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Assessment of materials from Meillionydd

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Abstract

The investigated materials comprised a total of 27 pieces weighing approximately 540g. Of this, 15 pieces (45.9g) were of coal, in one case slightly burnt. A further 11 pieces (462.8g) were of other geological materials, including volcaniclastic sandstones of probable local origin and haematite-bearing rocks also likely to be of local origin although a more distant origin is possible.

Of these natural materials, one piece (56g) was a pebble formed of a fine-grained siliceous volcaniclastic sedimentary rock centred on a partially-exhumed pale-weathering concretion. This concretion showed both a slight concentric structure and radial shrinkage cracks. Although, entirely natural, the piece has a very striking appearance.

A single fragment of partially-melted sandy ceramic (context (1028), find <493>; 28.7g) is the sole indicator of metallurgical activity. The piece shows coarse quartz inclusions in a bloated matrix forming an irregular concavo-convex fragment, 12-6mm in thickness. The external surface is slightly dimpled, with a dark green glaze preferentially preserved in the hollows. A small area shows a brick red glaze suggestive of contamination by copper, a contamination also detected by analysis. The internal concave surface is irregular, reddened, and overlain by a cream-buff coloured poorly preserved residue with elongate crystalline inclusions – probably cassiterite grains. Analysis indicates a strong contamination by copper and tin. The piece is suggestive of being part of an unusual crucible that had been heated from below.

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Methods

All materials were examined visually, using a low-powered binocular microscope where required. The catalogue of submitted material is presented in Table 1.

The pXRF analyses were undertaken with a Bruker Tracer IIISD portable X-Ray fluorescence spectrometer (instrument belonging to the Department of Archaeology, Cardiff University, and the National Museum Wales). The instrument was operated both with and without the Bruker 'yellow' filter (300µm Al + 25µm Ti), at 40kV and 9.60 µA, with a filament current of 189 µA, for 100s. The instrument was controlled by a PC running Bruker's S1PXRF software. Data were exported as text files for further imaging and processing in Bruker's Artax software. Data are presented here (Table 2) as the net peak area for the principal peaks as reported by Artax.

This assessment was conducted in December 2022 and was commissioned by Kate Waddington.

Results

Igneous and volcaniclastic rocks

Two pieces of igneous rock were present, both slightly altered. A small fragment (3.4g; (803), <287>) was rather decomposed, fragmented and possibly burnt. A larger fragment (222g; (822), <335>) was fresher, but had adhering iron pan. Both were probably of relatively local origin.

This assemblage included a fragment of volcaniclastic sandstone (8.5g; (6337), <815>) that had been included with the prehistoric pottery from the site, but subsequently rejected as such. The piece showed large dark chloritic inclusions.

A rounded (discoidally lenticular) piece of rock (56g; (130, <141>) measuring 50mm x 47mm x 17mm, has a recessed circular area 16mm in diameter close to the centre of one face. The majority of the surface is very dark, but the fresh rock (seen in a fracture on the

periphery on one side and on laminae overlying the dark surface on the opposite face to the indent) appears to be a buff-coloured, fine grained siliceous rock- possibly a volcaniclastic mudstone. Within the recessed area, the rock is fine-grained, variably pale to dark grey, with both concentric and radial cracking. These textures are strongly suggestive of alteration of a concretion hosted within the tuffaceous sediment.

The colour of the concretion is suggestive of a calcium phosphate concretion, but this is not supported by analysis. Analysis of the piece by pXRF showed no significant metal contamination, although the recessed area showed both elevated iron and, to a lesser extent, copper. This most likely reflects the former presence of pyrite (iron sulphide) within the concretion.

Even if the piece is essentially natural, this does not exclude the piece having been curated and/or modified. The surface in the area around the central recess shows zones of strong abrasion striae. These could have formed in the depositional environment, or even after retrieval, but it is also possible that they indicate a degree of cleaning or reshaping of the piece, perhaps even with the intention of boring it to form a whorl.

Iron-rich rocks

Two pieces of iron-rich rocks were present.

The smaller piece (14.3g; tr4, (001), <399>) appears to show a gradation from an iron-rich lithology into a chert.

The larger piece (158g; MD13 spoilheap) shows botryoidal goethite/hematite that is locally highly fragmented (brecciated).

Both pieces are fragments of smoothed pebbles. Although both are likely to have had a relatively local origin (perhaps in the haematite-rich cherts of the Gwna Mélange to the N and the more iron-rich sections of the Benallt Mn-Fe deposit 800m to the SSE respectively), the local Irish Sea drift deposits also include ores of Cumbrian origin.

A tiny porous spheroid (0.55g; (98), <198>) formed of tabular dark crystals arranged around the porosity, is of uncertain origin. It is probably a weathered concretion associated with the manganese mineralisation but, in the absence of detailed analysis, an igneous origin cannot be excluded.

Coal

The assemblage included fifteen fragments of coal, mostly fresh, but one was probably slightly burned. There are no intrinsic features which allow an origin to be ascribed to the coal. Three possibilities might be likely for this material – as waste from agricultural steam-powered machinery, as domestic waste from a post-medieval house, and as a natural component of the 'Irish Sea' glacial till.

A natural origin for the coal may be favoured by the absence of clinker (the partially melted inorganic residue from the burning of coal), which is usually recovered where either domestic coal fires or steam boiler waste has been deposited. The presence of coal within many deposits probably of Phase 3b, as well as from topsoil, probably also favours a natural origin, rather than the widespread occurrence of intrusive particles.

Archaeometallurgical residue

The collection included a single piece of archaeometallurgical residue, a fragment of partially-melted sandy technical ceramic (context (1028), find <493>; 28.7g). The piece shows coarse quartz inclusions in a bloated matrix, forming an irregularly concavo-convex fragment, 12-6mm in thickness. The external surface is slightly dimpled, with a dark green glaze preferentially preserved in the hollows. A small area shows a brick red glaze suggestive of contamination by copper, a contamination also detected by analysis. The internal concave surface is irregular, reddened, and overlain by a cream-buff coloured poorly preserved residue with elongate crystalline inclusions (probably tin oxide grains). Analysis indicates a strong contamination by copper and tin.

Interpretation

The fragment of technical ceramic shows the effects of external heating and the internal containment of bronze. The simplest and most likely interpretation of this piece is that it is a sherd of crucible. The morphology is unlike the typical British Iron Age crucible, a rather thin walled, 'triangular' vessel, often rather open in profile and heated from above (e.g. Spratling 1979, Figure 99). The present material shows a very thick wall and is strongly vitrified for the full wall thickness and has a glazed exterior.

The general appearance of the external surface and the fabric strongly resembles the clay coats used during the brazing of iron objects (e.g. Young 2012 Illustration A3.7), but these do not usually retain contamination from the copper alloy on their interior surfaces.

Examples of Middle Iron Age egg-shaped crucibles (14C dated to the late 5th century BC) recently been described from The Netherlands (Huisman *et al.* 2020; with similar material quoted from Switzerland, France and Germany) that have a deeply vitrified external outer layer (referred to as a 'mantle' by these authors) are of rather similar character to the present material. The 'mantle' is similar to the 'extra outer layer' (EOL) as described from Roman crucibles by Bayley (1992) and subsequent workers. Both the egg-shaped crucibles from the European Iron Age and the Roman examples were heated from below.

The examples studied by Huisman *et al* (2020) were interpreted as having been used for the recycling of scrap copper alloy – and such a use would be compatible with the occurrence of sparse material on a site that otherwise did not yield evidence for archaeometallurgical activity.

Further work

No further investigation of the materials is recommended.

References

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Table 1. Catalogue of materials from Meillionydd submitted for investigation, grouped by context.

code	trench	context	sf	no	wt	notes	phase
MD13	Tr4	1	358	1	0.56	coal	topsoil
MD14	Tr4	1	399	1	14.33	rounded grain of haematite dominated rock, grades locally into a cherty material	topsoil
MD10	Tr3c	98	198	1	0.56	coal	3a
				1	0.55	unusual spheroid formed of black plates, defining considerable internal porosity, possibly coke, but probably a manganese concretion	
MD11	Tr3F	130	141	1	56	natural concretion in cherty fine sediment	3a
MD11	Tr1e ext	451		1	1.64	slightly burnt coal	topsoil
MD11	Tr1e ext	451		1	1.25	coal	topsoil
MD11	Tr1e ext	454		1	5.21	coal	topsoil
MD12	Tr1w ext	602		1	19.59	coal	?
MD12	Tr2w ext	803	287	4	3.37	decomposed (burnt?) igneous rock	3a
MD13	Tr2w ext	822	335	1	222	weathered igneous rock with some iron panning on surface.	3a
MD14	Tr4	1020	452	2	0.91	coal	3b?
MD14	Tr4	1020	459	1	1.86	coal	3b?
MD14	Tr4	1020	489	1	0.53	coal	3b?
MD14	Tr4	1020	499	1	1.10	coal	3b?
MD14	Tr5	1028	493	1	28.70	fragment of thick crucible or brazing shroud.	2
MD14	Tr4	1203	502	2	11.15	coal	3b
MD14	Tr4	1203	510	2	1.55	coal	3b
MD15	Tr6	6337	815	2	8.50	snapped fragment of volcaniclastic sandstone (?) with large chlorite crystals replacements	?
MD13		Spoil-heap	359	1	158	polished pebble (incomplete) of probable haematite ore. Internal structure is highly fragmented. Some ore grains appear strongly cleaved	u/s

Table 2: net peak area for selected peaks from pXRF analyses of the crucible sherd (from context (1028), <493>) and a concretion (context (130), <141>) from Meillionydd.

Element	Mn	Fe	Cu	Zn	Sn	Pb
Line	K12	K12	K12	K12	K12	L1
Energy/keV	5.9	6.405	8.046	8.637	25.271	10.551
crucible exterior	5776	125748	7988	635	2294	1363
crucible interior	1784	115451	23539	809	18922	2530
disc centre with filter	1890	584185	2974	1610	608	1508
disc centre (no filter)	13766	3219903	12606	4549	429	3794
disc rear (no filter)	6469	1608087	9631	4714	669	4025

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