GeoArch

Report 2010/08

Evaluation of archaeometallurgical residues from Robeston Wathen, Pembrokeshire

Dr Tim Young
29th January 2010

Evaluation of archaeometallurgical residues from Robeston Wathen, Pembrokeshire

Dr T.P. Young

Abstract

This small collection of material was dominated by specimens of tapped bloomery iron smelting slag. The pieces were mainly indicative of small flows, although a few pieces were from thicker accumulations of flowed material, with charcoal moulds and chaotic textures, suggestive of deposition within the furnace or its tapping arch. A substantial proportion of the iron slag was not identifiable, but much of this may too have been tapped smelting slag, but examples lacking the characteristic surface features. One piece of tapslag contained a substantial piece of unreacted ore, but this was not identifiable in hand specimen.

The collection included a small piece of fuel ash slag of uncertain origin (not necessarily metallurgical), some pale vitrified ceramic and two pieces of coal (possibly from steam-powered agricultural machinery).

Dense tapped slags are unlikely, in this area, to be earlier than Roman and might be as young as medieval, but are not in themselves indicative of a more precise age.

Contents

Abstract 1

Methods 1

Results 1

Interpretation 2

Evaluation of potential..... 2

References 2

Catalogue 3

Methods

All investigated materials were examined visually, using a low-powered binocular microscope where necessary. For microscopic residues a general statement of the nature of each assemblage was recorded (Table 1). As an evaluation, the materials were not subjected to any high-magnification optical inspection, nor to any other form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

Results

Iron-smelting slags

The most abundant components of the assemblage were pieces of tapped iron-smelting slags from a bloomery furnace. These were mainly fairly small fragments from thin flows, but there were a few more substantial pieces.

One 326g block showed a dimpled base overlain by slags in small amalgamated prills which penetrated between moderately large (25mm) fragments of charcoal (now represented by striated-faced moulds). This part of the block gave the appearance of a rather chaotic texture and it is possible that the prilly accumulation had flowed slightly and become disrupted. The block was topped by a series of dense flows of tapslag-like material. It is likely that this block formed either in the base of the furnace or within its tapping arch in order to have acquired both furnace slag-like and tapslag-like features.

One block of tapslag showed a substantial (c.20mm) clast of unreacted (although roasted and cracked) ore. The fragmentation of the ore by cracking (probably

during the dehydration of goethite to haematite) has rendered the original texture unrecognisable in hand specimen.

Another larger tapslag fragment contained numerous angular clasts of pale reduced-fired clay. These showed no sign of reaction with the enclosing slag, so are probably fragments of furnace, floor, or tap-arch blocking picked up by the tapslag flow as it exited the furnace.

Indeterminate iron slags
A significant proportion of the iron slags were unidentifiable. Many of these may have been tapped bloomery slags, but lacked the characteristic surface features. Others were slags with a well developed basal crust that were possibly furnace slags. There were no pieces that were certainly from smithing rather than smelting.

Miscellaneous residues
A single fragment of low density fuel ash slag was of uncertain origin. Fuel ash slags may be generated during metallurgical process, but many are not (for instance the fuel ash slags from the corn driers at South Hook; Young 2010b). Very similar slags (clinkers) can also be produced during the burning of coal (for instance in steam engines), but the present example doesn't show the usual characteristics of coal clinker.

A tiny fragment of oxidised fired and vitrified ceramic is very likely to be a piece of furnace material associated with the iron slags. A fragment of vitrified pale ceramic may also be furnace material, but might alternatively be associated with the fuel ash slag.

Interpretation

The iron slags are indicative of iron-smelting in a slag tapping furnace. The ore being smelted remains unknown and various sources seem to have been exploited in Pembrokeshire (Young 2010a, c).

Slag tapping furnaces were introduced into the Bristol Channel Orefield probably late in the pre-Roman Iron Age. They were used in various forms until the early post-medieval period. The present material most closely resembles slag from a fairly small furnace and the most likely date range is Roman to earlier medieval.

Evaluation of potential

The presence of bloomery iron smelting in this part of SW Wales was not previously known and therefore this occurrence has significant potential and is worthy of further investigation, even if the assemblage is dominantly residual.

The slags appear well-preserved (thus permitting further meaningful analysis) and with one of the specimens bearing an ore clast there is scope for detailed analysis of both the slag and ore. This would clarify the source of the ore being smelted.

Chemical analytical and microstructural investigations on two tapslag specimens and the ore fragment are therefore recommended.

References

Young, T.P. 2010a. Archaeometallurgical residues from the South Hook LNG Terminal. *GeoArch Report 2010/03*, pp.

Young, T.P. 2010b. Fuel ash slags from corn-drying kilns, South Hook LNG Terminal. *GeoArch Report 2010/04*, 24 pp.

Young, T.P. 2010c. Analysis of archaeometallurgical residues from Brownslade, Pembrokeshire [NPRN 94225]. *GeoArch Report 2010/07*, 23 pp.

			weight (g)	no.	notes
TR1	TP1		340	24	tap slag fragments in small pieces
			3.3	1	weathered boxstone-like concretion fragment - doesn't appear particularly iron rich
			4.9	1	fuel ash slag fragment. Has smooth maroon upper surface, highly vesicular, variably white crystalline and black glassy
			5.9	1	pale ceramic with occasional large quartz grains, surface irregular and vitrified with black glass
			8.8	1	natural stone
			188	11	fragments of dense iron slag, variably vesicular. None shows characteristic textures of tap slag- they all could be, but lack appropriate preserved surfaces
TR1	(B)		13.5	1	naturally fractured flint
			416	21	tap slag fragments, mostly small, one larger fragment shows a clast of roasted ore of c20mm diameter
			190	3	larger slag blocks, all with a basal crust, with rather granular slag adhering - could be furnace slags but strictly indeterminate
			90	8	indeterminate vesicular iron slag fragments
			80	1	block with lobate base but rather irregular chaotic upper parts - rather similar to block from (018) but without definite dense tapslag top. Contains lots of small angular fragments of pale reduced fired clay
			8	1	dense dimpled slag surround part of a 25mm diameter cavity - possibly slag coating from a tool.
			2.7	1	coal
TR1	(C)		10.8	1	small tap slag fragment, dense
			13.3	1	flow lobed slag, probably tapped, porous, possibly etched but originally very vesicular, fayalitic and cindery
TR1	(D)		30	1	tap slag - small piece from flow c20mm thick
TR3	3001	e. end	26.1	2	rottenstone
			1.3	1	coal
			0.6	1	oxidised fired clay with vitrified surface
			2.8	1	natural rock
TR3	3002	w. end	22.3	1	piece of grey vesicular slag with dimpled base, probably lobate, top lost but shows large rounded vesicle suggestive of tap slag
	18	8	326	1	large block of slag with flow lobed dense upper part, lower part more chaotic with small lobes and moulds of c25mm charcoal, base dimpled, suggests tapped slag flow of c55mm thick

Table 1: Summary catalogue

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