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AUTHOR Justine Bayley Jan 1983

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CRUCIBLES AND CLAY MOULDS FROM THE MARLOWES AND CAKEBREAD ROBEY SITES IN CANTERBURY KENT

Justine Bayley
Ancient Monuments Lab

A group of mixed technological samples (A.M Nos 815404-53) were submitted for examination and an interim report of basic identifications produced (see Appendix below). The crucible and mould fragments were then subjected to a more detailed examination and all traces of metals were analysed qualitatively by x-ray fluorescence (XRF).

THE CRUCIBLES

The crucible sherds (see table 1) are representative of only a few types each of which has a distinct fabric and form.

The fabric of type A is fairly soft and contains a little fine sand as well as some vegetable temper. The form is a shallow triangular bowl, each of the corners acting as a pouring lip. These crucibles are heated from above so the most heavily vitrified areas are on the inside and around the rim. The outside is little affected and may even have an oxidised-fired surface (as in AM 815406 and 815409) though the bulk fabric is dark grey to black in colour. This combination of form and fabric is a prehistoric one; similar examples are known in both Bronze Age and Iron Age contexts eg Mucking (Jones 1980), Gussage All Saints (Spratling 1979, 132), Gallows Hill, Thetford (Linton and Bayley 1982) Beckford, Worcs (Linton and Bayley 1982a). Tylecote (1962, 341f) lists other examples from earlier excavations.

AM 815406 had been used to melt bronze (copper and tin detected by XRF) while AM 815409 gave only signals for copper. AM 815407 contained many minute gold droplets adhering to its inner surface showing it had been used to melt the metal. The copper that was also detected was probably alloyed with the gold.

TABLE 1: THE CRUCIBLES

AM No	Crucible type	Sherd type	Thickness (mm)	Metals detected by XRF	Date of context
815404	Y	B +	6	(Cu)	1400-1550
05	Z	B +	6½	(Cu)	1200-1400
06	A	R	12	Cu + Sn (+Pb)	70-100
07	A	R	over 10	Cu + Au (+Pb)	70-100
09	A	R	C.12	Cu	70-100
10	X	B	9	Pb + Ag + Cu	1200-1400
13	Z	B +	7½	(Cu + Zn)	1400-1550
40	B	R +	6	Zn + Cu	Saxon-Med
41	cf.B	B	8-9	Zn + Cu	Post 8th C
44	B	C +	8-10	Cu + Zn (+Pb)	290-350
45	Y	B +	6½	(Cu)	1200-1400
46	cf.B	Ba	6	Zn + Cu	375-Mid 5th C
47	B	R +	8	Cu + Zn + Sn (+Pb)	350-375
48	B	B +	10	Cu + Zn (+Pb)	375-Mid 5th C
49	B	B +	13	Zn (+Cu + Pb)	290-350
50	B	B +	8-12	Cu + Zn (+Pb)	mid 6th-mid 7th C
51	B	Ba+	9	Cu + Zn (+Pb)	290-350

Key:- R = rim
B = body sherd
Ba = base
C = fairly complete
+ = extra outer layer

In all tables metals written within brackets gave only very weak XRF signals.

The majority of the crucible sherds are of type B. These, like type A, appear to be hand-made but the fabric is far more refractory. It is a low iron clay (which fires pale grey) with very abundant quartz temper of a fairly uniform and fine size. The shape is basically conical with the maximum diameter just below the rim (see Fig 1). There is no indication of any pouring lip on the fragments seen here. Most of them have a thin extra layer of less refractory clay on the outside which shows varying degrees of vitrification. Extra clay layers of this general type are relatively common on crucibles of Roman and later date but they are usually far thicker than these ones. Their function is not clear but it has been suggested that they may help protect the crucible from thermal shock as it is removed from the fire and also increase its thermal capacity, allowing a longer pouring time before the molten metal solidifies. Thin layers, as here, would have little effect in either of these directions; no good reason for their application can be suggested. One body sherd (AM 815447) is from a crucible that has been used more than once as the

vitrified extra layer overlies an already vitrified surface on the crucible itself. The variation in the vitrification on the nearly complete crucible (AM 815444) suggests that it may have stood in rather than on the fire as the top is far more affected than the rest of it.

AM 815446 is of a similar form to the type B crucibles but is thinner walled, presumably smaller, and of a similar but finer fabric. AM 815441 is another type B variant; the fabric is the same and the rim-form similar but it is wheel thrown rather than hand made.

All the type B crucibles gave signals for copper and zinc which suggests they were used for the melting of brass rather than bronze. Tin was detected on one sherd (AM 815447) so the metal it contained was probably a gunmetal (copper + zinc + tin). Most of the type B crucibles come from contexts dated late 3rd to mid 5th century, though some are from later contexts. The uniformity of the metal deposits suggest only one period of use so the post-Roman sherds are probably residual. Many Roman crucibles of this sort of size have flat, almost pedestal bases but one example, very similar to these is known from Sewingshields, a fort on Hadrian's Wall (Bayley 1982) while Gestingthorpe, Essex has also produced conical crucibles (Frere 1970, 266), but they are wheel-turned rather than hand-made.

The remaining crucible sherds are all from medieval contexts and are probably of medieval date. They are parts of fairly large wheel-thrown vessels of unknown form and all except AM 815410 have a thick extra outer layer of vitrified clay. The fabrics are coarser than those of type B and fired grey (types X + Z) or black (type Y). The Y and Z type crucibles contain only slight traces of copper but were probably used for melting copper or one of its alloys. The X type crucible sherds do not have an extra outer coating and are only slightly vitrified on their outside which suggest they may not have been heated as strongly or for so long as the other crucibles. Their inner surfaces however have thick glassy deposits with distinct

'tide-marks' which have attacked the crucible fabric, eroding it. Analysis of these deposits detected major amounts of lead together with silver and copper suggesting a metal purification or refining operation of some sort.

THE MOULDS

A total of three samples are definitely fragments of clay moulds. It is not possible to say if they are from piece moulds or investment moulds as no diagnostic features are preserved.

Two mould fragments (AM 815414) are in a fine but sandy fabric. In both cases a two layer structure is visible. The surfaces in contact with the metal are quite fine and these and the adjacent mould parts are reduced fired while the outer surfaces are oxidised. Mould wall thickness is nearly 10 mm.

The other samples (AM 815411 and 815432) are of a finer textured clay which is quite soft and contains quantities of vegetable temper. The metal contact surfaces are fine and look white with the adjacent clay fired black while the outer parts of the mould fragments are red. Overall mould thickness is around 15 mm.

TABLE 2: THE MOULDS

AM No	Metals detected by XRF	Date of context
815411	Pb (+Cu + Zn)	Modern
815414	Zn (+ Pb)	1000-1100
815432	Pb + Cu	70-100

It is not possible to date the fragments on the basis of their fabric as variations do not seem closely tied to chronology but depend more on the size of object and the

type of mould. It may be possible to identify the objects being cast and hence date the moulds.

NON-SPECIFIC INDUSTRIAL CERAMICS

These pieces (listed below in table 3) are not obviously either crucibles or moulds. They are described and the evidence for their use presented.

There are three sherds AM 815407A, 815408 and 815417 from Roman contexts (1st or 2nd century) which may or may not have had an industrial use of some sort. They are from large, wheel turned vessels of a hard sandy fabric and are dark red (ie oxidised fired). They have extra clay layers which are vitrified on the surface and deep blue-green in colour; XRF analysis detected traces of copper. They cannot have been used to melt metals as this requires reducing conditions but the extra clay layer and its vitrification are unlikely to have been accidental and are not generally found on domestic wares.

AM 815431 contains a variety of material, mostly fired clay containing much vegetable temper. Two of the pieces which are 15-20 mm thick and reduced fired have vitreous inner (concave) surfaces with trapped corroded metal droplets (XRF detects copper and tin). The fabric is what one could expect for a large mould, though the form and deposits are more reminiscent of iron age crucibles, though far larger and thicker than those mentioned above. These two pieces are definitely connected with metal working but whether as crucible or mould cannot be said for certain.

AM 815435 and 815439 are both the same sort of material. They are reduced fired, fairly fine clay sherds that are vitrified to a greater or lesser extent on the outside. The inner (concave) surface is usually grey but sometimes pinkish purple and in some cases a two layer structure, reminiscent of crucibles with an extra outer layer, can be seen. The initial impression is that these are fragments of

small (? 5 cm diameter) thumb-pot crucibles but if so they are very un-circular and there are some pieces whose curvatures cannot readily be fitted into this sort of shape. On the other hand, moulds are not usually so strongly heated and have a better finish on their inside surface.

TABLE 3: THE OTHER CERAMICS

AM No	Metals detected by XRF	Date of context
815407A	Cu + Zn	70-100
814408	Cu + Zn	100-290
815417		100-290
815431	Cu + Sn	70-100
815435	(Cu)/Zn	Belgic
815439	(Cu)/Zn	Belgic

POSTSCRIPT

Since writing this report some material very similar to AM 815435 and 815439 has turned up among a group of crucibles from Culver Street, Colchester. Preliminary examination and analysis of these finds suggest they may be brass-making crucibles. Only a small proportion of the fragments from Canterbury have the very high zinc levels that are typical of the Colchester material but fabric and form, as far as it can be discerned, seem to match.

REFERENCES

1 Bayley J. (1982) Some technological finds from Sewingshields, Hadrian's Wall (AML Report No 3782).

2 Frere, S.S. (1970), Mould for Bronze statuette from Gestingthorpe, Essex. Britannia 1, 266-7

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5 Linton, R. and Bayley, J. (198a) Technological samples from Beckford, Hertfordshire (AML Report No 3762).

6 Spratling, M.G. (1979) The debris of metal working in G.J. Wainwright, Gussage All Saints - an Iron Age settlement in Dorset, DOE Arch.Rep. No 10.

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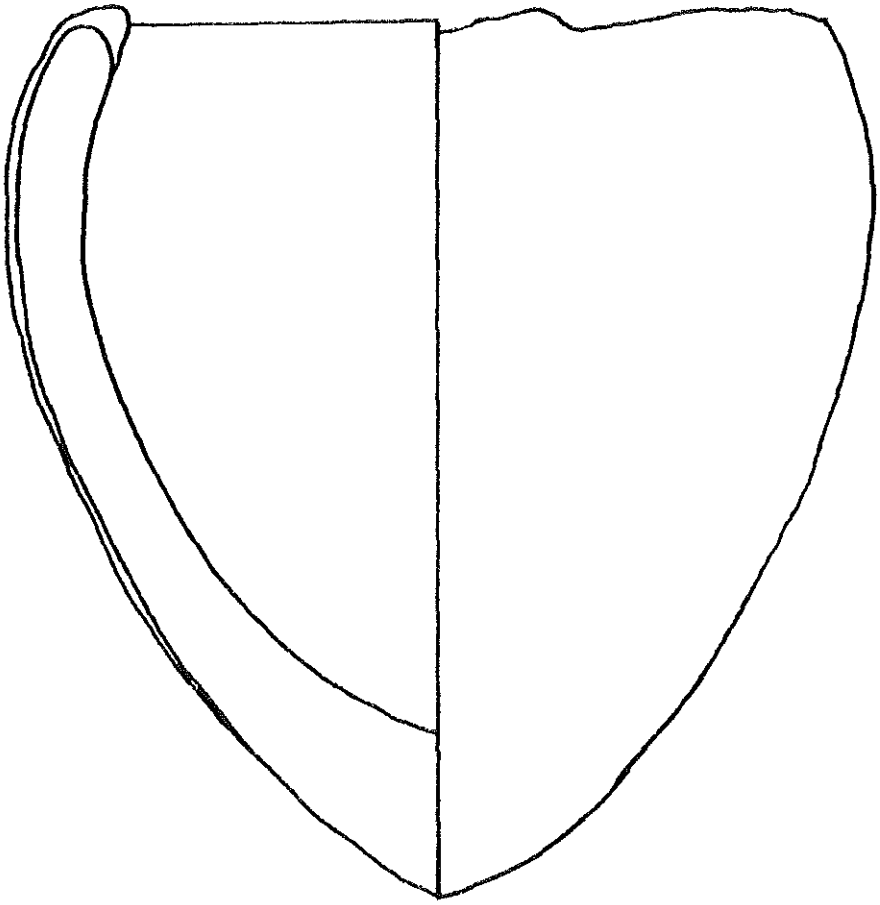

Figure 1 - Sketch of type B crucible (1:1)

Appendix - Preliminary sample identifications

AM No	Detailed Report to follow	Photo No	Description and Report
Marlowes IV			
815404	✓		Crucible frag
815405	✓		Crucible frag
815406	✓		Crucible frag - probably iron age
815407	✓		Crucible frag and oxidised sherd with partly vitrified sandy deposit
815408	✓		? crucible frag, but oxidised fired
815409	✓		Crucible frag - probably iron age
Marlowes IIB and IV			
815410	✓		Probably crucible sherds (2 frags) with vitreous contents
815411	✓		Mould (clay)
815412			Hearth lining
815413	✓ (crucible only)		Crucible frag and piece of dense iron slag
815414	✓		2 frags of clay moulds
815415			frag of magnetic iron ore nodule ?
815416			Corroded iron object
815417			? crucible frag, but oxidised fired
815418			Sherd that fell into the fire and was accidentally vitrified
815419			hearth lining
815420			Corroded iron object that was 'copper' plated
815421			Fired clay lump. No form to suggest use as mould
Marlowes IV			
815422			4 bits of smithing slag
815423			Over-heated daub that is partly vitrified
815424			Hearth lining with copper alloy blobs
815425			Hearth lining
815426			Hearth lining
815427			Hearth lining and piece of iron-rich fuel ash slag
815428			Frag of highly fired clay
815429			Hearth lining
815430			Hearth lining
815431	✓		Vegetable tempered fired clay, some bits with metal-rich deposits on the surface and some with a hearth lining type of appearance. Cf. bell mould but the shapes are wrong
815432	✓		Fired clay mould frags. Again cf. bell mould though the shapes are not quite right. Fabric is different from that of 815431

AM No	Detailed ~~X-Ray No.~~ report to follow	Photo No	Description and Report
Cakebread Robey			
815433			Smithing bun, fuel ash slag, iron-rich fuel ash slag and hearth lining
815434			Iron-rich fuel ash slag
815435	✓		Fragments, ~~possibly~~ of clay moulds or possibly crucibles
815436			Smithing bun
815437			Hearth lining including frag of a tuyere of diameter c. 2 cm
815438			Smithing slag, hearth lining and fuel ash slag
815439	✓		Frag of hearth lining and many bits cf. 815435
815440	✓		Crucible frag
815441	✓		Crucible frag
815442) 815443)			Plates of vegetable tempered and marked 'daub'.
Marlowes III			
815444	✓		Nearly complete crucible
815445	✓		Crucible frag
815446	✓		Crucible frag
815447	✓		Crucible frag
815448	✓		Crucible frag
815449	✓		Crucible frag
815450	✓		Crucible frag
815451	✓		Crucible frag
815452			Probably not a crucible - 2 layer ceramic with white, highly tempered outer layer and thicker, finer, darker inner which is red/brown near the boundary
815453			Probably not a crucible - again a 2 layer ceramic with a fine, dark grey layer and a coarse, paler grey lump attached.

Smithing slag forms in an iron working hearth, often collecting in plano-convex buns in the bottom of the hearth.
Fuel ash slags form when silica rich material, eg clay, is heated in contact with ash in a fire at high enough temperatures. They are not necessarily associated with metal-working. Iron-rich fuel ash slags do probably form in iron-working hearths.
A special form of fuel ash slag is hearth lining where the silica-rich material is only fluxed on one side from contact with the fire. A more intense fire produces deeper changes and hence a thicker layer of hearth lining.

Justine Bayley
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