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Evaluation of archaeometallurgical residues from Andoversford Sewage Treatment Works, Glos. HER 12199

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Abstract

A small assemblage of 16 pieces weighing 850g was presented for assessment.

The material from stratified RB contexts included one small scrap of corroded iron and one slightly incomplete smithing hearth cake from blacksmithing.

Most of the material was from post-Roman deposits. With the exception of one small fragment of probably residual dense iron slag (perhaps a fragment of smithing slag), the assemblage was dominated by pieces of a glassy clinker or slag. Much of this was rather variegated from the partial melting of included shale fragments, but some was very dark, even textured and obsidian-like. Much of this clinker had a surface colour that was a reddish brown, rather than the maroon that is typical of a simple clinker (i.e. a partially melted inorganic residue from the burning of coal). One of the largest pieces bore small spheroidal droplets of iron. It is likely, but not certain, that these clinkery slags are residues from an iron foundry and are hence likely to be later post-medieval in date.

Contents

Methods

All materials were examined visually with a low-powered binocular microscope where required. As an evaluation, the materials were not subjected to any high-magnification optical inspection, not to any form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional. The summary catalogue of examined material is given in Table 1.

This project was undertaken for Gloucestershire County Council Archaeology Service.

Results

Smithing residues
A single example of a smithing hearth cake (SHC) was recovered from context 167. The cake was small (although slightly incomplete), but dense. It contained a prominent fuel particle, apparently charcoal. At 164g (even bearing in mind the incompleteness) this cake is entirely typical of residues from Roman-British smithing. The piece has a small quantity of flake hammerscale adhering to its surface.

A small fragment of somewhat similar slag was recovered from context 60.

Iron
A small fragment of corroded and disintegrating ion was found in context 162. The piece is too corroded to determine whether it is part of an artefact or smithing waste.

Clinker
The majority of the materials recovered (from contexts 2, 60 and 88) were of clinker. They were very varied in colour, but typically with a dark glass containing

inclusions of paler, often more strongly vesicular glass and of grey shale. The most dense glasses varied from a black, translucent, almost obsidian-like material, through to pale, dense, more opaque material. The largest piece of the opaque, pale material bore numerous <2mm spheroids of iron.

The surface of the clinkery materials was also varied. In places it was smooth and either maroon or a tan-reddish brown. In other areas it was more wispy or bubbly, probably representing highly bloated ceramic inclusions (presumably originally coal-shale).

Interpretation

The dominant clinkers were more dense and more homogeneously glassy than typical clinkers from the burning of coal (e.g. in boilers) or from the use of coal in a smithy. The extreme degree of melting of much of the coal shale and other included material suggests that the clinker had been formed in a very high temperature process. In particular, the fragment of obsidian-like glass was indicative of flowage of the melt.

The presence of the small spheroids of iron in one of the larger pieces presents a strong indication that at least part, and possibly all, of this clinker assemblage is actually slag from a cupola furnace. Cupola furnaces were introduced in very late 18th century and continue in use to the present, as a means of remelting cast iron for the production of iron castings in a foundry. The cupola furnace is a shaft furnace in which the fuel (coke) and iron (either fresh pig iron or recycled scrap cast iron) are together. The fuel will form a clinkery slag, which often contains droplets of the metal (e.g. Young 2011, plates A5- A9). The slag can either be tapped from the cupola (particularly if a flux, such as limestone, has been added to enhance slag fluidity in a larger melt), or in most later cupolas, the base of the furnace can be dropped open to allow the slags to fall from the base of the shaft at the end of the melt. The blocky appearance of the larger pieces of the present slag assemblage suggests the latter process, although the obsidian-like piece might be more indicative of a tapped slag.

Small droplets of iron may occur in smithing slags, but the clinkers from coal-fuelled smithing are never as dense or massive as the current examples and the droplets are usually microscopic.

Foundry waste, along with other classes of residue, were often transported large distances in the 19th century as aggregate for railway track beds and other similar purposes, so the occurrence of foundry residues does not necessarily depend on the presence of a nearby foundry.

The single slag cake stratified in deposits interpreted as Roman-British is entirely compatible with known RB smithing residues. Smithing was a common activity on most sites of any significant size during that period.

Evaluation of potential

The smithing slag would be unlikely to yield further useful information through additional analysis.

The occurrence of probable foundry slags is somewhat unexpected in this context and further work could be done to confirm this identification (although it is reasonably certain), should this be of concern. Unless there are compelling archaeological reasons to investigate this material further, additional analysis is not recommended.

References

YOUNG, T.P . 2011. Archaeometallurgical residues and associated materials from the M74 Completion, Glasgow. *GeoArch Report 2010/22*, 274 pp.

Table 1. Summary catalogue of residues

Area	Trench	Context	Weight	Notes
A		2	138	variable greenish to dark vesicular glassy clinker, with highly vesicular pale clasts and some grey shale clasts. Highly convoluted maroon surface.
F		60	24	grey resinous clinker, highly vesicular with some shale clasts and red-brown surface
			34	grey resinous glassy clinker, passing into highly convoluted surface with a tan-brown colour
			4	rounded and dimpled fragment of the surface of a grey glassy material, probably clinker, with abundant pale clasts
			8	variable clinker ranging from even dark slag, through pale patches, to rather unaltered shale clast. Surface has wispy/bubbly texture, either in maroon or yellow-brown glass.
			4	angular fragment of flow banded dark obsidian-like glass with small vesicles
			4	dark glassy clinker with pale inclusions - one seen to be bloated shale, and with maroon blebby surface
			8	mainly pale, but variegated glassy clinker, vesicular
			2	fragment of dense dark (but some pale patches) glassy clinker, shale fragments ,and blebby maroon surface
			6	small (20x20x7mm) fragment of dense dark iron slag
F	T3	88	232	very dense clinker - mainly very hard, dense and siliceous. Bears small (<2mm) magnetic spheroidal droplets, apparently of iron. Surface is smooth and has brown/tan colour on three faces.
			182	piece of highly variable glassy clinker - mainly rather dense and pale, c. 40mm thick.
			28	mainly green to pale vesicular glassy clinker, surface mainly tan, some unaltered shale clasts
			4	variable dark obsidian-like glassy clinker with greener patches. Surface very convoluted and maroon.
M	T6	162	4	corroded iron fragment
M	T3	167	164	incomplete small dense SHC, 70x60mm and 30mm thick. Top dense and slightly dished, lower face rather blebby and irregular. One weathered fuel clast is probably calcified charcoal. Outer surface is accreted - and includes some adhering flake hammerscale.

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