Evaluation of slags from Hartshill Copse, Upper Bucklebury, Berks.

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Abstract

The assemblage includes both micro- and macroscopic metallurgical residues. The total quantity of residue is very small, suggesting that the excavated area was probably not the focus of the metallurgical operations which were occurring in the vicinity.

The microscopic residues are dominated by amorphous, vesicular materials. It is likely that the majority of these materials are not of metallurgical origin. The distribution of these materials on the site is largely dependent on the location of suitably sampled contexts.

Amongst the microscopic material are also more certain metallurgical residues: some thirty one environmental samples yielded spherical hammerscale, and four samples contained flake hammerscale. Three contexts yielding flake hammerscale and fifteen of the contexts yielding spherical hammerscale were in the area of the structure interpreted as roundhouse D, including spheroidal hammerscale from the hearth. Some care must be taken in assuming that roundhouse D was used for metalworking because the actual amount of material involved is very small, the incorporation of micro-residues into postholes does not necessarily indicate use of that structure and also because the features containing the residues appears to suggest a rectangular, rather than circular area. Lesser amounts of slag were recovered from features associated with roundhouses B and C, none with roundhouse A.

The macroscopic slags include several large pieces which are best interpreted as slags from iron smelting within a non-slag tapping furnace. These smelting slags were mainly (apart from one in an R-B pit) found within the area enclosed by ditch G. A few slag pieces were probably from blacksmithing, and one large piece might either be from bloomsmithing or smelting.

It must be concluded that iron making and iron working were undertaken on the site, although the main smelting operation may have been outside the excavated area. Roundhouses B, C and D all yielded micro-residues from smithing and those contexts must therefore be of Iron Age rather than Bronze Age date.

Although the assemblage is very small, this find is particularly important given the early date and the location of the site. It is recommended that follow-up analytical studies are undertaken to attmept to provenance the ore employed.

Contents

Description

Micro-residues

The micro-residues have been examined within the constraints of time available and provisional identification made of all particles.

The dominant type of particle present is of dark, vitreous, vesicular, non-magnetic material. This material cannot be identified precisely by optical methods. It is likely indeed, that this class covers various types of material. It may include some slag-like materials, particularly the dark glass that may be derived from the melting of the lining of a furnace or hearth at

temperatures in excess of about 1000C. Most of the material is probably highly coked organic matter, particularly wood charcoal, but a small proportion of the material may be derived from mineral coal. Some of this material might also include a small proportion of burnt bone.

Some non-magnetic slag-like materials are more certainly identified, and these are dominated by glassy materials, mainly of a pale colour, but there are also some darker crystalline non-magnetic slag particles which may be small fragments of iron-smelting slags. There are rare examples of large non-magnetic slag spheroids, and these are likely to be slag droplets from the base of an iron smelting furnace.

Magnetic particles included some which appear to be heated rock (and which may, in part, be tiny fragments of iron ore), magnetic slag particles (derived from smithing slags), spheroidal hammerscale (produced during fire welding) and flake hammerscale (produced during smithing).

Particles in the residues which are not associated with slags or metallurgical residues include fragments of iron-rich sandstone, charcoal and coal.

Macro-residues

Only a small amount of macroscopic slag was recovered, so this will be described by context:

(5). The larger piece appears to be corrosion around a piece of iron, rather than slag. The smaller piece of slag is small nub of vesicular, dense slag, but is too small to be certain whether this piece of iron slag is derived from smelting or smithing.

(20). This is a slightly unusual slag piece. It has a distinctly purple surface patina, and contains inclusions of what appears to be shale. The slag has been fairly fluid, but the piece is rather amorphous. The piece has superficial lichen growths, suggesting it has been lying in a surface environment for some time. The piece cannot be attributed to any particular process, but the shale fragments suggest that the process was coal/coke fired, and the piece looks likely to be industrial/modern despite the recorded context.

(323). Two broken slag pieces: first with flow lobes of dense in right angle between two original contact surfaces. Some slight lineation on the contact surfaces creates strong impression that these are charcoal/wood contacts, so that this is a piece of slag within a hearth rather than a runner. Such a form could be interpreted as forming close to the blowing wall, below the hotzone of a non-tapping iron smelting furnace. The other piece is a rusty slag, probably, but not certainly, from iron smelting. A bag of small material from the same context is dominated by fired wall material, but also including some dense flow lobes of fayalitic slag. Material labelled from the equivalent context 422 <23> comprises a small bag with fired clay, prills and blebs as well as more corroded material The entire assemblage is likely to have been derived from iron smelting.

(325). A highly irregular crudely plano-convex slag cake. The lower part includes a lobe of flowed slag, but the upper part is dominated by melted wall material, with abundant gravelly inclusions and vitrified upper surface. A small plano-convex cake of this type is likely to be from blacksmithing.

(407) <48>. Dense slag, locally with rusty surface. Includes small area of wall contact and interaction, suggesting orientation of the piece is approximately 100m along the wall, extending 55mm into furnace and up to 50mm thick. Upper (?) surface is irregularly broken; lower surface comprises impressions of large charcoal fragments. Charcoal ranges up to at least 40 x 40x 30mm. The most likely interpretation of this piece is that it derives from close to the blowing wall of a non-tapping iron smelting furnace. The open texture of the dense slag, with large charcoal voids and areas of wall attachment would be typical features of material from Irish sites recently examined by the author (particularly that at Tullyallen 6, unpublished).

(588). Two small pieces of grey slag with large charcoal impressions. One of the pieces has some original lobate surface. These are almost certainly slags from within an iron smelting furnace.

(821). A complexly lobed mass, probably from just in front of the burr area in a non-tapping iron smelting furnace. One side of the specimen shows slag with a coarsely equant texture, a common feature of the burr area (the zone of interaction between the iron-rich furnace contents and the wall immediately beneath the blow hole). The slag has flown around very large wood or charcoal pieces, ranging up to at least 80mm long.

(1030). The larger slag piece is a small smithing cake with very fine charcoal impressions, the smaller slag piece is melted furnace/hearth wall. 25 g of the sample comprises corroded iron pieces, including nails.

(1076). This is a large piece (90 x 80 x 55mm thick) of plano-convex slag cake. The piece is extremely dense, and has little internal vesicularity. The upper surface is marked by rather rusty impressions of small charcoal pieces. The upper part of the cake has a dense slag layer some 30mm thick, with an equant granular, crystalline texture distally, with a more radial, lath texture proximally, where the cake shows adhering altered lining. This burr region is marked by the development of flow lobes in the lower part of the cake. Suggesting a high mobility of slag close to the furnace wall. The lower surface shows flow lobes proximally, becoming replaced by charcoal impressions distally. This is a difficult slag piece to identify, with no certain indicators of origin. It shows some features which would be unusual an a plano-convex bloomsmithing cake, particularly the lack of a smooth upper surface and the presence of flow lobes, so an origin within a non-slag tapping smelting furnace appears likely, but is by no means certain.

(1395). Stone. Piece of natural ferruginous conglomerate.

Distribution

The distribution of the metallurgical residues is shown in figure 1.

Microscopic residues from metallurgical activity were present in the area of roundhouses D and C. The fines were dominated by magnetic materials including spheroidal hammerscale (roundhouse D including 17 of the 32 contexts yielding spheroids; C including a further 5 samples), but with rather little flake hammerscale (although the samples from roundhouse D included 3 of the 4 samples yielding this material). Whether this is a failure of collection or a genuine feature remains to be determined. The residues do not necessarily indicate that the iron working was taking place with these structures, but the circumstantial evidence suggests it was. Both houses have large hearth-like features on their northern sides; in house D this hearth contained some residue (spheroidal hammerscale) and in house C pit 201 in a similar location also yielded spheroidal hammerscale. However, derivation of the micro-residues through being residual on the ground prior to house construction, intrusive during post decay, or simply carried into the house on people's clothing or footwear might also account for the distribution. It may be significant that there are no accumulations of macroscopic slags adjacent to these houses, which would be extremely likely if either, or both, had functioned as a smithy.

Microscopic residues from the area of Roundhouse B were typically less diagnostic, but included spheroidal hammerscale from two post holes (406 and 408). One of which (406) also yielded some macroscopic iron smelting slag. Both post holes also yielded a small piece of what may be mineral coal – a material more commonly encountered in southern England in Roman contexts than earlier.

Spheroidal hammerscale also was retrieved from within pit 1262 – a component of prehistoric pit group R, from within ditch 745 (a component of enclosure ditch G). Ditch G also yielded two collections of macroscopic slag (contexts 5 and 1076).

A particularly important collection of both micro- and macro-residues was retrieved from posthole 322 (contexts 422 and 323) within the enclosure. This material included a large block of iron smelting slag, a second probably from iron smelting, together with a large collection of small debris including prills, flows, lining fragments and rusty slags.

A smaller collection of material derived from pit 1030 (to the north of Roundhouse D) includes an example of a blacksmithing slag and a furnace/hearth wall fragment, occurring in association with some small iron artefacts including nails.

This wide distribution of material across the prehistoric site therefore encompasses three of the four roundhouses, the enclosure ditch and isolated pits and postholes both inside and outside the enclosure. Therefore all these components were receiving fills and sediments after the Bronze Age. A single context (820, fill of pit 821) dated by artefacts as Romano-British, yielded a piece of iron smelting slag. This piece is extremely similar to the material from post hole 322, and is likely to be residual.

The material from the south-western corner of the site poses some slight problems. The slag from context 20 (pit 19) is undiagnostic to hand-specimen inspection, but is similar to industrial period forge slags. The adjacent pit (27) yielded a spot sample (#2) with a considerable quantity of coke-like residue which might be true mineral coal coke. The age of these might need to be reconsidered.

Discussion

The volume of metallurgical residue from the site is very small, but indicates that both iron smelting and iron working took place somewhere on the site. However, determination of the scale of that activity must await the discovery of its focus. The amount of iron smelting slag recovered represents the equivalent of perhaps one tenth of one smelt!

The iron smelting appears to be reasonably closely tied to the prehistoric structures recognised, with microscopic residues occurring widely in their postholes and macroscopic slags occurring within pits and holes within the enclosure and within the fill of its ditch (G). The small number of slag pieces do not permit much comment on the technology and scale of operation, but do point to the use of non-slag tapping furnaces. Such furnaces are widely presumed to have been in use in the early Iron Age, but direct evidence for them has not generally been forthcoming in southern England. Identification of the ore involved in the smelting operation would be very important. The best known iron-smelting site in the area is the Saxon site at Ramsbury (Haslam, 1980), some 27km further up the Kennet Valley, but still within a broadly similar geological setting.

Until recently it had been assumed that most of the iron being employed in early Iron Age Wessex was sourced from outside the region, but a number of smelting sites within the area have started to be recognised.

The technology of iron smelting appears to be very close to that on several unpublished sites in Ireland for which the author has undertaken review of the metallurgical residues.

Recommendations

Extensive further analysis of this rather small assemblage would probably not be justifiable, but in view of the scarcity of earlier Iron Age smelting operations in lowland Britain, full chemical analysis of the macroscopic smelting slags would, at least, be desirable. These studies would be aimed at producing data to assist in provenancing the iron ore employed, and possibly to provide some information on the efficiency of the smelting operation.

Reference

Haslam, J. 1980. A Middle Saxon Iron smelting site at Ramsbury, Wiltshire. *Medieval Archaeology*, **24**, 1-68, pls 1-3.

Figure Caption

Figure 1. Geographical distribution of metallurgical residues from Hartshill Copse. The upper diagram shows the residues and unproductive samples, the lower shows the data superimposed on a site basemap.

Microresidues are divided by class; the dark, vitreous, vesicular, non-magnetic material is excluded from the metallurgical residues (although a proportion of this material might derive from metallurgical hearths).