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Evaluation of possible archaeometallurgical resides from Malmesbury, Wiltshire

Dr Tim Young
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Dr T.P. Young

Abstract

Submitted samples included a variety of materials. None of the materials was indicative of in-situ metallurgical activity.

The most significant collection was from c1038, which comprised over 4 kg of "fuel ash slag", mainly in large blocks. The origin of such material is rather uncertain, but this material was probably produced through low temperature slag formation in a hearth cut into the calcareous subsoil. The combination of wood ash and calcareous substrate allowed fluxing of the debris within the hearth to produce partial melting. The larger blocks of this material show a lower rough surface and an upper surface with wood/charcoal impressions, supporting the suggestion of an origin within a hearth and this argues against an origin as fired daub, which is a possible alternative explanation of such material.

As well as a small as a small quantity of strongly fired and vitrified clay of uncertain, though possibly metallurgical origin, the site has yielded two small scraps of iron smelting slags of uncertain pre-industrial age.

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

"Fuel ash slags" (C1038)

Description

This material comprises approximately 31 pieces weighing 4.3kg of an extremely low density, vesicular, slag-like residue of frothy appearance. The overall form of the original slag mass is not known. Several pieces show a curved lower(?) contact, suggesting an origin within a bowl-shaped feature (although the curvature might conceivably have result from deformation of the slag if removed from its orginating feature when hot and soft). Some pieces show a crude internal stratification with aligned vesicles (and moulds of charcoal?).

Approximately one third of the material shows a smooth surface, bearing moulds of large charcoal or wood pieces. The thickest blocks indicate an original maximum thickness of at least 150mm.

Associated with the slag-like material are several pieces of apparently baked stone.

Interpretation

Materials such as this is commonly (although probably frequently erroneously) described as being fuel ash slag. A fuel ash slag is one in which the slag is dominated by material derived from the inorganic component of the fuel.

Chemical analysis of similar material from other sites has suggested that the dominant elemental input may actually be from material closely related to the local substrate. Analyses may indicate a high content of elements such as potassium and calcium which have acted as a flux to permit melting, fusion and sometimes flow of the precursor material at relatively low temperatures (possibly well below 1000C). These elements may be contributed by wood ash, but are also locally major components of soils.

The intensely vesicular nature of the material is suggestive of significant gas release from the precursor material, rather than just the inclusion of burning fuel particles. The volatiles most likely to be involved are water (from a wet precursor or more likely from structural water within the minerals) and carbon dioxide (from breakdown of carbonate minerals such as calcite). Included with the specimens is an adhering matrix of strongly calcareous clay soil and limestone weathering debris; this is exactly the sort of material the heating of which might have generated these residues.

Archaeological significance

There are two strong possibilities for the explanation of materials such as this. One possibility is that the material originated through combustion of a wattle-and-daub structure. In particular, one in which the daub contained a high proportion of organic material (e.g. dung) might have a sufficiently intimate mixture of organics and clay to promote the fluxing of the ceramic at a low temperature.

A second possibility, which is attractive given the morphology of the fragments in the present collection, is that the slags originated within a hearth. There are circumstances in which the moderate temperatures in a large hearth can cause slagging of the hearth margins, particularly where the margins are highly calcareous, and therefore capable of generating a melt at a low temperature.

The bowl shape apparently indicated by some of the slag might also support an origin in a hearth cut into the calcareous soil/subsoil.

The so-called fuel ash slags have been rather neglected in the past and there are extremely few published analytical investigations of them. Although the present material is rather unusual in detail, particularly in the extreme size of the pores in some of the specimens, there are parallels, probably the closest is the residue developed in large hearths during the Iron Age on Mound 1 at Bornais (Young *in prep.*). Here large hearths were cut into the highly calcareous sands of the machair. The calcareous sand reacted with the iron-rich peat fuel to allow the development of slabby vesicular slags on the floors of these hearths. The later Norse occupation on the same site produced evidence for smaller scale, slag formation, involving a similar chemical process, in both domestic hearths and corn driers (Young 2005). In the large Iron Age hearths, the "avalanching" of sand from the walls mixing with the peat fuel to produce a vesicular slag which has a texture of remanent sand grains in a partially melted matrix. The slag has a dominant sintered texture on the base (in contact with in-situ sand below) and a smooth upper surface with indications of contact with the fuel. These features are very similar to that of the Malmesbury material, allowing for the differences in fuel and in the likely grain size/mineralogy of the underlying sediment.

An example from closer to Malmesbury, also on calcareous geology, are the fuel ash slags from Hucclecote (Young & Bowstead Stallybrass 2003), which were argued to be probably non-metallurgical. In the case of Bornais the originating hearth also has no metallurgical association, but may have been a large communal hearth, possibly kept alight for long periods.

A similar origin for the Malmesbury material seems quite possible, although the details may differ. The material may have originated in a large domestic hearth, or possibly in a kiln, but a metallurgical origin for the material seems unlikely. Although some similar material elsewhere has been interpreted as fired daub, the sense of “way-up” (rough lower? face, smooth upper? face with wood impressions) strongly suggests an origin within a hearth for this assemblage.

Iron smelting slags (C2005 and C2020)

The collection includes two small fragments from C2005 and C2020 (20g and 72g respectively) of dense lobes of slag that have been tapped from a bloomery iron smelting furnace. The use of slag-tapping furnaces may have started in this region in the middle Iron Age and they continued in use until the Middle Ages; the current pieces are not indicative of age. There are no iron resources close to Malmesbury, so any smelting would have been of ores imported from outside the area, possibly from southern Wiltshire, but more likely from the Forest of Dean or possibly the Bristol area.

Fired clay (C2002, C2023 and C2027)

The submitted material includes 7 pieces of vitrified and reddened clay from C2023 together with 2 pieces of fired and vitrified red ceramic from C2027. These pieces are intensely oxidised fired, show vitrification and show the development of vesicles. They might be fragments derived from metallurgical hearths, but are not specifically identifiable.

A piece of fired clay from C2002 is of a lower density and contains small clasts of limestone. This material is not necessarily indicative of a very high temperature origin.

References

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54 Heol y Cadno,
Thornhill,
Cardiff,
CF14 9DY.

Mobile: 07802 413704
Fax: 08700 547366
E-Mail: Tim.Young@GeoArch.co.uk
Web: www.GeoArch.co.uk