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Evaluation of metallurgical residue from the Peboc Site, Llangefni (G2207)

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Abstract

This site produced a single item of probable archaeometallurgical residue. The piece has a crudely planar upper surface, one approximately vertical end and a lower convex face. The slag is a highly vesicular slag, similar to a fuel ash slag (FAS), with a high concentration of sand and some gravel-grade particles, all bound by a dark, almost black, glass.

Such slags are difficult to interpret because they were formed mainly of material derived from the hearth and had little input from the materials being processed. FAS can be formed where the combination of hearth ceramic and fuel ash permits the generation of partial melting at hearth temperatures. This can occur in some cases in situations such as domestic hearths and corn driers. This piece, however, has an overall form suggesting a concentration of the hotzone in the fire in a similar pattern to that in a metallurgical hearth or furnace, where the hotzone location is produced by a single directed air blast. The most likely interpretation of this piece, therefore, is that it represents residue from metalworking in which little metal entered the hearth, so that the slag remains dominated by input from the hearth substrate/ceramic. Such types of metalworking might include the casting of non-ferrous alloys by melting in crucibles, heating non-ferrous metals for working/annealing or ironworking that did not involve welding.

In summary a metallurgical origin is likely, but the precise process cannot be determined.

Contents

Abstract 1

Methods 1

Results 1

Interpretation 2

Evaluation of potential..... 2

References 2

Methods

The materials was examined visually, with a low-powered binocular microscope where required. As an evaluation, the material was not subjected to any high-magnification optical inspection, nor to any form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

This project was undertaken for Richard Cook of the Gwynedd Archaeological Trust.

Results

The material (unstratified find <038>) constitutes a single block of low density, porous slag, of a type commonly referred to as fuel ash slag, although the fuel ash probably only contributes a minor component of the slag (albeit an important fluxing role).

The slag block is 115mm wide, 60mm high and 75mm deep and weighs 224g. The upper surface is triangular in plan, broadly horizontal and formed of various wispy lobes of rather viscous appearance. The surface is of a lilac-grey glass, with streaks of darker pink. The reddish surface continues onto the vertical face, where it appears in areas to have been in contact with oxidised fired ceramic (presumably the hearth wall.

Other areas of the vertical (proximal?) face appear fractured and reveal coarse porosity within the cake.

The lower surface is evenly rounded, with suggestions of sub-horizontal layers of lobes of slag. This face is surfaced with a mid- to dark- grey glassy slag, which is a pale khaki on fracture. There are abundant inclusions of sand and granule grade. The larger inclusions mainly appear to be polycrystalline quartz.

Interpretation

The slag is clearly dominated by grains (mainly quartz) inherited from the substrate, bound by a dark glass resulting from partial melting to form an overall highly porous structure. Such slags are generally known as fuel ash slags (FAS). In fact they probably differ little in origin to the 'lining slags' of metallurgical hearths, but have a lower degree of contamination from the process in the hearth and have a typically porous, bloated, texture.

Various forms of FAS have been described recently. FAS in small particles (from sub-mm spheroids up to accumulations a few 10s of mm across) have been recorded from corn drying kilns (Young 2005, 2010). FAS in larger sheets is common on some Iron Age sites (e.g. Young 2011; Young & Bowstead Stallybrass 2003) and has earned the informal term 'Iron Age grey slag'. These larger sheets have been examined in detail for some Norse hearths at Bornais, S. Uist (Young in press) where it appears the hearths slagged rapidly from the calcareous sand into which they were dug.

In one of the above non-metallurgical occurrences of FAS, however, does the slag mass take on a plano-convex form, approaching that of a smithing hearth cake (SHC) as it does in this instance. The form of this cake suggests it was a discrete mass, attached to or adjacent to the hearth wall, just below the zone of incoming air, where the localised hot zone promoted the formation of a plano-convex slag cake. Rather than the non-directional form of the FAS from domestic hearths, this example seems to indicate presence of a blast, as in a metallurgical hearth.

Two factors might promote the generation of a FAS mass in the form of an SHC:

1. the hearth might have been formed of reactive, wet and/or unstable material which would readily fall into the hearth and react

2. the metalworking process did not involve any significant amount of metal actually entering the hearth (and thereby being able to react with the developing slag).

Factor (1) might be appropriate to a metalworking hearth or furnace of many different kinds, but perhaps particularly to temporary hearths, or hearths simply cut into the ground; factor (2) would be most appropriate for situations when non-ferrous metal melting was undertaken in a crucible (although even then spills are common), a non-ferrous process in which the hearth was employed at fairly low temperature for heating/annealing or when ferrous materials were worked at fairly low temperature (thereby reducing the rate of iron oxidation and hence loss to the hearth).

In summary, the precise origin of the piece is uncertain. Although broadly a fuel ash slag (and hence not necessarily metallurgical), the form of the slag cake suggests it formed against the wall of a hearth with a single air supply (as in most metallurgical hearths/furnaces). The lack of obvious contamination by any metal suggests that if from a metallurgical operation, the slag was either from a non-ferrous metal process in which the metal was contained in a crucible, or from a process with either a ferrous or non-ferrous material being heated to only a fairly low temperature (as in annealing copper alloy between episodes of working, or heating iron for a low-temperature activity involving some simple forming).

Evaluation of potential

The sample is of rather ambiguous origin and further detailed analysis would be unlikely to provide suitable additional information to clarify that. Such pieces are sometimes interpretable through understanding of their context, but unfortunately this piece was unstratified.

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