# GeoArch

Report 2011/29

# Evaluation of possible archaeometallurgical residues from Bourton Business Park (34301/35138)

Dr Tim Young
8th July 2011

# Evaluation of possible archaeometallurgical residues from Bourton Business Park (34301/35138)

**Dr T.P. Young**

## Abstract

*The submitted collection represents a very sparse level of possible pyrotechnological residues (just 165g from approximately 1.5 ha of excavation). Three pieces were of coked organic matter and two were residues from the working of copper alloy, but the assemblage was dominated by various forms of porous, partially-vitrified, ceramic material of uncertain, but probably mainly not of metallurgical, origin. These materials are probably best considered as bloated ceramic materials, although there is a fine distinction between such material and that which might be termed a fuel ash slag. Whatever terminology is employed, these 'slags' are likely to represent the vitrification of materials with organic inclusions in a silt or clay matrix, such as daub or simply topsoil.*

*Four pieces were more clearly indicative of high temperature metallurgical activity: the upper fill of the sunken-featured building (2422) contained one piece of clay wall and one piece of stone that had been fired to a high temperature, probably in a metallurgical hearth, the fill of adjacent SFB (2561) produced a small fragment of probable hearth lining contaminated by drops of copper alloy, finally a small prill of copper alloy was found in an Iron Age posthole (3063) 20m south of SFB (2561). In addition to these pieces, five tiny scraps of reduced fired clay with a smooth external surface, from an Iron Age posthole (3279) might represent sherds from a small crucible.*

*Given the evidence from elsewhere on the site for the casting of copper alloy objects in the Bronze Age, it is quite likely that these scattered occurrences of metallurgical debris represent residual material.*

## Methods

All materials were examined visually with a low-powered binocular microscope. 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.

This project was undertaken for Gloucestershire County Council Archaeology Service.

## Results

*Material of metallurgical origin*

Material clearly of metallurgical origin included a tiny blebby prill of copper alloy from context (3086) and a small fragment of ceramic, probably hearth lining, contaminated by copper alloy from context (2562). Two further probable pieces associated with high temperature activity came from context (2423), including a small fragment of vitrified ceramic (hearth lining) and a dense vesicular piece, probably vitrified stone, rather than a metallurgical slag.

*Pieces of possible metallurgical origin*

Five tiny sherds of reduced-fired ceramic, including some with quite tight external curvature, a smooth external surface and in one case a slag inclusion, from context (3280), the fill of an Iron Age posthole, are likely to be fragments of a single original piece that may have been a crucible. The fragments are too small to be certain. There is no visible internal residue and no clear glassy vitrification, but the curvature shown by the pieces is suggestive of a vessel of the size of a small crucible.

*Material unlikely to be of metallurgical origin*

Much of the rest of the assemblage comprised vitrified and/or bloated ceramics. The bloating is caused by gas, produced during the heating of the material, being unable to escape. This gas may produced by rapid loss of water, carbon dioxide from breakdown of calcite or carbon dioxide/monoxide from the burning of included organic matter. Bloated ceramics are gradational with the fuel ash slags, in which melting of the ceramic material has been facilitated by the fluxing effect of alkalis from the wood ash of the fire. These various reactions mean that quite substantial alteration of the texture of a ceramic material (clay, daub, soil...) may be possible at relatively low temperature.

Such materials are not typical of the residues produced during ironworking, because the iron tends to contaminate the hearth and lead to the generation of true metallurgical slags. With the melting of non-

ferrous metals in crucibles, such materials may be generated, and may not show contamination by the metal if it was handled carefully. However, most such bloated clays and fuel ash slags will be the product of domestic hearths, cereal driers and other non-metallurgical processes.

Three of the items submitted (from contexts 2166, 2225 and 2752) were coked organic residues. Organic materials that have been heated so strongly that they melt, rather than simply burning, are extremely difficult to differentiate. The piece from context (2166) is very finely vesicular, as is the case with coke formed from coal; it is possible, though by no means certain, that this piece is intrusive. The piece from (2752) shows small fragments of probable wood charcoal which suggest its origin. The third piece, from (2225) is apparently formed from discrete tubular particles – possibly carbonised straw or reeds.

## Evaluation of potential

The very low level of occurrence of material indicative of metallurgical processes suggests that this material may be residual. There is strong evidence for the casting of copper alloys on the site during the Bronze Age. Despite the occurrences of metallurgical residues being at some distance from the context yielding the sword mould fragments (pit [2555]), and their stratification in Iron Age and Anglo-Saxon features, a Bronze Age origin for these materials is possible.

These materials are in such small quantities that there is little potential for furthering understanding though any additional analysis.

Although the precise origin of the bloated ceramics/fuel ash slags is uncertain, there is little potential for significant additional understanding through the analysis of the present small assemblage.

It is recommended that the scrap of burnt organic material from (2225) is considered for examination by a botanist – for such material, with aligned stems, might be a fragment of burnt thatch or floor covering.

*Table 1: summary catalogue*

| context | context note | no | wt | description |
|---|---|---|---|---|
| 2166 | E-MIA fill of pit 2165 | 1 | 1.82 | coked organic material |
| 2168 | fill of E-MIA pit 2167 | 12 | 37.56 | 10 pieces very unusual finely vesicular fuel ash slag, variable pale grey to orange - occurs in rounded masses to 30mm, perhaps with more reduced and porous centre, each formed of small (2-3mm) rounded pellets and fragments (+ debris); 2 pieces of denser, reduced fired silty clay with impressions of organic temper (quite large rounded-sectioned – grass?), clay has a slightly pelletal texture. |
| 2225 | fill of AS pit 2224 | 8 | 8.57 | fragments of highly vitrified organic material - possibly straw or reeds (refer to botanist) |
| 2423 | upper fill of AS SFB2422 | 1 | 9.48 | vesicular pale grey slag attached to red sandy lining - probably a piece of hearth wall |
| | | 1 | 68 | dense slagged material. Extremely dense, vesicular at one end but massive and fine-grained at the other. Probably a slagged stone. The vesicular part is slightly dimpled. |
| 2562 | fill of AS SFB2561 | 1 | 7.13 | oxidised fired, silty, ceramic passing forward into grey, bloated, vesicular ceramic, bearing inclusions and a sheets (within a crack) of Cu-alloy material. Somewhat resembles heating tray material, but could be hearth wall/floor. |
| 2752 | fill of undated p/h 2751 | 1 | 0.27 | highly vitrified and vesicular organic matter, some fibrous inclusions resemble wood charcoal |
| 2857 | fill of E-MIA pit 2856 | 1 | 11.5 | fragment of fossiliferous oxidised ironstone |
| 2859 | fill of E-MIA p/h 2858 | 1 | 3.21 | highly boated ceramic/FAS, finely vesicular - varies grey-tawny brown. |
| 2861 | fill of E-MIA pit 2860 | 1 | 5.3 | unusual grey micaceous silty ceramic with blebby texture - hard to know if a reduced fired clay or a natural concretion, probably the latter, but pelletal clays (though less dense) were seen in 2168. |
| 3064 | fill of E-MIA p/h 3063 | 5 | 8.35 | highly bloated, somewhat pelletal ceramic, pale grey with cream vitrified surfaces, appears to have bloated so that individual pellets have curved around elongate organic temp. Fired porous dub? |
| 3086 | fill of E-MIA p/h 3085 | 1 | 0.91 | small descending blebby prill of altered Cu-alloy |
| 3280 | fill of E-MIA p/h 3279 | 5 | 5.99 | small fragments of grey sandy ceramic, smooth exterior, variably bloated, not strongly vitrified, porous, contains an inclusion/intrusion of vesicular dark slag in one piece. These may be crucible fragments. |
| 3510 | undated pit 3509 | 1 | 7.8 | pale grey, apparently slight vitrified sandy clay with inclusions of probable burnt bone |

GeoArch

*geoarchaeological, archaeometallurgical & geophysical investigations*

Unit 6,
Western Industrial Estate,
Caerphilly,
CF83 1BQ

*Office:* 029 20881431
*Mobile:* 07802 413704
*E-Mail:* Tim.Young@GeoArch.co.uk
*Web:* www.GeoArch.co.uk