CHEMICAL ANALYSES OF ENGLISH SCEATTAS

D. M. METCALF

THE problems of dating and attributing the hundred or more varieties of English sceattas cannot be fully solved by the sovereign method of hoard-analysis, since so few hoards or grave-finds are known (and those few are mostly early and east Kentish). The typological arguments of an earlier generation of scholars have rightly been called in question by Morehart.[1] The style of the coins is extremely varied, and, as fewer than ten specimens each are known for most varieties, stylistic argument is often inconclusive. In these circumstances information about the metal contents of the sceattas is not to be neglected. The series shows a wide range of alloy, covering every degree of fineness from *c.* 98 per cent silver to *c.* 20 per cent silver. Coins of the same variety tend to be very much the same in their composition, and a progressive debasement beginning in the 730s or thereabouts has been postulated. Analytical results should help to place the varieties in their correct chronological sequence, and may yield other incidental information of historical value.

Summary of previous work. A few sceattas from Frisia were analysed and the results presented briefly by Rethaan Macaré in 1838 and 1856. The starting-point for modern studies was the analysis of the eight coins in the Southend hoard, and of two sceattas of *Pada* by Forbes and Dalladay. Their figures were published in *BNJ* 1961.[2] X-ray fluorescence analyses of a numbered series of 112 sceattas were undertaken in the 1960s by Mrs. J. M. Merrick, Miss L. K. Hamblin, and D. M. Metcalf, and the results were published in a series of articles and in a book, *Studies in the Composition of Early Medieval Coins*.[3] These sceattas were all analysed by the 'Milliprobe', in the Research Laboratory at Oxford.

The new programme of analysis. A new series of analyses was planned and undertaken in 1976–7 by Metcalf, using a second-generation spectrometer, the 'Isoprobe'. The programme benefitted from McKerrell's published work on Anglo-Saxon coins and his experiments on trace-elements, and also from concurrent programmes on the Isoprobe by Mayhew on sterlings and by King on late Roman coinage. It was intended to be supplementary to the foregoing researches on sceattas in the following respects:

(i) It seemed desirable to try to repeat some of the earlier results, measuring the same coin at the same spot on the edge. The correspondance was for the most part adequate. The main point which emerged was that Mrs. Merrick had sometimes been too gentle in abrading a cleaned area on the edge of the coin, so that the results were still being influenced by surface enrichment (or depletion)—usually, it would seem, because the abraded area was not large enough (given the difficulties of positioning such tiny objects) for the X-ray beam to fall completely within it. Mr. Mayhew's experiences in 1977 in the analysis of sterlings were helpful here.

[1] M. Morehart, 'Some Dangers of Dating Sceattas by Typological Sequences', *BNJ* xxxix (1970), 1–5.

[2] J. S. Forbes and D. B. Dalladay, 'Composition of English Silver Coins (870–1300)', *BNJ* xxx (1960–1), 82–7, and an appendix to Rigold's paper in the same volume, at pp. 52–3.

[3] The numbering of the sceatta analyses is given in parentheses after each publication. S. C. Hawkes, J. M. Merrick, and D. M. Metcalf, 'X-ray Fluorescent Analysis of Some Dark Age Coins and Jewellery', *Archaeometry*, ix (1966), 98–138 (F. 1–10, O. 14, O. 16–20); D. M. Metcalf and J. M. Merrick, 'Studies in the Composition of Early Medieval Coins', *NC*[7] vii (1967), 167–81 (O. 38); D. M. Metcalf, J. M. Merrick, and L. K. Hamblin, *Studies in the Composition of Early Medieval Coins*, Newcastle upon Tyne, 1968 (Ca. 1–10, Sc. 1–2, O. 41–84, Ly. 1–2, Y. 1–5); D. M. Metcalf and L. K. Hamblin, 'The Composition of Some Frisian Sceattas', *Jaarboek voor Munt- en Penningkunde*, iv (1968), 28–45 (O. 118–42, M. 1–6). (The missing numbers O. 143–84 are other Dark Age coins published in *Archaeometry*, xi and xii.)

(ii) The availability of a radioactive source (^{241}Am) in connection with the Isoprobe opened up the possibility of rather more accurate (surface) measurement of traces of tin. This has turned out to be an interesting diagnostic element in the sceatta series: preliminary results were announced by Metcalf and Walker in 1976. Below about 1 per cent Sn the repeatability of the results is not good, and individual results less than *c.* 0·5 per cent in relation to silver, as measured by the Isoprobe, should be considered merely as $< 0{\cdot}5$ per cent. Where they are below this level the measured values have nevertheless been printed, to give a better idea of the general contrast in tin contents between early sceattas and the later series.

(iii) X-ray fluorescence using such a low-powered spectrometer is really a very unsatisfactory technique for the accurate measurement of trace-elements in silver and silver-copper alloys. The zinc peak, for example, falls between the first and second copper peaks, and is swamped by them. The reading for gold is similarly affected by the presence of zinc. These two metals can at best be estimated from the aggregate peak heights. Lead was not measured quantitatively in many of the analyses of the 1960s. Accurate measurement, of gold as well as lead, in the multi-channel analysis for which the Isoprobe is designed, is hampered by 'background noise', and peak height measurements may tend to overstate the smaller amounts. The main point here is that all the measurements for a particular trace-element should be made by the same method, if comparisons of trace-levels in different series of sceattas are to have any validity. The repeatability of the peak-height measurements was good, and within-series variations should be reliable, even if the absolute calibration of small values presents difficulties.

(iv) The same techniques of analysis and the same procedures for calculation were used for the 1977 sceatta programme and a 1976–7 programme of analyses of contemporary Merovingian silver coins (to be published in the volume presented to Philip Grierson) to ensure comparability.

Abbreviations. The analyses are numbered in continuation of the earlier series, the prefixed letters O and M standing for Oxford and Metcalf, to indicate the collection where the coin is found. The percentage contents of solid metal are given to one decimal place, but this does not imply a corresponding degree of accuracy or even repeatability, merely computational convenience. A dash signifies below the level of detection; nd means not determined, i.e. not looked for.

Series Pa. Two thrymsas of Pada were found to contain 30 and 26% gold respectively (F. 2, O. 13). Forbes and Dalladay analysed two sceattas of Pada, which may both be contemporary counterfeits. One other specimen (O. 14) has been analysed. The Pada found at Kew is a thrymsa with *c.* 40% gold in the surface layers.

Series Va. A thrymsa was found to contain 10% gold (O. 15). Another, in Professor Grierson's collection,[4] gives the following results:

	Ag	Cu	Au	Pb	Zn	Sn	*'Gold'*
G. 101	85·6	4·3	7·9	1·3	0·8	0·23	94·7

O. 16–17 and Ca 1 show an alloy closely comparable with the best of the primary sceattas.

(*Series F.* A thrymsa in this series is discussed below.)

Series A. Previously published analyses were of one coin from the Southend find and two from Finglesham—all showing 95% silver, 1–2% gold, and 3–3½% copper. Lead added 0·64% in the Southend coin, so that the 'silver' contents of series A (silver plus gold plus lead) could be estimated at *c.* 97%.

The most surprising of the new results was that A2, 2a turned out to contain almost enough gold for it to be considered as a thrymsa.[5] It is difficult to argue that this was unintentional, and there may therefore be implications for the relative chronology of Pada and Series A.

[4] One hundred analyses of Merovingian silver coins, made using the same instrument, the same standards and calibration, and the same analytical procedures and methods of calculation, are published in the volume of studies presented to Philip Grierson. Five Anglo-Saxon coins analysed at the same time are included here in a slightly simplified form, with the numbering G. 101–5.

[5] The range of values quoted for gold is because exactly suitable standards were not available. The coin was, however, analysed at two different places on the edge, with consistent results.

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
O. 185 A2, 2a	84·5	6·8	6·2/7·5	0·5	1·3	(0·25)	91·8
O. 186 A2, 2b	93·7	4·3	0·8	1·0	0·2	—	95·5
O. 187 A2, 4f	91·7	5·9	1·2	1·15	—	(0)	94·05
O. 188 A3, 2b	93·5	5·3	0·65	0·55	—	(0)	94·7
O. 189 A3, 15a	92·5	5·8	0·7	0·95	—	(0·1)	94·15

O. 185 1·29 g. Evans bequest.
O. 186 1·25 g. Ex Barnett duplicates.
O. 187 1·27 g. Ex Barnett duplicates.
O. 188 1·14 g. Evans bequest.
O. 189 0·96 g. Purchased 1940. Found at Compton.

Although these are not the identical coins, they suggest that, with sufficient preparation of the sample area, slightly lower silver values could have been obtained than those that were published. (The Southend results may have been influenced by previous electrolytic cleaning.) Surface examination of coins with a golden tinge failed to reveal any trace of gilding.

Series B. Previous analyses: F. 5–10 (all BI) and Southend 2–3 (both BII, 3)—90–95% silver, 2–5% gold, and 3–5% copper; 'silver' contents 95½–97½%.

		Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
O. 190	BIA, 4	92·8	5·5	0·7	0·6	—	(0·4)	94·1
O. 191	BIA, 7	93·5	4·5	0·4	1·5	—	(0·1)	95·4
O. 192	BIB, 1	93·5	4·8	0·8	0·9	—	(0)	95·2
O. 193	BIC, 4	92·9	4·6	1·15	1·0	0·35	(0)	95·1
M. 7	cf. BII, 3	93·0	5·4	0·5	0·9	—	(0·2)	94·4
O. 194	BII, 4i	93·1	4·5	0·4	0·8	0·3	0·9	94·3
O. 195	BII, 11	90·7	6·7	0·8	1·0	—	0·8	92·5

O. 190 1·24 g. Ex Barnett duplicates.
O. 191 1·18 g. Ashmolean ancien fonds.
O. 192 1·26 g. Evans bequest.
O. 193 1·26 g. Evans bequest.
M. 7 1·25 g. Found at Hunsbury.
O. 194 1·08 g. Evans bequest. Found at Birchington.
O. 195 1·09 g. Bodleian Library ancien fonds.

Contrary to the indications of the earlier results, there is no significant difference between series A and B, and certainly no systematic difference in the gold traces. BIB (variety with bust) shows no difference from BIA and C (with head). BII, 4 and BII, 11, however, have rather higher tin contents.

Series C. Five primary runic coins in the Southend hoard were analysed by Forbes and Dalladay. They are of variety R1a (9490, 9494), R1a with standard inverted (9493), and R1b (9491–2). Their 'silver' contents are very high. Six other coins, O. 66–71, varied from *c.* 85% to *c.* 94½% 'silver', with high lead contents in the poorer coins. Five were reanalysed, with the following results:

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
O. 66	92·97	4·89	0·42	0·88	0·34	0·49	94·27
O. 67	92·55	5·70	0·50	0·69	0·17	0·39	93·74
O. 68	92·65	6·12	0·37	0·86	—	—	93·88
O. 69	91·80	6·49	0·39	0·78	—	0·54	92·97
O. 71	90·04	6·26	0·72	1·00	0·43	1·54	91·76

On the basis of the new results, there is no early decline in the alloy of the primary runic series, and the only perceptible difference between it and the alloy of series A and B is the presence of small amounts of tin. The zinc and tin values are rather high in comparison with the Southend results, but it is difficult at present to judge the reason.

Series D. Previous analyses of the Frisian runic types are O. 118–20 and O. 121 (*BMC* type 8). A destructive analysis by Rethaan Macaré gave 92·5% Ag, 5·9% Cu, 1·6% Au. To these can now be added:

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
O. 196	91·40	5·83	0·81	0·88	0·41	0·68	93·09
O. 197	89·19	8·39	1·01	0·93	—	0·49	91·13

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
O. 198	91·74	5·13	1·14	1·16	0·82	—	94·04
O. 199	92·11	4·34	1·49	1·00	0·62	0·43	94·60
O. 200	90·90	5·60	0·85	1·23	0·56	0·87	92·98

O. 196 0·88 g. Ex G. E. L. Carter.
O. 197 1·23 g. Ex Carter.
O. 198 1·12 g. Ex Carter.
O. 199 1·11 g. Ex Carter.
O. 200 0·67 g. Ex Carter.

The 'silver' is almost as good as that of the English primary series. The gold traces are marginally higher; zinc is apparently a more regular constituent; and the pattern for tin is comparable with that in series C.

Series E. The early porcupines are of good silver, like the other primary sceattas (O. 20, O. 38, O. 41, Sc. 3). The 'Æthiliræds', etc. (O. 42–4) are also of good silver; but the Frisian finds (O. 138–42, M. 1–6, all probably from the Kloster Barte hoard) show a decline to around 80% silver.

A detailed reappraisal of the metal contents of the porcupines has been left on one side, but they have been checked for tin. The early English varieties (VOIC, G, plumed bird) contain only negligible amounts of tin, matching Series A and B. The Kloster Barte coins contain tin in variable amounts up to 3%. One of the Æthiliræd coins (O. 43), contains *c.* 2½% tin, the other, O. 42, *c.* 0·8%, and there is therefore some reason to suspect that they are late revivals, rather than from the primary phase.

Series F. These coins (*BMC* type 24), which are of uncertain attribution, span the transition from pale gold to silver in the same way as the issues of Pada and Varimundus. No comparable transitional series have yet been found in the Merovingian coinage. There are several specimens of type 24 in the Hunter collection and in the British Museum (pre-1837), and the presumption that the type is English is further increased by a find from Wareham.[6] The design is variable (like those of Pada and Varimundus), and the legends extremely blundered. Many specimens (but not the earliest) incorporate the votive TT/II formula, presumably an eclectic borrowing from series A. This again argues for an English origin. It is intriguing to speculate on the mint: Southampton is an obvious candidate, even though no specimens have been found in the excavations. In any case, the recognition that Series F is English should further modify the view that the sceattas had a single point of origin in east Kent.[7] Four specimens in Professor Grierson's collection were analysed at the same time as his Merovingian series.[8]

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
G. 102	84·51	4·20	9/10·6	—	1·41	0	(94·3)
G. 103	91·90	5·60	0·69	1·49	0·17	0·17	94·1
G. 104	92·30	4·85	1·14	0·97	0·15	0·60	94·4
G. 105	93·06	5·41	0·78	0·76	0	0	94·6

G. 102 1·15 g. Bought from a London dealer.
G. 103 1·12 g. Ex Grantley.
G. 104 1·07 g. Ex Grantley.
G. 105 1·10 g. Ex Grantley.

Series G. Reanalysis confirmed the high gold, lead, and tin contents of *BMC* type 3a, O. 124 (*c.* 85% silver), and an imitative coin, O. 125 (*c.* 52% silver), although a higher silver value was obtained from O. 124, a very corroded coin. Two stylistically degenerate coins (which may be continental) proved to be very base, with large amounts of tin:

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
M. 8	90·7/88·9	6·8	0·59	1·22	0·68	n.d.	*c.* 91·6
O. 201	37	54	—	—	—	8/10	37
O. 202	22	65	—	—	—	11/15	22

M. 8 1·06 g. Ex Lockett 214.
O. 201 0·94 g. Ex Carter.
O. 202 1·10 g. Ex Carter.

[6] S. E. Rigold and D. M. Metcalf, 'A Check-list of English Finds of Sceattas', *BNJ* xlvii (1977), 31–52, s.v.

[7] D. M. Metcalf, 'Monetary Expansion and Recession: Interpreting the Distribution Patterns of Seventh- and Eighth-century Coins', *Coins and the Archaeologist* (ed. J. Casey and R. Reece), British Archaeological Reports, IV, 1974, 206–23.

[8] See note 4 above.

Series H. Previous analyses for the Hamwic series (O. 60, Ca. 6) were on the high side. The chronological ordering of the series remains uncertain.

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
H1 (*BMC* type 49)							
O. 203	85·60	8·16	0·67	1·59	0·40	3·58	87·86
Ca. 6	62·79	33·07	0·20	1·05	—	2·88	64·04
H2 (*BMC* type 39)							
O. 60	67·38	29·57	0·52	1·16	—	1·36	69·06
H3 (*BMC* type 48)							
O. 204	62·78	26·91	1·61	4·04	—	4·66	68·43

O. 203 0·82 g. Ex Shortt. Found in 'South Hampshire'? O. 204 0·78 g. Same provenance as last.

The tin contents are similar to those found in the 'bird and branch' coins.

Series J. Previous analyses of J1 (otherwise BIIIb) and J4 (*BMC* type 37) showed them to be of good silver, but often counterfeited (O. 18–19, Ca. 2–3, Sc. 1–2; also the Banbury and Repton find). Some of the figures for silver were, again, too high.

		Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
J1	O. 18	86·35	10·67	0·51	0·64	—	1·82	87·50
J4	Ca. 3	91·04	6·07	0·73	1·31	—	0·85	93·08
	O. 205	87·59	8·87	0·64	1·07	—	1·83	89·30
	O. 206	87·38	7·60	0·24	0·76	2·20	1·82	88·38
	O. 19	82·21	14·51	0·35	0·87	—	2·07	83·43

O. 205 0·68 g. Evans bequest. O. 206 1·01 g. Evans bequest.

There are very clear contrasts between series B and J. The 'silver' contents are lower; and tin is present in the alloy as a minor constituent. This raises interesting questions about the routes by which it was obtained, and about the practices of metal-working on which the mint drew. Zinc is present in one coin (as it is in Sc. 2).

Series K. The 'wolf' sceattas (*BMC* types 32–3) and related types (*BMC* types 20, 42, 52) have yielded silver analyses ranging from 65–70% down to 45–50% or less (O. 47–8, O. 62–4, O. 65). They await full reanalysis. Two coins from Walbury Camp give additional results, which may be affected by their deeply corroded fabric, and probably exaggerate the silver contents.

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
BMC type 42							
O. 206 bis	81·3	14·9	0·32	0·52	—	2·93	82·1
BMC type 52 var							
O. 207	*c.* 84·4	*c.* 10·4	nd	nd	nd	4·27	*c.* 85

O. 206 bis. 0·93 g. Reading Museum. Found at Walbury Camp.
O. 207 0·97 g. Purchased 1977. Found at Walbury Camp.

Series L. It seems clear that the measurement of tin was accidentally omitted in some of the published analyses, O. 49 and O. 52–5. All the coins reanalysed in fact contain very substantial amounts of tin. If debasement is any guide to the chronology of the sceatta series, the coins signed *Lundonia* cannot follow swiftly upon the primary phase. If they were seen as marking Æthelbald's taking control of London probably in 731 or 732, it would be necessary to move the end of the primary phase back, perhaps as much as a decade, from the date that has hitherto been envisaged. The historical interpretation of *BMC* type 12 should therefore probably be modified.

		Ag	Cu	Sn	*'Silver'*
'London' style					
BMC type 12					
	M. 9	47·5	48·5	4	*c.* 47·5
	O. 53	27·5	61·5	11	*c.* 27·5 (T)
BMC type 16/15b					
	O. 49	23·5	66·5	10	*c.* 23·5 (T)
BMC type 15 and var					
	O. 54	18	69	13	*c.* 18 (T)
	O. 55	20	69	11	*c.* 20 (T)
'Hwiccian' style					
BMC type 18/20					
	O. 52	16	64	20	*c.* 16
BMC type 15					
	O. 208	15	53·5	31·5	*c.* 15

M. 9 0·85 g. Ex Glendining, 9 June 1976. O. 208 0·70 g. Found at Shakenoak.

The coins from the Thames hoard (marked T) have a thick patina. Tin was therefore measured on the cleaned edge of those four coins.

Series M. All three specimens of type 45 are probably corroded and leached throughout their fabric, and the measured silver contents may accordingly be too high.

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
M. 10	72·5	23·9	0·4	1·0	0·7	1·35	73·9
O. 209	54	42	nd	nd	nd	4	*c.* 54
O. 210	50	46·5	nd	nd	nd	3·5	*c.* 50

M. 10 0·98 g.
O. 209 0·91 g. Purchased 1977. Found at Walbury Camp.
O. 210 1·03 g. Bodleian Library ancien fonds.

The unique specimen of type 62 was similar:

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
O. 211	38·26	52·83	0·07	0·28	—	8·56	38·61

O. 211 0·88 g. Ex Passmore. Found near Oxford.

Series N. No analyses have been made.

Series O. BMC type 40 (analysis O. 50) gave a range of 62–74%, but remeasurement reveals that this was too high:

O. 50	54·40	42·74	0·39	0·43	—	2·04	55·22

One specimen of type 57 was available for analysis:

O. 212	60·20	36·90	0·33	0·74	—	1·84	61·27

O. 212 1·02 g. Evans bequest.

Series Q. O. 79 is comparable in its alloy with the other East Anglian types.

Series R. A good selection of series R, including derivatives of the substantive type originally called R2, have been analysed (Ca. 7–10, O. 73–8 and 80–1). Where tin was not recorded (O. 75, 77), its presence has now been confirmed, suggesting the following modified results (not complete reanalysis).

	Ag	Cu	Au	Pb	Zn	Sn	*'Silver'*
O. 75	39–44	49–54	¼	2·8	*	3·7–4·2	42–7
O. 77	21–3	59–61	¼	6·4	*	11·5	27½–29½

The Normanby find (M. 11), for which provisional figures were given in *BNJ* 1976, has been reanalysed in line with the other results published here, as has Ca. 8 (type 70), and a sceat resembling the earliest pennies (M. 12), both of which may be late revivals.

	Ag	Cu	Au	Pb	Zn	Sn	'*Silver*'
M. 11	48·39	44·67	0·27	0·89	—	5·77	49·55
Ca. 8	72·69	22·96	0·41	0·69	—	3·25	73·79
M. 12	58·83	37·61	0·45	1·14	—	1·97	60·42

M. 11 1·04 g. Glendining, 20 July 1976. Found at Normanby.
M. 12 0·94 g. From Norwich area.

Series S. Reanalysis of the 'late' sphinx coin, Lockett 265, after more thorough abrasion of the edge, contradicted the earlier conclusion that it was of 80–85% silver. The new figures are:

	Ag	Cu	Au	Pb	Zn	Sn	'*Silver*'
M. 13	48·25	50·22	0·25	0·29	—	0·98	48·79

M. 13 1·12 g. Ex Lockett 265.

Series T. O. 45 gave 60–74% silver.

Series U. Two 'bird and branch' coins previously analysed (O. 58–9) were found to be rather variable in their silver contents. Consistent readings were obtained by reanalysis.

		Ag	Cu	Au	Pb	Zn	Sn	'*Silver*'
'Mercian' style								
	O. 213	88·94	7·21	0·52	0·87	—	2·45	90·33
	O. 58	81·51	15·52	0·23	0·39	—	2·35	82·13
'London' style								
	M. 14	82·56	8·67	1·55	2·44	—	4·79	86·55
	O. 59	79·66	18·08	0·32	0·36	—	1·57	80·34
	M. 15	65·22	26·64	0·72	1·45	—	5·97	67·39
'Archer' type								
	O. 214	70·69	23·56	0·57	0·94	—	4·24	72·20

O. 213 1·07 g. Purchased 1971. Found at Abingdon.
M. 14 — (Formerly Metcalf coln.)
M. 15 0·93 g.
O. 214 1·13 g. Glendining, 9 February 1977. Found at or near Walbury Camp.

The Abingdon find, O. 213, which is of elaborate style, also has the highest silver contents. The series evidently witnessed a decline from *c.* 90% to *c.* 80% and perhaps further. (The result for M. 15 is provisional, as the coin was abraded only very slightly.)

Type 23a (O. 51) gave 38–40% silver. Type 23e (O. 56–7) gave *c.* 30–35% silver, and both specimens contained some zinc.

Series V. The she-wolf and twins type was found, upon reanalysis, to contain a substantial amount of tin, which had not previously been measured. The silver reading was affected by surface enrichment, as O. 46 *bis* presumably was also.

	Ag	Cu	Au	Pb	Zn	Sn	'*Silver*'
O. 46	57·68	36·88	0·44	0·74	—	4·26	58·86

Series W. No analysis has been made.

Series X. Earlier information is discussed in connection with analyses O. 122–3 (92–94% and 34–39% 'silver' respectively). A provisional analysis of the Tackley find showed 80–84% silver at the surface.

Series Y. Analyses Y. 1–5, O. 82–4, and Ly. 1–2 range from *c.* 85% down to *c.* 50%. In the context of later Northumbrian alloys, the results have been interpreted as suggesting a chronic shortage of silver stocks.[9]

Series Z. An East Saxon attribution has been proposed for the type, which imitates one of Cunobelin.[10] Analysis Ca. 5 gave 65–74% silver.

[9] G. R. Gilmore and D. M. Metcalf, 'Neutron Activation Analysis of Drillings from Northumbrian Stycas', *Edinburgh International Symposium on Scientific Archaeology* (forthcoming).

[10] D. M. Metcalf, 'Twelve Notes on Sceatta Finds', *BNJ* xlvi (1976), 1–18, at p. 12. The type is copied from Mack 223.