UNCORRECTED ARCHIVE REPORT

APPENDIX 14 – SLAG

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Introduction

A total of 14 samples were examined. The total weight of the samples was about 1150gs., though only four samples weighed more than 100gs. The heaviest sample, B56 (from 203/m/3), weighed 436gs., which contributed 38 percent of the total mass of the collection. This was also the only sample that showed no signs of fracture. The samples could be divided into a number of classes on the basis of their external morphology and density. The groups were as follows:

Results

The results are summarised in Table A14:1.

Table A14:1: Classification of samples of slag examined

Type	*Weight (gms)*	*Sampled?*	*Context No*	*Period*	*C. Salter Ref*
1) Natural	10	no	200+203/J	MIA	BS4.2
2) Slagged clay	20	no	263/A/1	MIA	BS4.3
	5	no	340/A/1	?RB	BS4.1
3) Low density slags	23	yes	203/J/l	MIA	BS4.4
	7	yes	131/A/2	LIA	BS2
	35	no	505/B/1	MIA	BS5.2
	44	yes	506/A/l	MIA	BS1
4) Metal working slags	46	no	200, 203, 203/8/M	MIA	BS7.3
	134	no	203/M/1	MIA	BS7.2
	434	yes	203/M/3	MIA	BS6
	27	yes	200/M/3	MIA	BS3
	72	yes	539/A/1	MIA	BS5.1
	152	no	661/A/1	?RB	BS7.1
	142	no	50/C/1	?RB	BS7.4

Natural

This sample was a coarse-grained iron cemented sandstone, with quartz sand particles with diameters between 2 and 4 mm.

Slagged clay

This group of samples all showed a .clear but gradual transition between highly baked clay and a glaze type slag. This type of product is most often produced by the slagging of the lining of metal working furnaces and hearths.

Low density and glassy slags

These slags were vesicular and mostly of light colours (pale greens or yellows), with a glassy fracture. However, BS2 was much darker, but this was probably due to its slightly higher iron content (analysis BS2 as compared with BS1). The analysis showed high concentrations of silica and or calcium. This indicates that they are a different class of material from the smelting slags of the Roman Period described by Morton and Wing [ref (1)]. Plotting their compositions on the CaO.SiO?e 2CaO.Al203.SiO2-FeO phase diagram, the melting points of these materials would be from 1100o to 1300oC. The other elements present would probably reduce this to temperatures around 1000oC. This is the sort of temperature that would be found at the lining of metal working furnaces if the furnaces were used for melting copper, smelting iron or welding iron.

Metal Working Slags

The Microstructure of all the slags of this group that were sampled was more or less typical iron working slags, containing well-defined crystalline phases. Analysis BS5b is more or less "fayalite" (fe,S1O) representing the normal major phase. The analyses DS5c and ?3SSd were rich in calcium and aluminium, which represents the minor phase. The other phase present was an oxide of iron (almost certainly wustite, FeO). The amounts of this phase present varied considerably, from virtually zero to 100 percent.

Samples BS6 and BS7.4 were virtually complete, the former containing charcoal marks. This sample also had a rusty colour on one side. These features are very similar to those found in Roman Smithing slags from Winterton, Lincolnshire, where the furnace bottoms weighed between 350 and 700gs each. The average weight of the Winterton furnace bottoms was 4l0gs which is very similar to weight of the heaviest piece of slag recorded at this site.

Conclusions and Discussion

There are two basic groups of products in this set of samples, those slags produced by the slagging of the furnace lining and a second group of slags directly produced as a result of the smithing operations, ie the metal working slags.

The presence of fairly low quantities of slagged clay and low density and glassy slags suggest the existence of metal working furnaces or hearths operating on a modest scale.

The metal working slags probably form due to the reaction between the silica flux and surface iron oxides during welding. Very similar slags are formed during smelting, which makes it very difficult to distinguish the two types of slag. However, smelting operations tend to produce rather more slag and the furnace structures are very much heavier. In this case all the evidence points towards the hypothesis that the metal working slags found were the result of smithing operations: the amount of slag found was small; the individual pieces of slag were small; and the chemical compositions were right. Thus, this material probably represents a few welding operations that might be involved in the repair or manufacture of a small number of artefacts.

The vast majority of the material (73% by weight) is of middle Iron Age date, and the few pieces that are not come from later contexts with significant amounts of redeposited (or potentially redeposited) middle Iron Age pottery. It is therefore at least possible that all the evidence of metal working on the site is actually of middle Iron Age date.

There is also a notable degree of concentration of the material in particular areas of the site. In the main northern area of excavation the slag was concentrated around the main west-facing penanular enclosure (Ditches 200 and 203, sections J and M) with small items up to ?50m away (F263, and the later features F131, F50). In the southern area the slag was concentrated in the vicinity of another penanular enclosure (Gully 539 being one of its terminals with Ditches 505 and 506 immediately adjacent and the later Waterhole 661 cutting them).