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Why Bronze?

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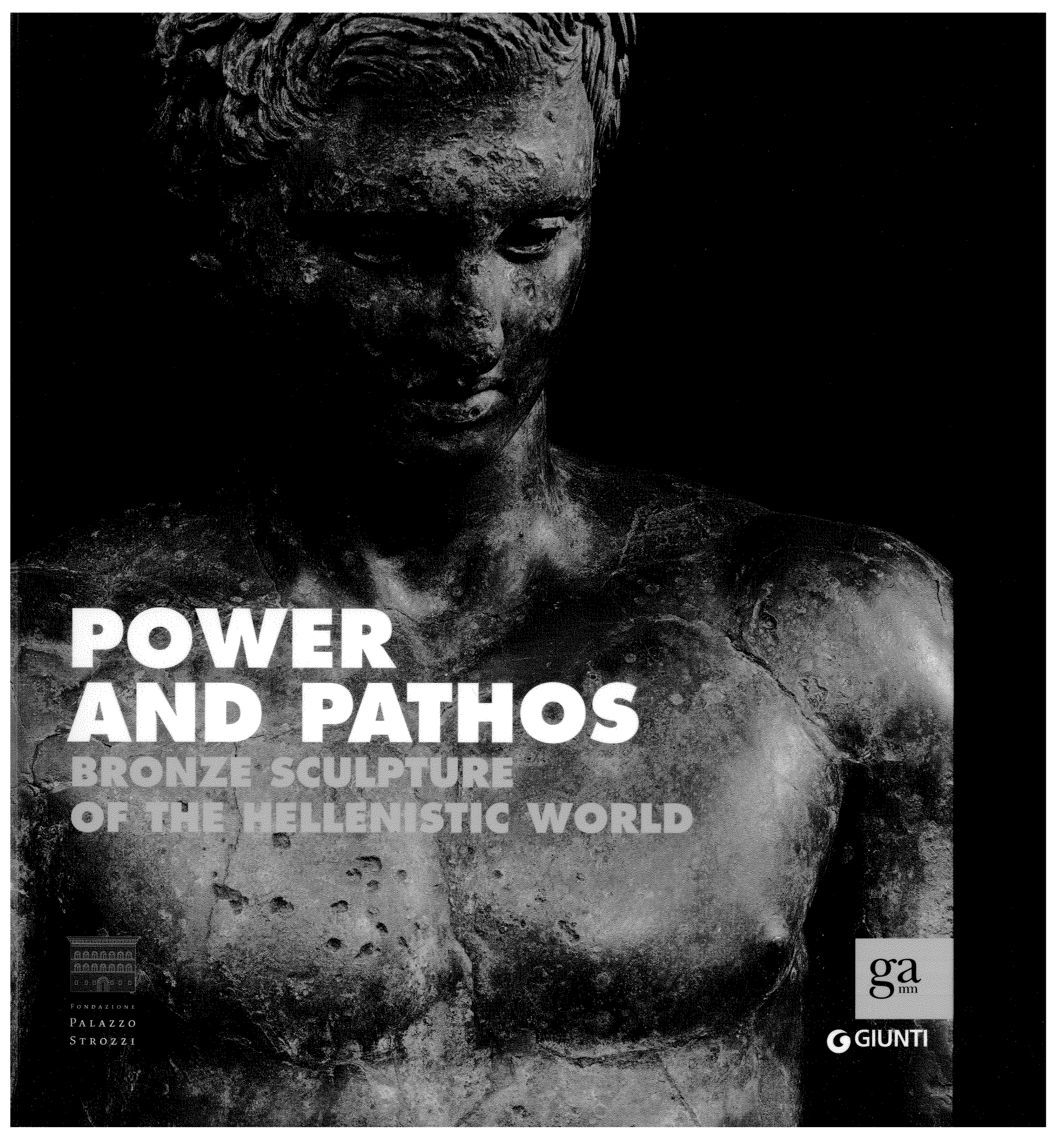
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**POWER
AND PATHOS**
BRONZE SCULPTURE
OF THE HELLENISTIC WORLD



FONDAZIONE
PALAZZO
STROZZI

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POWER AND PATHOS

BRONZE SCULPTURE OF THE HELLENISTIC WORLD

EDITED BY JENS M. DAEHNER
AND KENNETH LAPATIN



FONDAZIONE
PALAZZO
STROZZI

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WHY BRONZE?

ANDREW STEWART

Mythology of a Metal

In ancient Greece, bronze had a unique status. It was the metal from which the men that had preceded the heroes were made, and the one that both gods and heroes had overwhelmingly employed for everything from palaces and fortifications to chariots, armor, weapons, vessels, tools, utensils, and even jewelry. It was also the standard of value against which all other metals and commodities were rated.¹

Homer and Hesiod, the first epic poets of Iron Age Greece, codified the mythology and status of bronze for the rest of antiquity. For the *Iliad*, *Odyssey*, *Theogony*, and *Works and Days* defined the three complementary and interlocking life-worlds of the ancient Greeks: the heroic, the divine, and the quotidian, respectively. Together, these poems' unique prestige and "sky-high" fame (*Odyssey* 8.74); nostalgia for the lost glories of the Heroic (i.e., Bronze) Age; and the strongly revivalist temper of the Greek eighth-century "renaissance" guaranteed the centrality of bronze for all time in the ancient Greek – and Roman – imaginary.

In his *Works and Days*, Hesiod told the myth of the Bronze Men – though as he admits (106), the story itself was traditional and must have been invented centuries earlier. Created by Zeus as the third in

a series of five "races" (preceded by Gold and Silver Men, and succeeded by the heroes and the poet's own Iron Age contemporaries), these Bronze Men were born of ash trees, and were rough, brutal, and violent (140–55). They worshiped the war god Ares (whose standard epithet is "brazen") and dedicated themselves completely and solely to battle. Their armor was bronze, and their houses and implements too; hunter-gatherers, they knew nothing of bread. Implacable fighters, they eventually exterminated each other and passed nameless into the House of Hades. Once one is aware of all this, it is difficult to look at Greek bronzes such as the spectacularly rugged killer of figures 2.1 and 2.2 in quite the same way again.

Homer, supposedly Hesiod's contemporary, invests his heroes with some of these traits. Mentioning bronze and its cognates no fewer than four hundred thirty-eight times, he occasionally calls heroes "brazen-hearted" or "brazen-souled," but otherwise is concerned mostly with arms and armor. His spears and swords are "sharp," "stubborn," "clanging," "indestructible," and "pitiless;" they and the armor of their "bronze-clad" owners are "ruddy," "variegated," "bright," "shining," "shimmering," "flashing," "gleaming," and "glittering." Given Greek epic's clear Indo-European roots and its close

2.1
Head of Warrior A from Riace Marina
(see fig. 2.2).

poetic, thematic, and material links with the Near East, it is no coincidence that this “aesthetics of radiance” flourished in Syria and Mesopotamia as well.²

So when Achilles takes up the new inlaid bronze shield that Hephaistos had made him, it shines like the moon, and its light shoots up into the sky like a blazing fire high in the mountains. Hefting it, and encased in his new bronze armor (fig. 2.3), Achilles is “hard” and “brilliant,” “shining like the sun when he crosses above us” (*Iliad* 19.362-403). To Homer, then, bronze is the most prestigious and useful of metals, and the Achaeans’ standard of value. Witness his oft-repeated mantra, “treasures of bronze, of gold, and of iron, laborious metal” (*Iliad* 6.48, 10.315, 379, 11.133, 23.549; *Odyssey* 2.338, 21.10), and another favorite epithet of his for it, “useful to men.”

Yet neither poet tells us who discovered bronze and why. Hesiod dutifully records the birth of the smith-god and divine craftsman, Hephaistos; his marriage to Aglaia, youngest of the Graces; and the success of the first human craftsman, Prometheus, in stealing fire from Zeus (*Theogony* 927-9, 945-6; *Works and Days* 42-59), but nothing more. To Homer, Hephaistos (whose wife is now Charis, Grace herself: *Iliad* 18.382-3) both owns fire and metonymically stands for it (*Iliad* 2.426, 9.468, etc.), and the scenes he embosses upon Achilles’ brazen shield encompass both the entire universe, including heaven, earth, and encircling Ocean, and the gamut of costly inlays: gold, silver, tin, and enamel (*Iliad* 18.468-617).³

Later writers, drawing on local legends rather than these Panhellenic ones, had somewhat more to offer. Prime candidates were two shadowy families of sorcerers and magicians, the Rhodian Telchines and Cretan Daktyloi. The Telchines were “the first to work iron and bronze” according to one Augustan-period writer and “the first to make images of the gods” according to another.⁴ The Daktyloi, local demigods supposedly dwelling around Mount Ida, were equally inventive and versatile.⁵ Though all this must come from earlier, local sources, these later compilers were far more interested in the families’ other adventures than in their metallurgical skills. A major Bronze Age center and the easternmost of the Aegean islands, Rhodes was the closest to copper-rich Cyprus and the Near East; and Crete probably was settled from Cyprus and Syria and always maintained close ties with them.

Aesthetics

Bronze is hard, strong, resilient, and flexible, and a body made of it (fig. 2.2) naturally takes on some or all of these attributes in the

observer’s mind – especially if s/he knows or suspects that it is hollow cast, so that its metal envelope assumes the role of human skin. But, as Homer’s epithets emphatically suggest, its aesthetic appeal is equally if not more a function of its finish, where not one but three factors are at issue: tooling, patina, and polychromy.

First, *tooling*. There is debate about how much cold work, as tooling after casting is called, was done on Greek statues. Some believe that much of their fine surface detail was cut with the chisel at this stage. Others argue that most of it was already present on the sculptor’s wax-coated model and thus in the clay piece-molds taken from it; that Greek investment clays were quite fine enough to transmit such detail from wax to bronze; and that after casting, only a simple cleanup with a fine-pointed tracing tool was needed to make it presentable. Possibly, too, the techniques of large and small bronzes diverged at this point, and the former were cold-worked less extensively than the latter. As far as these big ones are concerned, technical evidence currently seems to favor the skeptics. A careful examination of Riace statue A (figs. 2.1-2), for example, has revealed no evidence of cold chiseling but plenty of the tracer.⁶

Tooling creates textures and contrasts: rough/smooth; even/uneven; regular/irregular; sharp/blunt; ridged/striated; jagged/curvy; bright/shadowed; tinted/toned; and so on. It thereby engages the most direct and least analyzed of our senses, namely touch.⁷ Touch is the grounding sense, the sense of tangibility that places us in the world, producing sensations of texture, weight, and resistance. Aristotle, for one, had no doubts about this. He regarded it as “the first, essential factor of sensation . . . existing apart from all the other senses . . . and the most indispensable” of them. In fact,

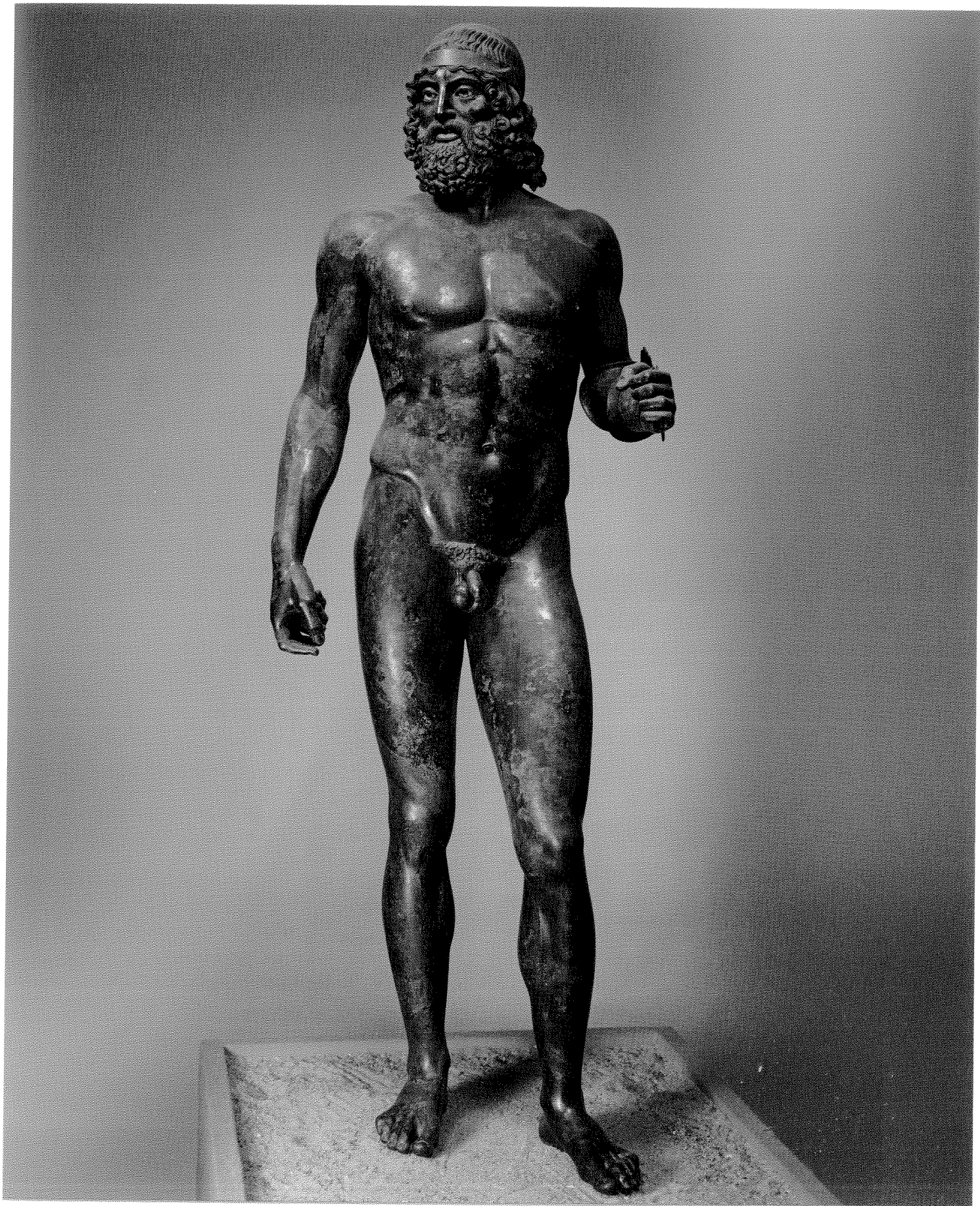
. . . touch reaches in man the maximum of discriminative accuracy. While in respect of all the other senses we fall below many species of animals, in respect of touch we far excel all other species in exactness of discrimination. That is why man is the most intelligent of all animals.⁸

So by tooling and texturing his statue’s surface, the sculptor invites the viewer to become the toucher.

Though these surface details (however finished) are often called naturalistic, in one important respect quite the reverse is true, for most of the marks thus produced do not characterize the real-life anatomy of the bodies of humans and animals. Instead, they declare themselves as autonomous signs *both* for that anatomy *and* for the

2.2

Statue A from the Mediterranean Sea off Riace Marina, c. 460 BC. Bronze, h 198 cm. Reggio Calabria, Museo Archeologico Nazionale, inv. no. 12801.





2.3
Archaic hoplite from Dodona, 525-
500 BC. Bronze, h 12.8 cm. Berlin,
Staatliche Museen, Antikensammlung,
inv. no. Misc. 7470.

labored process of its translation into metal by the artist. They are visible actions, documenting both the thrust of the sculptor's desire and his discriminating intelligence. Simultaneously iconic (representations of reality) and indexical (physical traces of his handiwork), they derive much of their power from our appreciation of his artifice.

As to *patina*, newly cast bronze varies in hue according to the amount of tin or lead it contains. The greater the amount, the more its color shades from auburn to a golden brown (fig. 2.4), duller if leaded.⁹ Yet as the alloy oxidizes in the open air, it soon turns red-brown or even black; the rich greens and occasional blues and reds that so attract modern collectors are due to later corrosion through burial in the soil. Both Greeks and Romans were well aware of this process, and soon devised methods to protect their statues from it, often coating them with an artificial patina of lacquer, olive oil, and/or natural resin. Also, Hellenistic inscriptions occasionally mention the periodic removal of accrued patinas, dirt, scale, and encrustation (for an example, see below).¹⁰

These coatings bring us to artificially *applied* patinas. The black ones that now cover many ancient bronzes are modern and Renaissance-influenced, caused by the crude and fortunately now obsolete restorer's practices of lacquering them or passing them through fire to inhibit corrosion. Electrochemical cleaning is worse and even more frowned upon, for it brutally strips off the ancient surface and substitutes a bright, brassy color.¹¹ As a result, the original appearance of many ancient bronzes, especially those discovered long ago, is difficult if not impossible to discover.

Compounding the problem, no contemporary Greek source describes the color(s) they favored. Though it is often assumed that they liked the gleaming orange-red of their typical, roughly 9:1 copper-tin alloys, several bronze vessels from the now famous sealed and unlooted Macedonian royal tombs at Vergina had a bright golden patina upon discovery.¹² The Romans also prized Greek bronzes of this color, and note that Corinthian bronze, a late Hellenistic invention and the most prized alloy of all, was blended with gold, silver, or both, tinting the bronze white, yellow, and black accordingly.¹³

Some Greek virtuosi, we are told, even used such alloys to create ephemeral effects such as a blush of shame (rust) or the pallor of death (silver). Suggestively in this context, recent cleaning shows that the Terme Boxer (cat. 18) has a bruise of darker bronze discreetly inserted below his right eye.¹⁴ These sources also speak of bronzes that "wore the colors of life," of some that imitated the tanned flesh



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2.4
Krater from Derveni (Macedonia),
375-350 BC. Bronze, h 90.5 cm.
Thessaloniki, Archaeological
Museum, inv. no. B 1.

of an athlete's body, of "liverish" brown ones, of black ones artificially patinated through burning or the application of black lacquer, even of a group at Delphi that was deep blue – though supposedly this was caused by the site's unique microclimate.¹⁵

Bronze bruises and silver teeth lead us, finally, to *polychromy*. Since the Greeks enjoyed *poikilia* (variegation) in their sculpture and other arts and crafts, they made numerous polychrome additions to their bronzes. Riace A (figs. 2.1-2) has silver-clad teeth; copper eyelashes, lips, and nipples; tear ducts inlaid with red stone; and stone eyeballs. Probably, too, his irises and pupils were of semiprecious stone or colored glass. He also carried a bronze spear, (inlaid?) shield, and probably a helmet too (some, preserved, are inlaid in silver). Other bronzes exhibit a similar variety of inlays, including enameled shield devices, silvered headbands and fingernails, marble or bone pupils, copper eyebrows, and copper blood streaming from wounds. Some were wholly or partially gilded, using hammered gold foil or gold leaf. And if such additions were impracticable or too expensive, paint was always a last resort.¹⁶

All these supplementary materials had their own histories and particular associations. Gold, for example, shining and incorruptible, was the color of the gods and the first "race" of men, and together with silver, tin, and enamel had been used by Hephaistos to inlay Achilles' shield (*Iliad* 18.468-617). Like the cold work described above, they stood not only as signs for reality but also for the sculptor's skill-at-hand or *technē*. Suspending us between artifice and representation, between the means and the goal of *mimēsis*, they invite us to appreciate them on their own account whilst savoring the heightened expressiveness of the figure thus enhanced. One can easily imagine the reflected light streaming off the smooth, polished skin of the warrior of fig. 2.2, glancing from his silver teeth, and reflecting off his minutely traced hair. Thus, as Euripides noted, the brilliance of such bronzes simply reflected that of their subjects, whether heroes, warriors, or (cat. 12), "athletes lambent in youth that lounge like living statues about the city."¹⁷

All these techniques – tooling, patination, and polychromy – have one thing in common. They reflect *light*. Differential tooling creates facets and textures that break up the light and reflect it kaleidoscopically and *diffusely*; acquired or applied patinas create surfaces ranging from matt to shiny, that when smooth and glossy (expanses of flesh or armor, for example) produce *specular* reflections of different colors and intensities; and inlaid or applied materials create variegated *polychromatic* reflections that are either diffuse or specular

depending upon their own tooling, patinas, and refractive indexes. Moreover – enriching these effects still further – the contrast between specular shininess and the more diffuse light of the surrounding surfaces creates *luster* or "contrast gloss:" gleaming specular highlights that flash and dazzle the roving eye like searchlight beams.¹⁸ As Richard Neer has observed:

That the Greeks valued this quality is clear from the fact that they were willing to spend money to attain it. Although Archaic and Classical bronze-casters often included lead in statuettes, for example, for larger figures they employed a pure alloy of copper and tin. This material is more expensive and more difficult to work than leaded bronze, but it takes a significantly brighter finish. Later Hellenistic and Roman sculptors gradually abandoned the practice and used lead in all their statues, large and small. These figures are, literally, "leaden" by comparison. The metal is duller. The Classical sculptors had every incentive to use lead, and they knew how to do so. That they did not implies that surface brilliance was an overriding goal.¹⁹

So we have come full circle, back to Homer's spectacular arsenal of lustrous epithets ("bright," "shining," "shimmering," "flashing," "gleaming," "glittering," and so on), and especially to Achilles' brilliantly inlaid shield, "shining like the moon" and gleaming "like a blazing fire high in the mountains," making its owner appear "hard" and "brilliant," "shining like the sun when he crosses above us" (*Iliad* 19.362-403).

Hellenistic Materials and Hierarchies

By the Hellenistic period, a broad (but not universal) consensus had emerged that bronze was the proper material for statues of humans, especially portraits (honorary and votive) and athletic victor statues; and marble for cult statues of the gods and of deified mortals such as (if appropriate) the kings. Marble also remained the universal medium for architectural, funerary, and domestic sculpture. Votive statues of the gods could be of either material. As to sculptors, some were all-rounders. Praxiteles, for example, though famously better in marble,²⁰ made bronzes of both gods and mortals and developed a lucrative sideline in bronzes of priestesses and devotees of the Eleusinian cult.²¹ Others, however, specialized in one medium or the other. Hellenistic inscriptions and lists of famous sculptors often distinguish *agalmatopoioi* (makers of gods or deified mortals, usually in marble) from *andriantopoioi* (makers of humans, always in bronze).²²

No ancient source explains why, but since these distinctions evidently were important, producing a clear hierarchy of materials and thus of craft specializations, a conjecture or two is hard to resist.²³

Marble – white, sparking, and radiant – is the shining stone: the Greek word *marmaros* derives from the verb *marmairein*, to shine or sparkle, “a wonder to see.” To quote Neer again, “the Greeks positively valued glitter and glow in their artworks, and marble has few rivals in this regard.”²⁴ Yet apropos the particular genres listed above, one must still ask, “Why marble?” Possible reasons are, first, that it is a natural material and bronze is an artificial one; second, that it is rock – the basic, primordial substrate of our world (in rocky, mountainous Greece, an inescapable fact) in its purest form; and third, that it is incorruptible (since it cannot be melted down, alloyed, or reconstituted) and thus *prima facie* imperishable and eternal. It is therefore particularly appropriate for deities and the deified, and (as a chthonic substance *par excellence*) for memorializing the dead.

Greek religious practice offers some support for these ideas. Worshiping the gods in the form of natural materials such as rocks, stones, trees, and water had deep roots in Greece, where these natural, aniconic foci of worship were ubiquitous. The Thespians, for example, revered Eros in the form of an unworked stone, and around 350 BC commissioned Praxiteles to make a marble statue of the god to accompany it; Zeus spoke from the oaks at Dodona; the Thebans venerated a log fallen from heaven as Dionysos Kadmos; the Athenians worshiped the Kephisos and Ilissos rivers; and so on.²⁵ And at Lykosoura, supposedly the oldest city in the world, the locals showed the pious but normally skeptical Pausanias a colossal marble cult group of Artemis, Demeter, Despoina (“Mistress”), and the giant Anytos (fig. 2.5) by the Hellenistic sculptor Damophon of Messene, and in complete defiance of probability and his own eyes, he revealingly remarked:

The images of Despoina and Demeter, the throne they sit on, and their footstool, are all of one single stone. No part of the drapery or any of the parts carved around the throne is clamped to another stone by iron or cement; instead, everything is made from a single piece of stone. They did not import this stone but say that after a vision in a dream they dug into the earth within the sanctuary and found it there.²⁶

As to bronze, although its constituent materials (copper, tin, lead, and so on) are natural, it is itself an artificial alloy, relatively eas-

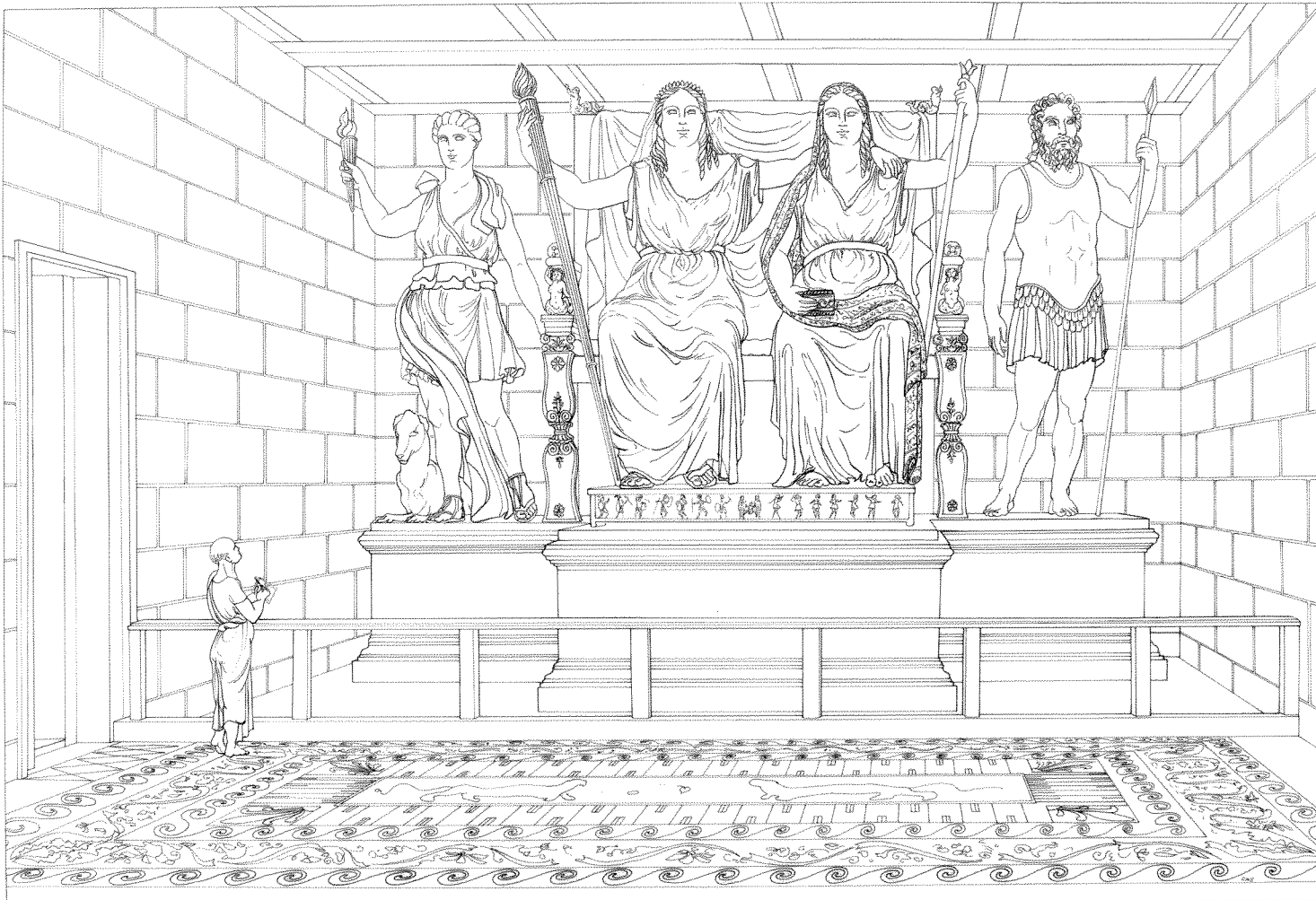
ily created, destroyed, or corrupted (e.g., by adding rust for a blush of shame; silver for the pallor of death; and so on, as mentioned previously: cat. 18), and thus falls short on several grounds.²⁷ Yet by the same token, precisely *because* it is artificial and relatively easily shaped to human desires, it is perfect for the very subjective enterprise of making an image or “likeness” (*eikōn*) of an individual person, living or dead. And by the Hellenistic period such likenesses, whether decreed by cities to honor prominent benefactors (*euergetai*) and the powerful, or by individuals for these and other reasons, had become immensely popular, especially in Greece, the Aegean, and Asia Minor.²⁸

In support, the countless Hellenistic inscriptions awarding these individuals with honorary portrait statues never specify a bronze statue (*andrias*) as such but always a bronze “likeness” (*eikōn*).²⁹ Indeed some inscriptions explicitly distinguish the two. One from Erythrai in Asia Minor even does so twice, in the context of the restoration of a bronze of a certain Philites, a democrat, symbolically bereft of its sword by a revolutionary clique no longer in power. Introducing the clique’s target as Philites’ “likeness” (*eikōn*), the decree describes their removal of the sword from his statue (*andrias*), and resolves to replace it. A rider then appropriates money for a restorer, repeating the two terms. It also specifies that the restorer leave the statue (*andrias* again) clean and “shining” (*lampros*) – in other words, exactly like Euripides’ “athletes lambent (*lamproi*) in youth that lounge like living statues about the city.”³⁰

Economics³¹

It is important to understand, first, that Greek sculptors competed for commissions, and second, that during the period in question, an assortment of texts shows that honorary portrait bronzes were quite uniformly priced. (Bronzes of the gods, cat. 21, 24, also made on commission, probably were pricier, but no figures survive.) Cities budgeted around three thousand drachmas (dr.) or half a talent for a (probably somewhat over life-size) statue in the fourth-third centuries, but apparently only around two thousand dr. in the second-first.³²

For comparison, the kings and their courtiers were fabulously wealthy; the Athenian equivalents of the One Percent had annual incomes of 1500 dr. or above; when paid by the day (a rarity), skilled laborers earned only one to two and a half dr.;³³ a suit of armor and weapons cost three to five hundred dr.; building a trireme (war galley) cost ten talents; and funding its gear and two-hundred-man crew for a



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2.5
 Reconstruction by Candace Smith
 and Andrew Stewart of Damophon
 of Messene's marble cult group of
 Artemis, Demeter, Despoina, and
 Anytos at Lykosoura (Arkadia),
 c. 200 BC, h of ensemble, c. 5.7 m.

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year's worth of practice days cost another talent. So a bronze honorary statue was a significant but not ruinous outlay for the client, and securing a commission for one was a major coup for a sculptor.

As to prices and profits, these lump-sum payments would also cover all likely expenses (including the brick-lined casting pit, fuel, materials, transport, labor, per diem, stone for the base, and cutting the inscription), since estimating, contracting, and paying for these were best left to the experienced sculptor-contractor, who would also bear the burden of any missteps.³⁴ Moreover, competition of this sort tends to keep prices low and even – witness the figures below – to drive them down.

Yet complications abound. These later Hellenistic inscriptions number only half a dozen and come from different locales.³⁵ The drachma varied in value from one monetary zone to another, and on the single occasion where the statues' size is noted, they are an impressive seven and a half feet tall but still cost only 2000 dr. each; the others range from 1750 to over 3000 dr. So the decline in question may have been unevenly distributed across the Hellenistic world, or may be overstated or simply illusory. As a result, the following paragraphs aim to show only that whatever the truth, and estimating expenses generously, these commissions were both very profitable to begin with and remained reasonably so throughout the period.

If trustworthy, this apparent 33% price decline suggests that these statues were priced probably by “poundage,” as in Roman times and often today: a generally accepted formula based on the cost per pound or *mina* of the metal required, the statue's size, and the portraitist's anticipated expenses and profits.³⁶ It thus caters to time and effort in the same way as pricing a marble sculpture by block size or a painting by the figure.³⁷ For after 200 BC, the walls of these bronzes were often thinner also by a third (averaging around 3 mm thick instead of 4-5 mm), proportionately reducing the amount of metal required, and thus their price to the consumer.³⁸ In turn, such matching decreases on *both* sides of the equation would indicate that the pricing formula itself – the actual poundage *rate* for such bronzes – remained the same throughout the period.

Under such a system, cutting costs in this manner was the *only* way in which bolder and more skillful sculptors could decisively undercut the bids of their less accomplished rivals. Yet squeezing the molds also greatly increased the risk of the molten metal cool-

ing during the pour, hardening, and failing to fill them completely, forcing one to patch one's statue or even to melt it down and start over. The price tag: a whole new set of molds, another load of fuel, much extra time and money, and serious loss of face and profits.³⁹ Hence, presumably, the startling decrease in the amount of tin and simultaneous increase in the amount of lead in these alloys, from mere traces in the fifth-fourth centuries to 10-15% in the second-first. It was far cheaper than tin and more ductile.⁴⁰ (Though which came first, the chicken or the egg?) And hence, too, the rising popularity of gilding during the same period, for it was relatively cheap, robust, and restored the surface brilliance lost thereby.⁴¹

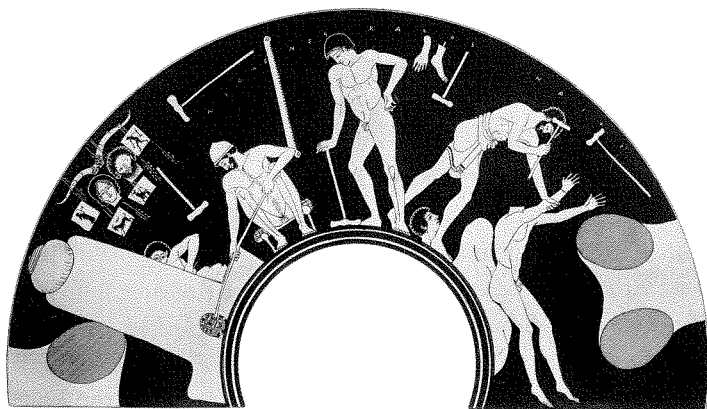
So much for generalities: what of the details?

A six-and-a-half feet or two meter (or 6 1/2 feet or 2 m high) high bronze of a naked man with walls from 4 to 5 mm thick weighs around 210 lbs./minas.⁴² Factoring in accessories such as sandals, clothing, crown, scroll, sword, and/or spear, and estimating generously, its weight might reach 250 minas. Pricing such a statue at 3000 dr. would therefore represent a poundage rate of twelve dr. per mina. (Individual variations on this price recorded in the inscriptions must reflect variations in scale and/or the number and type of accessories included.) Yet under this same formula, as we have seen, by thinning the statue's walls to only 3 mm and thus its weight to ca. 140 minas naked or ca. 166 minas with accessories, a skilled practitioner could save his client a full 33%, or 1000 dr.: *prima facie* an adroit move indeed. It did not, however, come cost free, for the metal represented only part of his expenses. Since the rest of them – mostly driven by the statue's *size*, not its weight – had changed hardly if at all, his profits would take a substantial hit.

Now, since two Delian inscriptions show that in the 290s and 280s bronze was sold there for around one dr. one-two obols per mina, the bronze for a 250-mina statue would have cost around 290-330 dr., local price spikes apart. By the later second century, though, the bronze silver ratio had declined somewhat, dropping the alloy's floor price by up to 33%.⁴³ This windfall, together with the weight savings mentioned earlier, could have cut one's metal budget by up to 50%. Adding a generous estimate of ca. 450 dr. for incidentals, and reckoning about three months from start to finish, we arrive at around 2200 dr. profit per statue in the early Hellenistic period and ca. 1350 dr. later on.⁴⁴

To summarize:

Date	Price	Walls	Lead	Ductility	Gloss	Reflectivity	Gilding	Expenses	Profit
4 th -3 rd cent.	3,000 dr.	4-5 mm	<1%	Fair	Bright	High	Rare	c. 800 dr.	c. 2200 dr.?
2 nd -1 st cent.	2,000 dr.	2-3 mm	>5-15%	Good	Duller	Lower	Frequent	c. 650 dr.	c. 1350 dr.?



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2.6
Athenian red-figured cup from Vulci by the Foundry Painter, showing (tondo) Hephaistos, Athena, and the arms of Achilles; and (sides A-B) a bronze foundry, c. 480 BC. Diam. 30.5 cm. Berlin, Staatliche Museen, Antikensammlung, inv. no. 2294.

Did the maestro take half or even two-thirds of this and leave the balance for his assistants (apprentices and slaves excluded), as in the Renaissance? One can easily imagine virtuosi such as Praxiteles and Lysippos both happily reaping their profits and schooling their sons (all of whom would become distinguished bronze sculptors) in this way.⁴⁵

No wonder these fourth-century giants were rich and their Athenian contemporaries turned so readily to portraiture in bronze when the marble gravestones were banned in 317 BC. As to their late Hellenistic successors, were their profits really squeezed so heavily? And if they were, did they somehow manage to economize even further? As mentioned earlier, substituting lead for tin would have helped, since it was far cheaper and easier to obtain, but so too would using recycled bronze scrap, speeding up production, replacing profit-sharing free workers with slaves, taking on more commissions, and achieving economies of scale. If all this sounds very modern, *plus ça change*. Like contemporary capitalism, the ancient Greek contest system operated by its own harsh rules and sometimes brought unintended consequences.

Other evidence suggests that the better Hellenistic bronze sculptors were indeed affluent. At Athens, the versatile Praxiteles clan maintained its wealth for several generations, while around 280, the Athenian Telesinos, also an all-rounder, both donated two statues (a marble and a bronze) to the Asklepieion at Delos and restored all the others in the sanctuary free of charge.⁴⁶ Around 200 Damophon of Messene, the author of the marble cult group of fig. 2.5 but also expert in bronze, was rich enough to forgive the city of Lykosoura's debt to him of 14,184 dr., or over two and one-third talents, a huge sum owed over and above his contract price because of some violation on the city's part. (Unfortunately, both the details of the infraction and the price itself are lost.)⁴⁷ A generous donor to his native city of his time and sculptures, he may also have dedicated bronzes of his two daughters to Demeter and Korē as "basket-bearers" (*kanēphoroi*) in her cult at Megalopolis in Arkadia.⁴⁸ Back at Athens, the Polykles family, twice named in Pliny's notorious list of the "inferiors" who supposedly revived the art of bronze casting in 156 BC, also excelled in marble and won major commissions at Rome, earning enough to become socially and politically prominent at home.⁴⁹

Finally, sculptors' dedications are more common than previously (e.g., Damophon's, above), and one, at least, was sumptuous: a colossal ten-figure marble group dedicated at Athens around 120 BC by Euboulides, a prolific portraitist in bronze, of which two pieces and his signature survive.⁵⁰ Evidently, with skill, good luck, and good management, Hellenistic bronzework could be both a goldmine for sculptors and a good bargain for their clients.

2.7
Mark
Bronze
Unive
Photo



2.7

Mark Twain, by Gary Price, 2002.
Bronze, h 132 cm. Doe Library,
University of California at Berkeley.
Photo: Erin Babnik.

Notes

¹ Van Driessche 2009, 31-3, 35, 78-9, 114. Parts of this essay are updated from Stewart 1996, 47-56, with significant address to Neer 2010, 72-83. Its final section revises and replaces Stewart 1979, 113, n. 31 and Stewart 1990, 67. I thank Kenneth Lapatin and Jens Daehner for inviting me to contribute it, thereby affording me the pleasure of revisiting and revising my earlier work on the subject; Chris Hallett for reading and commenting on a draft; Jelle Stoop for alerting me to inscriptions I had overlooked; Richard Neer, Kristen Seaman, and lecture audiences in Berkeley and Chicago for their encouraging comments; Beate Fricke and Elizabeth Honig for help with Medieval, Renaissance, and Baroque comparanda; and bronze sculptor Gary Price (<http://www.garyleeprice.com/>) for generous help with technical and production questions.

² Winter 1994; Winter 1999; see also Morris 1992; Neer 2010, 74.

³ See most recently D'Acunto 2009.

⁴ Strabo 14.2.7; Diodoros Siculus 5.55.1-2, etc.; Blakely 2006.

⁵ Diodoros Siculus 5.64.3-5; Scholiast to Apollonios of Rhodes, *Argonautika* 1.1126, 1129; etc.

⁶ Haynes 1992, 61.

⁷ But see most recently Bacci and Melcher (eds.) 2013, especially the essays (chapters 3-7) by Geraldine Johnson, Charles Spence, Rosalyn Driscoll, Elio Franzini, and Francesca Bacci; cf. also Hermann 2006.

⁸ *De Anima* 2.2, 413b5-8, 414a4; 2.9, 421a20-4.

⁹ The Derveni krater, fig. 2.4, is an excellent example. Often still described erroneously as gold or gilded, its alloy is actually bronze containing 14.88% tin, the maximum amount to achieve this color: Barr-Sharrar 2008, 191 n. 66; cf. Haynes 1992, 84. On leaded bronzes see also Pliny, *NH* 34.8, 15, 98-113, 140; 35.182; with, e.g., Cato, *De agri cultura* 98.2; Dio Chrysostom, *Oratio* 28.3, 289M; Plutarch, *On the Pythian Oracle* 2-4, 395B-6C; id., *Quaestiones convivales* 5.1.2; cf. Mattusch 1988, 98-9; Haynes 1992, 60-1, 85-7, 99-102, 114-6; W.-D. Heilmeyer, in *Das Wrack* 1994, 801-7; Mattusch 1996a, 26-32; and especially the extensive new scientific analyses of the Riace Bronzes, the Terme Boxer, and others by Edilberto Formigli, published with numerous color illustrations in Brinkmann 2013, 265-307. See also Descamps in this volume.

¹⁰ On patinas, colors, and coatings, see Pliny, *NH* 34.8, 15, 98-113, 140; 35.182; with, e.g., Cato, *De agri cultura* 98.2; Dio Chrysostom, *Oratio* 28.3, 289M; Plutarch, *On the Pythian Oracle* 2-4, 395B-6C; id., *Quaestiones convivales* 5.1.2; cf. Mattusch 1988, 98-9; Haynes 1992, 60-1, 85-7, 99-102, 114-6; W.-D. Heilmeyer, in *Das Wrack* 1994, 801-7; Mattusch 1996a, 26-32; and especially the extensive new scientific analyses of the Riace Bronzes, the Terme Boxer, and others by Edilberto Formigli, published with numerous color illustrations in Brinkmann 2013, 265-307. See also Descamps in this volume.

¹¹ On Renaissance patinas, often devised after the antique, see most recently Stone 2011 (I thank Richard Neer for this reference). Electrochemical cleaning: when I became curator of antiquities at the Otago Museum in 1972, I discovered that a European "restorer" had passed through some years earlier and had reduced several of its bronzes to this condition. Fortunately the most important ones were intact: either he had missed them or had been shown the door beforehand.

¹² Yalouris *et al.* 1980, pls. 18-9; the composition of their alloys has not been published.

¹³ Pliny, *NH* 34.6-8; Plutarch, *On the Pythian Oracle* 2-4, 395B-6C; Craddock 1982 and Stapleton *et al.* 1995 reconstruct these alloys' composition.

¹⁴ Formigli 2013a, 268-88, figs. 367-8.

¹⁵ For references, see n. 10, above.

¹⁶ Examples: Haynes 1992, 106-14; Hallett 1995, 141; Brinkmann 2013, 268-88 for a recent collection and analysis, liberally illustrated in color; for Renaissance parallels (so-called "damascene work" or *lavoro alla damascena*) and techniques see Allen 2011; Smith and Sturman 2011.

¹⁷ *Autolykos* fragment 282.10-1 Nauck².

¹⁸ Well understood by ancient connoisseurs: see, e.g., Plutarch, *On the Pythian Oracle* 4, 396C, on "light and luster" (*phōs kai auge*).

¹⁹ Neer 2010, 77. For these late Hellenistic and Roman leaded alloys, see, e.g., Himmelmann 1989, 176-7; Haynes 1992, 87: for example, the Terme "Ruler" contains 89% copper, 8% tin, and 3% lead, and the Boxer (cat. 18) 80% copper, 10% tin, and 10% lead; also Perocco 1979, 181; Pernicka and Eggert 1994, 1054 (Mahdia Eros: average, 70.8% copper, 11.5% tin, and 17.3% lead); Lahusen and Formigli 2001, 471-8; Lahusen and Formigli 2007, 167-70 (Roman bronzes); Bennett 2013, 60: "The [Cleveland Sauroktonos] is composed of approximately 10% tin and between 10% and 15% lead with the remainder consisting of copper." Petriaggi 2003, 68-9 and Michelucci 2006, 116, record quite high but erratic proportions of lead in the Satyr from Mazara del Vallo and Apoxyomenos from Croatia, attributing their wide range to varying degrees of saltwater corrosion of the alloy's other components.

²⁰ Pliny, *NH* 34.69.

²¹ See Stewart 1990, 277-81 for the evidence.

²² See Stewart 1990, 63-4. Terracotta, made from a base, drab material that was abundant everywhere and literally dirt cheap, ranked a distant third: see, e.g., Isokrates, *Antidosis* 2.

²³ Though pediments, metopes, and friezes started life as integral parts of their temples, and the last two of them always remained so.

²⁴ Neer 2010, 74, independently of Stewart 1990, 36, but gracefully acknowledging the latter's priority.

²⁵ Pausanias 9.27.1-4 (Thespieae); 9.12.3-4 (Thebes); Gaifman 2012.

²⁶ Pausanias 8.37.3.

²⁷ As Hesiod understood when in evident contrast to "normal" bronze he described the massive bronze threshold of Tartaros as "immoveable, . . . self-nurtured, and having unending roots" (*Theogony* 811-3).

²⁸ On the genre and its development, see Stewart 1990, 51-2; Ma 2013.

²⁹ Ma 2013, 2.

³⁰ *SIG*² 284; Ma 2013, 306; *Autolykos* fragment 282.10-11 Nauck².

³¹ For a fuller and more comprehensive version of this section, including marble sculpture, see Stewart, forthcoming.

³² Diogenes Laertios 6.2.35; *IG* II².555, etc.; Ma 2013: 245, 257, 264 (table). 6 obols (1 obol = 0.725 g/0.025 oz.) = 1 dr. (4.35 g/0.153 oz.); 100 dr. = 1 mina/pound (435 g/<1 lb.); 60 minas = 1 talent (T: 25.8 kg/57 lbs.). The same weight system was used for all types of metal, including silver, the Greeks' basic currency.

³³ Loomis 1998, 232-9, 240-50, 275-84, 332-4; Feyel 2006, 395-428, though on p. 415 he posits impossibly short carving times for marble sculpture, and his statistics mix apples and oranges, since (pp. 404-5 excepted) he equates payments in Attic drachmas (Athens, Eleusis, Delos) with higher-value Aeginetan ones (Epidauros, Delphi). In fact, the exchange rate was 10:7.

³⁴ *Contra*, implausibly, Ma 2013, 245, 257-8, n. 104; the Knidian decree quoted but not referenced there is (to my knowledge) unique. In fact, the inscriptions show that from the late fifth century onwards, contracts were usually awarded on a piecework basis, often paid in lump-sum installments, evidently for these very reasons: see, e.g., *IG* I³.476, 144-81 (Athens, Erechtheion); IV².1.102, 87-90, 95-7, 109-10 (Epidauros, Asklepieion: see Burford 1969); etc.

³⁵ See Doyen 2012 for the details.

³⁶ For Roman prices, see Doyle 1976, 96 (Diocletian's price edict); Duncan-Jones 1982, 78-9, 126-7, 162-6, nos. 491-549a; Pékary 1985, 13-21; Oliver 1996, 146-7; Højte 2005, 52-6. Diocletian's profit ceiling for a bronze worker (evidently the smiths who smelted and sold the alloy in ingot form, not craftsmen, for one man cannot make a bronze statue or even a bronze bed) was 8% per pound. This is almost identical to the difference between (a) the individual prices for copper and tin recorded on the Hephais-teion inscription of 421/20-416/5 BC (*IG* I³.472, 139-66: 35 dr. and 230 dr. per talent, respectively, giving a base price of 0.91 dr. per mina of smelted bronze for a 9:1 copper-tin alloy); and (b) the fifth-century "poundage" rate of one dr. per mina for raw bronze itself (Le Rider 1994, 29-30; van Driessche 2009, 86-7).

³⁷ E.g., the Erechtheion friezes: *IG* I³.476 lines 144-81; cf. Loomis 1998, 91, 117-9. Paintings: Pliny, *NH* 35.107.

³⁸ See Haynes 1992, 67-8 for a comparative table; also Lahusen and Formigli 2001, 498; Mattusch 2005, 136-8, 333-4; Michelucci 2006, 100. The Getty bronze athlete (cat. 12),

for example, made around 300 BC, has walls only 4 mm thick, weighs about 48-50 kg/110 lbs. without its feet and attributes, and stands 1.515 m/5 ft. tall (Mattusch 1997, 23, 72, 100). Even with its feet, it cannot have exceeded 1.6 m/5¹/₄ ft. in height. The Berlin Praying Boy has walls 3-6 mm thick, weighs 38 kg/84 lbs. without its restored arms, and is 1.28 m/4¹/₂ ft. high (Zimmer and Hackländer 1997, 137). The walls of the Artemision horse and jockey, dated around 150, average only 2.5 and 3 mm thick, respectively (Hemingway 2004, 49, 53); those of the Cleveland Sauroktonos are 2-3 mm thick above its right elbow, and a mere 1-2 mm at its toes (Bennett 2013, 68); and those of the Mahdia Eros average 2 mm thick, though increase to 6-8 mm at stress points such as the bases of the wings (Willer 1994c, 975, 983 n. 4; Willer 1998, 85 n. 22); 1.365 m/4¹/₂ ft. high, it weighs 66 kg/145.5 lbs., but has lost its left thigh. Ma 2013, 258 overlooks this trend and greatly overestimates the cost of the incidentals.

³⁹ See, e.g., Benvenuto Cellini's *Autobiography* ch. 41.

⁴⁰ See n. 19, above; Haynes 1992, 88. The price of tin in the Hellenistic period is unknown, but in the late fifth century it cost a whopping 230 dr. per talent (*IG* F.472 lines 139-66), or almost four dr. per mina. In 269 BC, lead cost only seven dr. per talent, or less than an obol (one-sixth dr.) per mina (*IG* XI.2.203A, 52, 71-2).

⁴¹ I thank Chris Hallett for this insight.

⁴² A fairly typical size: Ma 2013, 250, with references. Greek bronze workers of this period were adept at extrapolating from linear to cubic measures: see Sextus Empiricus, *Adv. Math.* 7.107 (Chares of Lindos, Lysippos's pupil and the author of the Colossus of Rhodes). Weights: see also n. 38, above; Maryon 1956, 74; crosschecked with US ideal Body Mass Index (BMI), Body Surface Area (BSA), and Bronze SAE 620 standards (<<http://www.rush.edu/rumc/page-1108048103230.html>; <http://www.miniwebtool.com/bsa-calculator/>; <http://www.dura-barms.com/bronze/high-tin-bronze/c90300.cfm#physical>>, accessed 11/18/2013). A six-foot high bronze of a naked man with 4.5 mm walls would weigh only 178 lbs.

⁴³ See Murray 1985; Le Rider 1994; Feyel 2006, 169 (Épi 290), 231 (Dél 224, line 298), 232 (Dél 225); and especially van Driessche 2009, 86-90; Doyen 2012, 15, 38-57, 148-50 (105: 1 ca. 300; 125: 1 in the Seleukid Empire; 150: 1 in late 2nd-century Athens, as shown by *IG* II².1013, 29-37), dropping the alloy's floor price per mina to a mere five or even four obols, respectively (five-sixths and two-thirds dr.). Ma 2013, 258 n. 105 wrongly insists that its price *rose* substantially.

⁴⁴ The cost of incidentals is a minefield of unknowns. Fuel and transport were particularly expensive: see Burford 1969, 184-91; Ma 2013, 258. The basic cost of living is shown by the public dole: two obols or one-third dr. per person per day (Loomis 1998, 220-31, 242, 318-20). A workshop probably comprised around six-eight men, including apprentices and slaves: see fig. 2.6 (Berlin 2294: *ARV*² 400/1; *Paralipomena* 370; *Beazley Addenda* 230) with Burford 1972, 62, 78-80; Mattusch 1982; Mattusch 1988, 101-7, 219-40; Zimmer 1990, 170-1; Heilmeyer 2004, 408-9. Livy 36.6, 20 shows that an honorary bronze portrait could be finished within six months (Ma 2013, 248); in 1960s England, received wisdom estimated about three months; Bol 1985, 164, however, argues for an entire year. Conversations with practicing sculptors support the British estimate: thus, Gary Price (see no. 1) recalls three-four months for fig. 2.7 (i.e., working on three-four projects simultaneously per year, for a maximum of three-four hours per day each, and taking time at each stage to ponder: pers. comm. 11/26/13). Since these Hellenistic portraits were highly conventionalized; produced on a quasi-industrial scale (though not serially, re-using the same molds: see Barr-Sharrar 2004, 69-71, against, e.g., Mattusch 1996a; Hemingway 2004, 7-9); and lost time meant lost profits (suggestively, two Hellenistic building contracts specify that workmen are to work the whole day: *ID* 507, lines 13-5; *IG* VII.3073, lines 12-3; Burford 1969, 95, 99), three months seems a reasonable maximum for them. A relatively simple, undraped one such as the Getty bronze (cat. 12) might have taken considerably less. A basic daily room and board of around 2-2¹/₂ dr. per day for the team for 100 days = 200 dr. maximum Room and Bard per statue.

⁴⁵ Pliny, *NH* 34.51, 87; 66, 36.24; Stewart 1990, 295-300; for Renaissance and Baroque practice, see, e.g., Baxandall 1972, 19-20; Baxandall 1980, 315-6; Cavazzini 2008, 60-4.

⁴⁶ Telesinos, *IG* XI.4.514; Stewart 1990, 23, 28, 67, 71, 297, 317, 322.

⁴⁷ *SEG* 41 (1991) no. 332; 49 (1999) no. 423; 51 (2001) no. 466; 52 (2002) no. 425; 54 (2004) no. 452; etc.; Themelis 1996; Sève 2008; Platt 2011, 125-34.

⁴⁸ Paus. 8.31.2, also noting an alternative identification.

⁴⁹ Pliny, *NH* 34.52; for their social and political successes, see Stewart 2012, 668-70, 681-7.

⁵⁰ *IG* II².3867; Pausanias 1.2.5; Stewart 1979, 52, pl. 16d (only; the head probably does not belong to the body but both probably belong to this dedication).