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Assessment of possible archaeometallurgical residues from Dolbenmaen, G2293

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Abstract

The assemblage includes a very small proportion of fragments of indeterminate iron slag.

The more significant material is a fuel ash slag, very similar to slags from cereal kilns, as well as to poorly-known slags from other long-burning hearths. Detailed analysis of the fuel ash slags is not recommended at present, but may be informative if the likely originating feature (cereal kiln or other hearth) is identified.

The submitted material also included a particles of indeterminate burnt organic matter, as well as a variety of natural geological materials.

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Methods

All materials were examined visually with a low-powered binocular microscope where required. As an evaluation, the materials were not subjected to any high-magnification optical inspection, not to any form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

The examined materials are listed in Table 1.

This project was commissioned by Dave McNicol of the Gwynedd Archaeological Trust.

Results

Iron slag
Small fragments of dense grey slag were recovered from (1599) and (1609). Even the larger piece (from (1609)) weighed just 6g, so they were not identifiable in detail, although the textures would certainly be compatible with identification as smithing slags. Such materials might be from Iron Age to modern in date.

Fuel ash slag
Three contexts, (1603), (1607) and (1680) yielded assemblages of fuel ash slags. These materials comprised residues in the form of blebs and sheet fragments of up to 15mm thickness, formed of highly altered lithic clasts and grains in a dominantly glassy matrix. These slags are the result of partial melting of a substrate under the influence of alkali- and alkali earth-rich fuel ash.

The assemblage from (1667) weighed just 5g (18pieces), with larger collections from (1680) and (1603). That from (1680) comprised mainly rather spiky fragments and hollow blebs, showing inclusions of variously foliated and bloated grains, along with the dominant sand clasts. The collection from (1603) typically had a more glass-rich composition (indicating a higher degree of melting) and had more evidence for fluid flow. This collection also included fragments with an adhering red sandy ceramic, possibly from a hearth wall or floor.

Burnt organic matter
Fragments of burnt and/or coked organic matter occurred in contexts (1513), (1599), (1609), (1667) and (1669), as well as a minor component of the fuel ash slag-bearing assemblages ((1603), (1607) and (1680)). The original nature of the organic material was not determinable.

Natural materials
Fragments of a natural conglomerate, formed of small quartzose pebbles and granules, were abundant, occurring in contexts (1540), (1609), (1651), (1659), (1663) and (1667). Other fragments of rock occurred in (1511), (1517) and (1601), together with a piece of ferruginous crust in (1667) and an iron mottle in (1599).

Interpretation

The fragments of iron slag were not diagnostic of either process or age – except that they must be Iron Age or younger.

The fuel ash slags resemble those described from cereal kilns (Young 2005, 2010a, 2010b, 2015) in possessing a fine-grained or thin-sheet morphology and in the variety of detailed textures.

Examples associated with cereal kilns are mostly *ex situ*, in small fragments closely resembling the present material. A recent early medieval example from Llandeilo (Young 2015) was, however, *in situ*, and was a friable sheet, approximately 300mm by 400mm and up to 25mm thick, with a total original weight of 1755g. Chemical evidence was employed to suggest that the burning of grain contributed much to the formation of this slag mass. Emptying of the firebox of kiln by raking might typically dislodge any slag formed and fragment the slag into the small pieces more usually observed.

Somewhat similar fuel ash slags are common in Iron Age contexts, apparently generated in long-lived domestic hearths (Young 2011, 2012), with similar material having previously been labelled 'Iron Age grey slag' (Cowgill 2000, 2008; Cowgill *et al.* 2001; Swiss & McDonnell 2001). These materials usually differ from the present material in being fragments from much thicker (20-80mm thick) sheets.

In theory, at least, such fuel ash slags might be generated in a wide variety of mainly non-metallurgical contexts, but the firing of cereal kilns with straw and the accidental consumption of cereal grains, appears to produce a chemical environment that particularly favours the development of fuel ash slags.

Conclusion

The materials are not particularly diagnostic of processes or dates. The fuel ash slags are strongly suggestive of the nearby presence of cereal kilns, although other interpretations are possible.

No further analytical investigations are recommended for the present material at present, which should, however, be retained with the site archive. Should the field archaeology reveal the likely source of these residues, then their characterisation might have further value.

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Table 1: summary catalogue. FAS = fuel ash slag, BOM = burnt organic matter.

Context	Sample	No.	Item wt.	Notes
1511	3	1	<1	probable weathered rock
1513	4		7	2 tiny fragments of BOM, 1 large piece of probable natural concretion
1517	5	2	<1	probable weathered sulphide clast in conglomerate and small fragment of possible BOM
1540	11		8	fragments of natural conglomerate
1599	21	4	4	3g iron slag bleb, 1g iron mottle, 1 tiny iron slag bleb, 1 piece of coked BOM
1601	24	3	1	1 fragment of weathered stone, piece possible slag, 1 iron mottle
1603	17		26	coarser, darker fragments of more fluid FAS than that from 1680. Many rock inclusions, including slightly bloated red shale. Some pieces show well-formed grey glass. Fragments of sheet up to 15mm. Some pieces show red sandy adhering ceramic - very like furnace lining surface, but may be just hearth base.
1609	27		8	6g iron slag bleb, 6 small BOM pieces, 1 piece conglomerate and 1 pebble
1611	28	1	<1	conglomerate - but has smooth fissured texture so just possibly burnt
1651	35	2	<1	conglomerate
1659	44	2	4	two pieces of cemented gravel, probably naturally cemented material
1663	53	1	1	natural conglomerate
1667	55		7	5g (18 pieces) of conglomerate, 18 pieces of FAS, 2 pieces BOM, 1 piece ferruginous crust
1669	56	6	<1	BOM
1680	62		25	Assemblage of small fragments of FAS. Slag varies from thin spikey sheets to hollow blebs, white to dark grey and rarely maroon, Some larger fragments show inclusions of foliated and bloated grains, also sand and coarser grains. Sparse fragments of granular organic matter.

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