GeoArch

Report 2010/38

Evaluation of archaeometallurgical from Porthclew Chapel, Freshwater East, Pembrokeshire (PCC08/09)

Dr Tim Young & Thérèse Kearns

20th December 2010

Evaluation of metallurgical residues from Porthclew Chapel, Freshwater East, Pembrokeshire (PCC08/09)

Dr T.P. Young & T. Kearns

Abstract

This small assemblage included 1.7kg of archaeometallurgical residues, most probably from black-smithing (the end-use working of iron. One fragment (unfortunately not stratified) suggests iron smelting. There was no evidence that the metalworking activities had necessarily taken place within the excavated areas.

Contents

Methods

All investigated materials were examined visually using a low-powered binocular microscope where necessary and were summarily described and recorded to a database (table 1). As an evaluation, the materials were not subjected to any form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

Results

Approximately 2kg of material were submitted for analysis. These comprised 1.73 kg of archaeometallurgical residues, together with a few pieces of iron-rich natural rocks and some corroded iron.

Smithing hearth cakes (SHCs)

Smithing hearth cakes (SHCs) were represented by one complete example (602g), three probable fragments (348g, 278g and 132g) and possibly by some of the indeterminate material

The complete, dense, plano-convex smithing hearth cake (602g) had small areas of corrosion on its upper surface suggestive of the inclusion of metallic iron particles.

The basic mode of formation of an SHC is broadly the same across a number of morphologies – when the work-piece is placed in the hearth, it will undergo some superficial oxidation, and occasionally more serious breakage, which results in iron metal and iron oxides being lost to the hearth. Here the iron oxides will be fluxed by molten ceramic material from the hot tip of the tuyère/hearth wall and possibly by deliberate additions of sand flux too, with the resulting iron silicate melt forming the slag. This origin means that SHCs typically have a bowl-like form and generally form blow and in-front of the tuyère or blow hole.

The size and density of the SHC will be controlled by the amount of iron lost, the temperature the hearth is being run at, the rate of loss of the tuyère, the period of working and the way in which the smith manipulates the hearth.

Two examples were found associated with building B, one (602g) from C8006 (vicinity of a blocked doorway), and the second (132g) from C8022 (pit within the confines of building B). Two probable examples came from pit fill c137.

Indeterminate iron slag

A further 19g of material was categorised as indeterminate slag. This category includes the pieces of slag that were too fragmented to identify, as well as pieces that are of non-diagnostic shapes and textures. It is very likely that much of this material is derived from smithing and may include non-diagnostic fragments of SHC.

Iron smelting slag

A single piece of slag from the topsoil of Trench 1 (c101) is almost certainly a slag from iron smelting. The piece shows coalesced prills of dense slag, apparently from horizontal flow. The pieces lack the red surface colour often associated with tapslag (because of superficial oxidation to haematite of the outer veneer of slag), and are uniformly dark. This might be because this is a flow which cooled in the limited oxygen in the throat of the furnace, or perhaps because it is a flow from within a non-slag tapping furnace.

Corroded iron

Approximately 100g of fragments of corroded iron were among the assemblage. Several pieces were recognisable as fragments from a rather substantial nail or nails (probably from a single fragmented artefact). One piece (55g) had a distinct and rather unusual 'bowl' like form and would probably be worth an X-Ray investigation.

All of the corroded iron was recovered from C8009, described as being located 'next to the hearth' and further as a '5cm thick deposit of dark organic sand, directly above the floor level and cut into the natural shale' (Schlee 2009) Unfortunately no further detail is given about the nature of the 'hearth' or the deposit. Other materials from this context are ferruginous concretions formed around an unknown core, but containing fragments of both charcoal debris and more fragile organic material (such as ferns).

Fired clay

A single fragment of fired clay (56g) was recovered from context C604. The fragment has no discernable form and cannot be attributed to any specific activity, metallurgical or otherwise. It might be a fragment from the wall of a metallurgical hearth, but might equally be from a non-metallurgical process (e.g. a corn drier) or have been produced accidently in a domestic hearth.

Interpretation

This small assemblage suggests that iron working was taking place somewhere in the vicinity of the site, however not necessarily within the limits of the excavation.

The examples of SHCs seen here are relatively small and are suggestive of blacksmithing rather than bloomsmithing (the refining of raw blooms), however the overall low density of residues makes it impossible to say for certain whether or not these examples are representative of the main activities undertaken. The complete example weighs 602g, towards the upper end of the range of sizes currently recorded for blacksmithing slags in earlier medieval Britain (for instance the maximum size in the 12th century assemblages from Willow Street and Mill Lane Worcester was 782g; Young 2009).

As well as the evidence for smithing, a single piece of slag from topsoil provides evidence that iron smelting might also have been undertaken in the area. The piece is ambiguous as to whether it indicates a slag tapping technology or not. Most post-9th century iron smelting furnaces in Britain were slag tapping, but earlier post-Roman furnaces in Britain, and almost all early furnaces in Ireland, were non-slag tapping furnaces.

Evaluation of potential

The present material has little potential for further analysis at this stage. Further investigation of smelting slags to identify the resources being exploited is usually desirable, but since the present example is unstratified, the benefits of doing so at present are very limited.

References

SCHLEE, D. 2009. *The Pembrokeshire Cemeteries Project - Excavations at Porthclew Chapel 2009*, Interim Report.

YOUNG, T.P. 2008a. Evaluation of archaeometallurgical residues from Moneygall, Co. Offaly, O6E0321. *GeoArch Report* 2008/10.

YOUNG, T.P. 2008b. Archaeometallurgical residues from Coolamurry 7, GeoArch Report 2006/10. 46pp.

YOUNG, T.P. 2009. *Evaluation of archaeometallurgical residues from 35 Mill Street, Worcester*. GeoArch Report 2009/33, 9pp.

context	*notes*	*wt (g)*	*quantity*	*description*
101	TR1 south end - top soil	235	1	fragment of dense slag with coalesced prills – indeterminate, but quite possibly a smelting slag – if so may be tap slag, but no reddening of surface, so either from furnace throat or is a non-tapping flow slag
137	TR1 - pit fill (Cal AD880-1020)	348	1	dense fragments of slag, trace of one slightly lobate surface. This suggests it comes from a slag cake at least 80mm thick – probably a large SHC
		278	1	Dense slag fragment, irregularly crescent-shaped. Starting to "explode" suggesting a high metallic iron content now corroding – probably an SHC fragment
		122	2	2 natural stone fragments – one probably indicative of a very low grade iron replacement of limestone, the other a cavernous concretion of red silt
604	TR6 - fill in chapel	56	1	irregular fragment of fired clay, one surface is vitrified with bloated texture. Surface slagged with wrinkled irregular slag film.
7007	TR7 - general spreads of material outside building	7	1	Natural stone
8006	TR8 from vicinity of blocked doorway	602	1	dense plano-convex SHC (118x106x52mm), charcoal moulds abundant on lower surface, rusty area covers much of upper surface but also probably charcoal rich
8009	TR8 from next to the hearth - possible occupation AD1110-1260	43	4	fragments of corroded iron, one fragment (now exploded) is probable very large nail (70x12mm)
		55	1	small bowl like fragment of corroded iron (49x37x15mm) [worth X-Ray?]
		55	2	Concretionary materials – source of iron not seen. Larger piece is ferruginous fragment with charcoal and other plant remains (including ferns); smaller fragment has small stone attached to concretion
		7	2	small fragments of concretion – larger with a variety of wood/charcoal and other plants
8013	TR8 - ditch fill dated to Cal AD 810-1010	4	3	2 very small fragments of slag; one lining slag fragment with gravel inclusions
8015	TR8 - layer cut by graves	15	7	small fragments of indeterminate iron slag – possibly originally a single piece
8022	TR8 - pit fill (also contained e-ware, but could be over dug into underlying ditch fill dated to AD 810-1010	132	1	fragment of probable SHC (difficult to estimate original size), blebby base with large charcoal moulds on upper surface.
		35	1	small fragment of variably red-grey natural siltstone

GeoArch

geoarchaeological, archaeometallurgical & geophysical investigations

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