Philippe Jockey, Matthias Alfeld

# The Frieze of the Siphnian Treasury at Delphi : Interactions between Colour and Space in a Panhellenic Sanctuary

in: Zink et al. - Colour & Space. Interfaces of Ancient Architecture and Sculpture.: Proceedings of the 10th International Round Table on Polychromy in Ancient Sculpture and Architecture

https://doi.org/10.34780/2pfm1p32

Herausgebende Institution / Publisher:
Deutsches Archäologisches Institut

# The Frieze of the Siphnian Treasury at Delphi: Interactions between Colour and Space in a Panhellenic Sanctuary

*Philippe Jockey – Matthias Alfeld*

## Abstract

The Siphnian Treasury is a small archaic votive building, which the city of Siphnos dedicated to the god Apollo in his sanctuary at Delphi in 525 B.C. Constructed shortly after the discovery of the gold and silver mines in the chora of the island, the treasury boasted a variety of spectacular colour remains on both its architectural elements and carved friezes. While these remains are almost invisible now, they were perceptible to the naked eye at the time of the treasury's rediscovery in 1894. Vinzenz Brinkmann's acute study in 1994 provided the most complete systematic description of the treasury's polychromy in its state at the time. More than two decades later, technological advancements allow a fresh investigation of the frieze and its colours with new analytical methods.

The most recent analysis of the frieze, conducted in 2015 and 2016, included Macroscopic XRF Imaging (MA-XRF) as well as Mobile Reflectance Imaging Spectroscopy (RIS) in the visible and near infrared range. These methods revealed hidden traces of pictorial treatments and offered new insights into the placement and characterization of pigments, thus testifying a strong connection between a comprehensive chromatic programme and its different locations on the four sides of the exterior Ionic frieze, the pediments, and the Caryatid figures of the front. How did these different colour schemes interact with each other? Did the treasury's specific positioning within the sanctuary play a role in the selection of pigments and the final surface effects, including lighting and brilliance? To address these questions, we will first review the outcomes of our most recent investigations and then contextualize them within archaeological and historical data.

**Keywords**: Delphi, Treasury of Siphnos, Ionic frieze, Greek relief sculpture, polychromy, Greek mythology, XRF, Hyperspectral Imaging, Reflectance Imaging Spectroscopy, archaeometry.

## Introduction

In 2015 a new research programme on the polychromy of the Siphnian Treasury at Delphi was initiated as a part of the Program Polyre[1], which was funded by the Sorbonne Universities Project and involved the CNRS Laboratory of Molecular and Structural Archaeology (LAMS, UMR 820) of Philippe Walter and the French School of Athens in coordination with the Delphi Museum[2]. The immediate publication of the results of both our optical survey and the scientific analysis[3] focused on the methods used for identifying the unexpected traces of colours on the frieze surfaces.

The results of this study introduce new ways of comprehending both the specific placements and the role of colours on ancient monuments. Particularly,

**1** «L'Aventure Polychrome: Matérialité, Représentation, Reception». The seminal prior study was Brinkmann 1994.

**2** Thanks to A. Psalti, Director of Ephorate of Antiquities of Phocis.

**3** Alfeld et al. 2017; Alfeld et al. 2018.

https://doi.org/10.34780/2pfm1p32

the extent of the chromatic evidence, as revealed by the methods of prospection and the cutting-edge analysis of surface treatments, now makes it possible to ask how the numerous pilgrims visiting the sanctuary of Apollo during festivals would have perceived the colours of the Siphnian Treasury. This also raises the question of the role that visitors assumed and the diverse viewpoints they embraced, which not only influenced the perception of these chromatic programmes but also contributed to the construction of the narratives conveyed in these brightly painted friezes.

Thanks to the application of powerful characterization instruments, our systematic investigation of the relief surfaces has allowed an unprecedented precision in mapping colour traces and other surface treatments. This marks a crucial initial step in our re-assessment of the iconographic programme.

## Dedication, Location, and Iconographic Program

The Treasury of Siphnos (SD 122)[4] was dedicated to Apollo as a precious offering during the last quarter of the 6th cent. B.C. Detailed information is available regarding both the circumstances of the dedication, a consequence of the discovery of the gold and silver mines in Siphnos (an island belonging to the Cyclades archipelago), as well as the dedicants, who were the citizens of Siphnos[5].

Regarding the spatial context within the sanctuary, we can be certain about the preexistence of the Doric Treasury of the Sicyonians (SD 121), which had already been built in 560 B.C. in the immediate vicinity (Fig. 1). Also important is the fact that the Siphnian Treasury faced the west entrance to the peribolos (SD 232) while standing at the spot where the sacred way made a sharp turn to lead up to the Temple of Apollo. Finally, we also know their original location and thus their position on the building (Fig. 2)[6].

At the time of its dedication, the Sicyonian Treasury was the only other monument in the vicinity. Its façade, however, looked towards the sanctuary's other entrance in the southeast, which means that the Sicyonian and the Siphnian Treasuries came to stand back to back, each one facing one of the sanctuary's entrances. As the Siphnian Treasury stood at the crossroads to the temple of Apollo, it occupied one of the most prominent and highly visible locations within the sanctuary known as *epiphanestatoi topoi*[7].

As visitors ascended towards the temple, the initial sight to captivate them would have been the polychromatic façade of the treasury. This may well explain the choice of motifs and the colour palette of the frieze. The vibrant colours extended to all parts of the entablature, including the architectural moldings, friezes, and pediments. The Caryatides of the façade and the acroteria were certainly also painted, although concrete evidence of this is currently lacking. Possibly the polychromy also extended to the interior of the treasury.

The masterpiece of the building was the well-known continuous frieze. Measuring 28 m in length and 0.66 m in height, it included over 115 figures that were carved in high relief and painted[8]. The placement of the four sides of the frieze and thus the sequence of the iconographic programme are undisputed.

Regarding the themes of the frieze, the following subjects were clearly identified: the Divine Council and the Scene of the Trojan War on the east side (Fig. 3); the Gigantomachy on the north side (Fig. 4); and (probably) the Judgement of Paris on the west side (Fig. 5). The identification of the abduction scene on the south side remains uncertain (Fig. 6)[9]. It is generally assumed that two workshops had worked side by side to carve the frieze[10].

**4** Jockey 2021. Delphic Monuments are named after their ID in Guide de Delphes. For the first publication of the architecture Daux et al. 1987.

**5** Hdt. 3, 57–58; Paus. 10, 11, 2. For a comprehensive presentation of it, see Jockey 2021.

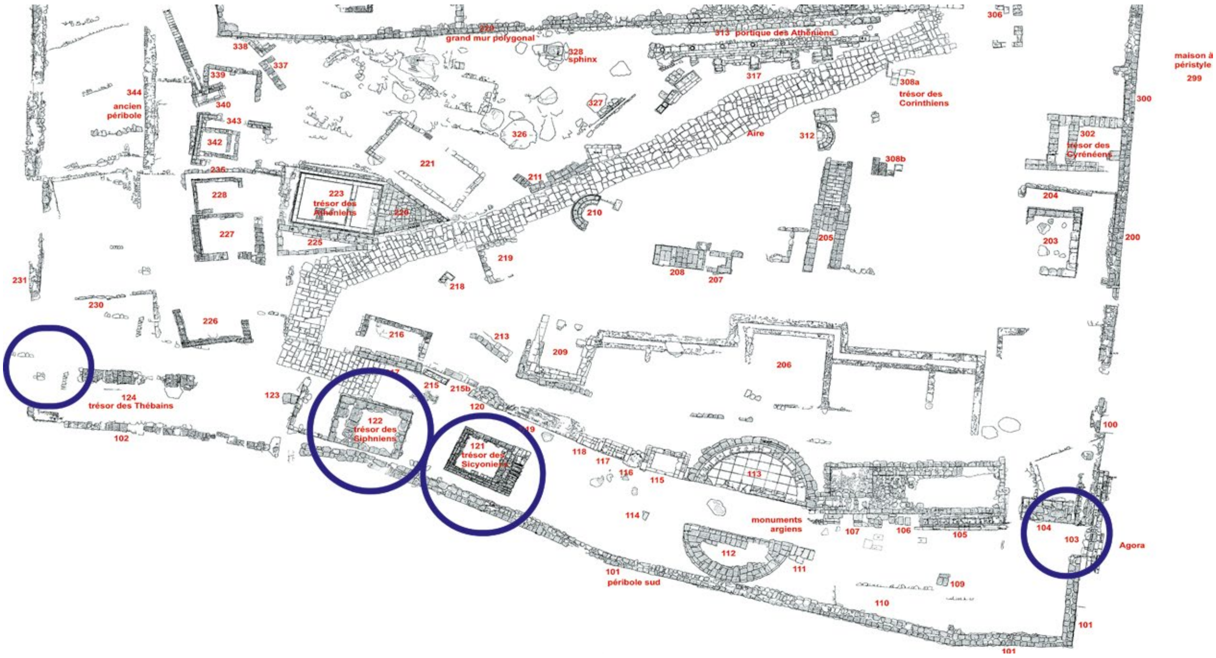
**6** Jockey 2021, 124 f.

**7** Literally ‹the brightest locations›. This brightness was a prerequisite for the installation of a monument in a sanctuary.

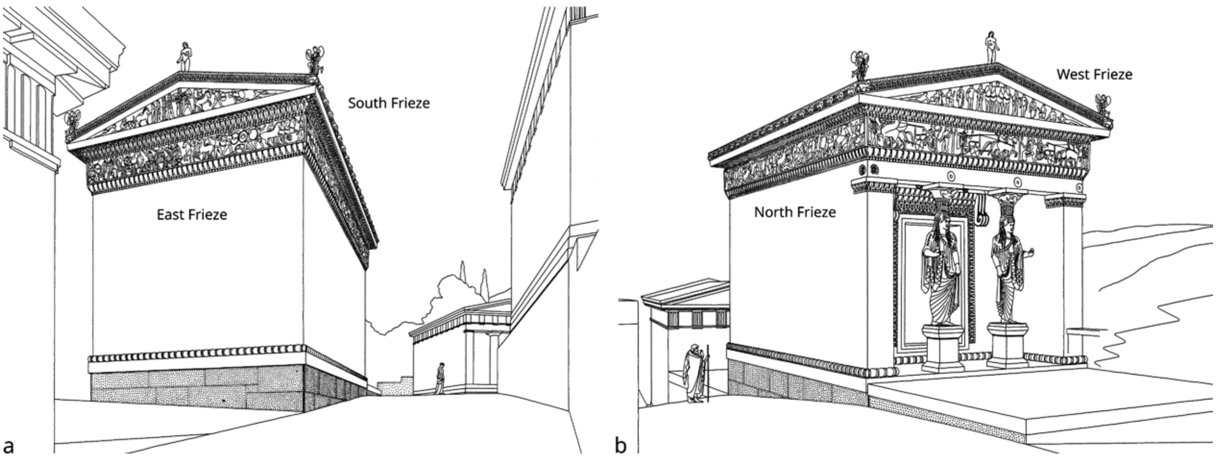
**8** Daux – La Coste-Messelière 1928; La Coste-Messelière, 1936; La Coste-Messelière 1944–1945; Jockey et al. 2017–2018; Jockey 2021.

**9** Daux – La Coste-Messelière 1927; Moore 1977; Moore 1985; Jockey 2021.

**10** See below, 14 f. for a discussion on this assertion.




1 The Siphnian Treasury located in Apollo's sacred precinct at Delphi (GDSite)




2 The Siphnian Treasury (525 B.C.): distribution of the frieze on the building

The question arises to what extent all these contextual factors played a role in the selection of both the themes and the palettes used for their colouring. Did these parameters result in the execution of a pictorial art comprising colours and underlayers, contrasts between backdrops and figures, specific colour applications, as well as light and shadow effects? To address this query, it was first necessary to identify the palette of applied pigments through spectroscopic methods.

3 East frieze: the ‹Divine Council› and the Scene of the Trojan War on the east side

4 North frieze: detail of the Gigantomachy

5 The Judgement of Paris

6 South frieze: abduction scene

# Technical Investigation

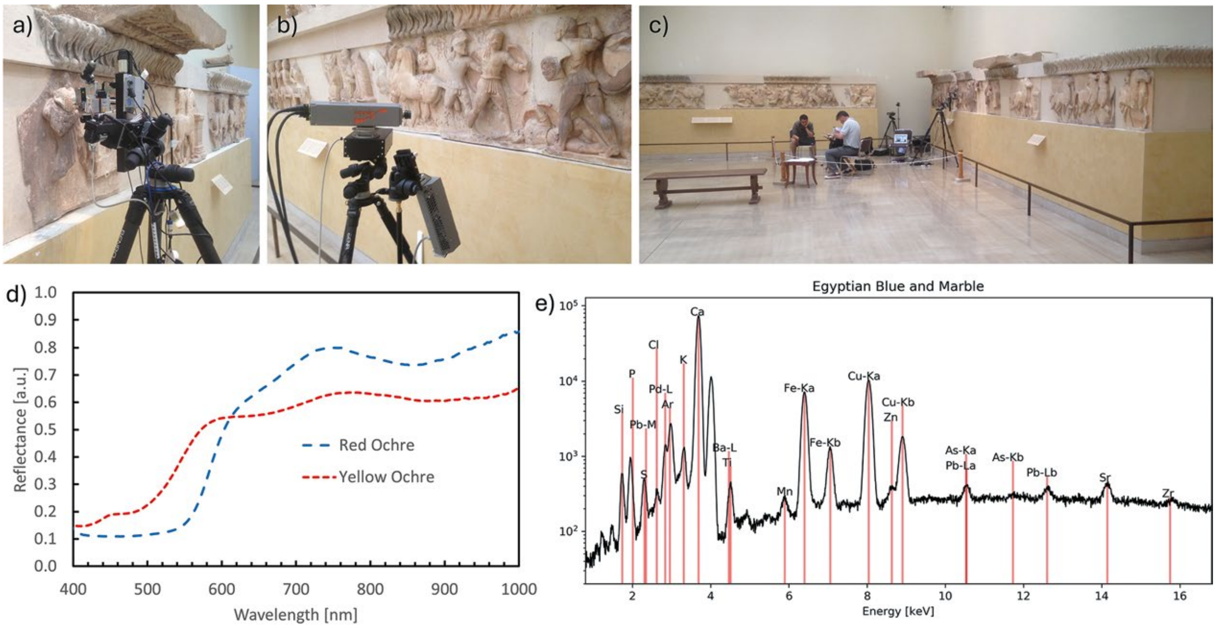
The investigation commenced with an examination of the frieze surface using the naked eye and microscopy, coupled with comprehensive documentation through photography, encompassing photogrammetry techniques. Zones in the areas where remainders of pigments were expected were investigated with the following methods of spectroscopic imaging: macroscopic scanning X-Ray Fluorescence Spectroscopy (MA-XRF) and Reflectance Imaging Spectroscopy (RIS). An overview of both techniques can be found in the literature[11].

Upon exposure to primary X-rays, e. g. if emitted by an X-ray tube, atoms in a sample respond by the emission of inner shell electrons, leaving behind inner shell vacancies. The atoms relax from this excited state when their outer shell electrons descend into the inner shell vacancy. The energy which stabilizes the atom is emitted partly in the form of X-rays, which have an energy several thousand times that of visible light. The precise energy of the emitted X-rays is dependent on the energy of the atom shells involved in the transition, which is dependent on the atomic number of the atom. Consequently, XRF allows the elemental composition of a sample to be identified. While this permits drawing conclusions on the chemical components present it does not directly provide information on the chemical species. It is thus not possible to differentiate between the red hematite ($Fe_2O_3$) and the yellow goethite (α-FeOOH) based on XRF alone. Mainly due to the absorption of the radiation in the air between the sample and the detector, XRF is limited to the study of elements heavier than aluminium.

By using a collimated or focused X-ray pencil beam, one can excite only selected parts of a sample and, by scanning such a pencil beam over the sample's surface, one can acquire elemental distribution images pixel by pixel.

The pre-fix ‹macroscopic› is used to distinguish this form of XRF from the more common micro XRF which is used to investigate small samples. The techniques also have different demands in terms of their instrumentation.

11 Alfeld – de Viguerie 2017.




7 On-site investigation of the Frieze of the Siphnian Treasury: a) MA-XRF instrument; b. c) RIS instrument area sectioned off during investigations; d) Examples of RIS spectra: red ochre (hematite, $Fe_2O_3$) and yellow ochre (goethite, α-FeOOH); e) Example of an XRF spectrum with indicated fluorescence lines

The acquired X-Ray fluorescence spectra contain several lines per element that are broadened by the limited detector resolution. A special software allows these spectra to be deconvoluted and the intensity of fluorescence lines to be extracted, which is proportional to the amount of the element present. An example of the XRF spectrum and the instrument can be seen in Fig. 7.

The results of MA-XRF are grey-scale elemental distribution images (one per element), in which each pixel corresponds to one recorded spectrum while a brighter colour indicates a stronger intensity. Alternatively, different grey-scale maps can be combined to produce RGB (Red, Green, Blue) images, in which each colour channel corresponds to a different element. These images are to be understood as qualitative in nature, as the absolute quantification of elemental concentration of a sample by XRF is feasible but requires homogeneous samples and precisely controlled experimental conditions.

In the experiments carried out in 2015 and 2016 in Delphi, we used an in-house build MA-XRF scanner of LAMS with a travel range of 20 × 20 cm$^2$, a 3 W Rh-anode X-ray tube and a single Silicon Drift Detector (SDD) with 17 mm$^2$ active surface. The instrument has elsewhere been described in detail[12].

In RIS, the surface of the frieze was illuminated with three 50 W halogen lamps that emit light from the visible into the near infrared. The reflected light was recorded by a hyperspectral camera in which one vertical line of the image is selected via a slit and projected onto a wavelength dispersive element that separates the lines according to their wavelength. In the camera used in these experiments, the camera was rotated by a motorized stage, so that the final image was acquired line by line, a process that is considerably faster than the pixel-wise acquisition used for XRF. The camera used was sensitive to the wavelength range from 400 nm to 1000 nm, as defined by the Si material of the semiconductor. In this project we used a VNIR Spectral Camera HS V10E by Specim (Oulu, Finland), which was sensitive to the visible and near IR range (VNIR, 400–1000 nm, 2.8 nm spectral resolution).

The reflectance curves of different pigments are highly characteristic, meaning that they can be used like fingerprints to identify a pigment by a known reference. However, on their own, these spectra provide little information about the chemical identity and composition of a sample. Examples of reflectance curves and the RIS instrument can be seen in Fig. 7. Consequently, RIS is commonly not deconvoluted by

**12** Alfeld et al. 2017.

an analytical model, but the data is instead factorized by statistical means. As has been detailed elsewhere[13], we used a statistical model to find pure spectral archetypes in the acquired data sets that can be used to describe the rest of the data as a linear combination. The pigments which an archetype stands for were identified by comparing them to known reference samples. By expressing each acquired spectrum as a linear combination of these archetypes, we calculated a measure of how similar the recorded spectrum was to the archetype. These ‹similarity maps› were also expressed as greyscale pictures, with a brighter tone indicating a higher similarity. As elemental distribution images, we could also combine several of these maps to RGB images.

In summary, RIS is faster and thus allows for the survey of larger surfaces. It has a larger depth of focus than XRF and is thus better suited for the investigation of three-dimensional objects. However, RIS is limited to investigating the compounds present at the surface of the object. Already thin layers of dirt or dust can render data difficult to evaluate. Compounds can be identified by their known spectroscopic fingerprint in RIS, but, if no reference spectra are available, little can be said about the chemical character of a compound. Mixtures of pigments are also not straightforward to resolve. However, RIS is well suited to enhance faded pigments at the surface, such as the barely visible hematite layer that was detected by RIS but barely, if at all, by XRF.

On the other hand, XRF allows for a clear and unambiguous identification of chemical elements heavier than aluminium while not being limited by mixtures of different elements. It can detect elements at the surface and in a few tens to hundreds of micrometres below it (depending on the element). This makes it well suited to detecting elements present below preserved soil encrustations. Due to the absorption of X-rays in the air and the small angle of observation of the X-ray semiconductors that are commonly employed, the instrument needs to be close to the surface and has a limited depth of focus.

For these reasons, both techniques are highly complementary as one probes the elemental and the other the chemical identity of species in the sample. Further, XRF is slower but can probe more deeply into the sample, while RIS is faster but is limited to the surface.

| Pigment | East | North | West | South |
|---|---|---|---|---|
| Hematite | X | X | X | X |
| Mixed Hematite | (X) | X | | |
| Lead White | (X) | | (X) | |
| Other Lead pigment | | | (X) | |
| Egyptian Blue | | | X | X |
| Other Copper pigments (Azurite+?) | X | X | X | |
| Cinnabar | | | X | |
| Minium | | | | X |
| Lapis Lazuli | | | | (X) |
| ‹Brass Black› | | ? | | |
| Manganese black | (X) | | | |

Table 1 Pigments found on each side of the frieze; key: X = presence confirmed; (X) = presence strongly suspected, ? = presence suspected (© Jockey)

**13** Alfeld et al. 2018. We also discuss the reasoning and limits behind this approach in detail in this article.

# Interpretations of the Results: Evidencing a Distinct Pictorial Art

These findings offer an opportunity to validate our preliminary investigations into possible correlations between colour/pigment selections and their precise placement on each side of the frieze, the narrative of the frieze, and the vantage points from which visitors to the temple perceived the frieze. All this represented an integral part of the challenge (agon) underlying the ancient commission itself. In order to better understand the nature of this challenge, it is worth summarizing the characteristics of this pictorial art.

Our scientific analysis allowed some of the main characteristics of the frieze's pictorial virtuosity to be recognized and tentatively related to the spatial context of the individual panels. Of course, we must remain extremely cautious of our results in light of the relative scarcity of the material evidence, even if the implementation of RIS makes it possible to determine the distribution of colours on a relatively large surface.

## Pictorial Art, 1: The Colour Palette

A series of analysis carried out in 2015 and 2016 brought to light an unexpectedly rich colour palette[14]. H. Brecoulaki had already noticed that, during the archaic period, «the palette of pigments applied to marble sculptures was much more varied than on terracotta artefacts and wall paintings[15]». The pigments that were identified on the frieze fall into two categories, which we suggest calling ‹common› and ‹uncommon› (Table 1). In this classification we adhere to H. Brecoulaki's illuminating definition of precious colours or, in other words, uncommon pigments: «considering their extraordinary visual properties, their intrinsic material value, their remote geological source, the complexity of the manufacture and preparation process, and finally the symbolic values they may have conveyed within a broader cultural context[16]».

According to our analysis, among the ‹common› pigments used on the frieze were hematite, Egyptian blue, and manganese black, all either pure or mixed (mixed hematite, mauve). Contrasting with them were the ‹uncommon› or ‹unexpected› pigments, such as azurite, cinnabar, minium, lapis lazuli, and possibly a brass-based black, all of which paved the way to the production of ‹precious colours›[17]. Except for the north side – which was perhaps owing to chance, due to the small amounts of pigments preserved – these ‹uncommon› pigments were found on all parts of the frieze, even if in very limited areas.

## Pictorial Art, 2: Evidencing a Preparation Layer

In the search for the exact chromatic hue, the choice of the preparation layer plays a key role as it interacted with the applied pigments and thus determined the final colour result (Fig. 8).

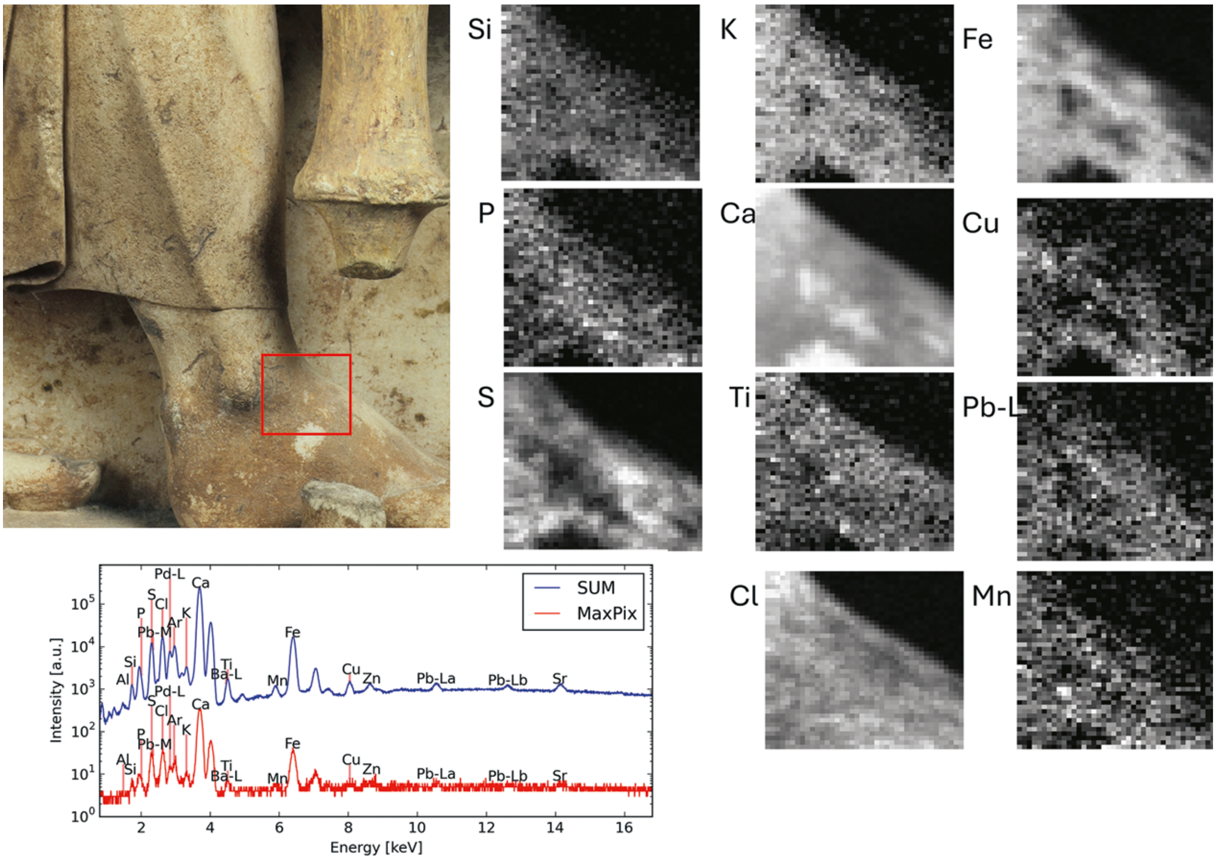
A clay-based brownish preparation layer containing earth pigments under a final azurite layer testifies this attentiveness to accurate colouring. In contrast, lead white, when used as an undercoat, would have homogenized rather than allowed for the creation of nuances (Fig. 9).

## Pictorial Art, 3: The Contrasts

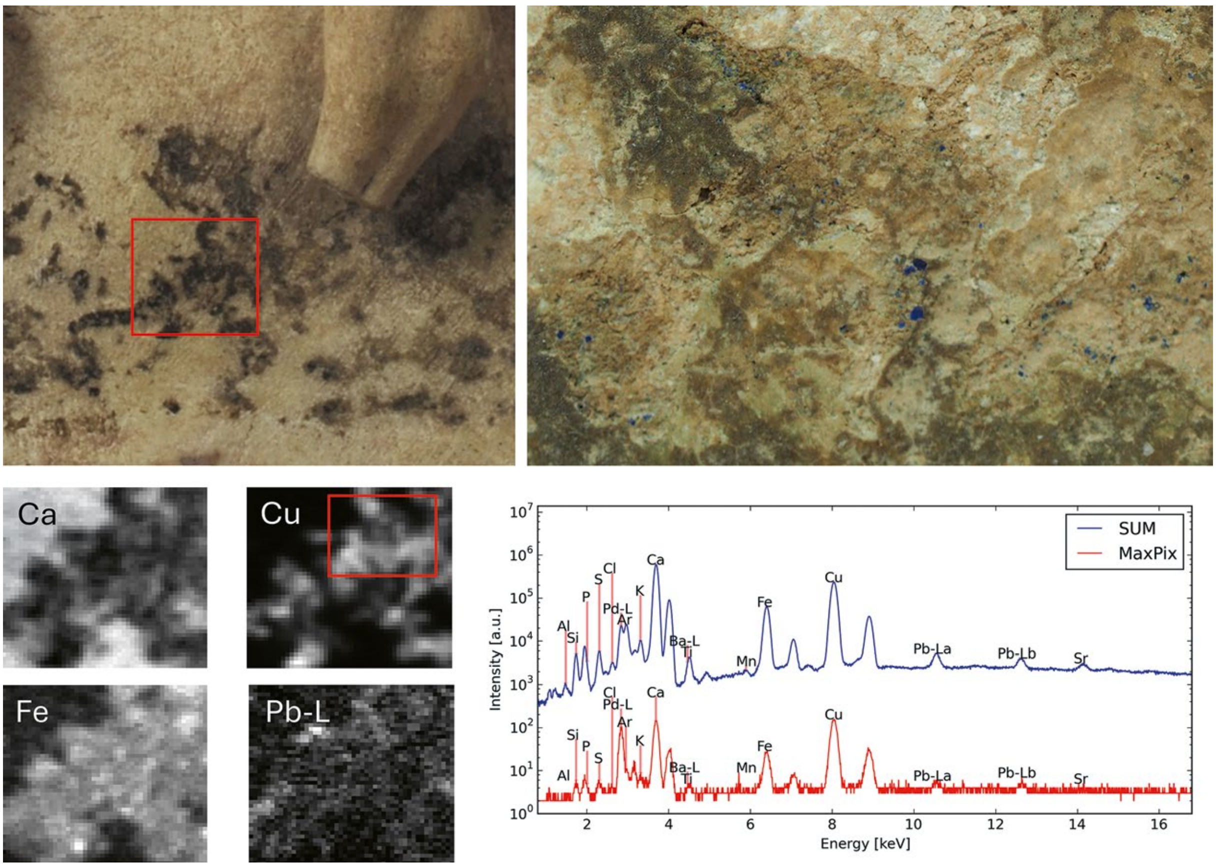
Certainly the distribution of the common/uncommon pigments on the friezes and their figures is not a matter of chance. They could have played a role in the strong contrasts on which the chromatic and iconographic narratives discourses are based, as is suggested by the contrasts between backgrounds and the corresponding figures. In some cases, hyperspectral imagery produced spectacular evidence for such contrasts (Fig. 10).

This kind of duality finds further expression in the fact that the background colours were different on the different sides of the building. Although it has long been noticed, scientific investigations now con-

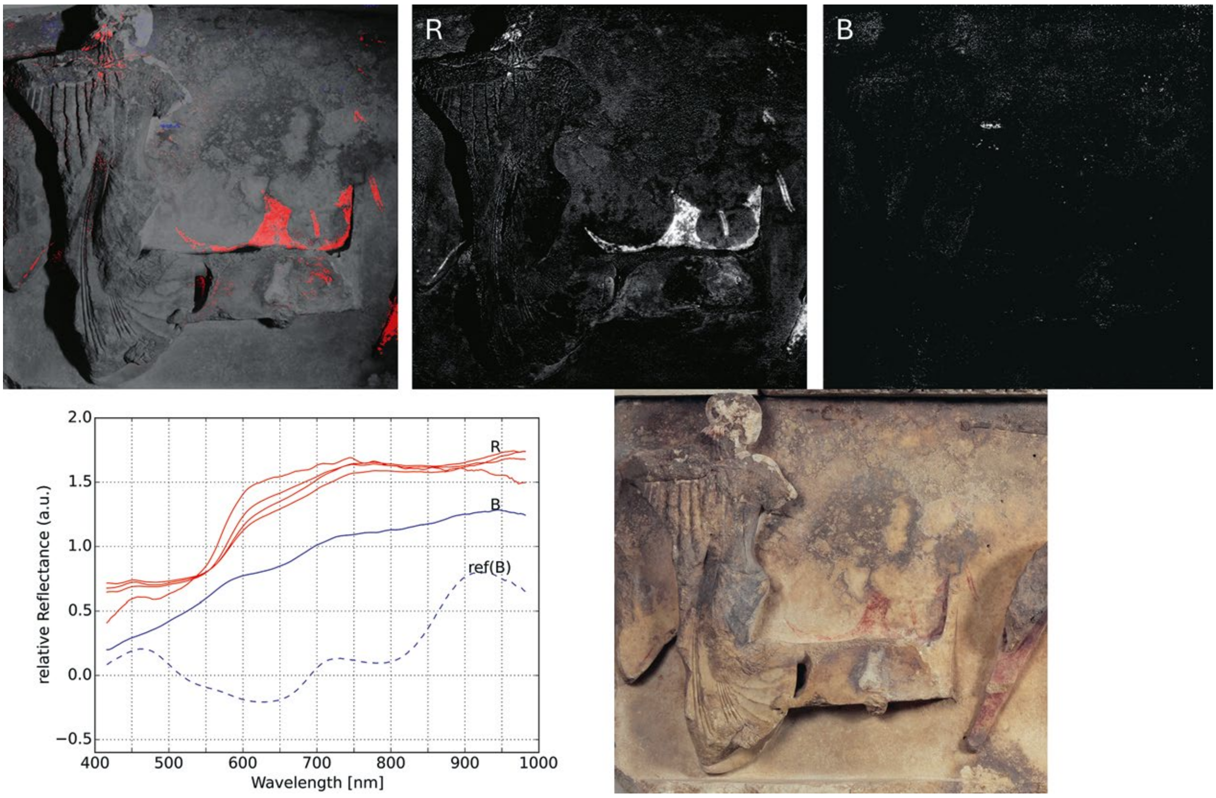
**14** Cf. above Table 1.
**15** Brecoulaki 2014, 14 f.
**16** Brecoulaki, 2014.
**17** For an extensive list of common pigments as evidenced on some of the wood panels of Pitsa, see Brecoulaki 2014, 15.




8 Remnants of an underlayer on the foot of Apollo, characterized by the presence of iron (Fe) and several minor elements, investigated with MA-XRF




9 East frieze: a degraded azurite background ($Cu_3(CO_3)_2(OH)_2$) on a brownish underlayer was evidenced by MA-XRF




10 Results of hyperspectral reflectance imaging of Artemis/Aphrodite and her chariot on the western frieze as false colour image, pure component images of R(ed) and B(lue) archetypes, representing hematite and Egyptian blue; plot of archetypes and photograph

firm two modes of background colours and their distribution: an Egyptian blue of lighter intensity was applied on the West and South sides, which contrasted with an azurite of darker intensity on the North and East sides[18]. Previous scholarship speculated that this difference represented evidence of the activity of two separate workshops which were in simultaneous operation. Although such a hypothesis remains possible on account of the carving styles, it cannot be established from the differences of colour tones. Rather, this discrepancy is more likely to be related to the general location of the building.

| Side | Background | Back-ground tone | «Uncommon» pigments | Light and shade effects | Brilliance |
|---|---|---|---|---|---|
| West | Egyptian Blue | Lighter | Cinnabar | No | Yes |
| North | Azurite | Darker | Manganese black | Shading | No |
| East | Azurite | Darker | «Brass based black» | Shading<br>Lighting? | No |
| South | Egyptian Blue | Lighter | Lapis Lazuli<br>Minium | No | Yes |

Table 2 ‹Common› and ‹uncommon› pigments as well as effects of light and shade in relation to position (©Jockey)

18 See already La Coste-Messelière 1928; La Coste-Messelière 1944-1945.

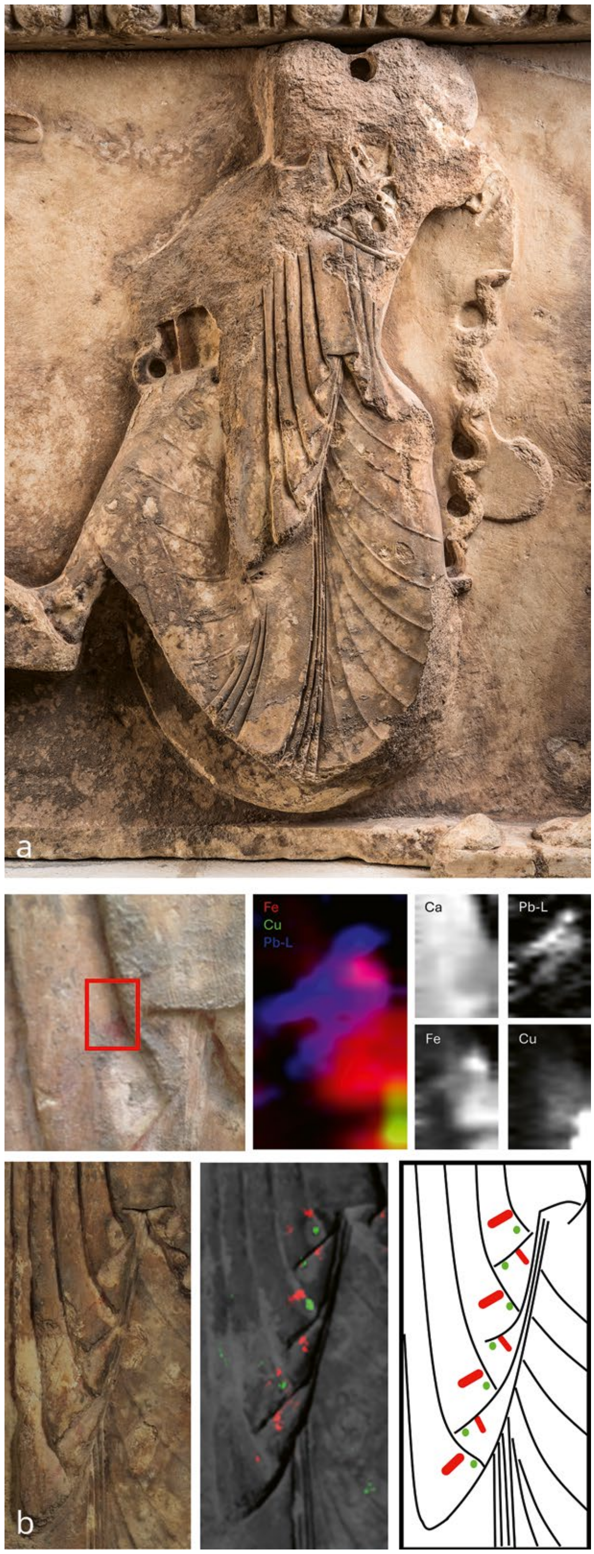
In essence, the opulence of the palette and the stark contrasts (‹common› vs ‹uncommon› pigments; azurite vs Egyptian blue backgrounds; background vs figures) prompt a fundamental question: is all this merely an outcome of pictorial virtuosity related to the ongoing rivalry between archaic Greek artists, as seen in various instances elsewhere[19]? Or were these choices also determined by specific context of display and the reception of the friezes?

By comparing different parameters of colour and space (Table 2), the following hypotheses can be formulated: it seems that the lighter the background, the more brilliant the figures, as suggested by both the west and south sides. Conversely, the darker the background, the darker also the figures and pictorial trends, as testified by the north and east sides.

This result differs from that observed by H. Bankel on the temple of Aphaia in Aegina[20]. There, exactly the opposite phenomenon can be observed: the Doric frieze of the main façade (which was exposed to sunlight) shows dark hues, while the Doric frieze around the cella (in shadow) shows lighter hues of the same colour palette. In the darker (and protected space), the more costly pigments were also used.

The location of the treasury, situated with its back to the rear side of its Sicyonian neighbour, can explain this chromatic contrast (see Fig. 1). In opting for a dark colour palette within a narrow and somewhat dimly lit space, the artists likely aimed to underscore the contrast with the brilliance of the main façade, the initial view for worshippers as they entered the sanctuary through its west entrance. We may recall here the prevailing rivalry among archaic cities in these panhellenic places, a competition that was mirrored in the choices of colours, hues, and pigments.

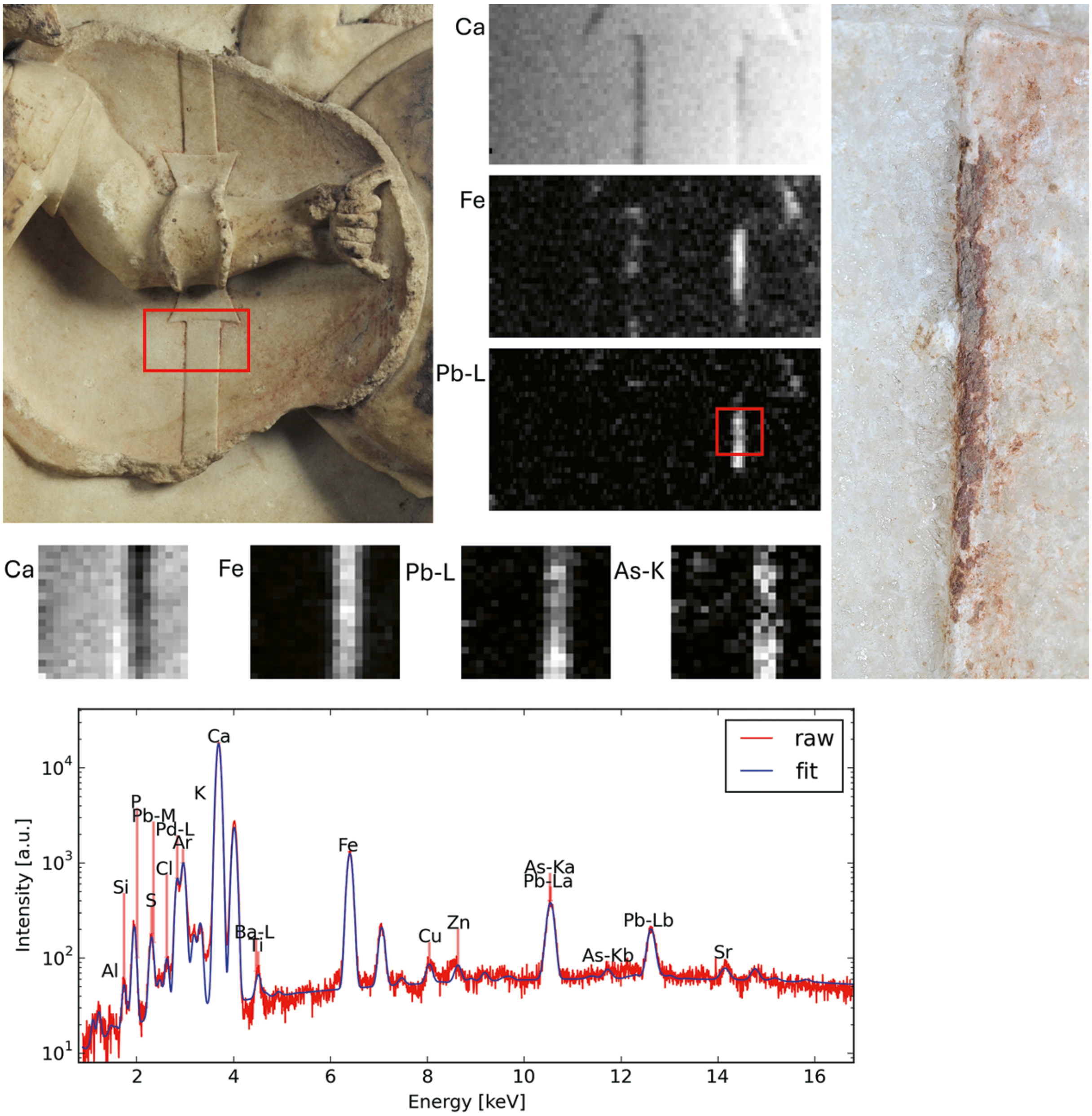
These distinctive ‹Siphnian preferences› and the taste for bold material and chromatic contrasts are further evidenced in the application of paint to the decorative patterns and expressive details. During our survey of the frieze, we were able to identify the pigments used for the decorative patterns, such as those on the folds of Athena's garment in the west frieze. A (very) partial reconstruction, based on hyperspectral imaging, reveals the red and green pattern of Athena's himation border (Fig. 11).




11 Detail of the south frieze showing Athena re-mounting her chariot: a) MA-XRF scan of detail of the himation, illustrating that, next to the visible red paint, traces of lead (Pb) and copper (Cu) based pigments can also be detected. The red shape indicates the investigated area; b) Partial reconstruction of the red and green pattern of Athena's himation border by means of hyperspectral imaging (west frieze)

**19** As noticed on the wooden panel of Pitsa: Brecoulaki 2014, 15 f.

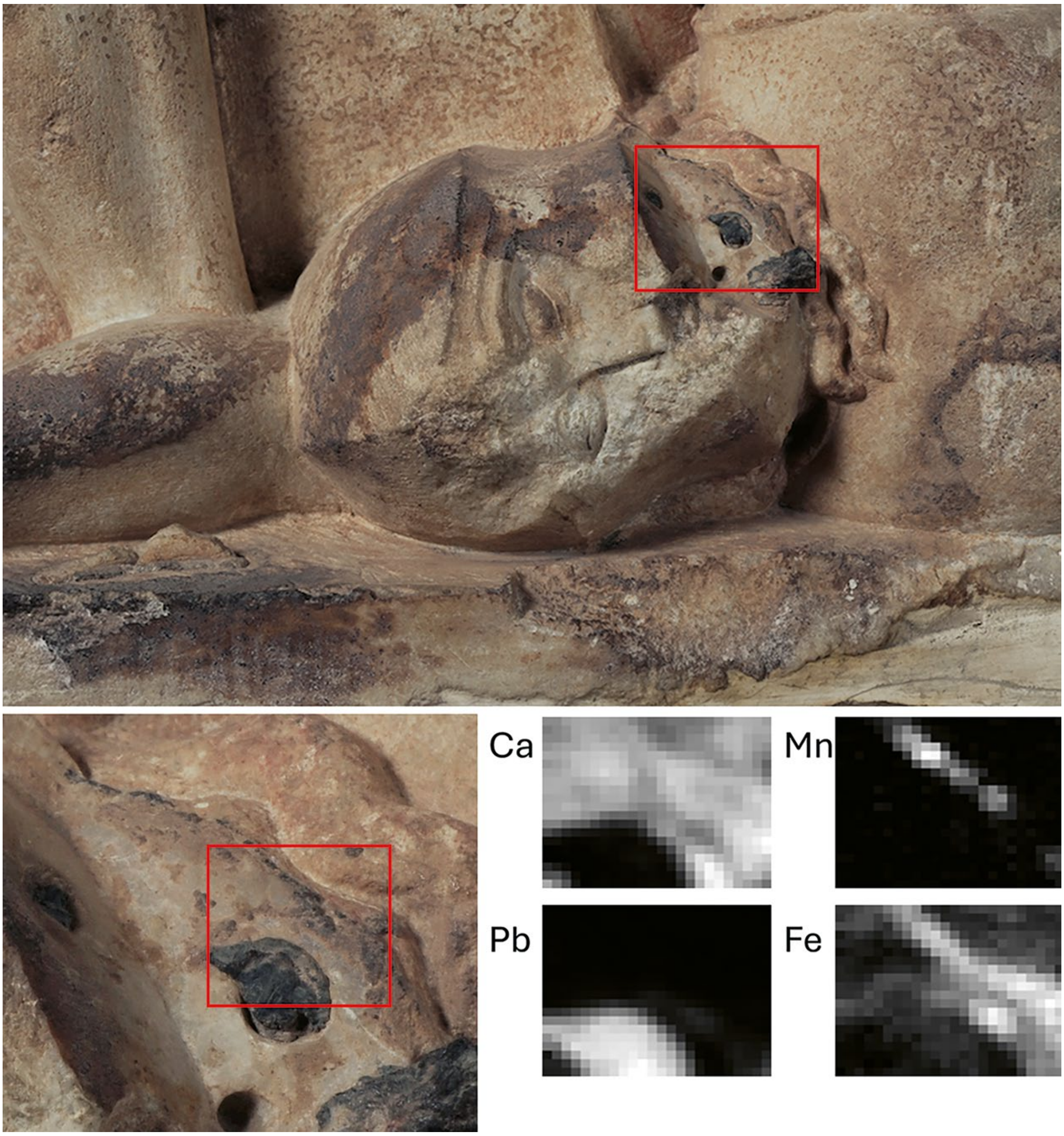
**20** Bankel 2004, esp. 80 f.




12 Gigantomachy of the north frieze; ‹modelling› was evidenced by the use of hematite ($Fe_2O_3$) mixed with lead (Pb) and arsenic (As) based pigments, which emphasized the carved and painted ‹leather› strip on the inner side of a warrior's shield.

## Pictorial Art, 4: Modelling

Furthermore, the use of colour additions to enhance the modelling of carved figures was evidenced in certain areas: hematite was found on several shields, and in the Gigantomachy of the north frieze, mixed hematite was applied to accentuate a carved ‹leather› strip on the inner side of a warrior's shield (Fig. 12).



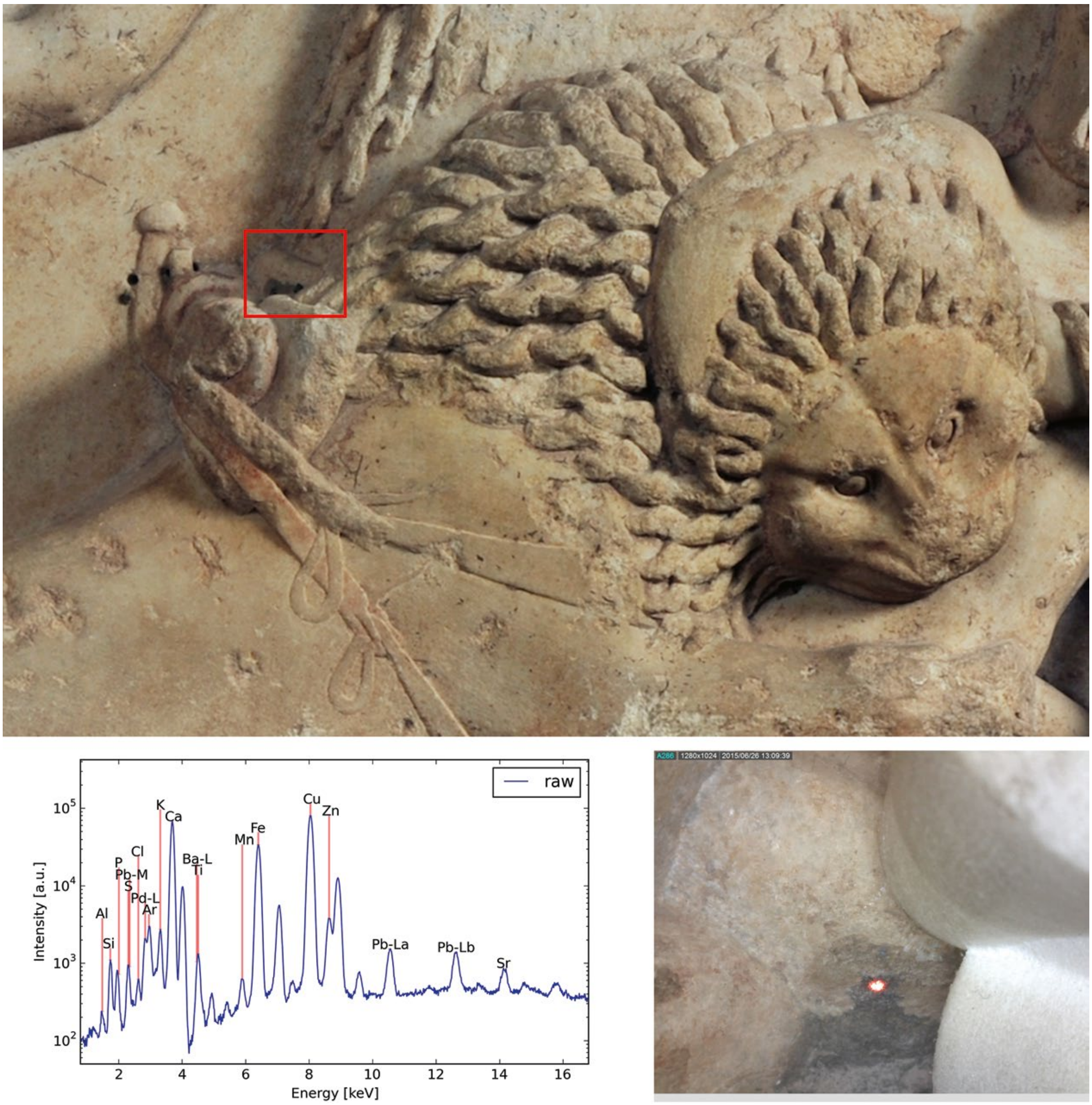

13 Probable effects of ‹light and shade› on a dead warrior (perhaps Antilochos). The red frames indicate the magnified area in the smaller image. In the highlighted *area a*, a black line rich in manganese (Mn) was identified by MA-XRF. The lead (Pb) at the bottom of the area is the remainder of a lead piece that was either used for joining marble parts or fixing metal parts, e. g. a weapon or arrow.

## Effects of ‹Light and Shading›

The specific use of painting for creating modelling effects likely extended to generating ‹light and shading› effects, as indicated by both survey and analyses. In certain areas, shading was achieved through black accentuations, as evidenced, for instance, on both the east and north friezes (Figs. 13. 14).

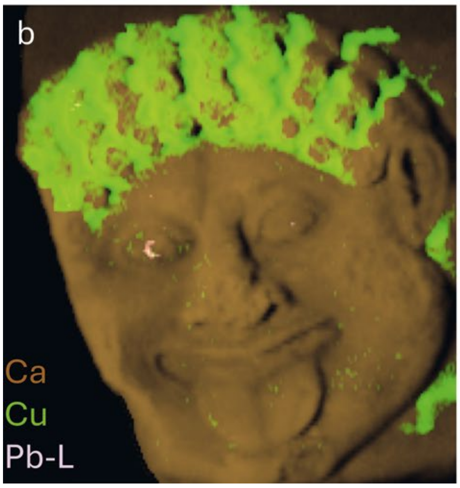
The creation of brilliance effects also involved a mix of pigments, as indicated by the XRF analyses on the gorgoneion of the Greek warrior (potentially Achilles) of the east frieze (Fig. 15).

On the right corner of the south frieze, two colour spots were examined (Fig. 16); one was identified as

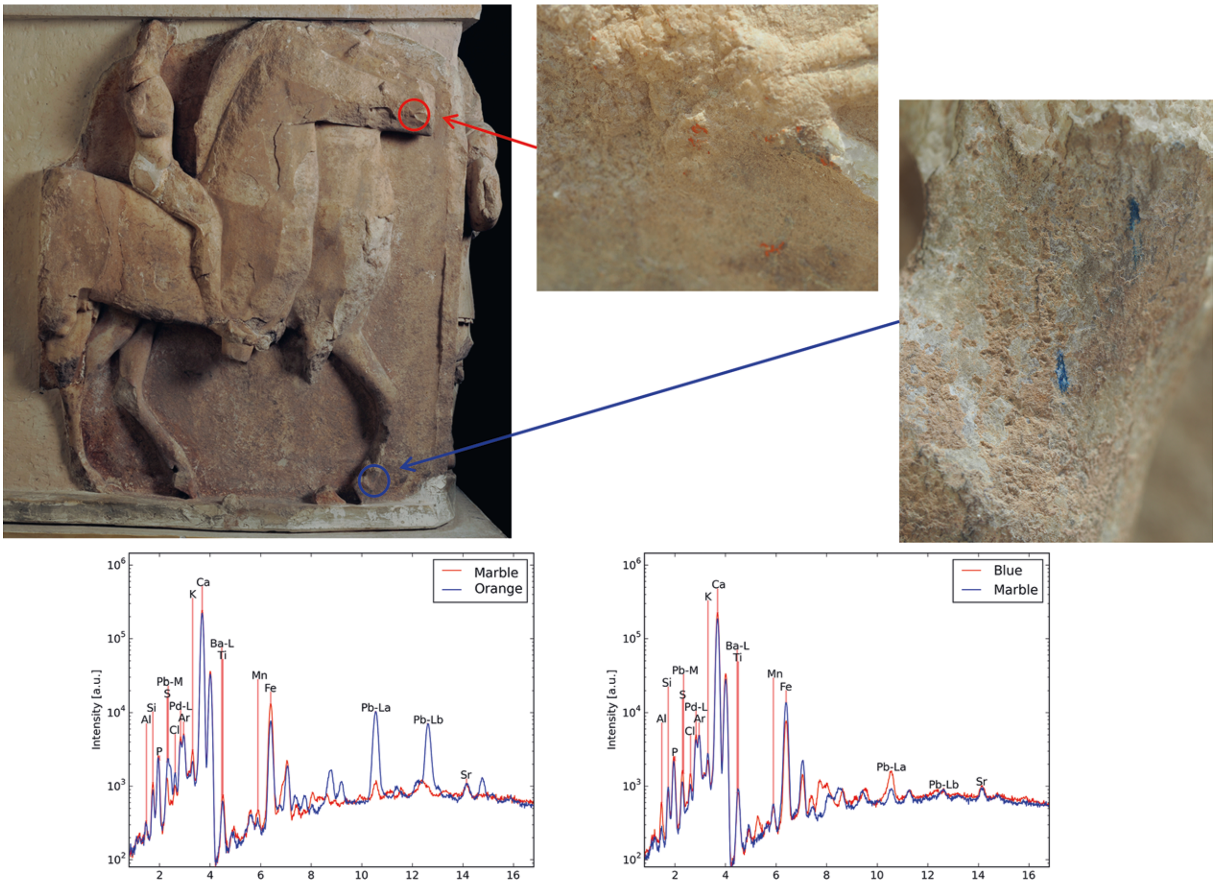



14 Probable effects of ‹light and shade› on the north frieze (Gigantomachy), chariot of Themis: shading with a touch of black (?); the red rectangle outlines the area in which a single XRF spectrum was obtained as initially marked by the laser spot in the high resolution photograph. The XRF spectrum clearly reveals the presence of copper (Cu) and zinc (Zn), the main components of brass, in addition other elements.

minium ($Pb_3O_4$) and the other as lapis lazuli ($Na_7Al_6Si_6O_24S_3$). Since both spots were situated on the horse, they raise the question whether this brilliance effect, applied to the edges of the horse's leg and nostrils, was really necessary at the corner of the frieze, as it would have been imperceptible from the southern part of the peribolos.


15 a) East frieze, detail of Greeks and Trojans in combat; b) Composite MA-XRF image of the Gorgon head (approx. 10 × 10 cm²) showcasing a stronger signal for the elements calcium (Ca) from the marble, copper (Cu), and lead (Pb), represented by a brighter hue. These pigments were used to accentuate the hair and formed round, luminous irises in the eyes.




16 Corner of the south and east frieze, where minium and lapis lazuli were identified.

# Types of Scenes, Modes of Perception, and Material Data

These observations prompt our final exploratory question, which concerns the potential associations between colours, pigments, and pictorial treatment choices alongside the frieze's placement (its exposure), the nature of discourse, and the viewing perspective (Table 3). The results of our analyses allow us to compare different contextual parameters. This approach may contribute to a better understanding of the overarching chromatic and iconographic programme, executed by the anonymous sculptors and painters upon commission by the Siphnians.

In the table provided, we juxtaposed the diverse frieze positions with the types of scenes and their iconographic viewpoint, meaning their arrangement as a diptych, triptych, or linear composition (from left to right), along with the observer's likely viewing perception of the scene (static and/or moving). We also considered the different chemical and pictorial features evidenced, taking into account an important factor that V. Brinkmann stressed some years ago, following P. de la Coste Messelière: the brilliance produced by weapons such as spears, swords or arrows inserted in the hands on the bodies of fighters.

Here, we could propose the hypothesis that the Siphnian magistrates who were in charge of this prestigious programme instructed the painters to enhance the west façade with a maximally brilliant appearance by utilizing ‹uncommon pigments› like cinnabar against a light blue background. One obvious rationale behind this could be that this was the main façade of the building. Another consideration could be linked to the western access point to the sanctuary, with the brilliant pigments intended to dazzle visitors using this entrance for sacrificial ceremonies in the morning, when the sunlight was less intense. This dynamic may have been in response to the need for the decorative friezes to shine, also in relation to the polychrome treatment of the lost pediment and the caryatids (but we lack further evidence on this point).

In this case, the colours and pictorial treatments would have played a major role in the definition of the *epiphanestatos topos* itself, which was not only the ‹most sacred and brightest place› to be seen by the largest possible number of visitors, but was also linked to its *epiphaneia*, i. e. the appearance of its surface, which was distinguished by its bright polychrome nature.

In contrast, the dark north side, which was never lit, was the ideal place for telling a long, dark story, such as a gigantomachy, with its dark red blood portraying the wounded warriors. Here, the brilliance of the weapons would have created a more spectacular and sinister atmosphere.

The situation on the east side is more complex and we must consider both the access to the sanctuary, either from the west or the southeast, and the diptych composition of the frieze. Independently of the access-point, it seems that the part of the east frieze that was on the beholder's left side was always painted to serve as a kind of counterpart to the west frieze, yet by other pictorial means than the latter. These involved a special pictorial treatment with ‹light and shade› effects, such as, for instance, a touch of lead white identified on the foot of Apollo. The two friezes shone with a similar brilliance, but as the result of different, and even opposing, pictorial methods. Through its warlike theme, the second panel of the diptych ensured the transition to the Gigantomachy depicted on the north side (from the northwest corner).

Finally, the south frieze poses a greater challenge for comprehension since it was largely hidden from within the sanctuary due to its proximity to the peribolos. Despite this, its orientation and the use of pigments such as minium and lapis lazuli (albeit with limited evidence currently) rendered it the brightest part of the frieze. Why so? One could speculate that it was intentionally painted in this manner to ensure visibility to worshippers standing outside the peribolos and looking at the frieze from a much lower vantage point.

In conclusion, the elaborate polychromy of the Siphnian Treasury cannot solely be understood in terms of its pictorial virtuosity, even though this is supported by the use of high-quality, innovative pigments and painting techniques including contrasts, shading, and shaping. Its rich colour was also strongly linked to the physical presence of political rivals, whose monuments could have overshadowed its own narrative of piety[21]. However, at the time of its dedication to Apollo in 525 B.C., few such monuments are attested, with the Sicyonian Treasury being one notable example. The Theban Treasury (SD 124)[22], which currently faces it, was built much later, after the Battle of Leuctra in 371 B.C., following the defeat of Sparta by Thebes. Hence, at the time of its original dedica-

**21** Neer 2001.

**22** Bommelaer – Laroche 2015, SD 124.

| Side | Kind of scene | Perception | Main contrast between background and figures | | Background tone | «Uncommon» pigments | Light and shade effects | Brilliance (pigments) | Brilliance (metal pieces) |
|---|---|---|---|---|---|---|---|---|---|
| West | Narrative | Synoptic | Background | Egyptian blue | Lighter | Cinnabar | No | Yes | Yes |
| | | | Figure | Hematite | | | | | |
| | | | | Cinnabar | | | | | |
| North | Narrative | Linear | Background | Azurite | Darker | Manganese black | Shading | No | Yes |
| | | | Figure | Hematite | | | | | |
| East | Narrative | Bi-synoptic | Background | Azurite | Darker | «Brass» black | Shading | No | Yes |
| | | | Figure | Hematite | | | Lighting? | | |
| South | Symbolic? | Linear | Background | Egyptian blue | Lighter | Minium | No | Yes | Yes |
| | | | Figure | Hematite | | Lapis lazuli | | | |

Table 3 Contextual parameters in comparison: scene type, perception modes, and material data (©Jockey)

tion, the Treasury of Siphnos faced no direct rival. Moreover, it was prominently visible to those entering the sanctuary from the west, who would have understood its brilliant chromatic and ideological narrative, which was connected to the brilliance of the newly discovered gold and silver mines on the island. Future research should explore how the Siphnians may have adapted their colour choices in reaction to the emergence of new buildings and dedications near their treasury.

## Acknowledgements

The authors extend their gratitude to Philippe Walter, Philippe Martinez, Maud Mulliez, Jonathan Devogelaere and Laurence de Viguerie for their support during the measurements on-site and the evaluation of the data. Further, we thank the French School in Athens (École française d'Athènes, ÉfA, dir. Alexandre Farnoux) and the Ephorate of Antiquities of Phocis (dir. Athanasia Psalti) for their support. Thanks go, finally, to Stephan Zink for his precious reading and improvement of the article and to Frederik Grosser for his overall care.

## Bibliography

**Alfeld – de Viguerie 2017** M. Alfeld – L. de Viguerie, Recent Developments in Spectroscopic Imaging Techniques for Historical Paintings – A Review, Spectrochimica Acta B, 136, 2017, 81–105; https://doi.org/10.1016/j.sab.2017.08.003

**Alfeld et al. 2017** M. Alfeld – M. Mulliez – Ph. Martinez – K. Cain – Ph. Jockey – Ph. Walter, The Eye of the Medusa: XRF Imaging Reveals Unknown Traces of Antique Polychromy, Analytical Chemistry, 2017; https://doi.org/10.1021/acs.analchem.6b03179

**Alfeld et al. 2018** M. Alfeld – M. Mulliez – J. Devogelaere – L. de Viguerie – Ph. Jockey – Ph. Walter, MA-XRF and hyperspectral reflectance imaging for visualizing traces of antique polychromy on the Frieze of the Siphnian Treasury, Microchemical Journal 141, 2018; https://doi.org/10.1016/j.microc.2018.05.050

**Bankel 2004** H. Bankel, Farbmodelle des spätarchaischen Aphaia-Tempels von Ägina, in: V. Brinkmann – R. Wünsche (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Exhibition catalogue Munich [2](Munich 2004) 70–83

**Bommelaer – Laroche 2015** J.-F. Bommelaer – D. Laroche, Guide de Delphes. Le site, Sites et monuments 7 [2](Paris 2015)

**Brecoulaki 2014** H. Brecoulaki, «Precious Colours» in Ancient Greek Polychromy and Painting: Material Aspects and Symbolic Value, RA 2014, 1, 1–36

**Brinkmann 1994** Beobachtungen zum formalen Aufbau und zum Sinngehalt der Friese des Siphnierschatzhauses, Studien zur antiken Malerei und Farbgebung 1 (Ennepetal 1994)

**de la Coste-Messelière 1928** P. de la Coste Messelière, Monuments figurés, sculpture. Art archaïque, les Trésors ioniques (en collaboration avec Ch. Picard), FdD 4, 2 (Paris 1928)

**de la Coste-Messelière 1944–1945** P. de la Coste Messelière, Nouvelles remarques sur les frises siphniennes, BCH 68–69, 1944–1945, 5–35

**Daux – La Coste-Messelière 1927** G. Daux – P. de la Coste Messelière, La frise du Trésor de Siphnos, dimensions et composition, BCH 51, 1927, 1–56

**Daux et al. 1987** G. Daux – E. Hansen – M.-Ch. Hellmann, Le Trésor de Siphnos, FdD 2 (Paris 1987)

**Jockey et al. 2017–2018** Ph. Jockey – H. Glanville – C. Seccarroni (eds.), Éclat. Brilliance and its Erasure in Societies, Past and Present: Vocabulary, Operations, Scenographies, Meanings, Kermes 101–102, 2017–2018, 7–100

**Jockey 2021** Ph. Jockey, Le Trésor de Siphnos, in: J.-L. Martinez (ed.), Un âge d'or du marbre. La sculpture en pierre à Delphes dans l'Antiquité, FdD 4, 8 (Athens 2021) 123–183

**Martinez 2021** J.-L. Martinez, Un âge d'or du marbre. La sculpture en pierre à Delphes dans l'Antiquité, FdD 4, 8, 1 (Athens 2021)

**Moore 1977** M. B. Moore, The Gigantomachy of the Siphnian Treasury: Reconstruction of the Three Lacunae, BCH Suppl. 4, 1977, 305–335

**Moore 1985** M. B. Moore, The West Frieze of the Siphnian Treasury: A New Reconstruction, BCH 109, 1985, 131–156

**Neer 2001** R. T. Neer, Framing the Gift: The Politics of the Siphnian Treasury at Delphi, ClAnt 20, 2, 2001, 273–344

**Picard – de la Coste-Messelière 1927** Ch. Picard – P. de la Coste-Messelière, Sculptures grecques de Delphes (Paris 1927)

**Picard – de la Coste-Messelière 1928** Ch. Picard – P. de la Coste Messelière, Les Trésors Ioniques, FdD 4, 2 (Paris 1928)

**Picard – de la Coste-Messelière 1929** Ch. Picard – P. de la Coste-Messelière, La sculpture grecque à Delphes (Paris 1929)

**Picard – de la Coste-Messelière 1936** P. de la Coste-Messelière, Au musée de Delphes. Recherches sur quelques monuments archaïques et leur décor sculpté (Paris 1936)

## Authors

Philippe Jockey
Paris-Nanterre University
philippe.jockey@parisnanterre.fr
ORCID: 0000-0002-9826-2564
ROR: https://ror.org/013bkhk48

Matthias Alfeld
Delft University of Technology
m.alfeld@tudelft.nl
ORCID: 0000-0001-7974-9564
ROR: https://ror.org/02e2c7k09

# Image Credits

**Fig. 1** after Daux et al. 1987, pl. I; © École française d'Athènes
**Fig. 2 a. b** after Daux et al. 1987, 222 fig. 132; © École française d'Athènes
**Fig. 3** after Martinez 2021, 143 fig. 16 a. Eirini Miari EFA, N727-128
**Fig. 4** after Martinez 2021, 152 fig. 23 b. Eirini Miari EFA. N727-157
**Fig. 5** after Martinez 2021, 161 fig. 27 a. Eirini Miari EFA, N727-143
**Fig. 6** after Martinez 2021, 166 fig. 30 b. Eirini Miari EFA, N727-138
**Fig. 7** © Matthias Alfeld
**Fig. 8** reproduced from Alfeld et al. 2018, fig. DSI-10
**Fig. 9** reproduced from Alfeld et al. 2018, fig. 3
**Fig. 10** reproduced from Alfeld et al. 2018, fig. DSI-11
**Fig. 11** reproduced from Alfeld et al. 2018, fig. 6 f.
**Fig. 12** reproduced from Alfeld et al. 2018, fig. DSI-8
**Fig. 13** reproduced from Alfeld et al. 2018, fig. DSI-6
**Fig. 14** reproduced from Alfeld et al. 2018, fig. DSI-9
**Fig. 15 a. b** reprinted with permission from Alfeld et al. 2017, fig. 5; © 2017 American Chemical Society
**Fig. 16** reproduced from Alfeld et al. 2018, fig. DSI-7

All images attributed to Alfeld et al. 2018 are reprinted from: Matthias Alfeld, Maud Mulliez, Jonathan Devogelaere, Laurence de Viguerie, Philippe Jockey, Philippe Walter, MA-XRF and Hyperspectral Reflectance Imaging for Visualizing Traces of Antique Polychromy on the Frieze of the Siphnian Treasury, Microchemical Journal 141, 395–403, Copyright 2018, with permission from Elsevier, © 2018.

**Table 1–3** © Philippe Jockey