

Metallurgical Residues from Wilcote, Oxon.

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Introduction

The metallurgical residues submitted for examination include 62 pieces totalling only 1.5kg, giving an average fragment weight of 25g. This small total weight, taken together with the small average fragment size emphasises the derived nature of this assemblage. Despite the small quantities involved, the material includes samples from a wide range of metallurgical activities, involving the use of iron, copper alloys and lead.

Iron working

The dominant material is from iron-working. These blacksmithing slags include small fragments of plano-convex smithing hearth slag cakes, but no even moderately complete cakes were recorded. Much of the assemblage comprised small lumps and blebs of fayalitic slag, which were not part of cakes, but which are typical of much blacksmithing residue. Hearth lining fragments, also probably from iron working hearths were also recovered. One piece of lining from Site A (1332) proved to be iron-enriched on examination under the SEM, despite a colour which suggested a non-ferrous metal contamination. Almost all the iron working residues either contained charcoal fragments, or had a dimpled surface characteristic of slag/charcoal contact. There was no evidence for any use of coal for fuel. Although most of the fragments appear to have been in derived contexts, the slags from Site A (1172) have adhering soil which contains micro-residues of flake hammerscale.

Copper alloy working

Copper alloy working was represented by small slag fragments from sites A (1066) and possibly B (2019). The site B midden (2004) yielded a small lump of copper alloy (2004W), which appears to have solidified in the hearth, presumably as a result of spillage. A copper alloy bleb was also recorded from this deposit (2004U), but was not submitted with the metallurgical residues. A piece of the copper alloy lump was subject to examination on the SEM, and was found to be an alloy of approximate composition Cu 78%, Sn 12%, Zn 7%, Pb 3%, broadly corresponding to a gunmetal in modern terminology, and within the range of the Roman quaternary copper-based alloys. A small (5g) slag bleb from (1066) was highly phosphatic (10-27% P on superficial semi-quantative EDS analysis). Phosphatic slags of this type have been recorded elsewhere as crucible slags. The analyses of the bleb suggest involvement of metal oxides, with the metals in the average proportion Cu 43%, Sn 41%, Pb 16%; such a composition would be compatible with residues derived from fire refining of the gunmetal composition under oxidising conditions.

A single unstratified crucible sherd was recovered from site B. This sherd is interesting in being from a thin-walled wheel-thrown crucible with an external clay coat. The internal face of the crucible has a blue-grey colour, the outside is covered with a buff coloured slag. The outer slag has a small area of red colouration, suggestive of incorporation of copper oxides. The sherd is 3-5mm in thickness, with an outer slag of 6-8mm. Semi-quantative EDS analysis shows a composition for the inner face of the wheel thrown material as including approximately 56% SiO₂ and 32% Al₂O₃, whereas the outer slagged clay layer shows a more siliceous composition with 65% SiO₂ and 22% Al₂O₃. Both surfaces show around 8% P₂O₅ and a significant content of nickel (0.1-2%). This type of crucible is less commonly encountered than hand-made, thick walled crucibles. Examples have been recorded from (amongst others) Colchester (C1, Bayley 1984), Silchester (C4, Northover & Palk 2000), Caerwent (C4, author's unpublished observations), and Caerleon (C1-C2, Zienkiewicz 1993; late C3-C4, Evans & Metcalf 1992). Where usage of these crucibles has been determined, they have been for copper alloy work; this sherd, however, shows no internal metallic residues. The published occurrences of such crucibles in Britain are mainly associated with military or possible "official" urban sites; they are much less common in rural settlements, where the hand-made crucibles are almost ubiquitous.

Lead working

Lead alloy working is represented by a piece of a small plano-convex cake of impure lead from site G (7008). The cake appears to have originally been subcircular, approximately 10cm in diameter and 1.7cm thick. The surviving piece weighs 100g and represents approximately 30% of the original cake. A small piece of this cake was removed for EDS analysis. These spot analyses are difficult to interpret, being taken from on a chip from the periphery, and being at best only semi-quantitative, but they record copper ranging from 2-45%. This suggests the cake was produced during a metal reworking or recovery process, rather than being primary raw material.

Distribution

The residues showed little discernable pattern in their distribution. Phase 1 deposits in Site A produced evidence for both blacksmithing and copper-alloy working. Phase 2 yielded blacksmithing slags in sites A and F, but the midden in site B gave evidence for both blacksmithing and copper alloy work. A phase 2 ditch in site G yielded the cake of lead. The small amount of material suggests that the metallurgical activity was occurring at some distance from the excavated area.

References

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Northover, J.P. & Palk, N. 2000. Metallurgical Debris: catalogue and analysis. pp 395-420 in: Fulford M & Timby, J., *Late Iron Age and Roman Silchester : excavations on the site of the forum-basilica, 1977, 1980-86*. Society for the Promotion of Roman Studies.

context	SF label	weight pieces	id	Period	Group
Site A					
1022	10 slag	20	1 iron slag quarry pit 1021	1	5
1066	77 slag	5	1 Cu slag quarry pit 1065	1	5
1172	slag	80	2 iron slag quarry pit 1065	1	5
1064	slag	20	1 iron in slag pit 1063	2	12
1413	slag	180	3 iron slag posthole 1411	2	16
1332	slag	25	1 iron slag posthole 1331	2	18
1332	fired clay/vitrified	75	2 lining posthole 1331	2	18
1074	slag	260	9 iron slag pit 1073	2	23
1122	slag	90	2 iron slag track 1013	3	26
	total wt (av.)	755	(34)		
Site B					
2019	slag	5	2 slag ?Cu ditch 2018	2	31
2053	slag	55	1 iron slag ditch 2052	2	31
2065	slag	55	3 iron slag ditch 2064	2	31
2066	slag	115	3 iron slag ditch 2064	2	31
2011	slag	70	9 iron slag ditch 2010	2	32
2026	slag	70	4 iron slag ditch 2025	2	33
2017	slag	15	1 iron slag pit 2016	2	34
2022	vitrified fc	20	1 ditch 2020	2	34
2009	slag	10	1 iron slag pit 2008	2	34
2004	slag	30	2 iron slag layer	2	36
2004 G	slag	75	3 iron slag layer	2	36
2004 S	slag	10	1 iron slag layer	2	36
2004 W	slag	30	1 Cu layer	2	36
2032	slag/fe	65	2 iron slag ?		
u/s	crucible	5	1 crucible u/s		
	total wt (av.)	630	(18)		
Site F					
6006	slag	15	2 iron slag ditch 6005	2	28
6011	slag	70	2 iron slag ditch 6009	2	29
	total wt (av.)	85	(21)		
Site G					
7008	slag?	100	1 lead ditch 7006	2	38
	total wt (av.)	100	(100)		

Table 1: summary of the metallurgical residues, by context.

	lining (1332)			lead cake 7008							crucible u/s site B							copper 2004W							Cu slag 1066													
	A1	A2	A3	C1	C2	C3	C4	C5	C6	C7	D1	D1	D2	D3	D4	D5	D6	D7	D8	E1	E2	E3	E4	E5	E6	E7	E8	E9	H1	H2	H3	H4						
Na	5.7	5.5	4.3								3.9	1.8	6.4	3.8	4.1	4.0	5.7	5.4	4.5														2.6	2.7	1.6	2.4		
Mg	2.4	2.2	2.0								58.3	21.0	39.9	28.6	35.6	37.2	21.0	20.6	20.4	0.8	0.9	0.8	0.5	0.7	1.0	3.1	1.5					9.9	21.7	18.6	22.5			
Al	21.4	48.2	21.1	1.4	0.8	5.7	1.3	0.2	1.9	0.6	31.5	62.9	44.7	47.4	48.9	49.7	51.9	50.7	56.1	0.3	1.1	1.3	15.0	4.5	2.5	0.4	1.1	2.2				14.0	35.1	32.8	30.6			
Si	43.8	29.4	45.9	3.2	2.8	<	1.0	0.3	2.6	2.0	4.3	1.2	8.4	11.3	10.5	8.3	5.9	7.4	5.5													26.6	14.5	9.9	16.4			
P	5.4	5.4	3.0							0.4																												
Cl	0.1	4.1	<								4.3	<	<	<	<	<	<	0.5	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<		
K	5.3	1.5	5.9	10.8	9.2	<	1.5	<	8.1	6.0	<	4.5	<	<	0.3	0.4	1.4	1.9	2.0	<	0.1	0.1	70.0	6.2	0.2	0.3	0.2				0.9	2.2	2.6	1.9				
Ca	3.6	1.1	3.2								<	3.4	<	<	0.2	0.3	0.6	0.7	0.8												33.4	10.1	8.9	8.3				
Ti	1.1	0.3	1.2								<	0.5	<	<	<	<	<	<	<																			
Cr	0.1	<	<								<	<	<	<	<	<	<	<	<																			
Mn	0.1	<	<	0.5	<	<	<	<	<	0.2	<	<	<	<	<	<	<	<	<																			
Fe	10.9	1.1	13.5	2.1	<	<	<	<	<	0.4	<	4.8	<	<	<	<	<	<	<																			
Ni	<	1.2	<	<	<	<	<	<	<	<	2.0	<	0.5	4.5	0.3	0.1	0.2	0.3	0.3																			
Cu	<	<	<	3.9	19.8	44.8	4.2	1.5	22.5	13.7	<	<	<	<	<	<	<	<	<																			
Zn	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<																			
Sn	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<																			
Sb	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<																			
Pb	<	<	<	78.1	67.4	49.5	91.9	98.0	64.8	76.6	<	<	<	<	<	<	<	<	<																			

Table 2: summary of semi-quantitative elemental EDS analyses, normalised to 100wt%. < = below detection. blank = not determined.