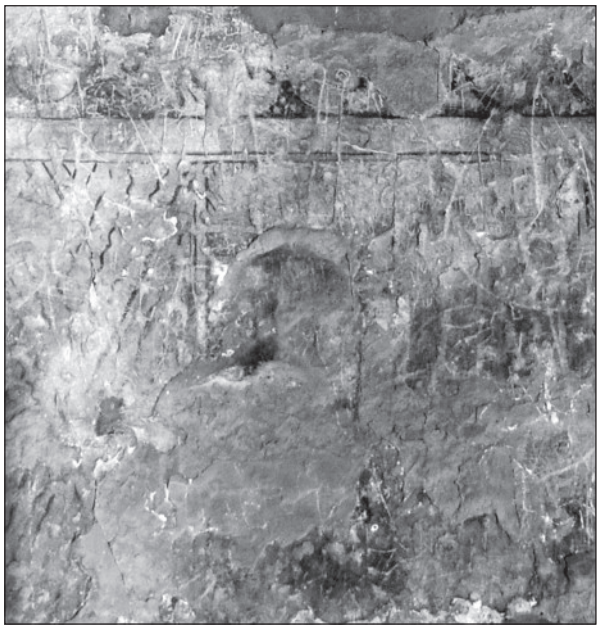
entrance. In Quṣayr ʻAmra, the length of the letter *alif* is 9m, just as at Ḥammām as-Sarāḥ[20]. In summary, these characters belong to the register of painted archaic monumental Kufic. The only known examples have been found in the Jordanian steppe east of ʻAmmān, at Ḥammām as-Sarāḥ and al-Kharrānah (painted in black ink on the wall in 710 AD), and in the paintings at Quṣayr ʻAmra. The concentration of painted texts in palaces and bathhouses in the *bādiyyah* shows the important role played by this region in the development of Arabic script, especially during the Umayyad period.

Investigation of the Faux Marble of the Lower Band

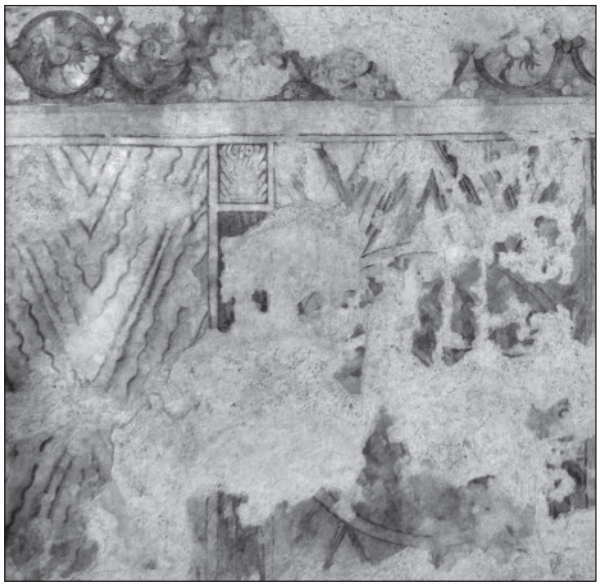
The whole west aisle of the Quṣayr ʻAmra reception hall is decorated with stylized patterns on the lower band. The south wall shows this horizontal partition too. Under the *tabula ansata*, bordered with a 4cm high colorful modillion pattern, there are 7.5cm wide monochromatic linear dividers with a 22.5cm high ornate band with joined circular phytomorphic volutes. The largest part is simply painted as faux marble. Imitation proconnesian marble stands out with raking and specular shaded veins, alternating with red porphyry pilasters surmounted by Corinthian capitals. The pilasters frame an insert with a yellow *marmor numidicum* (*giallo antico*) background and a circular inlay with a *sectilia* (marble mosaic) of different colors in the centre. The only layer of bright colored and fiber reinforced plaster is flat and the surface is probably polished (**Fig. 31**).

The discovery of numerous marble fragments, that once covered the walls and floor of the monument, has allowed us to define the types of stone that inspired the painters' composition.

The circle and flower patterned decoration on the frame running from the side walls up to the vault is the same of imitation marble. After the intervention, it proved to be very similar to reliefs found inside other Umayyad palaces such as Hisham's Palace and Khirbet al-Mafjar[21] (**Fig. 32**).



31. The faux marble area (before conservation).



32. The faux marble area (after conservation).

Site Management Planning

The site of Quṣayr ʻAmra was added to the World Heritage List in 1985 (ref. 327) under criteria i, iii and iv of the World Heritage Convention (http://whc.unesco.org/en/list/327). The nomination dossier did not include a site management plan, nor clear definitions of site boundaries. In fact, the nomination dossier only discusses the main building and its paintings, ig-

20. The inscription at Ḥammām as-Sarāḥ is in very poor condition. It measures 345 x 125 cm and consists of 11 lines and some 35 meters of text, written on 45 stones of the wall (without any kind of frame).

21. Visible *in situ* and in fragments conserved at the Rockefeller Museum, Jerusalem (Marie-José Mano, pers. comm.).

noring the presence of a vast complex of ancillary sites, all of which are related to the original establishment of the *quṣayr*.

These sites include (from west to east):

(1) A number of small structures on the edge of a slope overlooking Wādī al-Buṭum;
(2) A ruined *qaṣr* that was damaged by bulldozing in or around 1996;
(3) A possible mosque, of which only foundations remain (this mosque may also be interpreted as a ʻdesert mosqueʼ, that was never intended to be completed as a built structure) (Genequand 2002);
(4) Hydraulic features, including a diverting dam and perhaps a canal, much disturbed by the construction of a water basin in recent years;
(5) A square building or tower, midway between the *qaṣr* and the *quṣayr*;
(6) Traces of two rectangular structures to the north (near the visitor center), with a concentration of loose glass *tesserae* near the surface;
(7) A cistern not far from the present visitors' car park;
(8) Traces of structures to the east of the *quṣayr*;
(9) A long wall bisected by the ʻAmmān - Azraq highway;
(10) Stone blocks to the south of the *wadi*, south of the *quṣayr*;
(11) Another wall and a second *sāqiyya* to the east of the ʻAmmān - Azraq highway.

The 1971-1974 plan prepared by the Spanish team working at the site also showed a number of structures on the plateau between the ruined *qaṣr* and Quṣayr ʻAmra. All of these sites seem to belong to the same period of construction as Quṣayr ʻAmra, *viz*. the early 8th century AD. A number of recent studies have stressed the importance of these remains for gaining a better understanding of Quṣayr ʻAmra and its function(s) (Vibert-Guigue and Bisheh 2007; Genequand 2002). The perimeter wall that can be seen north and east of the main building, for example, might define the limits of a *paradeisos*, a garden in the tradition of Classical as well as Byzantine and early Islamic cultures (Vibert-Guigue 1998). Quṣayr ʻAmra might have been used as a lodge for the caliph, while the ruined *qaṣr* and other structures were perhaps built for the use of guests, servants and soldiers. More studies and investigations are necessary before these hypotheses can be consolidated, but the more pressing matter is the protection of these sites, which were left outside the fenced area.

Disturbances and Threats

These remains were either separated from the main building (with the construction of the ʻAmmān-Azraq highway thirty years ago), or have been bulldozed or vandalized without apparent reason. Moreover, the recent construction of a water reservoir 200m above the main site is a threat that should not be underestimated, since this reservoir can hold up to 40,000 cubic meters of water. A serious flash flood could compromise its embankments and release the water towards the site. More serious still is the 2011 construction of an earth dam 300 meters wide just above the junction of Wādī al-Ḥarth with Wādī al-Buṭum, at a distance of 2 km from the site. This effectively blocks all water flowing into Wādī al-Buṭum from this important tributary *wadi*, which supplies two-thirds of Wādī al-Buṭum's discharge.

Quṣayr ʻAmra is located on a *wadi* with a substantial stands of *buṭum* trees (*Pistacia atlantica*), some of which may be centuries old. The *wadi* can carry a large amount of water and, in fact, a flood occurred in 1994 when the site was submerged under 70cm of water.

The main disturbances in the vicinity of the site are:

(1) Illegal quarries 2km west of the site. Although it has been claimed that these quarries have been stopped, it seems that some quarrying activity is still taking place;
(2) A Ministry of Agriculture well and other installations to the north-east, and a private farm to the south of the site. These have scarred the desert surface to plant trees (now dead) and install irrigation pipes;
(3) Dirt tracks to access the farms and quarries;
(4) The ʻAmmān-Azraq highway, which bisects the site, separating the second *sāqiyya* and wall remnants from the rest of the site;
(5) A large water reservoir 200m west of the site;
(6) A dam on Wādī al-Ḥarth, 2km upstream, and at least two more check dams on Wādī al-Buṭum, 2-3km upstream;

(7) A long berm along a dirt track delineating the north end of the site. It is difficult to understand when, by whom and for what purpose this berm was built. One hypothesis is that it was made by the Ministry of Agriculture to define the nature reserve of Wādī al-Buṭum;
(8) Paths leading visitors to the main building;
(9) Bulldozing of the *qaṣr* 500m west of the main site. This seems to have taken place around 1996 and may have been linked to the construction of the paths mentioned above;
(10) An electricity line 400m east of the main building, along the ʻAmmān-Azraq highway;
(11) Another electricity line, this time buried, has disturbed the site passing between the second *sāqiyya* and the ʻAmmān-Azraq highway, bisecting the wall remnants just north of the second *sāqiyya*.
(12) Vandalism to the second *sāqiyya*, which photos taken by the Spanish team after the excavation and conservation of 1971-1974 show to have been good condition, but which today is an unrecognizable pile of rubble. This site was originally fenced, but the fence has either been stolen or taken down; only a few remnants are still visible.

It is clear that there has been very little coordination between the various Departments and Ministries in the past. Public works proceeded in the form of highway construction without proper archaeological assessments; the same can be said of the Ministry of Agriculture experimental station, water reservoir and the establishment of a nature reserve. The Ministry of Tourism's paths and tree planting schemes were unsuccessful and have contributed to make the original landscape more difficult to recognize. This is all compounded by active threats to the main site itself, especially the vandalism and graffiti that remain the most serious threat to the integrity and authenticity of the site (**Fig. 33**).

33. Vandalism in the alcove room.

All this calls for the urgent establishment of a management and conservation plan, which the Project is carrying out using a participatory approach with full involvement of all stakeholders. A team consisting of heritage specialists and DoA staff was formed, with the aim not only of compiling an operational management plan, but also of providing elements to define the limits of the World Heritage site, as well as suggesting improved presentation and visitor management for the site. Two stakeholder meetings were conducted in April and June 2012, and other consultations will take place during the course of the project.

Students from the Queen Rania Institute of Tourism and Heritage at Hashemiya University participated in a one-week survey aimed at understanding visitor behavior and *desiderata* at the site. The survey will be repeated in future season at the site.

Conclusions

The first three seasons of documentation and conservation at Quṣayr ʻAmra have achieved important results: the exterior of the building is now conserved, water infiltration has been stopped and the monument shows a more balanced palette of color and shadow. Inside, condition assessment and analyses have allowed the recognition of the original painting techniques used by the Umayyad artists, as well as the materials applied in recent interventions. Various experiments have allowed methodologies to be defined in order to reduce or eliminate the repainting and layers of shellac applied in the last century to protect the site, but which now pose a real threat to the conservation of the mural paintings. The results are extraordinary, not only because it has been demonstrated that apparently irreversible conservation interventions can at least be reduced in their negative effects, but also because of the surprising presence of layers of original paint that can still be read and interpreted. The changes in iconography and the discov-

34. South wall of the west aisle (after conservation).

ery of previous unknown details and inscriptions have added to the scientific and historic importance of the monument (**Fig. 34**). This work will continue is future seasons, in an effort to return the monument to stable conservation conditions with the care and protection it deserves.

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Bibliography

Almagro, M. *et al*.
2005 *Qusayr ʻAmra. Residencia y baños Omeyas en el Desierto de Jordania*. Granada: Junta de Andalucia.

Bentivoglio, G. and Oteri, A.M.
2005 Tanti sottili Filamenti Ravvicinati. L'integrazione Pittorica tra Ricomposizione e Ricostruzione nelle prime Esperienze di Cesare Brandi: il Restauro del ciclo di Affreschi di Lorenzo da Viterbo nella Cappella Mazzatosta (1944-49). Pp. 571-581, *Sulle Pitture Murali: Riflessione, Conoscenze, Interventi. Atti del Convegno di Studi, Bressanone, 12-15 July 2005*. Scienza e beni Culturali, 21. Venice: Edizioni Arcadia Ricerche

Betts, A.
2001 Graffiti from Qusayr ʻAmra: A note on dating of Arabian Rock Carvings. *Arabian Archaeology and Epigraphy* 12 (1): 96-102.

Bisheh, G., Morin T. and Vibert-Guigue, C.
1997 Rapport d'activités à Qusayr ʻAmra. *ADAJ* 41:

375-393.

Brandi, C.
2005 *Theory of Restoration*. Rome: ICR.

Fowden, G.
2004 *Qusayr 'Amra: Art and the Umayyad Elite in Late Antique Syria*. Berkeley: University of California Press.

Gaetani dell'Aquila d'Aragona, M.C.
2003 La Reintegrazione delle lacune Attraverso la tecnica del Tratteggio: Considerazioni sul Metodo. Pp. 277-285, *La teoria del Restauro da Riegl a Brandi, Atti del Convegno Internazionale* (Viterbo, 12-15 novembre 2003).

Genequand, D.
2002 Une Mosquée à Qusayr 'Amra. *ADAJ* 46: 583-589.

Imbert, F.
1996 *Corpus des Inscriptions Arabes de Jordanie du Nord.* Thèse de 3ème cycle, Aix en Provence.
(forthcoming) L'Épigraphie des traces: l'Inscription Monumentale Peinte de Hammâm al-Sarrâh en Jordanie. *Paléorient* 2. Institut Français du Proche-Orient.

Jaussen, A. and Savignac, R.
1922 *Mission Archéologique en Arabie, III, Les Châteaux Arabes de Qeseir 'Amra, Hâraneh et Tûba*. Paris: P. Geuthner.

Milburn, R.
1988 *Early Christian Art and Architecture*. Berkeley: University of California Press.

Morin, T. and Vibert-Guigue, C.
2000 Une Structure d'Accueil des Visiteurs à l'Entrée de Qusayr 'Amra. *ADAJ* 44: 581-591.

Mora, P., Mora, L. and Philippot, P.
1984 *Conservation of Wall Paintings*. London: Butterworths.

Musil, A.
1907 *Kusejr 'Amra*. Vienna: Kaiserliche Akademie der Wissenschaften.

Sharon, M.
1966 An Arabic Inscription from the time of the Caliph Abd al-Malik. *Bulletin of the school of Oriental and African Studies* xxix: 367-372.

Vibert-Guigue, C.
1994 L'état des Peintures de Qusayr 'Amra. *ARAM* 6: 343-358.
1997 *La Peinture Omeyyade du Proche-Orient: l'exemple de Qusayr 'Amra*. Thèse de 3e cycle, Université de Paris I, Panthéon-Sorbonne. Paris: Université de Paris I.
1998 L'oasis Raffinée d'un Calife Omeyyade. *Ulysse* 63: 56-58.

Vibert-Guigue, C. and Bisheh, G., (coll. Imbert, F.)
2007 *Les Peintures de Qusayr 'Amra. Un bain Omeyyade dans la Badiya Jordanienne, BAH 179-Jordanian Archaeology 1*. Beirut: IFPO / DAJ.