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Assessment of residues from Longney (LNG18)

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Abstract

The submitted material comprised 3884g of archaeometallurgical residues (twelve pieces) from six contexts, together with a small fragment (<1g) of coal and a burnt pebble (214g), plus 84g (1 piece) of unstratified residue.

Most of the residues (96% by weight) were slags from iron smelting, almost certainly from a type of large furnace of Roman date, although the assemblage does lack examples of the most diagnostic textures.

A small proportion of the assemblage was from smithing, with slags showing evidence for the use of both coal and charcoal as fuels. Smithing microresidues were present in the concretionary material adhering to one slag piece.

Smelting assemblages such as this are common in the Severn Vale, where Forest of Dean iron ore was imported for smelting using local charcoal.

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Methods

All materials were examined visually, using a low-powered binocular microscope where required. As an assessment, the materials were not subjected to any high-magnification optical inspection, not to any form of instrumental analysis. Concretionary materials are checked with a small hand metal detector to ascertain whether they contain any surviving iron.

The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

This assessment was conducted in October 2020 and was commissioned by Andy Hood of Foundations Archaeology Ltd.

Description of the assemblage

General

The submitted material (Table 1) comprised 3884g of archaeometallurgical residues (twelve pieces) from six contexts, together with a small fragment (<1g) of coal and a burnt pebble (214g), plus 84g (1 piece) of unstratified archaeometallurgical residue.

Iron smelting slags

The five largest pieces of slag (total 3790g, 96% of the residues by weight) in the assemblage were all from iron smelting in a large slag-tapping bloomery furnace. All five came from related contexts (2502), (2504) and (2512).

A 250g fragment from context (2502) was formed of flowed prills set rather chaotically in a large mass. Such textures can be formed when slag (usually after tapping) descends into a deep tapping pit or a deep layer of charcoal, rather than flowing a horizontally in a thin sheet. A 130g fragment from the same context is a vesicular slag, with a crude flow lobe on one surface. This piece is probably a smelting slag, possibly from a slag runner.

A 1200g block from context (2504) derives from the margin of an 80mm thick flow. The margin shows a vertical sheet of chilled lobes, probably a simple chilled margin, but just possibly a rotated pre-formed sheet.

A 150g piece of slag sheet with a lower dense basal section and a highly foliated porous upper part is indicative of a tapped slag flow in which the chilled surface of a vesicular slag has crumpled during flow (also from (2504)).

A very large dense block, with surficial accretion, with a weight of 2060g from context (2512) appears to be a fragment of a very large slag runner or channel, but might possibly be part of an irregular furnace bottom (the two slag types are laterally contiguous forms).

Iron smithing slags

An 84g unstratified fragment (2% of the assemblage by weight) of highly and irregularly vesicular iron slag had a structure strongly suggestive of being a fragment of a smithing hearth slag. The piece suggests an origin in a slag mass approximately 40mm thick and it contains small charcoal fragments indicating the fuel employed.

Indeterminate slags

The five smallest pieces of slag (total weight 94g; 2% of the assemblage by weight) were of indeterminate origin, being either from iron smelting or from iron working. However, there is a good likelihood that all are actually from iron working (smithing).

Context (421) produced a small (6g) stone fragment, bloated through being in a hearth or furnace and coated in a layer of dark slag. It is also produced a 32g fragment of prilly slag, with highly vesicular dark material between the denser lobes. This vesicular material was likely to have been coke (making this a coal-fuelled smithing slag), but might have been a lining-derived slag component.

Context (431) produced a small fragment of vesicular slag of indeterminate origin encased in a concretion rich in hammerscale. One slag fragment of coke may also have been present and it is quite likely, but not certain, that the slag piece is form a coal-fuelled smithing hearth.

Context (4108) produced tow rather worn slag fragments from indeterminate iron working origins.

Other materials

Context (3804) produced a single fragment (<1g) of coal. Coal does not occur naturally at Longney, so must have been imported from elsewhere. The smithing slags described above show a possible use of coal fuel, but use as a domestic fuel or in more recent steam boilers (including agricultural machinery of the late 19th and early 20th centuries) must also be considered possibilities.

Context (4107) produced a 214g fragment of a heat-fractured and altered sandstone pebble.

Interpretation

The occurrence of the smelting slags within a set of closely-related contexts suggests that they too may be related. The 150g piece from context (2504), with its dense lower part and a porous, imbricate upper layer, is a morphology perhaps more commonly encountered in medieval contexts than Roman. The chaotically prilly slag fragment (250g) from context (2502) and the 130g possible runner fragment from the same context are not particularly indicative of age when considered in isolation. The 1200g block from context (2504), with its complex, steep. probably chilled, margin and a possible incompletely-reacted ore fragment is more suggestive of the style of tapped slag from a Roman furnace than a medieval example. The very large (2060g) dense block from context (2512), apparently a fragment from a large runner or channel, is also very suggestive of an example of slag from a Roman furnace.

On balance, despite its small size, the smelting assemblage as whole resembles assemblages interpreted as having been produced in a type of large furnace, the precise mode of operation of which has yet to be understood.

The key features of the residues from this class of furnace may be a relatively low proportion of conventional tapslag, thick puddles of slag, internally massive but flow lobed towards the top, typically with inclusions of part-reacted ore and moulds of roundwood pieces, a high proportion slags with channelled and runner morphology

This characteristic assemblage has been recognised widely across the hinterland of the Forest of Dean and Glamorgan sectors of the Bristol Channel Orefield. Several of the sites on which it occurs have been interpreted (Young 2014) as being official, perhaps military-controlled, operations, but recently several new occurrences have been recognised which do not fit this model and suggest similar furnaces may have been used in smaller operations too.

Such evidence has been noted at major sites in the Glamorgan sectors of the orefield including Caergwanaf (author's unpublished data) and Cardiff Castle (Young & Kearns 2011; post-excavation analysis in progress). In the Forest of Dean and its hinterland west of the Severn this facies is known from Alvington, Glos. (Young 2009), Cannop (Young 2011, 2013), Lydney (Young 2019; post-excavation analysis in progress), Peterstow (Young 2012), Woolaston (Fulford & Allen 1982) and Weston-under-Penyard (Jackson 2012; Young 2015), as well as further afield in Worcester (McDonnell & Swiss 2004).

To the east of the Severn (where Forest of Dean ore is believed to have been brought for smelting with abundant local woodland resources), similar, although not identical, slags are known from Kingswood (Young 2017) and possibly at Frocester Court (Price 2000; Thomas 2000).

Despite the widespread distribution within the region of this slag assemblage, there are no recent excavations of well-preserved furnaces. Some general similarity can be seen with the residues from the large, dome-shaped, furnaces seen in SE England, which commonly produce 'furnace bottoms' and channelled slags. The SE England examples do not, however, bear roundwood and abundant ore clasts. Further understanding must await discovery of relatively intact furnace examples.

The presence of residues from smithing, with evidence for the use of both coal and charcoal as fuels is common in the region. Secondary smithing, or blacksmithing (the end use of iron for the fashioning or repair of artefacts) commonly employed coal for fuel in the Roman period and again from the later medieval. Roman examples are documented from, for instance, Frocester Court (Thomas 2000), Kingswood (Young 2017) and Cleevelands (Young 2018a) in the general area of the present site. The working of the raw blooms into usable iron, bloomsmithing, required the use of charcoal as fuel. Although both fuels are noted on the present site, there is insufficient smithing slag to determine the nature of the smithing being undertaken on the site.

In summary, although presented as undated material, the smelting slag assemblage is most likely to be Roman rather than medieval. It is also likely to present smelting in a very substantial furnace, usually indicative of a smelting operation of some substance. The smithing remains are few in number, but would be compatible with being also of Roman age, but are not necessarily so.

Further work

The slags are, as described above, are a rather small assemblage and are not capable of yielding further evidence of only limited extent if they were to be subjected to detailed analysis at this stage, so none is recommended. The likelihood of metallurgical activity in the vicinity of the evaluation is, however, very strong.

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Table 1: summary catalogue of submitted macroscopic materials. Weights in g.

Context	weight	number	notes
421	6	1	pale bloated fine-grained stone coated in dark glassy slag
	32	1	slag fragment with prilly base, more conglomeratic on top, some clinkery grains, some possible coke grains between lobes. Unclear if a bit of furnace base or a coal-fuelled smithing slag.
431	12	1	small fragment of worn vesicular slag encased in hammerscale-rich slag. One possible fragment of coal/coke, but it is unclear if it is in accretion or slag
2502	250	1	highly weathered tapslag formed of rather irregular prills set chaotically rather than in good flows
	130	1	irregular vesicular slag, probably but not certainly an iron smelting slag. Very fine dimples probably present on base, one rounded lobe present on one surface, but unclear if a slightly lobed base or top. An origin as a channel slag is possible
2504	1200	1	80mm thick dense flow, base irregular, top shows layers of flow lobed material. Body without obvious lobes, and shows large obliquely-oriented vesicle near margin. Lower part lobate also. One margin is steep and lobate, probably shilling of large flow against margin 10-15mm thick, but just possibly a misplaced prior sheet. On one corner a highly fractured zone suggests a possible ore inclusion
2512	2060	1	110mm deep double layer extremely dense slag in concretionary material, probably part of a very large double layered feed/channel. MD detects much iron, particularly around join of two layers, and corrosion suggests iron in lower flow towards one end. Lower flow shows large horizontal vesicle on one face, but otherwise little internal (or even external) detail visible
	150	2	dense flow, c.20mm thick, massive, smooth but slightly dimpled base, top is highly porous with foliated corrugated top
3804	<1	1	coal
4107	214	1	burnt and fractured pebble
4108	4	1	small fragment of broken slag prill, surface smooth, weathered, interior vesicular
	40	1	worn slag piece with clay and lime coatings, upper surface maroon layer, partly lobate, but not classic tap slag. Unclear if tapslag (probably) and blown SHC (just possibly)
u/s	84	1	irregular fragment, probably from a sheet c. 25-40mm thick, highly and irregularly vesicular, some small charcoal inclusions, probably a smithing slag

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