Summary and Keywords

The term “polychromy” has been in use since the early 19th century to denote the presence of any element of colour in Greek and Roman sculpture. The evidence for such polychromy is literary, epigraphical, archaeological, and archeometric; research on the subject therefore requires collaboration between the humanities, conservation science, and natural science. Such research should go hand in hand with the investigation of the polychromy of Greek and Roman architecture, since it is symbiotically related to sculpture, technically as well as visually.

Knowledge of Greek and Roman sculptural polychromy is still very uneven. Scholars have focused on stone sculpture, and most research has been directed towards the Archaic, Early Classical, Hellenistic, and Imperial Roman periods. For terracottas, the Hellenistic period has enjoyed the most research, while investigation of the polychromy of bronze sculpture has only recently begun.

The scientific research methodology applied concerns the materials and techniques employed. The main colouring agents are paints, metals, and coloured marbles. Pigments are based on inorganic and organic materials applied with proteins, wax, or plant gums as binding media. Metals used are bronze, copper, silver, and gold. A range of coloured marbles came into use in the Roman Imperial period, but in all periods, assorted materials such as semi-precious stones and metals were used for inlaid details and attached objects like jewelry and weapons.

The element of colour in Greek and Roman sculpture is of varied character and is found on works in all formats and materials, in a wide spectrum of contexts and functions covering the chronological and geographical history of sculpture in Classical Antiquity. No matter the period, sculptures had an element of colour; this element was not just a decorative addition but integral to the meaning and message of the sculpture. A logical relationship existed between the sculptural forms and their polychromy. A major division in the history of sculptural polychromy is therefore congruent with that found between the highly stylized forms of Archaic sculpture, on the one hand, and the naturalism dominant from the Classical period to the onset of Late Antiquity, on the other hand.
The list of sculptures on which remains of colour have been observed, but not analyzed, is long. Many are included in Reuterswärd’s 1960 monograph, which constitutes the point of departure for studies since then. This article is, however, based on the results of interdisciplinary investigation, an activity still in its infancy.

Keywords: polychromy, sculpture, Greek, Roman, metal, gold, marble, terracotta, colour, pigment, painting

What Is “Sculptural Polychromy”?  
The term “polychrome,” from Greek *poly* (“many”) and *chroma* (“colour”), was first used by Antoine-Chrysostôme Quatremère de Quincy in 1814 to denote the presence of colour on Classical sculpture.  

Polychromy in Greek and Roman sculpture is not limited to the application of pigments by painting on marble, but includes a variety of other techniques and materials: chryselephantine, bronze, terracotta, wood, and—rarely preserved—coloured semi-precious stone. Technically, iconographically, and stylistically related objects such as marble vases and marble furniture also lie within the ambit of sculptural polychromy.

Polychrome sculpture is found in all formats, from the colossal to the miniature. The formats, materials, and the style of polychromy correspond with the functions such sculptures fulfilled, from huge chryselephantine cult statues to terracotta votive statuettes and Imperial portraits in rare coloured stones. One should therefore speak not of polychromy, but of “polychromies.”

The complexity of the phenomenon of sculptural polychromy is further increased by its chronological range and geographical reach, being wholly identical with that of Greek and Roman sculpture as such.

Research Methodology
The nature of the evidence requires an interdisciplinary approach. Classical philology and epigraphy (see epigraphy, Greek and epigraphy, Latin), handle the ancient written sources, literary and inscriptive, while ancient history provides the historical framework and perspective. Thus, the written sources must be sifted for their information about such things as craftsmen, workshops, materials used, techniques, and audience reactions, as well as colour connotations. The material evidence is the province of Classical archaeology, objects conservation, conservation science, and the natural sciences. This evidence is provided by depictions on Greek vases (Figure 1) and in Roman wall paintings (Figure 2), and by the sculptures themselves.
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Figure 1. A statue of Heracles being painted in the encaustic technique. Apulian red-figure column krater, c. 360–350 BCE. H. 51.5 cm. New York, The Metropolitan Museum of Art, inv. no. 50.11.4. Rogers Fund, 1950.

Figure 2. Wall painting from the House of the Golden Bracelet, Pompeii (VI 17, 42): Garden scene (detail) with fully polychrome satyr’s heads carrying more discretely coloured reliefs. Mid-1st century CE. Approx. 200 x 375 cm. Pompeii, Antiquarium, inv. no. SAP 40690B. Archivio Fotografico Soprintendenza Speciale Pompei.

On the latter, the evidence may be direct in the form of preserved pigments (Figure 3), or be indirect, that is, not physically preserved but detectable by other means (Figures 4, 5, 6A, 6B, and 6C).
Tracking, documenting, and interpreting this evidence requires collaboration with conservation science and natural sciences, especially chemistry.
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Figure 5. Image in ultraviolet light of the funerary stele of Paramythion. From Athens, c. 370 BCE. Marble, h. 92 cm. Staatliche Antikensammlungen und Glyptothek, inv. no. GL 522. Photo courtesy Vinzenz Brinkmann, Städelstiftung.

Figures 6a. The “Treu Head” imaged under visible light (see figures 6B and 6C). From Rome, c. 140–150 CE. Marble, h. 37.5 cm. The British Museum, inv. no. 1884,0617.1.
Figure 6b. The “Treu Head” imaged in ultraviolet light. From Rome, c. 140–150 CE. The British Museum, inv. no. 1884,0617.1.

Figure 6c. The “Treu Head” imaged in VIL light. From Rome, c. 140–150 CE. The British Museum, inv. no. 1884,0617.1.

Investigation must take place according to agreed-upon protocols and standards, with data organized, presented, and shared in a manner compatible with professional guidelines. Protocols for examination typically consist of visual investigation, microscopy, technical imaging, and other methods of non-invasive in situ analysis; analytical investigation using invasive, nondestructive, and destructive methods may follow and are a priori permissible. The examination process is often iterative and has visual investigation as a first step, comprising photographic documentation and systematic macroscopy under tungsten...
light. Multispectral imaging (MSI) follows, providing the quickest, most affordable, and technologically most straightforward means of non-invasive, non-contact analytical investigation.8 Imaging in the ultraviolet (UV) and visible (VIL) range of light waves are of particular importance: ultraviolet-reflected imaging (UVR) strengthens contrasts, while ultraviolet-induced luminescence imaging (UIL or UV-FL) captures the luminescence from certain organic pigments on the surface. Finally, there is visible-induced luminescence imaging (VIL), which shows the luminescence of Egyptian blue, a synthetic pigment first produced in Egypt in the 3rd millennium BCE and subsequently widely used in Classical Antiquity. The traces revealed are subsequently examined and documented by video microscopy of the surface.9 At this point, decisions may be made to apply one or several methods of non-invasive or invasive analysis to obtain quantitative data on both inorganic and organic pigments. Non-invasive analysis is conducted without physical contact with the historical material; a standard protocol will include X-ray fluorescence spectroscopy (XRF), ultraviolet-visible spectroscopy (UV-VIS), fiber optics reflectance spectroscopy (FORS), and micro-Raman spectroscopy (μ-Raman, MRM).10 Under certain conditions, invasive methods should be considered since they provide information not otherwise attainable. Invasive methods require sampling and may be nondestructive or destructive, with the latter entailing the loss of the sample analyzed. Some non-invasive methods may also be used invasively (XRF, Raman), while others are invasive per definition, namely X-ray diffraction spectroscopy (XRD), scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM-EDX), Fourier transform infrared spectroscopy (FTIR), and inductively coupled plasma mass spectrometry (ICP-MS). This last is an analytical technique used for elemental determinations and has special relevance for polychromy studies because it permits the study of isotopes of lead and subsequently determination of its source. For nondestructive determination of the chemical composition of very small volumes of material, electron microprobe analyzer (EMPA) is used. For organic pigments (colourants), gas chromatography-mass spectrometry (GC-MS) is the most important method, including identification of components in the form of binding media. The method is destructive, as are chemical spot tests done on small samples to identify a substance.11

Techniques of Painted Polychromy

The results obtained from the application of these methodologies may be used for research-based experimental reconstructions of polychromy on a copy of the original. The experience gained from such reconstructions combines with the primary data from the sculptures and secondary evidence from other sources to throw light on the techniques employed in applying painted polychromy.12 Modern-day knowledge of this decisive aspect is scant in view of its millennia-long duration; its geographical range; and the diversity of materials, formats, and contexts concerned. Only three depictions of the act of painting a sculpture are preserved, one Classical Greek (see Figure 1) and two Early Imperial Roman.13 Written descriptions of the technical procedures in sculpture painting have not survived. Scholars’ evidence therefore comes primarily from the sculptures themselves. The gamut of colours employed—for stone as well as for terracotta sculpture and fresco painting—consisted of natural pigments, the majority inorganic and a few or-
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ganic (the latter also called colourants and used as dyes in other contexts). Synthetic pigments were the exception, the most important by far being Egyptian blue, produced from at least the 3rd millennium BCE onwards.\(^{14}\) Before being applied to sculpture, pigments had to be mixed with a binding medium, generally of organic origin. In Classical Antiquity, the binding medium was either wax (encaustic technique) or one of a range of protein-based components (tempera technique); the choice of technique would have been of vital importance to the visual effect and the durability of the paint layer. Being organic, the binding media have generally either decomposed completely or require resource-demanding analyses to be detected. Indications are that a high degree of technical and esthetical sophistication was attained\(^{15}\) and that collaboration between the sculptor creating a 3D “canvas” and the sculpture painter was from the Archaic Greek period.\(^{16}\)

The Polychromy of Greek Sculpture

Forerunners? Ancient Near Eastern and Egyptian Sculptural Polychromy c. 1000–500 BCE

Sculpture in the Ancient Near East and Egypt was polychrome from the earliest beginnings. The powerful transmission of “Orientalizing” traditions from the East to Greece and beyond in the earlier 1st millennium BCE may therefore well have included styles and techniques of sculptural polychromy. This remains to be investigated. Fortunately, research on the polychromy of neo-Babylonian, neo-Assyrian, Achaemenid Persian (see Achaemenid art), and late Period Egyptian sculpture has picked up speed in recent years.\(^{17}\)

The Archaic Period, c. 650–480 BCE

Traces of polychromy are especially well preserved on Archaic stone sculpture (see sculpture, Greek). They have therefore been extensively examined and documented, first and foremost by Vinzenz Brinkmann and his collaborators. Two Early and several Late Archaic works have been investigated in depth; they include freestanding and relief sculptures from funerary, votive, and architectural contexts. All are made of marble, with one exception.\(^{18}\) Recent initiatives taken by the Acropolis Museum at Athens have raised the possibility of applying a full suite of analytical methodologies to one or more of the korai held at the museum; the results would no doubt be noteworthy.\(^{19}\) The data available suggest that the stylized forms of archaic sculpture carried a correspondingly stylized polychromy, with no shading, no mixing of pigments, a “free” relation to reality (blue lion’s manes!), and a taste for strong colours.\(^{20}\) The closest stylistic parallels for early Archaic Greek sculpture are Egyptian (see Egypt, pre-Ptolemaic); Archaic polychrome sculpture from Cyprus, Rhodes, and the Greek-Egyptian town of Naucratis in the Nile Delta gain extra interest in this perspective as points of transmission of Egyptian traditions.\(^{21}\) The role of bronze in Archaic sculptural polychromy is being explored.\(^{22}\) To the spectrum of Archaic sculptural polychromy of the period, terracotta statuettes, which have hardly been
studied, must be added. Finds from Delphi bear witness to the existence of Archaic sculptures in the chryselephantine technique.\textsuperscript{23}

The Classical Period, c. 480–320 BCE

There is less evidence for the polychromy of stone sculpture in the Classical period than in the Archaic.\textsuperscript{24} The role of chance is a determining factor in preservation, but post-antique “cleaning” of the surfaces to make them conform to the idea of classical sculpture being monochrome white must be taken into account.\textsuperscript{25} This aspect of the history of reception needs further study. A relative lack of investigation of relevant sculptures may also reflect an unwillingness to document colour on Classical Greek marble sculpture. The evidence, however, is much richer as far as written, literary sources are concerned.\textsuperscript{26}

The polychromy of several Early Classical works was documented by Vinzenz Brinkmann (Figures 7 and 8).\textsuperscript{27}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{torso.jpg}
\caption{Torso of a cuirassed warrior. From the Acropolis of Athens, c. 470 BCE. Marble, h. 62 cm. Athens, The Acropolis Museum, inv. no. 599. Photo courtesy Vinzenz Brinkmann, Städelstiftung.}
\end{figure}
A gap follows, until the observations made of elements of colour on the Parthenon and Hephaisteion sculptures, including their metal attachments. Only one other Attic marble sculpture of the 5th century has been closely examined so far (Figure 9).

An anthropoid sarcophagus of Greek marble—found at Kition, Cyprus—has remarkably well-preserved colours. Dating from c. 400 BCE, it has been presented in an excellent preliminary publication. The so-called Alexander Sarcophagus of c. 315 BCE, from the royal
necropolis at Sidon (Lebanon), remains a prime example of polychromy of a high-grade marble sculpture from the Late Classical period. The sarcophagus’s wide range of pigments, and the shading technique used on the three-dimensional objects, supports the naturalism of the underlying forms (Figure 10).

![Figure 10. The “Alexander Sarcophagus.” Detail of a battle scene. Photo courtesy Vinzenz Brinkmann, Städelstiftung.](image)

Thanks to the polychromy, the two-dimensional representations and the three-dimensional forms form a coherent whole in the sculpture. Classical marble grave markers from Attica, Thessaly, and the Chersonesos also display these techniques (Figure 11).
The two-dimensional painted representations preserved on a range of Classical marble luxury objects also throw light on the technical and aesthetical character of Classical sculptural polychromy.³³ Insight on chryselephantine sculpture of the period is provided by the miniature reliefs from Macedonian royal graves.³⁴

Research on the polychromy of Classical terracotta sculpture has focused on the high-quality statuettes known as “Tanagras,” studied together with their successors of the Hellenistic period (Figure 12).³⁵
A close relationship exists between the polychromy of the terracottas and contemporary marble sculpture: the better preserved polychromy of the terracottas thereby provides invaluable indirect evidence.

Interest in the polychromy of classical bronze sculpture has increased, focusing on the Riace warriors and the “Terme Boxer.” The craftsmen seem to have intended a naturalistic effect, achieved through inlays, treatment of the bronze surface, and sophisticated manipulation of bronze alloys (Figure 13).
The consequence of the re-emergence of colour in sculpture of the Classical period for modern scholars’ understanding of the aesthetics of the period is being assessed. The Greek concepts of *mimesis* and *technè* should be viewed in connection with modern notions of “naturalism” and “art.” The development and character of Classical painting must also be taken into consideration. The Hellenistic Period, c. 320–31 BCE

Continuity of the Classical tradition, including the first retrospective “classicism,” and invention of new expressions characterize the forms of Hellenistic sculpture. If evidence for seeing polychromy as an integrated element of such sculpture is accepted, the use of colour in the Hellenistic period may be expected to follow suit in being fundamentally naturalistic, and the data so far available supports this thesis. Remarkable progress has been made since the late 1990s thanks to pioneering investigation of Late Hellenistic marble sculptures from Delos and research on Hellenistic sculpture in museum collections. Inscriptions from Delos provide evidence for maintenance (*kosmésis*) and renewal (*thérapéia*) of polychromy of sculptures and are now being studied.

The naturalistic “recipe” of forms and colour in mutual support of an intended *mimesis* continues in the Hellenistic period, often combined with a taste for pastel colours and gilding. Among the unexpected meeting of traditional and new is the complete gilding of a 2nd-century BCE Parian marble copy of the Classical bronze *Diadumenos* by Polyclitus. How colour interacted with the novel forms of Hellenistic “baroque” sculpture, as on the Pergamon Altar, largely remains to be seen. Fortunately, the far better preserved poly-chromatic sculpture of the Early Hellenistic period reveals a clear continuity with the Classical tradition.
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Research focus on Late Hellenistic Delos is of particular relevance to the question of the transmission of Greek traditions in sculpture to Roman Italy. The Roman reception of these traditions is likely to have included the polychromy of sculpture—technically, communicatively, and aesthetically. Hellenistic, acrolithic cult statues are a case in point.45

The Polychromy of Roman Sculpture, c. 200 BCE—500 CE

Only since the early 21st century has in-depth research been directed at works of the period, and knowledge is therefore very limited.46

The Late Republican Period, c. 2nd—Late 1st Century BCE

Marble sculpture produced for Roman contexts appears as a result of the conquest of the Greek Eastern Mediterranean in the course of the 2nd century BCE (see sculpture, Roman).47 Sculptural polychromy was then already a familiar sight in Rome, having been for centuries an integrated element in the Italo-Etruscan sculptural tradition of central Italy.48 The marble used in Late Republican sculpture was Greek, the stylistic spectrum Late Hellenistic Greek, and the sculptors surely Greek too; whether the polychromy of these sculptures was Late Hellenistic Greek in character remains to be discovered.49 Late Republican marble cult statues were largely acrolithic and thus intrinsically polychrome; they have close Greek parallels.50 The colossal bearded head of such an acrolithic sculpture has been investigated (Figure 14); isotopic analysis of the red lead paint identified on this head threw light on the provenance of the lead and thus highlighted the need for research on pigment production and trade.51
Only one other (possibly) Late Republican sculpture has been examined for its polychromy, namely the archaistic “Artemis from Pompeii.” Its pastel colours are in the Hellenistic taste.  

**Imperial Rome to Late Antiquity, c. Late 1st Century BCE—5th Century CE**

Of the principal classes of sculpture in this time period, portraits, so-called “ideal” sculptures, and sarcophagi have received in-depth investigations, while state reliefs remain understudied.  

*Portraits*: The polychromy of imperial portraiture in marble until the early 3rd century CE is known only from investigation of the statue of Augustus, “Prima Porta,” and two portraits of Caligula (Figure 15).
The polychromy reflects differences in format, iconography, and context, indicating the complex character of this category of portraits and the decisive communicative role of colour. The polychromy of private portraits remains essentially unexamined though many have traces preserved; only two portraits, also from the 230s CE, have been investigated. Judging from this meager evidence, it seems that a naturalistic effect was intended with sophisticated techniques being applied. The painting in eyes continued after the introduction of plastic for rendering the iris and pupil. The 4th and the 5th centuries CE saw portraiture reduced to an instrument of imperial propaganda; the polychromy of one such portrait—of the Empress Ariadne, c. 500 CE—has been examined.

"Ideal" sculpture: The vast majority of Roman sculptures belong to this category, but investigation of any depth has been carried out on very few. In continuing this work, one must here bear in mind the role of unpainted white marble. The earliest ideal sculpture to have been examined in depth is a 1st century CE head of an Amazon of hybrid type from Herculaneum (Figures 16 and 17; cf. Figure 6A).
Important work has also been done on ideal statuary of the imperial period from Aphrodisias. The so-called Venus Lovatelli from Pompeii and a Venus from the Roman baths at Bet Shean, Israel, remain tempting research targets (Figure 18).
Complete and sophisticated polychromy has been documented on the “Treu Head” and on the “Sciarra” Amazon in the Ny Carlsberg Glyptotek in Copenhagen. It is becoming clear that surface finish of marble should be seen in relation to and as preparation for the highly refined visual effects of such polychromy.\textsuperscript{62} It is noteworthy that in their polychromy, the two replicas of the “Sciarra” Amazon type share certain technical features, but differ in appearance; this opens the question of diversification of identical copies through colour.\textsuperscript{63} Ideal sculpture with a pagan content had no place in the Christianized world of Late Antiquity; it would be of corresponding interest to study the survivors.\textsuperscript{64}

\textit{Sarcophagi}: Thousands of stone sarcophagi with scenic relief decoration were produced from the 2nd to the 4th century CE, in Rome and elsewhere in the Empire.\textsuperscript{65} The few pieces investigated so far are all from Rome: two are from the late 2nd century CE, two others from c. 300 CE, and one from the first half of the 4th century CE (Figure 19).\textsuperscript{66}
A few others have been the subject of survey investigation. The indications are that the reliefs were always partly or wholly polychrome and that the turn-away from naturalistic forms of the Classical tradition from the late 3rd century CE onwards was accompanied by a similarly stylized polychromy and an increasing use of gilding.

Sculpture in coloured marble: The Roman conquest of the Mediterranean world brought quarries of rare coloured marble and other stones under Imperial control. These prestigious materials were soon mobilized for sculptures in representative public and private contexts.
In ideal sculpture and portraiture, dark, monochrome stones were reminiscent of the black-green patina of many Classical Greek bronze sculptures as they appeared in Roman times, while coloured marbles enjoyed particular popularity in representations of “barbarians” (Figure 20).  

_Sculpture in bronze_: Study of Roman bronze sculptures is a discipline of long standing, but investigation of their polychromy remains in the formative phase in 21st-century scholarship.  

Colour effects were achieved by a combination of sophisticated means: manipulation of the bronze alloy; polishing and other instrumental working of the surface; gilding; treatment of the surfaces for protection and/or artificial patination; and the use of inlays in coloured materials for eyes, lips, and other details.

_Sculpture in terracotta and chryselephantine technique_: Roman terracotta figurines and statues were painted, but their polychromy has not been studied. For the polychromy of marble sculpture, examination of the fragments of the refined Early Imperial terracotta statuary from the Palatine Hill would be relevant.  

The extremely rare large-scale Roman sculptures in ivory, belonging in all probability to chryselephantine statues, would also be helpful.

_The polychromy of sculpture in the Roman provinces_: Vast numbers of stone sculpture were produced outside the centres of excellence (i.e., metropolitan Rome, Athens, Aphrodisias). Traces of polychromy have been reported on many such provincial sculptures, such as those from Spain and Germany.  

No comprehensive survey of this important body of exists, and only one investigation of such a monument has been published (Figure 21).
Fortunately, a major project to investigate the polychromy of stone sculpture from Roman North Africa is ongoing in the 2010s.  

Experimental Archaeological Reconstructions

Like other branches of archaeology, Classical archaeology is no stranger to experimental methods of research. The relevance of experimental archaeology to the study of sculptural polychromy is obvious: by trying out interpretations of the data acquired on copies of the originals, their viability will be tested via the “learning-by-doing” method. The resulting objects have been called “reconstructions,” but other terms stressing their experimental nature are coming into use, such as “approximations.” Besides being a research tool, experimental reconstructions are also the most powerful means of communicating ancient sculptural polychromy to the public. Since the early 1990s, the potential of such physical reconstructions in research and divulgation has been systematically explored by Ulrike Koch-Brinkmann, Vinzenz Brinkmann, and their collaborators. Most recently, they have turned to investigations of the polychromy of Classical bronze statues. Criticism of this work has been voiced, but not published, leading to the development of an alternative, virtual method of reconstruction.

Discussion of the Literature

Since the Renaissance, the art of sculpture had by definition been monochrome, in white marble. As 18th-century neoclassicism gained momentum, this reception of classical sculpture became even more pronounced. The excavation of Pompeii and Herculaneum from the 1730s onwards was of pivotal importance. Thus, the polychromy of a statue of Artemis found 1760 at Pompeii was noted by Johann Joachim Winckelmann in 1762; he first saw it as Etruscan because of its colours, but subsequently came to see it as a Greek Archaic original (Figure 22).
He thereby arguably became the first to rediscover the polychromy of Greek sculpture. From the early 19th century onwards, antiquarians, artists, and architects began visiting Athens and reported traces of colour on the Classical Greek monuments. Early excavations followed, first at the temple of Athena Aphaia on Aegina, with finds of polychrome architectural sculpture (1811); further evidence came to light at the Mausoleum of Halicarnassos (1850s), Prima Porta north of Rome (1864), Olympia (1870s), and on the Acropolis of Athens (mid-1880s). The weight of these finds determined the outcome of the “polychromy debate” that had raged since the publication of Quatremère’s work, the case for polychromy being stated with particular force in the 1880s by the German classical archaeologist and director of the Albertinum in Dresden, Georg Treu. By the turn of the century, the scholarly consensus was that colour was a constituent element of Greek and Roman sculpture.

This did not lead to the surge of research one might have expected. Instead, virtual silence descended, brought about by a complex combination of factors. Of these, the late-19th-century modernist turn-away from the classical tradition was as important as the disruptions of World War I. In the 1920s and 1930s, Fascism and Nazism harnessed white marble for their “black” ideologies; after World War II, the idea of colour in ancient sculpture was kept at bay by a still deeply rooted aversion to polychromy as an esthetical contamination of classical sculpture (and architecture) and a subversion of European, Western identity.
Only in 1960 was a new start made, by Patrik Reuterswärd; his book stands next to Quatremère’s in importance. German pioneers in multispectral imaging, led by a group formed around Volkmar von Graeve, contributed to a breakthrough in polychromy research during the 1980s by Vinzenz Brinkmann and Ulrike Koch-Brinkmann. Postwar developments in classical archaeology towards a sociohistorical rather than an art-historical approach and the founding in the 1970s of academically organized schools of conservation contributed decisively, the latter by establishing interdisciplinary collaboration between natural science and the humanities.

Since the 1990s, the still ongoing “breakthrough phase” has been characterized by interdisciplinary research projects and increasing international collaboration, with the application of constantly refined research methodologies. As a result, the volume of available data has increased considerably—although it is still minimal in relation to the vast number of unexamined objects. This has opened new avenues of research and posed novel questions. Since polychromy must be seen as an integrated and intentional element of a sculpture, it is important to understand all facets of the relationship between the sculptural forms, the final finish of the surfaces, and the colours subsequently applied. Careful examination and documentation of the tooling of well-preserved sculptures becomes correspondingly vital. This connects directly with not only the aesthetic but also the communicative function of sculptural polychromy, the question of the identity of the persons commissioning sculptures, of those producing them, and of those tasked with their maintenance. All these aspects have only recently been comprehensively dealt with, in a monograph on the polychromy of the Hellenistic period. Focusing on the Roman period, the phenomenon of colour coding has been discussed in connection with the polychromy of togate statues. Finally, the accumulated evidence of the extent to which colour was applied to sculpture makes it clear that pigments must have been produced in large amounts. Knowledge of the location of centres of production and of trade in pigments is as obviously important as it scant. The application of interdisciplinary methodologies will no doubt lead to significant progress. Among several promising fields is the provenancing of certain pigments through study of isotope values of lead pigment compounds, and palaeo-content analysis of Roman transport amphorae, combined with their rare content inscriptions (tituli picti).

**Bibliography**


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Notes:

(1.) Antoine-Chrysostôme Quatremère de Quincy, *Le Jupiter Olympien, ou l’art de la sculpture antique considérée sous un nouveau point de vue, ouvrage qui comprend un essai sur le gout de la sculpture polychrome, l’analyse explicative de la toreutique, et l’histoire de la statuaire en or et ivoire chez les Grecs et les Romains, avec la restitution des principaux monuments de cet art et la démonstration pratique ou le renouvellement de ces procédés mécaniques* (Paris: Firmin Didot, 1814), xxii.

(3.) For a brief definition see Abbe, “Polychromy,” 173.


(6.) Clarissa Blume, Polychromie hellenistischer Skulptur. Ausführung, Instandhaltung und Botschaften (Petersberg, Germany: Imhof, 2015) is exemplary in this regard.


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(13.) Apulian red-figure column krater, c. 360–350 BCE, h. 51.5 cm., New York, Metropolitan Museum of Art, acc. no. 50.11.4. Carnelian ringstone, 1st century BCE, h. 1.2 cm., Metropolitan Museum of Art acc. no. 81.6.48. Fresco, Casa del Chirurgo, Pompeii, 1st century CE, 37 x 37 cm., Museo Archeologico Nazionale, Napoli, inv.no. 9018.


(15.) Verri, Opper, and Deviese, “The ‘Treu Head.’”


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(26.) Oliver Primavesi, “Antike Dichter und Philosophen über die Farbigkeit der Skulptur,” in Brinkmann and Scholl, Bunte Götter, 28–39; and Oliver Primavesi, “Colourful Sculptures in Greek Tragedy,” in Transformations, 70–79.

(27.) Brinkmann, Polychromie.

(28.) Christina Vlassopoulou, “Neue Untersuchungen zur Farbigkeit des Parthenon,” in Brinkmann and Scholl, Bunte Götter, 158–161, with bibliography 248–249; and András Patay-Horváth, Metallanstückungen in der archaischen und klassischen griechischen Skulptur (Rahden/Westf.: Verlag Marie Leidorf, 2008).
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(35.) Jeammet, Tanagras; Brigitte Bourgeois and Violaine Jeammet, “Peindre et repeindre sur terre cuite en Grèce hellénistique,” in Thérapéia, 84–95; and Blume, Polychromie, 87–94.


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(48.) Cf. Østergaard, Emergence, 43–44; and Blume, Polychromie, 96. See also Carlo Gasparri and Maria Antonietta Tomei, Museo Palatino. Le collezioni (Milan: Electa, 2014), 126–128, nos. 14–15. For an instructive insight into Hellenistic polychromy in Etruria, see Angelo Bottini and Elisabetta Setari, eds., Il sarcofago delle Amazzoni (Milan: Mondadori Electa, 2007).


(52.) Kunze, Die Artemis.


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(57.) On Ny Carlsberg Glyptotek IN 820 and IN 821, see Amalie Skovmøller and Rikke H. Therkildsen, “The Polychromy of Roman Polished Marble Portraits.”


(62.) Abbe, Polychromy, 180; Abbe, Recent Research, 288–289.


(65.) Guntram Koch, Sarkophage der römischen Kaiserzeit (Darmstadt: Wissenschaftliche Buchgesellschaft, 1993); and Reuterswärd, Studien, 230–242 (polychromy).

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(68.) Liverani, Osservazioni.


(73.) Trinidad Nogales Basarrate, “El color de Roma: Escultura y policromia en Augusta Emerita,” in El color de los dioses, eds. Vinzenz Brinkmann and Manuel Bendala (Madrid: Comunidad autonoma, 2009), 241–251. The polychromy of Roman funerary monuments from Neumagen kept in the Rheinisches Landesmuseum at Trier is exceptionally well preserved but remains to be investigated.

(74.) Jan S. Østergaard and Maria Louise Sargent, “The Polychromy of a Female Late 2nd Century CE Palmyrene Funerary Portrait,” in Proceedings of the XVIIIth International Congress of Classical Archaeology, eds. J. M. A. Martinez, Trinidad Nogales Basarrate, and Isabel Roda de Llanza (Mérida 2015), 1231–1236; Rubina Raja and Annette Højøn
polychromy, sculptural, Greek and Roman


(75.) A French-Tunisian team has been investigating sculptures in the Musée du Bardo, Tunis. A preliminary report has been accepted for Archaeometry.


(81.) Primavesi, Lächeln, 16-67.


(83.) James Stuart and Nicholas Revett’s stay in Athens in 1752-1754, and the resulting publication Antiquities of Athens, I-IV, (London: 1762-1816) stands as a lone precursor.
polychromy, sculptural, Greek and Roman


(85.) Maxime Collignon, La polychromie dans la sculpture grecque (Paris: Leroux, 1898); the polychromy of Roman sculpture is also dealt with on pages 66–76.


(88.) Reuterswärd, Studien; Volkmar v. Graeve, Der Alexandersarkophag und seine Werkstatt (Berlin: Mann, 1970); cf. Stiftung Archäologie by the Freiburg School.

(89.) Heilmeyer and Massmann, Berliner Göttin, is of seminal importance, particularly 63–69 and 88–97.

(90.) Blume, Polychromie, 101–130.
