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Evaluation of Archaeometallurgical residues from Alvington, Glos. (RCA08)

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Abstract

The submitted assemblage comprised 5.93kg of slag and associated materials. The material was a hand-picked sample of residues, so no comment can be made on abundance. The identifiable material is dominated by specimens produced during bloomery iron smelting. Some of the material was indeterminate and over half the material was encased in ferricrete, but no specimens were certainly attributable to iron working (smithing).

The smelting slags contain examples of tapped slags, mostly in fairly thin flows, and also material in much thicker bodies with flow textures on the top. It is unclear from these specimens whether they too represent tapped slags, or whether they represent material which solidified in the furnace arch area. The presence of fired clay adhering to one of these specimens certainly hints that these may have been internal slags. Two specimens of these dense, massive slags contain quite large pieces (c40mm and c75mm) of almost unreacted ore. Such pieces of ore would normally be considered too large to form part of the furnace charge.

The ferricrete adhering to many of the specimens is rich in quartz sand and poor in fine slag or fuel debris. The submitted assemblage comprises mainly angular, small rather equant lumps of dense slag. These factors taken together suggest that the material was not present in primary dumps, but in secondary locations, perhaps having been used as hard core or surfacing aggregate. None of the specimens entirely coated in ferricrete showed significant magnetism, suggesting the ferricrete encloses slag rather than iron, except in the case of one possible nail.

Preservation of the pieces is variable, with many showing alteration. The widespread ferricrete indicates considerable iron mobility in the deposits.

Contents

Methods

All investigated materials were examined visually, using a low-powered binocular microscope where necessary. All significant materials were summarily described and recorded to a database (Table 1). As an evaluation, the materials were not subjected to any high-magnification optical inspection, nor to any other form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

Results

The catalogue of archaeometallurgical residues is presented in table 1.

The materials are dominantly residues from bloomery iron smelting. The certain smelting slags large fall into two categories:

1.tapped slag (738g): slag which has been allowed to flow from the furnace. The slag shows characteristic flow-lobed textures. The examples in this assemblage are in flows of up to 40mm in thickness. One example

shows a planar, non-wetted base, suggestive of flow across a stone slab or similar substrate.

2. massive slags with flow-textured surface (1039g): these slags do not show (in hand specimen) evidence for an internal flow-lobed structure, but do show a flow-lobed top. The slags may represent thick tapped flows (in cases where a thick accumulation of tap slag is formed quickly the internal expression of the flow lobes may be subtle) or might be slags that have formed internal to the furnace, either within the furnace itself, or within the tapping arch. The presence of fired clay adhering to the side of one of the present examples would give support to an interpretation of cooling within the furnace arch. It is interesting that two examples of such slags from (2004) contain large pieces of iron ore that appear to have fallen through the furnace without significant reaction. The ore fragments have the steely-red colour of haematite, but are deeply cracked and fragmented, suggesting contraction during dehydration of an originally goethite ore. The ore fragments show small patches of a residual primary small-scale botryoidal texture, typical of much of the Forest of Dean ore. The size of the ore pieces is unusually large, with the furnace feed usually being less than 25mm.

These two classes together comprise almost 70% by weight of the visible slag; the other 847g are slags which are not closely identifiable. Some of this material is in the form of slag crusts. These specimens could be from either iron smelting or smithing, for in both processes molten slag accumulating on the floor of the hearth/furnace may show a similar morphology. One specimen has a "u"-shaped profile and might be part of a slag runner (from between the furnace and the accumulation of tapped slag), but the piece is not well-reserved and the identification is tentative. Other pieces are indeterminate from being too small for identification, or too covered in ferricrete.

Over half (3.3kg) of the material is formed by five large pieces of ferricrete entirely enclosing a core (presumably of slag rather than iron since the specimens are non-magnetic) which is entirely concealed. One small specimen of ferricrete appears to have been formed around a small elongate piece of iron, probably a nail.

Interpretation

The collection of residues is indicative of a secondary assemblage of iron smelting waste. There is a complete lack of the charcoal-rich low density internal furnace slags which normally form a significant proportion of smelting assemblages. The predominance of dense materials may be a results of sampling or preservational bias, but might also be indicative of slag selection for surfacing or use as "hard-core".

Many of the slags show only moderately good preservation, and the widespread development of ferricrete shows a high degree of iron leaching, mobility and reprecipitation. The extremely hard deposit (2003) may have been layer (not necessarily a depositional unit) which became entirely cemented through these processes. The ferricrete examined (not from (2003)) contained very little fine grained ferruginous detritus or fuel debris. Frequently, hard ferricrete deposits may be the results of iron mobility in fines (iron particles, hammerscale, small slag pieces and fuel waste) from smithing, but there is no indication that was the case here. The ferricretes appear to have developed in sandy deposits bearing smelting slags, presumably as a result of acidic porewaters.

The slag assemblage is small, but appears typical of Roman bloomery residues from the area. The key characteristics of this assemblage would be the relatively thin tap-slag flows and the rather thick, possibly internal, flows bearing fragments of iron ore. Similar features have been observed on other sites within the Bristol Channel Orefield. In particular the broadly contemporary nearby site at Woolaston (Fulford & Allen 1993) shows an occurrence of similar dense "within-furnace" slags forming a large proportion of the assemblage.

Evaluation of potential

The redeposited nature of the slag means that detailed analysis of the slag would be unlikely to generate information of significant potential to assist with the understanding of the site.

Chemical analysis of the slag and particularly of the ore fragments would probably be able to confirm whether the ores smelted were of a local, Dean, origin. However, the texture of the ore entrained in the thick flows is certainly compatible with a Dean origin and, given the location of the site, an origin for the ore outside Dean is extremely unlikely.

References

Fulford, M.G. & Allen, J.R.L. 1993. Iron making at the Chesters villa, Woolaston, Gloucestershire: survey and excavation 1987-1991. *Britannia*, **23**, 159-215.

Context	weight (g)	number	description
1004	342		ferricrete largely concealing angular fractured slag lump
	68		fragment of thin tapslag flow
	47		fragment of thin tapslag flow
2004	1506		rounded lump of ferricrete completely encasing core material - must be very dense slag, non-magnetic
(bag 1)	686		angular block of extremely dense slag, has a smooth, if curved, surface suggestive of a flow and possible impressions of flow lobes on other side - if so suggests a c80mm flow. Contains a moderately large 40mm piece of part-reacted ore
	28		small fragment from a thin tapslag flow
	18		angular chip of dense slag
2004	373		very dense massive slag similar to 686g piece above, has large ore lump (>75mm) also has fired clay attached to one face,
(bag 2)	524		ferricrete on dense concealed slag
	164		tap slag in >40mm thick flow
	182		tap slag in >40mm thick flow
	108		tap slag in >20mm thick flow
	139		ferricrete on curved crust fragment with possible tubular vesicles
	90		tapslag in c 20m thick flow resting on planar base - tapped onto stone?
	15		ferricrete on iron - nail?
	32		angular freshly broken weathered grey massive slag
	257	2	ferricrete on elongate vesicular slag with a rounded base - possibly a low-density runner, small separate piece broken from one end
	83		probably a crust fragment - but of uncertain origin
	47		fragment of vesicular slag similar to the possible runner above
	45		tap slag fragment
	13		probably burnt weathered chert?
	6		tap lag fragment
	47	12	small indeterminate slag fragments
2006	70		curved sheet of dark vesicular slag. Convex surface has fuel dimples and is very dark and shiny. Concave side is smooth with maroon bloom - similar to the top of some smithing cakes
	21		indeterminate grey vesicular slag fragment
	102		iron slag nub with concreted sand. Upper surface has some smooth areas visible - but unclear if this is flown surface on a smelting slag or upper face of a smithing slag.
2012	608		rounded dense ferricrete lump - presumably contains slag not iron since non-magnetic
2014	31		small angular fragment of dense dark slag
2024	277		ferricrete on angular fragment of very dense slag with very few vesicles, small area of flow surface on one end so probably tap slag or from furnace arch, but dense and thick

Table 1. Summary catalogue

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