The Goddess' New Clothes:
the Carving and Polychromy of the Parthenon Sculptures

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Abstract

A selection of the Parthenon's pedimental sculpture was studied to assess the carving and painting. Rich evidence was found for the stoneworking process and painting alike. The sculptors did not prepare the surface specifically for the application of paint, instead they focused on subtle adjustments to the finish according to the intended form (e.g. skin, wool, linen). Three-dimensional forms resulted that worked with and were enhanced by colour. Egyptian blue, gypsum, probably bone white and a purple organic colorant were identified. The discovery of the representation of complex figural, woven decoration on the mantle of East Pediment L is significant.

Introduction

Ancient Greek marble sculpture, like architecture, was painted. Although studies of ancient polychromy began at least a couple of centuries ago, the exact original appearance of ancient sculpture and architecture – that is to what extent and how it was painted – still largely escapes us. This is the result of several factors. Paint is in most cases lost during burial periods and, as a result, since the Renaissance, when sculpture was excavated in Rome and other centres, many artists began emulating ancient sculpture without adding colour to the finish – a trend that culminated in the paradigmatic whiteness of neoclassical sculpture. It became therefore common to think of ancient sculpture as being without a painted finish. Overly zealous cleaning procedures, aimed at 'retrieving' the 'original' whiteness of marble also historically contributed to the loss of original paint traces. From a contemporary archaeological standpoint, as only microscopic traces of original paint survive on sculpture, it is difficult to extrapolate how the finished product would have originally appeared to the ancient viewer.

The Parthenon sculptures are no exception. The Parthenon is a temple, originally dedicated to the goddess Athena on the acropolis of Athens in the middle of the 5th C. BCE. Over time, the monument was subjected to a number of detrimental events, each of which contributed to the loss of its original finish: these include exposure to the environment and associated weathering, conversion to a church and then a mosque, casting to make plaster copies, and the removal of a portion of the sculpture in the early 19th century by Lord Elgin followed by their transportation, cleaning and display in London. The remaining portion of the sculpture was also removed from the building and is now at the Acropolis Museum.

Ever since their departure from Athens, the sculptures have played an important role in the development of modern art history, and have acted as an emblematic example of the politicization of cultural heritage (Jenkins 2001). Endlessly studied and emulated, they have been considered one of the pinnacles of ancient art. Nevertheless, research into their making has been limited and the value of such investigations cannot be underestimated. A range of different production processes led to the polychromy, which was the finishing layer and what was intended to be seen as the finished product. Polychromy studies are a crucial starting point, therefore, that may provide information on the original appearance, and consequently role and significance, of monuments in antiquity but, at the same time, colour should be understood as an integral part of the whole building project.

It has been assumed that the marble surface of the Parthenon sculptures, whether highly-finished or weathered, does not preserve many carving traces (Brommer, 1963, pp. 17–21; Palagia, 1993, p. 21; Palagia, 2005, p. 240; Davison, 2009, pp. 579, 583, 585). As a result, the investigations into tools and the carving sequence have tended to be broad, treating the pedimental sculpture as a whole. Only a few surviving tool marks have been identified (Casson, 1933, pp. 201–2, 218; Adam, 1966, pp. 31, 50; Palagia, 2008, pp. 257–8). Even so, the importance of understanding the technical aspects continues to be emphasised in the scholarship (Palagia, 2005, p. 230).

Similarly, the evidence for colour has generally escaped scholars. While reports exist, the exact nature of the findings remain unclear (Fletcher, 1931, p. 101; Reuterswärd 1960 pp. 48-54; Jenkins, 1988; Brinkmann, 2014, p. 95). The complex three-dimensional nature of the carving and the sophisticated rendering of the drapery has drawn scholars to conclude that colour might have been added to the finish, but that ornamentation – in the form of patterns and decorations – was not conceivable (Brinkmann 2017, pp. 40, 44).

In 2008, conservators at the Acropolis Museum noticed a 'greenish' pigment on West Frieze Figure 17 – a horseman – and on the garment of Kekrops (West Pediment Figure B) (Vlassopoulou, 2010, pp. 277–89). In the same year, an initial imaging campaign for the analysis of Egyptian blue unequivocally confirmed its extensive presence (Verri et al, 2010). In 2018, a new campaign revealed a wealth of additional information on the use of colour. Recently, studies on the architectural polychromy of the temple were published (Aggelakopoulou et al. 2022).

This paper aims at providing a summary of the available evidence on the making of the Parthenon sculpture now in the collections of the British Museum. It reports on research into the carving and painting of the Parthenon sculpture, designed to understand their nature and reveal any links between them. Finally, it also discusses how studying the making informs our broader understanding of the sculpture in its historical and cultural contexts (Verri et al., forthcoming (a)).

Methodology

Following visual inspection, macro- and raking-light imaging were used to record tool marks. The polychromy of the sculptures was analysed using imaging techniques including visible-induced luminescence imaging (VIL), a non-invasive mapping technique that shows the presence of Egyptian blue as 'glowing white' against a grey-black background (Verri, 2009).

Fibre-Optic reflectance spectroscopy (FORS) (Ocean Optics Jaz, LS-1) and X-ray fluorescence spectroscopy (XRF) (XGLab Elio, Rh, 50kV, 40μA, 200s) were used to non-invasively investigate the sculpture *in situ*. Based on the results of the VIL investigation, submillimetric samples of Egyptian blue in cross section and dispersion were collected also analysed using optical and scanning electron microscopy (SEM) (Hitachi S-3700N, 20 kV, 50 Pa) and a Raman spectrometer (Jobin Yvon LabRam Infinity, 532 nm, 785 nm)).

Results

The Parthenon pedimental sculpture and frieze at the British Museum are placed on high plinths ((EP = East Pediment, WP = West Pediment, EF = East Frieze)). Access through ladders was possible outside of opening hours. As no pigment is easily visible to the naked eye, the quest for paint traces was mainly based on VIL imaging, which may detect the presence of Egyptian blue even when this is not visible to the naked eye. Limited by access, all sculptures were first imaged using VIL and subsequently inspected at close quarters, where evidence of the blue pigment was detected. Three microscopic samples were collected to further investigate the nature of the blue paint. Table 1 (supplementary material) shows the areas where pigments were revealed, evidence for carving found, as well as the location of the samples for analytical investigations. During the cleaning of a number of sculptures for an exhibition, traces of a purple colour were visually observed. Locations for the analysis of the carving process were selected based on the results of VIL imaging and where clear tool marks could be identified.

Discussion

The carving process

A survey was carried out documenting marks, which were then associated with the tools that made them. The results were organised based on their micro-chronological relationships and function so that the sequence of tool use could be reconstructed with reference to the traditional patterns of work (Adam, 1966; Rockwell, 1993, p. 12; Palagia, 2008; Wootton, Russell and Rockwell, 2013).

Limited evidence was found for the early stages of working, because the incremental progression through the sculptural phases usually erases the preceding one. Point-chisel marks were observed, however, on the underside of blocks (see Adam, 1966, pp. 14-15 for comparable marks on WP N (Iris?) and EP E (Demeter?)) (Figure 1a). Here, the roughing-out with the point was subsequently smoothed over by a claw chisel (Palagia, 1993, p. 21) (Figure 1b).

These two tools were used in association with a third, the drill. This was the workhorse, removing stone during rough-shaping, then drawing out the three-dimensional forms and creating the depth necessary to realise them (see Palagia 1993, p. 41 for the drill on the WP) (Figures 1c-d, 2a-d). The carvers had at least three differently sized drills – a "small, medium and large" one, from 3 to 10 mm (Adam (1966, p. 51) identified drills of 4 and 8 mm on AcrM 1363, compared to 2 and 4 mm on the West Pediment at Olympia). During rough shaping, a series of large holes were drilled both perpendicular to the surface and on the diagonal to create a honeycomb effect (Adam, 1966, pp. 50-57), with the bridges between them knocked out with a point chisel. The desired depth was attained by repeating this process. Finer drills were used for more detailed areas. Traces survive in the undercut folds of the drapery, and within the folds themselves, where it was deemed unnecessary to remove the marks completely (Figure 2a).

The claw chisel was used during rough- and fine-shaping. Marks are apparent on the drapery, smoothing the rippling forms created by the deep cuts of the drill, and on flatter areas such as the backs of the figures (compare with Adams' (1966, p. 20) observations on EP A). The size of the claw changes depending on how detailed the work was, with the number of teeth ranging between around five and seven (see Paga, 2015, p. 171) (Figures 2b-c).

The carvers worked in a non-linear manner during the fine-shaping. Rather than bringing the whole block gradually towards its final form, they worked by area, taking each towards a high level of finish before moving onto the next section. The tools and working processes were also adjusted according to the intended form (Figure 2d). This is most obvious when comparing the heavily draped mantles and the more subtly curving tunics. On EP L (Dione?), the mantle has fewer fine tool marks such as the rasp and small channelling tools; these were more apparent on the tunic, where the more delicate tooling accentuates the lighter, flowing material of linen. The mantle was carved to give a greater sense of volume. It is robust in its execution producing a form and finish more akin to woven wool.

Evidence for polishing on EP L and M (Aphrodite?) was difficult to discern due to weathering. The neckline of M is very smooth and the flesh would have been further differentiated from the drapery. This can be seen on EP A's neck (Helios), which has a polished surface (Haynes, 1975, p. 131; Jenkins, 2001, p. 23). In addition, there are drill holes for fixing attachments to the sculptures and further evidence for the point chisel being used late in the sequence, when the back of EP L and M was modified during installation in the pediment.

The carvers adjusted their approach according to what was being represented by, for example, considering the garments' material, in particular their texture, weight and hang. Their focus was on truth to form and the representation of each material through the sculpting of the stone. The final stage was the addition of colour. The carving and the polychromy had a symbiotic relationship (Heilmeyer 2014 and Blume 2015), even if there was no apparent correlation between the surface's finish and the polychromy such as a special preparation like 'keying' to facilitate the addition of colour (Adam, 1966, pp. 74-75).

The Polychromy

Egyptian blue (EB), in combination with two white pigments, gypsum and probably bone white, was found on a number of pedimental sculptures and the frieze. A selection of significant occurrences are presented here. A purple pigment, at this stage tentatively identified as an anthraquinone-containing colorant, was also discovered on EP L and M.

Water – EB was found on the waters from which EP A is rising (Figure 3). Blue for waves is commonly found on terracotta production, for example the wavelets on the Aphrodite in a Shell at the National Archaeological Museum in Athens (EAM 2060).

Snake skin – A few grains of EB were observed on the tail of WP B (Kekrops?). While the interpretation of extremely small quantities of pigment is problematic, the use of blue for snakeskin and sea creatures is well established in antiquity, for example on a ritual basin at Ascoli Satriano (Wallert, 1995, p. 178).

Background/empty space – A small amount of EB was found in between the rear legs of the stools/boxes on which EP E and F (Demeter? and Persephone?) are sitting. This area probably represents 'empty space/air' in between the legs of the seat. A considerable quantity was found under the peplos of EP G (Hebe?) (Figure 4), but no pigment on the dress itself. Despite the interpretative complications due to the partial cleaning of the figure in the 1930s (Jenkins, 2001, p. 24-5), it is possible that the pigment was not used for the peplos, but only to represent the emptiness under it.

This use of blue is well attested in antiquity. Featureless, solid-blue backgrounds behind figural representations have been found, for example, in the space between the legs of the basin mentioned above, and on the so-called Throne of Eurydice from Vergina amongst the Caryatids on the back and for the space between its legs. It is also applied in a more 'naturalistic' manner as a backdrop to the image on the backrest of the throne and to the landscape of the hunt frieze from the 'tomb of Philip II' at Vergina. The appearance of blue on the Parthenon's pedimental sculpture may also be related to the original colour of the architectural background against which the sculptures were placed.

Textiles – Extensive amounts of EB were found on garments. EP L and M retain a considerable quantity of pigments. The mantle of EP L showed clear traces of the presence of EB on the front of the figure, as well as the side and rear (Figure 5). These are interpreted as a woven design, obtained using dyed wool yarns in tapestry weave on a warp-weighted loom, but other techniques cannot be excluded (Spantidaki, 2016, pp. 78-96). The reading of the woven composition is complicated by the presence of eroded areas, where the original surface does not survive, and by areas covered by a black crust, where the blue pigment cannot be detected with the instrumentation used in this study. Nonetheless, all surviving traces of blue are exclusively found at the same distance from the lower edge, indicating a wide border, framing a central decoration – potentially decorated with other colours, of which no trace was found. While the exact characterisation of the woven pattern is difficult to discern, preliminary interpretation of the results can be made.

The analysis of the outlines of the various forms visible on the mantle suggests that EB was used as a uniform(?) background to a decorative pattern. On EP L's left knee, the outline of bent human legs, as if running to the right, can be discerned (see the athlete on the vase at the Museum of Fine Arts (MFA) in Boston (MFA 96.720) for a nearly identical position). Over the top and side of the proper right leg, parallel bands are painted with EB. By the knee, a stretched hand appears to be visible, and a foot wearing a shoe represented on EP L's calf.

The defined shapes suggest that the woven decoration was figurative, rather than geometric or floral. The absence of blue along the edge also suggests that the decoration was divided in panels or friezes, such as that on the vase in Chiusi with Penelope at her loom (Chiusi 1831). A motif with a running figure with bent legs, similar to that on EP L's knee, can be observed on the section most recently woven by her. Interestingly, the dimensions of the legs of the winged figure represented on Penelope's textile relative to Penelope's own knee roughly match the proportions on EP L's mantle. The most convincing comparative example is found on an attic vase at the British Museum (BM 1873,0820.375) (Figure 6). It shows Demeter wearing a mantle decorated with horizontal bands representing, among other decorative elements, winged human figures running with bent legs. The painter depicted the relation between the figures on Demeter's mantle and the folds as they would have behaved on a physical garment, with at least some figures disappearing into the folds.

The folds of EP L's mantle on her lap show a complex distribution of EB, possibly corresponding to appearing and disappearing figures, only partially represented. Similar, but later, representations of figures with bent legs are found in textile archaeological contexts, such as the fragment, originally part of a larger textile, preserved at the MFA (MFA 53.18). The shape on EP L's calf is tentatively interpreted as a sandaled foot, running parallel to, but not touching, the band where no EB was found. While straps appear to be visible, the form of the shoe does not seem to be a standard sandal, but rather a closed shoe with solid uppers and leather straps. A comparable example can be found on East Pediment N (Seer) of the Temple of Zeus at Olympia (Dohan-Morrow, 1985, p. 51). The network of straps, as well as the half-moon shape at the front of the shoe, is executed using

EB, representing what is likely leather. The use of blue pigment in this way, and mixed with other pigments to represent different hues (Verri, Opper and Lazzarini, 2014), is not surprising and was also found on the brown leather sandals of the philosopher pointing at a globe in the Tomb of the Philosophers in Pella (Brecoulaki, forthcoming). Brown leather might however not be the only explanation for the presence of EB. Bright blue boots/shoes are represented using EB on a plastic lekythos in Athens (EAM 2059). The half-moon feature at the front of the shoe could be explained as an embellishment, as observed on Treu's drawing of leather straps decorated with a palmette (Dohan-Morrow, 1985, p. 51) and the larger palmette visible in raking light at the front of the shoe of the Seer from Olympia (Brinkmann, 2003, Fig. 319.1).

Contrary to what is normally suggested, EP L's garment appears to have been highly decorated, and therefore does not correspond to what is commonly observed in representations of Athenian fashion contemporaneous to the construction of the Parthenon (Brinkmann, 2004, pp. 154–6). In addition, the tradition of weaving figurative elements on the dress dedicated to Athena Polias attests to a continued production of complex textiles; the epigraphic evidence from the Artemis Brauronia record confirms the fashion for figurative clothing in the Classical period (Llewellyn-Jones, 2003, p. 140).

A desire to distinguish between a representation of clothing worn by deities on a public monument and those sported by ordinary mortals on the streets of Athens may explain the decorative patterns found on EP L's garment. They would have aided the reading of the pediments' iconography, functioning like attributes as, for example, metal attachments would.

EP L and M are reclining on a rock softened by a draped cloth. EB appears on the back of the group. It forms a line equidistant from the edge of the cloth, suggesting a border running along its length (Figure 7a). A small sample shows that the blue pigment was mixed and layered over a phosphate-rich white matrix. Raman spectrometry revealed calcium phosphate under a now-orange, thick calcium oxalate layer in the form of whewellite/weddellite. SEM investigations of the sample show a very uniform distribution of phosphorus suggesting an intentional use of a phosphate-rich material, such as bone white (see Gratziu, Jenkins and Middleton (1989, p. 324) for a nearly identical stratigraphy on the Mausoleion of Halicarnassos).

The remnants of a palmette can be seen on the border of the same cloth at the front of the group in the protected area under the knee of EP L (Figure 7b-c). Under that, squares appear to run along the bottom edge of the textile. A similar pattern was observed on WP T (Kreusa?) and EP K (Hestia?), where extensive traces of EB were found on the mantle. An example of a battlement pattern on a mantle, together with borders with palmettes, can be seen on a kylix representing Hera in the Berlin Antikensammlung (Berlin 2685).

Bright purple particles were discovered on the back of the same cloth, where it meets EP M's mantle (Figure 8). It was impossible to establish to which of the two textiles they belong. The particles show a translucency and gloss typical of organic colorants and are embedded in a white matrix. A variety of purple colorants – as well as combinations of red and blue colorants – were available in antiquity and some are discussed in the Leyden and Stockholm papyri (Jensen 2008). The FORS spectrum of the purple colour, together with the absence of bromine in the XRF spectrum, is not in accordance with the use of shellfish purple, one the most precious and coveted colours in antiquity.

When compared with other available purple sources, the Parthenon purple shows a relatively good accordance with anthraquinones, which are possibly only one of the components that give the purple colour. The identification of the other components remains under investigation (Verri forthcoming (b)). The desirability of the colour purple in the Classical period is well attested in textual sources (for example the records of Artemis Brauronia mentioned above), as well as in Athenian luxury coroplastic (for example EAM 2059) and marble production (Brecoulaki, Kavvadias and Verri, 2014).

EB was found on the belt of WP N (Figure 9). This may correspond with the representation of a textile belt, the carving of which is difficult to interpret because it is recessed. A small hole at the back might have held a metal belt (for comparison, see the small hole for a metal belt on Metope North XXXII), but this may be the remains of drill-work for a fold. The reason for blue under a metal attachment is difficult to understand. It could be a later repainting or a blue background for a perforated metal belt. Repainting seems less likely because the blue at the back is in an inaccessible place. Interestingly, SEM and Raman analysis revealed the presence of gypsum, rather than bone white, as the white pigment with which the blue was mixed. Whether the presence of two different white pigments corresponds to different workshops, an intentional artistic choice or the result of a later intervention remains a matter of speculation. Gypsum can form from calcium carbonate in the presence of sulphuric acid, as in the case of ‘acid rain’; however, while the paint layer appears well-bound and cohesive—unlike a typically powdery alteration product—the presence of calcium carbonate instead of calcium phosphate as in the other examples still presents the same questions and uncertainties highlighted here.

Finally, EB was observed in the recesses of the folds of EF Block V, Figure 32 (Figure 10a-b). Its interpretation is also complex. A simple explanation is that they are the remnants of a representation of a blue textile, perhaps dyed with woad, as WP N’ belt above. Evidence from ancient painting practice, however, shows the difficulty involved in interpreting scant traces of colour. For example, on the Amathus stele in the British Museum (BM 1894,1101.717), Egyptian blue was used to represent depth in the folds of both white and coloured textiles (Figure 10c-d). The blue found on Figure 32 could have been a solid application of colour or part of a shading technique. A sample indicated the presence of a phosphate-rich white pigment, with a stratigraphic distribution similar to that observed on the EP.

The surviving evidence on EP L and M (Figure 11, Supplementary material) shows no distinct correlation between the surface finish of the marble and the application of paint. Instead, the available evidence indicates that the sculptors of the pediments focused on reproducing the intended form rather than crafting a special surface for the addition of colour. Tunics were executed with fine tooling, reflecting the lightweight flowing material made of crisp linen, in contrast with the style of carving for the mantles, which gives a vivid impression of a heavier draped and woven woollen fabric. It is anticipated that the finish applied to the skin, if any, offered further differentiation, as observed on other figures, such as Helios' polished neck.

The application of polychromy was a final stage in the process and, undoubtedly, as important as the carving. It was what the viewer saw. Even if the surface was not prepared explicitly for paint, however, carving and colour were unified in conception. The artists of the pediment were sympathetic to the final intended polychrome sculpture providing a surface 'similar' in texture to the real material subject of the representation. They used innovative modelling techniques to achieve the extraordinary sculptural effects and provide a virtuoso support for the complex decorative and figurative designs, which would subsequently be painted upon it.

The painters likely took advantage of the mimetic surface for the final effect. Egyptian blue was used to represent natural features and woven decorative elements, including figurative patterns, on garments representing wool. Parallels for the designs can be found on contemporaneous ceramic production as well as in textual sources. The palette also included white (gypsum and probably bone white) and, importantly, purple (possibly an anthraquinone-containing colorant likely with other currently unidentified purple components).

Conclusions

The evidence for pigments on the Parthenon sculptures brings us closer to their original appearance. The remains of small amounts of paint, however, are not straightforward to interpret. The presence of a particular colour does not necessarily mean that the surface was painted uniformly with it. The practice of mixing Egyptian blue with other pigments is attested for many hues, including brown for leather, flesh tones, grey for weapons, purple for textiles, and so forth. The Parthenon is likely no exception. The results reveal the complexity of ancient painting techniques and are a reminder of the need for care when interpreting the scarce survivals. Moving to a colour reconstruction should proceed carefully. The available evidence, albeit rich compared to what was known until now, is still insufficient to reconstruct a work of art painted with sophisticated details and a sumptuous polychromy.

This study opens up new interpretations on the role and significance of the monument in the development of ancient Greek art history. With their "new look", the current understanding of the sculptures can be revisited. As a first conclusion, it could be argued that the Parthenon is at least part of, if not an inspiration for, a general desire for a rich and elegant polychromy that has clear parallels in other media, including in luxury textiles, described in textual sources, as well as marble and coroplastic production of the same period, culminating in the predilection for 'colour and shine' of the Late Classical period (Brecoulaki et al., 2014).

Above the white surface of the marble, polychromy was one of the most visible parts of architectural sculpture. Alongside serving an aesthetic function, it was possibly intended to aid the viewer in the identification of the figures from a distance for religious and possibly even political purposes, as the Parthenon was the grandest of all works instructed by the strategist Pericles himself; emblematic in this respect is the episode narrated by Plutarch, in which Pericles and the sculptor Pheidias are incriminated for having included their own portraits among the decorative elements of the gold-and-ivory sculpture housed within the Parthenon itself (Plutarch, 31). A lavish polychromy likely served as an aid to demonstrate the grandeur and reach of the Athenian empire.

It is also surprising to notice that the sculptures were both carved and painted at the back, where they could not be seen, once placed on the building. While the exact reason for this choice will likely escape scholars, a few suggestions can be summarised here. The sculpture, like the building, was dedicated to the gods, to whom the entire sculpture was 'visibile', and, as such, had to be completed to the highest degree of finish, and this included carving and polychromy in the round. Plutarch tells of visitors brought in by the strategist Pericles to admire the works on the acropolis, making incomplete sculptures possibly a less attractive sight to important guests (Plutarch, 13). Finally, artists' *modus operandi* is somewhat an intangible aspect of the creation of a work of art; the highly finished sculptures may be the result of a practice, which required the modelling of a figure in the round for the sake of completion.

While further research is necessary and more avenues of interpretation can be brought forward, it is apparent that the Parthenon sculptures were part of a syncretic endeavour, in which the painted decoration was a significant component of the final effect, as important, elaborate and prominent as the much-celebrated carving. When understood together, carving and painting act in synergy, adding a dimension of complexity not previously known. Despite their troubled history, scientific analysis of the Parthenon sculptures has exceeded all expectations, revealing a wealth of surviving paint, and arguably making them best-preserved known examples of surviving polychromy of mid-5th C, BCE Athens.

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Figure captions

Figure 1. a) – b) Evidence for the point chisel on the underside of Figure G, and front of E and F, respectively; c) Evidence of the claw chisel on the back of Figures L and M; and d) Extensive use of the drill in the drapery folds of Figure M.

Figure 2. a) Drill marks surviving in the folds of Figure F; b) - c) The drill and the claw being used in tandem for the drapery of Figures L and M, and d) Evidence of the drill followed by fine tool finishing and the rasp on Figure M.

Figure 3: East Pediment A. a-b) visible and c) VIL images of the back of the sculpture.

Figure 4: East Pediment G. a-c) visible and d) VIL images.

Figure 5 (1-5): East Pediment L. Visible and VIL images of the front and side. Details and line drawings of the design.

Figure 6: Red-figure skyphos (BM 1873,0820.375).

Figure 7: East Pediment L and M. VIL image of a) the back and b) visible and c) VIL image of a detail of the front drape by L's feet. The white arrow in (a) shows the sample location for Raman and SEM-EDX analysis.

Figure 8: Detail of the purple organic colorant. The inset shows the location of the area. Absorption spectrum of the colorant in comparison to standards (for orcein/folium see Aceto 2014, for alkanet Angelini 2010).

Figure 9: West Pediment N. VIL image. The white arrow shows the sample location for Raman and SEM-EDX analysis.

Figure 10: East frieze, Block V, Figure 32. a) visible and b) VIL image. The white arrow in (b) shows the sample location for Raman and SEM-EDX analysis. Hellenistic stela from Amathus(?), Cyprus, showing two women (BM 1894,1101.717, 4th – 3rd C. BC). c) visible and d) VIL images.

Figure 11: East Pediment L and M. (Left) Detail of EP L's shin, showing EB under the orange calcium oxalate layer. (Right) Cross section from the location indicated in Fig. 7, showing EB particles in a calcium phosphate matrix. The blue paint layer is applied above a calcium phosphate layer and under the calcium oxalate layer.

Table 1: Areas where evidence for carving and colour was revealed (EP = East Pediment, WP = West Pediment, EF = East Frieze). Unless otherwise indicated, the identification of Egyptian blue was undertaken using VIL imaging and confirmed in select cases with Raman and SEM-EDX analysis. SEM-EDX and Raman analysis were performed on microscopic samples (<0.5mm diameter) collected from the surface of the sculpture, as indicated. The sample location can be seen in the corresponding figures.

Figure	Location	Toolmarks	Blue	White	Purple	Degradation products
EP A (Helios) and B (Horses)	Sea	Claw chisel Rasp Polishing	Egyptian blue • VIL			
EP E (Demeter?) and F (Persephone?)	"Empty space" below seat	Point chisel Drill	Egyptian blue • VIL			
EP G (Hebe?)	"Empty space" underneath dress	Point chisel	Egyptian blue • VIL			
EP K (Hestia?)	Decorative element on dress		Egyptian blue • VIL			
EP L and M (see Fig. 7 for sampling location)	Decorative element on EP L's dress and spread over rock by EP L's feet	Claw chisel Drill Flat chisel and channelling tool Rasp	Egyptian blue • VIL • Raman: 1085, 571, 430 cm^{-1} • SEM-EDX: Cu, Si, Ca, Na	Calcium phosphate (mixed with Egyptian blue) • Raman: 963 cm^{-1} • SEM-EDX: Ca, P		Calcium oxalate (Weddellite) Superficial layer • Raman: 1472, 910, 506, 495 cm^{-1} • SEM-EDX: Ca with Fe impurities
EP L (Dione?) and M (Aphrodite?)	Decorative element at the intersection between dress of EP M and spread	Claw chisel Drill Flat chisel and channelling tool Rasp			Unknown compound likely including an anthraquinone • FORS: c. 528, 570 nm • XRF: Ca, Fe	
WP B (Kekrops?)	Snake skin	Point chisel Claw chisel	Egyptian blue • VIL			
WP N (Iris?) (see Fig. 9 for sampling location)	Belt	Point chisel	Egyptian blue • VIL • Raman: 1085, 571, 430 cm^{-1} • SEM-EDX: Cu, Si, Ca, Na	Calcium sulphate (mixed with Egyptian blue) • Raman: 412, 491, 1005, 1135 cm^{-1} • SEM-EDX: Ca, S		
WP T (Kreusa?)	Decorative element on textile and surface of rock		Egyptian blue • VIL			
EF Block V, Figure 32 (see Fig. 10 for sampling location)	Dress		Egyptian blue • VIL • Raman: 1085, 571, 430 cm^{-1} • SEM-EDX: Cu, Si, Ca, Na	Calcium phosphate (mixed with Egyptian blue) • Raman: 963 cm^{-1} • SEM-EDX: Ca, P		

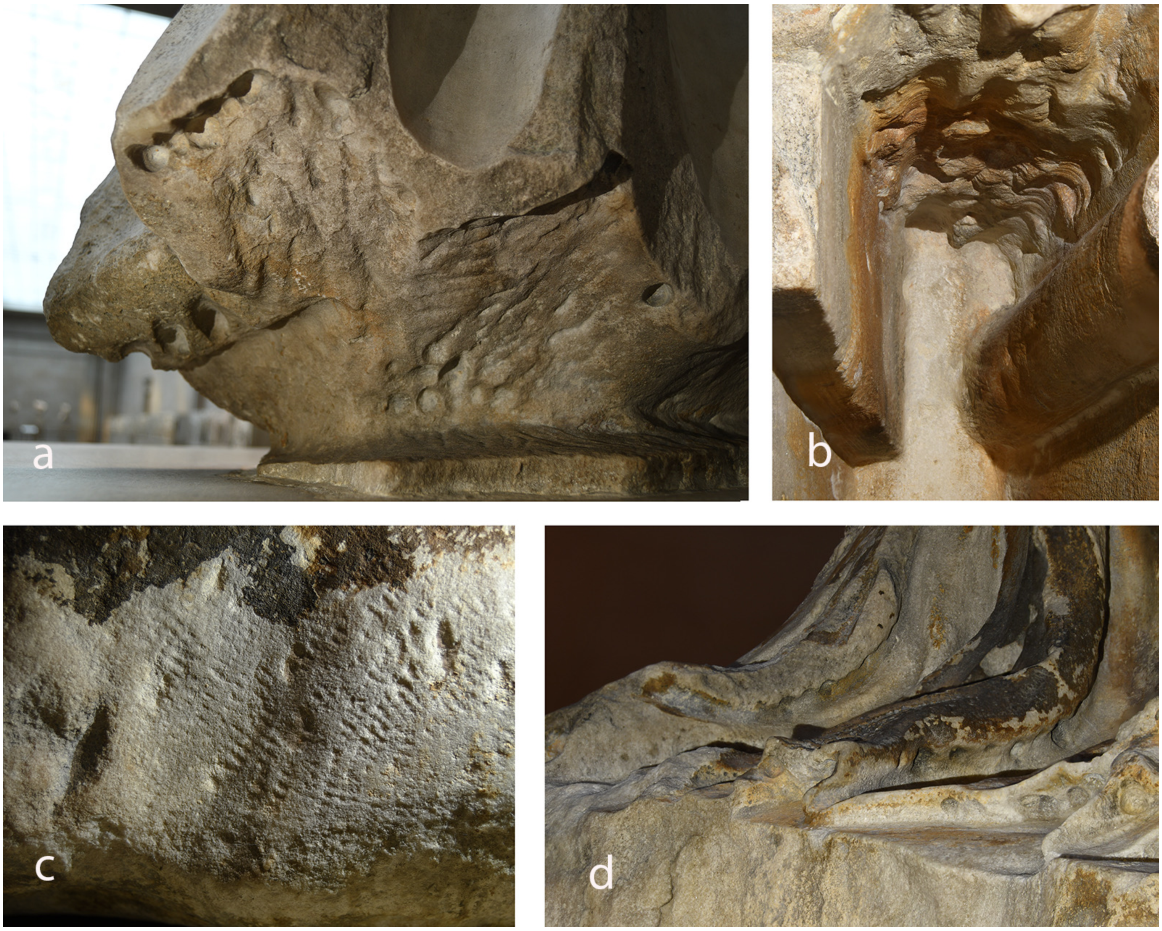

Figure 1. a) – b) Evidence for the point chisel on the underside of Figure G, and front of E and F, respectively; c) Evidence of the claw chisel on the back of Figures L and M; and d) Extensive use of the drill in the drapery folds of Figure M.

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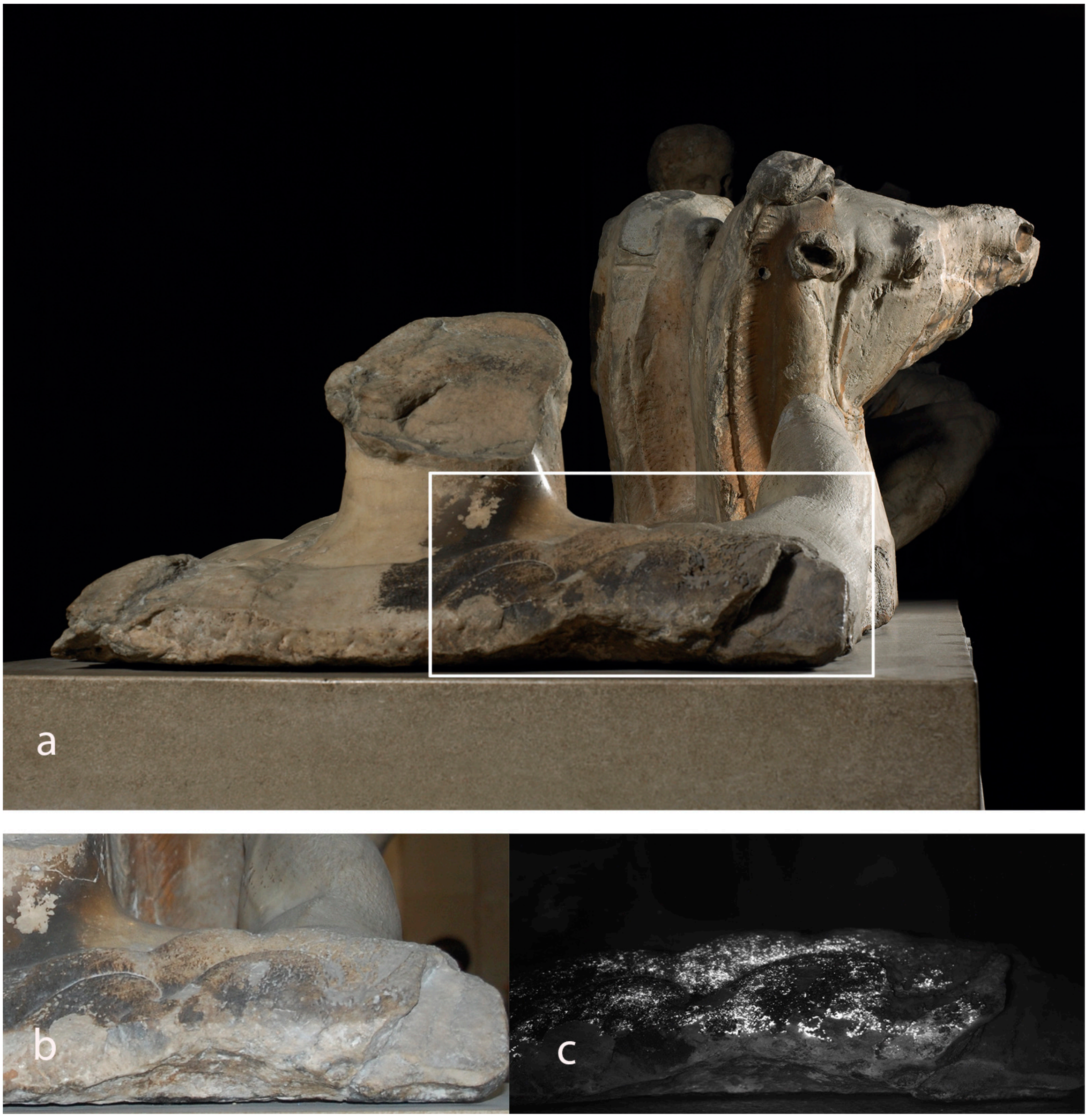


Figure 3: East Pediment A. a-b) visible and c) VIL images of the back of the sculpture.

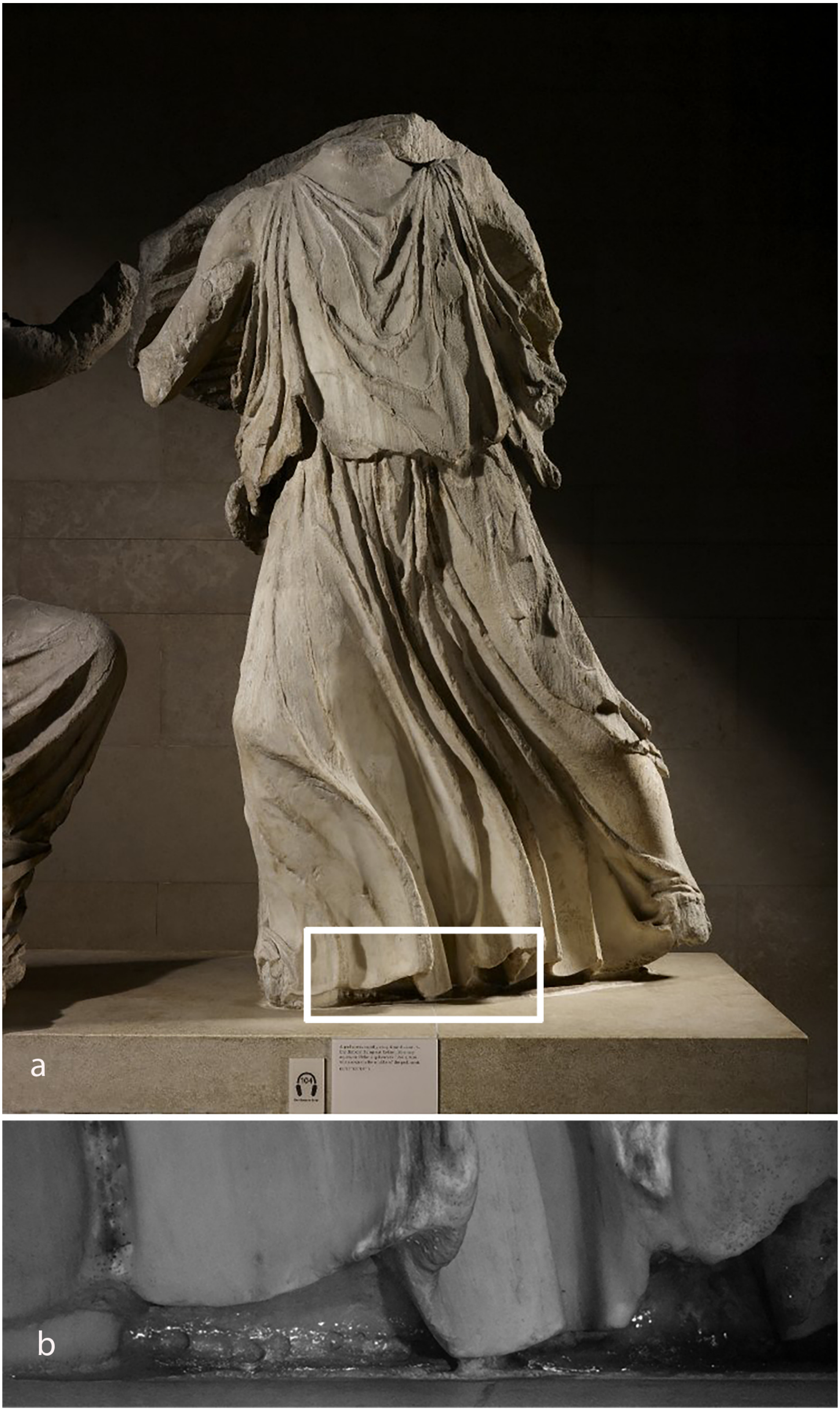


Figure 4: East Pediment G. a-c) visible and d) VIL images.

Figure 5 (1): East Pediment L. Visible and VIL images of the front and side.

Figure 5 (2): East Pediment L. Visible and VIL images of the side.

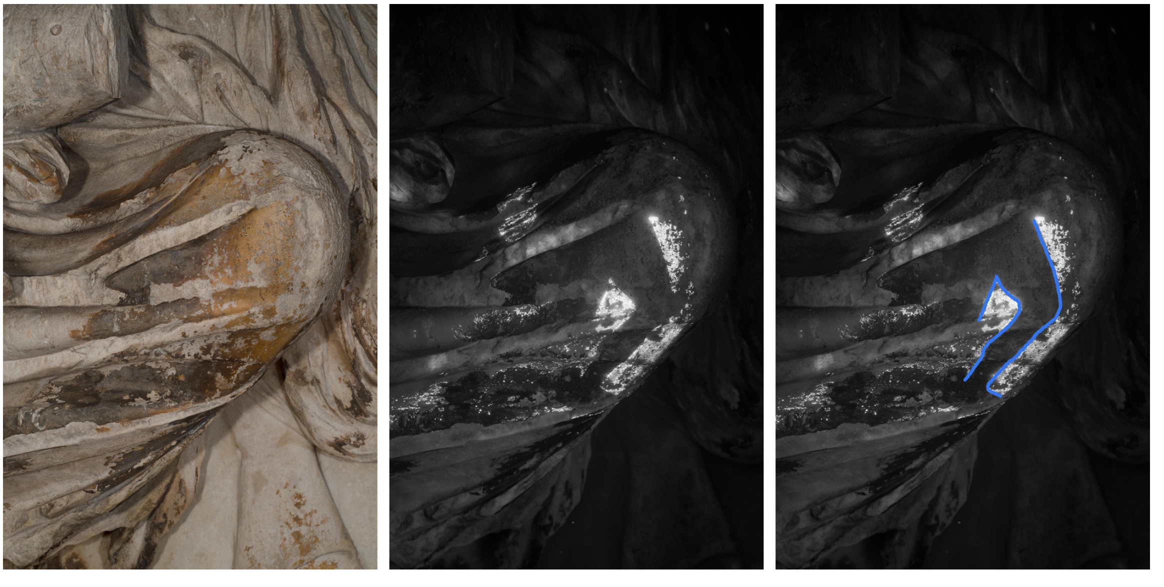


Figure 5 (3): East Pediment L. Visible and VIL images of the detail of the
'leg' and line drawing

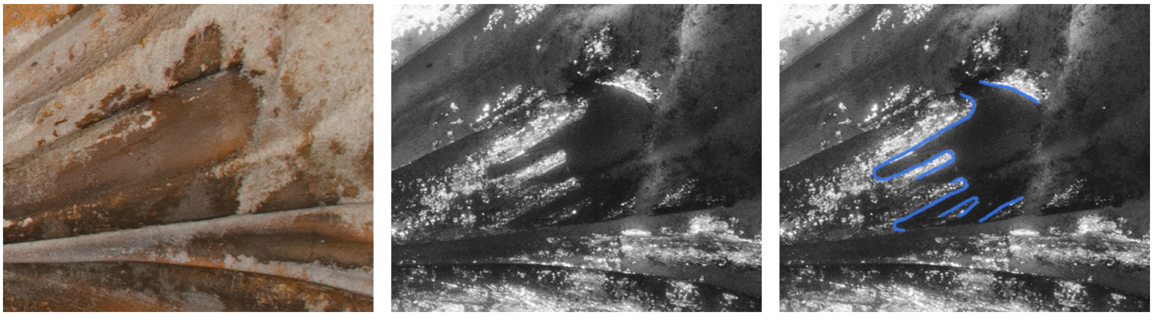
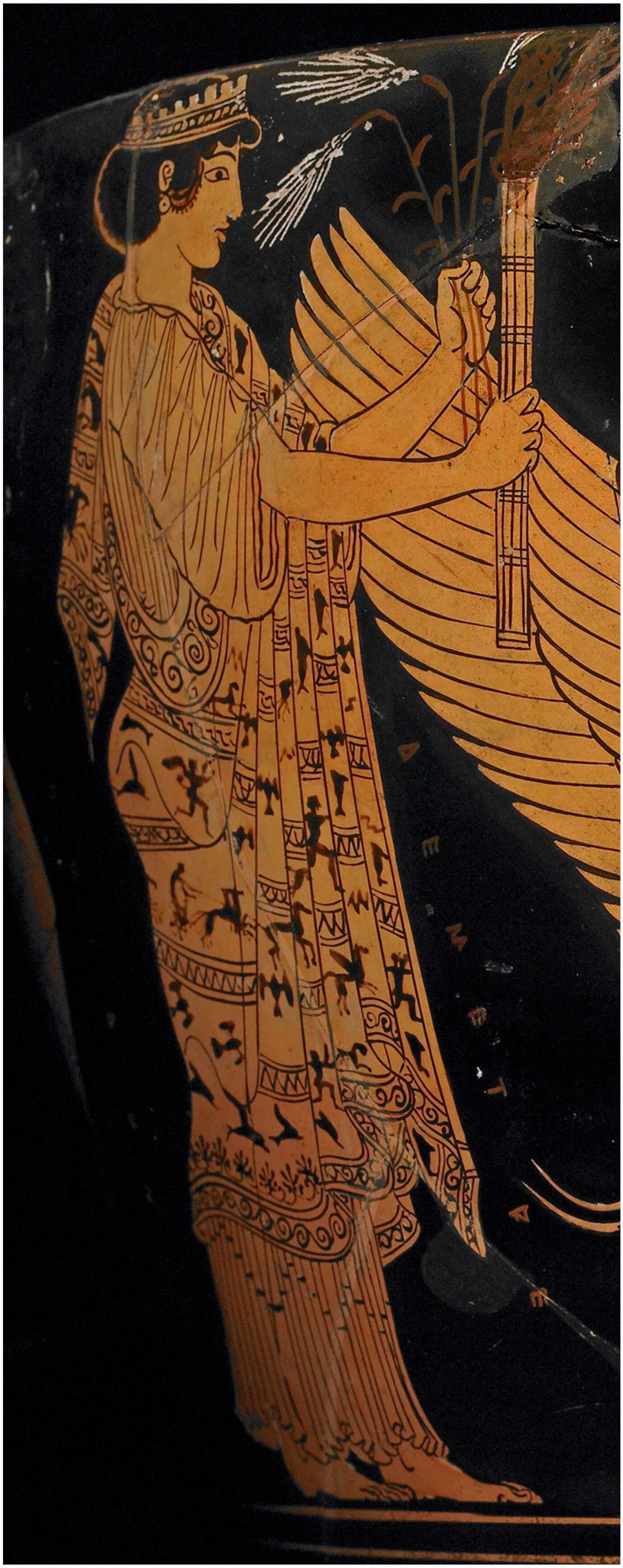


Figure 5 (4): East Pediment L. Visible and VIL images of the detail of the ‘hand’ and line drawing

Figure 5 (5): East Pediment L. Visible and VIL images of the detail of the ‘foot’ and line drawing



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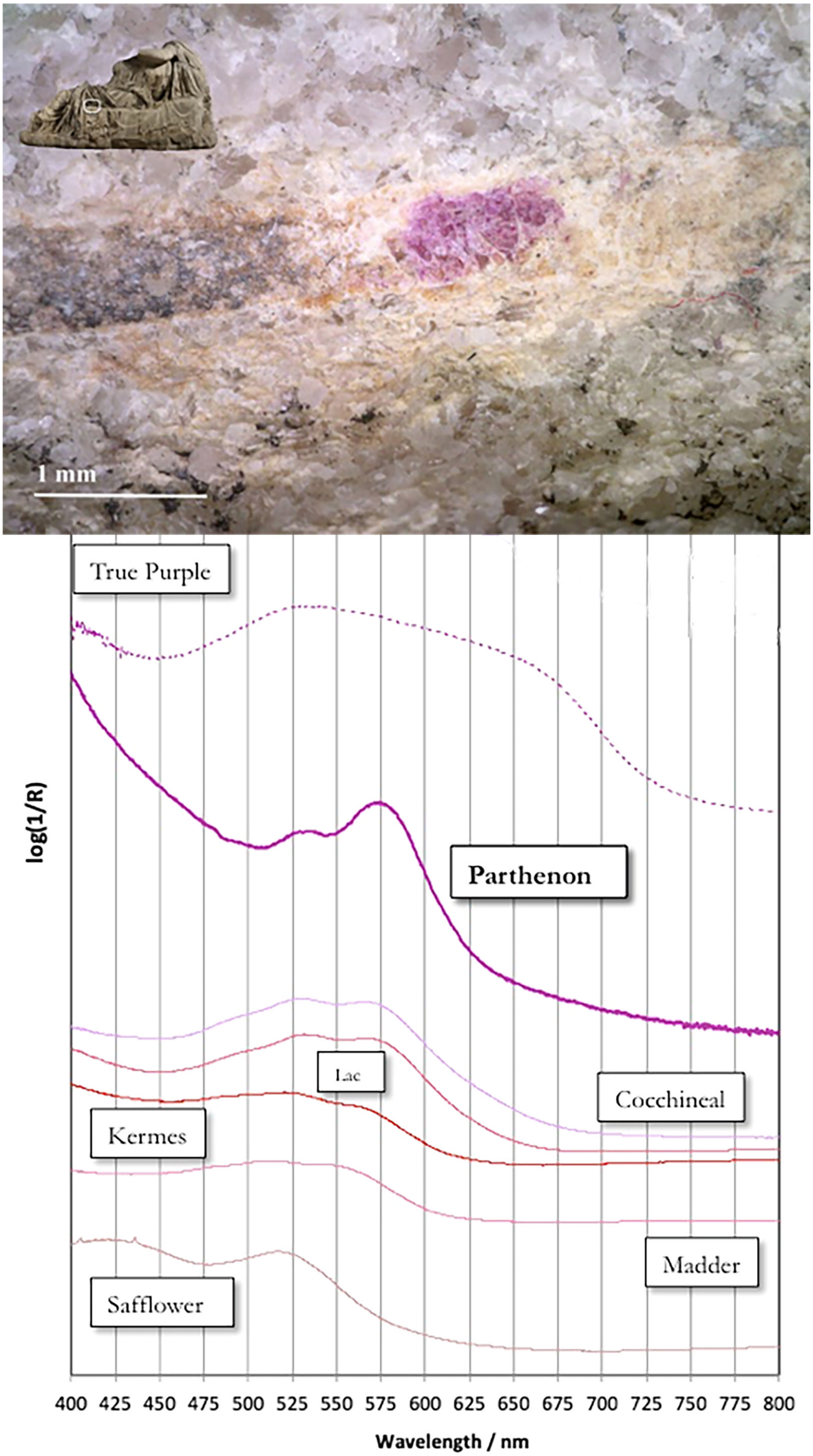

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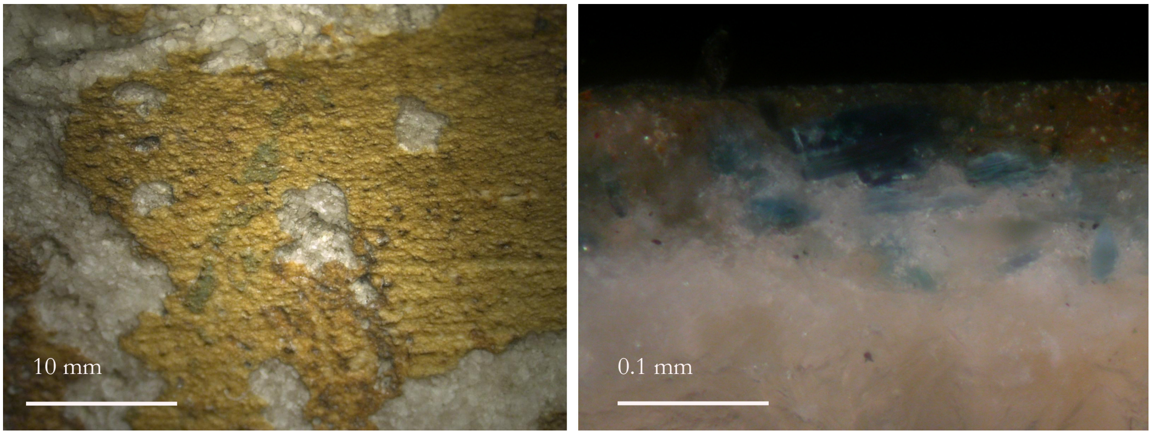

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