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Analysis of Non-Ferrous Metal Objects from Finglesham, Kent

Paul Wilthew

Ancient Monuments Laboratory

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Introduction

About 200 copper alloy and silver objects from the pagan Saxon cemetery site of Finglesham, Kent were analysed using qualitative energy dispersive X-ray fluorescence (XRF), a technique which analyses the surface of the object. It was necessary for the analytical method used to be totally non-destructive so no sample preparation was carried out prior to analysis. Because of this the results obtained may not accurately reflect the original composition of the bulk metal of the object. Corrosion of the base metal or deposition of contaminants during burial and original (but no longer visible) surface treatments could all affect the results obtained. The results have therefore only been used to describe objects in terms of general alloy types, which could be assigned with confidence in most cases. A large majority of the objects analysed were made of copper alloys and in these cases the significant elements detected were copper, zinc, lead and tin. Several different alloys can be defined depending on the relative amounts of zinc, lead and tin present.

Bronze - A copper alloy containing significant amounts of tin with, at most, a relatively small amount of zinc.

Brass - A copper alloy containing significant amounts of zinc with, at most, a relatively small amount of tin.

Gunmetal - A copper alloy containing significant amounts of both tin and zinc.

In addition each of the above alloys may also contain significant amounts of lead, in which case they are described as leaded bronze etc.

The relative compositions of these alloys are shown schematically in Figure 1; the further a point within the triangle is from the corner corresponding to a particular element, the less of that element is present. It is clear from the diagram that there are no sharp compositional boundaries between the different alloys, but the composition of the object could nevertheless be usefully described in terms of different alloys. The amount of lead present in leaded alloys can vary considerably so the objects described as leaded may have contained any amount from a few per cent upwards.

In some analyses anomalously high tin and/or lead values were recorded. These were almost certainly due to the presence, originally, of tinned coatings on the objects which were no longer visible though still analytically detectable by XRF.

The composition of each part of each object analysed is given in appendix 1, and the results are discussed below. It may be possible to draw further conclusions when the results are considered in conjunction with other archaeological information.

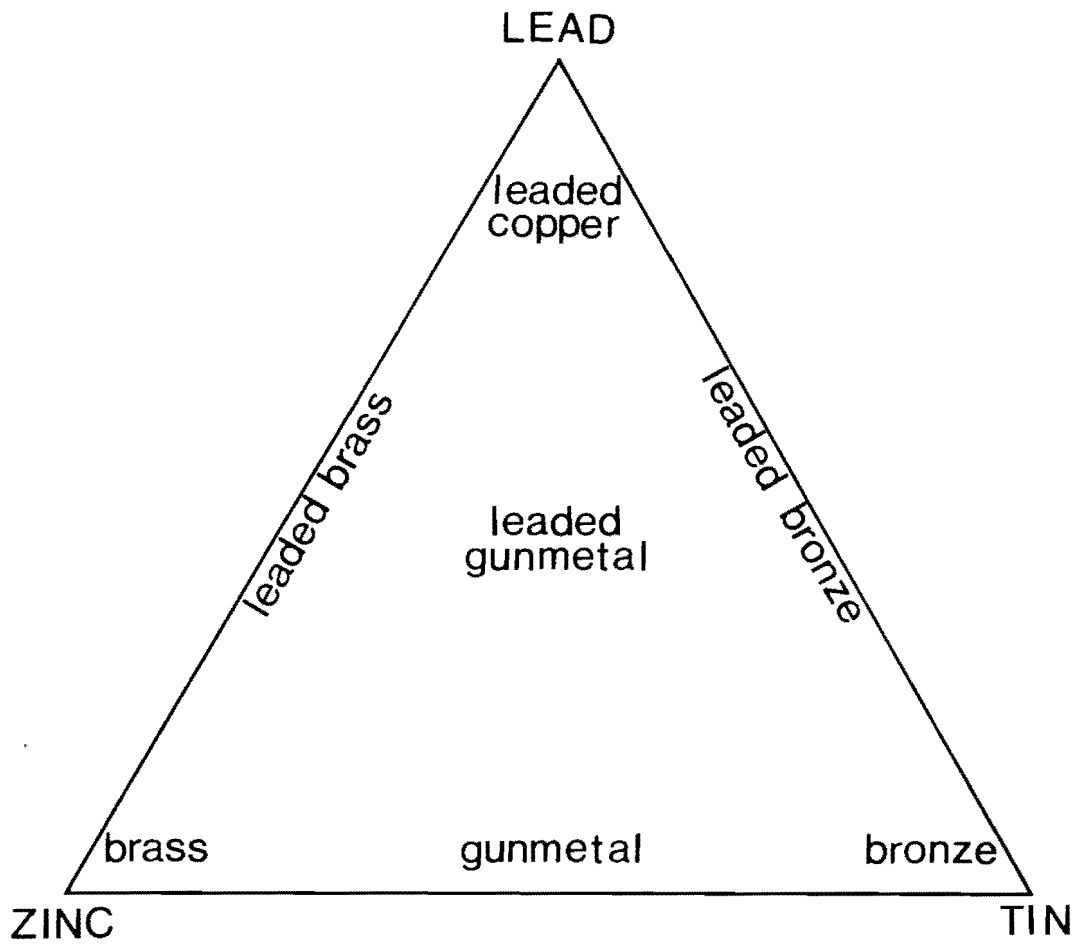


Figure 1: **Composition of copper alloys**

Results and Discussion

1) Copper Alloy Objects

Although a wide range of types of copper alloy objects were analysed, in most case only a few examples of any one type were present. One of the more numerous groups of objects were the small items such as clips, staples, rivets and tacks used for joining other components. They were often present as part of a larger object and could not be analysed separately, but enough detached ones were present to provide a reasonable sample. A high proportion of these objects were copper or bronze (about 72%), although some of the apparently bronze objects may have been tinned copper. Zinc was detectable in seven objects but only one (grave 138-object 13) was a brass. The other six were probably gunmetals. Significant, though not very high, levels of lead were present in many of these objects. This was almost certainly not because they were made of leaded alloys but because they were originally coated with a lead-tin alloy or, as was clearly the case with two clips (25-1 and 25-2), because they had been soldered to another object using a lead-tin solder. In no case was a significant level of lead detected when no tin was present. The presence of lead has a detrimental effect on the working properties of copper alloys so leaded alloys would not be suitable for use in small heavily worked components such as these clips, rivets, tacks and staples.

Several examples of lace tags were analysed. They were all bronze apart from two examples (157-23 and 157-25) which were leaded gunmetal and leaded bronze respectively. Apart from the leaded examples, the lace tags were formed from sheet metal bent to form a hollow cone. The leaded examples consisted of a fairly solid volume of metal which was probably cast, which would be consistent with the presence of lead in the alloy used, as lead improves the castability of copper alloys.

The most common type of larger object was the buckle, which in most cases consisted, of several components, usually including separate loop, bar and plate, A large majority (about 80%) of components were either bronze (31-1, 33-1, 62A-2, 83-5, 84-3, 133-2, 140-1, 144-1, 152-2) or gunmetal (31-1, 33-1, 44-1, 45-1, 57-3, 83-5, 97-1, 107-7, 157-20, 157-21, 159-4, 180-5, 198-12, 198-13, 215-1). Of the exceptions, five were leaded bronze or leaded gunmetal, four were brass and one was a fairly pure copper. The leaded bronze and leaded gunmetal components (83-5, 159-4, 207-2) were probably cast, which may explain the use of leaded alloys for these parts. Some tin was present in three of the four brass components (97-1, 152-2, 206-1) and they may have been 'high zinc gunmetals'. The other brass buckle (168-2) contained very little tin. The copper buckle (203-7) had been mercury gilded (which is the gilding technique usually used from the late Roman period onwards [1]). This would explain its unusual composition as fairly pure copper provides a better substrate for mercury gilding than any copper alloy, particularly one containing lead. Different parts of the same buckle were sometimes made from different alloys (31-1, 33-1, 83-5, 97-1, 159-4) but there was no evidence that this was due to later replacement of broken components. The back plate of one buckle (83-5) had, however, been repaired by lead-tin soldering a similar plate onto it.

Too few of the other types of object were analysed for any conclusions to be drawn about the alloys used for particular types of object. The most frequently used alloys were again bronze and gunmetal (used for over 60% of the objects), but, as with the buckles, there was no evidence of deliberate choice between these alloys. Both bronze and gunmetal were found in several graves (57-138, 174, 180, 182, 198) and similar objects were made from different alloys. There were, for example, bronze (57-13, 84-2, 163-6, 164-1, 182-1, 182-2, 202-5) and gunmetal (139-1, 182-2) pins, bronze (174-16) and gunmetal (96-57, 174020) rings and bronze (25-10) and gunmetal (62A-3, 180-9) belt fittings.

Leaded alloys were rarely found, but this probably reflects the fact that a very high proportion of the objects were wrought rather than cast. Apart from one pin

shaft (31-2) which was very corroded and may have been tin-lead coated and not a leaded alloy, all the objects made from leaded alloys could have been cast. They included a leaded bronze ring (87-92), a leaded gunmetal belt fitting (25-11), a leaded gunmetal loop from an annular brooch (57-11) and a leaded gunmetal bead (139-56i). The pin of the brooch (57-11), which was almost certainly wrought, was gunmetal and contained a relatively small amount of lead.

Fairly pure copper was used for several objects, mainly for heavily worked items such as studs (203-8, 203-9), rim mounts (25-1), catch hooks and pins (180-23), and wires (82-10) although shoe fittings (157-22, 157-24) and plates (213-7, 213-8) were also made from copper.

Brass was only used in objects from seven graves (68, 82, 103, 110, 174, 203, 211A). The objects included three similar pendants (68-11, 68-15, 68-17), fragments of a purse frame (82-9, 82-10, 82-11, 82-12), fragments of sheet (103-2), a mount (110-6), a wire supporting a glass bead (174-4) a girdle fastener (203-11), a pair of tweezers (203-14c) and a sheet riveted onto an iron shield boss (211-2a).

Several of the objects had been mercury gilded and others had been decorated by attaching a silver sheet to the copper alloy object using lead-tin solder. The gunmetal studs from a shield boss and shield grip (22-2a and 22-2b) had been decorated in this way, while a similar stud from shield grip 110-3 consisted of a gunmetal sheet lead-tin soldered to an iron stud. Another similar shield boss from Ozengell, Kent (Ozengell 157-1) analysed by the author had gunmetal studs, the heads of which were coated with tin. The presence of gilding and other surface decoration and soldering is noted in the appendix.

The extensive use of alloys containing both tin and zinc for a wide range of objects suggests that scrap Roman metal was a major source of metal during this

period. Similar patterns of alloy usage in the Pagan Saxon period have been found, for example, at Portway, Hampshire [2].

There was no clear evidence of deliberate choice between low lead bronzes and gunmetals, but leaded alloys were only used for objects which were likely to have been cast. Brass was rarely used, but was not completely absent. The source of small quantities of brass could have been scrap metal, or it might have been imported, either as finished objects or as a raw material. Relatively pure copper was also used, mainly for small very heavily worked objects for which a very ductile metal such as copper would be preferable.

2) Silver Objects

The most common silver objects analysed were the intertwined wire rings. In all cases copper was also detected and often minor amounts of zinc, gold, mercury or tin were also present. The levels of copper and the nature and concentration of minor elements detected varied considerably both between different rings from the same grave and between rings from different graves. Quantitative analysis of major and minor elements would therefore be necessary before any useful comparison between different rings or groups of rings could be carried out. The composition of the other silver objects was similar. Copper was always detected and some, at least, of the minor elements listed above were usually also present. Several of the objects were mercury gilded (see appendix 1) and some were inlaid with almandine garnets [3]. Some of the garnets may have been mounted on gold foil, as has been found elsewhere, but as the garnets could not be removed this could not be confirmed.

The zinc and tin present in some objects were probably in the copper alloy used to debase the silver.

Several silver sheets were soldered onto copper alloy objects as described above. One separate sheet (57-67) had the remains of a tin-lead solder on the back, and was very similar in shape to a brass pendant from the same grave (37-84) which had a tin-lead (?solder) coating on one side. They may have formed part of one pendant originally, consisting of a silver sheet soldered to a brass back plate using a lead-tin solder.

References

[1] PA Lins and W A Oddy "The origins of mercury gilding", Journal of Archaeological Science, 2(1975), 365-73

[2] J Bayley, Forthcoming.

[3] M Hutchinson, personal communication.

Appendix - composition of the objects

Key

In column 4 (Elements Detected) the following conventions have been followed.

1. The element present at the highest concentration is listed first, the order of the remaining elements is not significant.
2. Elements present at a relatively high concentration are underlined (apart from the element listed first).
3. Elements in paranthesis were detected at trace levels only.

Grave	No	Object Description	Elements Detected	Composition and Comments
22	2a	Stud on shield boss	Cu Zn <u>Sn</u> (Pb)	Bronze
		white metal sheet soldered to stud	Ag <u>Cu</u> Zn Au Pb	Silver sheet, lead tin soldered to bronze stud.
	2b	Stud on shield grip	Cu <u>Sn</u> (Pb)	Bronze
		sheet attached to stud	<u>Ag</u> Cu Zn Au Pb	Silver
25	1	Rim mount	Cu (Pb)	Copper
		clips fitted to rim mount	Cu Pb Sn	Copper, lead-tin soldered to rim mount
	2	Rim mount	Cu (Pb)	Copper
		Clips fitted to rim mount	Cu Pb Sn	Copper, lead-tin soldered to rim mount

Grave	No	Object Description	Elements Detected	Composition and Comments
	10	Belt fitting - front plate	Cu Sn (Pb)	Bronze
		back plate	Cu Pb Sn	Probably tin-lead coated bronze
	11	Belt fitting	Cu <u>Zn</u> <u>Pb</u> <u>Sn</u>	Leaded gunmetal
31	1	Buckle - Plate	Cu Sn (Pb, Zn)	Bronze
		- bar and loop	Cu Zn Sn (Pb)	Gunmetal
	2	Pin	Cu <u>Zn</u> <u>Pb</u> <u>Sn</u>	Leaded gunmetal
33	1	Buckle - bar	Cu Zn Sn (Pb)	Gunmetal
		- other parts	Cu Sn (Pb)	Bronze
34	1	Bracelet (intertwined wire)	Cu Zn Pb Sn	Gunmetal
44	1	Buckle - bar	Cu Zn Pb Sn (Au)	Gunmetal
		- plate and loop	Cu Zn Pb Sn	Gunmetal
45	1	Buckle plate	Cu Zn Pb Sn	Gunmetal
	2	Object	Cu (Pb, Sn)	Copper
51	3	Staple	Cu Zn Pb Sn)Probably tin-lead)
	4	Staple	Cu Zn Pb Sn)coated gunmetal
56	10	Clip	Cu (Pb, Sn)	Copper
57	3	Buckle	Cu Zn Pb Sn	Gunmetal
57	9	Catch	Cu Zn Pb <u>Sn</u>	Bronze
	10	Catch	Cu Zn Pb <u>Sn</u>	Bronze
	11	Annular brooch - loop	Cu Zn Pb Sn	Leaded gunmetal
		- pin	Cu Zn Sn (Pb)	Gunmetal
	12	Annular brooch - loop	Cu Zn Pb Sn	Leaded gunmetal
		- pin	Cu	Copper
13		Pin	Cu Sn (Zn, Pb)	Bronze

Grave	No	Object Description	Elements Detected	Composition and Comments
	17	Intertwined wire ring from necklace	Ag <u>Cu</u> Zn Au Pb	Leaded gunmetal
	22 or 23	Ring	Ag Cu (Pb)	Silver
	32	Wire ring from necklace	Ag Cu Zn Au (Pb)	Silver
	40	Intertwined wire ring from necklace	Ag Cu (Pb)	Silver
	46	"	Ag <u>Cu</u> (Pb, Zn)	Silver
	48	"	Ag Cu (Pb)	Silver
	49	Ring from necklace	Ag <u>Cu</u> (Pb)	Silver
	50	Hollow hemispherical bead	Ag Cu Au (Zn)	Silver
	67	Pendant (c.f. 84)	Ag Cu Pb Sn	Silver, with lead- tin solder on one side.
	76	Intertwined wire ring from necklace	Ag <u>Cu</u> (Zn, Au, Pb)	Silver
	77	Hollow hemispherical bead	Ag Cu Au (Zn, Pb)	Silver
	83	Wire ring from necklace	Ag Cu Au (Zn, Pb)	Silver
	84	Pendant (c.f. 67) - front	Cu Zn (Pb, Ag)	Brass with lead- tin solder on one side
		- back	Cu Zn Pb Ag Sn	
	89	Wire ring from necklace	Ag Cu <u>Au</u> (Zn, Pb)	Silver
	90	"	Ag Cu Au (Zn, Pb)	Silver
	92	Ring	Cu <u>Pb</u> <u>Sn</u>	Leaded bronze
58	1	Lace tag	Cu Pb Sn	Bronze
	2	Lace tag	Cu Sn (Pb)	Bronze
	3	Intertwined wire ring	Ag Cu Au	Silver
59	4d	Box fitting	Cu Zn Sn (Pb)	Gunmetal

Grave	No	Object Description	Elements Detected	Composition and Comments
62A	2	Buckle	Cu Pb Sn	Bronze
	3	Belt plate	Cu Zn Pb Sn	Gunmetal
62B	11	Catch plate and hook	Cu Sn (Pb, Zn)	Bronze
		Sheet fragments	Cu Sn	Bronze
67	6	Lace tag	Cu Sn (Pb, Zn)	Bronze
68	11	Pendant	Cu <u>Zn</u> <u>Pb</u> <u>Sn</u>	All brass. The
	15	Pendant	Cu <u>Zn</u> Pb Sn	lead and tin
	17	Pendant	Cu <u>Zn</u> Pb <u>Sn</u>	detected was
				probably from a
				lead-tin solder
				used to attach
				the hooks and
				outer rings
	22	Lace tag	Cu Pb Sn	Bronze
69	4	Intertwined wire ring	Ag <u>Cu</u> Au	Silver
82	9	Purse frame fragment		
		- bar and hook	Cu Zn	Brass
	10	- bar and hook	Cu Zn (Pb, Sn)	Brass
		- wire	Cu (Sn)	Copper
	11	- bent rod	Cu Zn (Pb, Sn)	Brass
	12	" - bent rod	Cu Zn (Pb)	Brass
	13	Buckle	Cu Zn Sn (Pb)	Gunmetal
	16	Iron object	-	Iron
	17	Iron object	-	Iron
	18	Iron object	-	Iron

Grave	No	Object Description	Elements Detected	Composition and Comments
83	5	Buckle - Front plate	Cu Pb Sn	Leaded bronze
		- back plate	Cu Zn Pb Sn	A bronze sheet
		(lower)		lead tin soldered
		- back plate	Cu Sn (Pb)	to a gunmetal
		(higher)		(probably) sheet
				beneath it.
84	1	Pendant - grey piece	Ag Cu Zn (Pb)	Silver
		- green piece	Cu Zn Ag Sn	Gunmetal
	2	Pin	Cu Zn Pb Sn	Bronze
	3	Buckle - loop and bar	Cu Pb Sn (Zn)	Bronze
		- plate	Cu Sn (Pb, Zn)	Bronze
	95	3a-d	Box fittings - 3 hinges and a plate	Cu Zn Pb Sn
96	57	Wire ring	Cu Zn Pb <u>Sn</u>	Gunmetal, possibly tinned
	58	Pendant	Ag Cu Au Pb	Silver
97	1	Buckle - back plate	Cu Zn Pb Sn	Brass
		- front plate	Cu Zn Sn (Pb)	Gunmetal
		- bar and loop	Cu Zn Pb Sn	Gunmetal
99	4	Staple	Cu (Pb, Sn)	Copper
103	2	Sheet fragments	Cu <u>Zn</u> Pb Sn	Brass
107	3	Clip	Cu Zn Pb <u>Sn</u>	Gunmetal)possibly
	4	clip	Cu Zn Pb <u>Sn</u>))tinned Gunmetal)

Grave	No	Object Description	Elements Detected	Composition and Comments
	7	Buckle	Cu Zn Pb <u>Sn</u>	Gunmetal
110	3	Sheet attached to rivet	Cu Zn Sn (Pb)	Gunmetal
	5	Tag fragments	Cu Zn Pb Sn	Gunmetal
	6	Gilt mount - gilded area	Cu Zn Au Sn (Hg Pb)	Mercury gilded
		- non gilded area	Cu Zn (<u>Au</u> , Hg, Sn)	probably fairly low zinc
117	4	Ring	Ag Cu (Zn, Au, Pb)	Silver
118	4	Clips - clip	Cu <u>Sn</u> (Pb)	Bronze, possibly tinned
		- rivet	Cu	Copper
120	6	Intertwined wire ring	Ag Cu (Zn)	Silver
	6	"	Ag Cu	Silver
	8	"	Ag Cu Au Pb	Silver
124	2	Box fitting - angle plate	Cu (Pb)	Copper
	3	Box fitting - angle plate pin	Cu (Pb, Sn)	Copper
			Cu (Pb)	Copper
	8	Pendant - hollow domed sheet	Ag <u>Cu</u> Au Pb	Silver
		- strip (?hook)	Ag <u>Cu</u> Au Zn (Pb)	Silver
	12	Intertwined wire ring	Ag <u>Cu</u> Au Zn (Pb)	Silver
	16	Pendant	Ag Cu Au Pb (Zn)	Silver
125A	3	Clip	Cu Sn (Pb)	Bronze)possibly
	4	Clip	Cu Sn	Bronze)tinned
	5	Clip	Cu <u>Sn</u>	Bronze)
	6	Clip	Cu <u>Sn</u>	Bronze
133	2	Buckle	Cu Sn (Zn, Pb)	Bronze

Grave	No	Object Description	Elements Detected	Composition and Comments
138	12	Clip - sheet	Cu Zn Pb Sn	Gunmetal
		- rivet	Cu (Zn)	Copper
	13	Clip	Cu Zn (Pb, Sn)	Brass
	14	Hanger loop	Cu (Sn)	Copper
	20	Pendant	Cu Sn (Pb)	Bronze
	21	Intertwined wire ring from necklace	Ag <u>Cu</u> (Pb, Zn)	Silver
	24(i)	Mount - sides	Cu Sn (Pb)	Bronze
		- back	Cu <u>Sn</u> (Pb)	Bronze
	29	Intertwined wire ring from necklace	Ag Cu (Au Pb)	Silver
	31	Pendant	Cu Sn (Pb)	Bronze
	33(i)	Bead	Cu <u>Zn</u> Pb Sn	Gunmetal
	46	Intertwined wire ring from necklace	Ag Cu Au (Pb)	Silver
	50	Wire loop (through a bead)	Ag Cu (Zn, Au, Pb)	Silver
	54	Intertwined wire ring from necklace	Ag Cu Au (Pb)	Silver
	55	Intertwined wire ring from necklace	Ag Cu Au (Pb)	Silver
	56(i)	Bead	Cu <u>Zn</u> <u>Pb</u> Sn	Leaded gunmetal
	57	Intertwined wire ring from necklace	Ag Cu Au (Pb)	Silver
	58	Intertwined wire ring from necklace	Ag Cu Au (Pb)	Silver
	63	Intertwined wire ring from necklace	Ag Cu Au (Pb)	Silver

Grave	No	Object Description	Elements Detected	Composition and Comments
139	1	Pin	Cu Zn Sn (Pb)	Gunmetal
140	1	Buckle	Cu Sn (Pb, Zn)	Bronze
	2	Plate	Cu Sn	Bronze
144	1	Buckle	Cu Sn (Pb)	Bronze
145(A)	7	Tack	Cu (Pb, Sn)	Copper
	8	Tag	Cu Sn (Pb)	Bronze
	9	Clip	Cu Sn (Pb)	Bronze
	10	Clip	Cu Sn (Pb)	Bronze
152	2	Buckle	Cu <u>Zn</u> Pb Zn	Brass
	3	Buckle - loop	Cu Sn (Pb, Zn)	Bronze
		- bar	Cu Sn (Pb)	Bronze
157	4	Intertwined wire ring	Ag <u>Cu</u> <u>Zn</u> Au Pb	Silver
	6	"	Ag Cu (Zn, Au, Pb)	Silver
	7	Ring	Ag Cu Au Pb (Zn)	Silver
	20	Shoe buckle	Cu Zn Sn (Pb)	Gunmetal
	21	Shoe buckle	Cu Zn Sn (Pb)	Gunmetal
	22	Shoe fitting - front	Cu (Sn, Pb)	Copper
		- other parts	Cu Sn (Pb)	Bronze
	23	Lace tag	Cu Zn <u>Pb</u> Sn	Leaded gunmetal
		Small fragment	Cu Pb Sn (Zn)	Bronze
	24	Shoe fitting - front plate	Cu Sn Pb	Bronze
		- back plate	Cu (Pb, Sn)	Copper
	25	Lace tag	Cu <u>Pb</u> Sn (Zn)	Leaded bronze
159	4	Buckle - loop	Cu Zn <u>Pb</u> <u>Sn</u>	Leaded bronze
		- bar	Cu Zn Sn (Pb)	Gunmetal
		- bar plate	Cu Zn Pb Sn	Gunmetal

Grave	No	Object Description	Elements Detected	Composition and Comments
159	4	- plate	Cu Zn Pb Sn	Gunmetal
		- plate, near rivet hole	Cu Zn <u>Pb</u> <u>Sn</u>	Gunmetal with lead-tin solder
162	1	Rivet	Cu (Pb, Sn)	Copper
	2	Rivet and plate	Cu Zn (Pb, Sn)	Brass
163	2	Lace tag	Cu Sn Pb (Zn)	Bronze
	6	Pin with small faceted head	Cu Sn Pb (Zn)	Bronze
164	1	Pin with perforated flat disk head	Cu Zn Pb <u>Sn</u>	Bronze
168	2	Buckle	Cu Zn (Pb, Sn)	Brass
174	1	Wire fragments	Cu Zn Pb Sn	probably tinned gunmetal
	2	Wire brooch	Cu Zn <u>Pb</u> <u>Sn</u>	Probably tinned gunmetal
	4	Intertwined wire loop with bead	Cu Zn	Brass
	5 and 20	Large ring	Ag Cu Zn	Silver
		Small ring	Cu Zn Pb Sn	Gunmetal, possibly tinned
	6	Pendant - front	Cu Au Hg Sn (Zn Pb)	Mercury gilded bronze
		- back	Cu Sn (Zn , Pb)	
	7	Pendant	Ag <u>Cu</u> (Zn, Au, Pb)	Silver
	13	Intertwined wire ring	Ag <u>Cu</u> Zn (Au, Pb)	Silver
	16	Ring	Cu Sn (Zn, Pb)	Bronze, possibly tinned

Grave	No	Object Description	Elements Detected	Composition and Comments
180	23	Hook	Cu Zn Sn Pb	Gunmetal
	24	Hinge fragment	Cu (Pb, Sn)	Copper
	25	Object	Cu Sn (Zn, Pb)	Bronze
	31	Sheet fragments	Cu Zn Pb Sn	Gunmetal
	1	Pendant (?) fragments	Cu Zn Pb Sn	Gunmetal
	2	Bead	Ag Au <u>Cu</u> Pb (Zn, Sn)	Silver
	3	Bead	Ag Cu Au Pb (Zn, Sn)	Silver
	4	Bead	Ag <u>Cu</u> Au Pb (Zn, Sn)	Silver
	5	Buckle and plate	Cu Zn Pb Sn	Gunmetal
	6	Bracelet	Cu Zn Pb Sn	Gunmetal
	8	Pricker	Cu Zn Pb Sn	Gunmetal
	9	Belt plate	Cu Zn Pb Sn	Gunmetal
	10	Object	Cu Zn <u>Pb</u> Sn	Leaded gunmetal
	181	23	Catch hook - catch	Cu (Zn, Pb, Sn)
		- pin	Cu (Pb, Sn)	Copper
		- plate	Cu Sn (Pb)	Bronze
2		Buckle - loop	Ag Cu Au (Zn, Pb, Hg)	Silver
	- plate	Ag Cu Au (Pb, Hg)	Silver	
182	1	Pin	Cu Sn (Pb, Zn)	Bronze
	2	Pin - shaft	Cu Zn Pb Sn	Gunmetal
		- ring through head	Cu Sn (Zn, Pb)	Bronze
	6	Intertwined wire ring	Ag Cu (Au, Pb, Zn)	Silver
187	5	Staples	Cu Sn (Pb)	Bronze
	8	Pendant	Ag Cu Zn Au Pb	Silver
192	1	Intertwined wire ring	Ag <u>Cu</u> Zn Au Pb	Silver
	4	"	Ag <u>Cu</u> (Zn, Au, Pb)	Silver

Grave	No	Object Description	Elements Detected	Composition and Comments	
198	6	"	Ag Cu (Au, Pb)	Silver	
	7	"	Ag Cu (Au, Pb)	Silver	
	4	Sheet	Cu Zn Pb Sn	Gunmetal	
	5	Rivet	Cu Zn <u>Pb</u> <u>Sn</u>	Probably tinned gunmetal	
	6-8	(Rivets (((Rivets	Cu Zn <u>Pb</u> <u>Sn</u>	Probably tinned gunmetal	
	10-11	Rivets	Cu (Pb)	Copper	
	12	(Shoe buckle (Cu Zn Pb Sn	Gunmetal	
		(Shoe buckle	Cu Zn Pb Sn	Gunmetal	
	13-16	(Sheet fragments & plate ((with rivets (Cu Sn (Pb)	Bronze	
		(Plate & rivets	Cu Zn Sn (Pb)	Gunmetal	
	200	6	(?Belt) Plate - front - back	Ag <u>Cu</u> Zn Au <u>Pb</u> <u>Sn</u> Cu Zn Pb Sn	Silver lead-tin soldered to leaded gunmetal plate
		7	Plate	Cu Sn (Pb)	Bronze
		5	Pin	Cu Sn (Pb)	Bronze
203	5	Square headed brooch - front - back	Ag <u>Cu</u> <u>Au</u> Hg (Pb) Ag <u>Cu</u> {Au Pb}	Mercury gilded silver	
	6	Square headed brooch - front - back	Ag <u>Cu</u> <u>Au</u> Hg Zn Ag Cu Zn Au Pb	Mercury gilded silver	
	7	Buckle	Cu Au Ag (Pb, Hg)	Mercury gilded copper	

Grave	No	Object Description	Elements Detected	Composition and Comments
	8	Stud	Cu Au Hg Pb Ag	Mercury gilded copper
	9	Stud	Cu Au Hg Pb Ag	Mercury gilded copper
	11	Girdle fastener	Cu Zn (Pb, Ag)	Brass
	14b	Strap tags	Cu Zn Sn (Pb)	Tinned gunmetal probably
	14c	Tweezers	Cu Zn (Pb, Sn)	Brass
	17	Girdle ornament	Cu <u>Au</u> <u>Hg</u> Sn (Pb, Ag Zn)	Mercury gilded bronze
	18	Rosette brooch	Ag Au Hg (Cu, Pb)	Mercury gilded silver
205	2	Brooch	Ag <u>Cu</u> <u>Au</u> Hg Zn Pb Sn	Mercury gilded silver
206	1	Buckle loop	Cu <u>Zn</u> Pb Sn	Brass
207	2	Buckle - plate	Cu <u>Zn</u> <u>Pb</u> Sn	Leaded gunmetal or leaded brass
		- loop & bar	Cu <u>Zn</u> Pb Sn	Leaded gunmetal
210	2	Intertwined wire bangle	Cu Zn Sn (Pb)	Gunmetal
211A	2a	Shield boss - stud	Cu Zn Sn (Pb)	Gunmetal
		- sheet	Cu <u>Zn</u>	Brass
213	7	Plate	Cu	Copper
	8	Plate	Cu (Pb)	Copper
215	1	Buckle	Cu Zn Sn (Pb)	Gunmetal