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Evaluation of archaeometallurgical  
residues from Crickhowell Rd.,  
Trowbridge (CRT05 / CHT06)

# Evaluation of archaeometallurgical residues from Crickhowell Rd., Trowbridge (CRT05 / CHT06)

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## Abstract

*The submitted material was almost entirely residues from the working of iron (smithing) in a coal-fired forge. Material from the enclosure ditches mainly comprised macroscopic slags, whereas the material from the internal features was dominantly microscopic residues.*

*The material was mainly contained in deposits assigned to phase 2c, although deposits of phases 2a, 2b and 2d also produced very small quantities of slag.*

*Only two items were suggestive of iron smelting: a possible smelting slag fragment from c2125 and a piece of iron ore from c3180 (Phase 2d). The ore was probably originally a goethite ore partially altered to haematite by roasting, and resembles ores from the Forest of Dean.*

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## Methods

All materials were examined visually with a low powered binocular microscope. Macroscopic slag pieces were individually weighed, described and recorded to a database. Assemblages of microresidues were given a summary description and weighed in bulk.

The conclusions reached in this report are therefore limited by the nature of the evaluation inspection. No chemical analysis or high-powered microscope work is attempted during an evaluation.

## Results

### Microresidues

Microresidues from pits 3204, 3222, 3225, 3242, 3245, 3275, 3276 all comprise good assemblages of hammerscale. The hammerscale is dominated by rather fine flake hammerscale, but some spheroidal hammerscale is present throughout. Some assemblages show the presence of macroscopic flats, which resemble flake hammerscale but are thicker, and which represent the shedding of thin slag films from the surface of the workpiece or tools.

The ferruginous microresidues are always accompanied by residues from the burning of coal and of fine coal debris.

In several contexts ferricrete has developed. This post-depositional cementation of the sediment by iron oxides may be natural in part, but probably demonstrates the mobility of within the sediment of iron derived from decomposition of both metal and slag material in the metallurgical deposits. In almost all cases the ferricretes were rich in hammerscale, coal, and fine slag debris.

## Macroscopic Slags

The macroscopic slag assemblage is frequently obscured by ferricrete. In general the material is dominated by rather amorphous slag lumps, but one certain smithing hearth cake (weighing 144g) and two less certain ones (240g and one encrusted in ferricrete at 290g) provide good evidence for smithing.

Assemblages with high proportion of amorphous hearth slag lumps are often associated with the use of coal (since the impurities in the coal provide an additional source of silicate material besides the normal source of melting of the blowing wall or tuyère).

In general the residues from within the enclosure only contained very small slag fragments, with all the larger slag fragments being recovered from the adjacent ditches.

## Iron Ore

The iron ore (c3180) was a piece derived from a thin ore seam with a stalactitic zone bearing fine-grained oxide stalactites slightly oblique to the overall seam, between rather denser marginal zones. The space between the stalactites was occupied by rather coarse botryoidal overgrowth.

The ore fragment was red, despite having a texture more normally associated with goethite ores, and had a surface broken by numerous shallow cracks. These observations indicate the ore had been roasted, a usual procedure prior to smelting.

## Distribution

Most of the macroscopic slag material was derived from the enclosure ditches. This is common feature on early forge sites, where the easily moved slags are dumped away from the forge itself and in the immediate area of the ironworking activity the main finds are of microresidues.

At Trowbridge the fines were recovered from a posthole (3202), 11 pits (3204, 3222, 3225, 3227, 3233, 3242, 3245, 3265, 3275, 3276, 3277) and a gully (3289). The plan of these features suggests that detailed investigation might be able to glean more information about the layout of the smithy and the purpose of these various features.

Surprisingly little evidence seems to have obtained which might relate to a structure enclosing the forge, and it is extremely unlikely that a well-used forge such as this would have been in the open-air.

## Interpretation

The assemblage provides remarkably coherent evidence for the smithing of iron using coal. Romano-British smithing employing iron is well-attested in the area, including examples at Caerwent (Young 2006) and Bulmore (Young 1999). Coal has not been observed in smithing slags examined by the author from the iron production centres at Caergwanaf, Cardiff or Usk, and it appears likely that coal was unsuitable for bloomsmithing. At Trowbridge the small size of the few examples of probable smithing hearth cakes (SHCs) supports the interpretation that this site was engaged with blacksmithing rather than bloomsmithing.

The assemblage does not provide detailed information on the type of work being undertaken, but the small size of both the SHCs and the small size of the flake hammerscale both suggest light blacksmithing.

Roman iron-working is known from sites at Rhymney Great Wharf, although the details remain obscure in the lack of published descriptions of in-situ slags. The residual slags on the modern beach, to which a Romano-British age has been ascribed, may be associated with iron production, although they remain undescribed.

The single piece of roasted ore from Phase 2d and a possible tiny piece of iron smelting slag from Phase 2a provide slight lines of evidence for iron smelting in the general area, but there was no evidence that this was undertaken within the excavated site.

The iron ore has a texture common in iron ores from the Forest of Dean and rather less common in the Glamorgan sector of the Bristol Channel Orefield. If indeed the ore is from the Forest of Dean it would be the farthest west occurrence of Dean ore recognised from the Romano-British period. Evidence to date suggests that the extensive Roman iron smelting in Cardiff employed Glamorgan ores (Thomas 2000).

## Evaluation of potential

Although the general interpretation of this material as coal-fuelled blacksmithing residues is unlikely to be enhanced by additional investigation, the assemblage has potential for provision of further information in several areas:

1. The origin of the roasted iron ore fragment would provide information on the sources of ore employed in the iron smelting which appears to have been undertaken on the Gwent levels in the Romano-British period (Allen and Fulford 1986). Detailed examination of textures and chemical analysis should provide suitable provenancing evidence.
2. The origin of the coal employed on the site would be a very useful addition to current understanding of the exploitation of coal in the Romano-British period. A few coal assemblages have been studied in this way, but the database remains very small. The amount of coal present in the collections is very small, but should be sufficient for a provenancing study.
3. In general the chemical reactions involved in the production of smithing residues is poorly known, and the closely associated micro-residue assemblage from the interior of the enclosure and the macroscopic slags from the enclosure ditches would be capable of producing a small set of analytical data (chemical and textural) which would enhance current understanding.

Further work should also be undertaken in order to attempt to resolve the nature of the individual features within the metalworking complex. Such work should include collaborative discussion on the detailed stratigraphic and morphological evidence for the usage of each pit.

## References

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- Thomas, G.R. 2000. *A chemical and mineralogical investigation of bloomery iron-making in the Bristol Channel Orefield, UK*. Unpublished PhD Thesis, Cardiff
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| <i>context</i> | <i>sample</i> | <i>label</i>              | <i>weight</i> | <i>description</i>                                                                                                                                                                                                                                      | <i>context notes</i>   | <i>phase</i> |
|----------------|---------------|---------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------|
| 2105           | 3             | slag                      | 0.5           | mainly coal and burnt coal residue                                                                                                                                                                                                                      | not known              | ?            |
| 2107           | 4             | slag                      | 9             | rusty iron pan material with tubular concretion                                                                                                                                                                                                         | not known              | ?            |
| 2113           |               | slag                      | 46            | 2 dimpled blebs of slag - no fuel inclusions                                                                                                                                                                                                            | not known              | ?            |
| 2125           |               | slag                      | 38            | dense well flowed lobate slag, worn, could be a smelting slag                                                                                                                                                                                           | not known              | ?            |
| 2126           | 5             | slag                      | 0.5           | mainly coal and burnt coal residue, some ?charcoal                                                                                                                                                                                                      | not known              | ?            |
| 2127           | 6             | choke                     |               | burnt stone, clinker, slag                                                                                                                                                                                                                              | not known              | ?            |
| 3030           | 1             | magnetic material         | <             | tiny scraps of ?flake                                                                                                                                                                                                                                   | 2nd fill of ditch 3028 | 2b           |
| 3033           |               | slag                      | 150           | 1 large slag lump, 3 small, 1 piece of ferricrete. Largest, 118g, is irregular broken piece, but has one smooth blown surface suggesting top of SHC, with angled lower part suggesting it was moderately sized                                          | 2nd fill of ditch 3031 | 2c           |
| 3033           | 2             | fired clay                | 96            | 14 pieces of granular ferricrete poor in archaeometallurgical residues                                                                                                                                                                                  | 2nd fill of ditch 3031 | 2c           |
| 3033           | 2             | magnetic material         | <             | burnt stone and 1 flake                                                                                                                                                                                                                                 | 2nd fill of ditch 3031 | 2c           |
| 3053           |               | slag                      | 82            | dense slag rich in shale fragments, in 3 pieces                                                                                                                                                                                                         | 5th fill of ditch 3052 | 2a           |
| 3054           |               | slag                      | 76            | 3 pieces of fired lining and 7 pieces of lining slag including fused gravelly material                                                                                                                                                                  | fill of ditch 3063     | 2c           |
| 3054           |               | slag                      | 44            | lining- or shale-rich slag nub                                                                                                                                                                                                                          | fill of ditch 3063     | 2c           |
| 3082           |               | slag                      | 6             | dimpled slag with coke in ferricrete                                                                                                                                                                                                                    | 3rd fill of ditch 3052 | 2a           |
| 3088           |               | slag                      | 22            | dimpled slag with coke in ferricrete                                                                                                                                                                                                                    | fill of ditch 3087     | 2a           |
| 3126           |               | slag                      | 440           | amorphous block of very charcoal-rich slag, porous                                                                                                                                                                                                      | fill of ditch 3125     | 2c           |
| 3146           |               | slag                      | 1.39          | reduced-fired vitrified clay with strongly curved surface                                                                                                                                                                                               | Fill of ditch 3145     | 2a           |
| 3171           |               | slag                      | 232           | small dense irregular SHC                                                                                                                                                                                                                               | fill of ditch 3233     | 2c           |
| 3171           |               | slag                      | 1             | shale-rich clinker                                                                                                                                                                                                                                      | fill of ditch 3233     | 2c           |
| 3180           |               | slag                      | 130           | rounded lump of reddish goethite iron ore broken into 4. Shows internal evidence for short stalactitic zone in centre with gaps between stalactite filled by botryoidal material, surface shows cracking and is slightly magnetic - so has been roasted | fill of ditch 3179     | 2d           |
| 3186           |               | slag                      | 204           | 2 pieces of slag, larger (144g) is small SHC with burr area and accretion                                                                                                                                                                               | 2nd fill of ditch 3184 | 2d           |
| 3203           | 5             | hammerscale               | 1004          | very rich smithing fines assemblage - flake, spheres, flats, slag                                                                                                                                                                                       | fill of posthole 3202? | 2c           |
| 3203           | 5             | slag                      | 38            | many small pieces, some slag but mainly coal                                                                                                                                                                                                            | fill of posthole 3202? | 2c           |
| 3205           | 6             | metal residue             | 17            | good hammerscale assemblage                                                                                                                                                                                                                             | Fill of pit 3204       | 2c           |
| 3223           | 9             | magnetic material         |               | rusty material                                                                                                                                                                                                                                          | Fill of pit 3222       | 2c           |
| 3226           | 7             | magnetic material         | 7             | good hammerscale assemblage                                                                                                                                                                                                                             | Fill of pit 3225       | 2c           |
| 3226           | 7             | hammerscale               | 0.5           | big flake hammerscale pieces and large spheroids                                                                                                                                                                                                        | Fill of pit 3225       | 2c           |
| 3228           | 8             | fired clay                | 234           | 35 -pieces of gravelly ferricrete                                                                                                                                                                                                                       | fill of pit 3227       | 2c           |
| 3228           | 8             | magnetic material         | 6             | good hammerscale assemblage                                                                                                                                                                                                                             | fill of pit 3227       | 2c           |
| 3230           | 12            | hammerscale               | 1             | big flake hammerscale pieces and large spheroids                                                                                                                                                                                                        | Fill of pit 3222       | 2c           |
| 3230           | 12            | magnetic material         | 4             | good hammerscale assemblage                                                                                                                                                                                                                             | Fill of pit 3222       | 2c           |
| 3231           | 22            | fired clay                | 348           | 25 pieces of gravelly ferricrete                                                                                                                                                                                                                        | fill of pit 3265       | 2c           |
| 3231           | 22            | magnetic material         | <             | small hammerscale assemblage                                                                                                                                                                                                                            | Fill of pit 3265       | 2c           |
| 3236           | 10            | hammerscale 0.5 - 11.2 mm | 204           | mainly slag and coal debris, but some coarse flake hammerscale and slag                                                                                                                                                                                 | fill of posthole 3202  | 2c           |
| 3241           | 13            | fired clay                | 28            | 45 small ferricrete pieces                                                                                                                                                                                                                              | fill of pit 3225       | 2c           |

| <i>context</i> | <i>sample</i> | <i>label</i>      | <i>weight</i> | <i>description</i>                                                                                                                                                                                 | <i>context notes</i>   | <i>phase</i> |
|----------------|---------------|-------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------|
| 3241           | 13            | magnetic material | 2             | good hammerscale assemblage                                                                                                                                                                        | fill of pit 3225       | 2c           |
| 3244           | 15            | fired clay        | 416           | c30 pieces of smithing pan. Only 1 tiny certain piece of slag                                                                                                                                      | 2nd fill of pit 3242   | 2c           |
| 3244           | 15            | magnetic material | 14            | good hammerscale assemblage                                                                                                                                                                        | 2nd fill of pit 3242   | 2c           |
| 3247           | 14            | fired clay        | 1625          | c40 pieces of slag and 4 pieces of lining in ferricrete. 290g and 252g two largest pieces. All smithing slag debris probably, with 290g piece roughly plano-convex. Ferricrete rich in hammerscale | first fill of pit 3245 | 2c           |
| 3247           | 14            | slag              | 54            | 26 slag pieces, mainly broken debris but also 2 irregular large spheroids                                                                                                                          | first fill of pit 3245 | 2c           |
| 3247           | 14            | magnetic material | 23            | good hammerscale assemblage                                                                                                                                                                        | first fill of pit 3245 | 2c           |
| 3251           | 16            | fired clay        | 206           | c 60 pieces of gravelly ferricrete                                                                                                                                                                 | fill of pit 3228       | 2c           |
| 3251           | 16            | magnetic material | 1             | good hammerscale assemblage                                                                                                                                                                        | fill of pit 3228       | 2c           |
| 3256           | 17            | fired clay        | 626           | 39 pieces of ferricrete mainly cored on slag, 1 lining fragment                                                                                                                                    | 2nd fill of pit 3245   | 2c           |
| 3256           | 17            | slag/coal 1-2mm   | 47            | coal and fired clay mainly - some slag including spheroidal scale                                                                                                                                  | 2nd fill of pit 3245   | 2c           |
| 3256           | 17            | magnetic material | 22            | good hammerscale assemblage                                                                                                                                                                        | 2nd fill of pit 3245   | 2c           |
| 3256           | 17            | hammerscale       | 0.5           | slag charcoal spheroids                                                                                                                                                                            | 2nd fill of pit 3245   | 2c           |
| 3256           | 17            | slag              | 72            | many tiny pieces of slag, coal and ferricrete fines (also burnt bone and stone)                                                                                                                    | 2nd fill of pit 3245   | 2c           |
| 3259           | 19            | fired clay        | 52            | 24 small ferricrete fragments and 4 small pieces of slag                                                                                                                                           | fill of pit 3276       | 2c           |
| 3259           | 19            | magnetic material | 9             | good hammerscale assemblage                                                                                                                                                                        | fill of pit 3276       | 2c           |
| 3260           | 18            | fired clay        | 204           | c 60 pieces of gravelly ferricrete                                                                                                                                                                 | 1st fill of pit 3245   | 2c           |
| 3260           | 18            | magnetic material | 5             | good hammerscale assemblage                                                                                                                                                                        | 1st fill of pit 3245   | 2c           |
| 3264           | 21            | slag              | 12            | 7 small slag pieces, largest has coke                                                                                                                                                              | fill of pit 3275       | 2c           |
| 3264           | 21            | fired clay        | 8             | 12 small ferricrete pieces                                                                                                                                                                         | fill of pit 3275       | 2c           |
| 3264           | 21            | magnetic material | 12            | good hammerscale assemblage                                                                                                                                                                        | fill of pit 3275       | 2c           |
| 3266           | 24            | magnetic material | 21            | good hammerscale assemblage                                                                                                                                                                        | 2nd fill of pit 3242   | 2c           |
| 3268           | 26            | fired clay        | 518           | c 50 pieces of smithing pan, 2 pieces of ferricrete on slag and 2 pieces of ferricrete on corroded iron                                                                                            | fill of pit 3275       | 2c           |
| 3268           | 26            | slag              | 10            | 8 small slag fragments and 11 sub-spheroidal drips                                                                                                                                                 | fill of pit 3275       | 2c           |
| 3268           | 26            | magnetic material | 25            | good hammerscale assemblage                                                                                                                                                                        | fill of pit 3275       | 2c           |
| 3278           | 23            | hammerscale       | 870           | v rich smithing fines assemblage - flake, spheres, flats, slag                                                                                                                                     | fill of pit 3277       | 2c           |
| 3278           | 23            | slag              | 0.5           | coal and slag fines                                                                                                                                                                                | fill of pit 3277       | 2c           |
| 3290           |               | slag              | 460           | 4 pieces of slag, some dense, particularly the largest a 240g somewhat pillulous amorphous irregular nub                                                                                           | fill of gully 3289     | 2c           |

Table 1. Summary catalogue of archaeometallurgical residues structured by bag

# GeoArch



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