Ancient Monuments Laboratory
Report 93/88

TECHNOLOGICAL FINDS FROM WALTON-LE-DALE, LANCASHIRE

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Summary

Excavations on this Roman site recovered around 50 kg of slag (mainly smithing slag), over 80 kg of fired clay and fragments of three crucibles, two of them used for working silver. In addition a large number of hearth structures were found, regularly laid out within a building of 2nd century date.

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Excavations recovered around 50 kg of slag, over 80 kg of fired clay and fragments of three crucibles. In addition a large number of hearth structures were found, regularly laid out within a building.

The table lists the material classified on site as slag. It includes small amounts of scrap iron and fired clay as well as quantities of smithing slag (including a few hearth bottoms), fuel ash slag and hearth lining (including two tuyeres). The post-Roman and modern contexts also produced other slaggy material of no archaeological significance as well as the only three fragments of tap slag. See glossary, below, and Bayley (1985) for details of the mode of formation of all these materials.

The types of slag represented in the Roman contexts are typical products of blacksmithing, making or mending iron objects from existing metal. This sort of activity is to be expected on any settlement site of reasonable size at this period. There is some slag at all periods and the only concentrations are in secondary contexts like the period 3-4 abandonment/agricultural horizon and period 5 post hole construction pits. This distribution could be interpreted as indicating a continuous low level of activity though the majority of the slag must have formed by the end of the 2nd century and could be as early as phase 1. There is no evidence for iron smelting in the Roman period.

Like the slag, the fired clay was widely distributed across the site with no very large concentrations. Nothing about its form or appearance could suggest a specific origin though some of it may well have been part of the superstructures of the regularly laid out hearths found in the buildings. These features are something of an enigma as they were clearly not associated with metal working or any other high temperature process as they show no signs of vitrification but they clearly indicate some large scale, well organised activity which is probably best described as industrial even though its exact nature is not known.

The crucibles

One crucible (SF 480) was sufficiently complete that its form could be identified. It was a shallow hemisphere with a single pinched-out lip about 5-6 cm in diameter and 2 cm high. It was hand made of a vegetable-tempered fabric with occasional fairly large mineral grains. X-ray fluorescence (XRF) analysis of the metal deposits on it suggest it was used for melting or refining silver. A somewhat larger crucible of similar form from Doncaster was used for melting silver and is probably roughly contemporary (Bayley 1986).

The second crucible is represented by a single fragment (SF 535) but was probably of similar shape to SF 480. XRF analysis detected high levels of lead together with traces of silver and copper, again suggesting silver refining. The final sherd (SF 632) was from a somewhat deeper small handmade crucible that had been used to melt a copper alloy of some sort. All the crucibles appear to have been heated from above rather than below and as their fabrics were not very refractory they all showed some signs of bloating, especially round the rim.

Glossary of terms used:

Smithing slag is produced in a blacksmith's hearth. Sometimes the slag collects together in the hearth into plano-convex 'buns', known as hearth bottoms.
Fuel ash slag can form in any hot enough fire where the ash from the fuel being burnt reacts with clay or other silicate-rich materials. It need not be associated with metalworking or other industrial processes though it often is.
Hearth lining is a specific type of fuel ash slag; it forms where the clay lining to a hearth has become vitrified (slagged) from contact with a fire at high temperatures. If the hearth had a bellows to provide a forced draught for the fire then the opening where the air entered the fire often survives and is known as a tuyere. It typically had a diameter in the range 1-3 cm.
Clinker is here used to describe a slaggy material produced when burning coal.
Smelting slags vary in form and composition depending on the sort of smelting process used. Tap slag has a similar composition to smithing slag but a far less vesicular texture as it was run from a smelting furnace as a liquid. It is a product of Roman or medieval iron smelting. Blast furnace slag is also a smelting slag but the technology that produced it is a post-medieval one.

References

Bayley, J (1985) What's what in ancient technology: an introduction to high temperature processes. In: P Phillips (ed) The archaeologist and the laboratory. CBA Res Rep 58.

Bayley, J (1986) A crucible from St Sepulchre Gate (Site DEH), Doncaster. In: P C Buckland and J R Magilton The Archaeology of Doncaster, 1. BAR 148.

Table: slag identifications

Context	Weight (Kg)	slag types Tap	Smithing	Fuel ash	Hearth lining	Others
Period 1						
151	.20		+			
195	.03		?			
249	.01		+			
481	.01			+		
504	.01			+		
807	.06		+			
984	.11		+			
1009	.09				+	
1030	.04		+			
1118	.63		+		+	
1137	.13		+			
1152	.18		+			
1182	.01			+		
1304	.11		+		+	
Period 1 or 2						
988	.30		+			
1014	.28		+			
1038	.20		+			
5	.24				+	iron
Period 2						
153	.03		+			
192	.03			+		
259	.03		+			
515	.01					baked clay
577	.07					iron
(SF 603)					+	
636	.01			+		
817	.05				?	
825	.01			+		
840	.05		+			
903	.04			+	+	
950	.39		+			
957	.08		+			
959	.18		+			
990	.78		+	+	+	
1013	.03				+	
1026	.47		+	+	+	
1051	.01			+		
1061	.03		+			
1133	.30		+			
1218	.11		+			
(SF 602)						fired clay
1243	.04			+		
1244(SF 614)					+	
1249	.07		+			
1251	.09				+	
1278	.13		+			
1329	.20		+			

Context	Weight (Kg)	slag types: Tap	Smithing	Fuel ash	Hearth lining	Others
Period 2 (cont)						
1334	.22		+			stone
1335	.35		+			
(SF 604)					+	
1345	.41		+			
(SF 610)					+	
1639	.39					iron
(SF 535)						crucible
Period 2 and/or 3						
194	.01			+		
198	.01			+		
214	.03					baked clay
282	.02			+		
308	.02				+	
311	.01		+			
849	.03		+			
994	.17		+			
1055	.93		+			
1057	.02			+		
1073	.01			+		
1299	.01			+		
1355	.13		+	+		iron
1469(SF 486)						crucible
1493	.03		+			
Period 3						
67	.32		+			iron
68	.01					charcoal
98	.02			+		
141	.03			+		
167	.02		+			
181	.03				+	
185	.04					iron
191	.10		+			
193	1.25		+		+	
243	.08			+		
271	.05				+	
272	.10		+			
377	.01			+		
533(SF 603)						fired clay
671	.01		+			
1072	.03			+		
1326	.05		+			
Period 3 or later						
330	.06				?	
435	.01			+		
Period 3-4 and 3-5						
160	.13			+		clinker
252	.03			+		
342	5.61		+	+		
(SF 622)			+		+	tuyere
355	1.40		+		+	
(SF 632)						crucible

Context	Weight (Kg)	slag types: Tap	Smithing	Fuel ash	Hearth lining	Others
Period 3-4 and 3-5						
359	.15		+			
360	8.16		+	+	+	iron. tuyere
312	.06		+			
594	.03			+		
1216	.12		+			
(SF 615)				+		iron
1333	.03			+	+	
1220	.53		+			iron
Post Period 3						
83	.02				+	
270	.03					iron
365	.09			+		iron
501	.34		+			iron
Period 4						
917	.02					overfired clay
1027	.02		+			
1029	.68		+	+		
1510	.11		+			
Period 4-5						
1301	.18		+			
(SF 606)					+	
(SF 607)						fired clay. iron
168	.12		+	+		clinker
Period 5						
97	.04			+		
143	.01			+		
262	.01			+		
289	.10		+			
351	.18		+	+		
352	.01			+		
353	.07		+			
358	2.40		+	+		
485	.01			+		
871	.01					clinker
882	.45		+			
922	1.16		+	+	+	
949	.80		+			
1002	.24		+		+	
1033	.08		+			
1034	.07		+		+	
1100	.56		+	+		
1122	.04			+		
(SF 605)						overfired clay
1336	.03		+			
1353	.01		+			
Period 5-6						
41	.28		+	+	+	
43	2.65		+	+	+	iron. molten glass
(SF 613)					+	
114	.30		+	+		

Context	Weight (Kg)	slag types: Tap	Smithing	Fuel ash	Hearth lining	Others
Period 5-6 (cont)						
115	1.45		+		+	
116	.11			+		
135	.02			+		
442	.03				+	
Period 6						
62	.14		+			
63	.06		+			
72	.23		+			
874	.01			+		
933	.02		+			
1381	.66					iron
Period 6 or later						
31	1.07		+			
65	.08		+		+	iron
Post Roman						
2	1.37		+	+		green glassy slag
16	.02					iron
22	.02	+				iron. molten glass
24	.01		+			
35	.62		+			iron. blast furnace
39	.01		?			
49	.29		+		+	clinker
Modern						
1	5.05	+	+	+		iron. molten glass
6	2.38		+	+		
12	.08			+		
13	.09			+		
32	.11					iron
33	.47		?			or ? modern clinker
36	1.50		+			
37	.57		+			iron.clinker. blast furnace
40	.06		+			
42	.01					iron
50	.06			+		modern refractory
59	.04					? unfired clay
61	.03		+			
76	.04		+			
100	.11		+			
111	.31		+			
137	.19		+			
182	.01					clinker
250	.01					? bitumen
343	.03		+			
827	.03	+				
855	.02		+			
1853	.07		+			
0(SF 612)					+	
1805	.03		+			