

The Walbottle Coin Hoard of 1879: re-examination and reassessment

*Frances McIntosh, Peter Guest and Matthew Ponting,
with a contribution by Alex Croom*

SUMMARY

This article reappraises the Walbottle (Throckley) hoard of late third-century Roman coins. The complicated biography of the hoard since its discovery in 1879 is described, followed by a summary of the re-identified coins and a discussion of the dating of the hoard. The results of a ground-breaking metallurgical study of a sample of the Walbottle coins are also presented, emphasising the on-going value of antiquarian finds when subjected to careful re-evaluation and analysis.

DISCOVERY OF THE WALBOTTLE HOARD AND ITS SUBSEQUENT HISTORY

THE WALBOTTLE HOARD OF ROMAN COINS was discovered in 1879 by a labourer digging to lay water-pipes in the road (now the B6528, Hexham Road, which runs through Walbottle and Throckley). The workman discovered an 'earthenware vessel full of Roman coins' about four feet below the surface of the Newcastle to Carlisle Road, close to the buried remains of the south face of Hadrian's Wall (Clayton 1880, 257). Clayton says it was found 'nearly mid-way' between the forts of Benwell and Rudchester, which would put it near Milecastle 10 (Walbottle Dene). Robert Blair, however, in the 4th edition of Bruce's Handbook to the Roman Wall, seems to put it near the presumed site of Milecastle 11 (Throckley Bank Top) (Bruce 1895, 54). This is the current belief, and is the location shown in fig. 1. In the past the hoard has been known as both the Walbottle and Throckley hoard after the names of the two neighbouring villages, although this article will refer to it as the Walbottle hoard as in its original publication (Clayton 1880; Robertson 2000, no. 702).

John Clayton, owner of the Chesters Estate and well-known antiquarian, purchased the jar and most of the coins soon after its discovery and published the first discussion of the hoard in *Archaeologia Aeliana* in 1880 (Clayton 1880). Robert Blair, a local solicitor and 'accomplished numismatist', had examined the coins and his detailed catalogue was an important part of the hoard's publication (Clayton 1880, 266–80). Clayton estimated that the coins contained in the jar 'somewhat exceeded 5000' and, while Blair reported that he had seen 5024 coins altogether, details of only 4608 were published.¹ This list showed that the hoard consisted of debased radiates (silvered-bronze or 'billon' coins), dating from the third quarter of the third century (AD 253–274), and including large quantities of issues of the emperors Gallienus and Claudius II, as well as the Gallic emperors Postumus, Victorinus and the Tetrici. A summary of the contents of the hoard as published in 1880 is shown in Table 1.

Clayton also included his thoughts on when and why the hoard had been deposited, identifying the tumultuous events that almost overwhelmed the Roman Empire between the secession of the usurper Postumus in 259/260 and its reunification by Aurelian in 274 as the

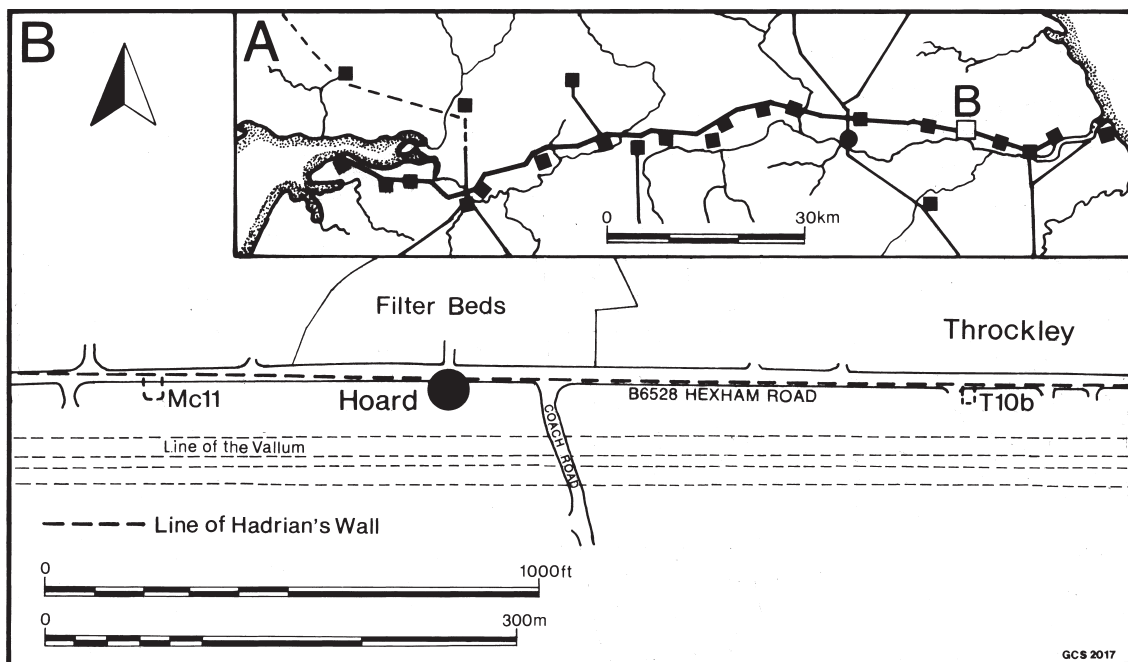


Fig. 1 Approximate findspot of the Walbottle hoard. Map drawn by Graeme Stobbs.

'occasion and circumstance' for the hoard's concealment. In his account, Clayton suggested the Walbottle hoard had been hidden by a soldier garrisoned in a nearby fort on Hadrian's Wall who was about to depart to join the forces assembled on the Continent by the Gallic emperor Tetricus I to face the army of Aurelian. It was assumed that the imagined soldier-owner would have intended to recover his buried wealth on his return, but the fact that the hoard remained in the ground was used to posit that he must have died on the ill-fated campaign, probably at the battle of Châlons-sur-Marne in 274 where Tetricus was resoundingly defeated (Clayton 1880, 264-5).²

Despite Clayton's best efforts to purchase the entire hoard, the finder retained at least 416 coins (and probably many more), and Clayton noted that 'without doubt some of the coins have been sold in small parcels and cannot be traced' (Clayton 1880, 260).³ Unfortunately, it has never been clear exactly how many coins were sold in this way (or indeed how many Clayton purchased along with the pottery vessel), but 603 coins from the hoard were donated to the Society of Antiquaries of Newcastle upon Tyne (hereafter SANT) in 1908 by Philip Spence, son of Charles J. Spence who had acquired them from the finder (PSAN 1907-1908; Spain and Wake 1931, 13).⁴ The dispersal of the hoard explains why although Blair lists 5024 coins in total, his catalogue detailed only 4608 (presumably he did not have access to the coins kept by the finder for full identification and study).

Between 1924 and 1926, W. Percy Hedley re-examined many of the coins in the Clayton Collection and later published a reassessment of the Walbottle hoard (Hedley 1931). Hedley

Table 1 Coins from the Walbottle hoard published in 1880.

CENTRAL EMPIRE			
Emperor	Date	coins	%
Otacia Severa (Philip I)	244-49	1	0.0
Hostilianus (Trebonianus Gallus)	251	1	0.0
Trebonianus Gallus	251-53	1	0.0
Volusian	251-53	2	0.0
Aemilian	253	1	0.0
Valerian	253-60	49	1.1
Mariniana (Valerian)	253-60	2	0.0
Gallienus	253-68	915	19.9
Salonina (Gallienus)	253-68	136	3.0
Saloninus (Gallienus)	258-60	21	0.5
Macrianus	260-61	1	0.0
Quietus	260-61	1	0.0
Claudius II	268-70	696	15.1
Quintillus	270	95	2.1
Aurelian	270-75	8	2.0
Total		1930	41.9%
GALLIC EMPIRE			
Emperor	Date	coins	%
Postumus	260-69	454	9.9
Laelianus	269	6	0.1
Marius	269	24	0.5
Victorinus	269-71	1678	36.4
Tetricus I	271-74	424	9.2
Tetricus II	273-74	92	2.0
Total		2678	58.1%
Total coins		4608	

updated some of the original identifications taking into account the advances made in numismatic scholarship since Blair's work, and he re-dated the coins of Aurelian to no later than 272. This, he claimed, demonstrated that Clayton's explanation of the hoard's burial could not be correct, as the coins must have been buried up to two years before the battle at Châlons and the fall of the Gallic Empire. This meant that a different explanation for the hoard needed to be found and it was proposed that the event that led to its burial was more likely to have been an attack by enemies from beyond Hadrian's Wall. Fear of these bar-

barians would have led to the hiding of the coins for safe-keeping and, although Hedley does not state why the hoard was never recovered, it is clear he believed that its owner must have perished or suffered some terrible fate as he did not dig up his coins once the threat had passed (Hedley 1931, 16–20).

Hedley's article also described the further dispersal of some of the Walbottle hoard's coins in the decades since its discovery. After John Clayton's death in 1890, his very large collection of Roman material was displayed in the museum purpose-built in 1896 by his heirs Nathaniel George and John Bertram Clayton at Chesters Roman fort. In 1928 Isabel Clayton, Nathaniel's widow who had managed the Clayton Wall estate for almost 30 years, died. Soon afterwards Isabel's heir, John (Jack) Maurice Clayton, decided to sell the estate's land along Hadrian's Wall as well as the mansion house at Chesters, including all the archaeological finds on display in the museum as well as in the house. Fortunately, the material in the museum was saved by the establishment of the Trustees of the Clayton Collection, though the objects kept at Chesters house, including many coins, were ultimately sold.⁵ Nevertheless, the prudent actions of the Clayton Collection's trustees saved a total of 1977 coins from Walbottle, which continued to be kept in the Clayton Museum at Chesters.⁶

SANT also holds 932 coins attributed to the Walbottle hoard, including the 603 coins donated by Philip Spence previously mentioned. Two further donations of Walbottle coins to the Society were made in 1931: 280 by Dr Ranken Lyle, bought in the 1930 House Sale (Hedley 1931, 12; Spain and Wake 1933a, 13–14), and 14 by Mrs H. Pease and her son Mr J. W. K. Pease from the late Mr H. Pease's personal collection (Spain and Wake 1932, 201).⁷ In addition to the 897 coins from the Lyle, Spence and Pease donations, the SANT collection contains another 35 coins reportedly from the Walbottle hoard, although there is no information on how they got there. A summary of the various groups of coins from Walbottle and their current locations (where known) is shown in Table 2.

Table 2 Current whereabouts of coins from the Walbottle Hoard and their origins.

No. of Coins	Current Location	Previous owner	Source
1977	Clayton Collection	John Clayton	From finder
280	SANT	Ranken Lyle	1930 House Sale
603	SANT	Philip Spence	Father purchased from finder
14	SANT	Mr Pease	Uncertain
35	SANT	Uncertain	Uncertain
Unknown but at least 2000	Unknown (sold in 1930 House Sale or given away?)	John Clayton	From Finder
416+	Unknown	Finder	Finder

At some point between 1969 and 1973, the Walbottle coins (with the exception of about 30 examples that remained on display in the Clayton Museum), together with more than 9000 coins from Coventina's Well, were taken to the British Museum where they were to be examined by Dr John Kent, curator of Roman coins in the museum's Department of Coins and Medals at the time. The Coventina's Well assemblage remained at the British Museum, but soon after their arrival in London the Walbottle coins seem to have been moved to the Institute of Archaeology in Gordon Square, where it was suggested the newly-appointed Dr Richard Reece might like to identify them.⁸ Unfortunately, time did not allow for this to happen but in 1990 Reece requested permission for two of his PhD students to work on the Walbottle coins. This was granted by Georgina Plowright, then curator of English Heritage's Hadrian's Wall Museums, after which Peter Guest produced an updated list of the coins, while Matthew Ponting undertook chemical analysis of 82 coins for his doctoral research. Guest would subsequently join Cardiff University and in 2001 or 2002 he arranged for the return of the 1977 coins to Corbridge, where they have remained ever since.⁹

In 2012 Frances McIntosh took up the newly-created post of Curator of Roman Collections based at Corbridge and began examining the records for the Walbottle coins.¹⁰ Although the original envelopes containing the individual coins had been retained, it was not clear what the information written on them, often in various hands, signified. To resolve this, McIntosh contacted Guest to request a copy of the catalogue he had produced in 1991. Unfortunately (but entirely predictably), the 3½-inch floppy disk that this had been stored on had corrupted and no hard copy could be found. In light of this disappointing turn of events, Guest was invited to re-identify all 1977 coins in the Clayton Collection at Corbridge and, generously supported by a small grant from the Trustees of the Clayton Collection, this work was completed in three visits during 2013 and 2014. In the meantime, Dr Rob Collins, Keeper of Coins for SANT, located a hand-written catalogue of the 932 Walbottle coins in the Society's collections that had been prepared sometime after 2000 by A. E. ('Gil') Gilmour, the Society's previous Keeper of Coins. This catalogue was digitised at Corbridge and the information added to the Clayton Collection database. An up-to-date, fully-referenced catalogue now exists of the 2909 coins that survive from the Walbottle hoard, which can be used to re-examine the circumstances of its burial and loss.

THE CERAMIC CONTAINER

(by A. T. Croom)¹¹

The vessel is a third-century narrow-mouthed coarseware jar manufactured in south-eastern or eastern England, complete apart from missing sections of the rim on two sides (61% of the rim survives). Burnished decoration consists of a wavy line above a series of wide bands and more widely spaced lines. The rim, shoulder and lower part of the vessel are also burnished. (figs. 2 and 3). The vessel is slightly misshapen, being more bulbous on one side than the other, and the burnished lines are quite carelessly drawn. The fabric is hard, mid-grey and slightly micaceous, with some soft black inclusions.

The eastern sector of Hadrian's Wall was supplied with storage jars from a number of different potteries in southern England during the third century, including the Thames region and the industries round Horningsea in Cambridgeshire. Both areas used cordons, wavy line decoration and burnished lines, though the Thameside examples tend to have narrow necks

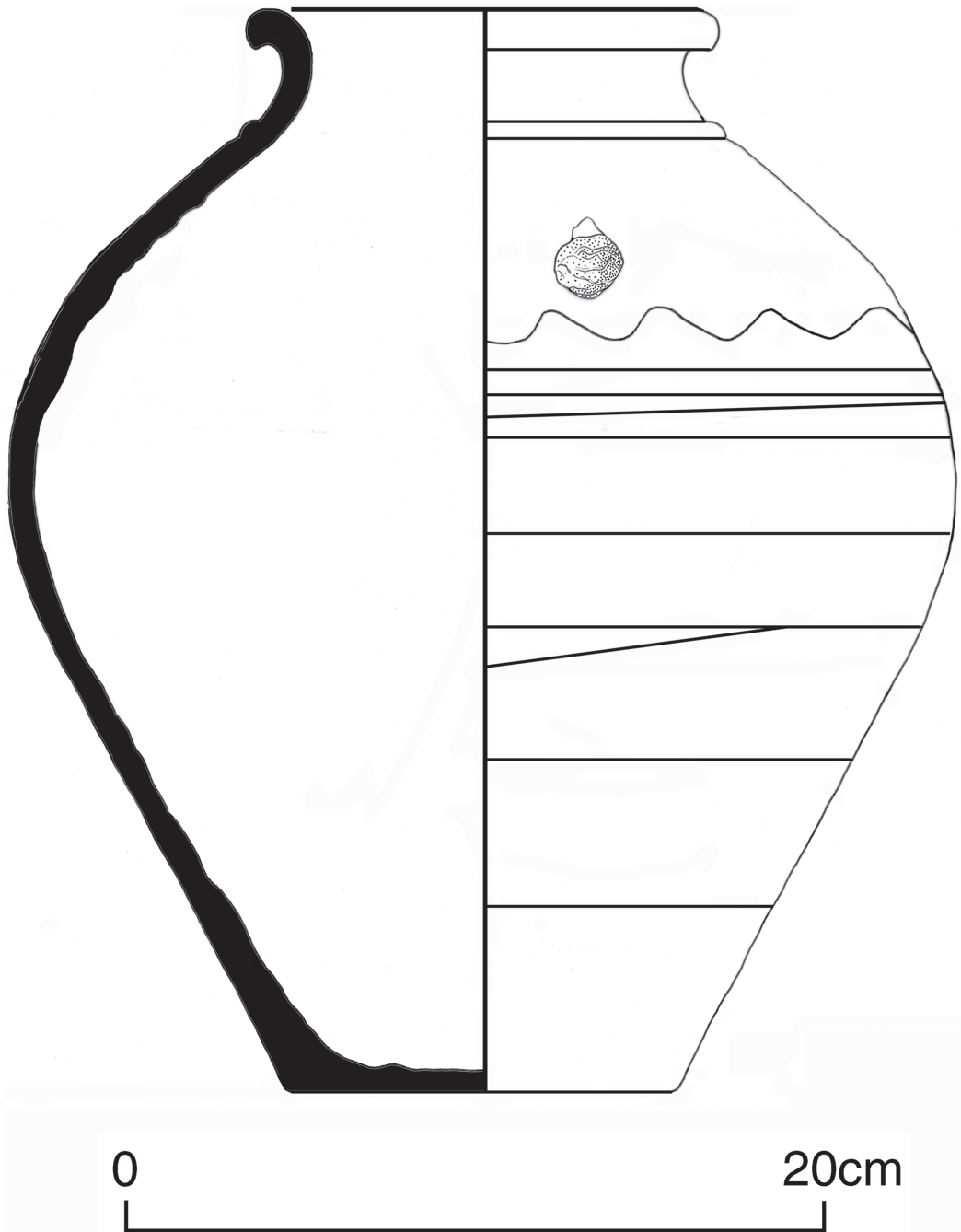


Fig. 2 Illustration of the jar. Alex Croom.



Fig. 3 Photograph of the jar showing the lead plug and an early label. For scale see fig. 2.

and more rounded profiles (Monaghan 1987, classes 3A5.1 and 2 and Turret 34a; Charlesworth 1973, fig. 11, no. 7), while the Cambridgeshire examples have wider mouths (Pullinger *et al.* 1999, pl. LXXIX, no. 460, poorly made). It is unclear how long the supply of jars to the north-east continued in the third century, but ethnographic parallels suggest that large vessels that were not used over a fire could have a long life (Shott 1996, 479).

On the shoulder of the vessel there is hole pierced from the outside, approximately 20 mm high and 13 mm wide and partially filled with the corroded remains of a lead plug. Usually such plugs are flat, but in its current state this example projects outwards by 9 mm and there is no disc-shaped terminal on the interior. It has been suggested that pierced vessels had both domestic and ritual functions, although it is likely that use varied not only according to the type of vessel but also the number and position of the holes, and if the holes were subsequently filled with lead plugs. Possible usages for pierced vessels without plugs include funnels, strainers, flower pots, timing devices, and for preparing food or drink (Fulford and Timby 2001). A concentration of lead plugs near the 'sanctuary' area at Springhead in Kent indicates that plugged vessels could have been used in ritual practices as well (Biddulph *et al.* 2011, 250), and examples of pierced vessels with plugs also have been found in burials. Pierced or plugged vessels are not common as containers for coin hoards, so it is likely the Walbottle vessel had been previously holed for some domestic purpose and was later plugged before being used for the hoard. Patches of copper-alloy staining on the interior surface indicate that the coins filled the vessel up to about the level of the wavy line.

THE COINS FROM THE WALBOTTLE HOARD: MONETARY AND HISTORICAL CONTEXTS

The Walbottle hoard is one of a large number of coin hoards dating to the later third century from Roman Britain (fig. 4).¹² It contains debased radiates (also known as *antoniniani*) struck between 253 and 274 and, from the hoard's contents as described in 1880 (summarised on Table 1), it is immediately apparent that the most common coins were issued in the names of the emperors Gallienus (AD 253–268) and Claudius II (AD 268–270), as well as the rulers of the so-called Gallic Empire, Postumus (AD 260–269), Victorinus (AD 269–271), Tetricus I (AD 271–274) and Tetricus II (AD 272–274).¹³

Robert Blair's original catalogue is a very competent list of the Walbottle coins arranged by emperor and reverse type and also including details of mint-marks. Yet, even though the final volume in Henry Cohen's pioneering arrangement of Roman imperial coinage had been published some years previously (Cohen 1859–1868), Blair did not make reference to this systematic numismatic research (possibly because Cohen's work only became widely known with the publication of the second edition between 1880 and 1892). By the time of the 1931 article describing the Walbottle coins in the Clayton Collection, however, the 1892 edition of Cohen had become the standard numismatic reference and Percy Hedley used this, as well as the recently published fifth volume of *Roman Imperial Coinage*, in his catalogue (Webb 1927).

Numismatics is a remarkably dynamic subject and numismatic knowledge is continually expanding with the discovery of new finds. Therefore, when the opportunity arose in 2013 to re-examine the Walbottle coins, it was decided to update their identifications with the latest modern references. These included the important publications of the Cunetio and Normanby hoards of late third-century radiates (Besly and Bland 1983; Bland and Burnett 1988), as well

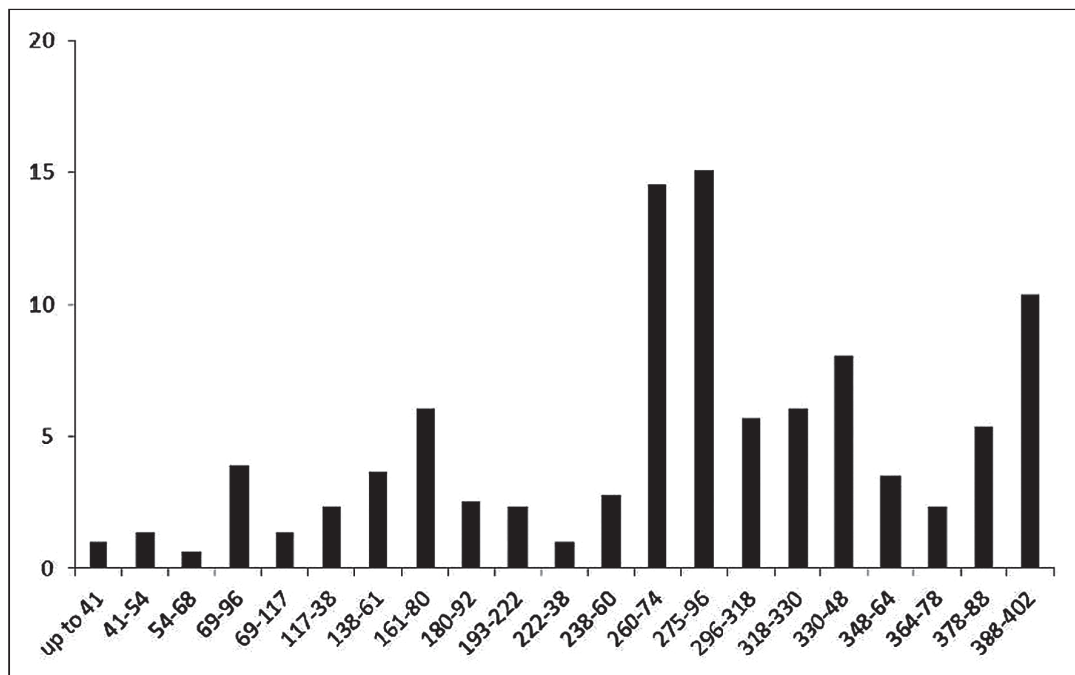


Fig. 4 Sequence of coin hoards from Roman Britain (based on Robertson 2000 and Abdy 2011). Vertical axis shows % (hoards containing 'barbarous radiates' are placed in the period 275-96, rather than with their earlier prototypes).

as Webb's volume of *Roman Imperial Coinage* and Georg Elmer's publication of Gallic Empire coinage that were, for many years, the standard works of reference for this period (Elmer 1941). Summaries of the Walbottle coins arranged by emperor, reverse type and mint are presented here in Appendix 1 (Clayton) and Appendix 2 (SANT), while a general overview of these two groups of coins can be seen in Table 3.¹⁴

Comparison of the 1880 and the 2014 lists of coins from the Walbottle hoard indicates that the 1977 coins in the Clayton Collection appear to be broadly representative of the original 5000+ coins. There are, however, some notable differences between the Clayton coins and those in the SANT collection today, particularly as the latter group appears to show the effects of deliberate selection or rejection of certain coins (those of Gallienus and Claudius II as well as the first Gallic usurper Postumus appear to have been favoured, while issues of Victorinus seem to have been avoided). Furthermore, the SANT collection contains many single examples of individual reverse types as though range and variety were important considerations (it is likely that Charles J. Spence in particular bought specific coins from the hoard's finder in order to obtain the widest assortment).

Hedley dismissed Clayton's original dating and interpretation of the Walbottle hoard's deposition (see above), based on his re-assessment of the eight coins of Aurelian in light of Webb's recently published work on the coinage of this emperor (Hedley 1931, 15-16). This indicated that the latest coins of Aurelian from the hoard were two issues from the mint at Milan that cannot have been struck later than 271 or possibly 272 (one of the ROMA

Table 3 Coins from the Walbottle hoard in the Clayton Collection (1977) and those held by the Society of Antiquaries of Newcastle upon Tyne (932)

CENTRAL EMPIRE						
Emperor	Date	Clayton collection	Clayton collection %	SANT collection	SANT collection %	Total
Valerian	253-60	1	0.1	7	0.8	8
Gallienus (joint reign)	253-60	4	0.2	14	1.5	18
Salonina (joint reign)	253-60	17	0.9	13	1.4	30
Saloninus	258-60	0	0	3	0.3	3
Gallienus (sole reign)	260-68	372	18.9	283	30.9	655
Salonina (sole reign)	260-68	24	1.2	19	2.1	43
Claudius II	268-70	262	13.3	193	21.0	455
Divus Claudius	270	27	1.4	15	1.6	42
Quintillus	270	8	0.4	34	3.7	42
Aurelian	270-75	1	0.1	0	0	1
Totals		716	36.3%	581	63.4%	1297
						44.9%
GALLIC EMPIRE						
Emperor	Date	Clayton collection	Clayton collection %	SANT collection	SANT collection %	Total
Postumus	260-69	170	8.6	128	14.0	298
Marius	269	0	0	5	0.5	5
Victorinus	269-71	856	43.4	73	8.0	929
Tetricus I	271-74	202	10.2	97	10.6	299
Tetricus II	273-74	29	1.5	33	3.6	62
Totals		1257	63.7%	336	36.6%	1593
						55.1%
Unidentified emperor		4		15		19
Total coins		1977		932		2909

AETERNAE type with Q in the exergue, the second of the type IOVI CONSERVATORI with possibly P in the exergue). It turns out, however, that these are not the latest coins from Walbottle at all. In fact, the most recent coins from the hoard are the 26 examples of the SPES AVGG type issued by the Trier mint in the name of the Gallic emperor Tetricus II, the son of Tetricus I who was awarded the title of Caesar in 273 and who surrendered with his father to the victorious Aurelian (AD 270–275) after their defeat at Châlons in 274 (only five of these coins survive in the Clayton Collection).

It is important to bear in mind, however, that these Tetrican coins provide only the latest point in time after which the hoard must have been buried (known to archaeologists as the *terminus post quem*, or *t.p.q.*), and that knowing when a coin was manufactured does not tell us for how long it remained in use and was, therefore, available to be hoarded. The period from 260 to 274 was a time of great political and economic crisis, complicated by the usurpation of Postumus in 260 and the de facto establishment of the Gallic Empire after which the western provinces of Gaul, Britannia, Germania and, for a time, Hispania were ruled from the Rhine rather than from Rome (Drinkwater 1987).¹⁵ Evidence from continental coin hoards suggests that coins of Aurelian, as well as his 'Central Empire' predecessors such as Gallienus and Claudius II, only began circulating in the provinces of the Gallic Empire after the defeat of Tetricus and the reunification in 274 (Guest 1994, 184–7). If this was also the case in Britain, as would seem likely, the eight coins of Aurelian from Walbottle also therefore push the *t.p.q.* for the burial of the hoard forward to 274 or later. Exactly how much later is a matter of considerable debate, not helped by the instability of Roman currencies in the second half of the third century that mean it is very difficult today to decipher which coins were in use at any particular point in time.

The radiate had been introduced by the emperor Caracalla in 215 after a period of rapid debasement of the silver *denarius* that began in the first century but had accelerated during the reign of his father, Septimius Severus. Originally tariffed at two *denarii* (signified by the radiate crown), but containing only 50% more silver than the *denarius*, the radiate proved to be unpopular and its production was halted in 219. Increasing pressure on the Empire's stocks of silver, however, resulted in further debasements of the *denarius* and the radiate was later re-introduced. Production of the *denarius* ceased after 238, from which point the radiate became just about the only Roman denomination in everyday circulation (Abdy 2012, 507–11; Bland 2012, 515–6).

The political and economic turmoil during the years from the 250s is reflected in the fortunes of Rome's currency and the radiate suffered a rapid fall in its weight and silver content (Harl 1996, 129–32; Bland 2012, 517–9). This period of virtually continuous debasement reduced the fineness of the radiate from approximately 45% silver during the reign of Gordian III (238–44), to less than 20% by 260 when Postumus usurped imperial power over the western provinces. Postumus established new mints probably at Cologne and Trier to produce coinage in his name and, for a time, these Gallic coins were of a far better quality than those struck in Italy. From 267 or 268, however, the standard of both Central and Gallic coinages fell at a faster rate than ever, so that by the 270s the radiate was a shadow of its former self, weighing less than half of the Caracallan coin and containing 2% silver or less.

There were probably many reasons for this rapid and dramatic devaluation in Roman coinage, but one consequence was that the production of radiates increased exponentially with their debasement. Study of the dies used to produce coins of the Gallic emperor

Victorinus, for example, suggests that some 476 million coins were struck during his short reign of under two years (Bland 2012, 521).¹⁶ This astonishing level of production meant that low-value coins would have been increasingly available to the population of the Empire, but it also had the effect of driving older, better quality, coinage out of circulation as the state sought to recover these for their silver content, while people simultaneously attempted to keep hold of them rather than hand them over to the emperor's tax collectors. This explains why so few coins predating the sole reign of Gallienus are present in the Walbottle hoard, where 95% of the coins were at most only fourteen years older than the most recent issues.

This downward spiral of ever-rapid silver debasement was eventually halted in 274 when Aurelian, probably after the reunification of the Gallic provinces with the Empire, attempted to reintroduce a tri-metallic currency, including a reformed radiate that was larger and of a better quality than pre-reform coins. These coins, today often referred to *aureliani* to distinguish them from the previous coinage, bore the mark XXI or XX•I in the exergue on their reverse sides that most scholars now agree stands for '20 to 1', and refers explicitly to the coins' 5% silver content (Estiot 2012, 545–8).¹⁷ The *aurelianus* contained approximately ten times the amount of silver as the pre-reform radiates and there is some debate about whether Aurelian's reforms demonetised the previous coinages or if these were retariffed as smaller denominations in the new post-274 currency (Estiot 2012, 547). Writing in the early sixth century, the Byzantine historian Zosimus indicates that old coinage was indeed recalled; '[Aurelian] then officially distributed a new silver coin, having had the public hand in the coins of poor alloy; in this way he avoided any confusion in financial dealings' (*Historia Nova* 1.61.3). The presence of pre- and post-reform coins in numerous hoards from the Roman Empire suggests that, whatever the official policy of the imperial treasury, in reality people continued to use and hoard both coinages together.

The *aurelianus* is found far more often in the central and eastern provinces of the Empire than in the west, and it would appear that there was a shortage of new currency in places like Britain and northern Gaul, in response to which the provincial populations took matters into their own hands and produced their own local coinage to meet on-going demand. Many hoards of the later third century contain large quantities of copied radiates of recent emperors such as Claudius II, Victorinus and the Tetrici and, although our understanding of this phenomenon is hazy at best, it appears that these coins, known as 'barbarous radiates', filled the void left by the uneven distribution of *aureliani* to those provinces that previously had been part of the Gallic Empire (Boon 1988, 124–32; King 1996; Kropff 2005). 'Barbarous radiates' contained very little silver at all (if any) and they circulated in vast quantities in Britain where, together with official pre-reform radiates, they seem to have made up a significant proportion of the more-or-less token currency in day-to-day use for around a decade after 274. Coins of Aurelian's successors in Rome (Tacitus, Florian, Probus and Carus) did not circulate in any great quantities in Britain and it is likely that this situation of low official supply supplemented by copied coins only ended with the introduction of a new better-quality coinage soon after the usurpation of Carausius in Britain in 286.

It is significant, therefore, that the Walbottle hoard does not contain a single example of a post-reform *aurelianus* and only a handful of 'barbarous radiates' (only four obvious copies were present in the Clayton Collection). This perhaps suggests that the hoard was concealed not long after 274, for if its burial had occurred closer to 280 or 285 we might anticipate the presence of more *aureliani* and far more 'barbarous radiates' in the jar (especially '*minims*').

METALLURGICAL ANALYSIS

As part of a PhD project conducted at the Institute of Archaeology, UCL between 1990 and 1994, 82 coins were taken from the Wallbottle hoard for chemical analysis by atomic absorption spectrometry (AAS) (Ponting 1994).¹⁸ The coins were chosen to give, typically, two examples of the commoner types represented in the hoard, together with the four coins identified as 'barbarous radiates' on the basis of style and fabric. All the coins were chosen for their relatively clean and uncorroded states, and all were clear enough to allow a full numismatic identification (with the exception of one of the copies).

The results of the AAS study are presented in Appendix 3. A preliminary examination of the data indicates a spread of values much as one would expect for the coins and alloy types involved. Silver values are generally less than 5% (with some exceptions), and the alloys contain significant levels of tin and lead. A comparison of these results with those of Cope's classical gravimetric analyses reveals passable agreement in most cases for those elements that Cope had measured (usually only silver, tin and lead) (Cope 1974). No structure was readily discernible in these data, apart from the gradual reduction in silver content that is an expected feature of the period.

The only significant difference in composition between coin types was in the alloys of some of the 'barbarous radiates'. Of the four examples included in the study, the coin with the Claudius II prototype had a considerably higher zinc content (2.5%) than any of the official issues, the Postumus and Gallienus copies had unremarkable compositions very similar to some of the official examples, while the coin that was worn so flat as to be un-attributable had a very high tin content (10.0%).

The official coins produced an apparently random collection of results. This is not surprising given the large number of types covered by the sample and the fact that only two to four examples of each type were analysed. The silver contents are particularly variable, reflecting the volatility of this period in Roman economic history, although most conform broadly to the values reported by previous studies (Cope *et al.* 1997).

Silver content of radiates from 260 to 274

In antiquity, pure elemental silver was not known (indeed, elementally pure silver could not have been produced by the technology available at the time). Instead, what was regarded as un-alloyed silver in antiquity was actually silver together with traces of gold and lead from the original ore and, in the case of lead, also from the refining process. It is therefore usual to regard the silver bullion contents of ancient silver-alloy coins as being the sum of the elemental values for silver, gold and lead. With these later third-century coins, however, the levels of lead are often considerably higher than can be attributed solely to the traces associated with the silver and most of this lead must have been an intentional addition made during alloying. This makes it unwise to include the lead concentrations in bullion calculations and, consequently, these have been omitted from the bullion values reported here.

The silver bullion contents of the analysed coins are shown on fig. 5. This indicates a marked decline in fineness during the joint reign of Valerian and Gallienus, down to levels somewhat below the figures quoted in previous studies. Bullion values between about 2% and 8% occur for Gallienus' sole reign, differing somewhat between mints but generally in agreement with Cope's values and spanning the same range of concentrations. The coins of

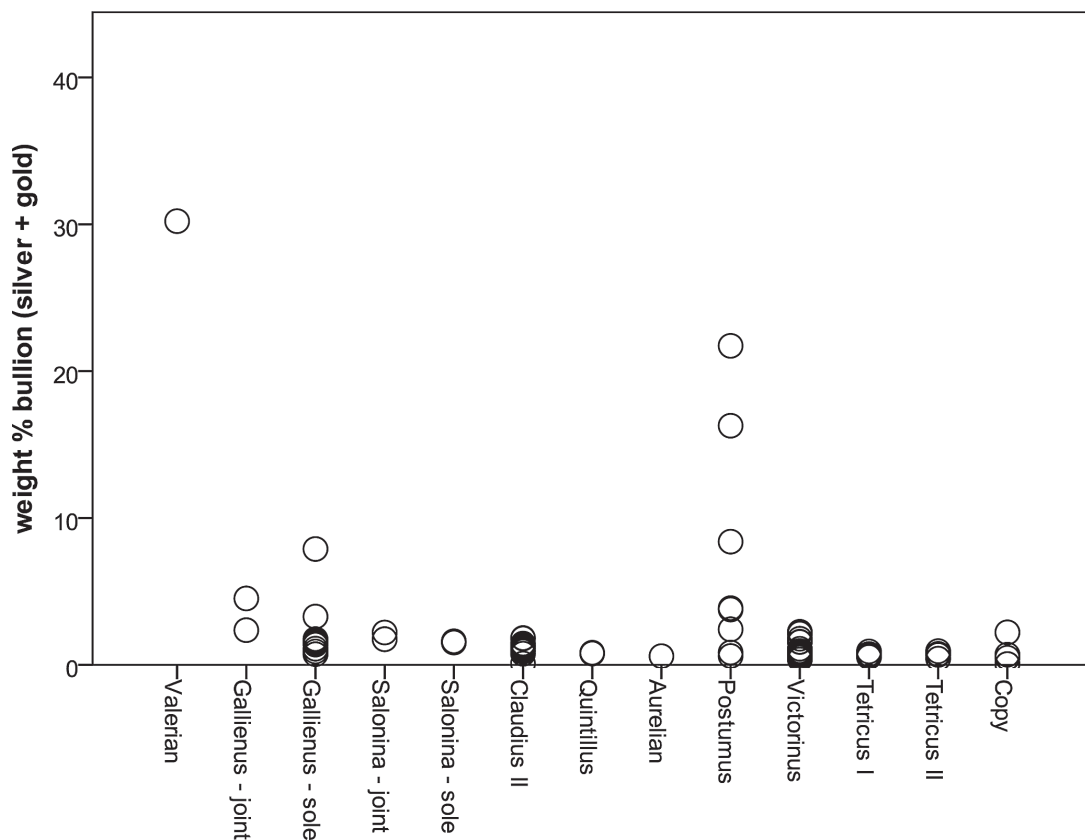


Fig. 5 Silver bullion values (less lead) for the coins analysed from the Walbottle hoard.

Postumus, the first ruler of the break-away Gallic Empire, mirror the finenesses of Gallienus' sole-reign issues until the debasement of 267/8, after which the standards of both the coinages of the Gallic and Central Empire plunged to less than 5%. The silver bullion contents of both coinages remained at similar low level until the reunification (and coinage reform) under Aurelian in 274.

Alloys of radiates from 260 to 274

The base-silver radiates of this period were also the first 'silver-alloy' coins produced by the Roman state to regularly contain significant levels of lead and tin in addition to copper. The use of these more complex alloys provides additional compositional features that would have been manipulated by mint officials and so provide potentially fruitful areas for investigation. Multivariate statistical methods were used to explore the alloys' compositions, firstly involving a principal components analysis (PCA) of the log-transformed covariance matrix of the matrix of the major components (silver, lead and tin, with the exception of copper).¹⁹ The results reveal significant differences between not just the two main groups (issues of the

Central and Gallic Empires), but also between many of the individual issues of Gallienus, Claudius II and especially the radiates of the Gallic emperors (fig. 6).

Figure 7 shows just the concentrations of tin and lead in the coins' alloys where the difference in tin content between most Central issues and those of the Gallic mints again is very clear. For coins of the Central Empire, issues of Mediolanum and Siscia appear to be less consistent in composition than those from Rome, where an alloy containing between about 5% and 8% of tin was used. The Siscia issues of Gallienus's sole-reign contain appreciably less tin (~1%) as do some of the Mediolanum issues (although there seems to be a greater similarity between the later coins of Claudius II from Rome and Mediolanum). A similar pattern can be seen in the lead concentrations, with some Rome issues containing over 15% lead.²⁰ In contrast, the Gallic Empire's coins are quite different from the Central issues, containing under 1% tin and less than 3% lead, and it is clear that the Central mints used varying levels of tin and lead in their coinage in a way that the Gallic Empire did not. The copies conform to neither group of official coins.

A second multivariate analysis, this time of the trace elements contained in the coins' alloys (arsenic, antimony, cobalt, nickel, iron, chromium and zinc), group the Gallic issues more discretely than the Central issues, which are themselves more discretely grouped by the major

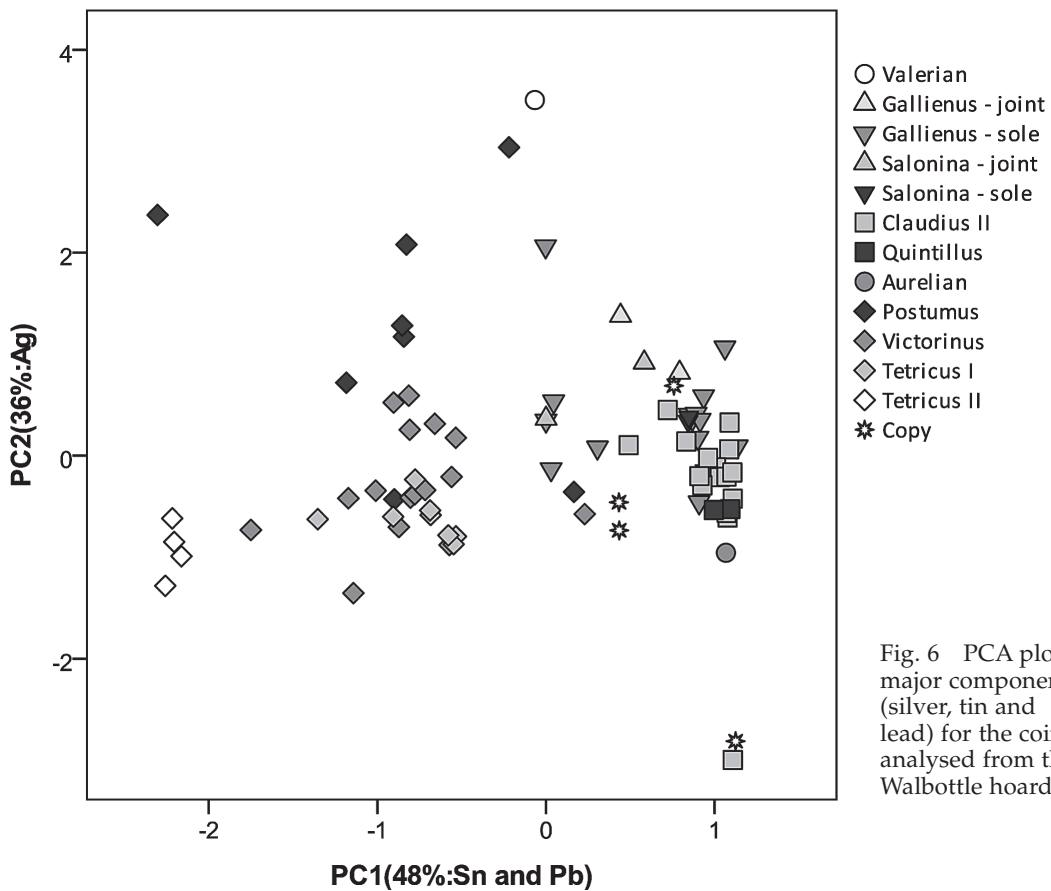


Fig. 6 PCA plot of major components (silver, tin and lead) for the coins analysed from the Walbottle hoard.

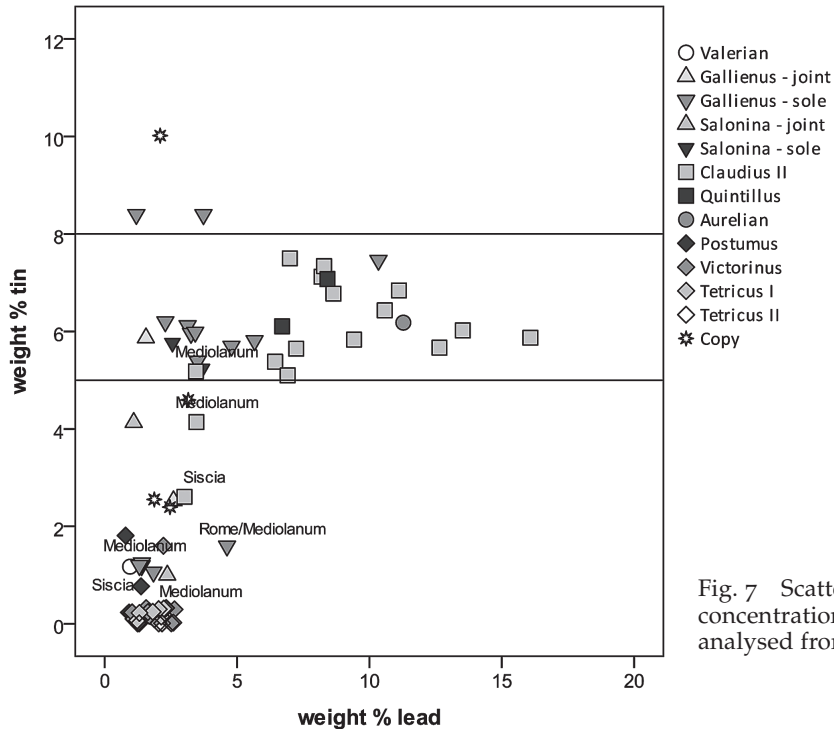


Fig. 7 Scatterplot of lead and tin concentrations for the coins analysed from the Walbottle hoard.

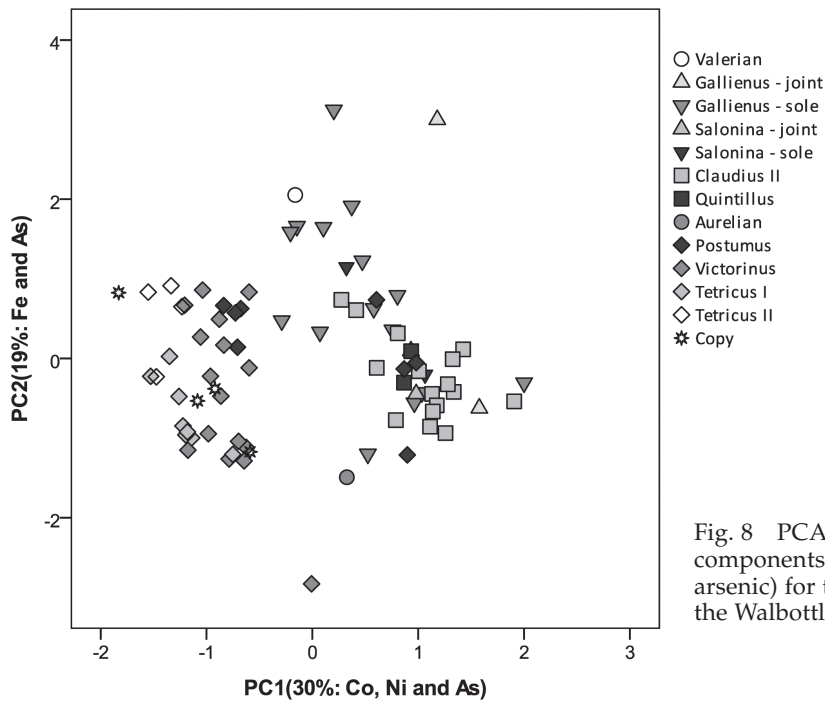


Fig. 8 PCA plot of minor components (cobalt, nickel and arsenic) for the coins analysed from the Walbottle hoard.

components (fig. 8). This suggests that the control of the amounts of lead, tin and silver in the issues of the Central mints is a more important factor for the grouping of these coins than the concentrations of the un-controllable trace elements (whose presence was unknown and relates to the origin of the metals that were controlled). The opposite appears to be true of the Gallic radiates and suggests that the 'supply pool' of metal going into these coins was less variable in its chemistry than the alloys used to strike the Central coinage. With five mints in the Central Empire (Rome, Milan, Siscia in Croatia, Cyzicus and Antioch in Turkey), as opposed to two in the Gallic Empire (Cologne and Trier), this difference in metal supply is not surprising. It is noteworthy that the four 'barbarous radiates' are most similar to the Central issues when comparing the major components (fig. 6), yet when we look at the PCA of the minor components (fig. 8) they are firmly grouped with the Gallic issues

DISCUSSION

This reassessment of the Walbottle hoard has provided much new information with which to better understand the nature of Roman coinage in the second half of the third century, as well as the practice of hoarding coins in Roman Britain at this time. The metallurgical analyses demonstrate, for example, that the radiates struck for the Central and Gallic Empires between 260 and 274 were manufactured from very different metal sources. While the precise nature of these is not yet known, the clear separation of these contemporary coinages' chemical compositions indicates that there was little mixing between the two.

It is also becoming clearer that the production of radiate coinage in the later third century required vast quantities of metal. The striking of hundreds of millions of radiates in the Gallic Empire alone would have consumed in the region of 800 tonnes of metal each year, of which at least 95% would have been copper, tin and lead.²¹ Yet, the Gallic authorities do not appear to have relied on recycling older coins from before 260 and the results of the metallurgical study show that they were able to obtain sufficient amounts of these metals in other ways (whether fresh or recycled cannot be determined at present). These very large quantities of metal were needed to fuel the astonishing output of low-value radiates that were just about the only coins in circulation at the time (gold was almost non-existent).

Each radiate, however, contained only a small fraction of the silver content of a first- or second-century *denarius* and it has been shown that the amount of silver consumed at all mints in the Roman Empire in the 260s and 270s had fallen by between 60% and 80% compared to levels in the 230s (Depeyrot and Hollard 1987; Bland 2012, 517–20). The rapid and steep reductions in the consumption of silver to strike coinage resulted in Roman currency consisting almost exclusively of the smallest of small change and it is interesting to speculate how much a collection of coins such as the Walbottle hoard would have been worth to its owner.

Monetary value is measured either by a relationship with another denomination or currency, or by how many coins are required for goods and services. Unfortunately, for the later third century we do not know how many radiates would have been required to exchange for a gold *aureus*, or how many coins a soldier received from the state, either as pay or in special donatives, or indeed how many radiates were needed to buy a single commodity or service. In these circumstances, the only useful method of measuring a radiate's value is to compare it indirectly to the earlier *denarius* and *sestertii* whose values are better understood. A 2.5 g

radiate of the late 260s and early 270s contains something like 0.06 g of silver metal compared to approximately 3.6 g of silver in an Augustan *denarius*, and 2.7 g in a *denarius* after the reforms of the emperor Nero in 64.²² Therefore, from these estimates of the intrinsic values of third-century radiates and first-century *denarii* (and based solely on their silver standards), the 5000 radiates in the Walbottle hoard contain the same quantity of precious metal as between 83 and 94 *denarii* (pre- and post-AD 64 reform respectively). An auxiliary infantryman in the first century is believed to have received an annual stipend of 187.5 *denarii* (Speidel 1992, 93), which we can use to postulate that the Walbottle hoard may well represent a quantity of silver equivalent to something like 45% to 50% of an auxiliary's yearly pay in the early empire. While this is likely an over-estimation of the monetary value of the radiate, it nevertheless provides us with an indication of how much the Walbottle hoard was actually worth in real terms.²³

In contrast, why the hoard was buried and not recovered is likely to remain a mystery for the foreseeable future. The absence of any reformed *aureliani* and the presence of only a handful of 'barbarous radiates' indicate that the hoard's deposition in all probability took place in the mid-270s, before the shortage of official reformed radiates resulted in the upsurge in production of locally-made copies (Davies 1992). Whether the Walbottle hoard was buried for safe-keeping while on campaign, or in response to a threat from beyond Hadrian's Wall (as Clayton and Hedley proposed in 1880 and 1931, respectively), is as yet unknown, but it is of course possible that its owner was not a soldier stationed in a nearby fort as was assumed in these earlier discussions of the circumstances of its burial and non-recovery. There are many reasons why a hoard of coins might have been buried and as many others to explain why it might have remained in the ground, and a better appreciation of the nature and distribution of hoarding in general is needed if we are to get closer to a sounder understanding of the histories of individual hoards in the future (Grierson 1975, 124–59; Casey 1986, 51–67; Reece 1987, 46–70; Robertson 1988; Reece 2002, 67–88; Abdy 2011; Guest 2015).²⁴

For the time being, it is striking that Hadrian's Wall and its militarised hinterland in northern England would appear to have produced relatively few coin hoards from the second half of the third century (Robertson 2000, xxvii and map 15). Instead, the vast majority of these hoards, that it should be remembered are the most common from the entire Roman period, are concentrated in the central, southern and eastern parts of England. It would seem unlikely that this pattern is caused by different methods of recovery or traditions of reporting in the northern English counties, and the genuine relative absence of hoards from the Hadrian's Wall area, precisely where coins were most likely to have been widely available, is unexpected.

Perhaps the militarised zone of northern Britannia did not experience the same levels of instability and fear as elsewhere on the island during the chaotic years of the 260s and 270s? An alternative explanation is that Hadrian's Wall had been denuded of much, if not most, of its garrison during the Gallic Empire period, when, consequently, far fewer coins arrived in its forts. Coin lists from excavations, however, suggest that plenty of late third-century radiates were in everyday use along the frontier, and a reliable explanation for the absence of coin hoards from Hadrian's Wall is likely to be more complex than we have supposed in the past. The Walbottle hoard is a rare find and, despite having been fragmented and dispersed since its discovery almost 140 years ago, it is gratifying to know that it still has new stories to tell.

NOTES

¹ Hedley misquotes the total as 5028 in his reassessment of the hoard (Hedley 1931, 12).

² Like his contemporaries, Clayton was influenced by Edward Gibbon's *History of the Decline and Fall of the Roman Empire* (published 1776–89) and Roach Smith's *Collectanea Antiqua* (published in 1848).

³ Clayton referred to his purchase in the original article with the following words: 'The lucky "Patlander" proceeded to realize the fruits of his discovery, and in doing so has shown much commercial ability'. Clayton was particularly keen to avoid the situation which had arisen after the discovery of the Thorngraston arm purse, when it took more than 20 years for the coins to be fully studied and saved for the future (Clayton 1859; Bruce 1871).

⁴ Although Hedley stated that Spence had purchased 599 coins, records show that 603 coins came to the Society of Antiquaries collection in 1908.

⁵ For more information on this period see McIntosh 2014. The 1930 House Sale catalogue listed at least 1225 coins in a variety of lots, albeit with few details and it is unclear how many of these came from the Walbottle hoard (Hampton and Sons 1930).

⁶ For many years the coarseware vessel and 30 coins were on display at the Clayton Museum. Since the refurbishment of the museum in 2016 the hoard and the vessel are stored in the reserve collection at Corbridge Roman Museum.

⁷ It is not clear from the entry in the Curator's Report when or how Mr Pease originally came into possession of the coins, whether from the Chesters sale, from the labourer, or directly from John Clayton (while he did not become a member of the Society of Antiquaries until 1891, he could still have known Clayton).

⁸ The coins were transported to London by Richard Du Cane, owner of Carrawburgh Roman fort, in multiple trips by car on the request of Grace Simpson, the Honorary Curator of the Clayton Collection (Simpson 2000). We are grateful to Richard Reece for his recollections of the transfer of the Walbottle coins to the Institute of Archaeology. Precisely when this happened is now lost in the mists of time.

⁹ Since 1981 the Clayton Collection has been cared for by the English Heritage curator based at Corbridge Roman Museum. The Walbottle coins were allocated the accession numbers 01.5059 and 02.5061.

¹⁰ The Walbottle coins were repackaged by Jane Lovett, Documentation Assistant at Corbridge, between 2009 and 2012. The vessel in which the coins were found now has the museum number CH1824, while the coins are CH1825-CH1851 and CH9949-CH11898.

¹¹ The authors are grateful to Paul Bidwell for his assistance in the discussion of the vessel.

¹² The 497 hoards ending with coins struck between 260 and 294/6 published by Robertson represent just over 30% of all securely datable coin hoards from Roman Britain in the Inventory (Robertson 2000). The *Coin Hoards of the Roman Empire* project currently includes details of 984 hoards that close with these coins on its database, or just about 40% of the 2505 hoards from the entire Roman period in Britain (<http://chre.ashmus.ox.ac.uk/> — accessed 15 January 2017). The *OHCE* is an on-going project and the picture is likely to change as more data is collected.

¹³ It is likely that these coins were called radiates (*radiatus/radiati*) in the Roman period. Today they are often referred to as *antoniniani*, derived from the name of the emperor Antoninus who first introduced the denomination. (Antoninus is better known as Caracalla due to his preference for wearing the caracallus, a hooded cloak.)

¹⁴ Full catalogues listing each coin from the Walbottle hoard in the Clayton Collection and in the SANT coin collection can be obtained on request from the Curator of Roman Collections at Corbridge Roman Museum.

¹⁵ The 'Gallic Empire' is a modern name for the territories ruled by the usurper Postumus and his successors until 274. There is no evidence that the 'Gallic' emperors saw themselves as anything other than Roman and, rather than conjuring up a picture of a secessionist regime, it is better to imagine the Gallic Empire as a state-within-a-state (a situation that the legitimate emperors in Rome always refused to recognise).

¹⁶ Bland suggests that this equates to 48 million coins per week, but this figure cannot be correct and is most likely a miscalculation based on the two-month reign of Victorinus' predecessor Laelian.

¹⁷ See Corbier 2005, 340 for alternative interpretations of the exergual marks on *aureliani*.

¹⁸ Samples for analysis were taken by drilling into the cylindrical edge of each coin with a 0.5 mm diameter drill and collecting the turnings. In every case it was necessary to discard the drillings from the first millimetre or so of surface metal as this would be contaminated by corrosion products and affected by the chemical changes caused by the corrosion processes. Approximately 20 mg of the clean drillings retained were then dissolved in aqua regia, a mixture of nitric and hydrochloric acids, and made-up to a volume of 20 ml with ultra-pure water. This solution was then run through the AAS instrument following calibration by matrix-matched standard solutions according to the method discussed by Hughes *et al.* (1976). Because of the tendency for silver to precipitate out of solution as silver chloride in aqua regia solutions, separate solutions using approximately 2 mg of sample were also prepared for the measurement of silver and copper in nitric acid only. Identically prepared solutions were made-up from appropriately matched standard reference alloys and these were run alongside the coin samples to monitor accuracy and precision.

¹⁹ The copper, as the main constituent, had to be removed in order to avoid the well-known statistical problems associated with all compositional data (Baxter 1994, 73–77).

²⁰ It should be pointed out, however, that lead is immiscible in copper alloys and when present appears in randomly distributed globules, which could account for the high variability observed here.

²¹ This estimate is based on the figure of 476 million coins issued in the name of Victorinus who reigned for at least 18 months between 268 and 272 (see above and note 16). Extrapolated production rates are 26.4M coins per month, 6.6M per week and 0.9M per day (assuming the striking of new coins took place every day of the year). These figures are similar to those obtained from other surveys of the Gallic mints' output (Burnett 1987, 123). Weight of metal required is calculated by multiplying these figures by the weight of the average contemporary radiate, which was in the region of 2.5 g (0.0000025 tonne).

²² Silver content is based on the following notional weights and finenesses: for the radiate, 2.5 g × 2.5% silver; for the Augustan *denarius*, 3.8 g × 98% silver; for the post-64 *denarius*, 3.4 g × 80% silver (Duncan-Jones 1994, 225; Butcher and Ponting 2005).

²³ These calculations are illustrative only and are not intended to represent real payments. Auxiliary infantrymen are thought to have received 5/6ths of legionary pay, which up to the reign of Domitian was 225 *denarii* per year (for alternative figures see Alston 1994).

²⁴ Robertson, for instance, speculated whether later third-century radiate hoards might have been abandoned when the coins they contained had been rendered almost worthless after the reforms of Aurelian in 274 (2000, xxvii). The recently-completed joint project between the British Museum and the University of Leicester, *Crisis or continuity. Hoarding in Iron Age and Roman Britain with special reference to the 3rd century AD*, promises to present a critical review of explanations for why hoards were buried at particular times and in specific locations. This will provide archaeologists with a much better understanding of the nature and distribution of hoarding, and the publication of this cutting edge project's results is awaited with great anticipation.

APPENDIX 1: CATALOGUE OF WALBOTTLE HOARD COINS IN
THE CLAYTON COLLECTION

CENTRAL EMPIRE (716 coins)

Emperor	Reverse type	Mint	coins
VALERIAN	APOLINI CONSERVA	Rome	1
			<hr/> 1
GALLIENUS (joint reign)	ORIENS AVGG	Rome	1
GALLIENUS (joint reign)	PAX AVG	Rome	1
GALLIENUS (joint reign)	PAX AVGG	Rome	1
GALLIENUS (joint reign)	VICTORIA GERM	Rome	1
			<hr/> 4
SALONINA (joint reign)	INVO REGINA	Rome	11
SALONINA (joint reign)	IVNONI CONS AVG	Rome	1
SALONINA (joint reign)	PIETAS AVGG	Rome	2
SALONINA (joint reign)	VENVS VICTRIX	Gaul	3
			<hr/> 17
GALLIENUS (sole reign)	ABVNDANTIA AVG	Rome	18
GALLIENUS (sole reign)	AEQVITAS AVG	Rome	3
GALLIENUS (sole reign)	AETERNITAS AVG	Rome	11
GALLIENUS (sole reign)	APOLLINI CONS AVG	Rome	32
GALLIENUS (sole reign)	DIANAE CONS AVG	Rome	68
GALLIENUS (sole reign)	FIDES MILITVM	Rome	2
GALLIENUS (sole reign)	FORTVNA REDVX	Rome	23
GALLIENUS (sole reign)	IOVI CONS AVG	Rome	8
GALLIENUS (sole reign)	IOVI CONSERVAT	Rome	11
GALLIENUS (sole reign)	IOVI PROPVG NAT	Rome	5
GALLIENUS (sole reign)	IOVI VLTORI	Rome	4
GALLIENUS (sole reign)	IVNO CONSERVAT	Rome	1
GALLIENUS (sole reign)	LAETITIA AVG	Rome	1
GALLIENUS (sole reign)	LIBERO.P.CON S AVG	Rome	14
GALLIENUS (sole reign)	MARTI PACIFERO	Rome	15
GALLIENUS (sole reign)	NEPTVNO CONS AVG	Rome	6
GALLIENUS (sole reign)	PAX AETERNA AVG	Rome	2
GALLIENUS (sole reign)	PAX AVG	Rome	11
GALLIENUS (sole reign)	PROVID AVG	Rome	6
GALLIENUS (sole reign)	SECVRIT PERPET	Rome	18
GALLIENUS (sole reign)	SOLI CONS AVG	Rome	12
GALLIENUS (sole reign)	VBERITAS AVG	Rome	14
GALLIENUS (sole reign)	VICTORIA AET	Rome	5
GALLIENUS (sole reign)	VICTORIA AVG III	Rome	3
GALLIENUS (sole reign)	VIRTVS AVG	Rome	4
GALLIENUS (sole reign)	VIRTVS AVGVSTI	Rome	1
GALLIENUS (sole reign)	AETERN	Milan	1
GALLIENUS (sole reign)	BON EVEN AVG	Milan	2
GALLIENUS (sole reign)	DIANAE FELIX	Milan	1
GALLIENUS (sole reign)	ORIENS AVG	Milan	12
GALLIENUS (sole reign)	PAX AVGVSTI	Milan	1
GALLIENUS (sole reign)	PIETAS AVG	Milan	2
GALLIENUS (sole reign)	PROVID AVG	Milan	3
GALLIENUS (sole reign)	SALVS AVG	Milan	4

APPENDIX 1 continued: Catalogue of Walbottle Hoard Coins in the Clayton Collection: Central Empire

Emperor	Reverse type	Mint	coins
GALLIENUS (sole reign)	SECVR TENPO	Milan	3
GALLIENUS (sole reign)	VIRTVS AVG	Milan	3
GALLIENUS (sole reign)	FIDES MILITVM	Rome/Milan	1
GALLIENUS (sole reign)	LAETITIA AVG	Rome/Milan	7
GALLIENUS (sole reign)	MARTI PACIFERO	Rome/Milan	1
GALLIENUS (sole reign)	ORIENS AVG	Rome/Milan	3
GALLIENUS (sole reign)	PROVID AVG	Rome/Milan	2
GALLIENUS (sole reign)	SECVRIT [...]	Rome/Milan	1
GALLIENUS (sole reign)	FORTVNA RED	Siscia	2
GALLIENUS (sole reign)	PAX AVG	Siscia	6
GALLIENUS (sole reign)	SALVS AVG	Siscia	1
GALLIENUS (sole reign)	VICTORIA AVG	Siscia	1
GALLIENUS (sole reign)	PROVI AVG	Siscia?	1
GALLIENUS (sole reign)	AEQVITAS AVG	uncertain	4
GALLIENUS (sole reign)	PAX AVG	uncertain	3
GALLIENUS (sole reign)	SALVS AVG	uncertain	2
GALLIENUS (sole reign)	VICTORIA [...]	uncertain	2
GALLIENUS (sole reign)	VICTORIA AVG	uncertain	1
GALLIENUS (sole reign)	VIRTVS AVG	uncertain	4
			<hr/>
			372
SALONINA (sole reign)	FECVNDITAS AVG	Rome	9
SALONINA (sole reign)	IVNO CONSERVAT	Rome	2
SALONINA (sole reign)	IVNONI CONS AVG	Rome	4
SALONINA (sole reign)	PVDICITIA	Rome	2
SALONINA (sole reign)	VENVS GENETRIX	Rome	2
SALONINA (sole reign)	VENVS VICTRIX	Rome	2
SALONINA (sole reign)	VESTA	Rome	3
			<hr/>
			24
CLAUDIUS II	AEQVITAS AVG	Rome	16
CLAUDIUS II	AETERNIT AVG	Rome	1
CLAUDIUS II	ANNONA AVG	Rome	11
CLAUDIUS II	FELICITAS AVG	Rome	9
CLAUDIUS II	FIDES EXERCI	Rome	19
CLAUDIUS II	FIDES MILITVM	Rome	1
CLAUDIUS II	GENIVS AVG	Rome	12
CLAUDIUS II	GENIVS EXERCI	Rome	13
CLAUDIUS II	IOVI STATORI	Rome	7
CLAUDIUS II	IOVI VICTORI	Rome	18
CLAUDIUS II	LAETITIA AVG	Rome	2
CLAUDIUS II	LIBERT AVG	Rome	10
CLAUDIUS II	MARS VLTOR	Rome	12
CLAUDIUS II	PM TR P II COS PP	Rome	11
CLAUDIUS II	PROVID AVG	Rome	3
CLAUDIUS II	PROVIDENT AVG	Rome	12
CLAUDIUS II	SALVS AVG	Rome	4
CLAUDIUS II	SECVRIT AVG	Rome	2
CLAUDIUS II	SPES PVBLICA	Rome	3
CLAUDIUS II	VICTORIA AVG	Rome	23
CLAUDIUS II	VIRTVS AVG	Rome	28

Emperor	Reverse type	Mint	coins
CLAUDIUS II	FELIC TEMPO	Milan	7
CLAUDIUS II	FIDES MILIT	Milan	4
CLAUDIUS II	PAX AVG	Milan	7
CLAUDIUS II	SPES PVBLICA	Milan	3
CLAUDIUS II	VICTORIA AVG	Milan	3
CLAUDIUS II	VIRTVS AVG	Milan	3
CLAUDIUS II	FELICITAS SAECVLI	Siscia	1
CLAUDIUS II	LAETITIA AVG	Siscia	2
CLAUDIUS II	PAX AVG	Siscia	2
CLAUDIUS II	SPES AVG	Siscia	2
CLAUDIUS II	AEQVITAS AVG	uncertain	3
CLAUDIUS II	FORTVNA [REDVX]	uncertain	1
CLAUDIUS II	LAETITIA AVG	uncertain	1
CLAUDIUS II	PAX AVG	uncertain	1
CLAUDIUS II	VIRTVS AVG	uncertain	1
CLAUDIUS II	uncertain reverse type	uncertain	4
			<hr/> 262
DIVUS CLAUDIUS	CONSECRATIO (altar)	Rome	17
DIVUS CLAUDIUS	CONSECRATIO (eagle)	Rome	10
			<hr/> 27
QUINTILLUS	APOLLINI CONS	Rome	1
QUINTILLUS	PAX AVGVSTI	Rome	2
QUINTILLUS	PROVIDENT AVG	Rome	2
QUINTILLUS	VICTORIA AVG	Rome	2
QUINTILLUS	MARTI PACIF	uncertain	1
			<hr/> 8
AURELIAN	SECVRIT AVG	Rome	1
			<hr/> 1

GALLIC EMPIRE (1257 coins)

Emperor	Reverse type	Mint	coins
POSTUMUS	COS IIII	Principal mint	4
POSTUMUS	FELICITAS AVG	Principal mint	12
POSTUMUS	HERC DEVSONIENSI	Principal mint	6
POSTUMUS	HERC PACIFERO	Principal mint	9
POSTUMUS	IMP X COS V	Principal mint	5
POSTUMUS	IOVI STATORI	Principal mint	4
POSTUMUS	IOVI VICTORI	Principal mint	4
POSTUMUS	LAETITIA //AVG	Principal mint	5
POSTUMUS	MONETA AVG	Principal mint	20
POSTUMUS	ORIENS AVG	Principal mint	15
POSTUMUS	PAX AVG	Principal mint	36
POSTUMUS	PM TRP COS II PP	Principal mint	9
POSTUMUS	PM TRP IIII COS III PP	Principal mint	1
POSTUMUS	PM TRP COS [II or III] PP	Principal mint	4
POSTUMUS	PROVIDENTIA AVG	Principal mint	6
POSTUMUS	SAECVLI FELICITAS	Principal mint	5
POSTUMUS	SALVS AVG	Principal mint	4
POSTUMUS	SERAPI COMITI AVG	Principal mint	1

APPENDIX 1 continued: Catalogue of Walbottle Hoard Coins in the Clayton Collection: Gallic Empire

Emperor	Reverse type	Mint	coins
POSTUMUS	VICTORIA AVG	Principal mint	6
POSTUMUS	VIRTVS AVG	Principal mint	5
POSTUMUS	CONCORD EQVIT	Milan	1
POSTUMUS	FIDES AEQVIT	Milan	1
POSTUMUS	FIDES EQVIT	Milan	1
POSTUMUS	VIRTVS AEQVIT	Milan	1
POSTUMUS	VIRTVS EQVIT	Milan	4
POSTUMUS	uncertain reverse type	uncertain	1
			<hr/> 170
VICTORINUS	FIDES MILITVM	Mint I	8
VICTORINUS	INVICTVS	Mint I	209
VICTORINUS	PAX AVG	Mint I	203
VICTORINUS	SALVS AVG	Mint I	167
VICTORINUS	VICTORIA AVG	Mint I	1
VICTORINUS	VIRTVS AVG	Mint I	72
VICTORINUS	VICTORIA AVG	Mint I/Mint II	1
VICTORINUS	AEQVITAS AVG	Mint II	7
VICTORINUS	PIETAS AVG	Mint II	75
VICTORINUS	PROVIDENTIA AVG	Mint II	103
VICTORINUS	VICTORIA AVG	Mint II	2
VICTORINUS	uncertain reverse type	uncertain	8
			<hr/> 856
TETRICUS I	COMES AVG	Mint I	36
TETRICUS I	HILARITAS AVG	Mint I	8
TETRICUS I	PAX AVG	Mint I	61
TETRICUS I	PRINC IVVENT	Mint I	1
TETRICUS I	SPES PVBLICA	Mint I	15
TETRICUS I	[SPES]?	Mint I	1
TETRICUS I	VICTORIA AVG	Mint I	9
TETRICUS I	VIRTVS AVG	Mint I	5
TETRICUS I	FIDES MILITVM	Mint II	23
TETRICUS I	LAETITIA AVGG	Mint II	2
TETRICUS I	LAETITIA AVG N	Mint II	21
TETRICUS I	LAETITIA AVG [N / AVGG]	Mint II	14
TETRICUS I	[LAETITIA AVG]?	Mint II	1
TETRICUS I	uncertain reverse type	uncertain	5
			<hr/> 202
TETRICUS II	SPES PVBLICA	Mint I	10
TETRICUS II	PIETAS AVG	Mint II	3
TETRICUS II	PIETAS AVGG	Mint II	1
TETRICUS II	PIETAS AVGVSTOR	Mint II	8
TETRICUS II	SPES AVGG	Mint II	5
TETRICUS II	[SPES AVGG]?	Mint II	1
TETRICUS II	uncertain reverse type	uncertain	1
			<hr/> 29
			<hr/> 1973

APPENDIX 2: CATALOGUE OF COINS FROM THE WALBOTTLE
HOARD HELD BY THE SOCIETY OF ANTIQUARIES
OF NEWCASTLE UPON TYNE

CENTRAL EMPIRE (581 coins)

Emperor	Reverse type	Mint	coins
VALERIAN	ORIENS AVGG	Lyon	1
VALERIAN	APOLINI CONSERVA	Rome	1
VALERIAN	FELICITAS AVG	Rome	1
VALERIAN	ORIENS AVG	Rome	1
VALERIAN	PM TRP III COS II PP	Rome	1
VALERIAN	PM TRP III COS III PP	Rome	1
VALERIAN	VICTORIA AVG	Rome	1
			7
GALLIENUS	APOLINI CONSERVA	Rome	1
DIVUS VALERIAN	CONSECRATO	Rome	3
GALLIENUS (joint reign)	FELICITAS AVGG	Rome	1
GALLIENUS (joint reign)	ORIENS AVGG	Rome	1
GALLIENUS (joint reign)	PAX AVGG	Rome	4
GALLIENUS (joint reign)	PROVID AVGG	Rome	1
GALLIENUS (joint reign)	VICTORIA GERM	Rome	1
GALLIENUS (joint reign)	VIRTVS AVGG	Rome	2
			14
SALONINA (joint reign)	DEAE SEGETIAE	Lyon	1
SALONINA (joint reign)	IVNO REGINA	Rome	6
SALONINA (joint reign)	PIETAS AVG	Rome	1
SALONINA (joint reign)	PIETAS AVGG	Rome	2
SALONINA (joint reign)	VENVS VICTIX	Rome	2
SALONINA (joint reign)	CONCORDIA AVG	Siscia	1
			13
SALONINUS	PIETAS AVG	Lyon	3
			3
GALLIENUS (sole reign)	ABVNDANTIA AVG	Rome	13
GALLIENUS (sole reign)	AEQVIT AVG	Rome	1
GALLIENUS (sole reign)	AEQVITAS AVG	Rome	1
GALLIENUS (sole reign)	AETERNITAS AVG	Rome	10
GALLIENUS (sole reign)	ANNONA AVG	Rome	1
GALLIENUS (sole reign)	APOLLINI CONS AVG	Rome	17
GALLIENUS (sole reign)	APOLLINI CONSER	Rome	1
GALLIENUS (sole reign)	CONSERVAT PIETAT	Rome	1
GALLIENUS (sole reign)	DIANAE CONS AVG	Rome	47
GALLIENUS (sole reign)	FELICIT AVG	Rome	2
GALLIENUS (sole reign)	FELICIT PVBL	Rome	1
GALLIENUS (sole reign)	FIDES MILITVM	Rome	1
GALLIENUS (sole reign)	FORTVNA REDVX	Rome	17
GALLIENUS (sole reign)	GENIVS AVG	Rome	1
GALLIENUS (sole reign)	INDVLG AVG	Rome	1
GALLIENUS (sole reign)	INDVLGENT AVG	Rome	1
GALLIENUS (sole reign)	IOVI CONS AVG	Rome	10

APPENDIX 2 continued: Catalogue of Coins from the Walbottle
Hoard Held by The Society of Antiquaries
of Newcastle upon Tyne: Central Empire

Emperor	Reverse type	Mint	coins
GALLIENUS (sole reign)	IOVI CONSERVA	Rome	1
GALLIENUS (sole reign)	IOVI CONSERVAT	Rome	2
GALLIENUS (sole reign)	IOVI PROPVG NAT	Rome	1
GALLIENUS (sole reign)	IOVI STATOR	Rome	2
GALLIENUS (sole reign)	IOVI VLTORI	Rome	1
GALLIENUS (sole reign)	LAETITIA AVG	Rome	16
GALLIENUS (sole reign)	LIBERO PCONS AVG	Rome	7
GALLIENUS (sole reign)	MARTI PACIFERO	Rome	9
GALLIENUS (sole reign)	NEPTVNO CONS AVG	Rome	6
GALLIENUS (sole reign)	ORIENS AVG	Rome	4
GALLIENUS (sole reign)	PAX AETERNA	Rome	2
GALLIENUS (sole reign)	PAX AVG	Rome	12
GALLIENUS (sole reign)	PAX PVBLICA	Rome	1
GALLIENUS (sole reign)	PROVID AVG	Rome	6
GALLIENUS (sole reign)	SALVS AVG	Rome	2
GALLIENUS (sole reign)	SECVRIT PERPET	Rome	4
GALLIENUS (sole reign)	SOLI CONS AVG	Rome	7
GALLIENUS (sole reign)	VBERITAS AVG	Rome	12
GALLIENUS (sole reign)	VICTORIA AET	Rome	8
GALLIENUS (sole reign)	VICTORIA AVG	Rome	1
GALLIENUS (sole reign)	VIRTVS AVG	Rome	11
GALLIENUS (sole reign)	VIRTVS AVGVSTI	Rome	3
GALLIENUS (sole reign)	AETERN AVG	Milan	5
GALLIENUS (sole reign)	BON EVEN AVG	Milan	2
GALLIENUS (sole reign)	DIANA FELIX	Milan	1
GALLIENUS (sole reign)	FIDES MILITVM	Milan	1
GALLIENUS (sole reign)	FORTVNA REDVX	Milan	3
GALLIENUS (sole reign)	MARTI PACIFERO	Milan	1
GALLIENUS (sole reign)	ORIENS AVG	Milan	3
GALLIENUS (sole reign)	PAX AVG	Milan	4
GALLIENUS (sole reign)	PAX AVGVSTI	Milan	1
GALLIENUS (sole reign)	PIETAS AVG	Milan	1
GALLIENUS (sole reign)	PM TRP VII COS	Milan	3
GALLIENUS (sole reign)	PROVID AVG	Milan	3
GALLIENUS (sole reign)	SALVS AVG	Milan	4
GALLIENUS (sole reign)	SECVR TENPO	Milan	1
GALLIENUS (sole reign)	FORTVNA REDVX	Siscia	1
GALLIENUS (sole reign)	PAX AVG	Siscia	4
GALLIENUS (sole reign)	PROVI AVG	Siscia	1
			283
SALONINA (sole reign)	FECVNDITAS AVG	Rome	5
SALONINA (sole reign)	IVNO CONSERVAT	Rome	1
SALONINA (sole reign)	IVNONI CONS AVG	Rome	1
SALONINA (sole reign)	PVDICITIA	Rome	3
SALONINA (sole reign)	VENVS GENETRIX	Rome	1
SALONINA (sole reign)	VESTA	Rome	5
SALONINA (sole reign)	AVG IN PACE	Milan	2

Emperor	Reverse type	Mint	coins
SALONINA (sole reign)	FELICIT PVBL	Milan	1
			<hr/> 19
CLAUDIUS II	AEQVITAS AVG	Rome	16
CLAUDIUS II	AETERNIT AVG	Rome	2
CLAUDIUS II	ANNONA AVG	Rome	17
CLAUDIUS II	APOLLINI CONS	Rome	1
CLAUDIUS II	FELICITAS AVG	Rome	9
CLAUDIUS II	FIDES EXERCI	Rome	6
CLAUDIUS II	FIDES MILITVM	Rome	4
CLAUDIUS II	FORTVNA REDVX	Rome	1
CLAUDIUS II	GENIVS AVG	Rome	8
CLAUDIUS II	GENIVS EXERCI	Rome	6
CLAUDIUS II	IOVI STATORI	Rome	16
CLAUDIUS II	LAETITIA AVG	Rome	1
CLAUDIUS II	LIBERALITAS AVG	Rome	1
CLAUDIUS II	LIBERT AVG	Rome	7
CLAUDIUS II	MARS PACIFERO	Rome	1
CLAUDIUS II	MARS VLTOR	Rome	10
CLAUDIUS II	PAX AVG	Rome	1
CLAUDIUS II	PAX AVGVSTI	Rome	2
CLAUDIUS II	PM TRR II COS PP	Rome	4
CLAUDIUS II	PROVIDENT AVG	Rome	12
CLAUDIUS II	SALVS AVG	Rome	3
CLAUDIUS II	SECVRIT AVG	Rome	1
CLAUDIUS II	SPEC PVBLICA	Rome	1
CLAUDIUS II	VICTORIA AVG	Rome	16
CLAUDIUS II	VIRTVS AVG	Rome	8
CLAUDIUS II	AEQVITAS AVG	Milan	1
CLAUDIUS II	FELIC TEMPO	Milan	5
CLAUDIUS II	FIDES MILITVM	Milan	2
CLAUDIUS II	FORTVNA REDVX	Milan	1
CLAUDIUS II	PAX AVG	Milan	1
CLAUDIUS II	PROVID AVG	Milan	1
CLAUDIUS II	SALVS AVG	Milan	1
CLAUDIUS II	SPEC PVBLICA	Milan	4
CLAUDIUS II	VICTORIA AVG	Milan	3
CLAUDIUS II	VIRTVS AVG	Milan	5
CLAUDIUS II	LAETITIA AVG	Siscia	6
CLAUDIUS II	PAX AET	Siscia	2
CLAUDIUS II	PAX AVG	Siscia	1
CLAUDIUS II	PROVIDEN AVG	Siscia	1
CLAUDIUS II	SALVS AVG	Siscia	1
CLAUDIUS II	SPES AVG	Siscia	1
CLAUDIUS II	VBERITAS AVG	Siscia	1
CLAUDIUS II	VICTORIA AVG	Siscia	1
CLAUDIUS II	Illegible	uncertain	1
			<hr/> 193
DIVUS CLAUDIUS	CONSECRATO	Milan	14
DIVUS CLAUDIUS	GENIVS AVG	Milan	1
			<hr/> 15

APPENDIX 2 continued: Catalogue of Coins from the Walbottle
Hoard Held by The Society of Antiquaries
of Newcastle upon Tyne: Central Empire

Emperor	Reverse type	Mint	coins
QUINTILLUS	AETERNIT AVG	Rome	1
QUINTILLUS	APOLLINI CONS	Rome	1
QUINTILLUS	CONCORDIA AVG	Rome	3
QUINTILLUS	FIDES MILITVM	Rome	3
QUINTILLUS	FORTVNA REDVX	Rome	3
QUINTILLUS	LAETITIA AVG	Rome	7
QUINTILLUS	MARTI PACIFERO	Rome	1
QUINTILLUS	PAX AVGVSTI	Rome	1
QUINTILLUS	PROVIDENT AVG	Rome	6
QUINTILLUS	SECVRIT AVG	Rome	3
QUINTILLUS	VICTORIA AVG	Rome	3
QUINTILLUS	VIRTVS AVG	Rome	2
			34

GALLIC EMPIRE (336 coins)

Emperor	Reverse type	Mint	coins
POSTUMUS	COS IIII	Cologne	3
POSTUMUS	COS V	Cologne	1
POSTUMUS	IMP X COS V	Cologne	5
POSTUMUS	IOVI STATORI	Cologne	4
POSTUMUS	IOVI VICTORI	Cologne	7
POSTUMUS	PAX AVG	Cologne	17
POSTUMUS	PROVIDENTIA AVG	Cologne	3
POSTUMUS	SERAPI COMITI AVG	Cologne	1
POSTUMUS	FELICITAS AVG	Lyon	3
POSTUMUS	FIDES MILITVM	Lyon	5
POSTUMUS	HERC DEVONIENSI	Lyon	1
POSTUMUS	HERC DEVSONIENSI	Lyon	6
POSTUMUS	HERC PACIFERO	Lyon	1
POSTUMUS	IOVI PROPVG NAT	Lyon	1
POSTUMUS	LAETITIA AVG	Lyon	3
POSTUMUS	MONETA AVG	Lyon	14
POSTUMUS	NEPTVNO REDVCI	Lyon	1
POSTUMUS	ORIENS AVG	Lyon	6
POSTUMUS	PAX AVG	Lyon	1
POSTUMUS	PAX AVG	Lyon	3
POSTUMUS	PM TRP COS II PP	Lyon	13
POSTUMUS	PM TRP IIII COS III PP	Lyon	1
POSTUMUS	PROVIDENTIA AVG	Lyon	1
POSTUMUS	SAECVLI FELICITAS	Lyon	5
POSTUMUS	SALVS AVG	Lyon	2
POSTUMUS	SALVS PROVINCIARVM	Lyon	1
POSTUMUS	VICTORIA AVG	Lyon	5
POSTUMUS	VIRTVS AVG	Lyon	3
POSTUMUS	CONCORDIA AVG	Milan	3

Emperor	Reverse type	Mint	coins
POSTUMUS	FIDES AEQVIT	Milan	4
POSTUMUS	FIDES EQVIT	Milan	1
POSTUMUS	VIRTVS AEQVIT	Milan	3
			<hr/> 128
MARIUS	CONCORDIA AVG	Cologne	1
MARIUS	SAEC FELICITAS	Cologne	1
MARIUS	VICTORIA AVG	Cologne	2
MARIUS	VICTORIA AVG	uncertain	1
			<hr/> 5
VICTORINUS	AEQVITAS AVG	Cologne	4
VICTORINUS	FIDES MILITVM	Cologne	4
VICTORINUS	INVICTVS	Cologne	13
VICTORINUS	PAX AVG	Cologne	11
VICTORINUS	PIETAS AVG	Cologne	9
VICTORINUS	PROVIDENTIA AVG	Cologne	5
VICTORINUS	SALVS AVG	Cologne	15
VICTORINUS	VICTORIA AVG	Cologne	2
VICTORINUS	VIRTVS AVG	Cologne	10
			<hr/> 73
DIVUS VICTORINUS	PROVIDENTIA AVG	Cologne	1
TETRICUS I	COMES AVG	Cologne	26
TETRICUS I	FIDES MILITVM	Cologne	20
TETRICUS I	HILARITAS AVGG	Cologne	3
TETRICUS I	LAETITIA AVG	Cologne	9
TETRICUS I	PAX AVG	Cologne	7
TETRICUS I	SALVS AVG	Cologne	1
TETRICUS I	SPES PVBLICA	Cologne	20
TETRICUS I	VICTORIA AVG	Cologne	6
TETRICUS I	VIRTVS AVGG	Cologne	3
TETRICUS I	VIRTVS AVG	uncertain	1
			<hr/> 97
TETRICUS II	PIETAS AVGVSTOR	Cologne	6
TETRICUS II	PRINC IVVENT	Cologne	2
TETRICUS II	SALVS AVG	Cologne	1
TETRICUS II	SPES AVG	Cologne	7
TETRICUS II	SPES PVBLICA	Cologne	15
TETRICUS II	MONETA	uncertain	1
TETRICUS II	Missing	uncertain	1
			<hr/> 33
			<hr/> 917

APPENDIX 3: RESULTS OF ATOMIC ABSORPTION SPECTROMETRY (AAS)
ANALYSIS OF 82 COINS FROM THE WALBOTTLE HOARD

No.	EMPEROR	RIC/ELMER	bullion (wt.%)	Major elements (wt.%)					Trace elements (wt.%)						
				copper	gold	lead	silver	tin	antimony	arsenic	chromium	cobalt	iron	nickel	zinc
1	Valerian	RIC71	30.21	66.85	0.129	0.95	30.08	1.17	0.09	0.36	0.109	0.050	0.010	0.079	0.119
2	Gallienus – joint reign	RIC175	4.52	89.62	0.162	2.60	4.36	2.52	0.15	0.02	0.111	0.111	0.141	0.071	0.131
3	Gallienus – joint reign	RIC392	2.36	87.11	0.355	1.56	2.01	5.87	0.20	1.63	0.502	0.423	0.098	0.148	0.093
4	Gallienus – sole reign	RIC572	1.38	88.97	0.110	3.13	1.27	6.12	0.11	0.08	0.050	0.036	0.042	0.051	0.031
5	Gallienus – sole reign	RIC575	0.91	96.09	0.041	1.39	0.87	1.19	0.06	0.15	0.051	0.030	0.040	0.038	0.041
6	Gallienus – sole reign	RIC499	1.74	94.76	0.043	1.40	1.70	1.25	0.09	0.51	0.054	0.076	0.034	0.043	0.040
7	Gallienus – sole reign	RIC499	1.58	95.07	0.048	1.84	1.53	1.06	0.07	0.02	0.048	0.026	0.071	0.048	0.165
8	Gallienus – sole reign	RIC534	7.89	88.85	0.171	1.31	7.72	1.19	0.08	0.02	0.050	0.295	0.112	0.086	0.111
9	Gallienus – sole reign	RIC157	1.59	86.78	0.158	1.19	1.44	8.40	0.60	0.65	0.485	0.116	0.011	0.053	0.120
10	Gallienus – sole reign	RIC157	1.10	87.01	0.029	5.66	1.07	5.81	0.09	0.02	0.049	0.069	0.056	0.047	0.090
11	Gallienus – sole reign	RIC157	1.71	87.99	0.048	3.50	1.66	5.39	0.14	0.88	0.048	0.105	0.058	0.056	0.121
12	Gallienus – sole reign	RIC177	1.62	79.91	0.049	10.34	1.58	7.46	0.04	0.19	0.107	0.083	0.095	0.067	0.080
13	Gallienus – sole reign	RIC193var	3.29	83.76	0.141	3.73	3.15	8.40	0.22	0.13	0.152	0.087	0.085	0.078	0.071
14	Gallienus – sole reign	RIC236	1.47	89.11	0.057	2.29	1.41	6.20	0.25	0.20	0.180	0.073	0.043	0.059	0.133
15	Gallienus – sole reign	RIC236	1.68	88.45	0.049	3.26	1.63	5.96	0.12	0.02	0.282	0.059	0.094	0.037	0.049
16	Gallienus – sole reign	RIC280	0.73	88.65	0.038	3.42	0.69	5.98	0.56	0.19	0.249	0.077	0.019	0.057	0.077
17	Gallienus – sole reign	RIC287var	1.75	87.01	0.047	4.79	1.71	5.70	0.15	0.05	0.283	0.062	0.043	0.038	0.130
18	Gallienus – sole reign	RIC249/494	1.50	91.48	0.051	4.62	1.45	1.59	0.16	0.40	0.051	0.059	0.023	0.044	0.073

19	Salonina – joint reign	RIC29	2.20	92.03	0.116	1.09	2.09	4.13	0.24	0.02	0.048	0.076	0.063	0.040	0.057
20	Salonina – joint reign	RIC29	1.75	94.44	0.068	2.36	1.68	1.00	0.19	0.02	0.048	0.088	0.034	0.047	0.026
21	Salonina – sole reign	RIC5	1.61	88.63	0.030	3.68	1.58	5.23	0.33	0.21	0.051	0.085	0.042	0.049	0.077
22	Salonina – sole reign	RIC5	1.52	89.61	0.038	2.56	1.48	5.76	0.21	0.02	0.058	0.076	0.046	0.062	0.071
23	Claudius II	RIC191	1.28	92.61	0.020	3.01	1.26	2.60	0.16	0.02	0.080	0.076	0.046	0.047	0.061
24	Claudius II	RIC149	1.80	89.96	0.019	3.46	1.78	4.14	0.22	0.02	0.114	0.131	0.064	0.064	0.031
25	Claudius II	RIC157	1.32	89.50	0.040	3.45	1.28	5.18	0.08	0.10	0.050	0.096	0.096	0.078	0.058
26	Claudius II	RIC46	1.45	82.67	0.010	8.19	1.45	7.12	0.18	0.02	0.058	0.077	0.060	0.058	0.110
27	Claudius II	RIC62	1.30	82.77	0.019	9.42	1.28	5.83	0.17	0.02	0.038	0.077	0.068	0.041	0.270
28	Claudius II	RIC91	1.28	79.87	0.020	12.65	1.26	5.67	0.15	0.02	0.069	0.140	0.046	0.046	0.071
29	Claudius II	RIC104	0.91	83.03	0.021	8.29	0.89	7.34	0.10	0.02	0.063	0.044	0.080	0.051	0.074
30	Claudius II	RIC104	1.82	82.34	0.029	7.00	1.80	7.50	0.69	0.02	0.049	0.209	0.180	0.071	0.119
31	Claudius II	RIC104	1.34	85.20	0.030	7.23	1.31	5.64	0.10	0.15	0.050	0.075	0.054	0.052	0.098
32	Claudius II	RIC104	0.76	83.08	0.010	8.64	0.75	6.77	0.10	0.29	0.051	0.069	0.083	0.063	0.090
33	Claudius II	RIC109	1.21	81.23	0.021	10.58	1.19	6.43	0.11	0.02	0.054	0.103	0.073	0.075	0.114
34	Claudius II	RIC109	1.27	80.25	0.021	11.11	1.25	6.84	0.11	0.02	0.083	0.084	0.081	0.089	0.058
35	Claudius II	RIC261	0.99	86.60	0.021	6.43	0.97	5.38	0.13	0.02	0.041	0.088	0.059	0.054	0.201
36	Claudius II	RIC261	0.09	77.61	0.010	16.08	0.08	5.87	0.11	0.02	0.041	0.050	0.026	0.051	0.046
37	Claudius II	RIC266	0.91	78.91	0.010	13.53	0.90	6.02	0.12	0.02	0.063	0.071	0.132	0.066	0.159
38	Claudius II	RIC266	1.11	86.24	0.021	6.91	1.09	5.10	0.13	0.02	0.094	0.052	0.088	0.090	0.153
39	Quintillus	RIC26	0.83	83.23	0.020	8.41	0.81	7.07	0.11	0.02	0.111	0.071	0.030	0.050	0.061
40	Quintillus	RIC33	0.77	86.06	0.010	6.70	0.76	6.10	0.02	0.02	0.072	0.072	0.031	0.041	0.103
41	Aurelian	RIC38	0.60	81.52	0.021	11.28	0.57	6.18	0.05	0.02	0.051	0.021	0.092	0.031	0.154
42	Postumus	E299	0.61	96.31	0.030	0.79	0.58	1.81	0.04	0.02	0.091	0.051	0.131	0.030	0.121

APPENDIX 3 continued: Results of Atomic Absorption Spectrometry (Aas) Analysis of
82 Coins from the Walbottle Hoard

No.	EMPEROR	RIC/ELMER	bullion (wt.%)	Major elements (wt.%)					Trace elements (wt.%)						
				copper	gold	lead	silver	tin	antimony	arsenic	chromium	cobalt	iron	nickel	zinc
43	Postumus	E299	8.39	90.09	0.090	0.91	8.30	0.23	0.09	0.02	0.111	0.060	0.010	0.050	0.030
44	Postumus	E335	21.73	75.60	0.117	1.37	21.61	0.77	0.20	0.02	0.058	0.058	0.029	0.058	0.107
45	Postumus	E335	16.29	81.98	0.147	1.24	16.14	0.01	0.14	0.02	0.108	0.078	0.039	0.039	0.059
46	Postumus	E566	0.84	96.84	0.012	1.74	0.83	0.16	0.15	0.11	0.050	0.014	0.037	0.025	0.033
47	Postumus	E566	3.77	94.32	0.024	1.33	3.75	0.20	0.12	0.11	0.047	0.019	0.018	0.027	0.029
48	Postumus	E568	2.42	96.01	0.020	1.08	2.40	0.10	0.15	0.08	0.063	0.014	0.015	0.029	0.027
49	Postumus	E568	3.86	94.52	0.023	0.99	3.84	0.21	0.12	0.12	0.059	0.012	0.012	0.038	0.068
50	Victorinus	E741	1.10	95.40	0.010	2.64	1.09	0.30	0.19	0.12	0.050	0.006	0.062	0.044	0.093
51	Victorinus	E741	0.63	94.99	0.010	2.22	0.62	1.60	0.12	0.10	0.048	0.005	0.158	0.039	0.102
52	Victorinus	E743	0.84	96.37	0.010	1.78	0.83	0.19	0.17	0.14	0.051	0.007	0.167	0.039	0.246
53	Victorinus	E743	0.82	96.07	0.010	2.59	0.81	0.02	0.22	0.12	0.050	0.006	0.010	0.048	0.045
54	Victorinus	E699	0.66	96.75	0.010	1.96	0.65	0.16	0.16	0.12	0.049	0.006	0.047	0.051	0.041
55	Victorinus	E699	0.95	96.48	0.010	1.90	0.94	0.12	0.18	0.10	0.050	0.005	0.099	0.010	0.081
56	Victorinus	E732	0.78	97.52	0.006	1.09	0.77	0.10	0.17	0.08	0.051	0.010	0.157	0.013	0.030
57	Victorinus	E732	0.74	93.22	0.008	1.03	0.73	0.23	0.13	0.10	0.049	0.010	4.406	0.027	0.057
58	Victorinus	E682	0.49	97.13	0.014	1.57	0.48	0.32	0.13	0.11	0.050	0.005	0.103	0.026	0.059
59	Victorinus	E682	0.36	97.33	0.012	1.88	0.35	0.09	0.12	0.09	0.051	0.009	0.020	0.022	0.016
60	Victorinus	E682var	1.56	95.40	0.025	2.32	1.54	0.32	0.12	0.12	0.050	0.013	0.007	0.020	0.061

61	Victorinus	E682var	2.25	95.49	0.023	1.66	2.23	0.20	0.11	0.12	0.049	0.013	0.025	0.022	0.065
62	Victorinus	E683	1.58	96.23	0.019	1.55	1.56	0.20	0.14	0.11	0.049	0.014	0.063	0.031	0.027
63	Victorinus	E683	2.13	95.52	0.008	1.68	2.12	0.16	0.13	0.07	0.049	0.007	0.155	0.031	0.067
64	Victorinus	E683var	1.78	95.43	0.023	2.13	1.76	0.26	0.11	0.13	0.049	0.019	0.015	0.044	0.037
65	Victorinus	E683var	0.89	96.86	0.028	1.63	0.86	0.24	0.14	0.12	0.050	0.019	0.020	0.011	0.027
66	Tetricus I	E774	0.71	96.61	0.007	1.97	0.70	0.24	0.12	0.12	0.050	0.006	0.121	0.012	0.038
67	Tetricus I	E774	0.68	97.56	0.008	1.23	0.67	0.07	0.15	0.11	0.050	0.006	0.087	0.011	0.059
68	Tetricus I	E764	0.75	96.40	0.006	2.13	0.74	0.15	0.14	0.11	0.051	0.005	0.043	0.011	0.218
69	Tetricus I	E764	0.59	96.50	0.006	2.31	0.58	0.32	0.06	0.11	0.049	0.005	0.023	0.011	0.024
71	Tetricus I	E786	0.54	96.36	0.009	2.23	0.53	0.31	0.17	0.09	0.050	0.010	0.144	0.009	0.082
72	Tetricus I	E787	0.58	96.52	0.010	2.04	0.57	0.30	0.17	0.13	0.050	0.006	0.085	0.011	0.105
73	Tetricus I	E775	0.73	96.66	0.007	1.81	0.72	0.25	0.14	0.15	0.050	0.006	0.040	0.016	0.150
74	Tetricus I	E775	0.91	97.02	0.008	1.31	0.90	0.22	0.16	0.19	0.052	0.006	0.027	0.017	0.084
75	Tetricus II	E791	0.75	96.61	0.005	2.17	0.74	0.01	0.17	0.16	0.049	0.006	0.010	0.051	0.023
76	Tetricus II	E769	0.93	96.54	0.009	2.04	0.92	0.01	0.14	0.16	0.048	0.008	0.009	0.028	0.095
77	Tetricus II	E769	0.43	97.93	0.007	1.30	0.42	0.01	0.08	0.15	0.049	0.008	0.009	0.015	0.013
78	Tetricus II	E778	0.68	96.38	0.010	2.51	0.67	0.01	0.16	0.13	0.051	0.005	0.032	0.011	0.030
79	Gallienus – sole reign	copy of RIC499	2.21	89.05	0.033	3.15	2.18	4.59	0.09	0.11	0.047	0.005	0.019	0.024	0.719
80	Claudius II	copy of RIC157	0.49	92.34	0.009	1.87	0.48	2.55	0.14	0.13	0.047	0.009	0.072	0.017	2.372
81	Postumus	copy of E299	0.69	94.12	0.007	2.47	0.69	2.39	0.07	0.20	0.048	0.006	0.007	0.012	0.024
82	unattributable	copy	0.06	87.05	0.009	2.09	0.05	10.02	0.08	0.12	0.046	0.009	0.023	0.017	0.509

BIBLIOGRAPHY

- ABDY, R. 2011 *Romano-British Coin Hoards* (2nd ed.), London.
- ABDY, R. 2012 'The Severans', in W. E. Metcalf (ed.), *The Oxford Handbook of Greek and Roman Coinage*, Oxford, 499–513.
- ALSTON, R. 1994 'Roman Military Pay from Caesar to Diocletian', *Journal of Roman Studies* 84, 93–104.
- BAXTER, M. J. 1994 *Exploratory Multivariate Analysis in Archaeology*, Edinburgh.
- BESLY, E. and BLAND, R. 1983 *The Cunetio Treasure: Roman Coinage of the Third Century AD*, London.
- BIDDULPH, E., SEAGER SMITH, R. and SCHUSTER, J. 2011 *Settling the Ebbsfleet Valley. High Speed 1 Excavations at Springhead and Northfleet, vol. 2: Late Iron Age to Roman Finds Reports*, Oxford Wessex Archaeol. Mono. 2
- BLAND, R. 2012 'From Gordian III to the Gallic Empire (AD 238–274)', in W. E. Metcalf (ed.), *The Oxford Handbook of Greek and Roman Coinage*, Oxford, 514–37.
- BLAND, R. and BURNETT, A. (eds) 1988 *The Normanby Hoard and other Roman coin hoards*, *Coin Hoards from Roman Britain*. vol. 8, London.
- BOON, G. C. 1988 'Counterfeit Coins in Roman Britain', in P. J. Casey and R. Reece (eds), *Coins and the Archaeologist*, second edition, London, 102–88.
- BRUCE, J. C. 1895 *Handbook to the Roman Wall ...*, 4th ed., [ed.] Blair, R., London and Newcastle.
- BURNETT, A. 1987 *Coinage in the Roman World*, London.
- BUTCHER, K. and PONTING, M. 2005 'The Roman Denarius under the Julio-Claudian Emperors: mints, metallurgy and technology', *Oxford Journal of Archaeology* 24 (2), 163–97.
- CASEY, P. J. 1986 *Understanding Ancient Coins*, London.
- CHARLESWORTH, D. 1973 'A re-examination of two turrets on Hadrian's Wall', *AA³*, 1, 97–109.
- CLAYTON, J. 1859 'The Thorngrafton Find', *AA²*, 3, 269–272.
- CLAYTON, J. 1880 'Discovery of a Hoard of Roman Coins on the Wall of Hadrian, In Northumberland', *AA²*, 8, 256–80.
- COHEN, H. 1859–1868 *Description historique des Monnaies frappées sous l'Empire romain, communément appelées Médailles impériales*, 8 vols. Paris.
- COPE, L. H. *et al.*, 1997 *Metal analyses of Roman coins minted under the Empire*, London.
- COPE, L. H. 1974 *The Metallurgical Development of the Roman Imperial Coinage During the First Five Centuries A.D.* unpublished PhD thesis (Liverpool Polytechnic).
- CORBIER, M. 2005 'Coinage and taxation: the state's point of view, A.D. 193–337', *Cambridge Ancient History*, vol. 12: *the Crisis of Empire, AD 193–337*, 327–92.
- DAVIES, J. 1992 'Barbarous radiate hoards: The interpretation of coin deposits in the late third century Roman Britain', *Oxford Journal of Archaeology*, 11 (2), 211–224.
- DEPEYROT, G. and HOLLARD, D. 1987 'Pénurie d'argent-métal et crise monétaire au IIIe siècle J-C', *Histoire et Mesure* 2 (1), 57–85.
- DRINKWATER, J. F. 1987 *The Gallic Empire: Separatism and continuity in the north-western provinces of the Roman Empire, A.D. 260–274*. Stuttgart.
- DUNCAN-JONES, R. 1994 *Money and Government in the Roman Empire*. Cambridge.
- ELMER, G. 1941 'Die Münzprägung der gallischen Kaiser in Köln, Trier und Mailand', *Bonner Jahrbücher* 146, 1–106.
- ESTIOT, S. 2012 'The Later Third Century', in W. E. Metcalf (ed.), *The Oxford Handbook of Greek and Roman Coinage*, Oxford, 538–60.
- FULFORD, M. and TIMBY, J. 2001 'Timing devices, fermentation vessels, 'ritual' piercings? A consideration of deliberately 'holed' pots from Silchester and elsewhere', *Britannia* 32, 293–7.
- GRIERSON, P. 1975 *Numismatics*, Oxford.
- GUEST, P. 1994 *A comparative Study of Coin Hoards from the western Roman Empire*, Unpublished PhD thesis (University of London).
- GUEST, P. 2015 'The burial, loss and recovery of Roman coin hoards in Britain and beyond: past, present and future', in J. Naylor and R. Bland (eds), *Hoarding and the Deposition of Metalwork from the Bronze Age to the 20th Century: A British Perspective*. BAR British Series, vol. 615, Oxford, 101–116.
- HARL, K. 1996 *Coinage in the Roman Economy, 300 B.C. to A.D. 700*, Baltimore.
- HEDLEY, W. P. 1931 'The Walbottle (Throckley) hoard of Roman coins', *AA⁴*, 8, 12–48.

- HUGHES, M., COWELL, M. and CRADDOCK, P. 1976 'Atomic absorption techniques in archaeology', *Archaeometry*, 18 (1), 19–37.
- KING, C. E. 1996 'Roman Copies', in C. E. King and D. Wigg (eds), *Coin Finds and Coin Use in the Roman World*. Studien zu Fundmünzen der Antike, Bd. 10, 237–63.
- KROPFF, A. 2005 "'Radiate copies": late third century Roman emergency coins', *Revue Belge de Numismatique et de Sigillographie*, 151, 75–96.
- MCINTOSH, F. 2014 'The Wall's First Great Collection; the Clayton Collection', in R. Collins and F. McIntosh (eds), *Life in the Limes. Studies of the People and Objects of the Roman Frontiers*, Oxford, 188–193.
- MONAGHAN, J. 1987 *Upchurch and Thameside Roman Pottery: a Ceramic Typology for Northern Kent, First to Third Centuries AD*, British Archaeol. Rep. Brit. Ser. 173.
- PONTING, M. 1994 *Folles and forgeries: an appraisal of the composition of Roman copper-alloy coinage of the mid-third to the mid-fourth centuries AD from Britain*. Unpublished PhD thesis (University of London).
- PULLINGER, J., BURNHAM, B., ROTHERHAM, A. and WHITE, P. 1999 'Roman pottery illustrations', in 'Roman Cambridge: Excavations on Castle Hill 1956–1988', *Proc. Cambridge Antiq. Soc.*, 88, 145–99.
- PSAN 1907–1908 '[Society of Antiquaries of Newcastle] Donations to the Museum', *PSAN*³, 3, 334–5
- REECE, R. 1987 *Coinage in Roman Britain*, London.
- REECE, R. 2002 *The Coinage of Roman Britain*, Stroud.
- ROBERTSON, A. 1988 'Romano-British coin hoards; their numismatic, archaeological and historical significance', in J. Casey and R. Reece (eds), *Coins and the Archaeologist* (2nd edition), London, 13–38.
- ROBERTSON, A. (R. Hobbs and T. V. Buttrey, eds) 2000 *An Inventory of Romano-British Coin Hoards*. London: Royal Numismatic Society Special Publication, 20.
- SHOTT, M. J. 1996 'Mortal pots: on use life and vessel size in the formation of ceramic assemblages', *American Antiquity*, 61, 463–82.
- SPAIN, G. R. B. and WAKE, T. 1931 '[Society of Antiquaries of Newcastle] The Curators' Report, 1930', *PSAN*⁴, 5, 12–15.
- SPAIN, G. R. B. and WAKE, T. 1932. '[Society of Antiquaries of Newcastle] The Curators' Report for 1931', *PSAN*⁴, 5, 199–203.
- SPEIDEL, M. A. 1992. 'Roman Army Pay Scales', *Journal of Roman Studies*, 82, 87–106.
- WEBB, P. H. 1927 *Roman Imperial Coinage vol. 5, Part 1, Valerian to the Interregnum*, London.

Archive Sources

- BRUCE, J. C. 1871 *The Story, Partly Sad and Partly Gay, of the Thorngraston 'Find'*. For Private Distribution, Newcastle.
- HAMPTON AND SONS. January 1930. 'Chesters', *Humshaugh, Northumberland*. By Direction of J. M. Clayton Esq. Newcastle upon Tyne.
- SIMPSON, G. 2000 *Letter to Lindsay Allason-Jones dated 24th April 2000*. Chesters Historical File 7.

Dr F. McIntosh, Curator of Roman Collections, Corbridge Roman Site, Corbridge, Northumberland, NE45 5NT.
frances.mcintosh@english-heritage.org.uk

Dr P. Guest, School of History, Archaeology and Religion, 4.12, John Percival Building, Cardiff University, Cardiff, CF10 3AT.
GuestP@cardiff.ac.uk

Dr. M. Ponting, Archaeology, Classics and Egyptology, The University of Liverpool, Room 103, 14 Abercromby Square, Liverpool L69 7WZ.
M.Ponting@liverpool.ac.uk

