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Evaluation of archaeometallurgical residues from Upton Bishop, Herefordshire

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Abstract

Archaeometallurgical materials recovered from a series of testpits and trench in the area of a moderately dense surface scatter of iron slag, were largely, and possibly entirely, derived from iron smelting in a slag-tapping bloomery furnace. All the material appears worn and appears to be residual.

The material is not age-diagnostic and could be anything from late Iron Age to early post-medieval. The site type probably most closely resembles examples of inferred Saxon-Medieval age, but such an inference must be extremely tentative.

The assemblage is typical from sites in the Forest of Dean and its hinterland that were smelting Dean ores with local charcoal supplies.

Contents

Methods

Material was submitted from 8 stratified contexts and 4 unstratified (topsoil) contexts (of which one sample, T9 ploughsoil, was lost in transit).

All the material was inspected visually, using a low-powered binocular microscope where appropriate, and classified by morphology whenever possible. Most samples contain some material that has a texture which is not assignable to a particular origin, or for which the pieces are too small for certain identification.

The samples were logged to a spreadsheet, which formed that basis for the catalogue contained in this report (Table 2).

Results

General observations

The archaeometallurgical residues were only moderately well preserved, with most pieces showing evidence for some weathering or leaching and also showing signs of physical abrasion.

The assemblage as a whole weighed 29.9kg and comprised 722 pieces. The average particle weight for the entire assemblage of archaeometallurgical residues therefore was 41g, with individual contexts varying from 17g to 286g. For contexts bearing 20 or more pieces, a rather more meaningful statistic, the average weight varied from 32-62g.

Almost all of the material in the collection could confidently be attributed to iron smelting in a slag-tapping bloomery furnace. 37% of the assemblage (by weight) was certain, or probable, fragments of tapped slag. 44% of the material has been classed as furnace slag, but much of this shows features of fluid flow and some may have solidified in the tapping arch or even in a deep tapped slag puddle. Only 4% of the material shows evidence for a basal crust. This material may have formed within the smelting furnace too, but an origin as smithing hearth cakes cannot be ruled put with certainty. 2% of the material was furnace lining or

lining slags and 12% of the slag could not be classified (because of inconclusive morphology or small size).

Tapped slags

The tapped slags are typical slags from the Forest of Dean and its hinterland. They are extremely dense, typically in rather small pieces, often suggestive of having cooled in rather thin sheets and generally bearing rather narrow slag rivulets. Although the small size of the tap slag fragments precludes determination of the overall cake size for this material, the general impression is that it was probably fairly small.

Some tap slag flows have their base preserved, and these vary from contacts with fragmental debris (including possible ore fragments), planar contacts suggestive of flow over stone, and lobate/prilly bases suggestive of tapping onto a base of charcoal.

Furnace slags

Several distinct facies of slags are grouped together under this heading:

Charcoal-rich slags – many pieces of slag are rich in charcoal, or more commonly the moulds of former charcoal pieces. The size of the larger fragments, the large size of some of the charcoal fragments and the lack of internal structure make it likely that this facies is all from iron smelting. Some of the pieces show upper surfaces with wrinkles, lobes and other indicators of flow.

Dense slags – irregular blocks broken from dense slag masses form the larger components of many of the assemblages. Some of these show some indication of flow (with features either on the upper surface or internally). The dense slags are very similar to the tap slags, and might represent accumulation of such material either inside the furnace, or possibly outside as thicker tap slag accumulations that have lost their characteristic upper surface during fragmentation.

Prilly slags with charcoal – this facies includes slags formed of aggregates of small descending prills, frequently penetrating between small charcoal particles. Slags of this general nature may form with the furnace, but may also form on the base of tapped slag flows running over a charcoal bed. Since these two cannot readily be separated they are all included with the furnace slags here.

Slags with basal crusts – a few pieces of slag show the development of a basal crust. This is formed when a slag descends to a surface within a smelting furnace or smithing hearth, particularly when that surface is the furnace/hearth floor. They are often characterised by the presence of tubular vesicles perpendicular to the lower surface, and that is the case here. The incomplete nature of the material in this assemblage makes confident attribution to either setting very difficult.

Lining and lining slags

These materials comprised only a small component of the assemblage (2% by weight) and were typically abraded and lacked any structural information. Distinction of these lining fragments between an origin in a smelting furnace or a smithing hearth is not possible.

Interpretation

The assemblage indicates production in slag tapping bloomery iron smelting furnaces. These furnaces were the technology employed for smelting ores in the Bristol Channel Orefield (including the Forest of Dean) from, possibly within the middle Iron Age, and certainly from the Roman period, through to the 16th century AD. The slags are very hard to differentiate, although increasing furnace size from around the 13th century onwards may allow recognition of later examples in some areas. In this case, the limited evidence hints at rather small tap slag flows and a pre-13th century age would seem likely, though not certain. The pattern of rural iron smelting sites in the hinterland (a zone extending out some 50 km from Dean) of the Forest of Dean was certainly well-established in the Roman period, but seems to have continued right through the period of bloomery usage, thus neither the slag types, nor the site type are particularly indicative of age.

There is very limited and uncertain evidence for any smithing activity to accompany the smelting. A physical segregation of the two stages of the iron production process is common. In some areas iron smelting was largely undertaken close to the sources of charcoal in or close to the woodlands, whereas the bloomsmithing may have taken place in settlements (or in the later middle ages, near water supplies for the water-powered hammers).

The dense slag spread covering an area of approximately 120m x 90m, with less dense spreads around is not unusual. The vector for slag dispersal across the broader area has not been investigated. The general situation in Upton Bishop is reminiscent of the slag deposit south of Iron Acton church (South Gloucestershire; Young 1999, Young & Macdonald 1999), where the core of the slag seems to have been an area perhaps 30m in diameter on a slight ridge, with subsequent dispersal of up to 100m to the east of the ridge and 30m to the west. Test pitting suggest 100 tonne of slag remaining on the Iron Acton site, although there is some evidence for post-medieval quarrying of the slag (for roadstone). The Iron Acton site remains undated, but is interpreted as probably being from within the period of Saxon to about 13th century.

Although the pattern of slag is probably best explained through disturbance of a smelting site, it must be remembered that slag was often re-used as a surfacing rubble, and it is possible the slag concentration on the site might represent such a secondary accumulation.

The disturbance of the site and dispersal of the slag is probably agricultural but slag quarrying, both for constructional materials as previously mentioned, and in the early industrial period for resmelting in blast furnaces, also remains as another possibility.

Evaluation of potential

Reworked slag assemblages of this kind have little potential for further detailed investigation unless it can be demonstrated that the site is coherent and not mixed. Since even the stratified slag on this site is residual, the present assemblage with its present contextual understanding, probably does not justify detailed analytical work.

References

YOUNG, T.P. 1999. Geophysical and testpit survey of an iron-making site, Parsonage Ground, Iron Acton [ST 6813 8323], July 1996. *Geoarch Report 99/03*. 18pp.

YOUNG, T.P. & MACDONALD, P. 1999. Iron Acton, Parsonage Ground. *In:* RAWES, J. & WILLS, J. (eds) Archaeological Review No. 22 1997, *Transactions of the Bristol and Gloucestershire Archaeological Society*, **116**, 204-205.

Context	tap slag	probable tap	probable furnace slag	furnace slag or possible smithing slag	indeterminate slag	lining and lining slag	no. of pieces (residue)	artefact/ stone	no. of pieces (other)		notes
Trench1						285	12				slagged lining and lining
/us	4286						179				tap slag
			724				42				material with small descending prills and charcoal moulds
					2045		93				indeterminate slags
			2185				14				dense slags with some internal flowed surfaces, but not normal tap slags
	406						5				flowed pieces, but not normal tapslags - maybe edge of slag puddles
	256						2				slag tubes or rods
			242				2				dense slag massive nubs - uncertain nature
				512			2				massive slag pieces which may be SHC fragments, they have some evidence of a basal crust
				104			1				small piece of slag puddle, vesicular with smoothish top - might just be part of a small SHC
			400				7				charcoal-rich slags
	102						1				small flowed body with smooth top and lobate base, with possible ore on underside and small fragments, more questionably ore, on the upper surface.
								3	2		coal
								140	18		stones
total	***5050***	***0***	***3551***	***616***	***2045***	***285***	***360***	***143***	***20***	*11547*	residue total
										32	average residue weight
Trench1	2644						87				tap slag
/1004						258	10				lining slag and lining
			972				7				charcoal dominated slags, including 1 very large piece
			826				15				slag with descending prills, some with good charcoal moulds, in one case with very large charcoal pieces
			2530				9				dense slags with flowed surfaces internally, but not typical tapslags - may be thick tapped material or from within furnace
			2285				6				dense slags, highly vesicular, with some charcoal and signs of some flow surfaces, probably furnace slags
				284			1				vesicular slag with basal convex sediment contact, could be base of furnace but probably a piece of smithing slag; has some tubular vesicles.
					1385		92				indeterminate slags
								32	6		stones
total	***2644***	***0***	***6613***	***284***	***1385***	***258***	***227***	***32***	***6***	*11184*	residue total
										49	average residue weight

T6/014		36					3				probable tapslag
					56		1				massive vesicular slag fragment
total	***0***	***36***	***0***	***0***	***56***	***0***	***4***	***0***	***0***	*92*	residue total
										23	average residue weight
T7/us					130		3				indeterminate vesicular massive slags
						16	1				slagged furnace lining
		280					8				flowed material not certainly tap slag
			414				1				large block of vesicular slag with poorly flowed top - probably furnace slag
			632				5				rounded nubs of massive dense slag
			86				1				charcoal-rich prilly slag
	1440						37				tapslag
total	***1440***	***280***	***1132***	***0***	***130***	***16***	***56***	***0***	***0***	*2998*	residue total
										54	average residue weight
T7/030	298						10				tapslag
			388				1				large block, mainly charcoal-rich, but dense, less vesicular material on one side and end. Possibly from tap arch throat
					22		3				indeterminate vesicular slags
		86					10				indeterminate slags with some flowage
total	***298***	***86***	***388***	***0***	***22***	***0***	***24***	***0***	***0***	*794*	residue total
										33	average residue weight
T8/022	438						10				tapslag
		48					4				indeterminate flowed material
			292				2				indeterminate large dense slag fragments
			458				3				dense slag blocks with some tapslag-like surfaces
						8	1				lining slag
								18	3		nails
total	***438***	***48***	***750***	***0***	***0***	***8***	***20***	***18***	***3***	*1244*	residue total
										62	average residue weight
T9/024					68		4				indeterminate slag pieces
	360						10				tapslag
						42	1				slagged lining
			342				5				massive dense slags with some hint of cooling surfaces, possible tapslags
total	***360***	***0***	***342***	***0***	***68***	***42***	***20***	***0***	***0***	*812*	residue total
										41	average residue weight

T10/029	236						3				tapslag
					30		1				indeterminate brecciated slag
								12	1		brown glass
total	***236***	***0***	***0***	***0***	***30***	***0***	***4***	***12***	***1***	*266*	residue total
										67	average residue weight
T10/028		50					3				probable tap slag
total	***0***	***50***	***0***	***0***	***0***	***0***	***3***	***0***	***0***	*50*	residue total
										17	average residue weight
T11/03! Topsoil			420				1				massive irregular piece of vesicular slag - probably a furnace slag
		96					1				piece with rounded flow lobes - not a normal tapslag, but probably related
				342			1				massive irregular block of slag with prilly base and smoothly curved top. Probably a furnace slag, but might just be from smithing
								32	1		fired clay - brick like material
total	***0***	***96***	***420***	***342***	***0***	***0***	***3***	***32***	***1***	*858*	residue total
										286	average residue weight
T12/1002	48						1				lobate slag - probably atypical tapslag
								50	13		1 piece of lead, 4 pieces of glass, 8 pieces of coal
total	***48***	***0***	***0***	***0***	***0***	***0***	***1***	***50***	***13***	*48*	residue total
										48	average residue weight
	10514	***596***	***13196***	***1242***	***3736***	***609***	***722***	***287***	***44***	29893	overall totals
										41	average residue weight

Table 1: Catalogue of the material from Upton Bishop, organised by context. All weights in gram.

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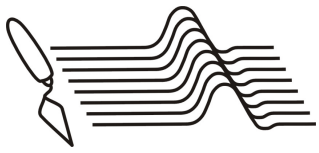

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