

Denys Haynes, *The Technique of Greek Bronze Statuary*. Verlag Philipp von Zabern, Mainz 1992. 156 Seiten, 9 Abbildungen, 15 Tafeln.

Research on ancient bronze technology is flourishing, owing in no small part to the work of Denys Haynes, whose new book provides a brief but valuable commentary on work in this field. Haynes discusses sphyrelata, various methods of casting, alloys, cold-working, and patination, with a final chapter on how the colossus of Rhodes might have been cast. Although the longest of the twelve chapters, on color, is only ten pages, footnotes are copious, sometimes nearly equal in length to the text. Summaries of important issues are clear and to the point, but the scarcity of illustrations is a serious drawback for those who do not already know the material. The rather arbitrary definition of the subject also presents some difficulty. Is it reasonable to include literary testimonia from widely-ranging dates, including the Renaissance, in a survey

that is limited to 'Greek' bronzes? If so, Haynes could also have considered recent important technical studies of such Roman works as the Marcus Aurelius and the Cartoceto bronzes. He does in fact include the San Marco horses, whose date is far from being secured during the Greek period. In an attempt to focus upon large-scale bronzes, Haynes has eliminated works like the bronze head of a youth from Kythera in Berlin and the clay mould for a kouros in the Athenian Agora, both from figures of about 1 m. in height (ch. 3 p. 40 n. 23; ch. 7 p. 72), but not the Ugento Poseidon (H. 71 m.), the Selinus Youth (H. 85 m.), or the head of the so-called Nike from the Athenian Agora (original H. 8-9 m.).

In emphasizing the point that sphyrelata did not have carved wooden cores, Haynes refers to an important technical link between sphyrelata and armor (ch. 1). Readers who wish that he had said more on this subject may wish to look up a 4th-century B.C. tropaion in Munich (Antikensammlung Inv.-Nr. 15032; H. 2.4 m.): B. KAESER, *Tropaion mit westgriechischer Rüstung*. *Münchner Jahrb.* 38, 1987, 233-234. Though Haynes is correct to disagree with R. Carpenter's theory of the glyptic and plastic in cast bronzes (ch. 6), he still subscribes to the modern theory that wood influenced the styles of early Greek sculpture. For an analysis of this theory, see A. A. DONOHUE, *Xoana and the Origins of Greek Sculpture*. *Am. Class. Stud.* 15 (1988) 208-218.

To introduce the various casting processes (ch. 2), Haynes relies primarily upon evidence from the Renaissance. Readers unfamiliar with the documents and with the monuments mentioned in this chapter may wish to have in hand G. SAVAGE's well-illustrated "Concise History of Bronzes" (1968). Current substitutes for the outdated works by H. Maryon and H. Hodges include publications by practicing bronze-workers who are familiar with ancient bronzes, as P. K. CAVANAGH, *Practical Considerations and Problems of Bronze Casting*. In: *Small Bronze Sculpture from the Ancient World* (1990) 145-160; and J. MILLS, *The Encyclopedia of Sculpture Techniques* (1990).

Haynes does not believe that any large Greek bronzes were made by the direct lost-wax process (ch. 3; p. 34). This does not rule out, however, direct modeling in wax, for which there is ample evidence. The Greeks practiced piece-casting, with variations (ch. 4). Haynes has previously described how one series of griffin protomes were cast indirectly with piece-moulds (ch. 4; p. 46). A fuller presentation of serial production would have helped to explain the advantages of lost-wax casting and of the additive process. The remarks on sand-box casting (ch. 2) and on piece-moulding in refractory moulds (ch. 5), albeit brief, no longer need be included in studies of ancient bronze technology, particularly in one of this brevity.

In the course of his summary of the indirect lost-wax process (chs. 6-8), Haynes states that Greek artisans used relatively small and simple moulds to cast statues in pieces (pp. 49; 75). He does not explain why nude statues, like the Riace bronzes, might be cast in very few pieces, with a single section extending from neck to feet. And it has now been shown that the cores of the Riace bronzes are not "more or less uniform in composition" (p. 67): see G. SCHNEIDER/E. FORMIGLI, *Untersuchungen von Gußkernen griechischer und römischer Großbronzen*. In: *Akten XIII. Internat. Kongr. Klass. Archäologie*, Berlin 1988 (1990) 618-619. Haynes's brief explanation of the furnace on the Berlin Foundry Cup as that of a smith is convincing, as is his identification of the framework as a support for the colossal statue during coldworking (p. 102). It is not clear why the drawing on p. 78 (fig. 5) is preferable to a photograph.

The discussion of the alloys of Greek bronzes is based largely upon a broad range of literary testimonia (ch. 9); J. ISAGER's cautionary remarks on considering the testimonia in context are well worth reading (Pliny on Art and Society [1991]). The list of alloys needs a qualifying note on the reliability of alloy analyses (pp. 87-88, and table 2); and the notion that the Greeks used brass (pp. 86; 88) needs documentation. Not all of the bronzes that Haynes lists are universally accepted as being "Greek", and his generalizations about the inclusion of lead in bronzes at certain dates depends upon accepting his stylistic dates for those bronzes. He does not consider the possibility of regional variations.

The longest chapters are about inlays - eyes (always inset from the outside [p. 106]), brows, teeth, nipples, fingernails, blood, and drapery details - and about joining and artificial patination (chs. 9-11). Haynes agrees with Formigli that oval "basins" were cut in Riace A's wrist to strengthen welded joins (p. 95 and fig. 6 p. 96), but his statement that this method was also used on the Artemision God, the Antikythera Youth, and the Marathon Boy is not documented, and the evidence is normally interpreted as representing the puddling from fusion welds.

Because the field of ancient bronze technology is such an active one, generalizations like "the only known ancient example of a crenellated neck-joint . . ." (p. 96), and "With very few exceptions, Greek bronze statues were destined to be mounted on stone bases" (p. 102), risk quick disproval. In this vein, a gilding technique "extensively used by Greek craftsmen" (p. 108) is in fact based upon only two examples, both of them from the Athenian Agora (p. 112).

Unfamiliar terms are common in this specialized field, as a few examples from this book show, and standardization is needed. In describing the gate system, by which the bronze is poured and the gases are released, Haynes uses "jets", "vents", and "risers", to describe what most (but not all) refer to as "gates" and "vents" (U.S.) or "runners" and "risers" (G.B.). His use of "intermodel" for what might better be called the "wax model", and a passing reference to the "mother-mould" may also confuse readers. A core is more easily understood as "poured" than as cast (p. 70). For "fire-skin" (p. 92) read "casting skin". For "sump" (p. 75), try "drain".

The work of Denys Haynes was a driving force in the emergence of a new understanding of ancient bronze-casting techniques, and the rapidly-expanding bibliography provides strong testimony of the continuing quest for knowledge in this important field. Several additions to Haynes's already extensive bibliographies have recently appeared in a single volume: *Small Bronze Sculpture from the Ancient World* (1990): R. S. BIANCHI, *Egyptian Metal Statuary of the Third Intermediate Period, from Its Egyptian Antecedents to Its Samian Examples* (p. 61-84); H. KYRIELEIS, *Samos and Some Aspects of Archaic Greek Bronze Casting* (p. 15-30); W. A. ODDY *et al.*, *The Gilding of Bronze Sculpture in the Classical World* (p. 103-124); H. BORN, *Patinated and Painted Bronzes: Exotic Technique or Ancient Tradition?* (p. 179-196). A new publication on ancient casting is G. ZIMMER, *Griechische Bronzegußwerkstätten* (1990). The bibliography on Corinthian bronze can now be augmented by A. GIUMLIA-MAIR/P. CRADDOCK, *Corinthium aes. Ant. Welt* 24 (1993).

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