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THE DENARII OF OTHO: A STYLISTIC AND COMPOSITIONAL STUDY

Introduction

Marcus Salvius Otho seized power in a coup on 15 January AD 69, and committed suicide on 15 or 16 April after his army was defeated in battle by the forces of his rival, Vitellius (1). Apart from some provincial silver and bronze produced at Antioch in Syria and Alexandria in Egypt, the bulk of the coinage of this short reign consists of aurei and denarii issued by the mint of Rome (2). As is well known, no base metal issues were produced at Rome for this emperor.

This paper presents the results of analyses of twenty-six denarii and is the largest group of coins of Otho ever subjected to metallurgical analysis (3). A large group has been analysed before: in 1976 D.R. Walker published surface analyses for 21 denarii of Otho as part of a larger programme of analyses of Roman silver coins. Until the 1990s his results were taken as definitive,

(1) The well-known historical and biographical accounts provided by Tacitus, Cassius Dio, Suetonius and Plutarch supply considerable detail, enabling extraordinarily full modern narratives for such a short reign, e.g. Wellesley 1975; Murison 1993, 1999; Morgan 2006 (rather downbeat about the contribution of numismatics to study of the period: p. 3).

(2) Antioch: Butcher 2004: 70, 71, 348-350; *RPC* I, nos 4199-4200, 4316-4321; Alexandria: *RPC* I 5354-5370; Savio 1991, 1993; Rome: *RIC* I^2, pp. 258-261.

(3) These analyses were undertaken as part of a larger ongoing project to analyse Roman silver coins from Nero to Commodus funded by the Arts and Humanities Research Council (AHRC) of Great Britain, ID No: 119434. Additional funding for one of the authors (KB) was provided by the University Research Board of the American University of Beirut.

but more recent work has shown that his sampling technique was defective and that the finenesses he reports for various issues are usually too high (Butcher and Ponting 1995, 1997a, 1997b, 1998, 2005a, 2005b, Gitler and Ponting 2003). What is more, significant changes in fineness were sometimes masked completely so that they went unnoticed in his body of data, as this paper will show to be the case with the denarius coinage of Otho.

Chronology

Even allowing a few days for news of Otho's death to reach the mint in Rome (19 April at the latest, the last day of the *ludi Ceriales*: Tacitus, *Hist.* 2.55), the entirety of Otho's coinage cannot have been produced over a period longer than about 94 days. Given the brevity of his reign, it is all the more astonishing that such a large quantity of coins was produced (4). It is estimated that nearly a thousand obverse dies were used for Otho's gold and silver (5). Production must have been extraordinarily intense. Indeed, one could narrow the window of production to an even briefer period of about 50-51 days, because all of Otho's denarii and aurei refer to his tribunician power. One of our principal epigraphic sources for the period, the *Acta Fratrum Arvalium*, demonstrates that this power was conferred on Otho on 28 February, almost two months after he seized control (6). However, the narrative of Tacitus states that the senate had already granted him this power on 15 January (*Hist.* 1.47). Yet, as Murison points out (1999, p. 50) 'in strict constitutional theory the Senate had no right to bestow ... *tribunicia potestas* ... on anyone ... Clearly, what the Senate did on occasions when a new emperor was being recognised was to pass an ''enabling act'', which was subsequently confirmed by formal resolutions of the People'. Would this

(4) This contradicts the opinion of Sutherland, *RIC* I^2, p. 258: 'Not that the coinage of Otho was at all profuse (even given its short duration) ... It was all very limited in output.' See the observations of Metcalf 1993, pp. 157-8: 'if the survival rate in hoards is any indication, the rate of production in silver was higher than that for the entire remainder of the century and in fact would not be matched again until the reign of Antoninus Pius'.

(5) The estimated number of obverse dies is 997, plus or minus 88, with a coverage estimate of 68.4%, plus or minus 6.7% (95% confidence), using the method recommended by Warren Esty (1986). This estimate is based on a die study being undertaken by one of the authors (JM) using a sample of 97 aurei and 903 denarii, from which 521 obverse and 644 reverse dies were observed (the die estimates published by Muona 2005 are incorrect).

(6) *ILS* 241, 58-62: *Isdem cosulibus* (Otho and his brother Titianus) *pr k Mart mag imp M Othonis Caesaris Aug II promag L Salvio Othone Titiano college fratr Arval nomine immolavit in Capitolio ob comit trib pot imp Iovi b m Iunoni vacc* etc.

"enabling act" allow Otho to issue coinage referring to his tribunician power before it was formally conferred? If so, it would certainly make it easier to accommodate the large output implied by surviving coins and the estimate of obverse dies; but it would also mean that one could no longer rely on coin inscriptions as an indication of a coin's date since, if Otho could ignore constitutional propriety, so presumably could other emperors (7). The sources imply that once he had seized power, Otho was particularly sensitive to constitutional propriety (8). Presumably he could have pressed for earlier formal conferral of titles had he so wished. If he had started issuing coinage before the comitia conferred the tribunician power on him, his successor Vitellius may have shown more restraint. It would seem that some similar "enabling act" was passed by the senate for Vitellius once news had reached Rome, on 19 April, of Otho's death (Tacitus *Hist.* 2.55), yet the *Acta Fratrum Arvalium* shows that the assembly for Vitellius' tribunician power was not held until 30 April (9). This would concur with the fact that Vitellius' first denarius coinage at Rome (no gold is known) lacks any reference to his tribunician power (10), whereas all subsequent issues record it (11).

The other date relevant to the coinage is 9 March, when Otho received the title *pontifex maximus* (12). This title is confined to his last issue which, as we will see, can be distinguished by its metallurgy (at least where the denarii are concerned) as well as by reverse types and titulature. If Otho waited until 28 February before issuing coins, the coins marked PONT MAX must have been issued quite some time after 9 March, because the volume of the earlier issues without PONT MAX is simply too great to be confined to a period of 9-10 days. Alternatively, if Otho's coinage began soon after his coup in January, the PONT MAX issues could have begun closer to 9 March. But if one fixed point in the chronology (28 February) can be abandoned, there is no reason to adhere to the other, leaving 15 January as the *terminus post* and 19 April as the *terminus ante quem*.

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(7) See the arguments of Clay 1980 with regard to Nero's coinage.

(8) See especially Tacitus, *Hist.* 1.71 and comments by Wellesley 1975: 57-8; Murison 1999: 56; Morgan 2006: 97.

(9) *ILS* 241, 81-84.

(10) *RIC* I^2, nos 66-71.

(11) *RIC* I^2, nos 72-112. We exclude the anomalous quinarius *RIC* I^2 no. 84, the authenticity of which 'invites some reserve'.

(12) *ILS* 241, 72-76: *Isdem cos VII idus Mart mag M Othonis Caesaris Aug promag Othone Titiano college fratr Arval nomine immolavit in Capitolio ob comitia pontif max Othonis Aug Iovi b m Iun vacc* etc.

The issues

In spite of this uncertainty over the internal dating in absolute terms, a relative chronology for the issues can be constructed. *RIC* I^2 divided the coinage into two issues only: those with PONT MAX and those without. There are however reasons for thinking that the issues without PONT MAX comprise at least two issues, if not three (the observations that follow are applicable to both gold and silver) (13).

Two different obverse legends are employed: IMP M OTHO CAESAR AVG TR P; and a second, in which the praenomen is dropped: IMP OTHO CAESAR AVG TR P. Given that the PONT MAX issues bear only the latter, and that pontifex maximus is the latest of Otho's titles to be noted in the historical record, the legend without the praenomen is assumed to be the later form. Issues without PONT MAX exhibit both obverse legend varieties. That in itself is not enough to suggest a division of the issues without PONT MAX into two separate issues based on obverse legends, but with the addition of other factors, a chronological separation between coins with IMP M OTHO CAESAR AVG TR P and those with IMP OTHO CAESAR AVG TR P seems likely.

There are some notable stylistic differences to be observed, even though the coins were issued over such a brief period. On the coinage with PONT MAX the obverse busts are normally shown from the front (a few show the bust from the rear). On coins without PONT MAX, but with the same obverse legend (IMP OTHO CAESAR AVG TR P), both frontal and rear types of bust are apparent. Most of the coins with the legend IMP M OTHO CAESAR AVG TR P, on the other hand, have portraits where the bust is seen from the rear. So one might detect traces of a stylistic progression in the portraits of Otho based on bust type, from those seen mainly from the rear to those seen mainly from the front (frontal busts continue to be common on the earliest Rome issues of Vitellius). Typically, the portraits with busts seen from the rear treat Otho's hair somewhat differently from those where the bust is seen from the front. On those with the bust seen from the rear the hair at the back of the head is treated as a random collection of locks, while the top of the head is characterised by a patch of locks arranged in Neronian-style 'waves' (3 or 4 in number: fig. 1, a-c) (14). On coins with PONT MAX and

(13) For a discussion of Otho's coinage see Metcalf 1993 and Pontone 2000.

(14) Usually interpreted as evidence of Otho's toupée (Suetonius, *Otho* 12), though it seems hard to believe that he would have made it so obvious on his coinage, and perhaps it was merely a fashionable hairstyle of convenient form for toupée wearers. The earlier portraits

frontal busts the hair at the back of Otho's head is usually treated as a series of two or three waves very like those on top of his head; indeed, sometimes these waves continue from front to back or encircle the head like a series of rings (fig. 1, d-f). All of these changes in legends, position of bust and hairstyle seem to constitute a progression rather than a series of abrupt breaks, so that one can also find portraits with intermediate features (e.g. waves on top and at the back of the head combined with busts seen from the rear). However, the change in obverse legend, from IMP M OTHO to IMP OTHO, seems to be a pivotal point in the evolution of the hairstyle (15).

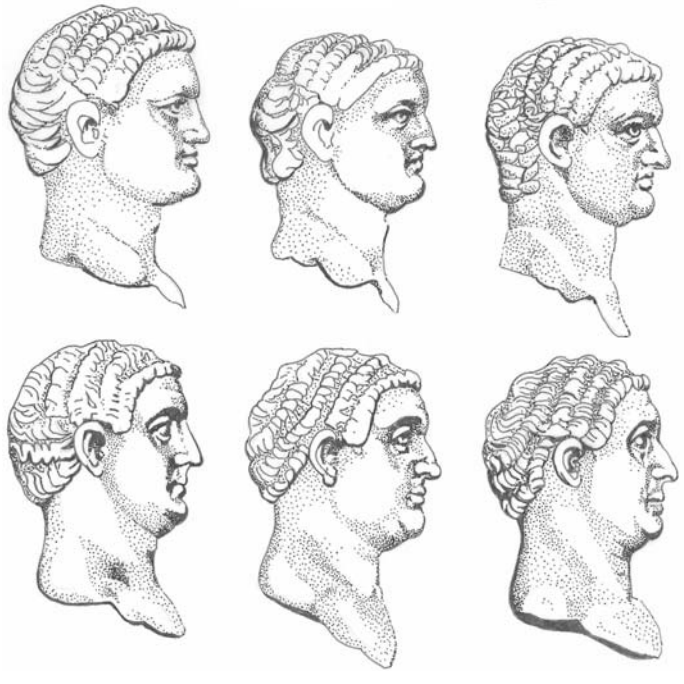

FIG. 1 - Some stylistic varieties in Otho's portraits (not intended as an exhaustive survey).
A-C (left to right) taken from coins with legend IMP M OTHO CAESAR AVG TR P; Busts seen from rear, hair on top of head arranged in waves.
D-F (left to right) from coins with legends IMP OTHO CAESAR AVG TR P / PONT MAX (D with bust seen from front and waves on top and at back of head;
E-F with bust seen from front, waves arranged in rings around head). Drawings by KB.

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of Otho resemble those of Nero. This may have been deliberate (Tacitus, *Hist.*, 78; Suetonius, *Otho*, 7) or it may be the case that the die engravers, accustomed to producing portraits of Nero, took time to habituate themselves to engraving new, individual portraits of Otho.

(15) This observation about the change in hairstyle is also noted by PONTONE (2000).

There are five main reverse types associated with the obverse legend IMP M OTHO CAESAR AVG TR P: VICTORIA OTHONIS (three variations with Victory right or left); PAX ORBIS TERRARVM (Pax standing); and SECVRITAS P R (Securitas standing) (16). Of these types, Pax and Securitas are also found on coins with the legend IMP OTHO CAESAR AVG TR P; whereas VICTORIA OTHONIS is not. This and the fact that VICTORIA OTHONIS occurs only with the early bust type (seen from rear, waves at top of head) support the idea that victory is the earliest of Otho's types, perhaps constituting a separate issue in itself.

This would imply two successive issues bearing the obverse legend IMP M OTHO CAESAR AVG TR P: A) with reverses VICTORIA OTHONIS only (three varieties) and B) with reverses Pax and Securitas. On some coins of the latter group features associated with Otho's later portraits begin to appear on some dies, such as hair arranged in waves at the back of the head as well as the top.

If these divisions should prove chronological, we would have three reverse types with Victory succeeded by two new reverse types. However, there are extensive obverse die links between the Victory, Securitas and Pax types, which make it difficult to determine whether there was a clear succession or whether the Securitas and Pax types were introduced alongside the Victory ones. In spite of this, it is interesting to observe that one of the Victory types (Victory standing left on globe) appears to have been produced using re-engraved dies intended for issues of Otho's predecessor Galba, which suggests that this type should be placed at the beginning of Otho's coinage (17).

Coins with IMP OTHO CAESAR AVG TR P but without PONT MAX employ two reverse types carried over from the previous issue: PAX ORBIS TERRARVM; SECVRITAS P R; with the addition of a third, CERES AVG, which is very rare and seems to have been struck from a single pair of dies. Obverse busts seen from the front begin to appear; there are also several dies where Otho's portrait faces left.

(16) The reverse CERES AVG does not appear to exist in combination with obverses bearing the legend IMP M OTHO CAESAR AVG TR P (*RIC* I^2 1).

(17) This fact was brought to JM's attention by C.L. Clay. Four out of 9 reverse dies observed for this type appear to have had their reverse legends re-cut to read VICTORIA OTHONIS instead of Galba's VICTORIA P R (*RIC* I^2 233-4).

In support of a chronological succession from IMP M OTHO to IMP OTHO, it may be noted that reverse dies are shared between the two, but these are not many: 3 SECVRITAS P R and 2 PAX ORBIS TERRARVM dies have been observed employed for coins with both obverse legends; this compared with 210 SECVRITAS P R dies known only in combination with IMP M OTHO and 166 with IMP OTHO, and 79 PAX ORBIS TERRARVM dies combined with IMP M OTHO and 42 with IMP OTHO. Given the frequent sharing of obverse dies between reverse types this degree of separation supports the idea that there was a chronological succession from IMP M OTHO to IMP OTHO, and that this change was quite rapid.

Five reverse types are employed for the PONT MAX issue. Of these types, only Ceres has been used before. The others (Aequitas, Jupiter seated, Otho on horseback, Vesta seated) are new. There are obverse dies (all with the obverse IMP OTHO) shared between coins with and without PONT MAX, but in this case the metallurgy leaves us in no doubt that the PONT MAX coins are chronologically separate from other coins with the IMP OTHO legend.

The breaks between the two types of obverse legend and the change in metallurgical composition between coins without and with PONT MAX are clearly chronological. The separation of coins with VICTORIA OTHONIS from other issues with IMP M OTHO is less certain but is certainly possible. One could therefore make a case for three or four successive issues under Otho, as follows:

Issue 1a IMP M OTHO CAESAR AVG TR P / VICTORIA OTHONIS
1. Victory standing left on globe
2. Victory flying right
3. Victory flying left

Issue 1b IMP M OTHO CAESAR AVG TR P
4. PAX ORBIS TERRARVM Pax standing left
5. SECVRITAS P R Securitas standing left

Issue 2 IMP OTHO CAESAR AVG TR P
6. CERES AVG Ceres standing left
7. PAX ORBIS TERRARVM Pax standing left (combined with obverse busts right and left)
8. SECVRITAS P R Securitas standing left (obverse busts right or left)

Issue 3 IMP OTHO CAESAR AVG TR P / PONT MAX
9. Aequitas standing left
10. Ceres standing left
11. Jupiter seated right
12. Otho on horseback riding right
13. Vesta seated left

Whether this can support the notion of a mint divided into three or five officinae cannot be dealt with here; the metallurgy of the issues cannot be enlisted in any argument for or against, as will become apparent (18).

Coins analysed

Issue 1a

IMP M OTHO CAESAR AVG TR P
VICTORIA OTHONIS Victory standing left on globe, holding wreath and palm
RIC I² 17, BMCRE 25
1. M22. JM Coll
VICTORIA OTHONIS Victory flying right, holding wreath and palm
RIC I² 14, BMCRE 22
2. M19. JM Coll
VICTORIA OTHONIS Victory flying left, holding wreath and palm
RIC I² 16, BMCRE 24
3. M21. JM Coll

Issue 1b

IMP M OTHO CAESAR AVG TR P
PAX ORBIS TERRARVM Pax standing left, holding branch and caduceus
RIC I² 4, BMCRE 3
4. SH22. Shapwick hoard
5. W22. Winterthur
6. M14. JM Coll
7. M15. JM Coll
SECVRITAS P R Securitas standing left, holding wreath and sceptre

(18) The case against officinae is succinctly stated by METCALF 1993.

RIC I^2 *8, BMCRE 18*
8. SH21. Shapwick hoard
9. M16. JM Coll
10. M17. JM Coll
11. M18. JM Coll

Issue 2

IMP OTHO CAESAR AVG TR P
CERES AVG Ceres standing left, holding corn ears and cornucopia
RIC I^2 *2*
12. M28. JM Coll
PAX ORBIS TERRARVM Pax standing left, holding branch and caduceus
RIC I^2 *6, BMCRE 4*
13. M23. JM Coll *With obverse bust of Otho right, not in RIC*
14. M26. JM Coll
SECVRITAS P R Securitas standing left, holding wreath and sceptre
RIC I^2 *10, BMCRE 19 (bust of Otho right)*
15. SH20. Shapwick hoard
16. M24. JM Coll
17. M25. JM Coll
18. MCHR4. Manchester Museum.
RIC I^2 *12, BMCRE 20 (bust of Otho left)*
19. M27. JM Coll

Issue 3

IMP OTHO CAESAR AVG TR P
PONT MAX Aequitas standing left, holding scales and sceptre
RIC I^2 *19, BMCRE 6*
20. LW3. Laurence Weston hoard
21. M29. JM Coll
PONT MAX Ceres standing left, holding corn ears and cornucopia
RIC I^2 *20*
22. M30. JM Coll
PONT MAX Jupiter seated right, holding thunderbolt and sceptre
RIC I^2 *21, BMCRE 10*
23. MCHR5. Manchester Museum.
PONT MAX Otho on horseback right, holding spear
RIC I^2 *22, BMCRE 12*
24. M32. JM Coll

PONT MAX Vesta seated left, holding patera and sceptre
RIC I^{2} *24, BMC 11*
25. M33. JM Coll
26. M34. JM Coll

The sampling technique and method of analysis has been described before (Butcher and Ponting 2005; 173-174) and involves drilling a 0.6mm diameter hole into the edge of each coin and collecting the turnings, which are then dissolved in acid and analysed by inductively-coupled plasma atomic emission spectrometry (ICP-AES) and atomic absorption spectrometry (AAS). Because of incompatibilities between the sample preparation methods needed for silver on the one hand and gold and tin on the other, ICP-AES is used to measure copper and twelve minor and trace elements while AAS is used to measure copper and silver. By measuring copper using both methods and ensuring that good agreement is always achieved, and by measuring specially prepared quality control standards during the analysis and analysing certified standard reference metals (19) alongside the coin samples, a reliable and robust set of data has been acquired.

In addition to drilled samples, three coins (M16, M19 and M23) had sections removed from them, which were then mounted and polished to investigate the metal structure to both inform on the method of manufacture and on the rigour of the sampling method.

Results

Walker obtained a mean of 93.59% silver for all of Otho's denarii, very similar to his results for Nero, Galba and Vitellius (1976: 85). This implied that a single standard was in use from AD 64 (Nero's debasement of the denarius) until the beginning of Vespasian's reign, when a second debasement occurred. He concluded that during AD 69 'the stresses of the civil war did not cause the slightest falling away from the Neronian standard' except under Vitellius, where 'the first signs of what is probably financial difficulty can be detected in the coinage' (1976: 111). These differences, between Nero, Galba and Otho on the one hand and Vitellius on the other, were very

(19) Gunmetal standard Bundesanstalt für materialprüfung No.211 and Silver standard Gliwice AG5-chem were used for most elements; gold and bismuth were checked by the analysis of Royal Numismatic Society 'round-robin' coins kindly supplied by M. Cowell.

slight, and the low standard deviation he obtained for Otho's denarii implied that there was very little variation in fineness under this ruler. The impression given by WALKER's results was that the fineness of Otho's denarius coinage was part of a continuum stretching from the Neronian debasement to the accession of Vespasian.

WALKER also reported the results of his analyses as percentages of pure elemental silver. This is not appropriate for ancient silver coins when assessing fineness, because the smelting and refining technology used in antiquity was not sufficiently rigorous to produce elementally pure silver. The silver bullion used in the past contained significant traces of other metals that were present in the original ores or were added through smelting and refining. The most significant of these contaminants are gold, bismuth and lead. It is therefore sensible to calculate the silver bullion content of ancient coinages as the combination of the elemental silver, gold, bismuth and lead contents. This results in a figure that is a percent or so higher than that of the elemental silver alone. Using this calculated bullion figure our results for the denarii of Otho produce the graph in figure 2.

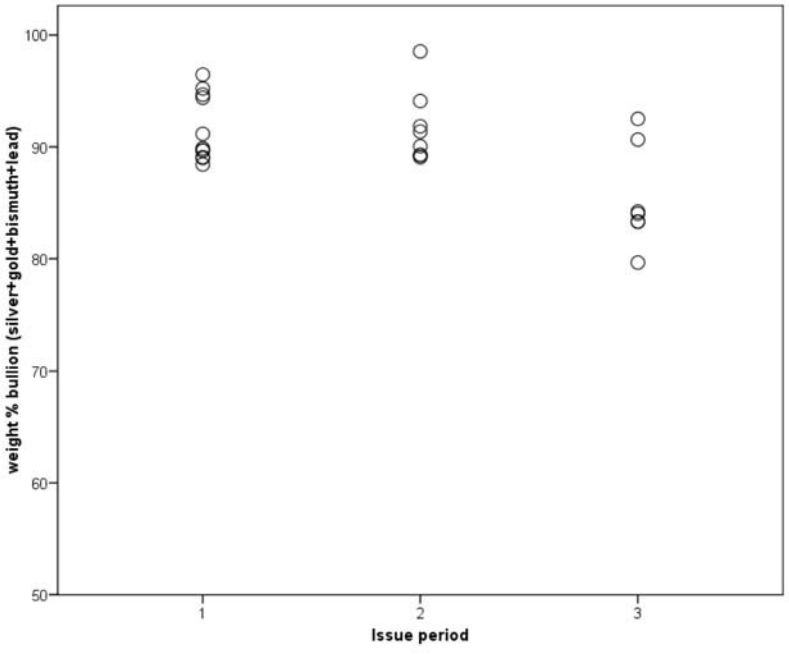

FIG. 2 - Dot-plot showing the silver bullion contents by issue groups.

The graph shows the individual silver bullion contents for each of the twenty-six denarii of Otho analysed arranged according to the three main issue groups discussed above. It is quite clear that the third issue (PONT MAX reverse legend) was struck on a lower standard of about 85% (average 85.4% sd 4.5) compared to the first two issues that were struck at about 90% fine silver. Issue group 1 averages 91.6% (sd 2.9) and group 2 averages 91.7% (sd 3.3). There are also a small number of coins that have higher silver contents than the majority for each issue; two coins of 92.5% and 90.7% in group 3 (LW3 and MCHR5), 94.1% and 98.5% in group 2 (M28 and MCHR4) and 96.5%, 94.4%, 95.2% and 94.7% in group 1 (M14, M16, M18 and M21). Given the small numbers of coins overall, it might be tempting to see these higher fineness coins as evidence for poor mint control or, in the case of group 1, even of a dual standard (20). However, metallographic study of sections cut through three of these coins show that the higher silver values are due to the sampling drill picking up silver enriched metal from unusually deep enriched areas of the coins' surfaces (fig. 3). The analysis of such samples will inevitably result in a higher silver content; if we remove the higher silver values discussed above and recalculate the average figures we get 89.6% (sd 0.9) for group 1, 90.1% (sd 1.2) for group 2 and 82.9% (sd 1.9) for group 3. These figures are more tightly grouped (as the lower standard deviations indicate) and suggest that 90% was the standard of the first two issues whilst a standard of about 80% could be suggested for issue 3. Walker analysed only three specimens of issue 3 (1976: 85, nos 742-744), but his results for these were in line with his results for the other issues of Otho, with no hint that they were issued at a lower fineness.

(20) Note that the three coins with higher readings in group 1 do not correspond with any particular type or the subdivision between 1a and 1b. The finenesses of the group 1a VICTORIA OTHONIS denarii analysed (91.8% silver bullion sd 2.6) are identical to those of group 1b (91.5% silver bullion sd 3.3), nor is there any significant structure apparent in the minor and trace elements measured that might indicate any difference between these two sub groups.

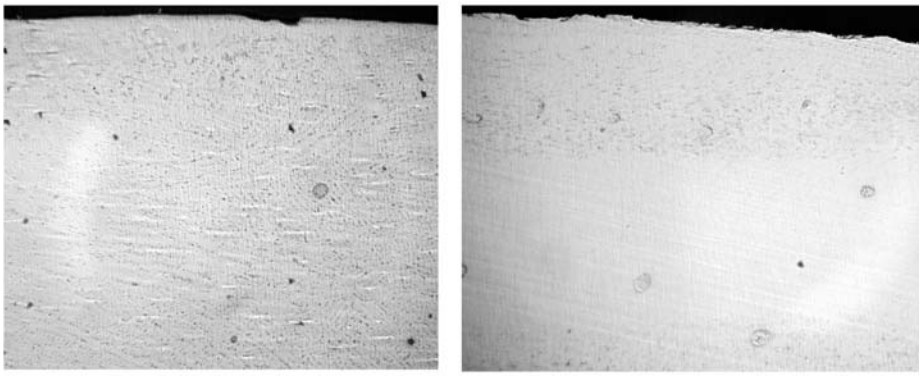

FIG. 3 - Photomicrographs of sections of two issue 1 denarii (Field of view approximately 1mm). On the left is M16 (issue 1b, SECVRITAS P R), on the right is M19 (issue 1a, VICTORIA OTHONIS). M16 shows a widespread pattern of voids and pockets of mineralised copper where the copper phase has been leached out. These are spread throughout the thickness of the coin making an estimate of the original bulk composition impossible. In M19 these structures are only found at the surfaces and therefore leave a core that remains representative of the original metal. An analysis of the 'heart metal' of M19 would therefore provide a reliable estimate of the fineness of this issue whereas an analysis of M16 would not. This is reflected in the measured silver bullion content of these coins; 94.4% for M16 and 89.7% for M19. Clearly the analysis of M19 is more reliable and representative of the alloy from which this issue was made.

We therefore propose that Otho's group 1 and 2 denarii were struck to an identical standard of fineness (about 90%), but that his last issue witnessed a significant debasement to about 80%. The latter standard of fineness appears to be the same as the one utilised by Nero after his debasement of the denarius in AD 64 and by also by Vespasian in AD 74; the former is that adopted by Nero at the very end of his reign in AD 67-68 ([21]). The standards employed by Otho were therefore not new, but correspond to those in use both before and after his brief reign.

It is difficult to gather adequate data on the weight standard used for Otho's denarii, assuming that a single standard was employed. WALKER obtained a mean weight of 3.18g, identical to the weight he obtained for Nero's post reform denarii (1976: 17; 85). However, as we have argued elsewhere (BUTCHER and PONTING 2005b) this weight seems far too low, and we

(21) For Nero, see BUTCHER and PONTING 2005a; for Vespasian, BUTCHER and PONTING 1995. Our results for the Rome denarii of Galba show that he too used a standard of about 90% (BUTCHER and PONTING forthcoming).

proposed an average target weight of 3.45g for Nero's post reform coins. Using a sample of 87 coins drawn from museum collections and sales catalogues, and excluding coins in anything less than 'good very fine' or 'extremely fine' condition, we obtained a mean weight of 3.41g for all groups of Otho's denarii, meaning that issues 1-2 would have averaged about 3.1g of silver per denarius and issue 3 about 2.7g.

One question that arises is whether there was any change in weight standards over issues, particularly between issues 1 and 2 on the one hand, and the baser issue 3 on the other. We intend to explore the weights of first-century denarii in more detail elsewhere, but the average weights for each of Otho's issues can be summarised here:

Issue 1 (55 coins): Mean 3.42g; Median 3.39g; Mode 3.37g
Issue 2 (17 coins): Mean 3.44g; Median 3.43g; Mode 3.39g
Issue 3 (16 coins): Mean 3.33g; Median 3.32g; Mode 3.36g (22).

This might look like there was a slight reduction in weight between issues 1-2 and issue 3, but the numbers of coins in the samples for issues 2 and 3 is small and it would perhaps be unwise to postulate a reduction in both weight and fineness until more evidence is available.

The concentrations of gold, bismuth and lead associated with the silver can sometimes be used to characterise the silver bullion used for different issues as the gold and bismuth levels will relate back to the types of ore from which the silver was extracted, whilst the lead will relate to the technology used to refine the silver (Craddock 1995, pp. 211-213). However, when these elements are plotted the most striking feature is the homogeneity of the silver bullion, with no clear distinction between groups 1, 2 and 3 (fig. 4). This probably reflects the fact that Otho was only striking coin in Rome and that coinage bullion was limited to one source. It may well be the case that silver coins were frequently re-melted, re-refined and the metal mixed and re-used. There is a little more variation in the group 1 coins than in 2 and 3, but this probably reflects the greater size of the group 1 issue.

Therefore the trace elements do not shed any light on the structure of the issues proposed above. This is perhaps not surprising, given the short time span in which the coinage was produced. The only distinction is the lower fineness for the PONT MAX issues.

(22) An independent calculation of mean average weights for the three issues by JM, using coins in 'extremely fine' condition, produced very similar results: issue 1 (34 coins) 3.44g; issue 2 (31 coins) 3.42g; issue 3 (14 coins) 3.32g.

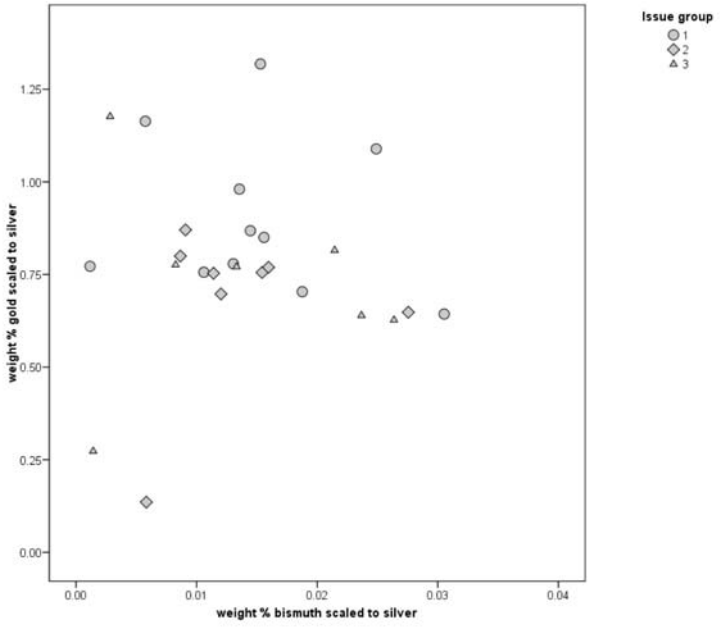

FIG. 4 - Scatter-plot of gold and bismuth scaled to silver for all denarii of Otho.

When compared to earlier issues of denarii (fig. 5) the low bismuth, moderate gold composition of Otho's denarii closely resembles that of the majority of Nero's post reform denarii (BUTCHER and PONTING 2005; 188) but the latter shows greater variability which is probably the result of Nero's mint having access to bullion from a greater range of sources. Furthermore, Otho's denarii are chemically quite different from the anonymous civil war issues of AD 68-69 and the issues of Galba that are attributed to western mints in either Gaul or Spain, no doubt due to different sources for silver being employed. Additionally, it can be seen in figure 5 that the denarii of Galba struck at Rome cluster with the denarii of Otho. Thus one can be confident that the attribution to Rome of Nero's post reform denarii (23), together with the denarii of Galba that have long been given to that mint, and all of the denarii of Otho, is correct (*RIC* I^2: 258). As discussed in an earlier paper (BUTCHER and PONTING 2005), Nero's reform of AD 64 was accompanied by a change in the gold and bismuth concentrations that suggests a change in the ore type/s exploited (and therefore ore source/s) and it is pro-

(23) For a discussion of this coinage see CLAY 1980.

posed that this change also signals the move of the main denarius mint from Lugdunum to Rome ([24]). This elemental signature continues for the Rome issues of Galba and the denarii of Otho and so appears to be diagnostic of the silver bullion available to the Rome mint; a source that was limited and was homogenised through intensive re-cycling.

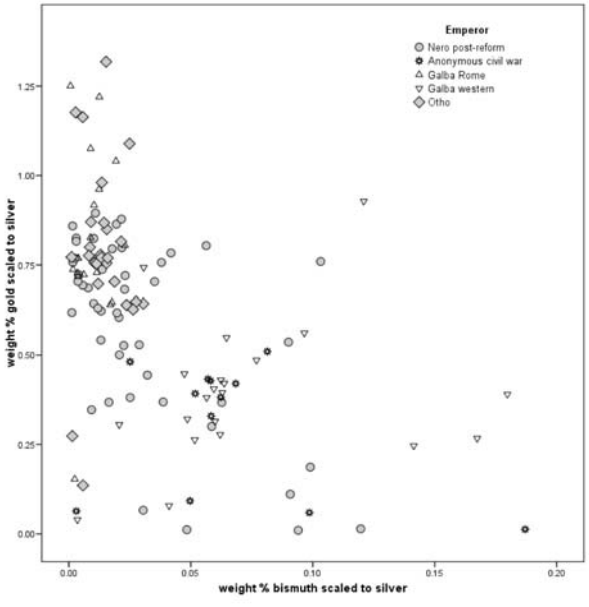

FIG. 5 - Scatter-plot of gold and bismuth scaled to silver for issues immediately before Otho.

Conclusions

The appearance of stability during the conflicts of AD 69, which so surprised WALKER (1978: 115), has been shown to be false. Instead of continuity, using a single standard from Nero's reform in AD 64 until Vespasian's accession, and instead of Otho's denarii all being of a single fineness, the pressures of the civil war between Otho and Vitellius did result in a reduction of the silver content of the denarius at Rome in March or April 69. The

(24) Though there is evidence for one of Nero's pre-reform issues possibly having been produced at Rome as well (BUTCHER and PONTING 2005a).

metallurgy of Otho's issues implies a limited supply of bullion; the evidence of the dies and surviving coins suggests intense minting. The source of raw materials appears to have been the same as that employed by Nero and Galba for their Rome coinages, and so is likely to represent either the same bullion reserve or recycling of a similar range of earlier coinages.

Given the apparently circumscribed sources for silver available to Otho, it seems not unreasonable to suggest that a shortage of silver, combined with a need for a very large quantity of new denarii, probably to pay the legions that had declared for him and had recently been ordered to mobilise (25), compelled him to reduce the fineness of his silver coinage at some point after 9 March. Output of gold coinage, which was relatively plentiful in the earlier part of his reign, was greatly reduced after this point (26). This may indicate that all available manpower at the mint was diverted to the production of denarii, and/or that Otho was running short of gold as well as silver (27). The difficulties may be reflected (albeit hardly explicitly) in Tacitus' remark that Otho's diversion of all available money to his war with Vitellius led to price rises at Rome (*Hist.* 1.89). By this time full preparations for the campaign were under way and Otho himself left for the front on 14 or 15 March. However, his debasement needs to be placed in context: the same, or a similar standard had been employed by Nero until about a year before, and Otho had already produced substantial issues on a higher fineness, following the standard used by Galba and introduced by Nero towards the end of his reign. His reduction therefore returned the denarius to the standard employed by Nero for the bulk of the latter's 'post-reform' denarii. There is no evidence that he was desperate enough to experiment with lower finenesses. In this sense Otho's denarii do form part of a continuum with the coinage of Nero, using as they do the same or similar two standards employed at Rome by the latter emperor.

The Othonian reduction, though quite substantial in terms of the amount of silver employed per denarius, would certainly not have been apparent to contemporaries who handled them (unless, of course, there was an

(25) Perhaps no earlier than the beginning of March: Wellesley 1971: 41-45, 47; 1975: 61.

(26) Of the 97 aurei in the die study sample, only 5 are of the PONT MAX issue.

(27) In this context it is worth noting that Vitellius' first issue at Rome also concentrates on denarii, perhaps an indication that gold for coinage was not readily available in the capital in April 69.

accompanying slight reduction in their weight). Indeed, up to now Otho's debasement has evaded detection in modern numismatic scholarship, and Vespasian has shouldered the blame for reducing the fineness of the denarius after Nero (Walker 1978: 114-117). Vespasian may have had a reputation for avarice, but debasement of the coinage may not have been among his measures to restore the finances of the empire after the long year of AD 69.

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