[title]The Use of Inlays in Early Greek Bronzes

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[A-head]Abstract

[abstract]

Ancient Greek bronze-smiths had a variety of techniques at their disposal to enhance the appearance of their creations. Due to their often fragmentary state of preservation, the modern observer tends to think of early Greek bronzes as monochromatic, but it is clear that the practice of inlaying other materials into bronze started early in ancient Greece.

Inlays appear in a broad variety of bronze object types from weapons and armor, vessels and jewelry to relief-decorated objects and figural sculpture. Many of the finest early Greek bronzes were embellished with inlays that enlivened the sculptural forms and may have added symbolic or even magical qualities. Eyes were often given particular prominence with inlays.

Of special interest is a new technical analysis of a Late Geometric statuette of a man and a centaur (Metropolitan Museum of Art, inv. 17.190.2072), in which the eyes of the man were inlaid with silver to contrast with the eyes of the centaur, which appear to have an iron-rich inlay. Although the evidence is frequently incomplete, it is clear that a wide variety of colorful inlays such as gold, silver, iron, bone, ivory, and amber were utilized, and other materials, such as stone and shell, were certainly used as well.

This paper looks at the evidence for the Geometric (900–700 BC) and Archaic (700–480 BC) periods with particular reference to artworks in the collection of the Metropolitan Museum of Art in New York.

[main text]

Ancient Greek bronze-smiths used a variety of techniques to enhance the appearance of their creations. Due to their often fragmentary state of preservation, the modern observer tends to think of early Greek bronzes as monochromatic, but it is clear that the practice of inlaying other materials into bronze started early in ancient Greece. This paper looks at the evidence for the Geometric (ca. 900–700 BC) and Archaic (ca. 700–480 BC) periods from many different regions, with particular reference to artworks in the collection of the Metropolitan Museum of Art, where a variety of nondestructive scientific analyses were conducted in the Museum’s conservation and scientific laboratories. While not the focus of this paper, the history of inlays on copper alloy artifacts began much earlier in ancient Greece, during the Bronze Age. Certainly among the most spectacular and accomplished examples of the Late Bronze Age are the daggers inlaid with figural scenes of gold, silver, and copper found in the Shaft Graves at Mycenae and in other coeval tombs, which have been catalogued and discussed in detail.[[1]](#endnote-1) Exquisite new examples continue to be discovered in archaeological excavations. Although these inlays are often described as using niello (a mixture of sulfur and various metals) in the archaeological and art-historical literature on the subject,[[2]](#endnote-2) scientific analysis has shown that a different technique was used to produce the rich black or blue-black patination.[[3]](#endnote-3) Such fine complex figural inlays in bronze artifacts made in Greece generally do not appear again until the Archaic period and niello is not securely attested until the Roman Imperial period.

Turning now to the Geometric period, of special interest is the statuette of a man and centaur (**fig. 14.1**), said to be from Olympia, which came into the Met’s collection in 1917 as the gift of J. P. Morgan.[[4]](#endnote-4) This rare figural composition of a man and a centaur locked in mortal combat likely represents a Greek myth such as the battle between the centaur Nessos and the hero Herakles. It is among the finest Greek Geometric bronze sculptures preserved today. It has long been known that the male figure has hollowed out eyes in which considerable traces of the gray-black inlay are still preserved, especially in the right eye. The remains of the inlay in the man’s eye were identified as silver through X-ray fluorescence analysis (XRF).

In 2013, while preparing the statuette for loan to an exhibition in Rome at the Palazzo Massimo (Paris et al. 2014), the statuette was X-rayed (see fig. 14.1, inset) and an important discovery was made. The centaur also clearly has cavities for inlays in the eyes, inlays that are still *in situ.* Examination of the eyes under magnification revealed a difference in color and texture in these areas, as can be seen in a detail image of the left eye (**fig. 14.2**, left). Analysis using XRF detected a significantly higher amount of iron than found elsewhere on the object, suggesting an iron-rich inlay in both eyes.

To confirm the XRF results of the material of the centaur’s eyes, Energy Dispersive Spectroscopy (EDS) was undertaken in the scanning electron microscope. Due to the geometry of the instrument and the figures, only the area of the proper left eye of the centaur could be examined. EDS confirmed the XRF results of iron; **figure 14.2** (right) maps elemental distribution, with iron shown in green. It is notable that imaging turned up neither aluminum nor silicon, which one would have expected to see if the iron derived from ochre, or even simply from soil embedded in the cavity. Given the way the iron fills the cavity of both eyes completely, it seems more probable to us that it was used as an inlay itself and was not merely the remains of an iron pin used to hold another material, such as bone or ivory. Iron is not a common inlay with bronze but does occur elsewhere, such as on Thracian cuirasses of the sixth century BC.[[5]](#endnote-5) The use of silver for the man’s eyes, versus the iron for the centaur’s eyes, would have created a dramatic contrast between the two figures.

One of the most popular subjects of Greek Geometric bronze statuettes is the horse.[[6]](#endnote-6) Thousands of small horse statuettes have been found at Greek sanctuaries, most notably at Olympia, where they were likely votive offerings by the aristocratic horse-owning class. Typically, the statuettes do not feature inlays, being instead embellished with incised details, but some of the largest and finest examples appear to have had inlays as well. One likely candidate is the large bronze statuette from OIympia, dated to ca. 730 BC and now in the Berlin Antikensammlung (inv. 31317). Its large hollow eyes probably originally held inlays that are now lost. Another example is a Geometric statuette of a horse (**fig. 14.3**) in the Metropolitan’s collection. The original surface of the Met’s horse is in poor condition, but ancient holes in each hoof support the hypothesis that it was not a stand-alone work but was once attached to the rim or handle of a large tripod cauldron, a typical and expensive votive offering at Greek sanctuaries in the Geometric and Archaic periods.[[7]](#endnote-7) An X-radiograph of this object, shot from above (see fig. 14.3, inset), shows how each eye was carefully hollowed out to receive an inlay; these cavities have the same basic shape as the eyes of the man-centaur statuette discussed above (see figs. 14.1–2). XRF analysis of the horse’s eyes did not yield any positive results for identifying the material of the inlay. The poor state of preservation hampers further identification of the inlay, whether it was of metal, stone, or an organic material.

Fine bronze sculpture of the Orientalizing period (ca. 700–600 BC) typically is embellished with inlays as well, especially in the eyes. Good examples from the seventh century BC are the small statues from Dreros on Crete, whose hollow eyes were surely originally filled with inlays.[[8]](#endnote-8) The use of inlays in bronze artifacts had a long history in the ancient Near East,[[9]](#endnote-9) perhaps inspiring Greek developments at this time.

A Late Archaic bronze head from Kerkyra now in the Antikensammlung in Berlin (inv. Misc. 6324) preserves part of its original inlay, which naturalistically renders the whites of the eyes. In the succeeding Classical and Hellenistic periods, such inset eyes were highly articulated, as is evident in a pair in the Met’s collection (inv. 1991.11.3a–b) that perhaps date to the fifth century BC.[[10]](#endnote-10) Statuettes also could have inlays like their large-scale counterparts, as for example the eyes of the Mantiklos Apollo statuette in the Museum of Fine Arts, Boston[[11]](#endnote-11) or the nipples of the early fifth-century BC statuette of Apollo from Kosmas in Arkadia now in the collection of the Athens National Archaeological Museum (inv. 16365).

Griffin protomes attached to large cauldrons set on tripod stands are another type of bronze object that frequently received inlays, especially for the eyes. The famous Cypro-Archaic cauldron and rod tripod stand from a royal tomb at Salamis, Cyprus, is a particularly well-preserved example.[[12]](#endnote-12) A variety of materials were used for inlaying the eyes of Archaic Greek bronze protomes. Amber was used for griffin eyes, as on an example from Olympia, dated 680–650 BC, in the Athens National Museum.[[13]](#endnote-13) Bone and ivory were also employed, sometimes with articulation for the pupil, as in a pair of griffin protomes dated to 625–575 BC in the collection of Chicago’s Art Institute.[[14]](#endnote-14)

One of the largest and most splendid griffin protomes to survive from antiquity is in the collection of the Metropolitan Museum of Art (**fig. 14.4**).[[15]](#endnote-15) It is said to have come from Olympia and has been associated with two other similar examples, one in the Athens National Museum and the other in the Olympia Archaeological Museum.[[16]](#endnote-16) Its scales are carefully punched and its large eyes would have been inlaid, probably much like the examples from Chicago. The Greek historian Herodotus tells us that such tripod cauldrons could be truly monumental; he mentions one made for King Croesus of Lydia that could hold 2,700 gallons (Herodotus 1.70).

Since it is clear that the Met’s griffin had inlaid eyes, the relevant areas were examined under magnification and using XRF, in case any physical evidence remained. Unfortunately, as expected, none was found. However, a difference in the alloy of the beading that surrounds the edge of the neck (see fig. 14.4) was identified. The main metal alloy, including that surrounding the eyes, is made of copper, tin, and lead with significant traces of numerous other elements. By contrast, the beaded rim and rivets that attach it to the neck are made of an alloy that is mostly copper with trace amounts of tin and lead. The dramatic differences between the bronze alloy of the main sculpture and the copper beading would have produced a noticeable chromatic variation.

A massive Archaic Greek bronze support in the form of a sphinx (**fig. 14.5**) was gifted to the Metropolitan Museum in 2000.[[17]](#endnote-17) Small hollows in the center of its eyes most likely served to secure inlaid pupils of another material. Visual examination of the eyes revealed small bits of iron. However, analysis turned up silica and a copper alloy similar to others areas analyzed, such as the chest. Thus it appears that the cavities in the center of the eyes contain the remains of soil that mask any clearer signals. Because there is a massive lead fill on the back of the bronze, X-radiography was not a useful tool. Interestingly, the pronounced bulbous center of the diadem crowning the sphinx’s head (**fig. 14.6**) was found to differ from the general copper alloy used in the sculpture, having a higher level of silver, bismuth, and arsenic. Conceivably, this area may have had a silver overlay that enriched the surface but is no longer preserved. The ears of the sphinx are pierced and quite likely would have originally had earrings made of another material, which would have enhanced the polychrome effect.

The practice of inlaying eyes on vessel and stand protomes extended to animal subjects as well as humans and mythical creatures. Bull’s heads embellish fragments of a bronze and iron rod tripod from Kourion, Cyprus, dating to the seventh century BC, that once belonging to Luigi Palma di Cesnola and are now divided between the collections of the Metropolitan and Berlin.[[18]](#endnote-18) As reconstructed, six bull’s head protomes originally decorated the upper ring and three smaller bull protomes decorated the lower ring. All of these have eyes that are carefully hollowed out to receive inlay, which is no longer preserved. The bull’s head protome in the Met’s collection (inv. 74.51.5620) is a particularly good representative example where the hollowed eyes are well preserved. A Greek bronze cauldron from a tomb at Leontini in southern Italy and now in the collection of the Antikensammlung in Berlin (inv. Misc 8600) illustrates the same basic kind of inlay, about a century later, for the eyes of ram’s head protomes. Again the inlays are missing.

The finest Archaic Greek armor and weapons were also frequently embellished with inlays. With examples to choose from in almost all known types of arms, here we focus on just a few particularly interesting examples. The kneecaps of a pair of greaves found in a tomb at Ruvo in southern Italy, now in the British Museum, are carefully decorated with gorgons, whose eyes, teeth, and tongue are inlaid with ivory. Several examples of this type are known. One example in the Shelby White and Leon Levy Collection, which only represents the head of the gorgon on the kneecap, has amber inlays for the pupils set into whites made of bone or ivory.[[19]](#endnote-19) A bronze pectoral from a horse’s armor, found in another tomb in Ruvo, exhibits ivory inlays for the gorgon’s eyes, mouth, and fangs, which are particularly well preserved.[[20]](#endnote-20)

A Late Archaic spear butt (**fig. 14.7**) in the Metropolitan Museum’s collection exhibits evidence of a decorative inlay at the end of the shaft.[[21]](#endnote-21) Narrow bands are inset on either side of an ivy motif (**fig. 14.8**). The spear butt bears an inscription identifying it as a dedication at a sanctuary. Analysis of the inscription shows no indication of inlay. However, XRF analysis of the bands and the ivy inlay show compositional differences in their corrosion products, although not the elements that one would expect from a different metal inlay such as silver, gold, or lead. Evidence of a higher content of copper and zinc and a lower content of tin when compared to the main corroded alloy of the spear butt may indicate a different copper alloy used as an inlay, or possibly an organic filling. A Corinthian helmet excavated at Olympia (dated to ca. 650–545 BC) in the collection of the Olympia Archaeological Museum also exhibits carefully executed bands of inlay along its outer edge; most of the silver inlay is preserved *in situ*.[[22]](#endnote-22)

One of the best preserved and most important Archaic bronzes in the Metropolitan Museum of Art’s collection is the chariot from the tomb of an Etruscan noble discovered in 1902 in Monteleone.[[23]](#endnote-23) The chariot was re-examined in great detail in preparation for installation in its newly restored form in 2007. A major study of the object by Adriana Emiliozzi was published in 2011 in the *MMA Journal*, incorporating a great deal of technical and scientific analysis undertaken in collaboration with the Met’s team of conservators and research scientists.[[24]](#endnote-24) In her article, Emiliozzi makes a strong case for identifying the chariot as the work of an East Greek artisan; she also elucidated how this spectacular chariot features a large number of inlays especially of ivory, from both elephant and hippopotamus. The eyes of many of the figures on the chariot are hollowed out to receive inlay, including the figures on the main panel,[[25]](#endnote-25) the eagle’s head that caps the chariot pole, and the boar’s head that was part of the attachment between the pole and the chariot carriage. The boar’s tusks are made of hippopotamus ivory and are quite well preserved.[[26]](#endnote-26)

The main relief panel of the chariot was singled out for particular embellishment with inlay. The eyes of the main figures, Thetis presenting the armor to Achilles, are hollowed out to receive inlay. Likewise, the shield of Achilles, which occupies the center of the scene was elaborately inlaid, particularly the eyes and mouth of the gorgon and the eyes of the panther; some of the original inlays, such as the gorgon’s tongue and one of the panther’s eyes, are preserved. The effect of the gorgon’s head would have been much like the horse pectoral from Ruvo discussed above. The same design, but done with incision, appears on one of the chariot’s side panels, where Achilles’s shield is also represented as he battles the Ethiopian King Memnon.[[27]](#endnote-27) Fragments of ivory inlays were also found that belonged to the main panel and were used to fill the spaces around the figures and in the shield’s lateral cutouts. Further, less elaborate ivory inlays appointed the side panels and other parts of the carriage. The overall effect of this sumptuous polychrome display, combined with the superlative metalwork, must have made this parade chariot a prized showpiece.

In conclusion, it is apparent that inlays were used on Greek bronzes from very early on and many of the types of inlay that exist in later periods are already evident by the Archaic period. Special prominence was given to inlaying eyes. In this paper alone, we have seen the inlaying of eyes belonging to humans, deities, mythical creatures, animals, and birds. Often the inlays are no longer preserved but scientific analysis can sometimes help determine the nature of inlays that appear missing to the naked eye. Figural sculpture and decorative elements of vessels, armor, weapons, and a variety of bronze reliefs were sometimes richly inlaid with various materials of contrasting colors to enhance their appearance. It is evident that inlaying was a favored technique, in addition to careful modeling and incised details, for embellishing the finest Archaic bronzes. Further chromatic variations were sometimes made by the overlaying of contrasting metals such as silver or copper. This paper presents a small sample focusing on examples from the collection of the Metropolitan Museum of Art but future investigations combining careful archaeological research with scientific examination of other existing collections promises to further our knowledge of this interesting aspect of ancient bronze work.

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[A-head]Acknowledgments

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2. See, for example, Betancourt 2007, 145–46; Hemingway 2014, 34; Andreadaki-Vlazaki and Balaska 2014, 66, no. 37. [↑](#endnote-ref-2)
3. Giumlia-Mair 2013. [↑](#endnote-ref-3)
4. Padgett 2004, 133–36, no. 13; Picón et al. 2007, 50 and 415, no. 33; Paris, Sotari, and Giustozzi 2014, 187–91, no. 1. [↑](#endnote-ref-4)
5. See Born 2010, 145 and 150, fig. 14. [↑](#endnote-ref-5)
6. Zimmerman 1989; Andrews 1994. [↑](#endnote-ref-6)
7. See Valavanis 2004, 39, 176–78, fig. 236. [↑](#endnote-ref-7)
8. See Mattusch 1988, 42–44, figs. 3.11–12. [↑](#endnote-ref-8)
9. Lie and Bewer 2014, 59–60. [↑](#endnote-ref-9)
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19. Bothmer 1990, 110–11, no. 91. [↑](#endnote-ref-19)
20. Paris et al. 2014, 164–65, no. 4. [↑](#endnote-ref-20)
21. Richter 1939, 146–47, fig. 3; Picón et al. 2007, 91, 424, no. 99. [↑](#endnote-ref-21)
22. Valavanis 2004, 52–53, fig. 54. [↑](#endnote-ref-22)
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24. Emiliozzi 2001. [↑](#endnote-ref-24)
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