# Survey, conservation and restoration in Egypt's Western Desert: combining expectations and context

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**Fig. 4a**
The interior of the Dabashiya Pigeon Tower showing the modern intervention on the ancient remains (photos: F. Fassi, 2016)

## Abstract

This article discusses the necessity to combine theoretical expectations and practical context in the case of logistically challenging projects, such as the multidisciplinary study of the Late Roman archaeological site of Umm al-Dabadib, located in an remote position at the outskirts of the Kharga Oasis, in Egypt's Western Desert. This Italo-Egyptian project must conform and respond to rules and regulations from both countries, and faces the problem of identifying the most efficient methodologies to obtain a long-lasting result in an extremely complex environmental context. This article contains a description of the current trends in the management of mud-brick remains in the Egyptian desert environment, and a discussion on the methodology that the will be adopted at Umm al-Dabadib.

## Introduction

The Politecnico di Milano and the MUSA Centre (Musei delle Scienze Agrarie) of the University of Napoli Federico II recently started the 5-year project LIFE (Living In a Fringe Environment), funded by the ERC Consolidator Grant 681673. Aim of LIFE is to carry out a comprehensive study of the Late Roman archaeological site of Umm al-Dabadib, located in the Kharga Oasis, in Egypt's Western Desert (Fig. 1).

Umm al-Dabadib is a large, remote site, belonging to a little-known network of fortified settlements installed by the Romans along what used to be the empire's southern border, along an important crossroad of desert routes that unfold across the Western Desert (Fig. 2). Due to its extremely isolated position, the environmental conditions and the ensuing logistic difficulties, with the exception of a description of its subterranean aqueducts (Beadnell, 1909) Umm al-Dabadib remained unexplored and unsurveyed until 1998, when the author visited the site and produced a first cursory description of these imposing archaeological remains (Rossi, 2000). This first step led to the creation of the North Kharga Oasis Survey (NKOS), a survey project co-directed by the author (then at Cambridge University) and S. Ikram (American University in Cairo), that between 2001 and



RA 2 | 2017, pagg. 20 | 35
ISSN 1724-9686 (print) | ISSN 2465-2377 (online)

2007 produced the first theodolite survey of all the archaeological sites located in the northern portion of the Kharga Oasis: some of them were little-known and their real extent was only revealed on that occasion, whilst others were just discovered during the survey (Ikram and Rossi, 2004 and 2007; Rossi and Ikram, 2006 and 2010).

Umm al-Dabadib belongs to a chain of aggressive-looking settlements dating to the IV century AD, that survive to various degrees of preservation. They all consist of a central fort surrounded by compact settlements made of unfired mud-brick buildings; the use of stone was limited to a few architectural elements such as lintels and steps. The excellent construction technique and the dry environment allowed an optimal preservation of these remains. NKOS also documented the presence of relatively well-preserved remains of ancient irrigation systems and cultivated areas.

After the completion of the first general survey, the author therefore decided to focus on investigating the relationship between built-up portions and agricultural systems, and in 2012 founded the project OASIS (Old Agricultural Sites and Irrigation Systems) in collaboration with the MUSA Centre of the University of Napoli Federico II. Umm al-Dabadib offered the best combination, and was selected as a case-study. The Department ABC of the Politecnico di Milano joined the project shortly afterwards; between

**Fig. 1**
The archaeological site of Umm al-Dabadib, Kharga Oasis, Egypt's Western Desert (photo by P. Viviani, 2013, ©paoloph. carbonmade.com)

2013 and 2015 OASIS performed the 3D survey of the Fortified Settlement and a survey of the entire agricultural system (Fassi et al., 2015; Rossi, 2016), and collected enough information to launch a new, more ambitious project called LIFE, finally involving the archaeological excavation of select areas. This project received an ERC Consolidator Grant in 2015 and started its activities in mid-2016; directed by the author, it is a joint enterprise of the Politecnico di Milano (Host Institution) and the University of Napoli Federico II (Partner Institution).

The first two actions of LIFE were the definition of the criteria to build a database, and a discussion on some specific aspects of the methodology to be employed and applied on the field. The availability of funding and the possibility to plan five years of work offered the chance to take into consideration a number of possible actions to be carried out at Umm al-Dabadib: beside the archaeological excavation of specific portions of the Fortified Settlement, operations of restoration and conservation were also considered. It became immediately clear that there were several issues to be analysed, and that we had to find a solution that would represent an acceptable compromise between theoretical expectations, practical approach, local traditions, environmental context and logistic constrains.

When dealing with an interdisciplinary project in an international envi-

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**Fig. 2**
Sketch map of Egypt showing the most important oases and desert routes (C. Rossi)

ronment, we must bear in mind that expectations and rules may not be the same, and that not everything can be successfully exported from one disciplinary field to another, and from one country to another. Survey methods that represent the optimal solution in one place might be impractical to adopt in another place, whilst restoration techniques that are uncommon in one place might correspond to the best solution in another context. It is thus necessary to build bridges between disciplines and between countries.

Egyptology has become a wide and complex field, ranging from the physical management of a variety of different finds retrieved on the field, to the philosophical interpretation of ever-evolving translations of religious texts; in particular, the archaeological practice is deeply related to habits and traditions specifically linked to Egypt and to the history of Egyptology, which are not necessarily known in detail by scholars from other disciplinary fields, and which may not correspond to the current practice implemented in other countries.

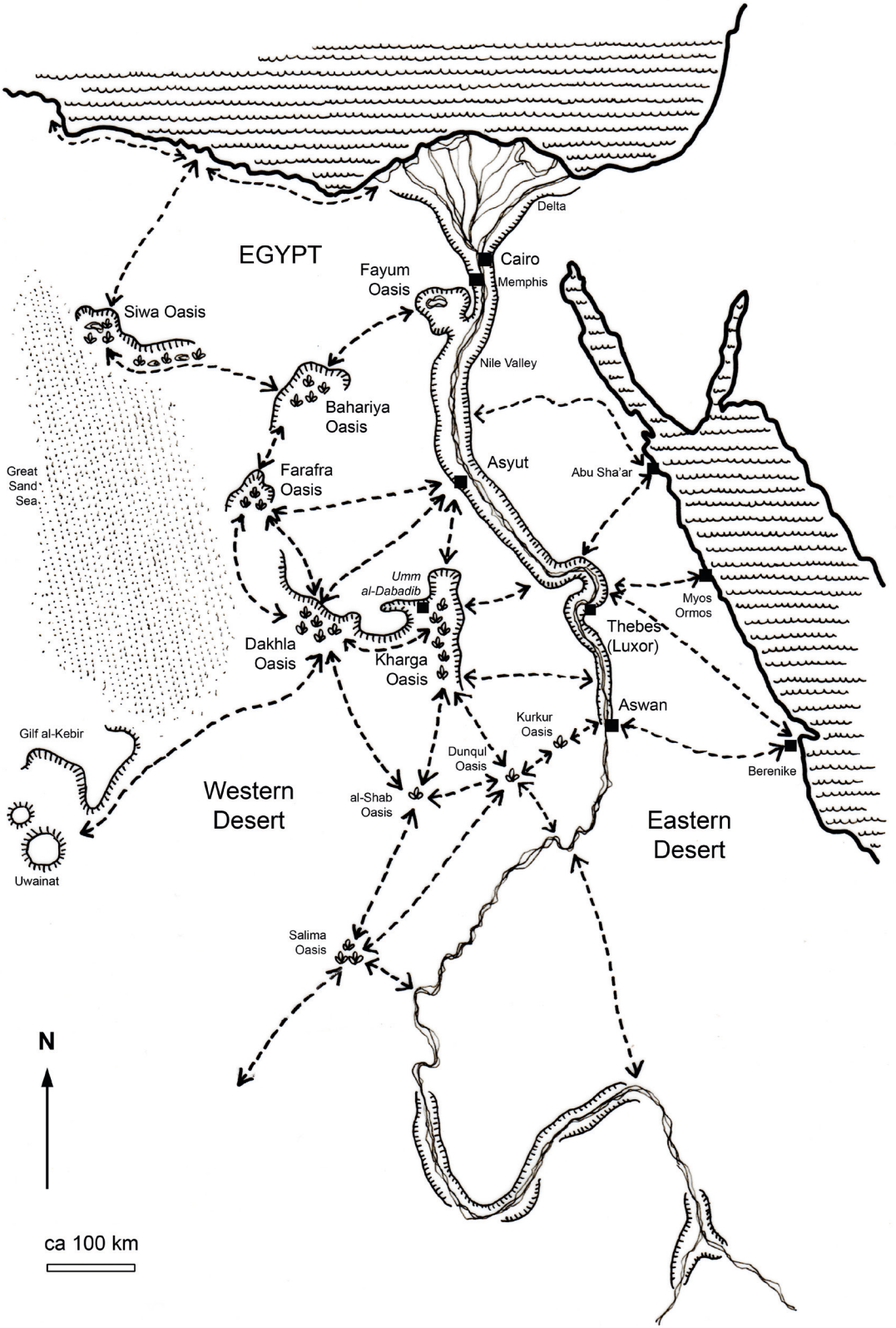
The existing differences of approach towards the issues of conservation and restoration depend, first of all, on different starting conditions, and then on different expectations. In the case of Egypt, for instance, the presence of strong, sand laden winds that are able to constantly and inexorably erode everything is a factor that cannot be underestimated: any conservation work must be planned to resist under these conditions and last for a significant amount of time. This often combines with the importance of making the archaeological sites available for and comprehensible to tourists, a major source of income not only for the country in general, but also for the Egyptian Ministry of the Antiquities, that constantly re-invests the income from cultural tourism into projects of protection and valorisation of the local antiquities.

This article summarises the history and especially the current practice of the management of mud-brick remains in Egypt; it is meant to illustrate the scenario of our project, based in Italy but operating across these two countries. I hope that this description will offer the chance to broaden the theoretical discussion on survey, restoration and conservation by highlighting the necessity to combine different theories and different practices.

**Conservation and archaeological restoration in Egypt**

Although the interest towards the vestiges of the ancient Egyptian culture dates back to Antiquity, the birth of Egyptology as a discipline is conventionally fixed to the early XIX century. Key events were the publication of the monumental *Description de l'Égypte* (1809-1829), the illustrated and comprehensive account drawn by the scholars who had followed the Napoleonic expedition, and the decipherment of the Rosetta Stele by Jean-François Champollion in 1822.

In the late XIX century private individuals (who could afford it) could dig up a tomb whilst leisurely travelling along the Nile (cf. Edwards, 1877, pp. 51-2). No law protected the antiquities, perceived, in the best cases, as ele-


EGYPT
Delta
Cairo
Memphis
Fayum Oasis
Siwa Oasis
Nile Valley
Bahariya Oasis
Great Sand Sea
Farafra Oasis
Asyut
Abu Sha'ar
Umm al-Dabadib
Myos Ormos
Thebes (Luxor)
Dakhla Oasis
Kharga Oasis
Aswan
Kurkur Oasis
Gilf al-Kebir
Dunqul Oasis
Berenike
Western Desert
al-Shab Oasis
Eastern Desert
Uwainat
Salima Oasis
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ca 100 km

ments of the landscape, and as convenient quarries of building material most of the times. The British gentlewoman Amelia Edwards, during her 1870 six-week trip along the Nile realised the dangers of this situation, and after her return to England co-founded the Egypt Exploration Fund (that later became the Egypt Exploration Society, devoted to the study and the preservation of the Egyptian antiquities.

By the beginning of the XX century, archaeologists who received the permission to excavate could remove and take abroad all their finds. The most famous example in Italy is the intact tomb of Kha and Merit, discovered in 1906 by Ernesto Schiaparelli, Director of the Museo Egizio of Turin and of the Missione Archeologica Italiana in Egypt: the entire funerary equipment was transferred to Turin, where it still represents one of the museum's major attractions (Schiaparelli, 1927). The discovery of the famous bust of Nefertiti at Tell al-Amarna in 1912 and its subsequent transfer to Berlin sparked significant controversy: during the division of the finds between Egypt and Germany, the latter managed to secure the precious object by downplaying its importance, a circumstance to be later bitterly regretted by the Egyptians, who still demand for its return. The situation has deeply changed over the years, and nowadays a strict code regulates the discovery of archaeological remains in Egypt: objects must be stored and studied in proximity of the site where they were found. In special cases, items or samples may be taken to Cairo to undertake special examinations, but nothing can be taken abroad.

The attitude towards ancient Egyptian buildings has also deeply changed over the years. In the early years of archaeological prospections, all the spotlights were dedicated to stone buildings; mud-brick buildings failed to attract the attention of archaeologist for a long time, leading to the loss of a large amount of material (Spencer, 1979). The study of settlements was particularly affected, as houses (including royal palaces) were not built in stone as temples and tombs (cf. Moeller, 2016); enclosure walls, fortifications, magazines and official buildings also suffered neglect and destruction before they could be properly studied (Kemp, 2000).

Moreover, mud-brick architecture obviously suffers the exposure to the sun and sand-laden winds far more than stone buildings. Mud-brick buildings that have been left exposed after they had been excavated quickly decayed. An example is the large-scale German and British excavations at Tell al-Amarna, carried out between 1907 and 1936, that had the invaluable merit of uncovering most of the ancient city and all the peculiar temples built by the pharaoh Akhenaten (e.g. Pendelbury 1951). Although the wind and sand slowly covered the excavated areas again, the paintings and the upper portions of the walls were irreparably lost (cf. Kemp 2012, pl. XV-XXXIV). An example that is directly related to Italy is the tomb of Iti and Neferu: excavated by Schiaparelli in 1911, yielded a series of beautiful paintings that were removed from the walls and sent to Turin. The mud-brick tomb, at the time of the discovery already in precarious conditions, emptied of everything that could be taken away, was left to its fate and has

**Fig. 3a-3b**
The Pigeon Tower at Ain al-Dabashiya (Kharga Oasis) before and after the 2011 conservation work showing the reconstruction of the north face (photos: C. Rossi, 2004; F. Fassi, 2016)


now disappeared. The current display of the painting in the Museo Egizio echoes their original distribution, as they are placed on a series of pillars reflecting the original design of the tomb.

In general, mud-brick buildings also suffered for a long time the widespread practice of *sabbakh*-digging. This operation consisted of the removal ancient ruins, that were pulverised and spread over the fields as fertiliser (Bailey 1999). Amelia Edwards reports this chilling story, dating to 1870: "rowing round presently to Kobban [...] we land under the walls of a huge crude-brick structure, black with age, which at first sight looks quite shapeless; but which proves to be an ancient Egyptian fortress, buttressed, towered, loopholed, finished at the angles with the invariable moulded torus, and surrounded by a deep dry moat, which is probably yet filled each summer by the inundation. [...] We enter the enclosure [...] and find ourselves in the midst of an immense parallelogram measuring about 450 feet from east to west, and perhaps 300 feet from north to south. All within these bounds is a wilderness of ruins. [...] Over these mounds and at the bottom of these pits, swarm men, women and children, filling and carrying away basket-loads of rubble. The dust rises in clouds. The noise, the heat, the confusion, are indescribable. [...] It is only by an effort that one gradually realises how the place is but a vast shell, and how all these mounds and pits mark the site of what was once a huge edifice rising tower above tower to a central keep [...]. The towered edifice and the central keep – quarried, broken up, carried away piecemeal, reduced to powder, and spread over the land as manure – has now disappeared almost to its foundations" (Edwards, 1877, pp. 366-8).

*Sabbakh*-digging was officially declared illegal in 1910, but it only actually stopped to a large scale in the '30s (Moeller 2016, p. 54); small-scale activities, however, have been continuing since then, along with brick-robbing aiming at re-using the old building material. Nowadays in Egypt manufacturing mud-bricks is forbidden, as the construction of the Aswan Dam greatly reduced the availability of mud. The only exception is represented by the necessity to restore ancient monuments; in those cases, a special permission can be obtained to produce the necessary amount of mud-bricks (see below).

The current approach to the excavation of mud-brick buildings in Egypt includes re-burying them at the end of the work, when this operation is applicable. Sometimes the remains are left deliberately exposed for educational and touristic purposes; in these cases, special measures must be implemented in order to stabilise and preserve the ruins. At Amarna, for instance, the British Mission carried out a number of interventions to facilitate the comprehension of the archaeological remains, including reconstructions and positioning of re-created architectural elements.

Amarna has a peculiar history: founded on virgin soil by the pharaoh Akhenaten, it included a sprawling city, royal palaces and temples dedicated to the god Aten, the Disk of the Sun. All these monuments were mainly built of mud-bricks, apart from the core of the temples, built of stone. Af-

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**Fig. 4b**
The interior of the Dabashiya Pigeon Tower showing the modern intervention on the ancient remains (photos: F. Fassi, 2016)

ter the death of Akhenaten, both the cult of the god Aten and his city were abandoned. Within a few years, his monuments were thoroughly dismantled, the stones reused and the mud-bricks left to decay; of the stone temples, all that remained was the impression of the lowest courses of blocks on the underlying mortar layer.

In these conditions, the site (flattened and covered by sand) would be totally invisible and could not be appreciated by visitors and scholars; for this reason, a number of interventions have been planned and implemented. In the North Palace, for instance, low mud-brick walls have been capped by new mud-brick courses (Spence 1999). In the Small Aten Temple the foundations of the stone temples have been highlighted by new limestone courses that make the outline clearly visible on the ground. Moreover, in 1994 a giant replica column was re-erected, in order to give an idea of the scale of the imposing building that once occupied the area; the column is made of glass-fibre reinforced concrete, and was cast from a clay mould modelled on a surviving segment of an original column (Anderson 1998; see the webpage of the Amarna Project for a description of the work and pictures of the site).

In the Kharga Oasis, where Umm al-Dabadib is located, two conservation works have been carried out in recent years, at the Pigeon Tower of Ain al-Dabashiya (2011) and at the legionary fortress of al-Deir (2013-2014), both directed by Dr N. Warner, architect and conservator, and member of the NKOS project.

The remains of several pigeon towers dating to the Late Roman Period (III to V century AD) dot the Kharga Oasis; they typically consist of a tower rising around a central pillar, its internal walls punctuated by pigeon-holes. The example of Ain al-Dabashiya was nearly complete, as only the roof and the northern wall had collapsed; however, this made the building vulnerable to the strong, sand-laden, northern winds, as well as to the flash floods that occasionally hit the oasis. The remains of similar pigeon towers can be found at Umm al-Dabadib, in the area of Beleida, at Qasr al-Nessima, and at Qasr al-Baramoudy; the latter also contains the well-preserved remains of a second pigeon tower with unique characteristics, consisting of a central rectangular structure surrounded by six semi-circular spaces. Apart from Umm al-Dabadib and Ain al-Dabashiya, the other sites have never been properly studied and no publications on these pigeon towers exist. The restoration of the Dabashiya building represented an occasion to draw the attention to these monuments and to ensure the preservation of at least one of them.

The aim of the conservation work was to repair the building to ensure its optimal survival: for this reason, the northern wall was totally reconstructed, as well as part of the roof (Ikram and Warner, 2012, Fig. 3a-b). About 13,000 new mud-bricks were manufactured to this scope; their dimensions were slightly smaller in comparison with the original mud-bricks, in order to ensure their differentiation. Transporting the mud-bricks and the water necessary to mix the large amount of mortar to the site was a major

undertaking: the 5 km of soft and sandy terrain that separate the Pigeon Tower from the nearest village required time, patience, a tractor, a 4x4 and enough energy to periodically dig out these vehicles from the sand.

The new portions of the building were designed in order to be clearly discernible: the interior of the new northern wall is solid, and the position of the pigeon-holes that would have originally punctuated the inner face is simply marked by a series of squares drawn on the plastered surface. The unshaped branches of trees that originally spanned across the passage around the central pillar (their position was clearly marked by the surviving holes on their side) were substituted by new ones (Fig. 4a-b). The modern access through the north wall was closed by a metal door endowed with a normal bolt, that can be easily opened by tourists and visitors but that prevents the northern wind from entering the building. The original door was robbed shortly after the end of the work, and had to be replaced.

Two years later, another major conservation work was started at the legionary fortress of al-Deir, a large enclosure endowed with twelve semi-circular towers that still reach a height of about 15 m, currently excavated by the French team directed by G. Tallet of Limoges University (Tallet at al. 2012). As in all ancient buildings of the Kharga Oasis, sixteen centuries of sand-laden winds took their toll on the northern face of the building, which survives in poor conditions. The southern side, instead, even if fully exposed to the scorching sun, is preserved in a far better shape; for this reason, over the years it has been used as a convenient quarry for mud-bricks by the inhabitants of the village located at a distance of about 8 km. A large amount of mud-bricks was removed from the lowest courses of the southern face, to the point of undermining the stability of the south-western tower. In this instance, the mud-bricks to be employed in the conservation work were manufactured on site, and were used to replenish the missing portions of the basement (Fig. 5a-b), as well as to repair the nearby mud-brick temple. This work has not been published; a brief description and some photographs can be found on the project's website.

In conclusion, in the case of mud-brick buildings that must remain exposed, in Egypt it is possible to implement a number of significant interventions aiming at sheltering the structures from the sand-laden wind

and keeping them structurally sound and stable. In the desert, considering the logistic and environmental conditions, the most efficient system to obtain long-lasting results is to restore the buildings to their original closed shape by using local materials and building techniques. These interventions, however, must be carefully calibrated and tailored to the specific needs of each archaeological site.

**Combining theory and practice: the case of Umm al-Dabadib**

The archaeological site of Umm al-Dabadib represents a typical case in which what would work very well in theory, does not work in practice. The remoteness of the site, the lack of water and electricity, the absence of any structure and facility, combined with the bureaucratic difficulties of importing any complex instrument in Egypt, as well as the current situation of general uncertainty dictate the working conditions and greatly reduce the actual possibilities at our disposal (Rossi et al., 2016).

A typical example is represented by the possible survey techniques: in theory, Umm al-Dabadid would be an ideal candidate to perform a 3D survey with the aid of a drone; in practice, importing a drone in Egypt is currently out of the question, let alone the possibility to use it in a military area as the Kharga Oasis. Moreover, the strong winds that unpredictably batter the oasis might represent a significant danger for the drone's integrity.

The use of laser-scanner would be also problematic, as the fine sand penetrates everywhere and effectively and inevitably destroys every complex piece of machinery. Starting from 2014 we have been performing the 3D survey of the architectural remains of Umm al-Dabadib thanks to a photogrammetric software (Agisoft Photoscan) that automatically recognises the survey data and allows a rapid and efficient construction of a dense cloud of points, from which measurable 3D images can be derived (e.g. Fig. 6). This method is ideal for logistically complex and endangered archaeological sites, not only because it is a quick and efficient method, but also because it only requires normal digital cameras, a laptop and a small generator to recharge the batteries (Fassi et al. 2015). It is important to stress that the results that can be achieved at Umm al-Dabadib must be weighted against the challenging environmental conditions in which the work must



**Fig. 5a-5b**
The south-western tower of the legionary fortress of al-Deir before and after the 2014 restoration work (photos: G. Tallet and N. Warner; courtesy of G. Tallet)

**Fig. 6**
Elaboration of the 3D survey of the Fortified Settlement of Umm al-Dabadib (3D Survey Group, Politecnico di Milano, 2014)

Fig. 7
The corner house of the Fortified Settlement at Umm al-Dabadib, in theory a good candidate for a conservation work (photo: C. Rossi, 2014)

be performed, rather then against a conceptually similar work to be performed in a friendly environment endowed with all modern technological comforts.

Going back to the issue of conservation, the excellent preservation of the architectural remains at Umm al-Dabadib encouraged us to take into account the possibility to plan the reconstruction of some specific portions, in line with the current Egyptian laws and local traditions; after careful considerations, however, we decided not to pursue this direction, for two main reasons.

The first is purely economical: the cost would be extremely high. If the transport of the building material along the 5 km separating the Dabashiya Pigeon Tower from the nearest village was a difficult enterprise, the logistic organisation to cover the 50 km separating Umm al-Dabadib from the asphalted road would represent a significant challenge. Manufacturing the mud-bricks on site would be impossible, as there is no available wa-

ter; at any rate, we would not consider setting up a building yard on site for the second reason, which will be discussed below. According to N. Warner's simulation, the reconstruction of the missing portion of one particularly well-preserved domestic unit at Umm al-Dabadib (Fig. 7) would require the same amount of money that could be used to fund an entire season of archaeological excavation: in a place that has never been excavated, and that is unlikely to undergo excavations to a larger scale in the near future, pouring all these resources into the reconstruction of one already well-understood building seems unnecessary. Moreover, a reconstruction would make sense in a scenario of intensive touristic exploitation, and in an archaeological environment that requires to be enhanced: neither of these cases applies to Umm al-Dabadib, an extremely remote site that already contains well-preserved and attractive remains.

The second reason is ethical, and is based on the overall approach that we decided to adopt: Umm al-Dabadib represents an isolated mini-oasis

within the larger boundaries of the Kharga Oasis, where the archaeological sites lie relatively undisturbed; the area is one of the last natural habitats of *Dorcas* Gazelles and is characterised by a high level of biodiversity. We recently started a collaboration with the Egyptian Environmental Affairs Agency (EEAA) and the Ministry of the Antiquities to create a Protected Area around Umm al-Dabadib; at the same time, we collaborated with the UNESCO Cairo Office to enrol the Kharga Oasis into the UNESCO Tentative List as one of the few nature+culture protected areas of the entire region of North Africa and Middle East (Rossi et al., 2017).

Our global approach to the site fully reflects these initiatives: our aim is to avoid any major alteration of the site, and to carry out our archaeological investigation in a relatively non-invasive way. For this reason, we will direct our efforts to the excavation of a few, specific, meaningful spots, and will favour virtual over physical reconstructions.

The 3D survey that we have been performing will represent the basis of our future work: after aligning all internal and external surveys of the exposed and newly excavated portions of the Fortified Settlement, we will be able to X-ray the settlement and prepare a virtual reconstruction of its original arrangement and layout. Although the 3D reconstructions will be better appreciated on a web-based system, it will be possible to extract from them a large number of 2- and 3D images (plans and sections, as well as perspectives and 'transparent' views of the remains) that can be used for various purposes, ranging from a detailed study of the architectural and archaeological characteristics of the site, to a popular dissemination of the results (e.g. Fiorillo and Rossi, forthcoming). Both aspects will equally contribute to the preservation of this unique archaeological site, by encouraging a non-invasive, long-distance study of the archaeological remains, as well as by raising the awareness of visitors and travellers, and fostering the growth of a responsible eco-tourism.

**Acknowledgements**

Prof. Stefano Della Torre for suggesting to write for this journal and for his support to this project; Dr Gaëlle Tallet, Director of the French Mission to al-Deir, for sharing information on her unpublished work; Dr Ashraf Salem, Manager of the National Park of Gebel Elba, for his dedication to the protection of the Egyptian desert environment; Mr Ahmed Ibrahim Bahgat, General Manager of the Kharga Antiquities and the Egyptian Ministry of the Antiquities for their constant support and encouragement; and finally the late Professor Samir Ghabbour (Cairo University) for his unfailing commitment to protect the Egyptian heritage, who left us a few months ago.

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