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Evaluation of archaeometallurgical residues from Brownslade, Castlemartin, Pembrokeshire

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Abstract

This largely unstratified assemblage included 0.69kg of iron smelting slags, 2.69kg of smithing slags, 0.76kg of indeterminate iron slags, 2.88kg of goethitic iron ore, 0.40kg of other natural rock and 0.14kg of iron, mainly shrapnel.

Iron smelting was represented by 5 small pieces (each less than 80g) with textures compatible with, but not certainly indicative of, tapped slags, plus one large block 502g with a lobate vertical margin, indicative either of solidification within the tapping arch area of a slag-tapping furnace, or within the basal pit of a non-tapping slagpit furnace

Iron working was represented by pieces of at least 9 smithing hearth cakes (SHCs). Well-preserved examples ranged in weight from 140g up to an estimated 900g.

The iron ores are goethitic ores and appear to include both replacive and surface-coating morphologies. There are approximately 80 pieces of ore in the collection, a level in excess of that normally found on smelting sites. This strongly suggests that the ores may outcrop close to the site and that the ores found in the excavations may be largely present through natural, rather than artificial, processes. For instance, karstic dissolution (and other weathering processes) may release iron ore from their host limestones.

Despite the material not being stratified, the presence of iron smelting slags in conjunction with iron ore raises the importance of the assemblage and may suggest Brownslade as a previously unrecognised source of iron ore. The possible occurrence of non-tapping iron smelting slags is also significant, for these have not been recorded in southern Wales, although elsewhere in Britain they are known from both pre-Roman and early Medieval iron-smelting sites.

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Methods

All pieces in the assemblage were examined, where necessary using a low-powered binocular microscope, and weighed. The full catalogue is presented in Table 2. Distributional information is presented in Table 1.

Results

Iron-smelting slags

Slags produced during iron smelting are represented by six pieces, five of which are small. The small pieces show good evidence for flow, in at least two cases over a bed a charcoal, but represent only rather thin flows. These pieces resemble material commonly identified as tapped slags, although that interpretation is not strictly certain on pieces as small as these. One of these pieces was recovered in a stratified context (c105).

A large (502g) block of dense slag (from c156) shows the angle between a gently curved, possibly basal surface of the slag accumulation and an irregular,

strongly convex, sub-vertical bounding surface. The nature of the material forming the vertical boundary is not indicated by the surface, which is strongly lobate (with lobes elongated horizontally). The surface has a white encrustation, which may be calcified ash. The lobate surface indicates poor wetting of the surface by the slag. The convex nature of the vertical surface suggests that the most likely obstacles to have generated the curved surface would be either a stone (either lying on the floor on which the slag accumulated or as part of the margin of the area of accumulation) or a piece of wood (as commonly found as packing within the basal pits of non-slag tapping furnaces).The block does not appear to show flow lobes internally, and they are only weakly developed near the margin of the rough base. The slag is strongly vesicular, apparently becoming greatly so on the upper part of the surface away from the obstruction. Such a texture favours the block as a furnace slag rather than a true tapped-slag.

Smelting slags comprised 15% of the slag assemblage.

Smithing slags

The smithing slags mainly comprise fragments of smithing hearth cakes (SHCs). The fragments range from a complete example of 140g up to approximately 80-90% of an SHC weighing 728g (suggesting an original weight of 800-900g). Smithing slags comprised 65% of the slag assemblage. Where determinable, all the SHC material had textures suggestive of smithing using charcoal fuel.

Indeterminate iron slags

Material of too small a size to be identifiable with any certainty, together with larger pieces of indeterminate origin, provided 0.76kg (18% of the slag assemblage)

Iron ore

2.88 kg of iron ore was recovered. This material appears mainly to be goethite, but small amounts of haematite may be present. The material has a variety of morphologies, with sheet-like material dominant, although boxstone pieces also occur, together with more massive blocks. The general range of morphology suggests that the ore may have been present in mainly rather small accumulations (perhaps on joint surfaces). One piece shows gradation of ore into a crinoidal limestone and several others show low-grade materials of uncertain lithology.

Other materials

The submitted collection contained small quantities of natural stone, together with several pieces of corroded iron that were probably shrapnel. There was also a single piece of stout iron wire (or narrow rod).

Distribution

Only one piece of slag was firmly stratified, a small piece of probable tapslag from an early context, c105. The materials show an uneven distribution across the site, with the majority of both ore and slag recovered from the northwestern part of the excavation (areas 5, 8 and 9; Table 1).

area	***slag***				***ore***
	smelting	*smithing*	*indet.*	*total*	
1	38	240		*278*	
2			62	*62*	
5	12	88	34	*134*	288
6			90	*90*	
7					62
8	578	390	101	*1069*	1290
9	62	1974	474	*2510*	1241

Table 1: Distribution of materials by area

Interpretation

The assemblage of ores from the site is extensive, and is indeed rather more extensive than is normal for iron smelting sites. The ores show that they were originally hosted in the Carboniferous limestone (the bedrock geology at Brownslade). Minor iron mineralization is known to be associated with the Flimston Fault (which passes close to Brownslade), where it is exposed on the coast at Great Furznip (S. Howells, pers. comm. 2006). The ores found at Brownslade might well have been released from the host rock by natural dissolution of the limestone (there is no direct evidence of the pieces having been mined). Other small areas of iron mineralization are also recognised further east in South Pembrokeshire (Dixon 1921)

The smelting slags are difficult to interpret in detail, for the large block which is possibly from a non-slag tapping furnace does not show conclusive evidence for, for instance, large wood inclusions, and the smaller pieces of probable tapslag are too small to certainly exclude an origin as within-furnace flows in a non-tapping furnace. If some of the slags are from a non-tapping furnace then that would favour an Iron Age or Early Medieval age, whereas tapped slags could be Roman or later.

The smithing slags are generally rather undiagnostic, but the presence of a moderately sized cake (>800g) hints at bloomsmithing being undertaken (although larger SHCs do appear on blacksmithing sites from the Medieval period).

Evaluation of potential

The assemblage is both small and largely unstratified, but is none-the-less significant for its evidence for both smithing and, more especially, iron-smelting in area not normally noted for metallurgical activity. Other recent discoveries of iron smelting in the area (Young 2006) have raised the question of the nature of ore resources in this part of Wales. The abundant ore fragments present at Brownslade appear to be more indicative of a local geological resource, than of ore imported for smelting but lost or discarded on site. The ore fragments may largely represent material from the host Carboniferous limestone through dissolution of the limestone by Karstic processes.

The confirmation of this resource by analysis and comparison of the ores and smelting slags should be undertaken. If that relationship were to be demonstrated, it would be a significant step forward in unravelling the currently uncertain status of early iron-production in SW Wales. It would also be desirable that reference samples of iron oxide deposits should be made and analysed from the several localities around the area that currently expose geological materials similar to those conjectured to be responsible for the Brownslade ores.

Confirmation of the identification of non-slag tapping smelting slag would also be significant, for this technology is not yet recognised in southern Wales.

The unstratified nature of the material means that analysis of the smithing slags is unlikely to have great potential.

The site clearly has great potential beyond the current results, and the great significance of the metallurgical activity at the site should be recognised in any further archaeological investigations there.

References

DIXON, E. E. L. 1921. *The geology of the South Wales coal-field. Part XIII, the country around Pembroke and Tenby : being an account of the region comprised in sheets 244 & 245.* Memoir of the Geological Survey, England and Wales.

YOUNG, T.P. 2006. Evaluation of archaeometallurgical residues from South Hook LNG terminal, Dyfed (52787). *GeoArch Report 2006/14.* 12pp.

context	*weight*	*description*
102	240	small dense SHC shattered into 12 pieces - very altered
105	38	dense grey tapslag-like sheet, but only a small piece, charcoal dimples on base
114	62	small fragment of dense slag (from SHC?) broken in two
131	178	rounded cobble of iron-enriched rock - needs cutting to determine precise nature
133	152	small glassy SHC with included quartz pebbles. Top smoothly lobed, base dimpled
	138	fragment from small but very dense SHC, weathered pale grey, has lots of tubular vesicles
	10	fine debris
134	216	very dense, probably most of small SHC, with very dense iron rich lower part
	14	corroded iron
136	74	4 pieces of iron ore
	66	grey glassy slag in nub with khaki surface, lots of small charcoal impressions
	260	part of small dense SHC. Slightly prilly base with probable large tool mark, interior vesicular, top covered with fine rusty material
143	62	rather porous iron ore
145	14	small dense ore fragment
146	10	possible vitrified lining
	12	corroded iron - shrapnel
	12	small piece of tapslag-like material
	14	3 pieces of iron ore
147	198	13 pieces of iron ore
	6	iron - shrapnel
	100	natural coarse limestone
	12	vesicular grey indeterminate slag
	72	most of small SHC, dense
148	10	corroded iron - shrapnel
	10	iron ore

context	*weight*	*description*
150	14	corroded iron - shrapnel
	60	angular lump of slag with a very large charcoal impression
	30	4 pieces of vesicular slag
151	62	low density piece - probably stone, but needs fresh surface
153	138	5 pieces of goethite ore
	4	stone
	10	charcoal-rich slag
	78	fragment from small very dense SHC, thick crust, but small puddle
154	6	limestone pebble
	186	8 pieces of goethite ore
	64	dense angular slag piece - probably from margin of SHC
	42	smooth topped but lobate, with dimpled base - fragment of a very thin SHC?
	20	small nub of dense vesicular slag
155	16	iron rod
	1	lining slag
	8	corroded iron lump
	472	23 pieces of goethite ore
	52	natural stone
	66	small block of vesicular dense grey slag - probably an SHC fragment
	<	charcoal piece
	140	small complete SHC, with good charcoal impressions on top and dimples underneath. Slag rather pale
156	76	small tap slag like piece, mainly single flow with rough base, c 15 thick, lobed top
	38	small nub of charcoal-rich lining dominated slag
	232	10 pieces of goethite ore
	502	accumulation of lobate slag on floor and against object. Possibly from basal pit of slagpit furnace, but possibly from tapping channel
	30	3 pieces of vitrified lining?
	2	low density finely vesicular slag fragment
176	40	3 pieces of iron ore

context	*weight*	*description*
213	22	probable corroded iron lump
	10	poorly mineralised boxstone piece
	252	iron ore
243	2	low grade iron ore fragment in red clay
248	1065	block of goethite ore
	728	part of medium sized conventional SHC, <80%, charcoal rich. In 3 bits
	50	fine slag debris
	282	indeterminate charcoal-rich rusty slag block
	100	2 ore fragments
	218	charcoal-rich slag piece - possibly an SHC burr
256	262	dense rounded nub of slag, possibly part of an SHC, grey slag abundant vesicles near surface
	36	tapslag fragment in two pieces
	26	probable tapslag-like piece with charcoal dimpled base in two pieces
	22	corroded iron - shrapnel
	66	5 fragments of vesicular slag - some possibly SHC material?
	18	2 pieces of concretionary material - both probably from growth around corroding iron
266	16	small smithing slag nub
	12	piece of slagged lining
	12	probable iron ore

Table 1: Catalogue

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