The reliefs of Maltai (Halamata)

Introduction

The monumental rock carving complexes of Maltai (locally known as Halamata) and Khinis (Bavian) are associated with an extensive canal network built by the Assyrian king Sennacherib (704-681 BC). The need to bring water to Nineveh, his new capital, led to the construction of an impressive water-management system composed of a network of canals (about 240 km), tunnels, and aqueducts, with dams and reservoirs. This building project lasted for 15 years, from 702 to 688 BC.¹

In addition to its functional aspects, such as the supply of water to the new capital and for irrigation, this vast hydraulic system was also of propagandistic, ideological and religious importance. For this reason Sennacherib furnished the canals with monumental rock reliefs, in which he is portrayed accompanied by deities, with inscriptions that celebrate him as the executor of the work.²

Rediscovery of the reliefs

The reliefs’ rediscovery in the modern era occurred in the latter half of the 19th century. The first report and description of the Maltai reliefs was produced by Simon Rouet, French consul in Mosul. They are mentioned in several letters written to Jules Mohl, and published in 1846 in the Journal Asiatic, together with an illustration of the third panel.³ In 1849, Sir Austen Henry Layard briefly described the reliefs.⁴ The archaeologist Victor Place, who excavated Tell Maltai in 1852, published drawings of them but did not conduct a study of the panels.⁵ Carl Lehmann-Haupt took photographs of the reliefs in 1907, but unfortunately these are unclear and thus of little use.

¹ Bagg 2000, 316-317.
² Grayson-Novotny 2012, 310-317.
³ Thureau-Dangin 1924, 185.
⁴ Layard 1949, 230-231 vol. I.
⁵ Place 1867, tav. 45 vol. III.
The carvings were photographed again in 1909 by Gertrude Bell, followed by Walter Bachmann in 1914: the latter images were published together with the monograph 'Felsreliefs in Assyrien: Bawian, Maltai und Gundük' in 1927.

Photographs taken in 1923 by R.P. Nasse were published alongside an article by François Thureau-Dangin entitled ‘Les sculptures rupestres de Maltai’\(^6\), in which Thureau-Dangin outlined an art-historical study of the reliefs based on careful observation of them\(^7\).

Lastly, in 1997 Rainer Michael Boehmer published ‘Die neuassyrischen Felsreliefs von Maltai (Nord-Iraq)’\(^8\).

**Description of the reliefs**

The Maltai reliefs are situated about two-thirds’ way down the north face of Jebel Zawiyah, a mountain that overlooks the city of Dohuk from the south. **Fig 1\(^9\)**

![Image of Jebel Zawiyah](image1.jpg)

**Fig. 1. Jebel Zawiyah**

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\(^6\) Thureau-Dangin 1924, 185-197.  
\(^7\) Thureau-Dangin 1924, 185-197.  
\(^8\) Boehmer 1997, 42-84.  
\(^9\) Except when otherwise specified, all photographs are by the author.
Fig. 2. View of the town from the plateau in front of the carvings

Fig. 3. Maltai. Panel I
Fig. 4. Maltai. Panel II

Fig. 5. Maltai. Panel III
The monumental complex consists of four panels carved on the rock face, by convention numbered from I to IV, east to west. The first three panels are located on the same plateau, very close to each other, while the fourth is about 50 m west of the first three. The panels measure about 6 x 3 m and are located about 2 m from the current ground level, with the sole exception of panel IV, which is situated at head height. They may be reached on foot from the upper part of Jebel Zawiyah via a difficult path; it takes about 20 minutes to reach the narrow plateau onto which the reliefs face. The upper part of the mountain may be reached by car and in the evening and on non-working days drinks and food are sold for consumption at picnic tables; it is popular with town-dwellers on warm summer evenings. The plateau next to the reliefs is used for eating, drinking and recreation. These outings often result in rubbish being left on the path and near the reliefs, where there are also the remains of bonfires used for unofficial barbecues right next to the rock carvings.
The four panels all portray the same leftwards-facing procession of seven statues of deities on their symbolic animals, with the figure of the sovereign at both ends of the panel.

On the left there is the Assyrian king in a position of veneration with respect to the second figure, the god Assur standing on his two sacred animals, a mushkushshu dragon and a lion with bull’s horns. The third figure is the associated god Mullissu, sitting on a throne resting on a lion. Then come the moon god Sin, sun gods Anu / Enlil and Shamash, and the rain and storm god Adad. Last in the procession is Ishtar, goddess of love and war, followed by a second representation of the king.

Scholars have previously interpreted the sovereign figure as a representation of Sennacherib, but a new study has proposed that the protagonist of the Maltai reliefs is probably his father Sargon. In this case the Maltai reliefs would be associated with Sargon’s hydraulic and irrigation project. See Morandi Bonacossi 2018, 77-115.
Illustrations of the panels

Fig. 9. Panel I - drawing

Fig. 10. Panel II - drawing
Fig. 11. Panel III - drawing

Fig. 12. Panel IV - drawing
Sample collection and results of analyses

In order to perform the analyses required to plan targeted conservation treatment based on the criterion of minimum intervention, several samples were taken. The sampling did not cause any damage to the sculpted panels, since it involved small quantities of material taken from outside of them or small, completely detached flakes from unworked surfaces. The samples were collected according to the NORMAL 3/80 Recommendations. The first series of analyses were of rock samples taken by Dr Stefano Palpacelli from rocks external to the reliefs.

The samples were analysed in the Laboratorio di Analisi dei Materiali Antichi – LAMA, directed by Prof. Fabrizio Antonelli (IUAV University, Venice), with consultancy by Prof. Lorenzo Lazzarini.

The results are summarized below.

Mineralogical/petrographic and physical description

The purpose of the investigation carried out by LAMA was to produce a petrographic classification of the rock from which the reliefs are made, with determination of its non-carbonate components. By means of chromatographic analyses the soluble salt content was measured, and further laboratory tests enabled calculation of the open porosity volume and the water absorption capacity due to capillary action.

The samples are of a microcrystalline carbonate rock, a dolomite limestone that may be classified as a micro-grainstone of medium to high porosity.

The residue insoluble in acid was modest in quantity (c. ≤ 4% by weight), but nevertheless significant. The insoluble residue obtained was used to determine the clay fraction (particle size ≤ 4 μm), which was composed of phyllosilicates. There is an abundance of montmorillonite and palygorskite (attapulgite), while at least traces of kaolinite and swelling chlorite are present. Due to their structural characteristics, these are able to absorb significant quantities of water and for this reason undergo repeated cycles of absorption-desiccation inside the stone. Montmorillonite and palygorskite in particular, which are present in large quantities, possess marked thixotropic properties, i.e. they have a high capacity for hydration, which results in increased volume.

Mercury porosimetry was used to quantify the amount of open pores. This allowed estimation of the samples’ percentage of "Total Open Porosity" and the distribution of the various groups of pores according to size. This last datum enables evaluation of the material’s greater or lesser liability to frost damage and to negative effects caused by the crystallization of salts. All the rock...
samples analyzed had a high "Total Open Porosity", on average > 17% by volume and composed of pores of size 0.11 – 0.13 μm. Rocks with these porosity percentages are classified as "very porous" to "extremely porous".

In almost all the samples analyzed, the sum of the pores with diameters of less than 1 micron is always considerable with respect to the total porosity. This is an important fact, because materials that contain a high percentage of pores with diameters of less than 1 micron are usually less durable and more subject to physical deterioration caused by mechanical stress due to the crystallization of water (frost weathering) and salts (salt weathering).

Mineralogical, chemical and biological analyses of deterioration and products produced by biological deterioration present on samples\textsuperscript{13}

List of samples analyzed with sample location:

Fig. 13. Panel I samples

Panel 1

#M_P1-C1: rock fragment with biological colonization
#M_P1-C2: movable fragment
#M_P1-C3: movable fragment with traces of microorganisms and white deposit

\textsuperscript{13} Antonelli 2018.
Fig. 14. Panel II samples

Panel 2

#M_P2-C6: an old ‘repair’ using plaster

Fig. 15. Panel IV samples
Panel 4

#M_P4-C10: various fragments with white deposit
#M_P4-C11: inside of large nodule
#M_P4-C12: fragments with biological colonization

On samples #M_P2-C6, #M_P4-C10 and #M_P4-C12 mineralogical analysis was conducted using X-ray diffractometry.

The results obtained confirmed that sample #M_P2-C6 is a piece of plaster applied in the past (probably a ‘repair’) and that the composition of #M_P4-C10 and #M_P4-C11 is prevalently dolomite and calcite.

Ion-exchange liquid chromatography was used to determine the presence of salts in sample #M_P1-C2; it showed the presence of sulphates and much smaller amounts of chlorides and nitrates.

Analyses conducted by LAMA on the biological colonies showed the presence of moss, cyanobacteria and various types of lichen (foliose, crustose and fruticose).

**Preservation state**

Determination of the state of preservation was carried out by means of a close visual analysis where the relief’s height above the ground made this possible. Where the reliefs could not be reached, a pair of binoculars was used, and high-resolution photographic images were taken from a drone.

For description of forms of alteration and deterioration, see: AA.VV. “Beni culturali – Materiali lapidei naturali ed artificiali. Descrizione della forma di alterazione – Termini e definizioni” [Cultural Heritage - Natural and artificial stone materials. Description of forms of alteration - Terms and definitions]. UNI 11182/2006

**General considerations**

On all the panels there is a uniform alteration of the colour of the originally white rock, which is now yellowed and reddish in some areas.

In many places the uniformity has been interrupted by the detachment of flakes or by abrasions due to acts of vandalism (thrown bottles or other objects), exposing the lighter underlying rock.
The reliefs would originally have appeared white, as shown by samples of unaltered rock taken in situ, or been painted, like the contemporary palace reliefs\textsuperscript{15}.

Marked alveolization was observed (Fig. 16), due to karst hollows within the rock, which also involves important parts of the sculptured surface. It is not yet clear whether these cavities were brought to light during the execution of the relief or whether they formed later. In panels II and III many of these cavities and some cracks were filled in the recent past with plaster, which is harmful to the rock due to its solubility and hygroscopic properties (Fig. 17).

All the reliefs are affected by incrustations and surface deposits of various types and composition: biological incrustations (Fig. 18), carbon particles (Fig. 19), charcoal and paint (Fig. 20).

There are numerous gaps due to the detachment of variously sized stone fragments, or larger sections of rock; some carved portions have disappeared due to natural phenomena or human
actions. Reliefs I and III have been disfigured by the excavation of a niche (I) and a tomb (III) in antiquity.

The majority of the deterioration is due to the widespread occurrence of flaking and exfoliation that affects all the reliefs (Figs. 21, 22). Flakes, variable in size but generally not more than 6/7 cm across, and microflakes are present in all the panels, both inside and outside the frames. At some points, a minimal mechanical stress would cause them to fall.

Fig. 18. Biological colonization (Panel II)

Fig. 19. Carbon particles (between panels I and II)
Fig. 20. Paint marks (Panel I)

Fig. 21. Flaking and exfoliation on the surface of the carvings
Fig. 22. Flaking and exfoliation on the surface of the carvings

Fig. 23. Microkarst cavities (Panel II)
There are also a number of cracks, some of considerable size. There are no sizeable plants growing on the panels or in the immediate vicinity; present instead are colonies of mosses, lichens and cyanobacteria.

On the surface there are microkarstic cavities, some probably interconnected inside the rock. The more active (ancient or residual) are preferentially aligned along two distinct sub-horizontal layer boundaries (Fig. 23). There are also widespread calcareous concretions, some of which might continue to grow during particularly rainy periods.

Between panels I-II and II-III there are two vertical crevices perpendicular to the face. At the base of these cracks, where they intersect the two layer boundaries mentioned above, the percolation of water has given rise to (probably very ancient) dark grey carbonate concretions.

Panel I

On the right side of the relief, a niche dug out in the past has destroyed the first and second figures from the right and part of the third. This recess is also used for climbing by local young people, resulting in serious damage to the lower part of the niche and the relief. Vandalism has also occurred, with writing, paint stains and charcoal graffiti on the sixth figure from the left and inside the niche.

In February 2018, this panel was damaged by a serious act of vandalism. On the lower part of the third figure (Mullissu), a hole measuring c. 0.55 x 0.56 m by 0.36 m deep was made. The following parts of the relief were destroyed: the right extremities of the garment and foot of Assur and tail of the mushkushshu (the upper part of the tail was already missing); the garment and foot of Mullissu, part of the throne and the lion (already partially ruined) on which the goddess rests. The detached pieces were found buried at the foot of the relief and were recovered. A few days after the discovery of the fragments, a first attempt at their digital recomposition was made; a detailed study of the more than one hundred and fifty fragments is yet to be conducted. Figs. 24,25,28

Among the recovered fragments there was also a hand that probably belonged to the first figure on the panel. This was already missing when Gertrude Bell took the first photographs in 1909, which suggests that some of the pieces currently missing might be found in the material that has built up on the original ground surface associated with the reliefs. It is hoped that in the future it will be possible to excavate this accumulation, both to look for possible lost sculptural fragments and to lower surface to its original level. The consequent increase in the reliefs’ height above the ground would in fact help to protect them from vandalism and discourage climbing into the panel I niche, as well as the panel III tomb. Figs. 26,27
Fig. 24. Hole dug in Panel I in February 2018

Fig. 25. Discovery of the fragments at the base of the carving
Fig. 26. Sennacherib’s hand from the left side of Panel I found among the other fragments

Fig. 27. Searching for the hand’s original position
The left side of the panel outside the relief, as well as the upper and lower parts, are affected by a dense biological colonization. The central figures (fourth and fifth from the left) are also affected by biological deterioration, as well as carbonate concretions that hide the details. There is also leaching caused by flowing water.

A significant fissure runs horizontally across the relief at the height of the figures’ headgear. It is also present, at approximately the same height, on the second and third panels. The relief is dotted with many small cavities of karst origin formed over the centuries, which cause considerable damage to the sculpture in many places.

Consistent damage due to flaking and exfoliation mainly affects the lower part of the relief and continues below the panel. The detachment of rock fragments has caused the disappearance of many parts of the carved surface, exposing – in the case of more recent falls – rock of lighter colour than the surface patina.

Below some flakes, which tend to detach when subjected to minimal mechanical stress, a blue-green colour is present, due to the presence of cyanobacteria (Fig. 29).
Sometimes biological colonization beneath the flakes is associated with the presence of a white substance, which analysis has revealed to be composed of dolomite and calcite.

At several points outside the panel it proved necessary to anchor variously sized portions of rock. It is also proposed that a missing portion of the base of the panel should be reconstructed using lime-based mortar.

The rock in the lower part of the panel has deteriorated markedly, and requires consolidation treatment that should be given to all the parts that require it, in accordance with the principle of minimum intervention.

**Area between panels I and II**

The rock face between the two panels is crossed by a vertical crack that at the centre of a broad band of dark-grey coloured carbonate concretion. Numerous karstic cavities, some of considerable size, are present on the entire surface between the two reliefs.

On the right part of this inter-panel surface and on the first figure on the left of the second panel there is a thick layer of carbon particles due to a fireplace at the base of the relief that is still in use.
Panel II

In 2016, the area beneath the second panel was damaged by acts of vandalism: graffiti and a flag measuring 1.4 x 0.8 m in spray paint, subsequently covered with mud in an effort to conceal it. Both the mud and paint layers were removed in late summer 2016 by a careful cleaning operation\textsuperscript{16}. Fig. 30

![Flag painted in 2016 below Panel II](image)

Fig. 30. Flag painted in 2016 below Panel II

Numerous abrasions are present on the relief, due at least in part to vandalism (Fig. 31).

The second panel has the same kind of cavities found on the first, but in this case some have been plastered in the past, probably in order to make the surface of the relief more regular.

The crack present on the first panel continues across the upper part of this relief; on the right the fissure is accentuated, with probably interconnected microkarst cavities that might still be active in periods of high rainfall (Fig. 32).

The part under the lower frame of the relief is equally affected by this phenomenon, with numerous drip-marks and areas of darker and lighter colour.

\textsuperscript{16} Operation conducted by the Land of Nineveh Archaeological Project with funding from the Dohuk Governorate and support from the Dohuk Antiquities Directorate.
Flakes and microflakes are present on the second panel too. The rock requires mechanical support in correspondence to the inside and outside of the right-hand part of the panel, and reconstruction of part of the upper frame should be considered.

Fig. 31. Man-made abrasions on Panel II

Fig. 32. Microkarst phenomena on Panel II
Area between panels II and III

As between the first two panels, there is also a large area of carbonate concretions and biological colonization between reliefs II and III.

There are numerous cavities (some on the face), small sized karst phenomena, and one very large man-made hole at the base of the third panel (Fig. 33).

Panel III

The highly degraded lower strip present in the first and second panels continues in the third panel too, exacerbated by the painting of a large flag measuring 1.8 x 1.0 m by vandals, later covered with a thin layer of mud in order to camouflage it. Unlike the flag painted on the second panel, this second flag partially covered the lower part of the sculpture, specifically the feet of some figures in the relief and part of the procession of sacred animals (first four figures from the right). This flag was subsequently removed in the same manner as the previous one at the end of summer 2016 (Fig. 34).
Other graffiti in blue paint and charcoal disfigure the relief. A large tomb was dug into the first half of the relief in the past. Bachmann’s photographs (1914) show that the cavity excavated for the tomb had then destroyed part of the fifth figure from the right and the all of the sixth. Later, between 1923 and 1932, the enthroned figure (third from the left) was removed, probably for sale on the clandestine antiquities market. Part of the third figure missing from panel III was recovered by the Iraqi Authorities and is now kept in the Iraq Museum in Baghdad. Only the large ring held by the deity in his left hand and part of the tiara remain of this figure (Fig. 35). The part of the panel below the tomb is smooth and dirty due to the fact that many visitors have used it to gain traction with their feet so as to climb up and enter the tomb.

In addition to the drip-marks mentioned above, which cover the first relief figure to the left, numerous small cavities of karstic origin are present, some of them plastered during a previous intervention.

17 Bachmann 1927, Fig. 28.
18 Reade 1989, 320-322.
At the top of the relief the fracture line present in the first two panels continues. This area has suffered considerable deterioration due to flaking, exfoliation and abrasion of the rock surface.

On the right side of the panel stone is missing from the frame, probably due to a collapse, and grey drip-marks and whitening of the rock surface may be observed.

Fig. 35. Reconstruction of the figures missing from panel III

Panel IV

Panel IV lies about 50 m to the west of panel III.

There was a nodule largely composed of dolomite and calcite\(^9\) inside the tiara of the first figure; in May 2017 it was uncovered and dug out by vandals, leaving a sizeable hole that almost entirely destroyed the tiara (Figs. 36, 37).

A similar nodule is present in the right-hand portion of the relief.
This panel is in a poor state of preservation. The deteriorated strip seen in the lower parts of the panels of the first three reliefs, in this last panel reaches half-way up, then sloping down to the west. Along this band there is considerable loss of the sculpted and worked surface.

The entire relief is affected by a massive loss of material, flaking, exfoliation, drip-marks of various kinds and biological growths. At the top and the right vertical side the frame has suffered significant loss of stone. Reconstruction of the missing parts of the frame is recommended so as to provide greater protection to the relief. Of the four reliefs, panel IV undoubtedly the most seriously deteriorated.

Fig. 36. Sennacherib’s tiara on the left side of Panel IV before the 2017 damage
Fig. 37. The tiara after the hole made in 2017
Causes of deterioration

The causes of deterioration may be divided into those of human origin, mainly acts of vandalism, and natural processes, largely due to the nature of the rock from which the reliefs are made and their outdoor location. Due to its structural characteristics, the clay fraction found in the samples is capable of absorbing a significant amount of water and expanding, whereas while drying it tends to contract. Obviously, such cycles occur repeatedly. This capacity for hydration and the consequent phases of contraction/expansion lead to a marked increase in volume inside the rock, a disruptive action that results in cracking and flake formation on the surface and provokes rapid deterioration. Similar disruptive action is related to thermal expansion due to surface adsorption of solar radiation alternating with nocturnal cooling.

Rainfall during the winter and spring and the consequent movement of water within the rock cause percolation and runoff down the hillsides, favouring the formation of biological colonies and carbonate concretions. This also contributes to the erosion of protruding parts of the panel frames, which thus lose their protective function with respect to the sculpted surface. These problems are essentially caused by interruptions due to the presence of cracks and/or structural lesions.

The karst processes that characterize the whole area are probably responsible for the formation of the numerous small cavities in the rock.

Illustrations of deterioration Pls. 1-8

Conservation treatment

After scaffolding has been put up, analysis and photographic documentation of the state of preservation will proceed. It will thus be possible to detect any variations with respect to the assessments made during the project design phase; the mapping of the preservation state conducted during the design phase will then be updated. It was possible to perform a close visual survey only of the lower parts of panels I, II and III due to their location about two metres above the ground. Panel IV, located at eye level, has been investigated in its entirety.

The first intervention to be performed on the reliefs consists of elimination of the biological colonization and plant growth. Where necessary, pre-consolidation treatment will be carried out on the basis of on-the-spot assessments. The urgency of securely attaching potentially dangerous rock bodies will also be evaluated at each location, to ensure operators’ safety and avoid any further loss of relief parts. At the same time a delicate cleaning process will be begun, using soft hair brushes to
remove superficial deposits of unconsolidated material. All operations will be performed starting at the top of the panels and proceeding downwards.

There follows a description of the interventions for each condition of alteration or deterioration found during the study of the preservation state. The abbreviations are those used in the tables of deterioration states and specific treatments.

**BIO – Elimination/reduction and control of biological deterioration agents**

**BIO1 – Biological colonization**

Biological colonies – of moss, lichens and cyanobacteria – will be treated with a biocide based on quaternary ammonium salts in 5% aqueous solution and 3% Biotin T for the elimination of lichens. These will be applied with a spray or brush to the surface to be treated. When treatment is conducted in the dry season, the affected area will be wetted beforehand in order to restart the growth cycle and thus obtain optimal product effectiveness.

After 1-3 weeks, mechanical removal will be carried out with nylon or bristle brushes and/or scalpels and the surface rinsed with water sprayed on manually. More than one biocide application cycle may be necessary.

**BIO2 – Plant growth**

For the treatment of vascular plants, a broad-spectrum herbicide will be sprayed on the leaves or injected into the root system. After the leaves dry the plant will be removed mechanically. More than one herbicide application cycle may be necessary.

**CON – Consolidation and pre-consolidation**

**CON1 – Consolidation of flakes and re-attachment of detached fragments**

The larger flakes will be consolidated with injections of Ledan TB1, a fluid mortar composed of natural lime and special hydraulic binding agents. The edges of the flakes will be sealed with a

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20 Since 2014 in the Vatican Museums laboratories research has been carried out into biocidal treatments based on natural, non-toxic products, such as essences of oregano (*Origanum vulgare*) and thyme (*Thymus vulgaris*); see Devreux-Santamaria-Morresi-Rodolfos-Barbabetola-Fratini-Reale 2015, 199-206. If conservation work starts after the successful conclusion of this research, it is proposed that trials to evaluate the possible use of these products should be conducted.

21 Ledan TB1 injectable mortar was developed by Tecno Edile Toscana in collaboration with the Istituto Centrale per il Restauro.
lime-based mortar and stone powder to prevent the liquid mortar from escaping. Some holes will be left to allow the positioning of needles or tubes to enable penetration of the mortar. At the end of the operation any leaks will be cleaned off with a damp sponge.

If the use of lime mortar alone is not sufficient, small detached fragments will be repositioned using epoxy resin, keeping the resin always below the level of the surface and covering it with a mortar-based sealant.

**CON2 – Consolidation of microflakes**

Microflakes will be re-attached by means of injections of aqueous colloidal silica underneath them. The injections will be followed by gentle pressure with a pad that pushes the microflakes into position. Any residual material will be gently removed from the surface using a damp sponge.

**CON3 - Surface consolidation**

By means of a close-up visual survey of the entire surface of the sculpted panels, it will be possible to identify areas that are crumbling and consolidate them rapidly using ethyl silicate. This treatment will be performed after trials to verify absorption. The product will then be applied locally in disaggregated areas by brush or manual spray at very low pressure. The amount applied will be dosed according to its absorption, and in any case saturation will not be reached, so that no traces of silicate remain on the surface.

**SEC – Anchorage of large fragments or rock bodies**

Whenever the size of a fragment or body of rock makes the use of epoxy resin alone insufficient, these will be attached securely to the rock face using steel or fibreglass rods 6 –14 mm in diameter depending on requirements. The holes will be made with a non-percussive rotary drill and will be given a downward slope. The rods will be glued with epoxy resin.

**CLE - Cleaning**

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22 Given the rock’s very porous nature and reduced compactness, it was considered unsuitable to use epoxy glue – which is normally used to fix surface flakes, as it is believed that this resin is too hard, rigid and subject to expansion caused by solar radiation. We therefore opted for consolidation using more compatible and above all much more porous materials.

23 Since consolidation treatment is only theoretically reversible, it must have the following properties: durability, compatibility with the surface to be consolidated, and applicability according to the principle of minimum intervention. Since consolidation treatments might lose their effectiveness over time, another fundamental requirement is the possibility of treating the area again.
Various cleaning operations are planned and will be carried out, where necessary, after pre-consolidation work.

**CLE1 – Brush cleaning**

Brushes with soft bristles will be used to eliminate loose surface deposits.

**CLE2 – Cleaning with water**

Water, with or without the addition of a surfactant, will be applied using a manual spray and brushes. Deionized water will be used if necessary.

**CLE3 – Paint graffiti**

These will be removed by applying paint stripper and using stiff brushes. Solvents such as acetone or nitromethane may also be used. Afterwards, the surface will be rinsed (with a solvent compatible with the composition of the paint stripper) to remove all traces of the product.

**CLE4 – Charcoal graffiti**

These will be removed mechanically using pencil erasers.

**CLE5 – Carbon particle deposits**

The thick deposits of carbon particles will be removed using ammonium carbonate compresses. The compound will be mixed with water in variable proportions, with the addition of a surfactant, and will be spread over a layer of acid-free paper that is in direct contact with the rock, mixed with cellulose pulp and/or sepiolite. Application times and ammonium carbonate concentration will depend on the thickness of the carbon deposit. Preliminary test areas will be treated; if necessary, the compress will be kept moist by covering with polythene film. After removal of the compress the surface will be rinsed with water using a manual spray. If the deposit is very thin, Wishab sponges will be used.

**POU1 – Removal of salts**

Where these are present, after brushing a soft brush, compresses of cellulose pulp previously mixed with deionized water will be applied. If necessary, compress drying will be delayed by covering with a layer of polythene film. The pack will be removed when the absorbent material is completely dry and detached from the rock surface. The number of packs needed will be determined
by measurement of the salt concentration using a portable conductivity meter. This will be followed by cleaning with a soft brush and rinsing with deionized distilled water using a manual spray.

**POU2 – Removal or thinning of carbonate concretions**

Compresses of ammonium carbonate mixed with water in variable proportions will be applied for variable times determined by preliminary trials. The considerable thickness of the encrustations in some points may also make it necessary to use mechanical cleaning methods (e.g. small chisels, scalpels, precision micro-sandblasters). In very limited amounts and at minimum thicknesses, cationic ion-exchange resins will be used. The properties of ion-exchange resins are based on their ability to exchange ions with the material to be removed so as to dissociate it in the area of contact with the stone surface.

**FIL1 – Treatment of cracks**

The monument features numerous cracks of various types, some thin and others quite wide. Some of these are also of structural significance.

On the basis of on-the-spot assessments of each situation we will proceed with consolidation in one of several different ways. Firstly the colour of the plaster will be decided; it will then be prepared using lime and powdered stone of a suitable colour after appropriate trials.

In the case of fine cracks, only sealing will be carried out. In the case of fissures of some width, the gap will be sealed with the mortar, with fine tubes inserted or holes made, through which fluid mortars will be injected. These may be based on hydraulic lime and sand or lime with a suitable consolidating mortar (Ledan); the tubes will subsequently be removed and the holes filled.

In the case of large fractures associated bodies at risk of falling, in addition to consolidation with fluid mortars, we will also perform pinning with stainless steel or fibreglass rods.

**FIL2 – Filling cavities**

Cavities that are particularly disfiguring or present in carved areas will be filled in to improve the appearance of the relief. For deeper plastering, a mortar of hydraulic lime and powdered stone in a 1:3 ratio will be used, together with a mortar of lime and powdered stone that corresponds to the surface with regard to grain-size and colour. The repair surface will be kept slightly below that of the original sculpture and will be preceded by plaster trials.

**REM – Removal of added plaster**
The plaster applied in the past to the second and third panels will be removed mechanically using chisels and scalpels.

**REC1 - Reconstructing missing parts of frames**

The frames that enclose the bas-reliefs serve to highlight the sculpted panels and to protect them from flowing rainwater. Reconstruction of the missing parts of the frames has the purpose of affording better protection to the reliefs from the running water that is the main cause of their erosion, the formation of large gaps, and the proliferation of microorganisms.

The missing portions of the panel frames will be rebuilt using a fibre-reinforced mortar of similar colour to the original. When the thickness is considerable, 10 mm stainless steel pins will be inserted every 15 cm; these will be joined together with basalt fibre in order to create a greater adhesion surface for the mortar.

The shape and finish of these functional reconstructions will be decided after appropriate trials and verification of effectiveness against runoff.

**REC2 – Reconstructing missing parts**

The reconstruction of missing panel parts will be preceded by a study of the fragments and their digital repositioning after comparison with photographs. The deeper part of the cavity in panel I will be filled with hydraulic-lime-based mortar. For the upper part, mortar made of slaked lime and sand of varying grain-size will be used; the original fragments will be fixed onto this, with the aid of epoxy resin and/or fibreglass pins where necessary.

**PRO – Protective treatment**

The application of a water-repellent protective coat on the whole surface of the bas-reliefs is considered risky, since they constitute the natural face of a rock located in the open, subject to rainfall and capillary phenomena originating in the rock itself. It is considered necessary that this interchange be maintained. We will therefore intervene only on the frames that protect the relief carvings from rainwater runoff. In this regard, trials will be performed and the effectiveness of the frame rebuilds will be verified.
The Khinis-Bavian reliefs

Introduction

The Khinis monumental complex, like that of Maltai, is associated with the great water-management network built by Sennacherib. It is located on a rock face on the right-hand side of the River Gomel, at the beginning of the canal dug by the Assyrian sovereign to redirect the river and use it to irrigate the land around Nineveh and take water to his capital city.

Fig. 32

Rediscovery of the reliefs

F. M. Fales, in “Khinis/Bavian: changing models for an Assyrian monumental complex” narrates the history of the rediscovery and study of the reliefs over the last two centuries.

The first complete description of the site was given by Austin Henry Layard, who visited it in 1853 and stated that it had been discovered by Simon Rouet, French consul in Mosul. The site was visited in 1898 by Eduard Sachau, a German orientalist, and later by Leonard King (1904), who–ten years later, in a letter dated February 1914, quoted in its entirety by Bachmann–sent all his notes to his German colleague Eduard Meyer. The Khinis site was also visited and studied by Bell (1909), the Wilgram brothers–who in 1914 published “The Cradle of Mankind; Life in Eastern Kurdistan”, Bachmann in 1914, Jacobsen and Lloyd in 1934, and David Oates in 1953.

It is most useful to compare the photographs furnished by King, Bell, Bachmann, and Jacobsen and Lloyd with the current state of the reliefs.

Description of the reliefs

The niches

Immediately after the quarry, to the south, there are twelve niches carved into the cliff face. They are numbered from 1 to 11 from south to north, i.e. starting from the site’s entrance according to King's numbering, as reported by Bachmann. The niches were probably carved from 11 to 1, following the expansion of the quarry. In 2012, a new niche was added to the group, situated however further south than no. 1. The existence of this niche, number 12, was discovered by Prof. Morandi Bonacossi 2018.
Daniele Morandi Bonacossi while working on the LoNAP project (Land of Nineveh Archaeological Project).

The only niches that can be observed at close range are nos. 12 and 1-5, since the others are not accessible due to their position on the higher part of the cliff. Therefore, in this project we propose the conservation treatment of the first six niches (niche 12 and niches 1-5), but we also describe the state of preservation of niches 6-11 assessed from photographs taken by Alberto Savioli with a DJI Phantom 4 Pro drone.

In the niches the sovereign Sennacherib is represented facing right in an attitude of veneration to the right of the king together with the gods’ astral symbols, positioned above, to the right of the king

Niches 4, 7 and 11 contain the so-called Bavian inscription that celebrates the canal’s construction and the sovereign's achievements in battle.

**The Great Relief**

The Great Relief is a large sculpted panel measuring circa 9 x 9 m. It portrays four standing figures, each about 6.5 m tall. On the left, facing to the right, is the sovereign Sennacherib, his right hand near his nose in the typical gesture of veneration and reverence for the god. His left hand holds a hammer, one of his royal attributes. To the right of Sennacherib, in a central position, there are two deities facing each other. On the left is Assur standing on a mushkushshu and a horned lion, his sacred animals. In his left hand he holds a ring and a rod, measuring tools and attributes of the constructor king, symbols of his royalty.

Facing Assur is his accompanying god Mullissu, standing on a lion with a palmette, symbol of fertility, in his left hand and his right hand raised. On the right of the relief, the series closes with a figure of the sovereign looking to the left.

On the upper part of the relief, which may be reached from the rocky plateau housing niches 4 and 5, there are the remains of two pairs of lions, together with postholes and a drainage channel, which Reade interprets as the remains of a pavilion held up by columns.

![Fig. 33](image1)

![Fig. 11](image2)

**The Horseman Relief**
On the same rock face, south of the Great Relief, there is the Horseman Relief, a sculpted panel measuring 6.7 x 4.2 m.

On two side podiums – or more probably what was once a step that ran along the base of the relief (and thus higher than the base itself) – there are traces of the representation of two Assyrian kings. Of the right figure remain a foot and a heel, as well as traces of clothing. A drawing by Bachmann shows traces of the back of the garment and the heel of a left-hand figure that is no longer present. On the upper left, two deities were shown on their sacred animals, probably part of a procession similar to that seen on the Maltai panels. Nothing now remains of these two sculpted figures due to collapse of the rock, but they are clearly visible in Bachmann's 1914 photographs.

In the central part of the relief, a rider is carved on a horse with raised front legs. Of this relief the rider's head and bust survive, as well as part of the head, neck and right front foot of the horse. The lower part of a back foot, a hoof and the tail are also preserved. In at least two points of the relief a spear is also visible. Several hypotheses have been put forward concerning the execution of this relief; these are summarized in “Gunduk, Khanes, Gaugamela, Gali Zardak – notes on Navkur and nearby rock cut sculptures in Kurdistan”. The most interesting, proposed by Reade, suggests the presence of an Assyrian relief with a procession of deities in the upper part of the panel, two figures of the sovereign at the ends and a large celebratory inscription in the centre. After Alexander the Great's victory at Gaugamela (probably modern Tell Gomel) in 331 BC, the inscription was substituted by the figure of a man on horseback (perhaps Alexander himself) to celebrate his victory over Darius III. In Parthian times the horseman was modified to give it a Parthian appearance.

Fig. 34
Tav. 12

The Monolith

This monumental carved stone monolith was placed at the head of the canal built by Sennacherib. In an unspecified period, this gigantic monument slipped, resting partially on its side; it broke in two pieces and was partly covered by the water of the River Gomel. Carved on the main, northern, side are three figures seen face on: the king, shown twice on either side of a pedestal, and the larger god Assur at the centre standing on animals, as may be seen in the photographs of Jacobsen and Lloyd. On the left corner there was a lamassu (a winged deity, protector of gates), and probably another on the right corner. The left-hand lamassu, of which there are traces of a wing

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33 Bachmann 1927, 20 Fig. 14.
34 Bachmann 1927, 20 Fig. 14 and pl 19-20.
35 Reade-Anderson 2013, 97-118.
36 Jacobsen-Lloyd 1935, pl. XXXIV/B.
on the monolith's east side, disappeared several decades ago. Together with the *lamassu*, the king's pedestal on the north side was also destroyed. It is possible that the *lamassu* was removed for sale on the clandestine antiquities market, but the rock may simply have broken, sending it down to the riverbed.

On the east side of the monolith there is an upper register with the ruler placed centrally, looking leftwards towards Assur, who stands on his two sacred animals. In his left hand the deity holds a ring and staff, traditional symbols of power. Of the figure of Mullissu, represented to the right of the king and now lost, remains part of the paw of the lion on which the deity stood in the left-hand piece of the monolith, and part of its two hind paws on the right-hand fragment. In the lower register, above the pedestal, on the far left there is the wing of the corner *lamassu* and a figure that probably represents a hero. On the right-hand piece of the monolith there is a trace of the wing of the lost *lamassu*, which is recorded in the photographs of King, Bell, Bachmann and Jacobsen and Lloyd.

**Fig. 34**

**Fig. 35**

**Tav. 13**

**Tav. 14**

**The Fountain with two rampant lions**

The fountain consists of a square tank accompanied by an ornate fountain with two rampant lions and a large central mask representing the head of a roaring lion from whose jaws water once gushed. The two lions, already heavily deteriorated in the 1935 photographs, are barely visible today.

**Fig. 37**

**Fig. 38**

**Sample collection and results of analyses**

As for the Maltai site, a number of samples were also taken at Khinis in order to perform analyses that will allow targeted conservation treatment, following the criterion of minimum intervention.

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In the pictures taken in the mid – 1930s by Jacobsen and Lloyd the *lamassu* is still present (Jacobsen-Lloyd 1935, pl. XXXIV).
The samples were analysed in the Laboratorio di Analisi dei Materiali Antichi – LAMA, directed by Prof. Fabrizio Antonelli (IUAV University, Venice), with consultancy by Prof. Lorenzo Lazzarini.

The results are summarized below; complete analysis reports are given in project Attachments 1 and 2.

**Mineralogical/petrographic and physical description**

Microscopic examination of a thin section of sample #KHINNIS16_9 showed that it consists of a microsparitic calcareous rock with high porosity, classifiable as a *mudstone*.

Subsequently, after carbonate determination in samples #KHINNIS16_9 e #KHINNIS16_6 the insoluble residue obtained was used to determine the clay fraction (particle size ≤ 4 μm). This was composed of phyllosilicates (clinochlore and swelling chlorite), and especially clay minerals (*montmorillonite*, *palygorskite*, *illite* and *kaolinite*) which, due to their structural characteristics, are able to absorb significant quantities of water and for this reason undergo repeated cycles of absorption-desiccation inside the stone.

Mercury porosimetry was used to quantify the amount of open pores, which is the cause of damage due to the crystallization of salts since it determines the circulation of liquids.

Sample #KHINNIS 16_9_3 had a high "Total Open Porosity" – from minimum 19.44% to maximum 20.92% – made up pores with an “average diameter” of c. 0.14 μm. Rocks with these porosity percentages are classified as "very porous" to "extremely porous".

As at Maltai, pores with diameters of less than 1 micron constitute the majority, with negative consequences due to the crystallization of water (frost weathering) and salts (salt weathering).

**Mineralogical, chemical and biological analyses of deterioration and products produced by biological deterioration present on samples**

List of samples analyzed with sample location:

**Fig. 39**

Niche 12

#K_N1-C1: organic deposit and substrate

**Fig. 40**

Niche 3


Fig. 41
Niche 4

- #K_N3-C1: movable fragments
- #K_N4-C11: detached fragments with biological colonization and white deposit
- #K_N4-C12: biological colonization

Fig. 42
Horseman

- #CAV_C3: fragments with white deposit
- #CAV_C4: fragments with biological colonization
- #CAV_C9: fragments with biological colonization and white deposit

Analyses conducted by LAMA on the biological colonies showed the presence of moss, cyanobacteria and various types of lichen (foliose, crustose and fruticose).

The percentage of soluble salts is low although not negligible, varying from 0.18% (sample #CAV_C9) to 2.06% (sample #K_N3-C1). These are mostly sulphates, with much smaller amounts (sometimes only traces) of chlorides and nitrates.

**Preservation state**

Determination of the state of preservation was carried out by means of a close visual analysis where the relief’s height above the ground made this possible. Where the reliefs could not be reached, a pair of binoculars and high-resolution photographic images were used. Hypotheses will therefore be subject to verification after scaffolding has been erected, with possible modifications as work proceeds.

For description of forms of alteration and deterioration, see: AA.VV. “Beni culturali – Materiali lapidei naturali ed artificiali. Descrizione della forma di alterazione – Termini e definizioni” [Cultural Heritage - Natural and artificial stone materials. Description of forms of alteration - Terms and definitions]. UNI 11182/2006

**General considerations**

The various types of deterioration found on the Maltai reliefs are also present at Khinis, where however there are fewer areas with alveolization, and the cavities are smaller. At Khinis instead
there are marked differences in deterioration, depending on the characteristics of the rock and atmospheric phenomena. This takes the form of horizontal grooves (Fig. 43) and the presence of harder nodules visible on surfaces after less resistant components have been removed by erosion. Although the place is very popular and a destination for trips, degradation caused by human activity is slightly lower than at Maltai, due to the presence of a guardian and the height of the reliefs above the ground. In the past, holes have been dug into the surface of the reliefs to search for hidden treasure in the rock, in accordance with a belief that was widespread in the populations of northern Iraq and eastern Turkey (niche 4), as well as rock-cut tombs (2nd-4th century AD), while the sculpted surface was frequently used as a target for shooting or throwing stones etc. (Fig. 44).

**Niche 12**
Dimensions: 1.5 x 2 m
Of niche 12 part of the frame remains, but none of the relief has been preserved. Little or nothing of the original surface seems to have survived; some traces are perhaps visible on the right side of the niche.

The entire rock surface is in an advanced state of deterioration, with deep flaking, and the upper and left sides of the frame are missing. The lower part of the niche is affected by a massive biological colonization, which in some parts forms crusts up to several millimetres thick. Part of the lower portion is undergoing conversion to travertine, and there is abundant plant growth due to the constant presence of water.

**Fig. 45**
**Tav. 15**
**Tav. 16**

**Niche 1**
Dimensions: c. 1.5 x 1.4 m
The high and low parts of the niche have been lost due to rockfalls. The left hand and arm, and part of the right arm of the sculpted deity survive, as well as astral symbols on the upper right. The remaining surface is characterized by pale drip-marks, carbonate incrustations and biological attack. There are also the usual cavities in the rock due to the karst phenomena characteristic of the whole area, and obvious flaking in the lower part, where some rock has been lost. The rock into which the upper part of the niche was carved is composed of many thin diagonal layers, and is fragile and prone to disintegration. Earthy deposits around the niche have allowed the growth of grass and small shrubs.
Niche 2
Dimensions: 1.6 x 2.2 m

Niche 2 is located high above the road, just below the modern fence that runs along the entire upper part of the cliff. Compared to Bachmann's photographs, the sovereign's face and his right hand are now missing. The niche is affected by carbonate incrustations and biological colonization and in some places plant growth has caused splintering of the rock. On the right of the relief small karst cavities are present, which however do not affect the sculpted part. A large crack runs across the upper part of the relief, together with other smaller cracks.

Niche 3
Dimensions: c. 2.9 x 2 m

Niche 3 is actually an unfinished carved panel. It is rectangular in shape, with a badly damaged frame. Measures need to be taken to ensure the safety of the upper frame and the part of the relief with the astral symbols, beneath which runs a large crack. On the surface there are inscribed and painted graffiti underneath the lower frame.

In the left-central portion of the panel part of a sculpted sovereign figure may be seen. The feet resting on a flat surface and the left hand holding a hammer remain. Just a trace of the rest of the figure survives.

It is believed that this panel may not have been finished because the surface on which the figure stands does not continue up to the frame on the right.

The panel has lost of stone fragments and flakes, especially in the lower part. Biological colonization is light but widespread.

Niche 4
Dimensions: 2.32 x 2.81 m

Niche 4 belongs to the groups of three niches with inscriptions (4, 7, 11).

In the central part of the niche a figure of the sovereign was sculpted, of which the lower part of the garment remains with his feet. Nothing else is left of the figure except for its outline. On either side of the figure there is a cuneiform inscription, the conditions of which – due to loss of material – appear worse than in Bachmann's photographic documentation. This is due both to natural deterioration and to acts of vandalism. In the central part a hole has been dug and bullet marks can be seen.

Flaking is present over entire surface of the niche and there is deterioration caused biological colonization in the niche intrados and on the outside.

The presence of the cuneiform inscription makes conservation operations even more delicate. The detachment of even a tiny sliver of rock might prejudice the reading of the cuneiform signs.

Fig. 49
Fig. 50
Tav. 23
Tav. 24

**Niche 5**

Dimensions: 1.77 x 2.45 m

In the fifth niche only the outline of the figure and its feet standing on a shelf remain. Little may be understood of these. A horizontal crack runs across the upper part of the niche. There is localized flaking and the entire surface is subject to biological colonization and carbonate concretions.

Part of the upper frame is missing and needs to be rebuilt.

Fig. 51
Tav. 25
Tav. 26

**Niche 6**

Dimensions: 1.5 x 2.2 m

Preservation state assessed from photographs.

On the right-hand exterior of the frame there is a large rock fragment that needs to be fixed, and in the lower part, other smaller pieces also require anchorage. A small portion of the frame should
be rebuilt in the vertical part at the top left. The surface exhibits deterioration due to flaking. Salts and white drip-marks may be seen in the upper part under the frame. There is vegetation at the base of the niche.

Fig. 52
Tav. 27
Tav. 28

Niche 7

Dimensions: 1.98 x 2.31 m
Preservation state assessed from photographs.

Niche 7 is crossed horizontally by a deep fissure, along the sides of which the relief requires consolidation, anchorage and plastering. Some parts of the frame need to be fixed and its missing parts should be rebuilt to protect the relief from rainwater runoff. There is plant growth and biological colonization. Flaking is mainly located on the figure of the sovereign and in the upper right half of the niche.

Fig. 53D
Tav. 29
Tav. 30

Niche 8

Dimensions: 1.73 x 2.15 m
Preservation state assessed from photographs.

Comparison with Bachmann's photograph reveals that a considerable amount of the carved surface has been lost in the interim. The hammer's head and all the lower part of the figure of Sennacherib down to (but excluding) the feet are no longer present.

There are some signs attributable to gunshots, such as the large hole in the centre of where the garment once was, which may have been caused by a large calibre projectile.

In the upper part of the niche there are carbonate incrustations, and flaking is spread over the entire surface. The exterior and some parts of the niche intrados are covered by biological colonies. Some parts of the frame need to be anchored and other absent parts need to be rebuilt.

Fig. 54D
Tav. 31
Tav. 32

Bachmann 1927, pl. 21.
Niche 9
Dimensions: 1.4 x 2.06 m
Preservation state assessed from photographs.

The frame of the niche requires anchoring in some places, and some small parts need to be rebuilt. Numerous bullet impacts are visible. There is partial alveolization and flaking that affects the whole surface. The upper part of the niche appears to have been damaged by biological colonization, carbonate incrustations and the crystallization of salts.

Fig. 55D
Tav. 33
Tav. 34

Niche 10
Dimensions: 1.62 x 2.11 m
Preservation state assessed from photographs.

A few parts of the frame and the external part of the niche probably require anchoring. The reconstruction of some parts on the right-hand side should also be considered.

The surface of this niche is strongly eroded, a phenomenon not seen in the others. This might be due to the fact that the niche seems to have been cut from further into the cliff, and is perhaps made from a layer of rock more susceptible to atmospheric agents such as rain and wind. In the central part of the relief there are widespread microkarst cavities.

The niche suffers from deterioration due to flaking, but the extent is difficult to judge from photographs. The upper part of the niche under the frame shows biological deterioration and carbonate incrustations.

Fig. 56D
Tav. 35
Tav. 36

Niche 11
Dimensions: 2.25 x 2.48 m
Preservation state assessed from photographs.

Like the previous one, this niche is also in a poor state of preservation that is difficult to evaluate from photographs. The surface, especially that of the sovereign figure, is particularly rough, perhaps covered with thick incrustations. Large amounts of stone have been lost from the
upper part. Unquantifiable flaking is present. Parts of the frame are missing and require reconstruction.

**The Great Relief**

The relief was damaged by the construction of four tombs in the Early Christian era; only the second figure from the left, that of Assur, was left untouched.

The relief exhibits strong differential deterioration, with large horizontal bands that follow the layering of the rock.

Widespread degradation has contributed to considerable loss of the sculpted surface. Some columns of the triple entrances to the two largest tombs have been lost; unsupported arches may need to be made secure. There is also a marked biological colonization and plant growth in the fissures between rock strata and at the base of the relief. Some points inside the panel, on the frame and outside it need to anchored because of the risk of falling. Besides their importance as components of the relief, they also constitute potential risks for visitors.

Some parts of the frame, such as the upper left corner and the portion between the two groups of lions, need to be rebuilt so as to restore the frame's protective function against rainwater.

**The Horseman Relief**

The relief is in an advanced state of deterioration. It has undergone marked differential erosion, characterized by numerous deep horizontal grooves and the appearance of "nodules" that are components of the rock itself, and a considerable loss of sculpted material. On the right and left of the horseman, rock-cut tombs were dug in the 2nd - 4th century AD.

Sizeable rock falls have occurred from within the panel. A small relief depicting a procession of deities standing on their respective sacred animals that was present on the upper part collapsed during the second half of the 20th century along with a considerable volume of stone. Other parts which are essential for understanding the relief – such as the horse's neck and the rider's body – are seriously deteriorated and at great risk of falling.

A large bush has taken root in the crack that runs through the upper part of the relief and needs to be removed. In several places outside the frame there is also plant growth that should be eliminated.
Biological colonies are present above all on the left-hand and upper parts, with traces also in the central portion.

The entire surface is threatened by flaking and exfoliation.

**Tav. 40**

**The Monolith**

This extraordinary monument is surrounded by water and vegetation, making it difficult to study closely. The relief on the north face of the monolith is partially submerged in water. Both the part above and that under water exhibit widespread biological deterioration. On the exposed part alveolization and carbonate incrustations are present.

The eastern and southern sides are affected by widespread small and large-scale cracks. The horizontal surface presents microkarst erosion and is quite smooth, and damaged by scratches and abrasions caused by people walking and sitting on it. Flaking has resulted in the loss of portions of the worked surface.

We propose to intervene on this monument only on the parts that require urgent treatment, such as flake attachment or consolidation and elimination of the biological colonies on the subaerial part. The removal of all the vegetation surrounding the rock should enable assessment of the preservation states of the south and west sides.

After the (currently only hoped-for) operation to relocate the monolith on dry land in its original vertical position has been planned, a close-up assessment of its state of preservation will be made and a specific conservation project drafted for the monolith, also with regard to its mechanical stabilization.

**Tav. 41**

**Tav. 42**

**The Fountain with two rampant lions**

The fountain is in a state of severe deterioration. The lions from which it takes its name are today little more than traces on the rock, which is colonized by microorganisms, overgrown with plants and also affected by severe flaking and exfoliation. The preliminary pre-consolidation of flakes and micro-flakes is recommended.

**Tav. 43**

**Causes of deterioration**
The main causes of deterioration of the Khinis rock relief complex can be ascribed, as in the case of Maltai, to both human action and natural processes. The site's position, with the presence of the river and vegetation, makes it very popular for local tourism, especially on holidays. Despite the presence of a guardian, it is not unusual to see people climbing onto the more accessible reliefs, or find painted graffiti, the remains of bonfires, broken glass that scratches the horizontal surfaces and signs of bullet impacts. (Fig. 58)

With regard to natural causes, the outdoor exposure of these monuments (as for those at Maltai), which are subject to changes in temperature and humidity as well as rainwater in the autumn and winter and groundwater – present at Khinis even in the warmer seasons – is responsible for accentuated biologically determined deterioration. This, together with chemical and chemical-physical factors (disintegration, exfoliation, flaking, concretions, alveolization, chromatic alteration), has led to the reliefs' current precariously deteriorated state.

Wind also contributes to differential deterioration – particularly significant on the Great Relief and the Horseman – and surface erosion, as may be clearly seen in niche 10.

Conservation treatment

For the recommended conservation treatment, please refer to the list of descriptions given above, at the end of the section on the Maltai reliefs (pp. Xxxx).

Conclusions

The current highly precarious preservation state of the reliefs under study makes it essential that action be taken with the utmost urgency. However, conservation treatment is not sufficient to guarantee a future for these extraordinary works of art. As noted above, on both sites vandalistic and intentionally destructive human activity occurs with increasing frequency. This cause of deterioration could easily be avoided by means of control over the monumental areas by the local authorities – especially in the case of the Maltai reliefs, which, unlike those of Khinis, are not protected by any type of guardian service.

The question of deterioration provoked unintentionally by human actions is a more delicate matter. There are two different aspects. On one hand awareness that certain actions can cause damage to monuments: for example that a bottle broken on the reliefs can irremediably scratch the stone surface, or that climbing on reliefs can cause parts of them to become detached. On the other hand, it should be stressed that many inhabitants of the region are not aware that these monuments are a shared heritage and as such should be treated with respect and handed down to future generations.
This aspect of protection requires an initiative regarding education, especially that of the younger generation, with a programme to raise awareness of local cultural heritage. Long-term public instruction of this sort is the only type of intervention able to guarantee lasting benefits for the preservation of the Khinis and Maltai monumental complexes. The principles of protection, conservation, respect and responsible enjoyment of the cultural heritage are based on the awareness that they are unique, original and irreplaceable.

As well as damage caused by human agency, there is marked deterioration due to natural processes. The reliefs' outdoor location and their particular location on the rock faces of the Maltai and Khinis mountains makes it difficult to apply the notion of preventive conservation, i.e. "the removal or transferral of the causes of possible damage to the cultural heritage in the environment in which they are located [...]" as is done for works of art kept in closed and controllable environments, such as museums. It is clearly not possible to control variation in temperature, relative humidity, and atmospheric phenomena such as wind, rain and solar radiation on the sculpted surfaces, although these are the elements largely responsible for the marked deterioration affecting the reliefs. The stabilization of their current state of preservation through the conservation work described above and their inclusion in an extensive archaeological park project, and thus enclosed in a constantly protected and controlled area, are essential conditions for the rock reliefs' survival. Conservation operations would also allow local personnel to be trained, who would subsequently be able to monitor the preservation state of the reliefs over time. This monitoring, performed by means of close visual examination of the remains (where feasible) and photographic documentation with high-resolution images, would make it possible to review the conservation treatment applied (effectiveness of the materials and application techniques used, treatment duration). Moreover, the constant monitoring of the reliefs would guarantee the drafting of a maintenance program to be implemented periodically. In this way, the results obtained from the conservation interventions would be prolonged over time and the occurrence of new deterioration phenomena limited.

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44 Laurenti 2013, 21


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Captions

Fig. 1. Jebel Zawiyah

Fig. 2. View of the town from the plateau in front of the carvings

Fig. 3. Maltai. Panel I

Fig. 4. Maltai. Panel II

Fig. 5. Maltai. Panel III

Fig. 6. Maltai. Panel IV

Fig. 7. Relaxing beneath Panel II

Fig. 8. Remains of a bonfire between panels I and II

Fig. 9. Panel I samples

Fig. 10. Panel II samples

Fig. 11. Panel IV samples

Fig. 12. Alveolization (Panel III)

Fig. 13. Past plaster repairs (Panel III)

Fig. 14. Biological colonization (Panel II)

Fig. 15. Carbon particles (between panels I and II)

Fig. 16. Paint marks (Panel I)

Fig. 17. Flaking and exfoliation on the surface of the carvings

Fig. 18. Flaking and exfoliation on the surface of the carvings

Fig. 19. Microkarst cavities (Panel II)

Fig. 20. Hole dug in Panel I in February 2018

Fig. 21. Discovery of the fragments at the base of the carving

Fig. 22. Sennacherib’s hand from the left side of Panel I found among the other fragments
Fig. 23. Searching for the hand’s original position
Fig. 24. Flake with endolithic cyanobacteria (Panel I)
Fig. 25. Flag painted in 2016 below Panel II
Fig. 26. Man-made abrasions on Panel II
Fig. 27. Microkarst phenomena on Panel II
Fig. 28. Man-made cavity at the base of Panel III
Fig. 29. Flag painted in 2016 on Panel III
Fig. 30. Sennacherib’s tiara on the left side of Panel IV before the 2017 damage
Fig. 31. The tiara after the hole made in 2017
Fig. 32. View of Khinis showing positions of the monuments. Nos. 12 and 1 – 11: niches. RR: Horseman Relief. LG: Great Relief. SM: Monolith. (photo A. Savioli)
Fig. 33. Great Relief (photo A. Savioli)
Fig. 34. Horseman Relief (photo A. Savioli)
Fig. 35. North side of the Monolith
Fig. 36. The Monolith from above (photo A. Savioli)
Fig. 37. Lion Fountain
Fig. 38. Lion Fountain, detail
Fig. 39. Niche 12 samples
Fig. 40. Niche 3 samples
Fig. 41. Niche 4 samples
Fig. 42. Horseman samples
Fig. 43. Differential deterioration on the Great Relief
Fig. 44. Bullet marks (Niche 4)
Fig. 45. Niche 12
Fig. 46. Niche 1
Fig. 47. Niche 2 (photo A. Savioli)
Fig. 48. Niche 3
Fig. 49. Niche 4
Fig. 50. Niche 4, detail of inscription
Fig. 51. Niche 5
Fig. 52. Niche 6
Fig. 53. Niche 7 (photo A. Savioli)
Fig. 54. Niche 8 (photo A. Savioli)
Fig. 55. Niche 9 (photo A. Savioli)
Fig. 56. Niche a 10 (photo A. Savioli)
Fig. 57. Niche 11 (photo A. Savioli)
Fig. 58. Bullet marks (Niche 9) (photo LoNAP)

Illustration captions
Tav. 1. Panel I - drawing
Tav. 2. Panel II - drawing
Tav. 3. Panel III - drawing
Tav. 4. Panel IV - drawing
Tav. 5. Digital repositioning of several fragments from panel I
Tav. 6. Reconstruction of the figures missing from panel III
Tav. 7. Panel I – deterioration types and specific interventions
Tav. 8. Panel II – deterioration types and specific interventions
Tav. 9. Panel III – deterioration types and specific interventions
Tav. 10. Panel IV – deterioration types and specific interventions
Tav. 11. Great Relief – drawing
Tav. 12. Horseman – drawing
Tav. 13. Monolith – drawing of north side
Tav. 14. Monolith – drawing of east side
Tav. 15. Niche 12 – drawing
Tav. 16. Niche 12 - deterioration types and specific interventions
Tav. 17. Niche 1 – drawing
Tav. 18. Niche 1 - deterioration types and specific interventions
Tav. 19. Niche 2 – drawing
Tav. 20. Niche 2 - deterioration types and specific interventions
Tav. 21. Niche 3 – drawing
Tav. 22. Niche 3 - deterioration types and specific interventions
Tav. 23. Niche 4 – drawing
Tav. 24. Niche 4 - deterioration types and specific interventions
Tav. 25. Niche 5 – drawing
Tav. 26. Niche 5 - deterioration types and specific interventions
Tav. 27. Niche 6 – drawing
Tav. 28. Niche 6 - deterioration types and specific interventions
Tav. 29. Niche 7 – drawing
Tav. 30. Niche 7 - deterioration types and specific interventions
Tav. 31. Niche 8 – drawing
Tav. 32. Niche 8 - deterioration types and specific interventions
Tav. 33. Niche 9 – drawing
Tav. 34. Niche 9 - deterioration types and specific interventions
Tav. 35. Niche 10 – drawing
Tav. 36. Niche 10 - deterioration types and specific interventions
Tav. 37. Niche 11 – drawing
Tav. 38. Niche 11 - deterioration types and specific interventions
Tav. 39. Great Relief - deterioration types and specific interventions
Tav. 40. Horseman - deterioration types and specific interventions
Tav. 41. Monolith: north side - deterioration types and specific interventions
Tav. 42. Monolith: east side - deterioration types and specific interventions
Tav. 43. Fountain with lions - deterioration types and specific interventions