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Evaluation of archaeometallurgical residues from the Ilchester-Barrington pipeline

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Abstract

The submitted materials included three examples of slag from smithing hearth cakes. These are indicative of iron-working in a charcoal-fuelled hearth with a clay wall. Such technology was very long-lived in Britain, so is not indicative of age.

Sieved magnetic residues from features assigned to the early medieval period proved to contain burnt rock particles with some fuel residues. None of the residues was necessarily indicative of a metallurgical use and no samples contained hammerscale.

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Methods

All investigated materials were examined visually, using a low-powered binocular microscope where necessary and recorded to a database (Tables 1 and 2).

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.

This project was undertaken for Cotswold Archaeology.

Results

Description of materials

Macroscopic slag

The hand-picked macroscopic slag material amounted to three bags, each of which contained the fragmented remains of a single slag block. The piece from context 48124 is certainly incomplete, and the smaller piece from context 48138 is probably so. All three pieces contain almost identical slag and all three may be interpreted as smithing hearth cakes (SHCs).

In each case the SHC comprises a dimpled basal surface, overlain by dense, but vesicular, slag, with a thin veneer of paler, more glassy, slag on the upper surface. Where visible, the fuel employed was charcoal.

The larger specimen from context 48138 is apparently essentially a whole, if fragmented, example. The weight of 200g may have been reduced a little from the original weight, because of leaching, but is a typical weight for a SHC derived from blacksmithing (the end use of iron for forming or repairing artefacts). The cake appears to be transverse and formed along the wall below the blowhole, without significant attachment to the wall. Alternatively, the elongate form may have been accentuated by folding, if the cake was extracted from the hearth when still hot and plastic.

Microscopic materials

The sieved residues are dominated by natural materials (rock grains), although their magnetic properties would indicate that they have been heated – presumably through human agency. The rock materials include fragments of siltstone, sandstone, iron-rich crust and concretions.

One particular grain type contains dark, iron-rich, spheroidal particles of up to about 4mm diameter. Fragmented examples of these show that neither the internal structure nor the surface texture corresponds to slag. These particles are natural concretions, probably of iron oxides after primary sulphides.

Small anthropogenic particles are contained as a very minor element of many of the samples – and again are indicative of general burning. They include charcoal, fuel ash slags and coked organic material. The fragments are too small to be able to determine visually whether the coked material is coke *sensu stricto* (the residue from partial burning of coal); highly burnt bone, food residues and other organic materials may show very similar textures at this scale of observation.

Distribution of materials

The samples derived from the dated (early medieval) Phase 4 features do not show any evidence for metallurgical processes. The macro-slags, clearly from blacksmithing, are from contexts which, at the time of reporting, are undated although spatially associated with the Phase 4 features.

Interpretation

The macroscopic slags are indicative of ironworking in the general area. The slags themselves are not indicative of any particular date – and have a potential range, based on their intrinsic nature, from the early pre-Roman Iron Age to modern, although the increased use of coal/coke rather than charcoal as fuel since the 18th century and the progressive introduction of iron tuyères since the medieval period implies that a later post-medieval age is unlikely.

The sieved residues indicate that the Phase 4 pits contain heated materials, but there is no evidence to link that with metallurgical activity.

Evaluation of potential

The materials have no particular potential to produce enhanced results or interpretation through further analytical investigation.

Table 1: hand-picked macro-residues

Context	Weight	Notes
48124	74g	very dense piece of slag, slag pale vesicular in places, but one broken edge shows dark colour and extensive rusting, so denser areas probably contain metallic iron. There are small inclusions of charcoal. One face is strongly curved and dimpled, others are fractures or coated in concretion. The concretion preserves organic material, including longitudinally-striated stems (?straw), presumably from the depositional environment.
48138	200g	badly fragmented smithing slag, probably a transversely elongate mass just below blowhole, but the shape may represent some degree of folding. Lower surface shows small regular dimples. Upper face shows bend between smooth slightly flowed face (below blowhole?) and (protruding?) rusted dense material. Rear of possible vertical face is slightly blebby.
	65g	Many fragments from a very small SHC. The top is pale green, probably glassy, but containing some large fayalite crystals. This very thin skin rests on a pale-weathering slag, dense but vesicular, with some adhering blebs of iron corrosion. top shows some deep charcoal impressions, base is irregular, smooth but finely-dimpled. 12 moderate pieces, 16 tiny and some dust.

Table 2: sieved residues

Context	sample	Label on bag	Notes
48145	5	magnetic material	assemblage with dark brownish colour, mainly siltstone, but abundant polished iron oxide grains, rarer chert
48172	22	slag spheres?	material labelled slag spheres; 15 spheres, not of slag but probably weathered natural pyrite concretions
48172	22	magnetic	rock grains. Mainly brown siltstones/sandstones, but also concretions similar to the sphere collection (including aggregates) and other red sandstone/siltstones. Some more iron-oxide rich rounded grains. A few grains are possibly fired clay.
48172	22	?	organic material (modern?)
48172	22	magnetic material	dark sample, mainly reddish brown iron oxides, some siltstone, one piece of slag sheet, several small fuel ash slag fragments
48194	21	magnetic material	dark, slightly reddish brown assemblage of siltstone. Rare chert. Some iron oxide spheres
48194	21	magnetic	small assemblage of mainly iron rich grains - including both red and brown coated grains. Some quartz, chert and siltstone
48266	11	magnetic material	mainly grains of yellow brown micaceous siltstone. Some chert fragments and some iron oxide grains/
48266	11	magnetic	large collection, mainly yellow-brown siltstone. Some polished iron oxides, some spheres, some chert, rare fossil fragments
48274	12	magnetic material	very variable grey, yellow, brown, red, purple heated sandstones and siltstones. Some chert, some iron oxide grains. One piece of coked organic matter.
48274	12	magnetic	dark, strongly magnetic iron oxides grains, with tiny fragments of fuel ash slag/coked organic matter, some chert and quartz grains
48275	17	magnetic material	Mixed pale, yellowish, brown and red grains of siltstone. Some polished iron oxide grains and some possible fractured spheres. Rare chert
48275	17	?slag sphere	fractured iron oxide sphere
48275	17	magnetic	yellow brown siltstone, polished iron oxide grains, rare charcoal, some fuel ash slag/coked organic matter
48277	13	magnetic	pale assemblage dominated by brown siltstone. Some polished iron oxide grains. Rare grains of fuel ash slag and coked organic material. Some charcoal
48277	13	hammer scale	two iron oxide spheres
48277	13	magnetic material	mainly yellow/brown/red siltstone, a few pieces of chert and iron oxide grains, contains a few pieces of fuel ash slag/coked organic material
48278	14	slag spheres	three spheres of iron oxides
48278	14	magnetic material	rock grains, assemblage of pale, clay-coated grains, mainly dark iron oxide with lesser brown siltstone
48278	14	clinker	eleven fragments of coked organic material
48278	14	hammer scale	single iron oxide sphere
48278	14	magnetic material	rock grains, assemblage of pale, clay-coated grains, mainly siltstone with dark iron oxide and some fuel ash slag
48279	15	magnetic residue	yellow brown siltstone, polished iron oxide grains, moderately abundant charcoal (including one cereal grain), some fuel ash slag, some coked organic matter
48643	20	clinker	five small fragments of coked organic matter

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