Ancient Monuments Laboratory Report 50/89

IDENTIFICATION OF THE SLAG FROM SPONG HILL, NORFOLK.

Justine Bayley

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Summary

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A total of about 13 kg of slag was found, of which some 6 kg came from features that could be dated. There is evidence for iron smelting using a tapping furnace in late Roman times (only the second Norfolk site with definite Roman tap slag) and for iron smithing in early Saxon times.

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IDENTIFICATION OF THE SLAG FROM SPONG HILL, NORFOLK

All the slag found in excavations at Spong Hill was examined and identified as belonging to one of a number of types of material which are defined below. The individual identifications are given in the catalogue which is appended to this report. The total weight of the slag was about 13 kg which is not a large amount, considering the total area excavated.

On excavation each piece or collection of slag was given a Finds No which had associated with it either a Context or a Grid Square No. Those with only Grid Square numbers are essentially unstratified as they come from the topsoil clearance, but they can be located at least approximately which gives an idea of the spatial distribution across the site. Not all the contexts were datable so only a proportion of the stratified slag is dated. Those pieces that are dated are listed in Tables 1 and 2.

<u>Slag types</u>

The types of slag identified were smelting slag (mainly tap slag), smithing slag, iron-rich fuel ash slag, fuel ash slag and hearth lining. All are or can be associated with iron working. Bayley (1985) provides fuller details of their appearance and mode of formation than those given below.

When metallic iron is extracted from iron ores, the by-product is **smelting slag**. Often this slag is run out of the furnace while molten (tapped) which gives it a distinctive appearance. When the iron bloom, which is the product of smelting, is compacted and when the blacksmith works iron into objects further slag, known as **smithing slag** is produced. This is chemically similar to smelting slag but has a distinctive spongey texture.

Fires at high temperatures such as those used to smelt or smith iron can also produce other types of slag. The surfaces of hearths or furnaces in contact with the fire are often vitrified as ash from the fuel reacts with the clay of which the structure is made. This hearth lining shows a gradation from ordinary fired clay furthest from the fire to a fully vitreous surface. Discrete pieces of clay or stone can react with ash in a similar way to produce fuel ash slag. Where this happens in a blacksmith's hearth the slag often picks up iron compounds and is intermediate in composition between fuel ash slag and smithing slag, a material described here as iron-rich fuel ash slag. It should be noted that while fuel ash slag and hearth lining are often associated with metal working, they need not be as they can be produced in any sufficiently hot fire. Table 1 - Slag from Roman contexts

Finds No	Context No	Weight (gm)	Smelt	Smith	FeFAS	FAS	HL	Date
2173	2223	75		+				1
1448	1747	25	?					2 - 3
1558	2488	100		?				2 - 3
1576	2493	75		+				M – L3
1907	1732	275		+				L3 - M4
1748	434	1250	+					L3 - L4
1763	2750	50		+				L3 - L4
1767	2769	+	+					L3 - L4
1779	2804	1050	+					L3 - L4
1848	817	150	+					L3 - L4
462	1364	25	+					L3 - L4
428	1201	+				+		Roman
429	1201	+			+			Roman
705	2229	+		+				Roman
708	2229	+		+				Roman
709	2229	+	+					Roman
717	2229	+		+				Roman
722	2234	125	4					Roman
723	2234	+		+				Roman
730	2232	25	+					Roman
755	2233	50	+					Roman
762	2234	50	+					Roman
1031	2287	25		+				Roman
1775	2802	75	+					Roman
1847	1201	+			+			Roman
2172	2285	+					+	Roman
3000	148	125					?	Roman
761	2271	150	+					??Roman

Key to Tables 1 and 2

The headings denote SMELTing slag (mainly tap slag), SMITHing slag, iron-rich (Fe) and ordinary Fuel Ash Slag and Hearth Lining. "+" indicates the presence of that type of slag except when it appears in the weight column where it denotes less than 25 gm. Question marks denote uncertainty in the identification.

Finds No	Context No	Weight (gm)	Sme1t	Smith	FeFAS	FAS	HL	Date
1312	2506) 2507) 2533)	25	+					Urnpit
1463	23337	Ŧ		Ŧ				Urnnit
1761	2499	т 	- 1 -	т				Urnnit
10/3	2568	25	т 4					Urnnit
432	1229	2.J +	т			+		E Saxon
1140	2338	+		+		r		E Saxon
1149	2338	25		+				E Saxon
1170	2338	4		r			+	E Saxon
1454	588	, +		÷			r	E Saxon
1750	128	700	+	4	+	+	÷	E Saxon
1751	128	400		+				E Saxon
1752	128	150		+				E Saxon
2097	3457	200	+					E Saxon
2113	3611	+		+				E Saxon
2123	3626	+		+				E Saxon
2133	3631	+		+				E Saxon
2134	3631	50		?				E Saxon
2155	3670	+		+				E Saxon
2156	3638	+				+		E Saxon
2157	3482	250		+				E Saxon
2159	3482	130					+	E Saxon
2160	3482	120		+				E Saxon

Discussion

The total weight of slag found was about 13 kg, just over half of this being smelting slag. Of the rest, the majority was smithing slag with well under one kg of other types of slag. This balance suggests that both smelting and smithing were carried out near the area of the excavations as quantities as large as several kilos of slag are unlikely to travel far by accident. However, there is no definite evidence or iron working on site and, if smelting had been carried out in the excavated area, it is likely that hundreds of kilograms of smelting slag would have been found.

If only the slag from Roman contexts is considered rather more detailed conclusions can be drawn. Again both smelting and smithing slags are present in significant amounts but the balance is rather different; there is roughly five times as much smelting as smithing slag. This suggests iron smelting as the major type of Roman metal working, though there is no definite smelting slag in contexts that predate the late third century. The two largest concentrations of smelting slag (Find Nos 1748 and 1779) are from the large enclosure ditch and most of the other slag from the

ditch is also smelting slag. The only other concentration of smelting slag is in the far south east corner of the excavated area (Find Nos 722, 723, 730, 755 and 762). At any period it is normal for the bulk of the slag found to come from pits and ditches where it was dumped, unless it had been specifically re-used, eg to surface a roadway.

This find of smelting slag in a secure Roman context is a welcome addition to the record as only one other Norfolk site, Ashwicken, has produced positively identified smelting slag of definite Roman date (Tylecote and Owles 1960). This is not to say that smelting was rare in Norfolk, but most of the sites that have produced smelting slags are early medieval in date.

It is tempting to see the slag from the Saxon contexts as being all residual Roman material but its spatial distribution and the proportions, four times more smithing slag than smelting slag, suggest otherwise. The small quantity of smelting slag is identical to that from the Roman contexts and is probably residual as tap slag is not normally associated with early Saxon smelting; all furnaces known to date from this period are of a non-tapping variety. The majority of the Saxon slag comes from a cluster of large pits in the north west corner of the excavated area and relatively little is from the cemetery area. It would appear that some small-scale smithing was being carried out close to but probably no within the excavated area at this time.

In summary it can be said that there is evidence for both Roman and Saxon metal working. Iron was being smelted in a tapping furnace in late Roman times while in early Saxon times there was some iron smithing activity. It is unlikely that either process was actually being carried out within the excavated area.

References

- Bayley, J (1985) What's what in ancient technology: an introduction to high-temperature processes. In: P Phillips (ed) <u>The archaeologist and the laboratory</u>. CBA Res Rep 58, 41-4.
- Tylecote, R F and Owles, E (1960) A second-century iron smelting site at Ashwicken, Norfolk. <u>Norfolk Archaeology</u>, **32**(3), 142-62.

Spong Hill Slag Catalogue

Finds	Context	t Grid	Weight	Smelt	Smith	FeFAS	FAS	HL	Date
No	No	square	(gm)						
1.6			1.0.0						
40		207	100	+					
305		307	+		+			9	
309		330	+				+		
370		330	+				+		
381		319	+				+		
408		331	+			+			
409		319	+			+			
410		331	+		+				
414		307	25		+				2
428	1201		+				+		Roman
429	1201		+			+			Roman
432	1229		+				+		E Saxon
462	1364		25	+					L3 - L4
556	1961		+		+				
569		1026	+	+			+		
570		342	?				+		
571		319	+				+		
572		331	+			+			
574		330	?				+		
576		343	+				+		
580		318	+	?			+		
581	1192		?				+		
584		331	?				+		
594		318	+		+				
596		318	?				+		
598		318	+	?					
599		318	+				+		
601		318	+				+		
602		318	?				+		
603		318	?				+		
606	531		2.5		+				
608	501	325	+		+				
612	306	515	?					+	
617	000	342	• ?				+		
618		342	?				+		
610		330	50		æ		1		
621		617	1875		T				
622		6/1	1075		+				
023		041	100		+				

Finds No	Contex No	t Grid square	Weight (gm)	Smelt	Smith	FeFAS	FAS	HL	Date
624		330	+				+		
627		343	+				+		
629		294	75		+				
630		286	+				+		
631		340	+		+				
632		330	+		+				
634		607	+		+				
635		329	+			+			
636		many	+				+		
637		3115	25	?					
640		1013	+				+		
642		622	+				+		
646		631	25		+				
652		275	25		+				
667		609	75	+					
694		2012	125	+					
705	2229		+		+				Roman
708	2229		+		+				Roman
709	2229		+	+					Roman
717	2229		+		+				Roman
722	2234		125	+					Roman
723	2234		+		+				Roman
730	2232		25	+					Roman
755	2233		50	+					Roman
761	2271		150	+					??Roman
762	2234		50	+					Roman
771		2021	+		+				
792		2026	25	+					
797		2035	100	?					
821		2024	+		+				
824		2031	25		+				
825		2031	+		+				
830		2034	75	+					
831		2024	+	+					
834		2024	150	?					
838		2021	100			+			
840		2032	+	?					
842		2025	25	+ 0	r +				
844		2032	350		+				
851		2032	+		+				
862		2029	25	+					

Finds	Context	: Grid	Weight	Smelt	Smith	FeFAS	FAS	HL	Date
No	No	square	(gm)						
905		2033	+				+		
969		2021	+				+		
977	2312		+	+					
1024		2021	200		+				
1031	2287		25		+				Roman
1140	2338		+		+				E Saxon
1144	2319		+	+					
1149	2338		25		+				E Saxon
1167	2331		25		+				
1170	2338		+					÷	E Saxon
1179		2037	+		?				
1180		2023	+				+		
1197		2049	50	+					
1202		2049	300	+ o:	r +				
1217		2048	?					+	
1246		2039	+					+	
1309		2039	?				+		
1312	2506)		25	+					Urnpit
	2507)								
	2533)								
1318		2039	+		+				
1327		2042	125		+				
1330		2042	+				+		
1336		2041	+				+		
1340	2376		+		+				
1342		2045	+				+		
1352		2040	25	+					
1353		2040	+	+					
1373		2039	75		+				
1427		2041	+		?				
1429		2011	÷		÷				
1448	1747		25	?					2 - 3
1454	588		+		+				E Saxon
1463	2499		+		÷				Urnpit
1482		2059	75		?				
1484		2083	+	+					
1499		2068	50	+					
1513		2059	+				+		
1546		2056	100	+					
1558	2488		100		?				2 - 3
1576	2493		75		+				M - L3

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Finds	Context	Grid	Weight	Smelt	Smith	FeFAS	FAS	HL	Date
Νo	No	square	(gm)						
1620		2066	100	?					
1626		2061	+		+				
1643		2059	÷	+					
1688		2059	75	+					
1726		2053	÷		÷				
1741	2480		+	+					Urnpit
1748	434		1250	+					L3 - L4
1750	128		700	+	+	+	+	+	E Saxon
1751	128		400		+				E Saxon
1752	128		150		+				E Saxon
1763	2750		50		+				L3 - L4
1767	2769		+	+					L3 - L4
1775	2802		75	+					Roman
1779	2804		1050	+					L3 - L4
1808		2163	100		?				
1830	1895		50			+			
1832	2572		25		?				
1847	1201		+			Ŧ			Roman
1848	817		150	+					L3 - L4
1900	1188		÷		+		+		
1903	1186		÷		+				
1907	1732		275		÷				L3 - M4
1943	2568		25	+					Urnpit
1983		f/wk	÷	+ 0	r +				
1984	2267	f/wk	150	+					
1985	2243	f/wk	+			+			
1986	2432	f/wk	375	+					
1987		2050	200		+				
1988		2108	+	+					
1989		2244	+	+ o	r +				
1990		f/wk	50	?	+				
1991			÷				+		
1992		f/wk	800	+					
1993	2428	f/wk	400	+	?				
1994			25	+ 0	r +				
1995	2246	f/wk	÷				+		
1996			50				+		
1997		f/wk	25				+		
1998			+				+		
1999		f/wk	300	+	?	+			
2001		280	+				+		

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No	No	square	(gm)					
2002	2		+		+			
2017	/ 1200		+	?				
2019)	many	+	+				
2097	7 3457		200	+				E Saxon
2113	3611		+		+			E Saxon
2123	3626		+		+			E Saxon
2133	3631		+		+			E Saxon
2134	3631		50		?			E Saxon
2155	5 3670		+		+			E Saxon
2156	5 3638		+			+		E Saxon
2157	7 3482		250		+			E Saxon
2159	3482		130				+	E Saxon
2160) 3482		120		+			E Saxon
2172	2285		÷				÷	Roman
2173	3 2223		75		÷			Roman 1
3000) 148		125				?	Roman
3018	3 1189		+				+	
3019	9 1195		+				+	

HL Date

Finds Context Grid Weight Smelt Smith FeFAS FAS

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g.-