NY CARLSBERG GLYPTOTEK — THE COPENHAGEN POLYCHROMY NETWORK

Tracking Colour

The polychromy of Greek and Roman sculpture in the Ny Carlsberg Glyptotek

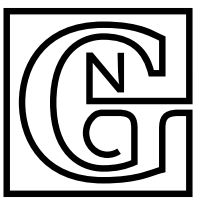
Preliminary Report 2, 2010

NY CARLSBERG GLYPTOTEK — THE COPENHAGEN POLYCHROMY NETWORK

Tracking Colour

The polychromy of Greek and Roman sculpture in the Ny Carlsberg Glyptotek

Preliminary Report 2, 2010



NY CARLSBERG GLYPTOTEK

NY CARLSBERG GLYPTOTEK & THE COPENHAGEN POLYCHROMY NETWORK

Tracking Colour

The polychromy of Greek and Roman sculpture in the Ny Carlsberg Glyptotek
Preliminary Report 2, 2010

The Copenhagen Polychromy Network is an interdisciplinary body formed in 2004 on the initiative of the Ny Carlsberg Glyptotek to conduct research on ancient sculptural polychromy in the collections of the Glyptotek.

PARTICIPANTS IN THE COPENHAGEN POLYCHROMY NETWORK

- Ny Carlsberg Glyptotek
  Jan Stubbe Østergaard, MA, research curator, project director; Maria Louise Sargent, project conservator, B.Sc.; Rikke Hoberg Therkildsen, project conservator, B.Sc.; Amalie Skovmøller, cand. mag., research assistant
- The Departments of Painting and Monumental Art, The School of Conservation of The Royal Academy of Fine Arts, Copenhagen
  Mikkel Scharff, M.Sc., conservator, Head of Department
- Nordic Center for Earth Evolution, Natural History Museum of Denmark
  Professor, Dr. Minik T. Rosing
- The Institute of Chemistry, Technical University of Denmark, Copenhagen
  Rolf W. Berg, Ph.D., associate professor

ACKNOWLEDGMENTS

We gratefully acknowledge a generous grant from The Kirsten and Freddy Johansen Foundation, for vital equipment and conservation staff.

THE INTERNATIONAL ADVISORY PANEL 2010

- M. Abbe (The Metropolitan Museum of Art, New York)
- D.H. Abramitis (The Metropolitan Museum of Art, New York)
- B. Bourgeois (Institut National d'Histoire d'Art, Paris)
- M. Bradley (University of Nottingham)
- V. Brinkmann (Liebieghaus Skulpturensammlung, Frankfurt a/M)
- A. Claridge (Royal Holloway, University of London)
- U. Koch-Brinkmann (Frankfurt a/M)
- Ph. Jockey (Université de Provence (Aix-Marseille 1); Maison Méditerranéenne des Sciences de l'Homme. Centre Camille Jullian)
- K. Lapatin (The J. Paul Getty Museum, Los Angeles)
- P. Liverani (Università degli Studi di Firenze)
- F. Queyrel (École Pratique des Hautes Études, Paris)
- J. Podany (The J. Paul Getty Museum, Los Angeles)

VALUABLE ADVICE AND SUPPORT HAS GENEROUSLY BEEN PROVIDED BY

Statens Museum for Kunst
The National Museum of Denmark
Leica Microsystems Denmark A/S

Editor: Jan Stubbe Østergaard and the Copenhagen Polychromy Network
Graphic design: Jakob Helmer, MAA

Published by the Ny Carlsberg Glyptotek, 2010. ISSN: 1904-1888

Contents

Preface

This report is a preliminary account of the 2010 activities of the NCG/CPN 'Tracking Colour' project. It offers an overview of salient aspects of developments in 2010, ending on a very happy note: an application to the Carlsberg Foundation for funding of a two-year prolongation of the project, from June 1st, 2011, has met with success.

Our project conservators, Maria Louise Sargent and Rikke Hoberg Therkildsen, have contributed two articles. One is a summary of the examinations carried out in 2010, the other is a case-study, dealing with the 'Sciarra Amazon', a mid-2nd century CE marble statue in the Glyptotek. Some brief archaeological comments are added.

Amalie Skovmøller, classical archaeologist and project research assistant, writes on our plans for bringing 'Tracking Colour' online. These plans can now move forward, thanks to the Carlsberg Foundation grant.

If we succeed in creating a project database, with a back-end accessible to researchers and a front-end website interface with a wider public, a prerequisite for future electronic publication of the project results will also have been secured.

For this report, the simple PDF-format developed last year is used again, in the clear and concise graphic design created by Jakob Helmer MAA.

Preliminary Report 2 does not contain contributions from our very busy external CPN partners, but they have actively assisted throughout the year, with advice and analytical input.

Nor does the report bring articles by scholars in our international network. The preface to Preliminary Report 1 envisaged such contributions, and it remains a vision – despite the odds against it. So: Preliminary Report 3, 2011, will be open for contributions from outside the NCG/CPN project. Such contributions will be subject to peer-reviewing and must be handed in by May 1st, 2011. Editorial guidelines will be made available on request.

It goes without saying that any critical comments on this second Report and suggestions for improvement will be much appreciated.

Finally, a *caveat*: Despite the signal advances made over recent decades, research in ancient sculptural polychromy still finds itself in a very vulnerable, formative phase. Its novelty, its interdisciplinary character and the considerable resources it requires, makes it the more difficult to find a footing of any permanence at humanistic academic institutions. As it is, research is not solely, but largely project-based and thus time-limited. To ensure that the resources invested, the data assembled and the experiences gained till now do not dissipate, a more durable international research platform needs to be constructed: a research centre.

Jan Stubbe Østergaard
Editor

On behalf of the Ny Carlsberg Glyptotek and the Copenhagen Polychromy Network

‘Tracking Colour’ in 2010

Jan Stubbe Østergaard

PROJECT FINANCING

In 2010, the Ny Carlsberg Glyptotek has continued to invest considerable resources in the project, primarily by providing the core staff. Funds have also been made available by the museum for minor ad hoc acquisitions of equipment, and, in particular, for travel abroad. As for external funding, an application to the Kirsten and Freddy Johansen Foundation met with success: a very generous grant allowed the appointment of a project conservation technician for May through December 2010, the acquisition of equipment for VIL-imaging and, most importantly, the installation of a high-end digital video microscope.

THE NCG TEAM

The writer of these lines has enjoyed the privilege of working full-time as research curator and project director throughout 2010. Maria Louise Sargent, B.Sc., has continued in her half-time position as project conservation technician. Rikke H. Therkildsen, B.Sc., joined the team as conservation technician in the late autumn of 2009 on an ad hoc basis. From April 1, she took up a half-time position for the rest of 2010, financed by the grant from the Kirsten and Freddy Johansen Foundation.

In mid-august, Amalie Skovmøller joined us as research assistant for a six month period. She holds a cand.mag. degree in Classical Archaeology from the University of Copenhagen.

THE CPN PARTNERS

The Copenhagen Polychromy Network partner institutions and their representatives remain the same as in 2009. They have assisted the project with advice, access to instruments and analytical studies of pigment samples. The contribution made by the partners will be described in more detail elsewhere in this Report.

The reigning difficult financial conditions have understandably limited the CPN partner institutions’ ability to provide analytical assistance free of charge. We must foresee a need for payment for future services rendered.

THE INTERNATIONAL NETWORK

Participation in meetings abroad have, together with meetings held here in Copenhagen and day-to-day collegial correspondence, strengthened the project’s international network.

The Round Table meeting in September retained the format of the 2009 meeting and went well. Given the financial situation, it was most encouraging that expenses could be held to a minimum: participants very largely paid their own way. The British Museum’s offer to host the next Round Table, in September 2011, was equally heartening.

It should be noted that one of the Round Table presentations was on the subject of ancient architectural polychromy (Stephan Zink, with Heinrich Piening, on the Palatine temple of Apollo). During subsequent discussions it was agreed that ancient architectural polychromy must henceforth be seen as an aspect of ancient polychromy which stands at the shoulder

of that of sculptural polychromy. The two are technically, contextually and aesthetically so closely associated that one must avoid the risk of a division into separate disciplines.

On a similar note, the decision by the Royal Danish Academy of Sciences and Letters to allow the seminar on later European polychrome sculpture to take place in its rooms was very much appreciated. Held in early November, this meeting was a follow-up to the one held last year, but expanded to two days, and with several speakers from abroad. Hopefully, an international dialogue between classical archaeology, art history and conservation science on the subject of polychrome sculpture will continue to develop. An initiative to establish a forum for the art history of European polychrome sculpture would be very welcome indeed – one might hope for an international, rather than predominantly Danish, meeting on the subject.

Summaries of the papers given at the two meetings in Copenhagen, and an overview of papers given by the NCG/CPN project in 2010, are to be found at the end of this Report.

Finally, we are grateful to the colleagues abroad who support our project as members of the Advisory Panel.

THE VISUAL EXAMINATION WORK SPACE AND INSTRUMENTATION

Having started up the work space in January 2009, by June this year we were finally able to declare it just about fully equipped.

Since last year[1], the interior height of the pavilion[2] over the work space has been increased to 3 meters to allow examination of large scale sculptures and a system for more convenient installation of black out has been devised (fig. 1 and 2).

In the matter of visual documentation, besides Tungsten, IR and UV photography, we can also now do VIL-imaging[3] – as evidenced by the examinations described in this report.

The project's capabilities in microscopy have been decisively upgraded: the grant mentioned earlier allowed us to purchase a Leica DVM5000 digital video microscope from Leica Microsystems[4], together with a heavy duty studio stand from FOBA AG.[5] A fitting for mounting the microscope on the stand was developed by Leica Microsystems, ensuring complete stability during the taking of micrographs (fig. 3).

GETTING 'TRACKING COLOUR' ONLINE

Thanks to a grant from the Carlsberg Foundation (see below), the project is now able to finance a database solution for proper management and communication of our digital data assets. We envision a back-end reserved area for storing and accessing the complete NCG/CPN project data, and open for data from others working in the field, together with a front-end website for the use of the general public. The base should also contain a systematic bibliography for ancient sculptural (and architectural) polychromy and a register of ancient sculptures known to have traces of polychromy.

1 The work space ultimo 2009, see Preliminary Report 1 (2009) 71.

2 Produced by FleXtents, cf. http://www.flextents.dk/Flextelte%20virksomheden.htm

3 For the VIL technique, see Verri, G., The spatial characterisation of Egyptian blue, Han blue and Han purple by photo induced luminescence digital imaging, Analytical and Bioanalytical Chemistry 394 (4) (2009) 1011–1021.

4 Cf. http://www.leica-microsystems.com/products/digital-microscopes/details/product/leica-dvm5000-3/

5 FOBA Arobo (DDS Omega), cf. http://www.foba.ch/eng/programm/programm.htm

Fig. 1: The pavilion over the project work space has been heightened to allow examination of full size statues.

Fig. 2: The work space pavilion with black out mounted.

Fig. 3: The Sciarra Amazon mounted on the heavy duty turntable, with the Leica DVM5000 video microscope array and FOBA stand ready for action. In the left foreground a UV-lamp, right foreground LED-lamps for VIL-imaging. In the right background the Leica M651 operations microscope.

It has been Amalie Skovmøller's task to begin building the bibliography and monument register, and put forward suggestions for a database solution. This is the subject of an article by her elsewhere in this Report.

RESEARCH

A preliminary overview of investigations conducted by the NCG/CPN project in 2010 and the presentation of a case-study constitute the core content of this publication.

During 2010, 15 sculptures were examined following the project's Survey protocol and 68 sculptures included in a VIL survey campaign. The methodology involved and a selection of results are dealt with below, in articles by project conservators Maria Louise Sargent and Rikke Hoberg Therkildsen. Some archaeological comments supplement their reports.

The original 2008 project description envisioned examination of a somewhat larger number of sculptures. But then, at the time, we were unencumbered by practical experience, allowing undue optimism. By now, we have much clearer idea of just how resource-demanding research in this field is and have made a number of adjustments accordingly. Seen in this light, we find that there is reason to be pleased with this year's 'turnover'.

The original project description stipulated a systematically ordered sequence of monuments passing through the project's work space, with chronology and sculptural category as criteria. Reality has again imposed itself. Our selection of sculptures for examination has been influenced by other factors. Thus, the advent of the VIL imaging technique for the spatially resolved characterisation of Egyptian blue determined a decision to conduct the 2010 VIL survey; which led to quite unexpected discoveries on the Glyptotek's 'Sciarra Amazon'. This in turn made us focus on her, and subsequently on her two 'sister replicas', in Berlin and Écija. We did this knowing that our investigations would provide comparative data for the work done on the 'Treu Head' in the British Museum,[6] all of them being of approximately the same 2nd century CE date.

So, flexibility has to some extent replaced systematics in our modus operandi.
The works examined in 2010 may be said to be representative of the chronological range of our collection of Greek and Roman stone sculptures, and of the types of sculpture found in it. Many works worthy of in-depth examination have been identified.

INVESTIGATION OF SCULPTURES IN OTHER MUSEUMS: AN ACTIVITY WITH A FUTURE?

The unexpectedly good results of the investigation of the polychromy of the Glyptotek's 'Sciarra Amazon', IN 1568 (see Sargent and Therkildsen's article below) – especially through VIL-imaging – led us to the idea of having a close look at two other replicas of the same Amazon type and of approximately the same date. One is in the Pergamon Museum in Berlin, and has no visible traces of colour, the other, in the Museo Histórico Municipal of Écija, in Andalucia, has copious remains of the original polychromy. With permissions being generously given, the project conservators assembled a portable kit for macroscopy, video microscopy, digital documentation photography and VIL-imaging.

Travelling by plane and hired car, the 'Amazon Expedition' was a successful trial run of an activity which one might imagine continued and expanded. A great number of sculptures

6 For VIL and the 'Treu Head' investigation, see Verri, G., Opper, T. and Deviese, T.: The 'Treu Head': a case study in Roman sculptural polychromy. In: The British Museum Technical Research Bulletin, vol. 4. The British Museum, pp. 39–54.

of interest to sculptural polychromy research are kept by museums which do not have the ways and means of carrying out investigations. It is tempting to think of the possibility of creating a mobile research unit for ancient sculptural polychromy in an EU-context, along the lines of the already existing MOLAB.[7]

LOOKING FORWARD: 2011 – AND ONWARDS

Just as this Report was on the point of completion, we received the really momentous news that an application to the Carlsberg Foundation for a two-year prolongation of the project, from June 1, 2011, has met with success.

What was said under the heading 'Challenges' in Preliminary Report 1[8] must now be seen in the light of this all-important grant. We have, to use a maritime metaphor, weathered a very difficult point and have a period of comparatively smooth sailing ahead of us. The immediate consequences of the grant are that the core staff can be retained for a two-year period, and that we can go ahead with our plans for bringing 'Tracking Colour' online.

We can continue the programme of research which was outlined in the application, broadening our field of view to include objects from the Egyptian and Etruscan collections. Work on closer definition of the programme for 2011–2013 can now start.

The longer perspective we now have puts our collaboration with colleagues abroad on a new footing. We can better commit ourselves to cooperative efforts and are able to expand our ideas on study visits to our collections by scholars from related projects.

Plans for the immediate future are clear: The coming months will see the completion of our renewed in-depth examination of the Glyptotek's portrait of Caligula (IN 2687) and the Palmyrene funerary portrait known as 'The Beauty of Palmyra' (IN 2795). We will then focus on two important Roman sarcophagi: the late-2nd century CE so-called 'Casali Sarcophagus' (IN 843) and a Late Roman garland sarcophagus (IN 2468).

As this goes on, we will be continuing work on the 'Tracking Colour online' project.

Happily, the prospects are both promising and exciting.

7 Cf. http://www.eu-artech.org/index.php?option=com_content&task=view&id=23&Itemid=68.

8 Preliminary Report 1, 9–10 (Østergaard).

The Technical Investigation of Sculptural Polychromy at the Ny Carlsberg Glyptotek 2009–2010 – An Outline.

Maria Louise Sargent and Rikke Hoberg Therkildsen

Since its establishment, the multidisciplinary Copenhagen Polychromy Network (CPN) has conducted research in the Ny Carlsberg Glyptotek's (NCG) collection of ancient Greek and Roman stone sculpture in order to contribute to an increase of data available for the study of ancient sculptural polychromy through systematic documentation and analysis of polychromy traces. This paper outlines the conservation-technical field of activity between 2009 and 2010.

The basis of the technical work is the so-called CPN protocol.[1] However a shorter version of the CPN protocol, the so-called survey protocol, has since the winter of 2009 become the framework for the investigation of polychromy on Greek and Roman stone sculpture. In the following the methodology behind the survey protocol is described in detail while the outcome of the technical investigation of a representative group of Greek and Roman sculptures is summarized. Alongside the protocol a so-called VIL survey has become part of NCG/CPN's research strategy and a series of investigations have been carried out in the Collection of Ancient Art at the Ny Carlsberg Glyptotek. This paper outlines the results of the VIL survey. Finally a newly established branch of NCG/CPN's research strategy on in-depth investigation of the coloration of areas of exposed skin on Greek and Roman stone sculpture is introduced.

THE SURVEY PROTOCOL

The establishment of the survey protocol as an alternative to the CPN protocol has become the methodological framework of the NCG/CPN's technical investigations of polychrome sculpture. In brief the survey protocol is a shortened version of the protocol developed in 2008. It was introduced in order to increase the volume of sculptures without compromising the quality of the work. Furthermore the methodological starting point of the survey protocol is non-invasive in response to the main characteristic of ancient stone sculpture, namely that only few traces of original coloration are left. The survey protocol is consistent with NCG/CPN's aim to contribute to an increase of data available for the study of ancient sculptural polychromy in order not only to create a better knowledge of the original state and visual appearance of the sculptures, but to gain insight into the preservation of the remaining colour.

METHODOLOGY AND MATERIALS

The survey protocol is divided into two main steps: visual examination followed by technical imaging, including variations in lighting angle (raking light), scale (microscopy) and type of radiation used (Ultraviolet Fluorescence (UVF) and Visible-Induced Luminescence (VIL)). When a qualitative research focus is required a variety of analytical tools, non-invasive and

1 Østergaard 2009.

invasive, are integrated. In the following the basic methodology of the survey protocol is described:

VISUAL EXAMINATION

The object is systematically examined under tungsten light with the naked eye. The visual examination is supported by a magnification glass and binocular magnifier.[2] Information on various features related to the surface of the stone such as degradation phenomena, tool marks and visible traces of colour is given in detail and included, in a report, together with documentation and analytical data.

The basic description of the conservation status of the object is followed by an in-depth investigation of traces of colour by means of an operations microscope.[3] The operations microscope is supplemented by a video microscope meeting high specifications for microscopic imaging and image processing. The video microscope is handheld and when it is combined with the zoom optics it is possible to reach difficult-to-access surfaces and make advanced surface analysis with 3D profiles of height, width and surface irregularities. Information on traces of colour and related phenomena is described and mapped in a grid and supplemented with micrographs. A grey reference standard is used on all micrographs.[4]

TECHNICAL IMAGING

Initially the object is mounted on a turntable with degree markings.[5] It is then photographed under tungsten light from four sides rotating the sculpture about its axis with an interval of 90 degrees.[6] A colour reference standard for subsequent colour balancing is included on every image.[7] The totals are supplemented with detail photographs and, when proven necessary, imaging in raking light is included.

Subsequently, the object is examined from all four sides by means of UVF and documented.[8] The totals are supplemented with detail photographs. In short, UVF photography is able to characterise spatially the presence of luminescent organic and inorganic materials, to differentiate between materials with similar optical properties but different chemical composition and to determine the overall condition of the object.

Finally the object is examined by means of VIL digital imaging.[9] The totals are supplemented with detail photographs. VIL digital imaging is a recently developed technique to detect and map Egyptian blue (EB).[10] EB is a synthetic pigment used throughout Antiquity. The pigment is very often left on the marble surface in minute amounts trapped in the pore structure of the stone which makes it difficult if not impossible to identify with the microscope. However, EB has the property of absorbing visible radiation and of re-emitting

2 Binocular magnifier, Eschenbach Lupe 3x.

3 Operations microscope, Leica M65; video microscope, Leica DVM5000.

4 Grey reference standard, Qpcard 101 v2.

5 The work space is equipped with two turntables (max 300 kg and max 1000 kg). Both are in-house designs.

6 Camera, Canon EOS 5D Mark II.

7 Colour reference standard, Munsell Color X-rite.

8 UVF: camera see note 6; UV-lamp, Harolux 8x18w; filter, Tiffen 2A filter (cutting at approximately 400 nm); colour reference standard, see note 7.

9 VIL: camera, Canon 40D modified by removing the IR-blocking filter; filter in front of the lens, Schott RG830 with a cut-on (50%) at 830 nm; lamp, LED light sources from EXcled (470–630 nm); white reference standard, Spectralon® (99% and 75% reflectance in the UV-VIS-IR range).

10 Verri 2009.

infrared radiation in the 800–1000 nm range. The luminescent emission by the pigment glows bright white and can be imaged in a darkened environment. This property makes it possible to identify single particles of the pigment, of sub-microscopic size, even when hidden beneath calcareous incrustations or the like.

ADDITIONAL ANALYTICAL TOOLS

When considered necessary samples are taken for cross sections and micro-chemical spot testing.[11]

For additional analysis external CPN expert knowledge and analytical equipment such as SEM, XRF, GC-MS, FT-IR, Mass Plasma Spectrometry and Raman spectroscopy is drawn upon.[12]

OUTLINING THE RESULTS OF THE SURVEY PROTOCOL EXAMINATIONS IN 2010

The objects selected for the survey protocol examination were to be representative of the sculptural types and the chronological range of the collection of Greek and Roman stone sculpture at the Ny Carlsberg Glyptotek. Moreover, the selection of objects for examination takes into account the conservation status of the sculptures; the more intact the surface of the stone is, the better preserved are the pigments. Besides the investigation of Greek and Roman objects from the Ny Carlsberg Glyptotek, two Roman ideal sculptures, in the Pergamon Museum in Berlin and the Museo Histórico Municipal in Écija, have been included and examined *in situ*. In all, sixteen objects were chosen for investigation and are listed below:

- Archaic Greek originals (1).[13]
- Classical Greek originals (5).[14]
- Hellenistic Greek originals (1).[15]
- Roman portraits (4).[16]
- Roman ideal sculpture including two replicas in Berlin and Écija (3).[17]
- Roman funerary monuments (2).[18]

Traces of ancient colour were observed on all the artefacts except a Classical Greek head of a young girl.[19] Red is predominant and is on the majority of the artefacts the only colour remaining.[20] This is most likely due to the fact that iron oxides such as ochre and hematite extensively used in Antiquity are stable, non-fugitive and inert pigments. The use of iron

11 Cross sections, embedded in Serifix® polyester resin with hardener from Struers. Struers wet-grinding paper size 80, 800, 1200, 2400, 4000; micro chemical spot testing, Simonsen 2007.

12 SEM, JEOL Superprobe jxd 8200; XRF (handheld), Innovex Systems; GC-MS, analysis carried out at Dipartimento di Chimica e chimica industriale, Pisa. Instructor: Illaria Bonaduce; FT-IR, Perkin Elmer Sprectrum One; Mass Plasma Spectrometry, VG Elemental Axium.

13 IN 418, Johansen 1994: cat. 18, pp. 62–4.

14 IN 431, Møller 1995: cat. 51, pp. 54–5. IN 1731, IN 1597, IN 451, IN 1508, Moltesen 1995: cat. 14, p. 68, cat. 17, pp. 71–2, cat. 19, pp. 74–5, cat. 45, pp. 104–5.

15 IN 481-82a, Nielsen 1997: cat. 12, pp. 38–9.

16 IN 1583, IN 1750, IN 2687, Johansen 1994a: cat. 13, pp. 50–1, cat. 47, pp. 118-19, cat. 56, pp. 136–37.

17 IN 1568, Moltesen 2002: cat. 60, pp.207-11.

18 IN 2795, Hvidberg-Hansen et al. 1993: cat. 77, pp. 121–22. IN 1299, Østergaard 1996: cat. 33, pp. 77–9.

19 IN 1597.

20 IN 418, IN 1731, IN 451, IN 1583, IN 1750.

oxides is found on both skin, hair and eyes as on the Archaic head of a young man, the so-called 'Rayet Head', and the Roman portrait of the emperor Tiberius (fig. 1–2). Red iron oxides are also used for garments. In a single case, natural cinnabar, a costly pigment in Antiquity used as red colour, has been identified on both garments and right knee on the Hellenistic or perhaps Roman statue group representing Artemis and Iphigenia.[21]

Mixtures of pigments to achieve refined tonal effects are observed on a variety of Greek and Roman sculptural types.[22] In the case of a 5th century BCE Sidonian anthropoid sarcophagus scattered particles of EB combined with red pigments are observed on both hair, skin and eyes.[23] The same phenomenon is observed on the portrait of the Roman emperor Caligula in combination with, probably, a carbon-based black on hair, eyebrows and eyelashes. A mixture of black, EB and brown-reddish pigments outlined with a pink madder lake is observed in the eyes of the portrait (fig. 9 and 10). The Roman ideal sculpture known as the 'Sciarra Amazon' reveals a delicate combination of red iron oxides, EB and a pinkish pigment not yet identified for skin tones and compact layers of iron oxides in combination with disparate particles of EB on the hair. The same mixture of pigments is seen on the examined marble replica of the'Sciarra Amazon' in Écija. In both cases polychrome patterns decorate the garments. On the 'Sciarra Amazon' a distinct band of EB decorates the lower part of the tunic and on the Spanish replica a blue band runs along the upper edge and fragments of both a red band and a green band run along the lower edge of the tunic.[24] Traces of ancient polychromy are extremely well preserved on the Roman provincial funerary bust, 'The Beauty of Palmyra' (fig. 3). The skin is toned in a yellowish colour with red cheeks and lips. The hair is black, traces of red are found on the garments and jewellery encircling the forehead. The turban, necklaces and bracelets are yellow. In comparison with the abovementioned Classical and Roman sculptures it is worth noting that traces of EB are not found on 'The Beauty of Palmyra' indicating a slightly different tradition regarding painting techniques. In the case of the Roman provincial funerary bust traces of gold leaf are found on the carved jewellery. On the decorative pendant encircling the forehead fragments of gold leaf are superimposed on a compact red layer whereas fragments of gold leaf found on the bracelets are superimposed on a yellow layer (fig. 4). Gold as part of the polychrome palette is also found on the Hellenistic or perhaps Roman statue group of Artemis and Iphigenia. On the Artemis gilding is found on top of a violet transparent layer on both dress and right knee suggesting the goddess was completely gilded (fig. 5–6). Finally, on the Republican portrait of a male, presumably a priest-king, traces of a silver alloy are found in the drilled holes above a circular hairband.[25] This indicates that a garland of silver was fastened in the holes.

21 IN 481-82a.

22 IN 431, IN 2687, IN 1568, IN 1299 and IN 2795.

23 IN 431

24 See the following contribution by Sargent and Therkildsen.

25 IN 1583.

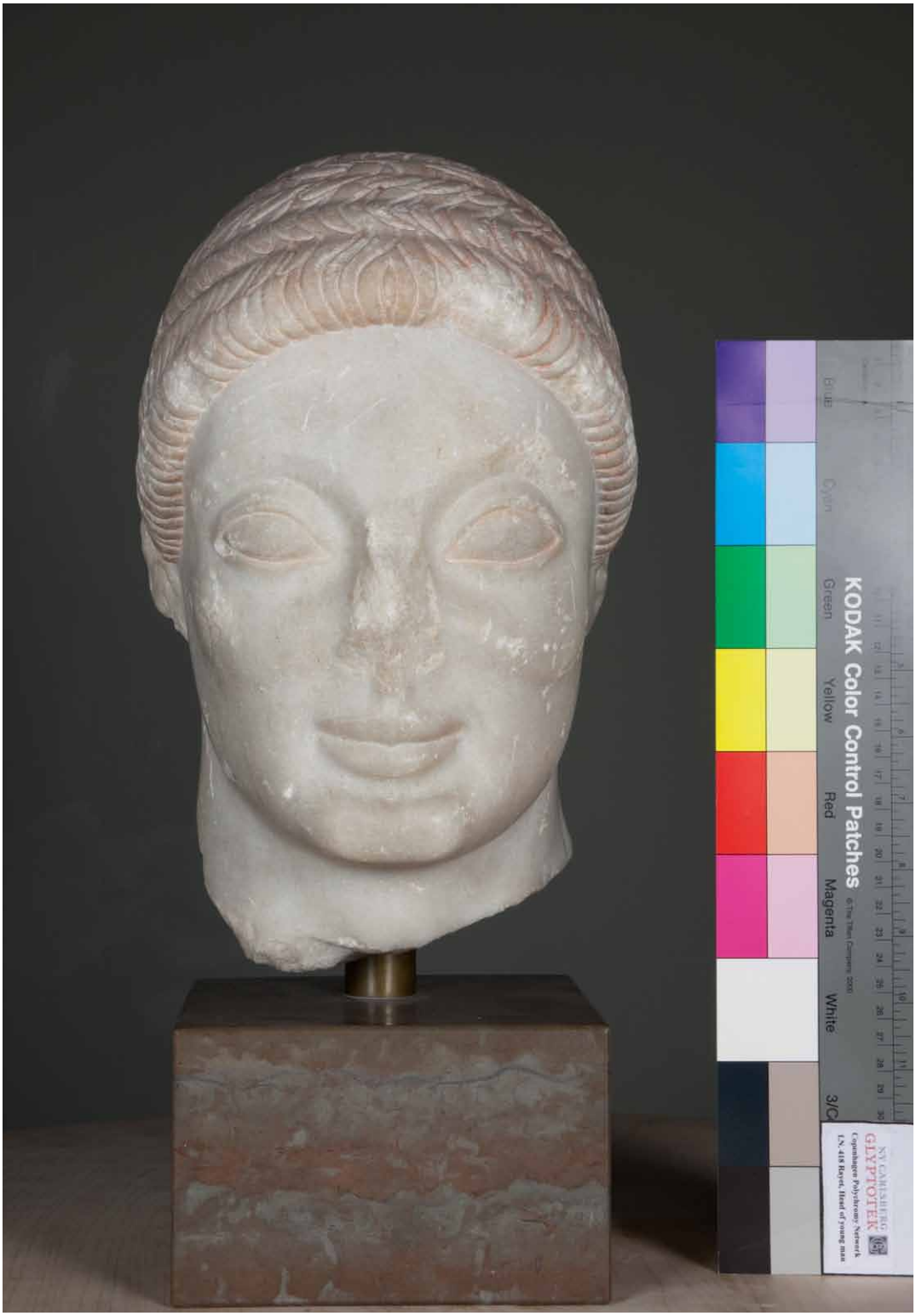


Fig. 1: Archaic head of a young man, 'The Rayet Head', IN 418, c. 530–520 BCE. A regular distribution of red colour on the hair and along the rim of the eyes. Red grains are also observed on the right iris and on the lips. Tungsten light photography.

Fig. 2: Portrait of the Roman emperor Tiberius, IN 1750, c. 20–30 CE. Compact layers of red are observed on the hair. On the eyebrows, left eye, lips and especially below the right eye extensive remains of red. Tungsten light photography.

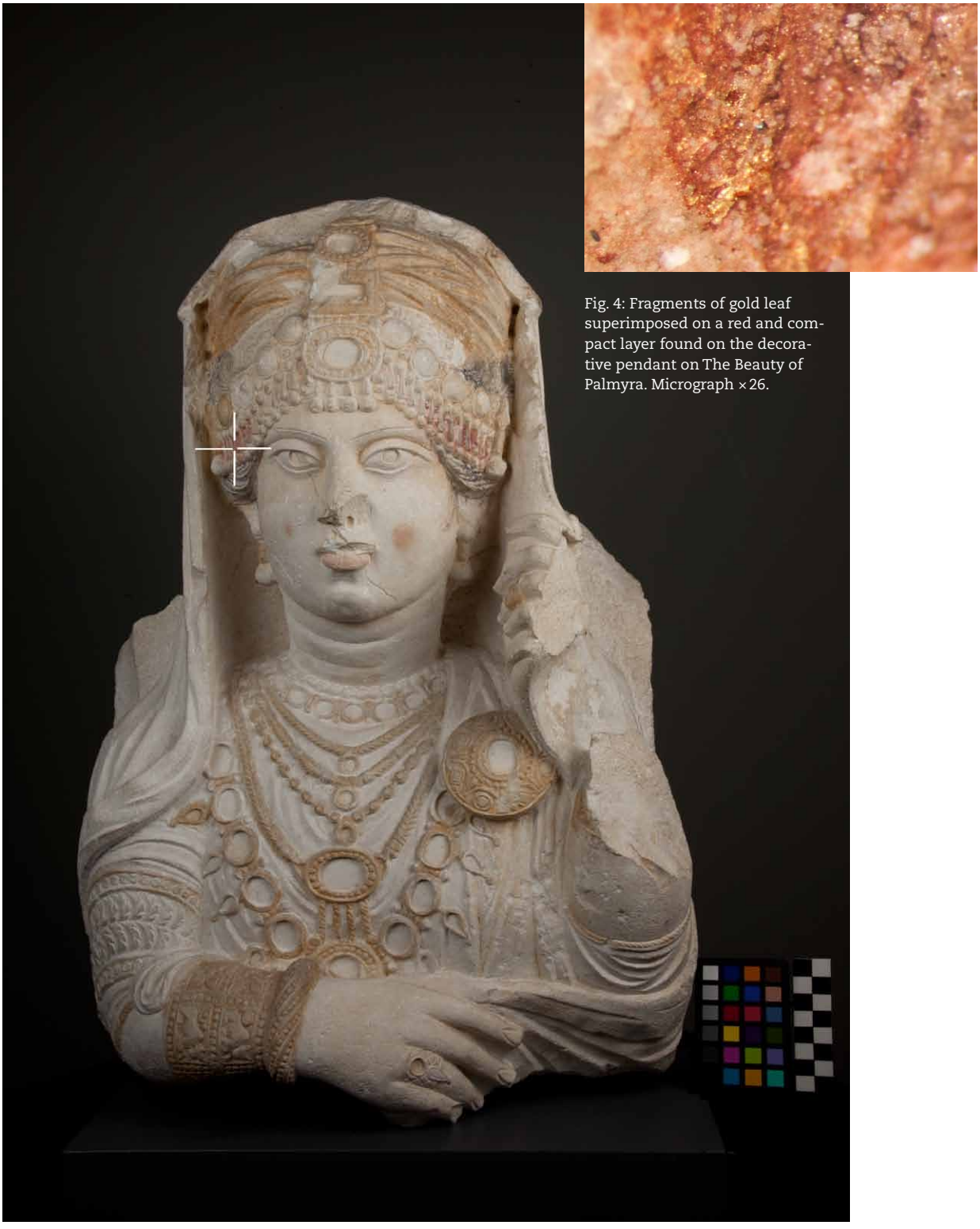


Fig. 4: Fragments of gold leaf superimposed on a red and compact layer found on the decorative pendant on The Beauty of Palmyra. Micrograph ×26.

Fig. 3: Roman provincial (Palmyrene) funerary bust, 'The Beauty of Palmyra', IN 2795, c.190–210 CE. Tungsten light photography.

Fig. 6: Fragments of gold leaf superimposed on a transparent purple layer of cinnabar and ochre found on the garments of the goddess Artemis. Micrograph × 26.

Fig. 5: Hellenistic statue group, Artemis and Iphigenia, IN 481-482a, c. 3rd–1st century BCE. Tungsten light photography.

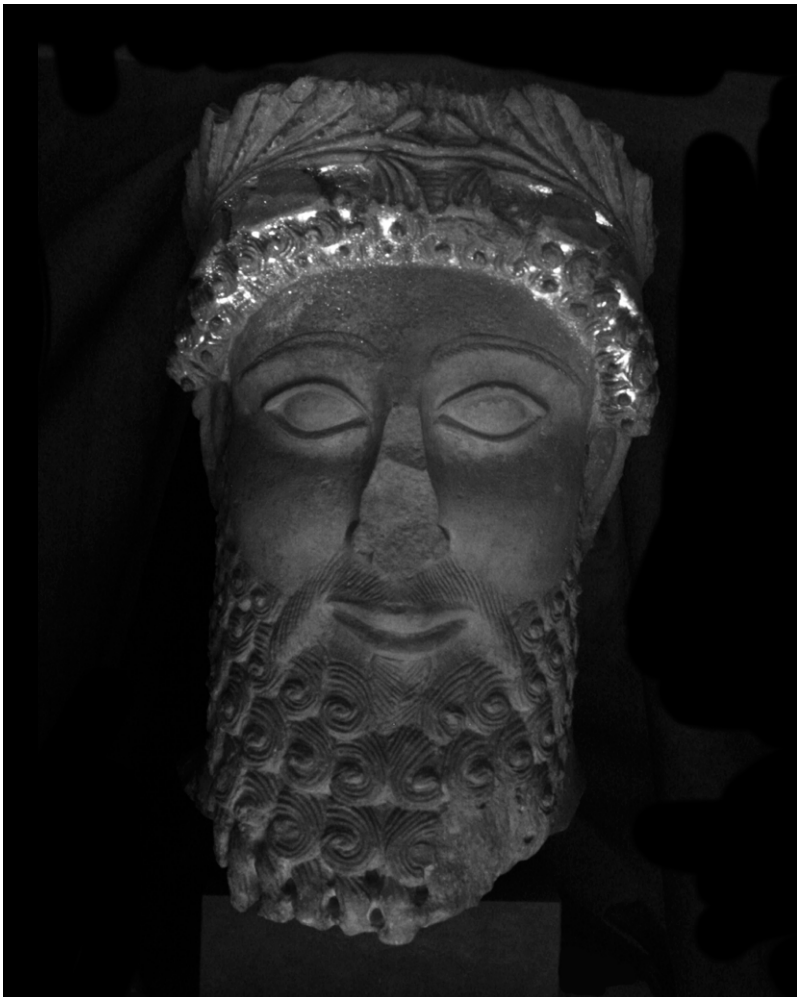
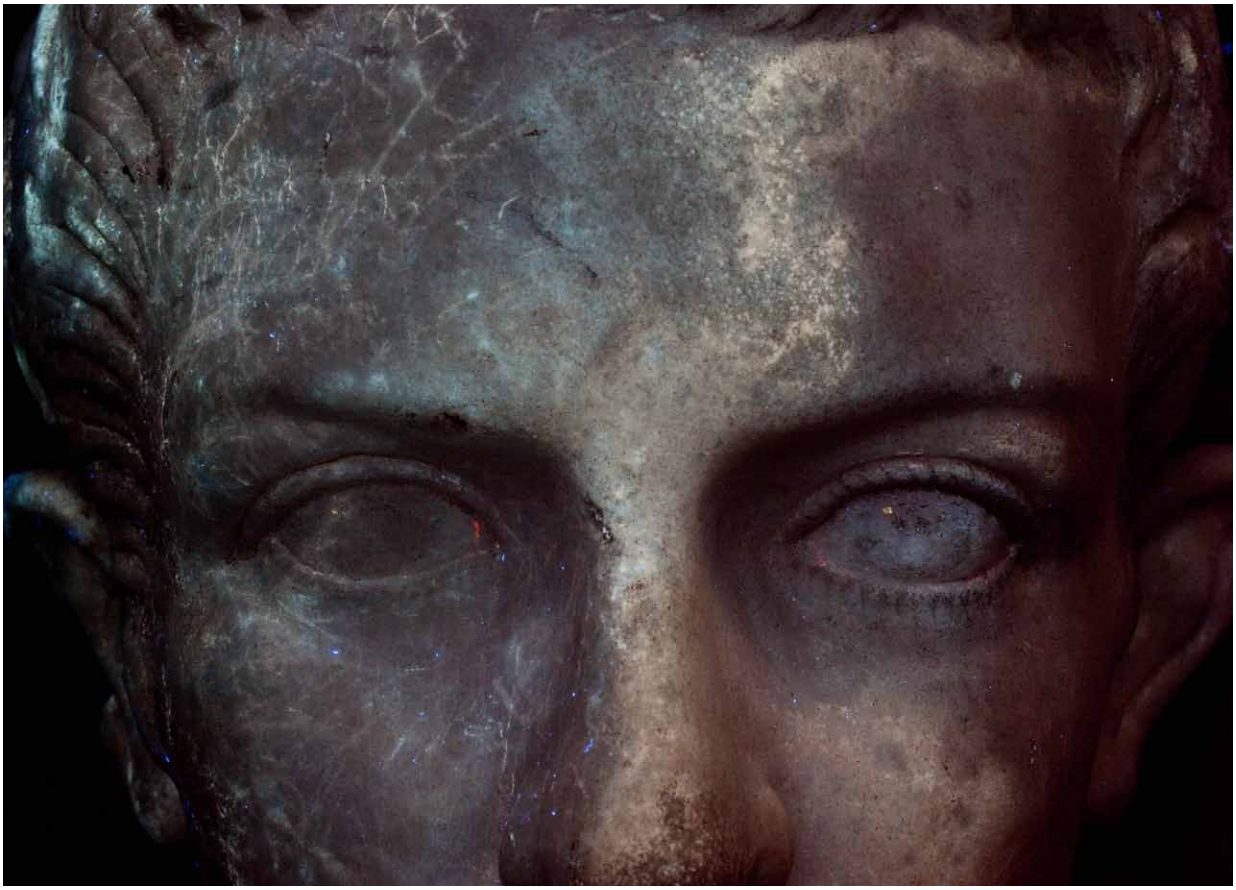


Fig. 7: Cypro-Classical head of a male, IN 2569, c. 5th century BCE. The VIL image shows the distribution of EB on the hair glowing white.

Fig. 8: Sidonian anthropoid sarcophagus fragment, IN 431, c. 450 BCE. The VIL image shows glowing white particles of EB. In the hair the grains appear as relatively compact layers and on the face as scattered particles.

Fig. 9: Portrait of the Roman emperor Caligula, IN 2687, c. 37–41 CE. Tungsten light photography.

Fig. 10: UVF photography of the eyes of Caligula. The pinkish fluorescence in the eyes indicates the use of madder lake.



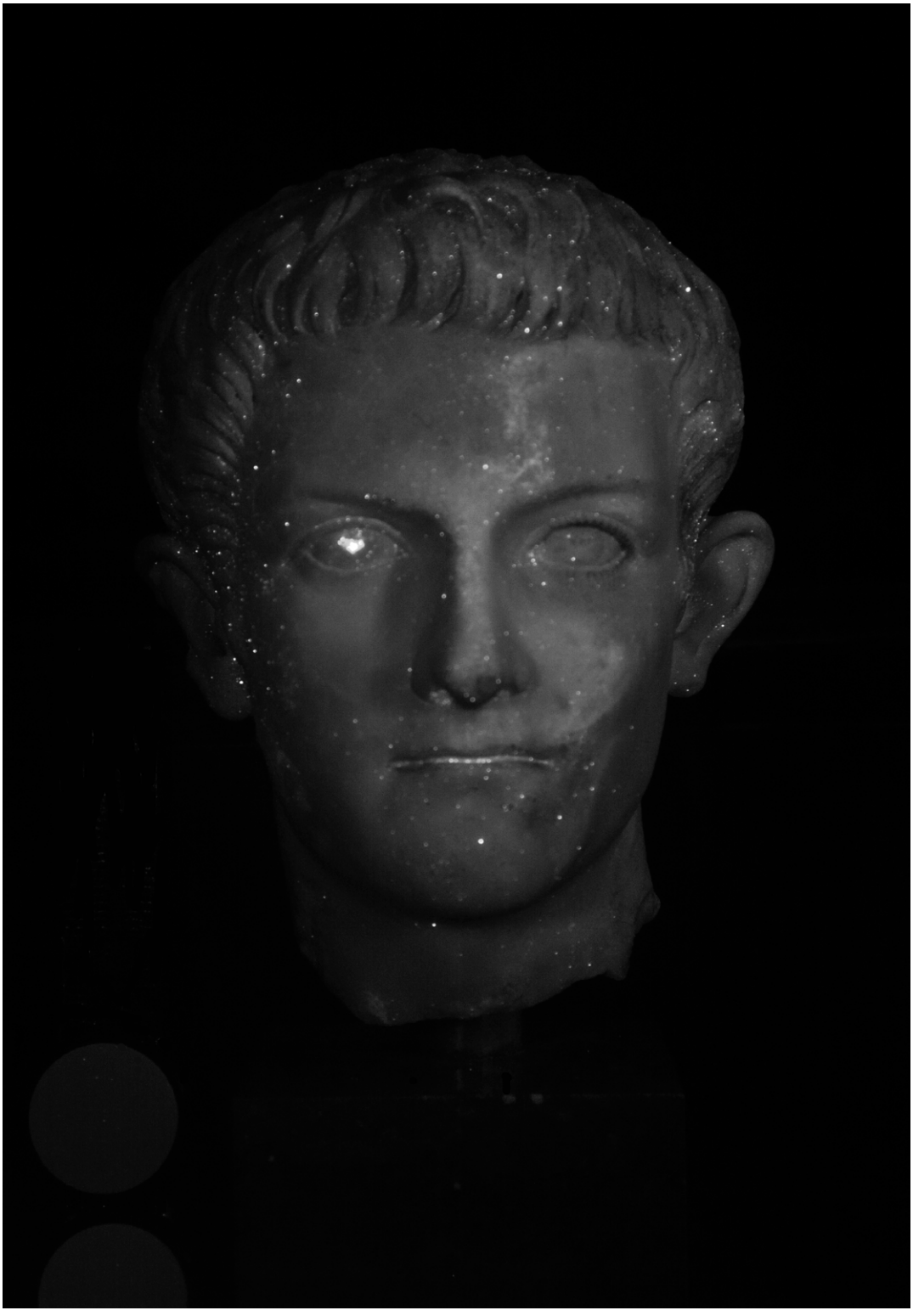


Fig. 11: VIL image showing the distribution of glowing white particles of EB on the portrait of Caligula. On the pupil of the right eye a compact layer of EB is observed. On the hair and skin EB is located as scattered particles.

Fig. 12: Roman sarcophagus chest, IN 1299, c. 300 CE. Tungsten light photography.

Fig. 13: VIL image showing the extensive use of EB glowing white on the waves on the main scene of the Roman sarcophagus.

Fig. 14: VIL image of the (observers) left narrow side of the sarcophagus. Concentrations of EB are located on both axe heads and spear.

THE VIL-SURVEY

Since the introduction of VIL imaging for detecting and mapping of EB, three VIL-surveys have been conducted in the Greek and Roman collection in the Ny Carlsberg Glyptotek. Furthermore VIL-imaging on two objects in, respectively, the Pergamon Museum, Berlin and Museo Histórico Municipal of Écija is included.

METHODS AND MATERIALS[26]

The VIL-survey was conducted *in situ* either at night or in daytime with the photographic apparatus and the object covered with black cloth to keep out daylight.

OUTLINING THE RESULTS OF THE VIL-SURVEY 2010

The selection of objects for the VIL-survey followed two directions. The first survey included a large number of Greek and Roman sculptural types, formats and genres, representative of the collection.[27] The subsequent surveys were confined to two categories of Greek original sculptures, Classical tomb- and votive reliefs.[28] Due to the decorative scheme of EB revealed on the 'Sciarra Amazon' in the Ny Carlsberg Glyptotek two replicas in Berlin and Écija were as already mentioned included in the VIL survey and investigated in October this year.[29]

Out of 68 Greek and Roman artefacts chosen for the VIL survey, 22 exhibit the luminescence properties of EB belonging to the following major groupings:

- Archaic Greek originals (1).[30]
- Classical Greek originals (14).[31]
- Roman portraits (1).[32]
- Roman ideal sculpture including the replica in Écija(3).[33]
- Roman funerary monuments, altars, votive reliefs (3).[34]

The emission of EB observed on Greek and Roman artefacts from 5th century BCE to the late 3rd century CE reveals a number of similarities. As the Cypro-Classical head of a male illustrates, EB is located in the curly hair encircling the forehead (fig. 7). The same pattern combined with an even distribution of particles of EB on the skin is repeated on several other examples like the anthropoid sarcophagus fragment from 5th century BCE and the 1st century CE portrait of the Roman emperor Caligula (fig. 8 and 11). In the case of Caligula, the pupil of the right eye

26 See note 9 and 10.

27 IN 471, IN 2630, IN 1594, IN 2787, IN 2569, IN 418, IN 1544, IN 1203, IN 2807, IN 2830, IN 431, IN 497, IN 2432, IN 2830, IN 1682, IN 1994, IN 546, IN 2016, IN 2321, IN 480, IN 1980, IN 1548, IN 2086, IN 520, IN 1583, IN 747, IN 748, IN 1438, IN 1750, IN 2687, IN 1453, IN 1299.

28 IN 460, IN2561, IN 2012, IN 1195, IN 1508, IN 2460, IN 1695, IN 532, IN 1695, IN 2615, IN 2564, IN 464, IN 2786, IN 463, IN 1515, IN 461, IN 1409, IN 448, IN 1408, IN 2587, IN 470, IN 2554, IN 469, IN 459, IN 2558.

29 Pergamon Museum, Sk7; Museo Histórico Municipal, inv. No. 8041-197.

30 IN 2559, Nielsen, A.M. 1992: cat. 11, p. 24.

31 IN 471, Nielsen 1992: cat. 29, p. 42. IN 2807, IN 1682, IN 1508, IN 2615, IN 1515, IN 1695, IN 2554, IN 1409, IN 2587, IN 469, IN 2558, IN 465, IN 2345, Moltesen 1995: cat. 53, pp. 112–13, cat. 3, pp. 48–9, cat. 45, pp. 104–05, cat. 32 and 33, pp. 90–1, cat. 46 and 47, pp. 106–07,cat. 28, p. 86, cat. 49, p. 109, cat. 40, p. 98, cat. 42, pp. 100–01, cat. 72, p. 137, cat. 76, p. 144.

32 IN 2687, Johansen 1994: cat. 56, pp. 136-37.

33 IN 1568 and IN 2086, Moltesen 2002: cat. 60, pp 207–11 and cat. 34, pp. 139–42. Inv. No. 8041-197, León 2008.

34 IN 459 and IN 1299, Østergaard 1996: cat. 87, pp. 180–81 and cat. 33, pp. 77–9. IN 2016, Moltesen 2002: cat. 63, pp. 216–17.

shows a relatively compact layer of EB glowing white. In other cases EB is frequently observed in the whites of the eyes to obtain the effect of optic white.[35] On both Greek and Roman sculpture in the round as well as in the case of a Roman relief and a Greek tomb relief the characteristic location of EB as scattered particles is observed on the garments too.[36] Another consistent feature of the tomb reliefs is the occurrence of scattered particles of EB on the background. The use of EB was undoubtedly extensive and the presence of single particles of EB on hair, skin, eyes, garments and so forth suggests that EB was part of a sophisticated technique using complex mixtures of pigments to achieve refined tonal effects.

However EB was also used alone or in the sense that blue was the dominant colour. The 'Sciarra Amazon' reveals an interesting decorative pattern of EB.[37] The same phenomenon is observed on the replica of the same Amazon type in Écija. Besides the presence of scattered particles of EB on the hair, skin and garments a compact layer of EB forming a distinct band runs along the hem of the tunic. Also luminescence properties of EB are observed on the buckle of the belt tied around the waist. In the case of the late 3rd century CE sarcophagus chest showing ships under sail the intentional use of EB is clear.[38] As suspected, the waves of the main scene are painted with a compact layer of EB. On the narrow sides of the sarcophagus are incised crossed shields laid over crossed spears and a double axe (fig. 12–14). Both axe-heads and one of the spear show a concentration of EB probably using the blue colour to imitate metal.

RESEARCH FOCUS ON SKIN COLOUR

Alongside the survey protocol and the VIL surveys, a special focus on skin colour has become part of CPN's research strategy. To what extent and how the areas of exposed skin on the sculptures were given a flesh tone remains little understood and accordingly much debated among archaeologists and conservators. Particular emphasis can therefore with good reason be put on investigating this aspect of ancient sculptural polychromy. The NCG/CPN is aware of this and hopes to contribute with useful data.

In this context it has been decided to investigate the portrait of the emperor Caligula where clear traces of a skin colour survive in several places visible to the naked eye, especially on the left side of the head.[39] The portrait was examined and a reconstruction of the polychromy made in connection with the exhibition Bunte Götter in the Munich Glyptothek from 2003.[40] However due to the application of analytical methods not available to previous researchers new knowledge of the complexity of the colour palette has resulted.

Preliminary investigations involving visual examination and microscopy followed by technical imaging (UV and VIL) have been conducted. A sampling strategy is being developed on the basis of the preliminary investigations in order to produce unmounted samples and cross-sections for further analysis and insight into the composition and stratigraphy of the skin colour on the portrait. The outcome of the investigations will be published in 2011 and set against comparative data where the general stratigraphy and pigment composition has been established in order to improve understanding of painting techniques on stone in Antiquity.[41]

35 Verri et al. 2010.

36 IN 1682, IN 1548, IN 459, IN 2558.

37 See the following contribution by Sargent and Therkildsen.

38 IN 1299.

39 IN 2687, Johansen 1994: cat. 56, pp. 136–7.

40 Stege et al. 2003. Brinkmann et al. 2003.

41 Verri et al. 2010. Scharff et al. 2009.

REFERENCES

Brinkmann, V., Kellner, S., Koch-Brinkmann, U., Østergaard, J.S. 2003: "Die Farbfassung des Caligulaporträts". In: Wünsche, R., Brinkmann, V. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur. Glyptothek München: 207–11.

Hvidberg-Hansen, F.O. 1993: Palmyra Samlingen. Ny Carlsberg Glyptotek.

Johansen, F. 1994: Catalogue. Ny Carlsberg Glyptotek. Greece in the Archaic Period. Ny Carlsberg Glyptotek.

—— **1994a**: Catalogue. Ny Carlsberg Glyptotek. Roman Portraits I. Ny Carlsberg Glyptotek.

León, P. 2008: "Nueva réplica de la Amazona Sciarra". In: Le Due Patrie Acquisite. Studi di Archeologia Dedicati a Walter Trillmich. L'erma di Bretschneider, Roma: 243–253.

Moltesen, M. 2002: Catalogue. Ny Carlsberg Glyptotek. Imperial Rome II. Statues. Ny Carlsberg Glyptotek.

—— **1995**: Catalogue. Ny Carlsberg Glyptotek. Greece in the Classical Period. Ny Carlsberg Glyptotek.

Møller, E. 1995: Catalogue. Ny Carlsberg Glyptotek. The Near Eastern Collection. Ny Carlsberg Glyptotek.

Nielsen, A.M. 1992: Catalogue. Ny Carlsberg Glyptotek. The Cypriote Collection. Ny Carlsberg Glyptotek.

Nielsen, A.M., Østergaard, J.S. 1997: Catalogue. Ny Carlsberg Glyptotek. Hellenism. Ny Carlsberg Glyptotek.

Scharff, M., Østergaard, J.S., Hast, R., Kalsbeek, N. 2009: "Investigating the polychromy of a Classical Attic Greek marble head". In: Tracking Colour – The Polychromy of Greek and Roman Sculpture in the Ny Carlsberg Glyptotek. Preliminary Report 1, 2009. Ny Carlsberg Glyptotek: 12–36. www.glyptoteket.dk/trackingcolour.pdf

Simonsen, K.P. 2007: Klassiske Pigmenter. Spottest. Konservatorskolen, Det Kongelige Danske Kunstakademi: 6–61.

Stege, H., Fiedler, I., Baumer, U. 2003: "Die Untersuchung der Pigmente und Bindmittel in der Farbfassung der Marmorbüste des Caligula". In: Bunte Götter. Die Farbigkeit Antiker Skulptur. Glyptothek München: 204–5.

Verri, G. 2009: "The spatial characterisation of Egyptian blue, Han blue and Han purple by photo-induced luminescence digital imaging". In: Analytical and Bioanalytical Chemistry 394 (4): 1011–1021.

Verri, G., Opper, T., Deviese, T. 2010: "The 'Treu Head': a case study in Roman sculptural polychromy". In: The British Museum Technical Research Bulletin, vol. 4. The British Museum: 39–54.

Østergaard, J.S. 2009: "The CPN Main Project 2008–2011: an outline". In: Tracking Colour – The Polychromy of Greek and Roman Sculpture in the Ny Carlsberg Glyptotek. Preliminary Report 1, 2009. Ny Carlsberg Glyptotek: 64–8. www.glyptoteket.dk/trackingcolour.pdf

—— **1996**: Catalogue. Ny Carlsberg Glyptotek. Imperial Rome. Ny Carlsberg Glyptotek.

Research on Ancient Sculptural Polychromy with Focus on a 2nd Century CE Marble Amazon

Maria Louise Sargent and Rikke Hoberg Therkildsen

INTRODUCTION

A study of a 2nd century CE Roman marble statue of an Amazon was conducted in the spring of 2010.

This article presents the examination and documentation undertaken to investigate traces of original polychromy on the Amazon. It also demonstrates the practical significance of an imaging technique recently developed at the British Museum called Visible-Induced Luminescence (VIL). The technique permits the detection and mapping of Egyptian blue.[1]

The paints used in antiquity generally comprised one or more pigments and an organic binder. Degradation of the binder results in the powdering of the paint layer and subsequent loss of paint. Provenance and acquisition history play an important role when investigating ancient sculptural polychromy. Many Greek and Roman sculptures in old collections were acquired from dealers and are often without any provenance or information as to the condition in which they were found.

Excessive cleaning procedures, often undertaken for aesthetic reasons, and the taking casts of sculptures to produce copies, have damaged numerous original polychrome surfaces. For many different reasons surviving pigments often exist only in minute amounts invisible to the naked eye. The problem is the detection and documentation of such small traces especially on large, monumental sculptures. The Amazon is one of many examples where the VIL-imaging is a quick and powerful tool for the spatial characterization of Egyptian blue, making the unseen visible.

THE 'SCIARRA AMAZON'

The sculpture represents a wounded Amazon (Ny Carlsberg Glyptotek IN 1568) called the 'Sciarra Amazon' (fig. 1–4). The sculpture is 197 cm in height and is considered to be a mid-2nd century CE Roman marble copy of a Greek bronze original from the mid 5th century BCE The marble has been identified by isotopic analysis as Pentelic.[2] The Amazon wears a short chiton with two belts, one invisible under the blousing (kolpos) of the chiton, the other visible, tied around the kolpos. The chiton is secured over one shoulder, revealing both breasts. On the feet the Amazon wears ankle straps around the heel, under the foot and up over the instep. With the right hand the Amazon touches her head thus exposing a stab wound and carved blood drops on the right side, level with the breast.[3]

1 Verri, G., "The spatial characterisation of Egyptian blue, Han blue and Han purple by photo induced luminescence digital imaging", Analytical and Bioanalytical Chemistry 394 (4) (2009) 1011–1021.

2 Attanasio, D., "The marble provenance of the Amazzone Sciarra (Ny Carlsberg Glyptotek inv. 1568)". Report (2010) 1–3. (Unpublished)

3 Moltesen, M. et al., Catalogue.Ny Carlsberg Glyptotek. Imperial Rome II Statues (2002) 207–211, no. 60.

Fig. 1: Amazon, Ny Carlsberg Glyptotek IN 1568, mid-2nd century CE. H. 197 cm. Tungsten light photography.

Fig. 2: Amazon, Ny Carlsberg Glyptotek IN 1568, mid-2nd century CE. H. 197 cm. Tungsten light photography.

Fig. 3: Amazon, Ny Carlsberg Glyptotek IN 1568, mid-2nd century CE. H. 197 cm. Tungsten light photography.

Fig. 4: Amazon, Ny Carlsberg Glyptotek IN 1568, mid-2nd century CE. H. 197 cm. Tungsten light photography.

This sculpture has been known since the 17th century and is the name piece of an Amazon type of which several other Roman replicas exist. The type is a marble copy of a famous Greek bronze original of the 5th century BCE. The Sciarra Amazon has been restored several times and has a long and complex acquisition history. Its provenance is unknown but it is likely to have come from Italy in the area around Rome. It has long been known that the sculpture was placed in the Palazzo Barberini, which is now the Galleria Nazionale dell'Arte Antica in Via Quattro Fontane. It was acquired for the Barberini collection in 1628 from Cardinal Francesco Maria Del Monte, who was an important ecclesiastical figure in Rome and it may have been discovered in the cardinal's own vineyard, situated in the area of the ancient Roman Gardens of Sallust.

While in the possession of the Barberini family, the sculpture was given a right hand, which rested on the crown of the head and a left arm which hung down at the side and covered a quiver, and also a shield and a helmet, which stood on the base.

In the 1830s the sculpture was acquired by the Sciarra family, hence its present name. After being in their possession for more than 60 years the sculpture came by a tortuous route to the Ny Carlsberg Glyptotek in Copenhagen. Here Conservator C. Nielsen removed all former attributes on the sculpture before reconstructing a new, left arm, resting on a marble pillar while holding a spear. The legs were taken apart and reassembled, probably to improve the joins. Between the years 1915–1932 it was decided once more to give the sculpture a new left arm, this time minus the spear. All previous restorations, the left arm, the marble pillar and the right hand which rested on the crown of the head were removed in 1978 and the sculpture was remounted to give it a new and, what was meant to be, a more correct posture. This meant that the many reassembled fragments from the legs were taken apart and put together again. To do this the surface of parts of the legs had to be rasped. In 1987 the upright stance of the statue was reinforced with a new steel support, and the plinth was placed on top of the base. At the same time the sculpture was provided with a newly-modelled left shoulder.[4] During the time it has belonged to the Glyptotek a cast has been taken of the Amazon.

METHODOLOGY

The Sciarra Amazon is one of a number of sculptures in the collection of Greek and Roman antiquities which have been examined as part of the VIL survey. The sculpture was first and foremost chosen for further investigation based on the results of the VIL survey and the presence of traces of pigment observed with the naked eye. As a comparative study, two other replicas of the same Amazon type and of approximately the same date were examined in October 2010 for traces of paint. One was excavated in 2002 in Écija, Andalucia, and now in the Museo Histórico Municipal of Écija (inv. no. 8041-197). The other is in the Pergamon Museum in Berlin (inv. no. Sk.7). The examination was made possible through the collaboration between these two museums and the Copenhagen Polychromy Network, Ny Carlsberg Glyptotek in Copenhagen.

The Sciarra Amazon was examined to locate and document traces of original paint according to the Copenhagen Polychromy Network (CPN) protocol by means of the non-invasive techniques VIL, ultraviolet (UV) and raking light photography, and *in situ* microscopy.

The results of the visual examination and the technical imaging called for further analysis and qualitative research. This was done with a variety of analytical tools, both non-inva-

4 Moltesen, M., "En restaureringshistorie", Meddelelser fra Ny Carlsberg Glyptotek 36 (1979) 51–67.

sive and invasive using X-Ray Fluorescence analysis (XRF)[5], the taking of samples, electron micro-probe (EMP), stratigraphic analysis and polarisation microscopy.

A sampling strategy was developed on the basis of the preliminary investigations. Minute samples with a surface area of circa 0.25–1 mm^2 were taken and prepared for cross sections; other samples were left unmounted. The unmounted samples were studied with polarisation microscopy[6]. The polished samples were analysed by means of stratigraphic analysis and subsequently carbon-coated and prepared for EMP analysis to investigate the elemental composition of the pigments.[7] A sample strategy for binding medium analysis has yet to be conducted.

RESULTS

The results of the investigations undertaken on the surviving polychromy on the Amazon are summarised below.

In situ microscopy of the surface shows traces of four different colours used for skin tones, mostly red and blue but also pink and few traces of yellow. The different pigments used for skin tones only exist in minute traces located side by side (fig. 5–6). The pigments are found in all areas of exposed skin; most clearly-defined on the feet where red is clearly visible to the naked eye. The majority of the pigments are found where the marble surface is covered in incrustation as seen on the calves and the back of the sculpture.

As a rare exception, groups of blue grains are visible, but in most cases the pigment exists only in minute amounts. The blue colour varies from greyish blue to clear, shining blue. The VIL-images reveal the extensive luminescent property of Egyptian blue. On the skin the pigment is, in the main, present on the surface as scattered particles but in some places it is more concentrated as observed in the area showing blood drops (fig. 5 and 7).

The hair seems to have been painted mostly a yellow/orange colour which is well preserved while smaller traces of red and blue might have acted as shadows (fig. 8–9). The blue is identified as Egyptian blue by the VIL-imaging. A sample of the red and yellow/orange is taken for polarisation microscopy and EMP. The red particles have a very intense dark red colour and correspond to the optical characteristics of hematite. The yellow/orange colour looks like a mixture of both yellow and a few red particles. The yellow is identified as ochre while the red particles are probably hematite.

The eyeballs were painted using white, blue and red. The white and blue are located in the sclera of the eyeballs while the red is found in the iris. VIL-imaging reveals a small concentration of particles of Egyptian blue in the right eye (fig. 10).

A sample of white from the right eye was analysed with EMP and showed a content of lead (Pb) and a smaller content of vanadium (V), representing the use of lead white. The few particles of blue pigment were probably mixed with lead white to achieve a brighter white. Red is found in the area of the eyebrows, though there appears to be no method to its application.

5 Hand-held XRF from Innovex Systems was used with assistance from Professor Minik Rosing

6 Zeiss Axioplan2 polarization microscope was used with assistance from geologist Jørn Bredal

7 EMP, JEOL SuperProbe JXA8200 operating at 15kV and 7nA in a vacuum with a built-in EDS detector for chemical characterisation and a backscattered electron detector was used with assistance from geologist Alfons Berger.

Fig. 6: Photomicrograph of red, blue and pink at ×52 magnification. Scattered small grains located side by side are observed on the skin in the area showing carved blood drops.

Fig. 5: Detail photo of the right side of the sculpture showing carved blood drops.

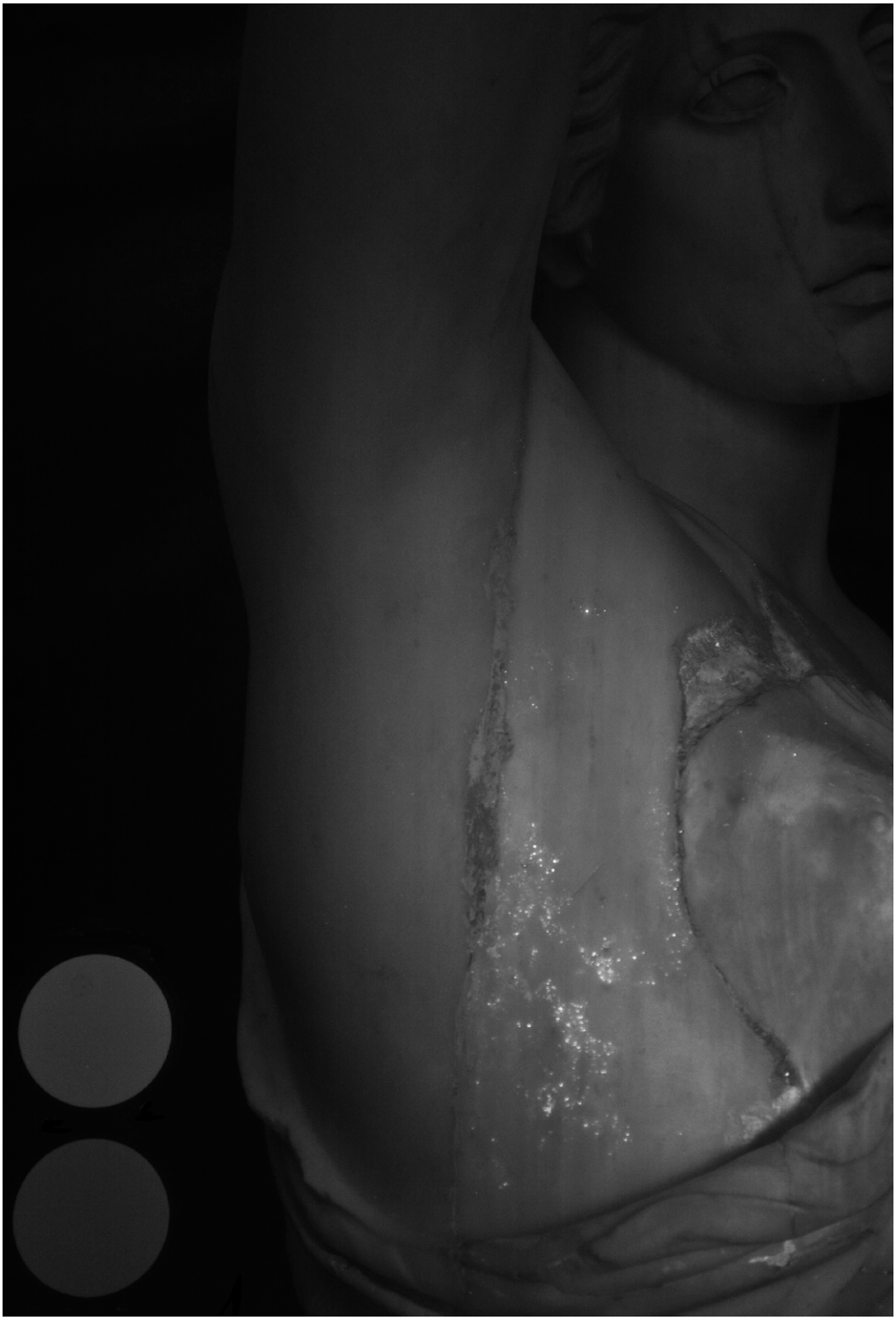


Fig. 7: VIL-image showing particles of Egyptian blue glowing bright white. On the skin area the presence of Egyptian blue is observed as scattered particles, whereas in the area showing blood drops the particles appear more concentrated.

Fig. 8: Macro-image showing the yellow/orange colour of the hair.

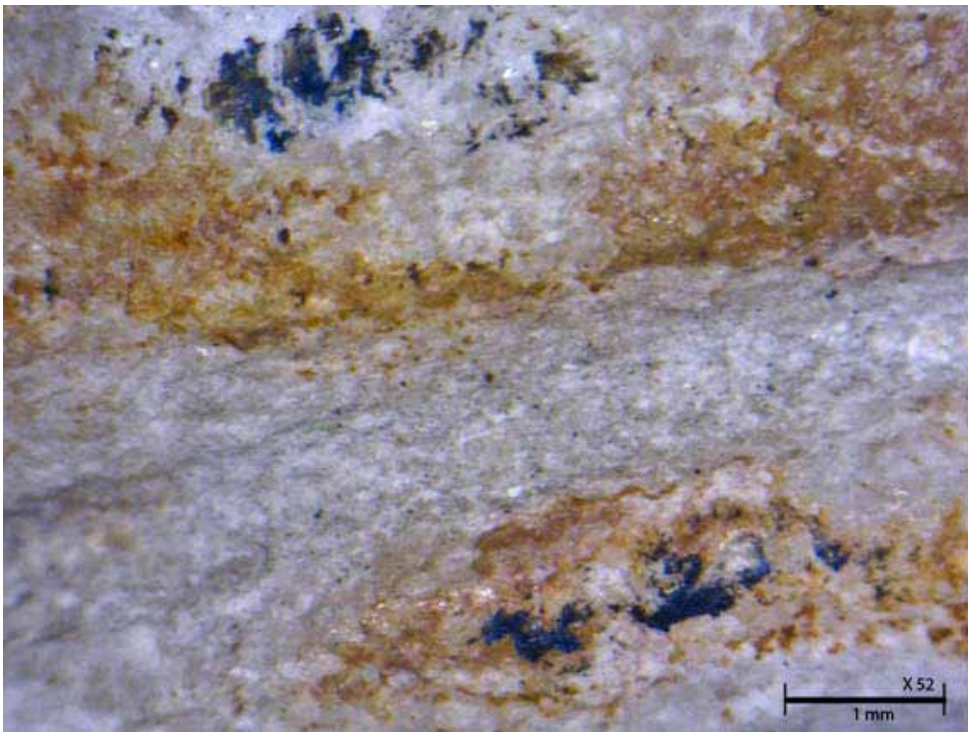


Fig. 9: Photomicrograph of Egyptian blue found in the hair at ×52 magnification. The blue only exists in minute amounts and may have acted as shadows.

Fig. 10: VIL-image of the head reveals clear luminescence from Egyptian blue in the white of the right eye.

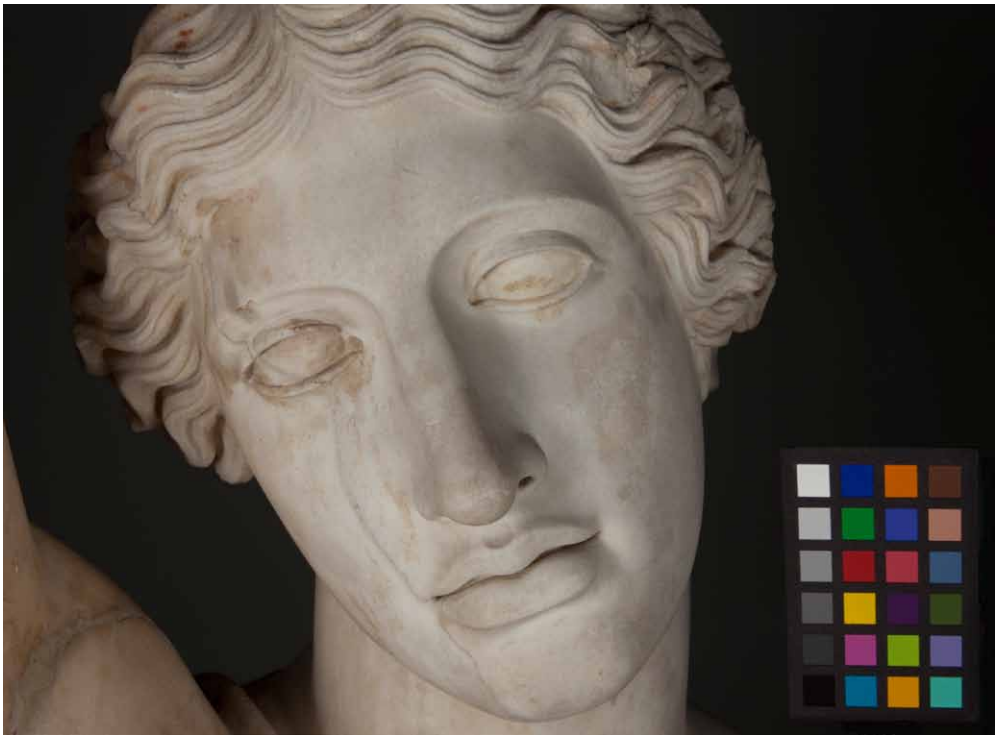


Fig. 11: Detail photo of the head. The face looks as if it has been deeply cleaned.

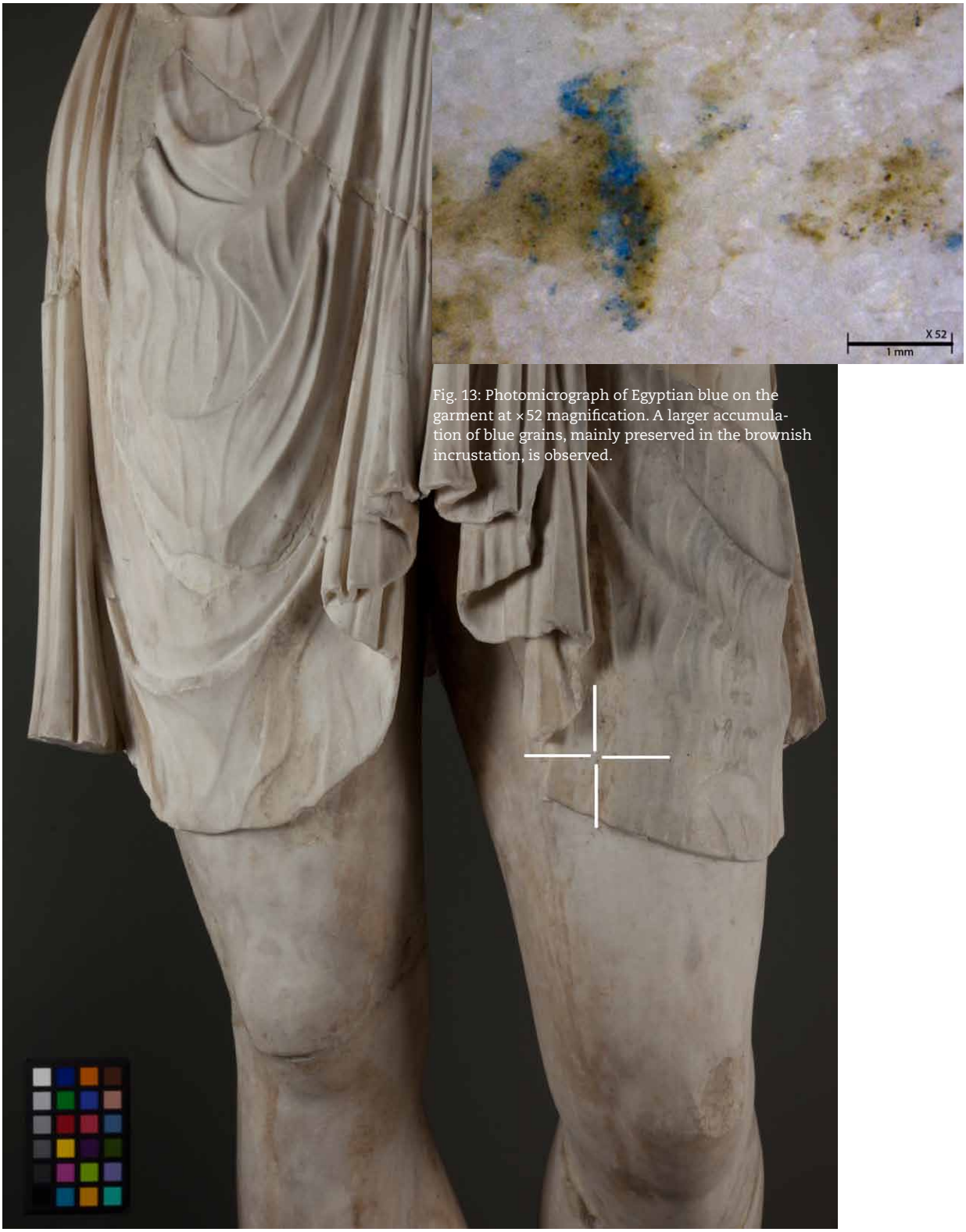


Fig. 13: Photomicrograph of Egyptian blue on the garment at ×52 magnification. A larger accumulation of blue grains, mainly preserved in the brownish incrustation, is observed.

Fig. 12: Detail photo of the front of the chiton.

Fig. 14: VIL-image showing bright luminescence from a defined band of Egyptian blue running along the lower part of the front of the chiton.

Fig. 15: Detail photo of the belt on the front of the sculpture. Clear traces of red identified by hand-held XRF as containing of iron (Fe), probably indicating the use of hematite or red ochre.

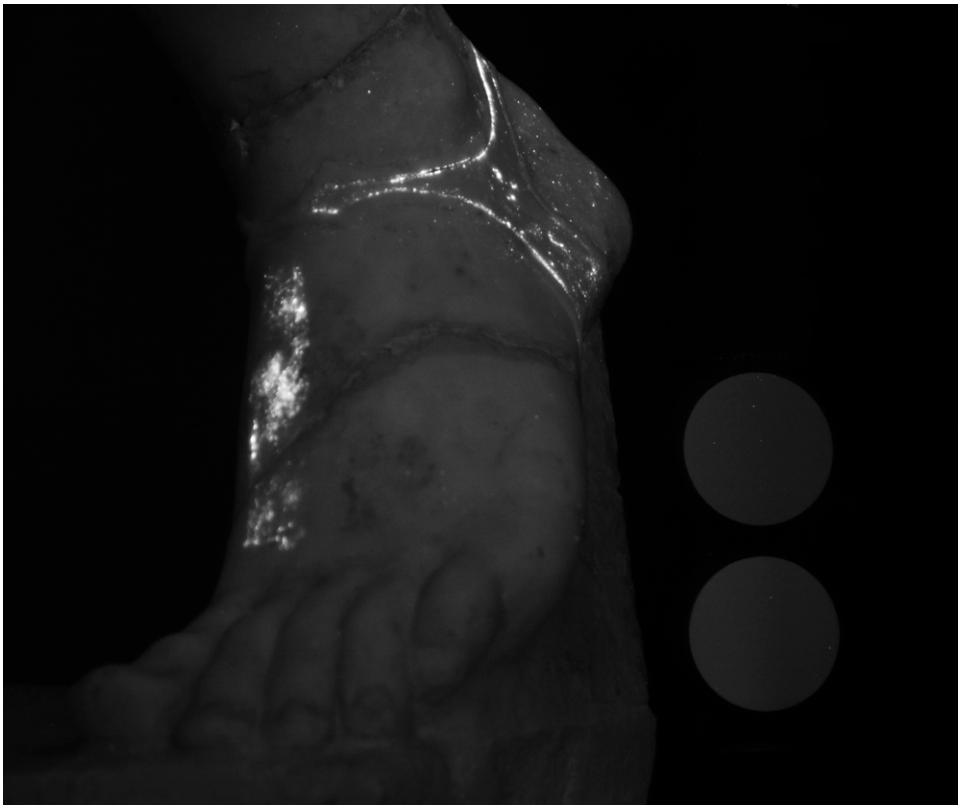


Fig. 16: VIL-image of the left foot. On the flat surface of the instep a clearly defined band of Egyptian blue is observed glowing bright white, whereas in the incisions of the ankle strap the Egyptian blue appears as small shining grains like beads of a necklace.

Fig. 17: Detail photo of the left foot. No traces of blue can be observed with the naked eye and nothing in the carving indicates the presence of a sandal thong.

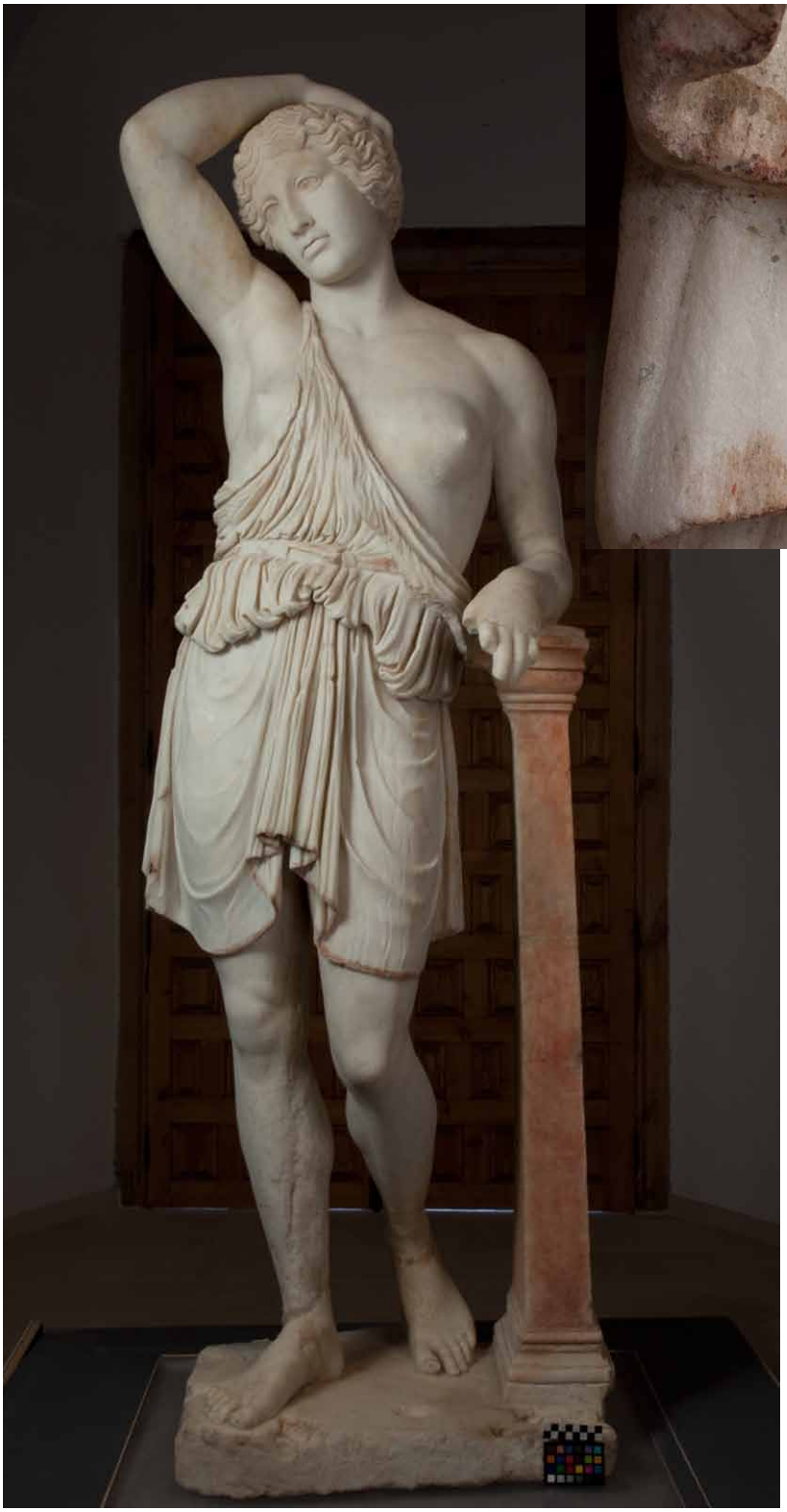


Fig. 18: Amazon in Museo Histórico Municipal of Écija, inv. no. 8041 – 197.
Tungsten light photography.

Fig. 19: Macro-image showing traces of a green next to the red band, running along the lower hem of the chiton.

Fig. 20: On the chiton the VIL-image clearly reveals the presence of a distinct band of Egyptian blue running along the edge next to the left breast. Egyptian blue is also seen on the belt buckle, to imitate metal.

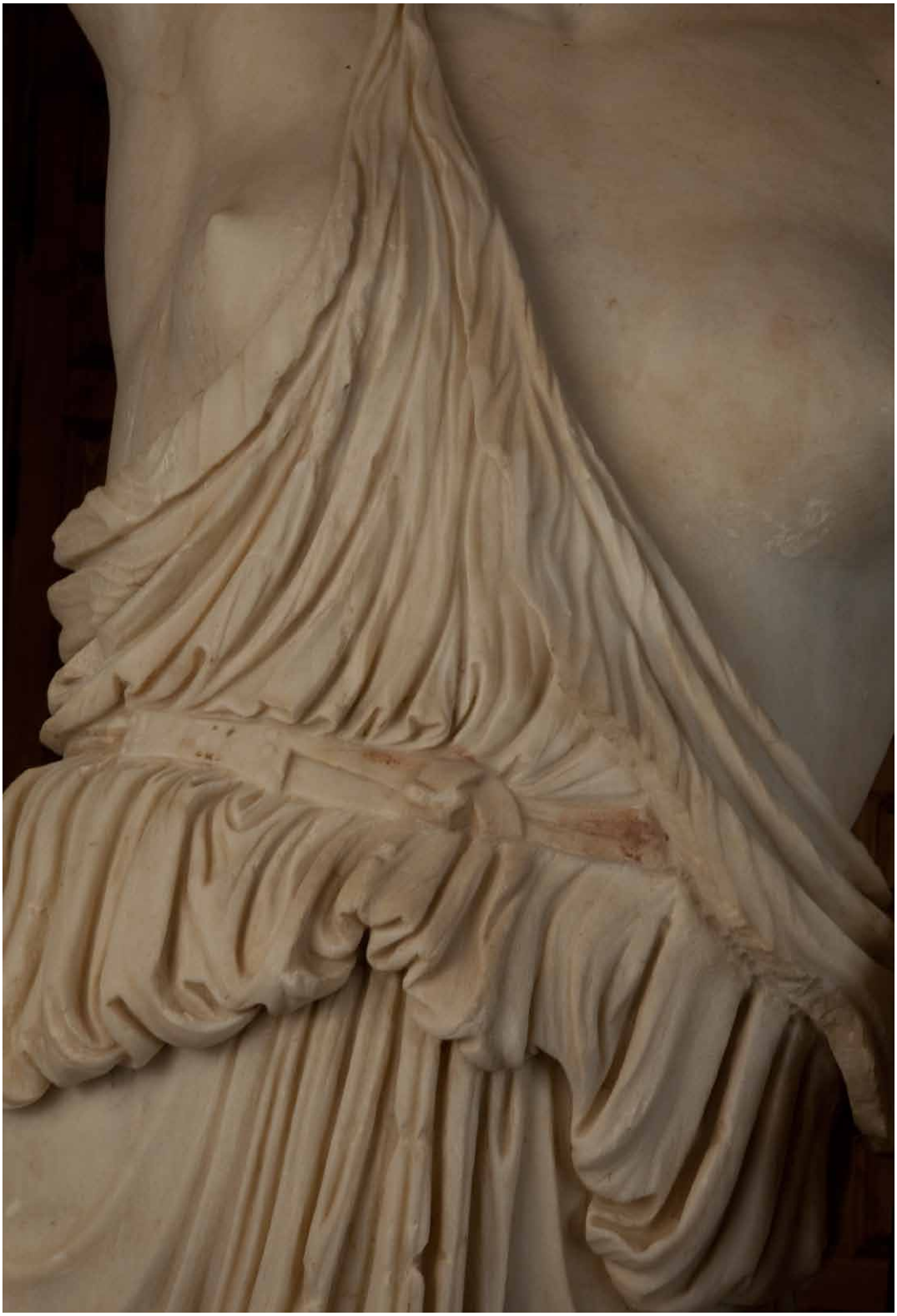


Fig. 21: Detail photo of torso showing remaining traces of red on the belt.

Fig. 22: Detail photo of the feet. On the right foot the red band is applied on a part of the surface which has been repaired presumably in Antiquity.

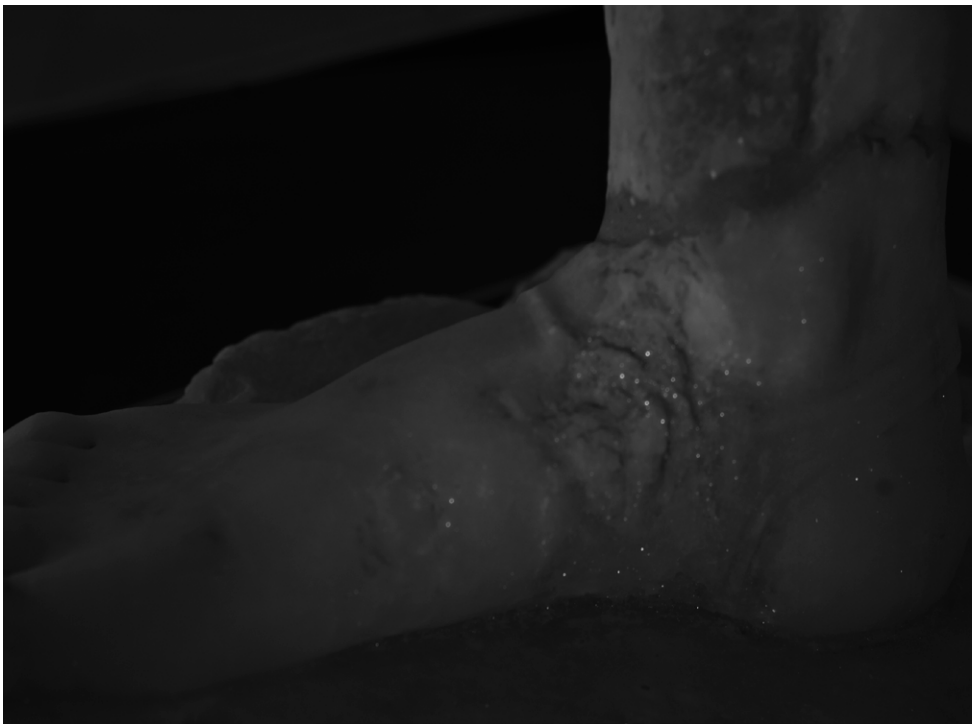


Fig. 23: VIL-image of the right foot. On the band defining the ankle strap small particles of Egyptian blue shining bright white are observed.

Fig. 25: Photomicrograph of the left eye at ×52 magnification. The contours of a black-reddish iris combined with particles of red, blue and yellow pigments.

Fig. 24: Detail photo of the head showing the well preserved traces of colour in eyes.

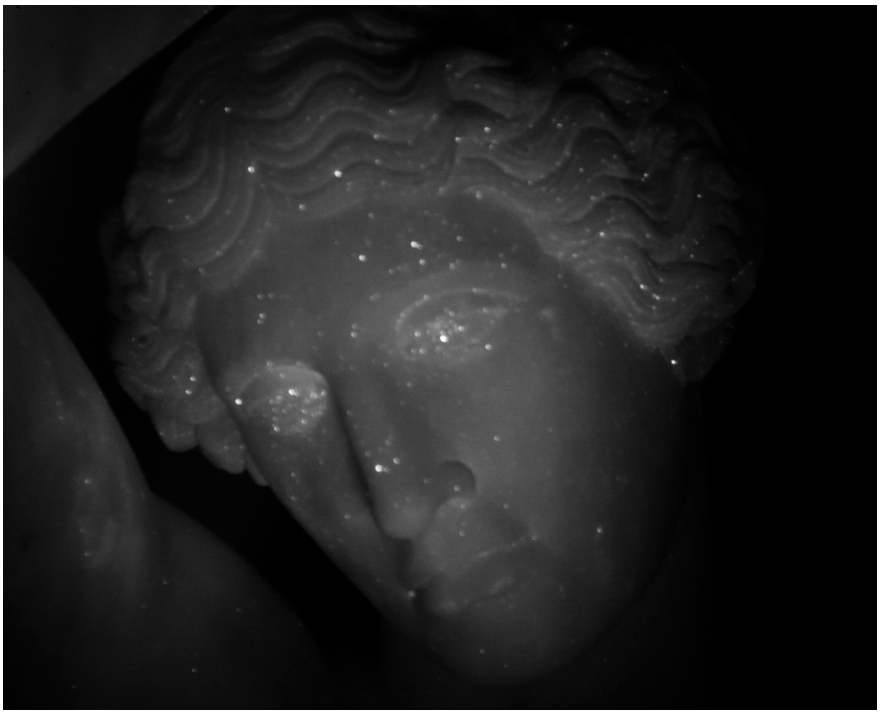


Fig. 26: VIL-image of the head. A few grains of Egyptian blue are located on the hair and skin parts, whereas the presence of Egyptian blue in the eyes appears more compact.

The visual examination also reveals traces of red on the lips and on the face. Despite the few traces of red on the face and the pigments observed in the eyes the overall impression of the surface is that the face has been deeply cleaned (fig. 11).

Red and blue seem to dominate the colours of the chiton. The majority of the grains of blue pigment are distributed around the lower part of the dress (fig. 12–13) while the red grains are more evenly distributed. With the VIL-images a bright glowing band is observed running along the lower part of the chiton, most sharply defined at the front and on the back (fig. 14). Larger concentrations of red can be observed with the naked eye on the belt on the front of the sculpture (fig. 15), on the ankle straps and on the chiton below the belt on the back of the sculpture. The red on the belt was analysed with a hand-held XRF and EMP while the other red colours were only analysed with EMP. Iron (Fe) was found in all cases, indicating the use of red iron oxide (FeOOH).

The VIL-image of the left foot shows a defined band glowing on the flat surface of the instep and in the incised edges of the ankle strap, giving the viewer the impression that the sculpture is wearing sandals (fig. 16). In this area only a minute amount of the blue pigment was observed with the microscope and only as small single particles. This means that the VIL reveals information on the pigment on a sub-microscopic level. The result came as a big surprise since nothing is visible to the naked eye and nothing in the carving indicates the presence of a sandal thong (fig. 17).

The foot pillar between the left foot and the base has well-preserved traces of red which are easily visible to the naked eye.

The Sciarra Amazon exhibits both similarities and differences compared to the two replicas of the Sciarra Amazon in Berlin and Écija. The one in the Pergamon Museum, Berlin, has only a few traces of red on the garments, while the one in the Museo Histórico Municipal of Écija has abundant remains of the original polychromy (fig. 18).

Along the lower hem of the chiton a distinct band of deep red combined with small blue particles was observed. Sometimes and in a fragmentary state a green band is seen above of the red band (fig. 19). The bands were only observed on the front of the chiton. Red is also found on the chiton as scattered particles located on and between the folds. On the chiton, the VIL-images clearly reveal the presence of Egyptian blue as a distinct band glowing bright white running along the edge next to the left breast. To the right of what remains of the band are separate accumulations of glowing white particles (fig. 20). On the belt tied around the waist the remains of a deep red layer are observed on the front (fig. 21). The buckle has red-orange layers beneath brownish layer combined with blue grains. The VIL reveals a glowing white band of Egyptian blue on the buckle, probably using the blue colour to imitate metal. Besides the distinct band on the edge of the chiton and the accentuation of the buckle few scattered particles glowing bright white are observed on both the front and back of the chiton.

On the feet, the carved ankle straps have a deep red combined with a few blue grains. On the right foot, a part of the ankle strap was damaged. As a repair it was painted in with red (fig. 22). On both feet the band defining the ankle strap has small particles shining bright white under the VIL (fig. 23).

The hair was painted red-yellow. Both eyes have a grey-brownish layer most pronounced in the left eye (fig. 24). Beneath the grey-brownish layer the contours of a black-reddish iris combined with scattered particles of red, blue and yellow pigments were observed. Along the upper and lower rim of both eyes traces of a red stroke together with dots of black-brown probably indicate eyelashes (fig. 25).

When looking at the VIL-images the face appears to hold a larger concentration of scattered particles and fairly large grains are observed on the forehead and nose. As for the eyes

the glowing white particles seem to be concentrated in the iris and tear duct. The right eye also displays glowing white particles along the lower eyelid (fig. 26).

On skin parts a thin and transparent red layer is observed on the left breast and left hand. The right hand and arm show traces of a red-yellowish layer combined with scattered particles of blue. The VIL-images clarifies the use of blue as part of the skin tones which can be seen on the neck and upper part of the shoulders.

The pillar supporting the sculpture has extensive traces of red colour. The front of the pillar is entirely red whereas the back of the pillar nothing of the pigment layer is preserved. The VIL-images show a dense distribution of shining white particles on areas where the red layer is preserved.

CONCLUSION

Despite the complexities of the sculpture and its long acquisition history, the visual examination of the Sciarra Amazon reveals well-preserved traces of pigments on most of the surfaces. The sculpture was completely polychrome using a complex technique which includes the use of more than one pigment to obtain sophisticated tonal effects. Red, Egyptian blue and pink was used for the skin tones. The hair was painted using yellow ochre together with a small amount of hematite and Egyptian blue. Lead white was used together with Egyptian blue in the white of the eyes. Red is found in the iris and in the area of the eyebrows. Red and blue seem to dominate the colours of the garments. A defined band of Egyptian blue runs along the lower part of the chiton. Red iron oxide was used for the belt and the foot pillar under the left foot. On the left foot, Egyptian blue is found as a sandal thong on the flat surface of the instep and in the incisions along the edges of the ankle strap.

As for the results of the examination on the Amazon from Écija, red, blue and yellow were used for skin tones. The hair was painted red and yellow. Egyptian blue has been used in the eyes just as on the Sciarra Amazon. Defined bands of Egyptian blue on the chiton of both Amazons are observed under VIL, though however, used differently.

In general, the pigments remaining on the Sciarra Amazon are found where the marble surface is covered in incrustation and dirt. This is especially observable on the back of the sculpture. Here the sculpture appears less cleaned compared to the front and, especially, the face which has a very white, clean surface.

The presence of pigments depends on a reasonable state of preservation of the surface; areas with no or only limited amounts of pigment have undoubtedly been deeply cleaned, rasped or reworked while the incrustation acts as a protective layer over the pigments.

When combined, microscopy and VIL-imaging complement each other. Microscopy elicits qualitative information on the pigments and their colours. The presence of microscopic particles depends of course on the surface being in a reasonable state of preservation. However, VIL-imaging visualizes the distribution of particles of Egyptian blue of submicroscopic size, so small that they are not even observable with a microscope capable of high magnification. VIL elicits not only invaluable information on the decorative patterns and defined bands on the sculpture but also documents the practice of using small single, particles of blue as a part of the skin tones and the white of the eyes.

Since even single particles of Egyptian blue can be revealed using VIL, it is possible to define its distribution within the scheme of the composition very clearly. VIL gives a far better impression of the distribution of the blue pigment than the visual examination. Important details such as the one showing a sandal thong cannot be visually detected without the VIL-images. These astonishing results certainly raise new questions on conservation practices,

handling and transportation. Surviving pigments can often be confused with discoloration, patina or dirt which means that they may be overlooked and in the worst case be removed as a result of cleaning. Even objects without clear traces of paint may prove to have important information on polychromy and must always be handled with care.

ACKNOWLEDGMENTS

We would like to thank the following for their valuable assistance:

- Dr. Donato Attanasió Istituto di Struttura della Materia del CNR ISM-CNR, Rome.
- Alfons Berger Ph.D., geologist, Department of Geography and Geology (IGG), University of Copenhagen.
- Jørn Bredal, MSc, geologist, School of Conservation of The Royal Danish Academy of Fine Arts.
- Professor Minik Rosing, Museum of Geology/Natural History Museum of Denmark.
- Prof. Dr. Andreas Scholl, director of the Antikensammlung in Berlin, as well as the members of the staff.
- Dr. Antonio Fernández Ugalde, director of the Museo Histórico Municipal of Écija, as well as the members of the staff.

The Sciarra Amazon Investigation: Some Archaeological Comments[1]

Jan Stubbe Østergaard

The statue in the Glyptotek belongs to the category of Roman sculptures often termed 'ideal', denoting works which represent deities and mythological characters. It is the name piece of a Roman Amazon type known as the Sciarra type. This is one of three types known collectively as the Ephesian Amazons – the other two are the so-called Mattei and Sosikles types. These Roman Amazon types may with great certainty be seen as reproducing famous Greek classical bronze originals created for the sanctuary of Artemis at Ephesos in the mid 5th century BCE. The written sources associate these originals with the sculptors Phidias, Polykleitos and Kresilas.[2]

The polychromy of Roman ideal sculpture in marble is very poorly investigated and documented, and the polychromy of Roman marble copies of known Greek originals hardly at all.[3] The results of the investigation of the two Amazon replicas in Copenhagen and Écija[4] is of correspondingly great interest.

THE FULL POLYCHROMY

The full polychromy of the two works supports what Reuterswärd wrote in 1960 about the polychromy of Roman ideal sculpture: "Beispiele wie diese mögen genügen, um zu belegen, dass kräftig und voll bemalten Skulpturen in antiken Rom nichts ungewöhnliches waren".[5]

To understand the status of such full polychromy in the eyes of contemporary viewers other important aspects must be taken into account.

The carving of both statues is of high quality, the Copenhagen version being the better of the two. The marble used is also first rate, certainly Pentelic in Copenhagen, and probably so in Écija.[6]

The sculptural workmanship of the Écija replica is characterized by its finish: with the exception of the face, the surface was left finely rasped. Pilar Léon has suggested that this might be evidence of the sculptor being trained in a Attic, Greek.[7]

The provenance of the Sciarra Amazon strongly suggests that it was carved in Rome or somewhere close by. There is good reason to think that it was copied by the pointing meth-

1 These comments should be read in continuation of the article immediately above, by Sargent and Therkildsen.

2 Ny Carlsberg Glyptotek IN 1568. For images of IN 1568, see Sargent and Therkildsen above p. 28-31, fig. 1–4. On this replica and the Ephesian Amazons see Moltesen 2002, 207–211, no. 60; Weber 1984; Bol 1990; Bol 1998; Bol 2004; Mattusch 2005; Weber 2008.

3 Reuterswärd 1960, 181–190 remains the only extensive survey. See also Østergaard 2008, 44–49. Recent investigations of single sculptures will be referred to below.

4 On the Écija Amazon see Romo Sala 2003 and 2004; Garcia-Dils and Ordónez Agulla 2007; Léon 2008; Weber 2008, 46–47.; Sargent and Therkildsen, above, 47–48, 42–46 figs. 18–26.

5 Reuterswärd 1960, 192–193. None of the sculptures he refers to are copies of known Greek originals.

6 Copenhagen: Unpublished analysis by Donato Attanasio, Rome 2010; Écija: Léon 2008, 251.

7 Léon 2008, 251. The same finish is found on other sculpture fragments from the site where the Amazon was found, cf. Léon, loc. cit. and Romo Salas 2003, 294–295 w. fig. 7 (male torso).

od from a plaster cast of the Greek original. Fragments of a plaster cast of the Greek original were found at Baiae and they fit perfectly into a plaster cast of the Copenhagen replica.[8]

On the basis of an estimate of the man-hours required, Christa Landwehr has recently argued that full-scale marble copies of Greek bronze originals were surely costly works of art in the eyes of Roman connoisseurs, much more costly than statues executed without the constraint of fidelity to a Greek original.[9] For an assessment of the status of statues like our Amazons, it is also important to note that on the evidence of the literary sources, sculpture in marble was placed above works in bronze.[10]

We do not know in which context the two statues were originally set up, but educated guesses can be made: on the background of what has been said above, it seems justified to assume that the context of such sculptures would be one of high social status if in a private home, or, if in a public space, one of representative importance – such as baths and theatres. This is confirmed by the known contexts of some of the Ephesian Amazons.[11]

These two mid-2nd century CE replicas show that high grade, full-size marble copies of famous Greek originals might be fully polychrome – and the polychromy must have been as appreciated as the other prestigious qualities of the sculptures.

It is far too early days for us to be able to say whether such full polychromy was the rule on Roman sculptures of this kind. On the other hand, we have no hard-and-fast documentation of similar sculptures of the period being either partially painted, or not painted at all. It would be of correspondingly great interest if it were possible to rule out a skin colour on the statue of Venus from the Hadrianic baths at Bet Shean / Nysa-Scythopolis in present day Israel (fig. 1).[12] The polychromy is spectacular, but no skin colour has been reported. One might especially hope for a VIL-imaging campaign on the sculpture.

What we do have is the recently documented, sophisticated and full polychromy of the so called 'Treu Head' in the British Museum. It is also dated to the mid-2nd century CE and the marble is probably Parian.[13] Also of the period is the marble statue body of a youth found in 1954 in a funerary context on the Via Prenestina (fig. 2),[14] although this ideal body would in all probability have had a portrait head. According to the publication, the sculpture was fully polychrome. Renewed study of the piece is called for.

Looking at the Imperial Roman period as a whole, I know of only one other well-documented instance of a completely polychrome, full-size 'ideal' sculpture in marble. This is the archaistic statue of a striding Artemis, from Pompeii and dated to the period mid-2nd century BCE to 1st century CE. Since replicas of the statue exist, we may be dealing with a copy of a Greek Late Archaic original. The polychromy does not reflect the polychromy of the Greek Archaic period, but that of Hellenistic and Imperial Roman times.[15]

Of interest is the head of the helmsman of the Scylla Group from Sperlonga (fig. 3),[16] on which a skin colour may be preserved in the region of the moustache. When viewing the

8 Landwehr 1985, 60–64.

9 Landwehr 2010, 37, with direct reference to the Sciarra Amazon.

10 Lahusen 1999, 38–39 and passim.

11 Cf. Bol 1998, 166–170. An example is the Sciarra Amazon replica from the 'Canopus' of the Villa Hadriana, Bol 1998, 169 and 179 no. I.10.

12 The Israel Museum, Jerusalem, inv.no. IAA 2001–2987. Foerster 2005.

13 Verri, Opper and Deviese 2010.

14 Rome, Antiquarium Comunale del Celio, Numero di ingresso 6907. Pettinau 1995 with figs. 2–5.

15 Museo Archeologico Nazionale di napoli, inv. 6008. Primavesi 2010; Primavesi 2010a; Brinkmann, Koch-Brinkmann and Piening 2010.

16 The bibliography is extensive. A point of entry: Vorster 2007, 325–327, 415 to Abb 335 a–g (bibliography). See also Cassieri 2006, 116–128, 149–151 (bibliography on Sperlonga and the sculptures).

Fig. 1: Statue of Venus from the Hadrianic Baths at Bet Shean, Israel. Preserved height 163 cm. Marble from Aphrodisias. The Israel Museum, Jerusalem, inv. IAA 2001-2987. Photo courtesy of The Israel Museum.

Fig. 2: Statue of a youth, from the Via Prenestina, Rome. Preserved height 89,5 cm. Carrara marble (?). Rome, Antiquarium Comunale del Celio, No. ingresso 6907. From Pettinau 1995, fig. 2.

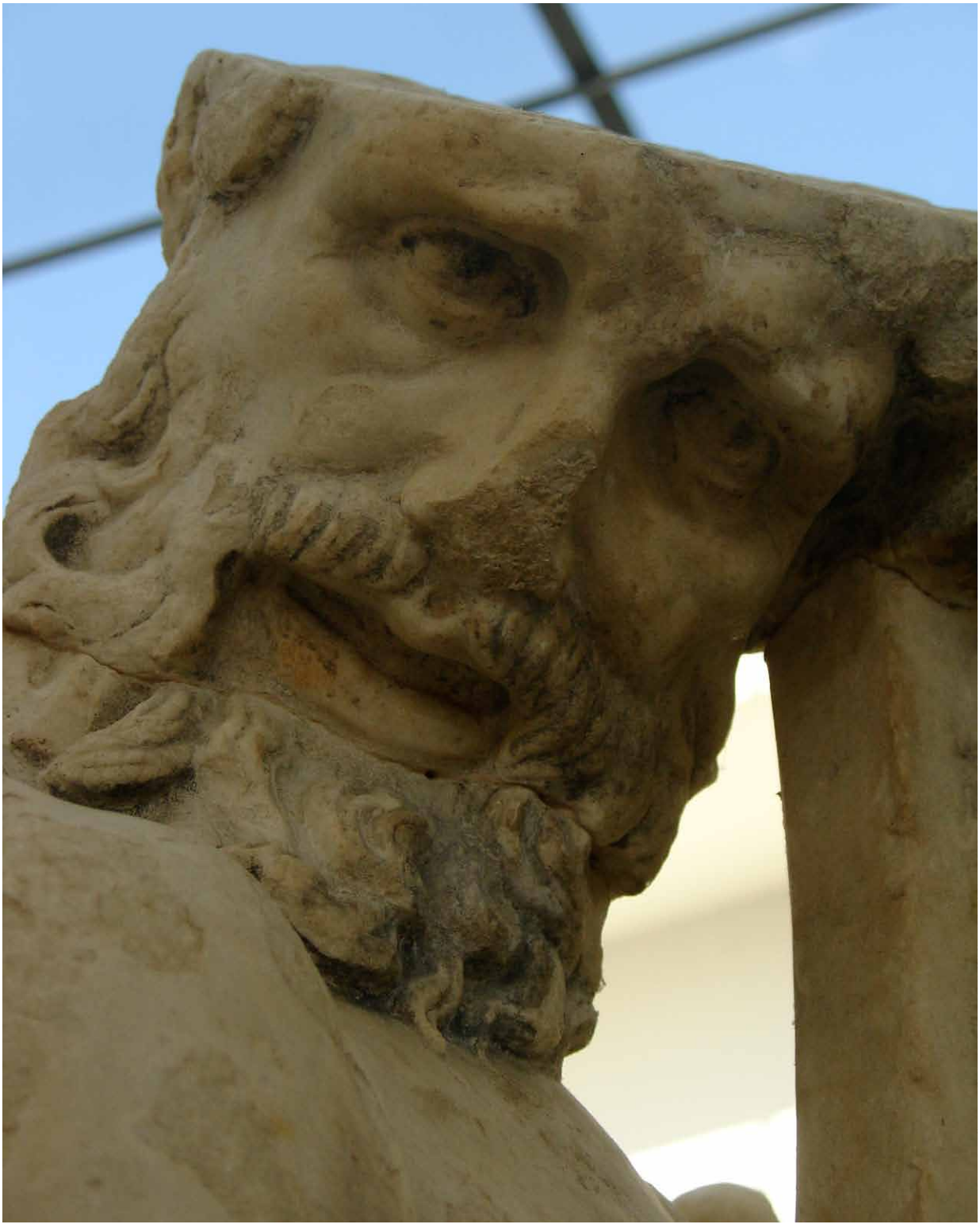


Fig. 3: Head of the helmsman of the Scylla Group from Sperlonga. Sperlonga, Museo Archeologico Nazionale. Over life-size. Photo courtesy of Stephan Zink.

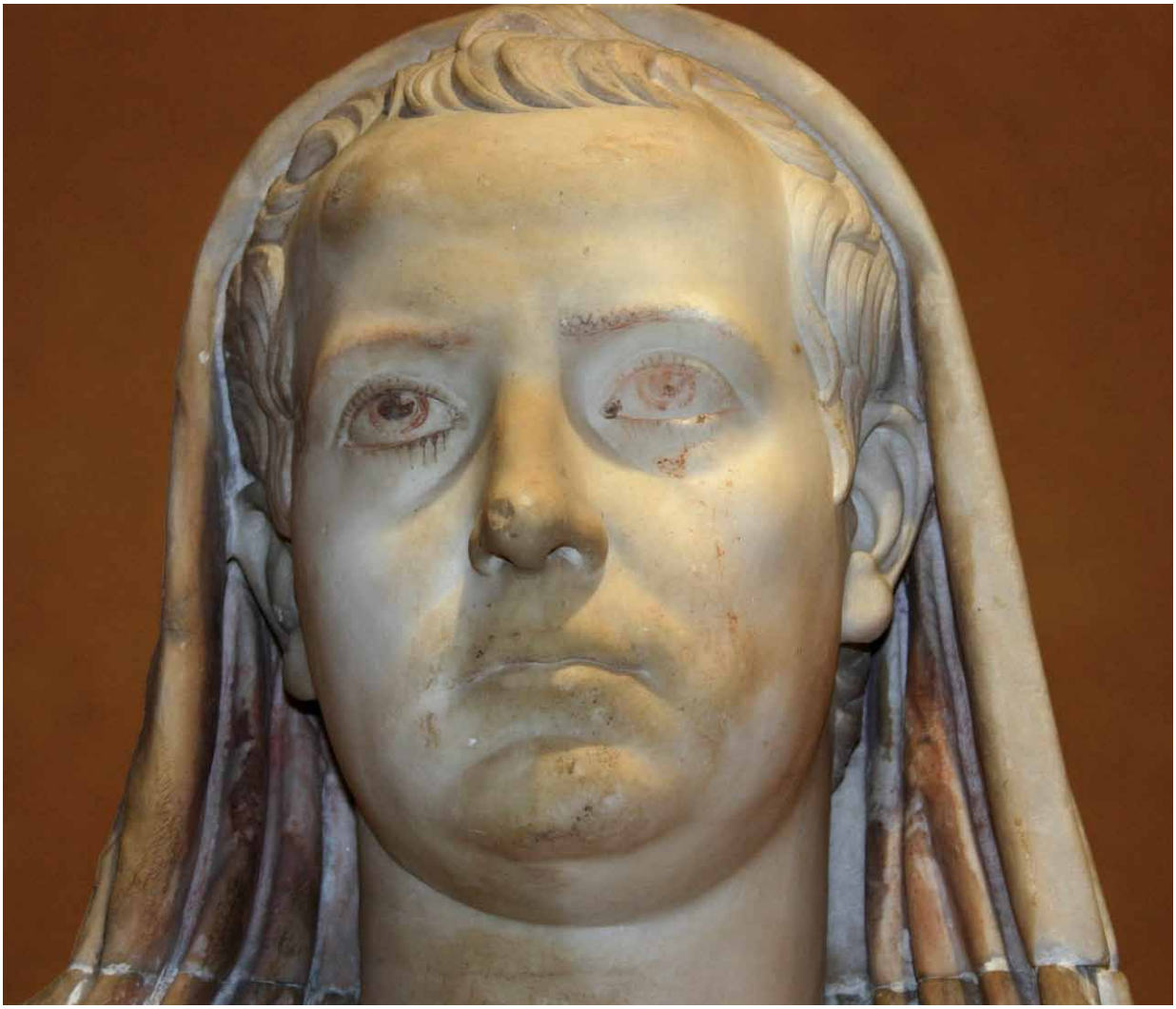


Fig. 4: Life-size portrait statue of a Roman in toga, capite velato. Detail of the head. Italian marble. Formia, Museo Archeologico Nazionale, museum number 10 (Museo Archeologico Nazionale di Napoli inv. no.147614). Photo courtesy of Paolo Liverani.

sculptures in the Sperlonga Museum, the copious remains of polychromy on this head are in striking contrast to the apparent monochromy of the rest. The helmsman's head clearly deserves close study – as do the Sperlonga sculptures in general, including unplaced fragments in the museum store rooms. One such fragment has found its place in the cloak of the Ulysses in the Polyphemus Group, and it is wonderfully (royal?) purple red – whereas the rest of the cloak is very white.

A PRESCRIBED POLYCHROMY FOR MARBLE REPLICAS OF GREEK BRONZE ORIGINALS?

The polychromy of the chitons of the Copenhagen and Écija replicas of the Sciarra Amazon type throws a first gleam of light on whether or not such replicas were not only carved but also painted according to a prescribed scheme. In this case, the difference in dress ornamentation is very clear.

But, again, we cannot draw any conclusions of more general validity. A similar comparative study of replicas of other famous types would be very useful indeed.

LEAD WHITE AND EGYPTIAN BLUE IN THE WHITE OF THE EYES

The use of lead white with an admixture of Egyptian blue for the white of the eyes of the Copenhagen and Écija[17] Sciarra Amazon replicas provides an important first Roman parallel for the similar technique observed in the eyes of the so-called 'Treu Head' in the British Museum, of approximately the same, 2nd century CE date.[18] The analogy provided by a Trajanic mummy portrait from the Fayum, also in the British Museum, strengthens the impression that there are close technical ties between this category of paintings and the polychromy of contemporary sculpture.[19] Thus, the highlights hypothetically introduced in the pupils of the experimental reconstruction of the portrait of Caligula in the Ny Carlsberg Glyptotek, on analogy with contemporary Fayum mummy portraits, have now been observed on a marble portrait statue of the Julio-Claudian period in the Museo Archeologico Nazionale at Formia (fig. 4).[20]

As demonstrated by Giovanni Verri of the British Museum, the technique of using Egyptian blue in the white of the eye is one which goes back at least to the 4th century BCE, being found on a female marble head from the classical phase of the Temple of Artemis at Ephesos.[21]

17 If one accepts the interpretation of the VIL-image suggested by Sargent and Therkildsen, above.

18 BM 1884,0617.1.,Verri Opper and Deviese 2010, 48–50.

19 BM 1994,0521.6: EA 74708. Verri, Opper and Deviese 2010, 47, fig. 7a–b, 49.

20 Brinkmann, Kellner, Koch-Brinkmann and Østergaard 2003, 211. The Formia portrait: Museo Archeologico Nazionale di Formia, museum no. 10 (Museo Archeologico Nazionale di Napoli inv. 147614); Cassieri 2001, 28–30, no. 7, fig. 18. The observation on the Formia-portrait is due to Paolo Liverani.

21 BM 1872,0405.121. Verri 2009, 1017, 1018 fig. 6a–f.

THE AMAZON'S WOUND

Emission of luminescence from Egyptian blue was seen in the area in the vicinity of the wound on the Copenhagen Sciarra Amazon. Microscopy showed this pigment to be mixed with others, presumably to form a blood colour.[22]

We do not have similar results from the Berlin and Écija replicas. But it seems worth pointing out that a comparison of the wound and the plastically rendered drops of blood on other replicas of the type evince a variety which must reflect differences in how this interface between sculptor and sculpture painter was dealt with. This is a point which deserves further study, and which should be seen in the light of such observations as those made by Christa Landwehr on differences in the rendering of details in copies of the Mattei Amazon type.[23] It is very encouraging that scholars studying Roman copies are now becoming aware of the importance of polychromy, also in the details.[24]

THE ANKLE STRAPS

In continuation of what has just been said above, the VIL-image of the instep of the left foot of the Copenhagen Sciarra Amazon shows us what is clearly intended to be the thong of a sandal, not carved by the sculptor. Nor has the sculptor carved soles for the presumed sandals.

The ankle straps on both feet are a feature of the Sciarra type, preserved only in the Copenhagen and Écija replicas. The ankle strap on the left foot only is a feature of another Classical Greek Amazon original copied in Roman times, the so-called Mattei type.[25]

These ankle straps have commonly been interpreted as spur holders.[26] In 1951, K. Friis Johansen offered a different interpretation: they are straps designed to support the ankle, used by Greek riders, dancers and acrobats. In this, he was followed by von Bothmer.[27] I agree, and intend to update the evidence in favour of this interpretation in our final publication.

The 2nd century CE sculpture painter doing his job on the Copenhagen Sciarra Amazon faced a dilemma: the sculptor had shown something like part of a sandal around the ankles, but no soles? He chose sandals, and painted in the thong; how could he know about Classical Greek Amazon iconography? On a Sciarra Amazon replica in Naples, the sculptor made the same decision and carved sandals complete.[28]

In the matter of ankle straps, the Écija replica is especially interesting in as much as it seems to offer evidence of ancient maintenance. A section of the sculptor's rendering of the ankle strap on the right foot had at some point been damaged, and was repaired by a painting in of the missing part.[29]

22 Sargent and Therkildsen, above p. 33 and figs. 5–7.

23 Landwehr 2010, 42–43.

24 Stähli 2008, 25–26 w. note 23.

25 Bol 1998, 58ff.

26 Bol 1998, 176.

27 Friis Johansen 1952, 42–46; Bothmer 1957, 220.

28 Bol 1998, 181 no. I.12.

29 Sargent and Therkildsen, above p. 47 and p. 45, fig. 22. We thank Paolo Liverani for this observation.

A BRIEF NOTE ON THE ISSUE OF THE CONSERVATION, HANDLING AND MAINTENANCE OF ANCIENT SCULPTURE

As pointed out by Sargent and Therkildsen[30] and others[31], the results achieved by our project and by others are making it very clear that the way ancient sculptures are physically dealt with, both in the field and in museums, must be reviewed.

It seems to me that there is an urgent need for a well-considered set of guidelines for best practise. One might imagine that a meeting on the subject would be useful, to include field directors and conservators, conservation scientist and scholars active in the field of sculptural polychromy. If well-prepared, such a meeting might perhaps lead to a proposal on which there was consensus among the participants, and which might be approved by relevant bodies, such as the AIAC and ICCROM.

30 Sargent and Therkildsen, above p. 48–49.

31 Verri, Saunders, Ambers and Sweek 2011.

REFERENCES

Bol, R. 1990: Die Amazone Sciarra. In: Bol, P.C. et al. (eds), Polyklet. Der Bildhauer der griechischen Klassik (1990) 213–216.

—— **1998**: Amazones Volneratae. Untersuchungen zu den ephesischen Amazonenstatuen (1998) 35–49 (Sciarra type), 173 no. I.2 (Berlin), 175–176 (Copenhagen).

—— **2004**: "Die ephesischen Amazonen". In: Bol, P.C., Die Geschichte der antiken Bilderhauerkunst II. Die klassische Plastik (2004) 145–158.

Bothmer, D. v. 1957: Amazons in Greek Art (1957).

Brinkmann, V., Kellner, S., Koch-Brinkmann, U. and Østergaard, J.S. 2003: "Die Farbfassung des Caligula-Porträts". In: Brinkmann, V. and Wünsche, R. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur (2003) 206–211.

Brinkmann, V., Koch-Brinkmann, U., Piening, H. 2010: "Alte Gewänder in neuem Look. Beobachtungen zu den Farben der pompejanischen Artemis". In: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur (2010) 212–217.

Cassieri, N. 2001: Museo Archeologica Formia (2001).

—— **2006**: La Grotta di Tiberio e il Museo Archeologico Nazionale Sperlonga (2006).

Foerster, G. 2005: "A Modest Aphrodite from Bet Shean", Israel Museum Studies in Archaeology 4, 2005, 3–21 (16–17, Appendix A: Nissenbaum, A., A Staple Isotope Analysis of the Aphrodite Statue, and 18–21, Appendix B: Porat, N., Composition of Pigments Decorating the Statue of Aphrodite).

Friis Johansen, K. 1952: "Et Bidrag til Rytterspørens ældste Historie" ("A contribution to the ealy history of the riding spur"). In: Kivikoski, E. (ed.), Corolla Archaeologica in honorem C.A. Nordman (1952) 41–57, esp. 43–47.

Lahusen, G. 1999: "Antenore, Plinio e la statuaria romana". In: Formigli, E. (ed.), I grandi bronzi antichi (1999) 35–41.

Landwehr, C. 1985: Die Antiken Gipsabgüsse aus Baiae. Griechische Bronzestatuen in Abgüssen römischer Zeit (1985) 60–64.

—— **2010**: "The Baiae Casts and the Uniqueness of Roman Copies". In: Frederiksen, R., Marchand, E. (eds.), Plaster Casts. Making, Collecting and Displaying from Antiquity to the Present (2010) 35–46.

León, P. 2008: "Nueva réplica de la Amazona Sciarra". In: La Rocca, E., León, P. and Parisi Presicce, C. (eds.), Le due patrie acquisite. Studi di archeologia dedicati a Walter Trillmich (2008) 243–253.

Mattusch, C. 2005: The Villa dei Papiri at Herculaneum (2005) 281-282.

Moltesen, M. 2002: Catalogue. Ny Carlsberg Glyptotek. Imperial Rome 2. Statues (2002).

Pettinau, B. 1995: "Una statua adolescente dalla Via Prenestina", BMusRom 9, 1995, 16–26.

Primavesi, O. 2010: "Artemis, Her Shrine and Her Smile: Winckelmann's Discovery of Antique Greek Polychromy. In: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December (2010) 24–77.

Primavesi, O. 2010a: "Winckelmanns Artemis. Zur Entdeckung der Farbigkeit antiker Skulpturen im 18. Jahrhundert". In: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur (2010) 206–211.

Reuterswärd, P. 1960: Studien zur Polychromie der Plastik: Griechenland und Rom (1960).

Romo Salas, A. 2003: "Recent excavations and sculptural finds in the colony of Astigi (Baetica)", JRA 16, 2003, 287–299.

—— **2004**: "La Amazona de Astigi y las circunstancias de su hallazgo", mus-A. Revista de las instituciones del Patrimonio Histórico de Andalucia 1, 3, 2004, 149-155.

Stähli, A. 2008: "Die Kopie. Überlegungen zu einem methodischen Leitkonzept der Plastikforschung". In: Junker, K., Stähli, A. (eds.), Original und Kopie. Formen und Konzepte der Nachahmung in der antiken Kunst (2008) 15–34.

Verri, G., Opper, T. and Deviese, T. 2010: "The 'Treu Head': a case study in Roman sculptural polychromy", The British Museum Technical Research Bulletin 4, 2010, 39–53.

Verri, G., Saunders, D., Ambers, J. and Sweek, T. 2011: "Digital mapping of Egyptian blue: conservation implications". In: Proceedings of the IIC '2010 Istanbul congress: Conservation and the Mediterranean', 2010 (forthcoming).

Vorster, C. 2007: "Die Plastik des späten Hellenismus – Porträts und rundplastische Gruppen". In. Bol, P.C, Die Geschichte der antiken Bilderhauerkunst II. Hellenistische Plastik (2007) 273–331. (325-327 on the Scylla Group), 415 to Abb 335 a–g (bibliography).

Weber, M. 1984: "Die Amazonen von Ephesos II", JdI 99, 1984, 76–92.

—— **2008**: "Neues zu den Amazonen von Ephesos", Thetis 15, 2008, 44–47.

Østergaard, J.S. 2008: "Emerging Colors: Roman Sculptural Polychromy Revived". In: Panzanelli, R. (ed.), The Color of Life. Polychromy in Sculpture from Antiquity to the Present (2008) 40–61.

Tracking Colour Online: Managing and Sharing the Digital Assets of the NCG/CPN Project

Amalie Skovmøller[1]

ABSTRACT

This article discusses the future online realization of research on ancient sculptural polychromy. It deals with the considerations and difficulties connected with the digitalization of this field of research, and with making it accessible to the general public. In conclusion a future online solution is outlined.

KEYWORDS

Polychromy research, ancient sculpture, Greek sculpture, Roman sculpture, digital asset management, database.

INTRODUCTION

"An effective asset management system could go a long way toward bridging the gap that exists between the sometimes esoteric world of advanced research and the knowledge-hungry public."
(Hilton, J.L., Digital Asset Management Systems, in: Educause Review, April 2003, pp. 52–53).

Since 2008 research on the Greek and Roman polychromy sculpture in the Ny Carlsberg Glyptotek – and elsewhere – has increased, and so has the general public interest. A point has been reached, where there is a need for a more immediate communication of the collected data between the scholars involved and the public.

From the start we wanted to create a platform for the project, where scholars would be able to share data and the public would be given access to the research. This will be the first online database exclusively for research on ancient sculptural polychromy, so serious thoughts and considerations are necessary. The platform will be the digital "face" of the project, and every choice on every detail will therefore to some extent have an effect on the public's perception of sculptural polychromy research.

Discussing an online solution for the project has been (and will continue to be) a matter of posing fundamental questions regarding all aspects of the project's function and purpose. When providing the general public with access to this research field, we have to make sure, that we communicate every detail in the best possible way. We want people not only to continue using the online opportunities, but also to develop a familiarity with the research field in doing so.

In this article I will draw an outline of our thinking so far, and of the online solutions, which we have under consideration. As the online project is still in its initial phase, we hope that colleagues in our field will let us have their comments, critical opinion and advice. At the present stage of development, this is something which would be highly appreciated – and taken into account.

---

1 Cand.mag. in classical archaeology; research assistant to the NCG/CPN project.

A DIGITAL PLATFORM: WHAT SHOULD IT PROVIDE?

Working from a partly undefined starting point, we needed to clarify what we aimed to accomplish by digitalising the project.

1 A RESEARCH STORAGE AND COMMUNICATION PLATFORM

At an international meeting in Copenhagen in September 2010 on ancient sculptural polychromy,[2] we agreed on the need for a communication platform, where results and data could be exchanged and discussed.

Since most of the data are quite large files (especially picture files), the online forum will need to be of a capacity to upload a vast amount of information. When this is uploaded the researchers would be able to share their information, discuss methodology, terminology, etc. and compare results.

2 A BIBLIOGRAPHICAL DATABASE

The database should contain the collected literature on sculptural polychromy, both antique, prehistoric (Bronze Age and Egyptian), modern European (Middle Ages, Renaissance, etc.), the research history (debate and theory on colour in the 18th, 19th and 20th centuries) and archaeometry (methodology). A bibliographical database containing all this literature would assist and guide anyone who has an interest in the research field. The prime users would be scholars and students from all over the world, but could also be teachers in elementary or high schools, who wanted literature for their teaching, or the interested layman. The bibliographic database would provide all of them with an easily accessible starting point.

3 A DATABASE OF THE SCULPTURES KNOWN TO HAVE TRACES OF COLOUR

This would basically have the same purpose as the bibliographical database: providing instant access to the field of polychromy research to scholars, students, teachers and the general public. The information given on the individual sculpture would not be as detailed as the reports written by the researchers, but would provide the user with the basic knowledge and research status of the individual ancient works.

CONSIDERATIONS ON DIGITAL ASSET MANAGEMENT AND ONLINE REALIZATION

The three main functions listed above called for different solutions according to the processing of data, the user target-group and the system's degree of flexibility. In the end we found a way to combine all three functions in one asset management system, but at the beginning we separated them in order to consider the different online possibilities.

1 First of all, the online solution for the research storage and communication platform of the project will demand a system able to upload a great quantity of information, which requires a dedicated server. Secondly, the server must be flexible and able to expand as research evolves and the data increases.

2 The 2nd Copenhagen Round Table on Greek and Roman sculptural polychromy, 9–10 September, 2010. The proceedings of this meeting will not be published. Programme and abstracts are found at the end of this report.

Besides this, the digital asset management system would have to be of restricted accessibility in order to protect the digital assets and the intellectual property. It should only be possible for the database to be accessed by a chosen group of scholars, conservators or others working with polychrome sculpture. Unlike the two other online functionalities, this one is not suited to an open source system.[3]

In order to seek inspiration, we consulted other museums in Copenhagen. Most of them have installed asset management systems designed to handle huge amounts of data and customized for the staff of the museum concerned. Almost all museums hire professional web-designers who tailor an online solution according to the museums' specific demands.

2 For the bibliographical database a library asset management system, able to handle a relatively large amount of unchanging data, was an obvious solution. The primary focus for this system would be to store bibliographical data in an open source and easily accessible system. Such systems are available on the internet for downloading. Some of them are free and work as add-ons or extensions to other web-browsers (for example Zotero), while others can be purchased before downloading (EndNote, Reference Manager, etc.). In our case all of these solutions would have been perfect, had they not been designed for other browsers or as installations for individual computers. All of the open source management systems we investigated would in one way or another restrict the instant access we wanted for the database. What we wanted was a bibliographical database that was free and available on the internet for everyone to use without, for example, having to install a browser. So we decided to build from the ground upwards, so that the resulting system could meet all of our demands.

Given all the online solutions it was not a problem finding inspiration, but planning and constructing ways of navigating through the data was a task that led to discussions of terminology in subcategorising the research field of sculptural polychromy. We wanted to make sure that users with none or limited knowledge of polychromy scholarship would be able to get positive results in searching through the bibliography. So besides the basic search engine that most library asset management systems have installed automatically, we wanted to add additional options when navigating or browsing through the bibliographic data. We wanted to organize the data categories, from which the system would extract the metadata. So when the user typed a certain name, title, word, etc in a search field, we wanted to add the possibility of choosing what kind of field or category he or she wanted to search through. The bibliographical data would therefore be divided into the following categories: "Archaeometry", "Monuments" and "Research History". For those who wanted to browse through even more specific literature, we arranged the three categories into more specific subcategories: "Archaeometry" was divided into "metal", "stones", "wood", "terracotta" and "other", "Monuments" were divided into periods; "Archaic", "Classical", "Hellenistic", "Roman" and "Late Antique", while "Research History" was divided into "Renaissance", "18th and 19th centuries" and "20th and 21st centuries". This way people, who wanted to browse through the literature concerning, for example, "Archaic, Greek sculpture", could do so easily.

3 In some ways the monuments database called for an asset management solution similar to that of the bibliographical database. But the data would not be static as the case of the non changing bibliographical data – so a flexible management system was required. However the concept of providing unlimited access to the public through an effective and navigable search engine would basically be the same as the bibliographical database. The user would

3 I define open source according to the Open Source Initiative (OSI), as a system that does not have restricted licence or access. See: http://www.opensource.org/docs/osd

be able to type in search words, and the system would provide the results matching their requests.

As with the bibliographical database, the purpose of the monuments database would be to create an overview of the research field through a collection of data on Greek and Roman stone sculptures known to have traces of colour. To ensure that no information would be overlooked, we needed to develop a model – or a frame – for the information provided on each sculpture. Or in more digital terms, we needed to formulate the standards for the creation of metadata.

With the data for the bibliographical database, the information we needed in creating the metadata would be a given (author, title, subtitle, year and place of publication, abstract, etc.), whereas with this database we had to develop our own model for arranging the basic information (see appendix 1). The system of the database would be instructed to recognize and extract the information according to our constructed model. Creating the model, and registering the monuments according to this frame of information, would therefore be a task that demanded attention to detail and ongoing terminological and theoretical discussions. Were a user to type "kouros" in the search engine of the database, and had we not included that particular information when registering the "Rayet Head" of the Ny Carlsberg Glyptotek in the model for the metadata, the system would not extract this particular detail to include it in the hits matching that particular demand. So we had to make sure that all relevant information that a user could possibly look for would be included.

ONLINE SOLUTION

After consultation with different web-designers, we identified a single solution able to cope with all the functions listed above and meet the various user requirements (fig. 1).

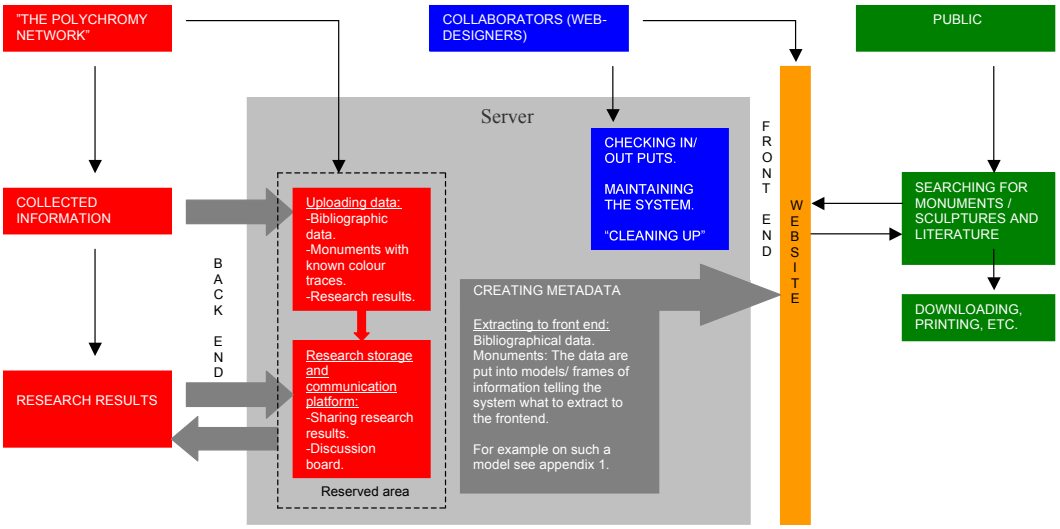


Fig. 1: An illustration of the proposed online solution for research in sculptural polychromy:
The red boxes indicate how researchers can use and benefit from the database. They will work within the reserved area of the server accessing from the back end. From here the metadata will be created by formalizing the research results according to a model. This will be sent to the front end, where the public (green boxes) will have access to the basic research information through a search-engine on the website.
The blue indicates the maintenance of the database.

Initially, combining all three database functions had seemed to be a problem because we wanted the databases for the bibliography and the monuments to be open source, whereas issues such as intellectual property ruled out an open-source solution for the research communication platform. So we had to make them meet somewhere in the middle.

The database will be constructed with an extended back end, which will be a reserved area for the research into ancient sculptural polychromy. Here professionals in the field will have password access to the core of the database (server, metadata and documents) and be able to discuss, share and exchange research data. From the back end selected information is sent to the front end and served to the user via the presentation layers that format the metadata into a web-page. When researchers upload their data it will be processed by fitting some of the detailed information from the reports on the sculptures into a customized system. Users providing data for the back end will be encouraged to update and maintain the metadata for the front end: New research results on a given sculpture will be uploaded to the reserved area by filling out or exchanging existing information, and in doing so, the scholar responsible will check off certain boxes, which will tell the system what to extract to the front end and what to leave on the server for the back end users only.[4]

The front end will provide access for the public. Here, it will be possible to search for a given sculpture, and the system will meet the user's demands by providing data extracted from the back end. The information given will be less detailed, but will provide basic data on the sculpture and its colour traces. This will include a concise bibliography extracted from the server, where the complete bibliography has been uploaded. If the user wishes to search through the bibliographical database, this too will be possible.

FURTHER CONSIDERATIONS

Having defined the purpose and the function of the digitalization of the project, we needed to prepare ourselves for all the relatively unknown challenges that would follow.

Maintenance was one of the major concerns. Given that the financial state of almost every public and private sector in Denmark is heavily influenced by the present economic crisis, we wanted the digitalization of the project to be as cost free as possible.

Estimating the maintenance expenses was difficult: We cannot know the exact amount of maintenance time required until we have gained actual practical experience. We could foresee that it would take some time to upload the data, maintain the metadata and extract it to the front end. And we could also expect time expenditure on updates, checks and "clean ups" of the system on a regular basis. To minimize the costs of these tasks we wanted to incorporate some of them into the function and purpose of the database.

Updating the data and maintaining the metadata will probably become one of the most time-consuming tasks, but by extending the back end and using it as a reserved area for sharing and debating results, we will create a system where uploading of data and creation of metadata will be managed on an everyday basis. Back end users will be accessing the area in order to upload or browse through their research results, and in the process we expect them to check off the boxes that inform the system what to extract to the front end.

4 Another function we discussed from the beginning of the project is the possibility of using the database as a resource for online publications. We imagine that publishing houses will be able to extract information directly from the database (either from the front- or back end), whether dealing with literature, monuments or (with given access) research results.

In this way updating the data and processing the metadata to web-pages will keep our financial costs to a minimum.

Maintaining the system, on the other hand, will not be undertaken by the users of the database. Most web-designing companies offer to stay on the project for an agreed period of time after the database is up and running. In that time, they will regularly check the system to make sure that everything is as it should be. But all databases will, in the long run, benefit from having someone to check the system regularly, making sure that the database functions as well as possible, both technically and functionally. The system must to some degree be able to keep up with the technological developments and internet media-trends in order to remain up to date and productive.

Another and different consideration concerns the level of international collaboration. Sharing scholarly research results freely and without costs is not an integrated part of the academic community, and sharing knowledge as digital assets could in some cases create certain problems concerning intellectual property rights. Today there are various kinds of digital rights management technology that can protect the assets, if one chooses to share them online. Render rights have been created in order to restrict the output of documents or control how the assets can be viewed, copied, streamed, printed, etc. It will for example be possible to put a lock on the data, so that only one or two scholars can use or change it. This will put the data on display for the others to see, but it wouldn't be possible to download or copy any of the files. In this way the scholars concerned will be able to control the flow and exchange of the assets. It is our intention to provide back end users with the unlimited access to the digital data assets of the NCG/CPN project.

CONCLUSION

To say that digital asset management is the future would be wrong. Digital asset management systems are the present. The tools that these systems provide are becoming essential to research all over the world. Data are made available and easily accessible because the physical boundaries are eliminated. Scholars can exchange knowledge in an easy and efficient manner, and the public can have instant access to information, which previously was a part of a closed or restricted world.

We hope that providing online access to research on ancient sculptural polychromy will help the research field to develop. On the one hand, by digitalizing the research field and providing the public with access to the results, the community at large will be able to understand better the value and purpose of the work being carried out in the academic sphere. On the other hand, research will benefit when communication of results is no longer restricted by the physical distances between the researchers. Sharing information or maintaining the momentum of the theoretical discussions is impeded and sometimes compromised by factors such as long distances. And in the end this prevents research moving forward. But with the opportunities that the tools of digital asset management create, these obstacles can be overcome, promising further growth and development in research into antique sculptural polychromy.

REFERENCES

Claman, T.: Digital Asset Management. A guide to broadcast applications and considerations, in Broadcast Engineering Magazine, April 2007: http://broadcastengineering.com/storage_networking/broadcasting_digital_asset_management_5/index.html

Cleland, W.: Best Practices in Digital Asset Management for Electronic Texts in Academic Research Libraries, Ohio 2007.

Hilton, J.L.: New Horizons: Digital Asset Management Systems, in Educause, March/April, 2003, pp. 52–53.

Scheer, C.: Factors to consider before building your own DAM, in Journal of Digital Asset Management 3, 2007, pp. 17–22.

APPENDIX 1

EXAMPLE OF THE DRAFT STANDARD MODEL FOR THE CREATION OF METADATA FROM UPLOADED DATA (RESEARCH RESULTS FROM THE RESERVED AREA):

IN 418

PRIMARY INFORMATION

City, museum: Copenhagen, København, Ny Carlsberg Glyptotek.
Registration number: IN 418.
Title: Head of kouros, the "Rayet Head".
Material: Parian marble.
Period/dating: Archaic, Greek, c. 530 BC

SECONDARY INFORMATION

Picture:
Dimensions: H.: 31 cm.
Documentation:

- W. naked eye: Traces of red in the hair, eyes and ears.
- W. microscope: Red pigments found in the hair, eyes, ears and on the lips.
- W. raking light: Traces of black in the eyes (iris) and hair-line.
- W. UV-FL: Iris in the left eye more visible. No fluorescence.
- W. IR/ VIL: No Egyptian blue.
- Micro chemical tests: XRF (in the hair): Iron (Fe), lead (Pb). Analysis carried out by: Maria Louise Sargent and Rikke Hoberg Therkildsen, November 2010. XRF by Minik Rosing.

Provenance: Acquired in 1879. Originated from Athens.

Bibliography:
Poulsen, F.: Catalogue of Ancient Sculpture in the Ny Carlsberg Glyptotek, København, 1951, cat. 11.
Johansen, F.: Catalogue. Greece in the Archaic Period. Ny Carlsberg Glyptotek, København 1994, cat. 18.
Brinkmann, V.: Die Polychromie der archaischen und frühklassischen Skulptur, München 2003, fig. 233.

This is an example of how information may be made available to front end users. Compared to the reports written by researchers on the individual monuments, this will be far less detailed and more basic. When researchers upload their data in the reserved area in the back-end, they will automatically instruct the system what to extract to the front-end by checking off boxes according to a model such as the one seen below. By doing this, the system of the database will create metadata via presentation layers that will serve it to the front end user.

It is crucial to the success of the database, that the model for this process contains all the information from which a user could possibly benefit.

Other NCG/CPN activities

69

Lectures and papers presented at scholarly meetings

J.S. Østergaard
"La polychromie de la sculpture grecque et romaine en marbre"
Paris, École Pratique des Hautes Études, Paris, 19 March 2010

J.S. Østergaard
"La polychromie de la sculpture romaine: état des etudes et perspectives pour la future"
Colloque International de la Societé Francaise de l'Archéologie Classique.
Archéosciences et Antiquité classique: approches pluridisciplinaires, Paris, 20 March, 2010

J.S. Østergaard
"Colour on High – polychrome sculpture from the Acropolis"
Annual Meeting of the Danish Institute at Athens, 9 April, 2010

M.L. Sargent, M. Scharff, R.H. Therkildsen and J.S. Østergaard
"Visible-induced luminescence (VIL) digital imaging in research on ancient sculptural polychromy: A 2nd century CE marble Amazon in the Ny Carlsberg Glyptotek, Copenhagen"
Contribution to poster session
Symposium on *in situ* technical imaging in art and archaeology
London,The British Museum, 15 July, 2010

M.L. Sargent, R.H. Therkildsen and J.S. Østergaard
Papers given at the 2nd Copenhagen Round Table on ancient sculptural polychromy
Ny Carlsberg Glyptotek, 9 – 10 September, 2010
(see separate programme below)

J.S. Østergaard
"The polychromy of Roman sculpture: A study in bad taste?"
Symposium on ancient sculptural polychromy
Stockholm, Medelhavsmuseet, 9 October, 2010

J.S. Østergaard
"The polychromy of Roman 'ideal' marble sculpture of the 2nd century CE – investigating the 'Sciarra Amazon' in Copenhagen, Ny Carlsberg Glyptotek IN 1568"
Giornata di Studi sulla policromia di sculture antiche"
Firenze, Università di Firenze, 15 November, 2010

J.S. Østergaard
Paper at the seminar Colour on form, form under colour: the aesthetic dimension of European polychrome sculpture, 4–5 November 2010
(see separate programme below)

Round Table on Ancient Sculptural Polychromy at the Ny Carlsberg Glyptotek, 9–10 September, 2010

Programme and summaries

THURSDAY SEPTEMBER 9, 2010, 09.00–18.00: PROJECT REPORTS AND DISCUSSIONS

09.30–09.45
Introduction to the Round Table
Jan Stubbe Østergaard

09.45–10.45
"Polychromy and painting on the Demetrias gravestones: Tracing stylistic markers, materials and techniques"
Hariklia Brekoulaki, National Hellenic Research Foundation, Athens

The Demetrias grave stones represent the largest painted corpus of Greek monuments that has been brought to light, so far. More than a thousand fragments and more than two hundred stelae preserved in toto were discovered a century ago by A. Arvanitopoulos during his excavation of the fortification towers of the city of Demetrias, now stored at the Archaeological Museum of Volos. Despite the obvious importance of the corpus for both the history of Hellenistic painting and the social history of ancient Thessaly, it still awaits final publication. After the first presentation of the stelae by Arvanitopoulos in 1912 in his impressive large format book, offering water colour copies of the best preserved documents, French and German scholars undertook more specialized studies on their pedimental decoration, technology and prosopography. V. von Graeve and his team initiated since 1975 a technological investigation of the stelae using technical photography and analytical methods for the characterisation of the painting materials, but this work has not still been published in its final form. As a result, the Demetrias corpus, although it is very familiar to the entire scientific community dealing with Greeek polychromy, in reality it represents a material with many unknown aspects that still need to be explored.

The aim of the present study was therefore to undertake a systematic examination of the stelae, both visual and analytical, in order to trace possible markers of workshops and investigate in depth the original painting techniques and the materials involved, towards an art historical interpretation. Using as a background the data that were already obtained by the V. von Graeve group, further investigation on the materials and techniques were carried out, providing additional results that will be presented and discussed. Within the vast production of the stelae, it was possible to trace differences in both the style and execution of the paintings, and in the choice of their materials. On the only well preserved painted relief of the collection, similar pigments and compatible techniques were identified as those retrieved on a number of painted stelae, suggesting a common background of technical knowledge. Problems in the identification of organic materials and binders will also be discussed.

The ongoing study on the Demetrias stelae is part of the larger project Colour in the Hellenic World hosted at the Institute of Greek and Roman Antiquity (KERA).

10.45–11.45

"Color siderum" – Current researches on gilding (Greek marble sculpture and terracotta figurines).

Brigitte Bourgeois, Institut National d'Histoire de l'Art, Paris

Based on two current research projects that I am working on together with French colleagues, my talk will address issues related to the practise of gilding, in ancient Greek sculpture. The projects are:

1 The research program on the polychromy of Hellenistic marble sculpture in Delos, supported by the Ecole Française d'Athènes and the Centre de Recherche et de Restauration des Musées de France (C2RMF), carried out by Ph. Jockey and myself, and now in its final stage ;
2 The research program on the polychromy of Greek terracotta figurines, supported by the Louvre Museum and the C2RMF, carried out by Violaine Jeammet, Sandrine Pagès-Camagna and myself (still under way).

Rather than speaking consecutively about each project, what I aim to do for the Copenhagen Round table of September 2010 is to insist, in a synthetic approach, on some aspects – or unsolved questions – related to the use and techniques gilding on marble or clay 3D objects. After presenting the methodology followed in each case, I will concentrate on the craftsmanship involved (choice of preparation layers, handling and applying the gold leaf, finishing treatment…), on how gilding and painting can complement each other, on traces of ancient "restoration" activity (repainting or redoing the gilding), and on present conservation issues for these fragile remains.

13.00–14.00

"UV-VIS spectroscopy in research on ancient sculptural and architectural polychromy: recent activities"

Heinrich Piening, Bayerische Verwaltung der Staatlichen Schlösser, Gärten und Seen, München

Many ancient buildings and sculptures still show unmistakable traces of their former polychromy. Even today, little attention is paid to these remnants of their original, splendidly colourful appearance, either because the traces of colour seem impossible to interpret, or because it would be irresponsible to take samples for the purposes of investigation. For a deeper understanding of the meaning of colour in ancient art, high quality reconstructions based upon actual findings on the original objects are extremely helpful.

In order to identify the pigments and other colourants that were used for that polychromy so as to create a reconstruction on the basis of that information, non-destructive methods of analysis should be applied. However, because of the way that the equipment is constructed, methods such as X-ray fluorescence analysis or Raman spectroscopy can be used only to a very limited extent at the location of the work of art, and do not produce usable results for every kind of colourant. Mobile UV-VIS absorption spectroscopy offers a highly practicable alternative.

In the field of analyzing colourants used on works of art, this method has been employed for almost twenty years to identify historical colourants in book illuminations. For over ten years it has been used in the archaeometrical laboratory of the the Bayerische Schlösserverwaltung (Bavarian Palace Administration) in Munich for identifying colourants in many different contexts (wall paintings, textile dyes, wood stains and painting and decorative polychromy on wood).

UV-VIS absorption spectroscopy is a strictly physical procedure in which white (polychromatic) light is directed onto the area that is to be examined. The size of the area from which readings are taken is 1.5 mm². Part of the light is absorbed by the surface, the rest is reflected. The reflected part of the light exhibits different characteristics for each colouring agent. The method makes use of the extended wavelength region between 300 and 1100 nm, since nearly almost all colourants are optically active within this region. Specific

interactions take place between electromagnetic radiation and the physical and chemical structure of the colourant. The interactions are multi-layered and lead to unambiguous, characteristic spectra. These "optical fingerprints" can be compared using mathematical criteria, though a mathematical similarity is not necessarily to be equated with a spectral similarity. A spectrum can only be interpreted, i.e. the colourant can only be identified, if it is compared with sufficient verified material.

In my paper I will describe the application of this method in research on ancient sculptural polychromy. I shall concentrate on the results of an investigation of the well-known statue of Artemis from Pompeii (Napoli, Museo Archeologico Nazionale, inv. 6008), but also report briefly on very recent examination of the Kekrops and Pandrosos Group in the Acropolis Museum, Athens, from the West Pediment of the Parthenon.

14.00–15.00
"The polychromy of the Palatine temple of Apollo: evidence and context"
Stephan Zink, University of Pennsylvania, Philadelphia

The polychromy of Roman architecture remains an understudied subject, not only for lack of interest. If traces of colour have survived on monumental architecture, they are usually badly preserved or difficult to investigate. As part of an ongoing research project on the architecture of Augustus' Palatine sanctuary of Apollo, Heinrich Piening has successfully carried out an on-site pigment analysis of the temple's architectural marble fragments, using UV-VIS Absorption Spectrometry. In conjunction with a careful documentation and study of the remains, it was possible to reconstruct in a digital model both the temple's exterior design and its polychromy (cf. S. Zink & H. Piening, Journal of Roman Archaeology, 2009, 109-21). This result represents no less than the first, evidence-based reconstruction of the colour scheme of a Roman marble temple. In this paper, I will put the results of our research in a larger context – both topographical and archaeological. A new digital model of the Palatine sanctuary allows assessing perception and visual effects of the temple's colour scheme, in which gold and yellow play a key role. Literary and archaeological evidence on the coloring of architectural elements attests the Hellenistic-Republican roots of the temple's colour scheme, but also suggests that it was pioneering in its lavish use of gold and yellow at the exterior façade.

15.30–16.15
"Sculptural polychromy of the Roman Imperial Period: recent research"
Paolo Liverani, Università di Firenze

1 Considering the technical aspects of the practices of the Roman painters I can add some more elements. Particularly interesting are the traces of ancient restoration of the colour and the first evidence of ancient treatment for conservation of the pigment.

Traces of restoration were found years ago on the Prima Porta Augustus and, by the French team (Bourgeois and Jockey), on sculptures and terracottas from Delos. In the collection of antiquities of Dresden a little statue of Asklepios from Kos shows a first layer of red – probably ochre – directly on the marble of the mantle. In a second phase were added two more layers: a white grounding and a coat of red lake. Some evidence of colour restoration could be read on the sandals of the Amazon of Ecija in Spain and if this interpretation is correct it raises the question whether the other traces of red on the statue are contemporary to this second phase or part of the original colour of the Amazon.

This is a point maybe not to underestimate from a methodological point of view.

The analysis of the hairs of the "Sinnende Muse" of Dresden confirmed the observations of Georg Treu about the presence of wax superimposed to the colour but under a layer of incrustation, which testify the treatment is ancient. This is of course a very important result for the discussion of the surface treatment.

A last example to consider is based on preliminary observations of the Apollo statue of the Antiquarium of Villa Corsini in Florence, recently restored. The provenance of this statue is not known and the state of conservation greatly differs between body and head.

The body was polished, maybe during the eighteenth century; on the other hand the head preserves much better his surface with interesting traces of colour in the eyes and on the hairs. Other traces of the skin are difficult to interpret without samples I hope to obtain in the next future.

2 Concerning the standardisation of registration, the SiCAR system we are testing to record the restoration and samples from the Sarcophagi of the Vatican Museums was modified considering the need of a more structured tree of classification of the various technical analysis. In this moment this part of the thesaurus is in Italian (with some English terminology) but a contribution of our informal group could be a sort of handbook with the correspondence among the various national terminologies, maybe to have on-line.

3 The last point is the study of the historical reliefs, both from the analytical and the archaeological point of view. Regarding the study of the background of the reliefs it was possible collect some more examples of blue background from the Hellenistic period (several Etruscan Urns) and some analytical results on the Altar of the Vicomagistri. For the monument I tried a graphic reconstruction. These studies need an integration with a careful research on the antiquarian and literary sources which involves a different series of methodological problems. Usually the philological research consider the archaeological documentation as a complementary evidence, more rarely the literary sources on the colour were used to reach a better understanding of the meaning of the statue.

Also in this case the growth of the corpus of archaeological evidence raises further discussions e.g. about the use of the toga praetexta, of the paludamentum and, more interesting, of the purple toga. Among the togati which preserve extensive traces of red, there is at least one – a togatus from Formia – which could not be interpreted as triumphing general for his chronology, so that it is necessary to explore other possibilities like a priestly connotation of this type of toga.

In other contexts we have to consider also that the assistants of the magistrates wore ceremonial garments according the occasion and following the costume of the magistrate itself: traces of red on the sagum of the lictor, in accordance with the sources, were found on the Cancelleria reliefs, a colour alluding to the red paludamentum of the emperor and to his imperium.

The aim is to give a sample of the problems that are waiting for a solution but also of the new possibilities of deeper understanding that research like that opens to our interpretation of the ancient society and not only of the artistic phenomenon.

16.15–17.15

"Results of the investigation of the 'Treu Head', BM inv. GR 1884.6 – 17.1. and future activities"

Thorsten Opper and Giovanni Verri, The British Museum

This contribution presents recent work on an important Roman marble head of the mid-second century ad from the collection of the British Museum (1884, 0617.1). The head was found on the Esquiline Hill in Rome in 1884 and soon after its discovery acquired for the British Museum. Unusually, it retained extensive traces of its original polychromy, including otherwise rarely preserved skin pigments. Ever since the German scholar Georg Treu published the sculpture in 1889, it has played a significant part in the discussion of ancient sculptural polychromy, and in particular the question whether the flesh parts of marble sculptures were originally painted or not. However, early doubts about the authenticity of the pigment traces led some twentieth-century scholars to question the authenticity of the sculpture as a whole.

For this study, the polychromy of the head was extensively investigated using non-invasive techniques (ultraviolet and visible-induced luminescence imaging) and invasive analytical technologies, including Raman spectroscopy, Fourier transform infrared spectroscopy, high performance liquid chromatography and gas chromatography-mass spectrometry.

Complex mixtures of pigments, and selected pigments for specific areas, were used to create subtle tonal variations. These included: calcite, red and yellow ochres, carbon black and Egyptian blue for the flesh tones; calcite to provide highlights on the flesh areas; lead white and Egyptian blue for the eyeballs; a red organic colorant in the nostrils, the lachrymal ducts and the inner parts of the mouth; and red and yellow ochre for the hair.

In addition, comparative material, including Greek and Roman sculpture and mummy portraits, will be discussed alongside further avenues of investigation.

17.15–18.00

"3D digital technologies and ancient sculptural polychromy: a report from the Digital Sculpture Project"

Bernard Frischer, The Virtual World Heritage Laboratory, University of Virginia, Richmond

This talk will survey the recent work of The Digital Sculpture Project (www.digitalsculpture.org), which is sponsored by The Virtual World Heritage Laboratory at the University of Virginia (http://vwhl.clas.virginia.edu). The mission of the DSP is to research ways in which 3D digital technologies can be applied to the capture, representation and interpretation of sculpture from all periods and cultures. Because 3D digital modeling often encounters a barrier when confronted with the kind of complex geometry that characterizes most sculpture, up to now 3D technologies have been used primarily to represent geometrically simple artifacts such as pottery or larger-scale structures such as buildings and entire cities. With some notable exceptions, sculpture has been neglected by digital humanists. The Digital Sculpture Project thus focuses on the following issues:

- 3D data capture and documentation of sculpture;
- digital restoration;
- digital tools for the processing and analysis of digitized sculpture, including colorization;
- analysis of earlier forms of sculptural reproduction, particularly the cast.

After surveying some of our previous projects, I will discuss our most recent project, the creation of a browser based on the concept of secure remote rendering that provides analytical tools to the end-user that go beyond simply viewing the digital model. Our new browser will also offer some basic tools such as a virtual measuring tape and virtual calipers to enable the end-user to undertake analytical work hitherto possible only in complex and often expensive 3D modeling software such as Polyworks, Rapidform, and Geomagic. Another feature of the browser will be a basic painting tool which will make it possible for the end-user to illustrate her hypothesis of reconstruction of polychromy. Until now, browsers created for viewing statues and other 3D objects have not offered such a tool and, moreover, have not even supported the display of color. Another limitation of previous browsers is that they have been standalone programs and have not run within standard web browsers such as IE, Chrome, Safari, etc. Our new browser will exploit WebGL and run inside the standard web browsers.

We are using the Augustus of Prima Porta in the Vatican Museums as our test-bed because the polychromy has been closely studied by our archaeological consultant, Prof. Paolo Liverani. This project, which will begin in October 2010 and run for one year, has received the generous support of the National Endowment for the Humanities (grant HD-51022). A second project, also funded by the National Endowment for the Humanities (grant RZ-51221), may also entail the restoration of lost polychromy. It is called "Creating a 'Total Environment'

for the 'Caligula' in the Virginia Museum of Fine Arts (Richmond, VA)". The project will start in mid-September 2010 when we will scan the statue. At the same time, our consultant for polychromy, Mark Abbe, will look for any surviving traces of paint. If they are found, we will add appropriate coloring to our digital reconstruction model of the statue.

FRIDAY SEPTEMBER 10TH, 09.00–12.00: PROJECT REPORTS AND DISCUSSIONS

09.15–10.00

"Updates from the Copenhagen Polychromy Network – Recent investigation and evaluation"

Maria Louise Sargent

The Copenhagen Polychromy Network has since January 2009 systematically examined and documented a selection of sculptures according to the Copenhagen Polychromy Network (CPN) protocol. The field of research has expanded due to the recently developed technique visible-induced luminescence (VIL). This paper presents an overview of the new and important information on the use of Egyptian blue based on a selection of Greek and Roman sculptures in the Glyptotek. Subsequently the latest examined sculpture, a 2nd century CE marble Amazon, is presented. The astonishing results of the examination, documentation and analysis of the Amazon has provide us with new knowledge on antique polychromy and raise new questions on conservation practices.

"Reflections on methodology in conservation practice and data asset management"

Rikke Hoberg Therkildsen

The minute traces of pigments left on antique marble sculptures put great demands on the technical examination and analysis. This paper reflects on the methodology carried out in the Copenhagen Polychromy Network taking a closer look on advantages and disadvantages of invasive and non-invasive techniques. Followed by a brief introduction to data asset management as a necessary tool in a multi-methodological approach to our field of research. The outcome of our observations and analysis of the sculptures is put on digital form. These digital resources are as valuable as the time, effort and finance that have gone into their creation and they require management strategies to improve our basis of knowledge on antique polychromy.

10.00–10.30

"Investigating the Sciarra Amazon, IN 1568: archaeological comments"

Jan Stubbe Østergaard

I will offer some very brief and very preliminary observations on some details of the polychromy of the Amazon. Specifically, I will be commenting on the traces of Egyptian blue found, on the skin, in the white of the eye, in the region of the wound and on the left foot. The traces were detected through VIL-imaging and microscopy.

This will be followed by a brief report on the status of our project and our plans for the autum of 2010.

10.30–11.00
Break

11.00–12.00
NCG/CPN
The NCG/CPN polychromy project's visual examination work space (visit)

End of Open Session II

12.00–13.00
Lunch at the museum (speakers and CPN only)

Closed Session (Round Table for speakers and CPN)

13.00–16.30
Discussion on topics of common interest (in the Glyptotek Library; meeting point the Project Workspace in Room 6)

16.30–17.00
Summing up and evaluation of the meeting.

End of the Round Table meeting

'Colour on form, form under colour – on the aesthetic dimension of European polychrome sculpture'

A seminar at the Royal Danish Academy of Sciences, Copenhagen, 4–5 November, 2010

Programme

THURSDAY, NOVEMBER 4

9.30–10.30
Welcome and key note
"Ancient and later European polychrome sculpture in dialogue" (in Danish)
Jan Stubbe Østergaard, research curator, Ny Carlsberg Glyptotek

11.00–12.00
"Danish wooden sculpture 1100–1300 – polychromy, repainting, cleaning" (in Danish)
Ebbe Nyborg, editor, Churches of Denmark (Danmarks Kirker, National Museum of Denmark)

The paper will present a project at the National Museum in Copenhagen investigating and publishing the rich heritage of Danish wooden sculpture from c. 1100–1300. All these crucifixes and saints images, almost 400, were originally polycromed with bright colours and gilding. Many were later 'modernized' according to new theological ideas and tastes. And all were repainted several times until by the 19–20th century they tended to suffer a total cleansing destroying much of their history. This restauration practise was of course founded in the misconception of the age, that such figural sculpture should be experienced as pure form.

13.00–14.00
"Polychrome sculptures by Donatello"
Dr. Jim Harris, The Courtauld Institute of Art, London

Donatello deployed a number of strategies in the polychromy of his sculpture, sometimes emphasising his media, sometimes imitating others, and always responding sensitively to the particular iconographic and functional demands of the object, his patrons and the contexts in which his work was viewed.

This paper will focus on three sculptures made for Franciscan contexts, the Bardi Crucifix, the Cavalcanti Annunciation, and the Entombment made for the High Altar of the basilica of Sant' Antonio in Padua. Each of these presents a very different polychromed surface. The Bardi Crucifix has been extensively conserved and is in good, legible condition. The Cavalcanti Annunciation has been stripped of most of its paint, but technical analysis by the Florentine Opificio delle Pietre Dure has enabled some understanding of its original appearance. The polychromy of the Padua Entombment has recently been examined technically for the first time, revealing a history of repeated treatments and changing aesthetics.

The paper will explore both the techniques and the aesthetic impact of the polychromy of these objects. It will consider in particular the visual transformations of their materials, effected by the application of paint and gold, and the relationships between those transformations and the particular contexts, functions and meanings of the sculptures.

14.00–15.00
"The Art of Painting Sculpture in 17th Century Spain"
Xavier Bray, Curator, The National Gallery, London

This paper will reappraise the Spanish art form of painted wooden sculpture in the seventeenth century and its relationship with painting of the period. Touching on artistic tradition, religious observance and the perceived boundaries between illusion and reality in a specifically Spanish context, it will explain how sculptors and painters combined their skills to depict, with astonishing realism, the great Christian themes. Wooden sculptures of the saints and the Passion of Christ were painstakingly carved, gessoed and intricately painted, even embellished with glass eyes and tears and ivory teeth. Sometimes shockingly graphic in their depiction of Christ's sufferings, or beautifully clothed, as if brought to life, these were objects of divine inspiration to the faithful, whether on altars, or carried through the streets on holy days.

15.30 – 16.30
"Coloured or painted?" (in Danish)
Professor Morten Stræde, The Royal Academy of Fine Arts, sculptor

Artist, art historians and others probably have different attitudes to colour in sculpture. From the seminar circulars one senses that we have to do with a problem; I have come to see it more as an artistic choice or approach.

Practising artists know that one has to follow the directions which the chosen material tells you about; one has to be very open and inquisitive when exploring these directions. Even when the venture leads you beyond the generally accepted.

I will talk about colour in sculpture from a practitioner's position. Not from an art historical or theoretical stand point. And I shall stick to what is rather vaguely termed 'our times', that is to say works and attitudes whose history I have lived to share.

I shall attempt to exemplify my point of view by taking some hazardous sweeps through art history, but then again: I have to stress that though the examples chosen may be very old and very different, I will really be talking about contemporary sculpture all the time.

16.30-17.00
Discussion of papers presented this day

FRIDAY, NOVEMBER 5

9.00–10.00
"The polychrome sculpture of Jean-Léon Gérôme (1824–1904): the last of Antiquity?"
Édouard Papet, Conservateur en Chef, Musée d'Orsay

Jean-Léon Gérôme's polychrome sculptures, mainly realized during 1890–1904, are still today appalling and disturbing artifacts, as controversial as they were when exhibited for the first time in fin-de-siècle Paris. Gérôme, attentive to the archaeological discoveries of his time, wished sincerely to offer his very personal revival of Antique circumlitio and gânosis. Through the context of the slow emancipation of polychrome sculpture in late nineteenth century Europe, the discussion will try to reflect the complexity of a work which is in the meantime the aporia of figurative sculpture and the ancestor of hyperrealism.

10.30–11.30
"Beyond colour – sculptural ideals around 1900" (in Danish)
Flemming Friborg, art historian and director of the Ny Carlsberg Glyptotek

Or: What happened to colour in sculpture in the period 1874 to 1900? A brief survey based on a choice of works exemplifying an apparent development in sculpture, from being a physical body – coloured or not – towards that of being an apparition, a surface, an image, and on to becoming the material object or 'lump' of matter which lies at the core of modernistic sculpture.

My thesis is that over a period of about 50 years (1850–1900) a 'disagreement' or dissonance is perceptible within sculpture itself – both as an artistic medium and as a 'physical' presence. There is a conflict between the mass and the surface of the sculpture. I shall investigate what the impact the appearance of Impressionism (and the popularity of various European arts-and-crafts movements) had on the ideals and forms of the art of sculpture.

11.30–12.00
Discussion of the morning's papers (in English and/or Danish)

13.00–14.00
"Reality incarnate – polychromy in earnest 1960–2000" (in Danish)
Mikael Wivel, art historian

A consciousness expanding development swept over the arts in the early sixties.It stands to reason that this also led to an unprejudiced reappraisal of the possibilities offered by polychrome sculpture. It was a movement of emancipation which entailed a curtailment of existing, modernistic precepts – in favour of a revitalisation of more 'popular' modes of expression which had not hitherto been seen as viable. Representatives of this trend are now gathered with a certain self-conceited delight under the common designation 'Pop Art'.

As with so many novelties in those days, this reappraisal was something which began in the USA. Thus, the first to take up polychromy was the American sculptor Georg Segal; he was as a matter of course, but perhaps unjustly, enrolled in the ranks of the pop artists. His extremely original contribution was followed up by a couple of more orthodox polychromists, Duane Hanson and John De Andrea.

The American take on polychromy was driven as much by curiosity as by irony. They were serious enough, but there was also a distancing in their approach. When European artists took to polychromy, this was not the case. The Dane Kurt Trampedach gave his polychrome sculpture a decidedly existential character, while English Anthony Gormley and Australian Ron Mueck subsequently contributed symbolic and surreal overtones. Finally we have such sculptors as Jana Sterbak and Christian Lemmerz, where the word literally has become flesh.

14.00–15.00
"Sculptures in hiding: considerations on the function of polychromy in works by the American sculptor David Smith and in reconstructions of ancient sculptural polychromy" (in Danish)
Lise Skytte Jakobsen, Department of Art History, University of Aarhus

The American sculptor David Smith (1909–1965) painted many of his abstract, expressionistic sculptures. He was especially concerned with the ability of the polychromy to function as an after-image, transcending the physical materiality of the sculpture. Smith's painting on his works may thus – in a wholly positive sense – be experienced as a surface which hides the object. My paper examines the aesthetics of this colouring, aesthetics which in a certain sense result in the image of a sculpture and its objective materiality step away from one another, becoming different.

This way of using colour will be compared to the colour effect of reconstructions of ancient sculptural polychromy. Thus, the paper proposes that the colour effect achieved by David Smith's sculptures from the 1960s may be seen as having important dimensions in common with the polychromy of the reconstruction of a portrait statue of the emperor Augustus, of c. 20 BCE, the so-called Augustus of Prima Porta.

15.30–16.30
"Ground and figure – form and material" (in Danish)
Henrik B. Andersen, sculptor
No summary available

16.30–17.00
Discussion of the afternoon's papers and concluding remarks (in English and/or Danish)

Seminar ends

Various activities in 2010

INVESTIGATIONS IN OTHER COLLECTIONS

M.L. Sargent, R.H. Therkildsen and J.S. Østergaard:
In situ investigation of the polychromy of the Amazon of Sciarra type in the Pergamon Museum, inv. no. Sk. 7, Berlin, and the Museo Historico Municipal de Écija, inv. no. 1804-197. 11–15 October, 2010.

PARTICIPATION IN PROJECTS ABROAD

Stiftung Archäologie, München[1]
J.S. Østergaard is a member of the Wissenschaftliches Beirat of the Stiftung

The Virtual World Heritage Laboratory, University of Virginia at Richmond
J.S. Østergaard is a member of the international advisory group for the Laboratory's project "Creating a 'Total Environment' for the 'Caligula' in the Virginia Museum of Fine Arts"[2]

PUBLICATIONS

J.S. Østergaard: "The Polychromy of Antique Sculpture: A challenge to Western Ideals?", in Vinzenz Brinkmann, Oliver Primavesi and Max Hollein (eds.), Circumlitio. The Polychromy of antique and Mediaeval Sculpture (2010) 78–105.

J.S. Østergaard: "The Copenhagen Polychromy Network: A Research Project on Ancient Greek and Roman Sculptural Polychromy in the Ny Carlsberg Glyptotek", in Vinzenz Brinkmann, Oliver Primavesi and Max Hollein (eds.), Circumlitio. The Polychromy of antique and Mediaeval Sculpture (2010) 324–335.

INTERNET AND FILM

'Tracking Colour' is the working title of a documentary film for television, on the NCG/CPN project. The film has received development funding in 2009 from the Danish Film Institute and from the EUROMedia programme in 2010. Shooting has been on-going since 2008. Funding of the production phase is now being sought.

'The Colour Portal' is the working title of a project for a website resource on ancient sculptural and architectural polychromy. The 'Colour Portal' aims to service Danish high school teachers and students working on interdisciplinary themes. The portal combines Classical culture, chemistry, physics and visual arts. The development phase of the project has been completed and funding is now being sought. The NCG/CPN is participating in an advisory capacity.

1 http://www.stiftung-archaeologie.de/

2 Cf. http://www.virginia.edu/uvatoday/newsRelease.php?id=13401

Author Contact

Email addresses of main authors

Maria Louise Sargent
mls@glyptoteket.dk

Amalie Skovmøller
amsk@glyptoteket.dk

Rikke Hoberg Therkildsen
rht@glyptoteket.dk

Jan Stubbe Østergaard
jso@glyptoteket.dk

A bibliography of publications on ancient sculptural polychromy in 2010[1]

Abbe, M.B.: Recent Research on the Painting and Gilding of Roman Marble Statuary at Aphrodisias, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 277–289.

Beale, G., Earl, G.: The Herculaneum Amazon. Sculptural polychromy, digital simulation and context, in: Moore, A., Taylor, G., Harris, E. et al. (eds.), TRAC 2009. Proceedings of the Nineteenth Annual Theoretical Roman Archaeology Conference, which took place at the University of Michigan, 3–5 April 2009 and at the University of Southampton, 17-28 April 2009, Oxford 2010, pp. 31–40.

Blume, C.: When Colour tells a Story: The Polychromy of Hellenistic Sculpture and Terracottas, in Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 240–257.

Bourgeois, B. and Jockey, Ph.: The Polychromy of Hellenistic Marble Sculpture in Delos, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010. pp. 224–239.

Bradley, M.: Colour and Meaning in Ancient Rome, Cambridge 2009. Rev.: Grand-Clément, Adeline, in.: Bryn Mawr Classical Review 17.09.2010
http://bmcr.brynmawr.edu/2010/2010-09-17.html

Brinkmann, V., Primavesi, O. and Hollein, M. (eds.): Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010.

Brinkmann, V.: Statues in Colour: Aesthetics, Research and Perspectives, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 10–21.

Brinkmann, V. and Koch-Brinkmann, U.: On the Reconstruction of Antique Polychromy Techniques, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 114–135.

1 This bibliography is intended as a service to readers of this Report. It does not claim to be exhaustive. Additions or corrections would be welcomed by the editor, cf. the article in this report by Amalie Skovmøller.

All articles in Brinkmann,V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, have been included although several have been published in identical form in earlier versions of the catalogue of the exhibition. Many of the earlier catalogues are however sold out, whereas the Berlin version is still available (Hirmer Verlag München, ISBN 978-3-7774-2781-2).

A ground-breaking article by Stephan Zink, with Heinrich Piening, on Roman architectural polychromy has been included. For contextual, aesthetic and technical reasons, research on ancient architectural and sculptural polychromy must develop in close unison., rather than diverge from one another.

Brinkmann, V., Koch-Brinkmann, U. and Piening, H.: The funerary monument to Phrasikleia, in: Brinkmann, V., Primavesi, O. and Hollein, M., Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010., pp. 188–217.

Brinkmann, V. and Scholl, A. (eds.): Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010.

Brinkmann, V.: Einführung in die Ausstellung. Die Erforschung der Farbigkeit antiker Skulptur, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 16–27.

Brinkmann, V.: Die Augen des Idols. Zur Farbigkeit der kykladischen Kunst, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 40–45.

Brinkmann, V.: Mädchen oder Göttin? Das Rätsel der "Peploskore" von der Athener Akropolis, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 84–93.

Brinkmann, V.: Die Wägung des Schicksals. Gemalte Namen am Schatzhaus der Insel Siphnos, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 94–101.

Brinkmann, V.: Das Grabmal des Aristion, in Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 102–107.

Brinkmann, V.: Der Prinz und die Göttin. Die wiederentdeckte Farbigkeit der Giebelskulpturen des Aphaia-Tempels, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 116–144.

Brinkmann, V.: Eine Rüstung auf der nackten Haut? Der frühklassische "Panzertorso" von der Athener Akropolis, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 148–153.

Brinkmann, V.: Die nüchterne Farbigkeit der Parthenonskulpturen, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 154–157.

Brinkmann, V.: Die blauen Augen der Perser. Die farbige Skulptur der Alexanderzeit und des Hellenismus, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 202–205.

Brinkmann, V., Koch-Brinkmann, U. and Piening, H.: Alte Gewänder in neuem Look. Beobachtungen zu den Farben der pompejanischen Artemis, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp., 212–217.

Brinkmann, V., Kellner, S., Koch-Brinkmann, U. and Østergaard, J.S.: Die Farbfassung des Caligula-porträts, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 228–235.

Brinkmann, V.: Farben und Maltechnik, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 236–243.

Franken, N.: Bunte Bronzen, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 162–169.

Koch-Brinkmann, U. and Posamentir, R.: Die Grabstele der Paramythion, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010. pp. 170–177.

Koch-Brinkmann, U. and Posamentir, R.: Ornament und Malerei einer attischen Grablekythos, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 178–185.

Köcher, D.: Madder in the sources from Antiquity to the Middle Ages, in: Brinkmann, V., Primavesi, O.and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 154–167.

Liverani, P.: New evidence on the Polychromy of Roman sculpture, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 290–302.

Mandel, U.: On the Qualities of the "colour" White in Antiquity, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 303–323.

Massmann, W.: Die "Berliner-Göttin". Überlegungen zu Form und Farbe einer archaischen Marmorskulptur, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 68–75.

Piening, H.: From Scientific Findings to Reconstruction: The Technical Background to the Scientific Reconstruction of Colours, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 108–113.

Piening, H. and Stege, H.: Pigmentanalysen an den Skulpturen des Aphaia-Heiligtums auf Ägina, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp., 145–147.

Piening, H.: Ein farbiges Vermächtnis – Die Farbmittel am "Alexandersarkophag", in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp., 202–205.

Primavesi, O.: Artemis, Her Shrine and Her Smile: Winckelmann's Discovery of Antique Greek Polychromy, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 24–77.

Primavesi, O.: Antike Dichter und Philosophen über die Farbigkeit der Skulptur, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 28–39.

Primavesi, O.: Winckelmanns Artemis. Zur Entdeckung der Farbigkeit antiker Skulpturen im 18. Jahrhundert, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp., 206–211.

Schmaltz, B.: Die Kore Akropolismuseum Inv. 682. Versuch einer Rekonstruktion. JdI 124, 2009, pp. 75–134.

Stege, H., Fiedler, I. and Baumer, U.: Die Untersuchung der Pigmente und Bindemittel in der Farbfassung der Marmorbüste des Caligula, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp., 226–227.

Verri, G., Opper, T. and Deviese, T.: The 'Treu Head': a case study in Roman sculptural polychromy, in: The British Museum Technical Research Bulletin 4, 2010, pp. 39–53

Vlassopoulou, C.: New Investigations into the Polychromy of the Parthenon, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10-12 December, München 2010, pp. 218–223.

Vlassopoulou, C.: Neue Untersuchungen zur Farbigkeit des Parthenon, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 158–161.

Zink, S. with Piening, H.: Haec aurea templa: the Palatine temple of Apollo and its polychromy, JRA 22, 2009, 109–122.

Østergaard, J.S.: The Polychromy of Antique Sculpture: A challenge to Western Ideals?, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10-12 December, München 2010, pp. 78-105.

Østergaard, J.S.: The Copenhagen Polychromy Network: A Research Project on Ancient Greek and Roman Sculptural Polychromy in the Ny Carlsberg Glyptotek, in: Brinkmann, V., Primavesi, O. and Hollein, M. (eds.), Circumlitio. The Polychromy of Antique and Mediaeval Sculpture. Proceedings of the Johann David Passavant Colloquium, 10–12 December, München 2010, pp. 324–335.

Østergaard, J.S.: Der Caligula in der Ny Carlsberg Glyptotek, Kopenhagen. Zur Rekonstruktion der polychromen Fassung eines römischen Porträts, in: Brinkmann, V. and Scholl, A. (eds.), Bunte Götter. Die Farbigkeit antiker Skulptur, Berlin, 2010, pp. 218–225.

NY CARLSBERG
GLYPTOTEK