

## BLACK BRONZE AND THE 'CORINTHIAN ALLOY'

Two recent studies by A. R. Giumlia-Mair and P. T. Craddock have been devoted to a form of bronze having a blackish tint.<sup>1,2</sup> The authors there describe examples ancient and modern, from as far apart as Mycenaean Greece, Egypt, Rome, China and Japan. In Japan such bronze is prominently represented in decorative art and known as *Shakudo*.

Giumlia-Mair and Craddock, repeating the latter's earlier suggestion,<sup>3</sup> identify this blackened bronze with the *Corinthium aes* described by Pliny the Elder and mentioned in other Latin and also Greek, Hebrew and Syriac sources.<sup>4</sup> The basis of this identification is that many of the black bronze items agree in two respects with what is said of Corinthian bronze in the literary sources: firstly, both are copper alloys containing silver and gold, and secondly both were endowed with a distinctive colour through surface treatment.

However, the identification of Corinthian Bronze as black is open to the fatal objection that the textual sources state clearly that the colour of Corinthian Bronze, for which it was prized, was that of gold or silver, or intermediate between the two. The most detailed account of the appearance of Corinthian Bronze is given by Pliny (*HN* 34.8):<sup>5</sup>

There are three kinds of this (*sc.* the Corinthian) sort of bronze: a white variety (*candidum*), coming very near to silver in brilliance (*argento nitore quam proxime accedens*), in which the alloy [of silver] predominates (*in quo illa mixtura praevaluit*); a second kind in which the yellow quality of gold predominates (*in quo auri fulva natura*); and a third kind in which all the metals are blended in equal proportions. Besides these there is another mixture, the formula for which cannot be given, although it is man's handiwork; but the bronze valued in portrait statues and others for its particular colour, approaching the appearance of liver and consequently called by a Greek name *hepatizon* meaning 'liverish', is a blend produced by luck; it is far behind the Corinthian blend, yet a long way in front of the bronze of Aegina and that of Delos which long held the first rank.

This account demonstrates that Corinthian Bronze was silvery or golden or of intermediate hue, depending on the relative proportions of silver and gold in the alloy. Pliny knows also of a dark 'liverish' alloy which likewise contained an admixture of silver and gold, but he is careful to distinguish this less valuable alloy from Corinthian Bronze.

Craddock and Giumlia-Mair interpret this passage very differently. In their view, Corinthian bronze was black, and Pliny's three kinds (*genera*) were differentiated only by the composition of inlays—gold, silver, or a combination of both. In support of this interpretation they claim that Pliny's term *mixtura* indicates a 'distinct and separable union', such as would be created by the process of inlaying.<sup>6</sup>

<sup>1</sup> A. R. Giumlia-Mair and P. T. Craddock, 'Corinthium Aes. Das schwartze Gold der Alchimisten', *Antike Welt* 24:5 (1993), 1–62.

<sup>2</sup> P. Craddock and A. Giumlia-Mair, 'Hsinn-Km, Corinthian bronze, *shakudo*: black-patinated bronze in the ancient world', in La Niece, S. and Craddock, P. (eds.), *Metal Plating and Patination: Cultural, Technical and Historical Developments* (Oxford, 1993), pp. 102–127.

<sup>3</sup> P. T. Craddock, 'Corinthian Bronze: Rome's Purple Sheen Gold', *MASCAJ* 2:2 (1982), 40–41; id., 'Gold in Antique Copper Alloys', *Gold Bulletin* 15 (1982), 69–72.

<sup>4</sup> D. M. Jacobson and M. P. Weitzman, 'What was Corinthian Bronze?' *AJA* 96 (1992), 237–47.

<sup>5</sup> English translation by H. Rackham, in Pliny, *Natural History*, vol. ix (Loeb edition: Cambridge, MA and London, 1952), p. 133.

<sup>6</sup> See p. 111 in the article cited in n. 2.

This understanding of *mixtura* is however incompatible with Latin usage, at least in Pliny. All of the many substances to which Pliny applies this term are homogeneous mixtures. Thus in the *Natural History* he uses the word *mixtura* of blended perfumes (13.6), unguents (13.6, 9; 29.23), remedies (17.264; 20.48; 23.51; 28.185; 32.30), wines (14.55), or juices (12.73), sauce (20.147), and porridge (18.117). In book 31 Pliny describes as *mixtura* the combination of acids and salts in natural waters (31.5), or a mixture of sea water with fresh water (31.64). In 28.181 Pliny tells us that the sight of a statue cast from a *mixtura* of hippomanes together with molten bronze will drive any stallion *ad rabiem coitūs*. In 34.161 Pliny observes that white lead—i.e. tin—is useless *sine mixtura*, i.e. without admixture of another metal; it is hard to see how a mere inlay would help here.<sup>7</sup> In short, there is not a single example where one section of a substance described by Pliny as *mixtura* has different physical properties (e.g. colour) from another, as the view of Craddock and Giumlia-Mair would require. The interpretation of Pliny which they propose in the interests of their theory is overwhelmingly contradicted by the evidence.

Quite apart from Pliny, there are sources in rabbinic Hebrew and in Syriac which confirm that the most estimable form of Corinthian Bronze had a golden hue. The Gate of Nicanor in the Temple of Jerusalem had doors of Corinthian Bronze which 'shone with a yellowish hue'.<sup>8</sup> The Hebrew 'goodly yellowed bronze' in Ezra 8:27 is rendered into Syriac as 'Corinthian Bronze' in the Peshitta version, which may be dated to the second or third century A.D.<sup>9</sup> Further confirmation comes from a Syriac text attributed to Zosimos, one of the early luminaries of alchemy, but composed apparently between the 7th and 10th centuries A.D. This text survives in a Cambridge manuscript, probably of the fifteenth century, and contains a recipe 'to make the golden or Corinthian colour'. The Syriac text has *l-m' bd gw[n]* ⊕ *'w qwryntynwn*; the symbol ⊕, primarily representing the sun, also indicates the associated colour (yellow) and metal (gold).<sup>10</sup>

Giumlia-Mair and Craddock deal with this further unequivocal textual evidence that Corinthian Bronze was chiefly celebrated as a gold 'look-alike'<sup>11</sup> by the simple expedient of ignoring it. Although they mention the 'Corinthian' Gate of the Temple in Jerusalem, they say nothing of its colour, which the sources extol.

Giumlia-Mair and Craddock are thus left resting their entire case on another

<sup>7</sup> Apart from these references to continuous substances, Pliny also uses *mixtura* of smells (17.239), light and colour (11.148; 35.30, 46; 37.80), or simply of a list of varied items (2.241). At 8.213 he uses *mixtura* of animal breeding, and at 16.46 he writes of trees that are closely inter-related: *tanta natalium mixtura est*, while at 17.187 he warns against the planting of different vines in close proximity as *mixtura generum*. Pliny also uses *mixtura* meteorologically, of a blend of heat and moisture (2.190); in the same way the colours of the rainbow are due to the *mixtura* of clouds, fire and air (2.150). None of these instances, of course, in any way support the view that *mixtura* could indicate a combination of one metal (Corinthian bronze) juxtaposed with others (gold and silver) in which each retains its characteristic properties including colour.

<sup>8</sup> Mishnah *Middot* 2.3; Tos. *Yoma* 2.4; TB *Yoma* 38a. See Jacobson and Weitzman, op. cit., pp. 240–41.

<sup>9</sup> P. B. Dirksen, 'The Old Testament Peshitta', in Mulder, M. J. (ed.), *Mikra. Text, Translation, Reading and Interpretation of the Hebrew Bible* (Assen. 1988), pp. 255–97, esp. pp. 259, 295.

<sup>10</sup> This is MS. Mm 6.29. See W. Wright, *A Catalogue of the Syriac Manuscripts preserved in the Library of the University of Cambridge* (Cambridge, 1901), pp. 1036–7. For a translation of this passage into French, see P. Berthelot and R. Duval, *La chimie au moyen âge. Tome II: l'alchimie syriacque* (Paris, 1893), p. 230.

<sup>11</sup> D. Engels, *Roman Corinth: An Alternative Model for the Classical City* (Chicago, 1990), pp. 206–7, with n. 66; Jacobson and Weitzman, op. cit., p. 244 with n. 65.

passage from the Syriac manuscript cited above, or rather on a French translation thereof.<sup>12</sup> The latter runs: 'Fabrication de lames de métal noir, ou alliage corinthien', meaning: 'the making of strips of black metal, or Corinthian alloy'. This wording certainly seems to imply that 'black metal' and 'Corinthian alloy' are interchangeable, so that it is understandable that Giumlia-Mair and Craddock should have inferred that the Corinthian alloy was black.

Unfortunately, the French here gives a misleading impression of the meaning of the Syriac text, as one of the present authors (MW) discovered on examining the manuscript in Cambridge. The Syriac phrase is *ngd' 'wkm' qwrynty' lm'bd*, meaning: 'to make black Corinthian metal'. There is no implication here that all Corinthian bronze is black, any more than it is implied that all bronze is Corinthian.<sup>13</sup>

Combining this passage with the other passage from Zosimos cited above, we see that the author of this text in fact considered that Corinthian bronze could be either golden or black. The best way to reconcile this with the remaining textual evidence is to suppose that a blurring of the definition of Corinthian Bronze had occurred by the time that this text was composed, whereby Pliny's *hepatizon*, with its dark 'liverish' hue, was also included. The reason would of course have been that this alloy too contains gold and silver. This was the 'black Corinthian metal', though the author of the text was still aware of the original golden variety.

Significantly, the Syriac text goes on to state that this bronze was especially suitable for statues (*andriante*, a loan-word from Greek *ἀνδριάντα*). This agrees with Pliny's reference above to 'the bronze valued in portrait statues and... called by a Greek name *hepatizon*'. Indeed, of the four objects from the Roman period illustrated by Giumlia-Mair and Craddock, one comprises *fulcra* ending in statuettes.<sup>14</sup>

The Syriac recipe for this black alloy implies low proportions (less than 7 % each) of gold and silver: '8 parts of gold and 8 parts of silver to 100 parts of copper'. The various blackish alloys adduced by Giumlia-Mair and Craddock have comparably low proportions of gold and silver. In particular, the black surface of Japanese *Shakudo* is associated with the establishment of a layer of a copper oxide, cuprite, which is modified by a relatively small concentration of gold and silver in a manner which subtly modifies its natural colour.<sup>15</sup>

All these black bronzes are best placed in the category of *hepatizon* 'liverish'. This term appears to indicate dark colour and sheen together. Both of course are properties of the liver, at least when first exposed. The original Greek term appears in Dioscurides' description of a substance obtained from the juice of aloes: *στίλβουσιν, υπόξανθον, εύθρυπτον καὶ ήπατίζουσιν, ραδίως ύγραινομένην* 'glistening, brownish, brittle, 'liverish', easily melted' (*De materia medica* 3.22.2). Although simple *ξανθος* is used of various shades of yellow, the compound *υπόξανθος* has been rendered 'brownish' as it indicates a far darker hue; thus Theophrastus (*De historia plantarum* 9.12.2) applies it to the colour to which certain black roots turn if broken (*ή δέ ρίζα παχεία καὶ μέλαινα διαρραγείσα δέ υπόξανθος*). Given the paucity and consequent

<sup>12</sup> Berthelot and Duval, op. cit., p. 223.

<sup>13</sup> The French translation of the whole passage is in other respects broadly reliable, though the Syriac form *w-mthblyn* which puzzled Berthelot and Duval (p. 222, n. 3) seems a scribal error for *w-mthmyn* 'and are heated'.

<sup>14</sup> Giumlia-Mair and Craddock (see n. 1), p. 36 (illustration no. 18).

<sup>15</sup> H. Oguchi, 'Japanese Shakudo: Its History, Properties and Production from Gold-containing Alloy', *Gold Bulletin* 16 (1983) 125-32; R. Murakami, S. Niiyama and M. Kitada, 'The Characterization of Black Surface of *Shakudo*', *Kobunkazai no Kagaku* 33 (1988) 24-32 (Japanese).

wide range of colour adjectives in Latin, *hepatizon* 'liverish' is an apt description of black bronze.

The elements of dark colour and sheen may also be present in the related Latin term *hepatites*. At *NH* 36.144 Pliny applies this word to a mineral of the type haematite 'blood-stone'. The latter term implies a reddish-brown or deeper hue (another variety of haematite is even said to be *colore nigrum*), though no sheen is mentioned. Conversely, at *NH* 37.186 *hepatites* is used of a precious stone, implying a sheen, though the hue is not apparent from the context.

In contrast to the dark *hepatizon* bronze, the golden hue which all the sources ascribe to Corinthian bronze required a far higher gold content. As the other author of this article, (DMJ), has learned through experimental investigation, the surface depletion gilding that was used for colouring the original golden version of Corinthian Bronze is only achieved easily if the gold content is higher than 15 wt %. It is true that examples have been reported from among the *tumbaga* artefacts of pre-Columbian Peru that contain as little as 12%.<sup>16</sup> However, the gold content of the alloys adduced by Giumlia-Mair and Craddock and of the 'black Corinthian metal' of the Syriac manuscript falls well below this level. This is because these alloys are all of the same basic type as Pliny's *hepatizon*, rather than the more noble and brilliantly coloured Corinthian bronze which the ancients valued 'before silver and almost before gold'.

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#### ROUGE AND CROCODILE DUNG: NOTES ON OVID, *ARS* 3.199–200 AND 269–70

In *Ars Amatoria* 3.267–72, part of a longer sequence which begins in 261, Ovid advises his female readers on how to conceal various physical shortcomings. Text and apparatus are quoted from Kenney's revised *OCT*.<sup>1</sup>

quae nimium gracilis, pleno uelamina filo sumat, et ex umeris laxus amictus eat; pallida purpureis tangat sua corpora uirgis, nigrior ad Pharii confuge piscis opem; pes malus in niuea semper celetur aluta, arida nec uinclis crura resolue suis;...	270
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269 tangat *RYA*ω: tangat s: cingat a: pingat *Watt*: spargat *Merkel*  
272 suis s: tuis *RYA*ω

The second couplet quoted contains, besides the textual problem in the hexameter, two interpretive cruces, one for each line. It appears that Kenney has become more worried about the first and less about the second in the twenty-nine years that

<sup>16</sup> H. Lechtman, 'Tradition and Styles in Central Andean Metalworking', in Maddin R. (ed.), *The Beginning of the Use of Metals and Alloys: Papers from the Second International Conference on the Beginnings of the Use of Metals and Alloys, Zhengzhou, China, 21–26 October, 1986* (Cambridge, MA, 1988) pp. 344–78, esp. 373.

<sup>1</sup> E. J. Kenney (ed.). *P. Ovidi Nasonis Amores, Medicamina Faciei Femineae, Ars Amatoria, Remedia Amoris* (Oxford, 1994<sup>2</sup>). References to 'Brandt' are to P. Brandt (ed.), *P. Ovidi Nasonis de arte amatoria libri tres* (Leipzig, 1902, reprinted Hildesheim, 1991), and are ad loc. unless otherwise specified.