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This volume presents the results of the Marmora Phrygiae Project, financed by the Italian Ministry of Education, University and Research (MIUR - Ministero dell'Istruzione, dell'Università e della Ricerca) as part of the "Futuro in Ricerca" programme (FIRB 2012). In the period 2013-2016, following a multidisciplinary approach, the project sought to reconstruct the building stone procurement strategies adopted in the city of Hierapolis in Phrygia (Turkey), across a broad chronological time span from the Hellenistic epoch to the Byzantine period. Extensive knowledge of the territory surrounding the city and detailed research into its monuments provided the basis for a painstaking historical reconstruction. The volume describes the economic, social, technological and legal aspects of the use of marble and presents the results of the archaeometric investigations that were conducted in order to characterise the building stones, determine their provenance and assess the state of conservation of the monuments. In addition, the volume illustrates recent research conducted by teams of various nationalities into the marble quarrying districts and monumental complexes of the main settlements of south-western Asia Minor in the Imperial and Byzantine epochs.

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ANCIENT QUARRIES AND BUILDING SITES IN ASIA MINOR
Research on Hierapolis in Phrygia and other cities in south-western Anatolia:
archaeology, archaeometry, conservation



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E S T R A T T O



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THE USE OF COLOURING ON THE STATUES OF HIERAPOLIS

Susanna Bracci, Marco Galli

ABSTRACT - The paper presents the main results of the research into the ancient use of colouring on marble statues in Hierapolis, which integrates the art-historical approach and the archaeometric investigations. The items discussed in the paper are the reliefs and decorative statuary of the Severan Theatre, and materials from the North Agora. Egyptian blue, red and yellow ochre were detected, together with traces of ancient treatments. Some new data on the ancient restorations of the statues of the larger-than-life statues of Demeter and Kore-Persephone, which underwent an interesting “updating” process, are also presented.

KEYWORDS: sculptures, ancient colours, ancient treatments, technical solutions, archaeometry, Hierapolis.

Introduction

As part of the *Marmora Phrygiae* Project, one specific line of research looked at the sculptural material. Indeed, the 2014 and 2015 campaigns¹ saw the start of a series of investigations of the sculptural finds with a view to assessing the presence of traces of the original colouring, as well as any ancient patinas and treatments. These investigations were accompanied by systematic sampling of the marbles². The items examined are the reliefs and decorative statuary of the Severan Theatre, and materials from the Sanctuary of Apollo and the North Agora.

The investigations of the ancient colouring initially concentrated on the Theatre. Close observation of the sculptures and reliefs of the podia visible in situ and in the Archaeological Museum of Hierapolis-Pamukkale enabled preliminary identification of the sectors that appeared most affected by the ancient treatments. On the most promising areas, special photographic techniques were performed. Specifically, Ultraviolet fluorescence images (UVf)³ were acquired in order to detect and map traces of organic materials. The other photographic technique applied was Visible Induced Luminescence (VIL) to detect traces of Egyptian blue⁴.

It should be pointed out that although the two photographic techniques employed are widely used, in Hierapolis the fact that the images were acquired directly in situ, in the Theatre and the Museum, gave rise to certain difficulties. In the first case, working at night was not allowed and sunlight was a near-constant problem. In the case of the Museum, the analyses were conducted during opening hours, in the presence of artificial light and tourists. In some specific cases, microsamples were taken for laboratory analyses such as X-Ray Diffraction (XRD) and mid-Infrared Spectroscopy (FT-IR) to study the patinas. For the traces of colouring, due to the small amount of material sampled, only Scanning Electron Microscopy, coupled with elemental analysis (SEM-EDS), was performed. In one specific case, High Performance Liquid Chromatography (HPLC-DAD) was applied.

Regarding the reliefs of the podia (figurative panels and upper mouldings), the search for traces of the original colouring proved fruitless. However, the research did produce significant results regarding the statues belonging to the decoration of the *frons scaenae*, particularly the two statues currently restored to their original position in the aediculae flanking the *Porta Regia*⁵.

S.B.

Examination of the traces of colouring

The sculpture occupying the aedicula to the south of the *Porta Regia* is a larger-than-life representation of a standing female figure, conserved intact except for the arms and

¹ In addition to the authors, the activities were conducted by Emma Cantisani, Cristiano Riminesi and Silvia Vettori.

² See ISMAELLI, SCARDOZZI, SOBRÀ in this volume (305-328).

³ VERRI *ET ALII* 2008; WARDA *ET ALII* 2011.

⁴ ACCORSI *ET ALII* 2009.

⁵ On the reliefs of the podia, see D'ANDRIA, RITTI 1985. On the sculptures of the *frons scaenae*, see BEJOR 1991; GALLI 2016.



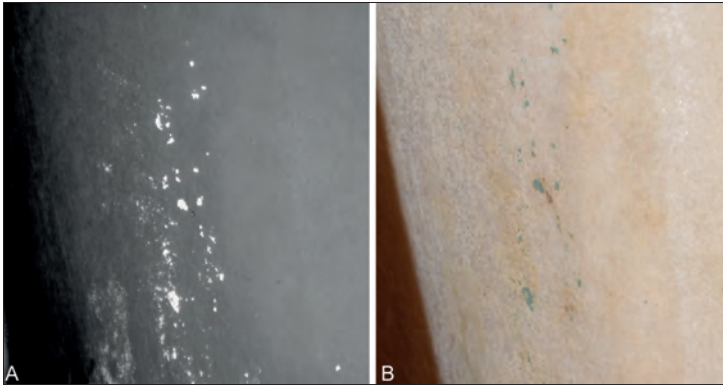
1. - Theatre, statue of Demeter displayed on the podium south of the Porta Regia; the arrow indicates the traces of colour.



2. - Theatre, statue of Kore-Persephone displayed on the podium north of the Porta Regia (nos. 1-5: traces of colour).

the head (Fig. 1). Comparison with two other specimens from Miletos and Aphrodisias makes it possible to recognise in the statue from the Theatre an early-Imperial copy of a famous Hellenistic original⁶. Specifically, the formal structure, volumes and treatment of the clothing show that the prototype for the statue from Hierapolis was a sculpture made in Pergamon in the first half of the 2nd century BC. The contrast between the heavy chiton and the skilfully rendered transparency of the himation, and the abstract rendering of the volumes of the body, are associated with this period. The presence of this sculptural type among the funerary stelai of the so-called “priestess of Demeter” in Smyrna demonstrates that the prototype must be a famous cult statue of the goddess.

⁶ BEJOR 1991, 26-27, no. 1, pl. 17. For a study of the copies and the identification of the original, see GALLI 2016.



3. - Statue of Demeter, A: VIL image of the lateral side with traces of Egyptian blue; B: VIS image of the same area.

The second female statue (Fig. 2)⁷, occupying the aedicula to the north of the Porta Regia, is a young woman wearing a chiton fastened below the breast, a broad cloak and another smaller fringed cloak that covers the head, leaving the face and long hair uncovered. The specimen is precisely carved in every detail (even the back, completely finished) and shows extraordinary skill in execution. It has also been carefully polished in order to remove all trace of having been carved with a toothed chisel.

The statue has been recognised as a copy of the type referred to as “Fortuna Braccio Nuovo”, a creation of the second half of the 4th century BC that was particularly popular in the Imperial period. Compared to most of the conserved exemplars, which often show a Fortuna with a cornucopia and a helm, the Hierapolis statue is characterised by a series of original iconographic attributes: the right arm

in the gesture of anakalypsis, the presence of the torch in the left hand, the veil with a fringe and the characteristic woollen infulae that decorate the head. The analysis of the late-Classical prototype and these significant attributes make it possible to recognise the Hierapolis statue as the image of a Kore-Persephone created in the Hadrianic period⁸.

M.G.

⁷ BEJOR 1991, 24-25, no. 13, pl. 15; study and identification of the original in GALLI 2016.

⁸ The closest comparison is the so-called Ceres, discovered in the 16th century in Villa Adriana and today on display in the Palazzo del Quirinale in Rome; see GALLI 2016.

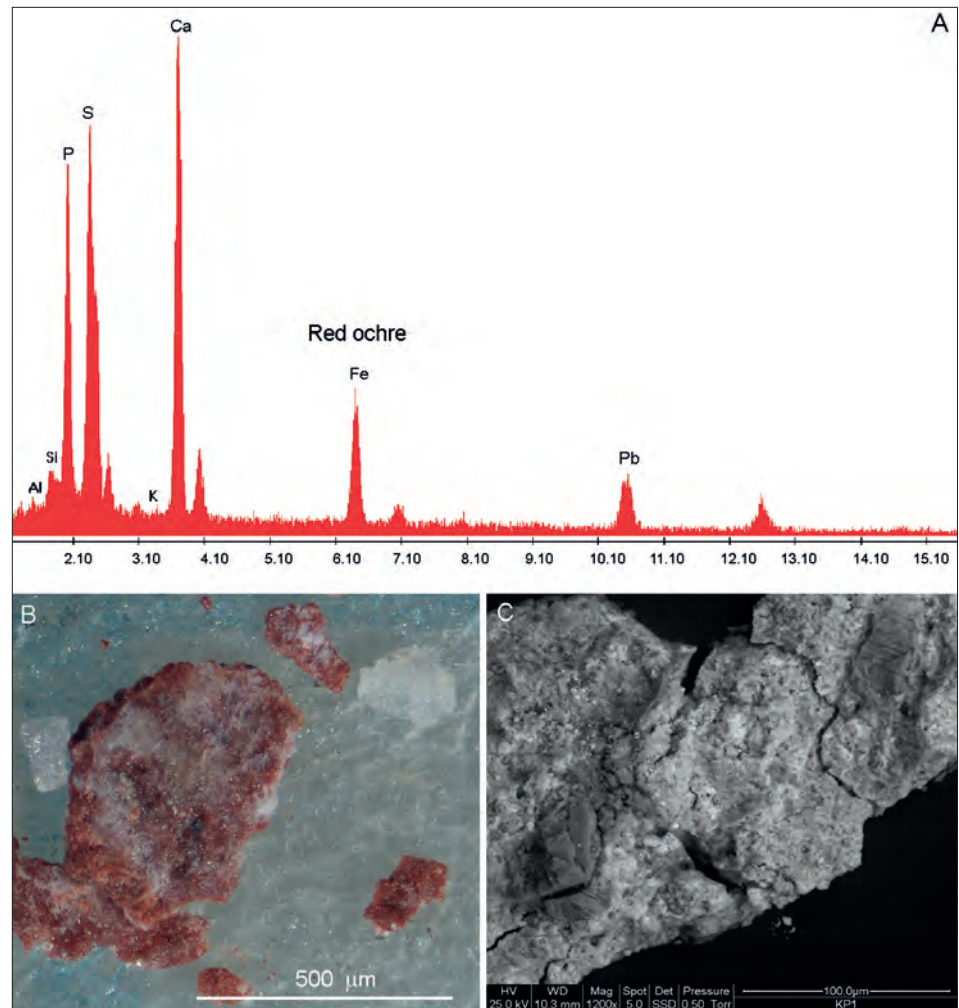
⁹ Despite the careful observation and the VIL imaging performed on other parts of the surface, no other traces of this colouring emerged. However, it should be remembered that the statue has been exposed to the elements since the moment of its discovery.



4. - Statue of Kore, traces of red ochre along the edges of the chiton and himation.

It was possible to document traces of the original colouring in both statues. In the statue of Demeter (Fig. 1), they were found on the left side of the figure, particularly in the sector of the himation, which hangs down the back behind the left shoulder. In the deep fold of the garment that was originally covered by the left arm, at the height of the left hip, the VIL identified substantial traces of Egyptian blue⁹ (Fig. 3). It is thus plausible that the rich himation was originally blue, thereby emphasising the contrast with the clothing beneath it.

In the statue of Kore (Fig. 2), direct observation of the surfaces made it possible to recognise traces of the original colouring of the clothing in various points. On the



5. - Statue of Kore, SEM spectrum (A) and images of the microsample of red ochre under the microscope (B) and SEM in back scattered electrons mode (C).

himation, they were identified along the lower edge of the triangular sector on the left hip (Figs. 2, 4, nos. 1-2) and along the lower right edge (Figs. 2, 4, no. 3); on the chiton underneath it, they were found inside the folds near the feet (Figs. 2, 4 nos. 4-5). The SEM analyses of micro-samples made it possible to identify the pigment as red ochre (Fig. 5). Given that all the traces were found along the lower edges, it may be imagined that both the chiton and the himation had a coloured hem. Other traces of colouring were identified by naked-eye examination of the locks of the hair that emerge from the veil. The UVf images of the piece ruled out the presence of organic materials, thus also confirming the use of yellow ochre, which was further confirmed on another sculpture from the Severan *frons scaenae*, the statue of Hades on his throne, in which ochre was found on the face (Fig. 6)¹⁰.

S.B.

The study of materials used in the sculptural decoration of the Severan *frons scaenae* included two fragmentary specimens conserved in the Archaeological Museum of Hierapolis, of considerable importance. Although it was not possible for organisational reasons to perform archaeometric analyses on these pieces, their good conservation made it possible to clearly identify extensive traces of original colouring.

The first piece (inv. T77.10-E558) consists of the top part of a female head (Fig. 21), with the remains of broad sinuous locks parted in the centre, which are skilfully

¹⁰ H. 1.49 m. BEJOR 1991, 3-6, no. 1, pls. 2-3.



6. - Statue of Hades from the Theatre with traces of red pigment on face, beard and hair.

carved with a very fine pointed chisel¹¹. The figure wears a high semicircular diadem (h. 11 cm), decorated with a six-pointed star in the centre and a series of plant motifs along the jutting edge. Traces of yellow pigment, perhaps ochre, can be recognised on the grooves between the locks, while there is a clear pink band, 1 cm wide, running along the upper edge of the diadem above the star.

The second piece (inv. H.66 T5.33-E527), in a better state of conservation (Fig. 7)¹², reproduces a female head, with hair parted in the centre and sinuous locks that are not carved in great detail. The carving of the hair and the eyelids is associated with the middle decades of the 1st century AD¹³. The figure wears a high diadem, the attribute of female divinities and Empresses¹⁴, consisting of two semicircular bands (upper band h. 5 cm, lower band h. 2 cm) decorated with three simple discs in relief, the central one being 3 cm in diameter, and the lateral ones 2.6 cm. A veil hangs down the back of the head, leaving the neck bare. The posterior part of the veil has several folds roughly carved with a point chisel; only the front fold is finely carved. The surfaces of the discs and the lower edge of the diadem were plausibly painted in red ochre (Fig. 8). On the face, the eyelids, nostrils and lips (which were probably

open, consistent with late-Classical models) appear to be painted in the same colour.

Of particular interest are the data from the investigation of the statue of the so-called Attis (Fig. 9), which more plausibly represents the personification of the Phrygian ethnos, dated to the early Severan period¹⁵. The sculpture represents a standing female figure, of robust build, wearing a long cloak fastened on the right shoulder, a heavy sleeved garment with an apotygmata, and a typical Phrygian cap. On the locks that hang on both sides of the neck, abundant traces of yellow pigment are clearly visible (Fig. 10). The same colouring is also visible on a band about 2 cm wide running along the right and left edges of the cloak (Fig. 11). In the UVf images, this yellow band is not fluorescent, ruling out the presence of organic material. Rather, the UVf images indicate the presence of inorganic material. No traces of gilt were found on the band and the SEM analysis of a micro-sample identifies the pigment as yellow ochre. Again thanks to the UVf images, substantial traces of pink colouring were found on both sides of the cloak (Fig. 12). The HPLC-DAD analyses of a micro-sample made it possible to identify the use of madder lake.

M.G.

Examination of the traces of ancient surface treatments

The UVf images and the subsequent micro-sampling of the surfaces of the sculptures and reliefs made it possible to identify residues of treatments performed in Antiquity. In the case of the Theatre, of particular interest are the results obtained for the surfaces of the reliefs on the frieze of the podia. Specifically, the UVf images showed traces of fluorescence on the palmettes of the crowning block of the frieze of the south versura (Fig. 13) and on the reliefs (Fig. 14) of a procession (panel ArIVe), specifically on a large part of the chiton of the female figure holding a garland. Similar traces were

¹¹ H. 20 cm; w. 27.5 cm; th. 22 cm. BEJOR 1991, 24, no. 13, pl. 16, 1-2.

¹² H. 33 cm, w. 25.5 cm; th. about 33 cm. BEJOR 1991, 26, no. 14, pl. 16, 3. The left earlobe has a hole, probably for the insertion of metal jewellery.

¹³ For a comparison, see SINN 2011a.

¹⁴ ALEXANDRIDIS 2004, 49-50; SINN 2011b.

¹⁵ PELLINO 2011.



7. - Female head from the Theatre.



8. - Female head from the Theatre, traces of red pigment.

also identified on the personification of a river (Fig. 15) on the north side of the first podium from the north (panel ApVb)¹⁶.

In the case of the sculpture of Demeter from the Theatre, UVf analyses identified the remains of a patina on the garment near the left breast (Fig. 16). The treatments are not evenly distributed but are present only in some areas. However, since these traces are found on surfaces exposed due to breakages (see the left arm) it is clear that the materials were applied after the breakage and these treatments cannot therefore be considered original. In addition to the presence of traces of calcite from the stone, the FT-IR analyses performed in transmission mode on micro-samples highlighted the almost exclusive presence of calcium oxalate in the form of weddellite ($\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$), to-

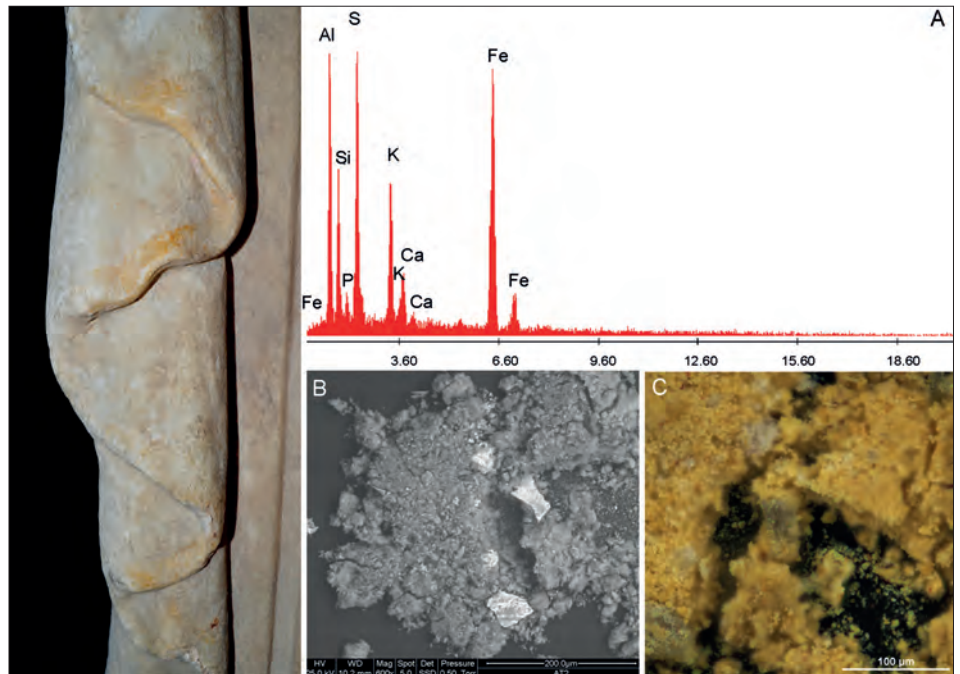
¹⁶ On these panels, see D'ANDRIA, RITTI 1985.



9. - Statue of the Phrygian ethnarch from the North Agora (photo M.A. Döğenci).



10. - Statue of the Phrygian ethnarch, details of the yellow ochre on the hair (photo MAIER Archive).



11. - Statue of the Phrygian ethnarch, SEM spectrum (A) of the microsample of yellow ochre and images of SEM in backscattered electrons mode (B) and under the microscope (C).

gether with traces of nitrates. The absence (or rather the unsuccessful detection) of organic material and the high quantity of oxalate suggest that the treatments were not performed in the recent past, since the organic component has mostly or entirely decomposed, with the formation of oxalate. Although it was not possible to conduct deeper analyses, traces of clearly ancient treatments were also found on the head of Hades on his throne (Fig. 17) and on the footwear of Apollo Kareios¹⁷.

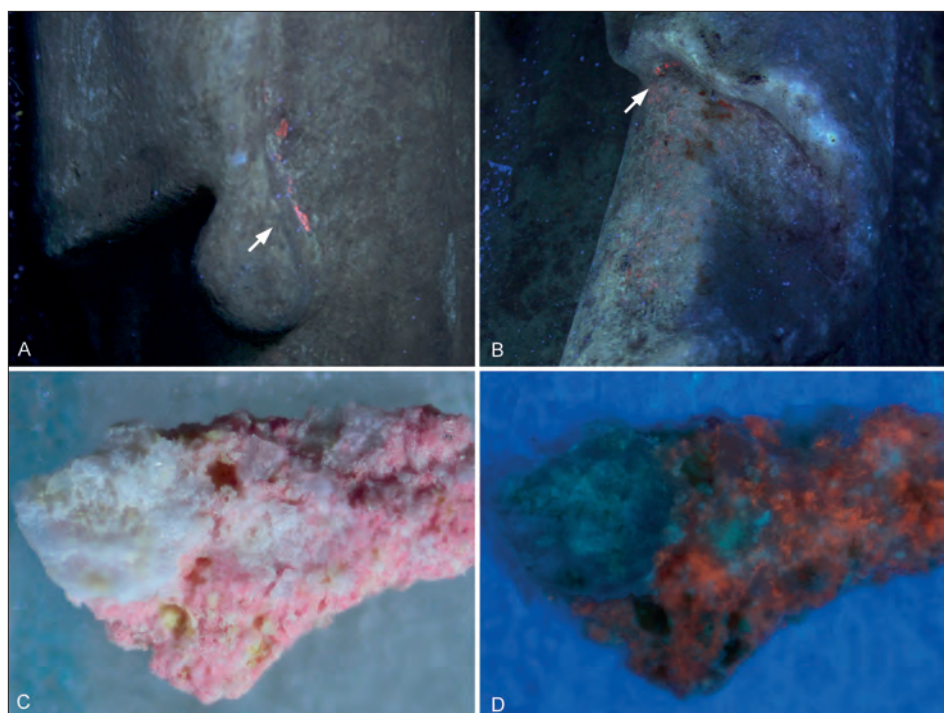
These results suggest the treatment of the marble surfaces with organic mixtures, which can plausibly be linked to ancient measures designed to protect and conserve the reliefs and statues of the Theatre.

S.B.

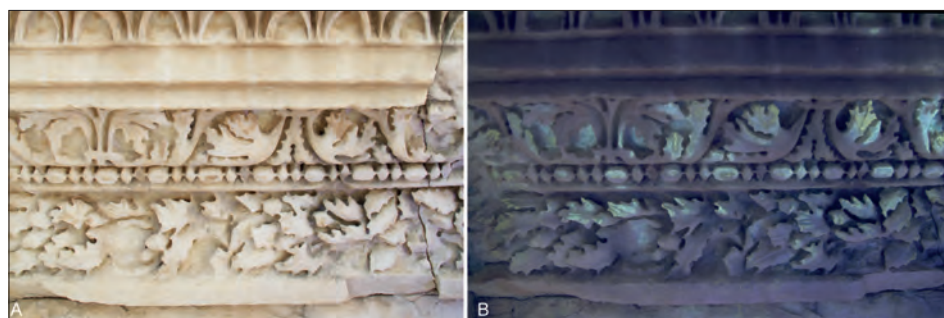
Examination of the technological aspects

The investigation of the technological aspects of the artefacts focused on the two statues and the two female heads from the Severan scaenae frons of the Theatre. Regarding the sculpture of Demeter (Fig. 1), the following restoration operations performed

¹⁷ H. 1.33 m. BEJOR 1991, 8-10, no. 3, pl. 5.



12. - Statue of the Phrygian ethnoid, A-B: UV fluorescence images of two areas of the mantle with traces of organic matter; C-D microsample of the pink material in the VIS and UVf images.



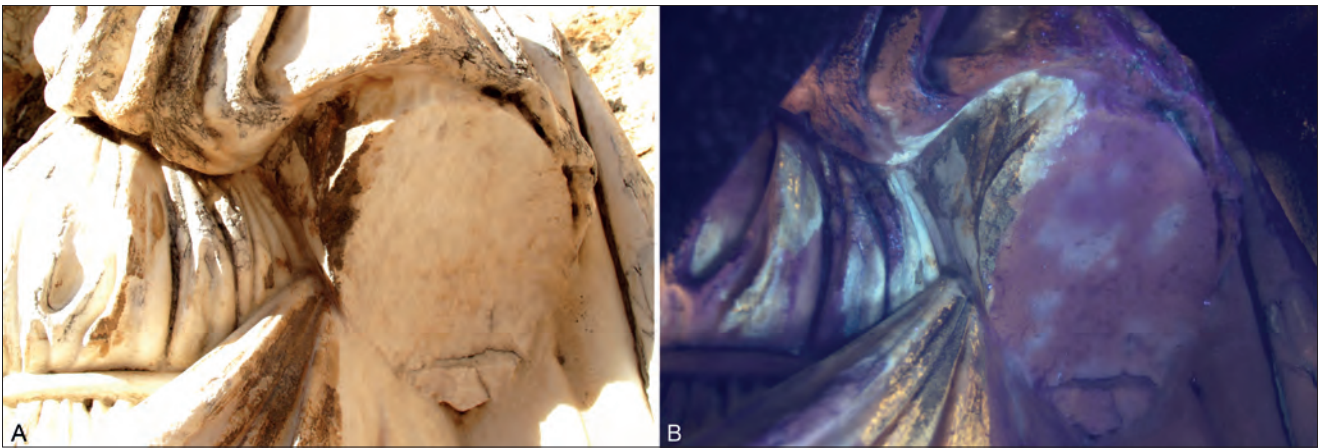
13. - South versura, crowning block: VIS and UVf images (respectively A and B).



14. - Fourth podium from north, south side (no. Ar IV e): VIS and UVf images (respectively A and B).



15. - First podium from north, north side (no. Ap V b): VIS and UVf images (respectively A and B).



16. - Statue of Demeter, detail of the traces of patinas: VIS and UVf images (respectively A and B).



17. - Statue of Hades, UVf image showing traces of patinas.

over time were recorded: the right arm, probably damaged (Fig. 18, B), was repaired by attaching a replacement part to the right shoulder using a metal dowel; evidence for this measure lies in the hole for the insertion of the dowel and the partially conserved remains of a channel into which molten lead was perhaps poured in order to better set the iron element. The presence of a rectangular recess in the neck (Fig. 18, A) indicates that at some point the head was also replaced.

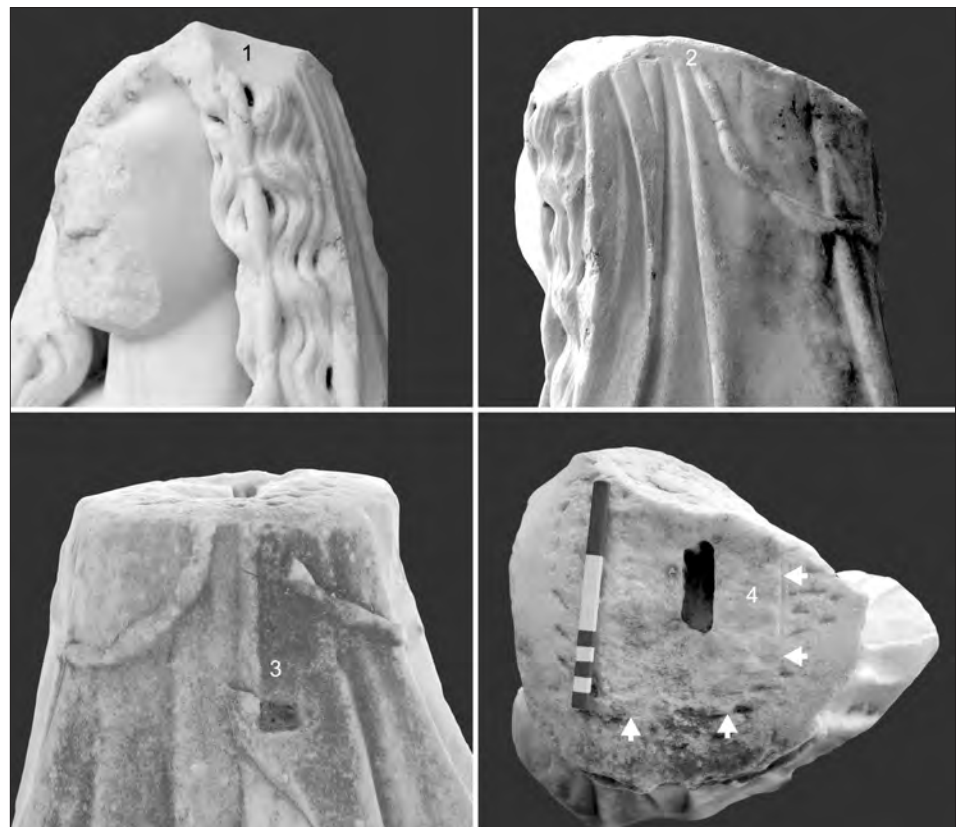
It has been proposed¹⁸ that the replacement head used to restore the statue of Demeter was the one discovered during the excavation of the logeion and described above (Fig. 7). Indeed, the underside of this head also has part of a quadrangular recess (4 x 9 cm) that housed a dowel for attaching it to the body. However, despite the clearly visible traces of restoration on both pieces, a connection between the sculpture and the head in question must be ruled out: the presence of the veil on the back of the head is not compatible with the way the himation rests on the left shoulder of the statue, and the carving technique is also different, as is the two pieces' state of conservation¹⁹.

¹⁸ BEJOR 1991, 26.

¹⁹ Given the absence of visible joins, a restoration measure with



18. - Traces of restoration works on the statues of Demeter (A: torso, B: right arm) and Kore-Persephone (C: left shoulder; D: left hand).

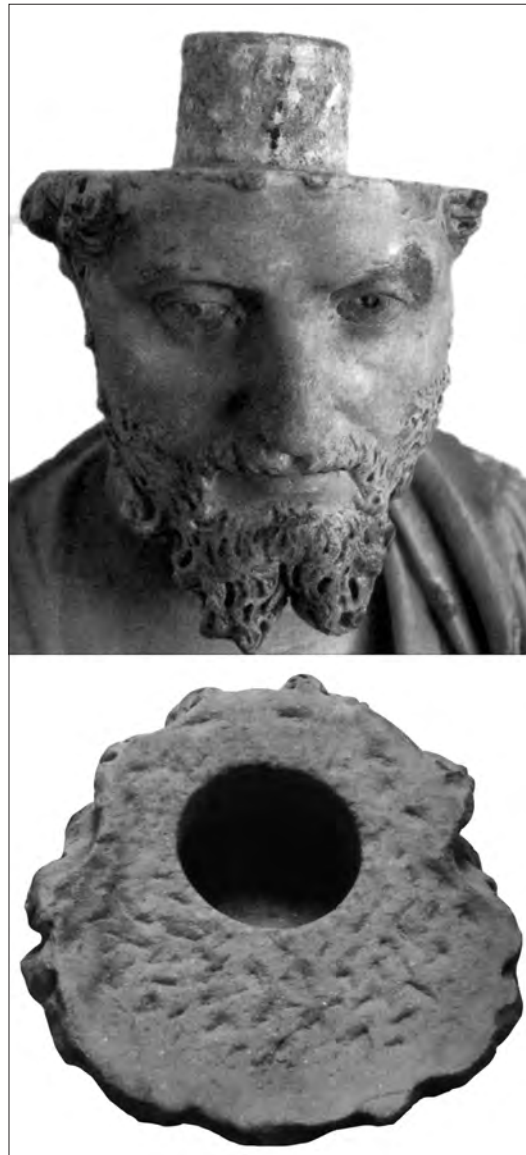


19. - Head of the Kore-Persephone statue (1: reworked and polished area; 2: partially recarved infulae; 3: secondary hole for a Π-shaped clamp; 4: evidence of the tenon, not preserved).

the assembly of a non-original head on the body of the statue can only be hypothesised.

In the case of the statue of Kore-Persephone (Fig. 2), various traces of ancient restorations were found. The torch held in the left hand required restoration, as clearly indicated by the holes for the metal dowels at the base of the torch, near the hand, and in the centre of the fractured surface left by the breakage of the marble support which originally joined the torch to the left shoulder (Fig. 18, C-D).

More complex is the situation at the top of the head of the figure. The head is cut



20. - Rome, Palazzo Altemps, head of Septimius Severus connected to the upper part by means of a tenon (after DE ANGELIS D'OSSAT 2008, figs. 4-5).

²⁰ As is clear from a comparison with the head described above (inv. T 77.10-E558).

²¹ For a general assessment of the phenomenon, see BRUSINI 2001, 268-274, with bibliography.

²² DE ANGELIS D'OSSAT 2008, with bibliography. See also the similar case of the head of an ephebe kept in the Barracco Museum (*FONDAZIONE BARRACCO* 1910, 32, no. 146).

²³ The two parts are made of the same type of marble.

horizontally above the forehead (Fig. 19). The resulting surface has a finely polished band about 3-4 cm wide along the perimeter, together with a more internal portion with grooves carved with a point chisel. In the centre is the base of the original tenon (11 x 11 cm), currently not conserved, which protruded vertically. In the centre of the tenon was a rectangular recess (2 x 6.4 cm, 4.4 cm deep) for the insertion of a lewis or, more plausibly, a metal dowel²⁰.

The distinctive approach used for the head of the Kore-Persephone of Hierapolis reflects the phenomenon of the so-called *capita desecta*²¹, which refers to the carving of the head in two separate parts that were then assembled using dowels or tenons. This carving technique is found, albeit in a modest number of cases, in sculptures produced from the Hellenistic to the Imperial periods, for both idealised subjects and portrait statues. In terms of the history of the research, there has been no systematic review of the archaeological evidence pertaining to this phenomenon that might help to understand the various techniques of assembly and to identify the reasons why this technique was adopted. The final effect it created could have been

slightly disturbing, given that the join remained clearly visible to the observer.

Regarding the type of assembly attested by the statue of Kore-Persephone, the most direct comparison is with the portrait statue of Septimius Severus conserved in the Palazzo Altemps (Fig. 20)²². In this case, the head was precisely cut at the hairline, leaving a cylindrical tenon in the centre that was inserted into a corresponding mortise carved in the upper part of the head²³.

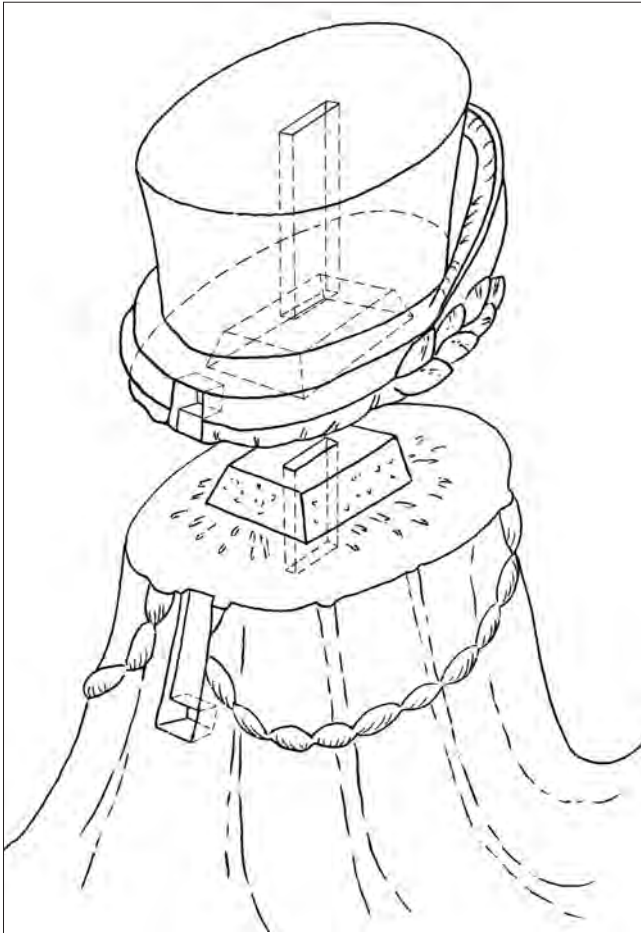
In the case of the statue of Kore-Persephone, we can be certain that this operation was carried out in a phase subsequent to its initial creation, as part of a restoration or rather an "update" process. Indeed, there is a further cut, sloping downwards on the hair near the left temple, with the same careful smoothing (Fig. 19, no. 1), and a re-



21. - Upper part of a diademated female head from the Theatre.

cess for a Π -shaped cramp among the infulae at the back (Fig. 19, no. 3). On the basis of these data it may be assumed that the original Kore-Persephone with a veiled head was transformed by adding a new “crown”. This new part was attached, possibly with the use of binders, by means of the tenon described above (fig. 19, no. 4) and the cramp inserted vertically in the back of the head.

On the basis of this distinctive conformation of the head, the first publication of the statue proposed a connection with the fragment of a head wearing a diadem with a star described above (inv. n. T77.10-E558) (Fig. 21). It is significant that on both sides of the diadem is a series of sheaves that converge towards the centre. Behind the diadem is a sort of cylindrical polos, about 15 cm in diameter and conserved to a height of about



22. - Hypothesis of recomposition of the Kore statue with the upper part of the diademated head (reconstruction T. Ismaelli).

7 cm, held in place at the base by two rings about 3.5 cm thick.

The fragment in question also shows the same attachment technique, using a tenon. The underside has a carefully prepared surface marked with grooves carved with a point chisel in order to facilitate the adhesion of a binder. In the centre is a recess 10 cm on one side (from the right to the left sides) and up to 10 cm on the other (the back edge is not conserved). Five cm deep, it served to accommodate a slightly trapezoid tenon. In the centre of the recess is a further recess measuring 1 x 6 cm and 8 cm deep: the presence inside it of clear traces of oxidisation suggest that this hole was for the insertion of a long metal dowel. At the back of the highly fractured upper section is a recess containing traces of lead that may have been used to set a metal cramp.

Despite the highly incomplete state of this fragment, as well as the difficulty of reconstructing its original appearance and verifying the exact connection of the pieces, it is still possible to suggest its relationship with the statue of Kore-Persephone (Fig. 22). There is obviously no correspondence between the two parts from the iconographic point of view, nor are there elements of continuity: the veil and the infulae of the statue do not continue on the headgear of the fragment. In addition, the statue has no sign of the attachment of the crown of sheaves. However, the following correspondences between the head and the statue appear significant: the presence and the dimensions of the tenon, the presence of the hole for a long thin dowel in the centre, the finish on the contact faces and, last but not least, their discovery in the same area.

It can thus be hypothesised that in the moment of its insertion in the Severan *frons scaenae* (or subsequently), the statue of Kore-Persephone underwent restoration or a deliberate modification, with the insertion of more imposing and higher headgear than the original version. In any case, judging by the presence of the sheaves, the link with the world of Kore was respected. In conclusion, while not being able to demonstrate the actual association of the two pieces, their connection represents an interesting hypothesis, which appears to be consistent with the practices of adaptation and transformation of sculptures in the ancient world.

M.G.