# Metallurgical residues and structures from an evaluation at Llynfi Ironworks, Maesteg

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## Abstract

*Materials sampled during the evaluation fall into two groups.*

*In material from the earlier group there is evidence for iron smelting, with a casting floor sand deposit in trench 3 and a dump of hot-blast blast furnace slag in trench 1.*

*These earlier features are then covered with a dark deposit, now hard and concreted, containing a higher proportion of residues from secondary puddling and forge processes. Particularly noteworthy is the deposit in context 305 of abundant sub-mm scale slag spheres (spheroidal hammerscale), which are probably the spatter from a power hammer. These deposits indicate that the evaluated area was more influenced by the secondary processing than the primary smelting of iron at this period, possibly indicating abandonment of the northern furnaces during the later history of the ironworks.*

## Contents



## Background

The metallurgical residues discussed in this report were sampled during BaRAS' evaluation on the site of the former Llynfi Ironworks, Maesteg in December 2004 (Trenches 1 and 3).

In the context of the nature of this particular evaluation, it was considered most appropriate to discuss on-site the significance of materials, deposits and structures with the field staff. Only a very limited amount of significant stratified deposits were dug, therefore there is only very limited reporting on the metallurgical residues retrieved.

The descriptions are limited to visual observations. No petrographic, analytical or sieved grain size analysis has been undertaken.

## Description

### Context 305

Hard, dark, heterogeneous, concretionary layer. The fine matrix contains a large amount of sand, broadly comparable with that present in 310/311, but containing a large admixture of other materials. These include small pieces of coke, coal and shale, together with larger pieces (up to several 10s of mm) of slag. The slag clasts are dominantly of dark, almost black, vesicular glass, but also include rarer pieces of dense fayalitic slag. The deposit is cemented by large amounts of iron oxides, indicating a large availability of iron in the deposit, most likely from corrosion of metallic iron.

Most significantly, the finer grained parts of the deposit contain a large proportion of slag spheres (spheroidal hammerscale) as shown in Figure 1. These spheres are mostly in the range of 100-600μm in diameter, with a hard, shiny exterior This material is most likely to represent spatter produced by a power-hammer (probably during the production of wrought iron from puddled blooms).

### Context 306

Hard dark, heterogeneous, concretionary layer. The sampled material was rather more sand-rich than the material from 305, with the sample from 306 apparently lacking the spheroidal hammerscale. Given the heterogeneity of the deposit and the small sample size, the significance of the difference is unknown. The material was rather variable cemented, with some pockets of very poorly indurated material. The material was seen to be particularly well-cemented adjacent to fragments of scrap wrought iron, including both rod up to about 40mm diameter and bar of about 40mm width.

The slag inclusions within the sandy matrix include the same dark vesicular glass as in 305, but also contain some pieces of paler glassy slag, probably blast furnace slag.

### Context 311

Yellow-brown concretionary layer of sand, dominantly in the very fine sand class (but rarely up to about 600μm, particularly in small angular chips of chert/flint), well-cemented by iron oxides. The material contains some small clasts of other materials, particularly coke, especially near the top. This material is essentially the same as 310 but having undergone post-depositional cementation

### Context 310

Unconsolidated very fine sand. Grains with moderate to good sorting and with shapes varying from sub-rounded to well-rounded. Grains dominantly quartz (>95%). Some small localised patches of partial cementation occur.

### Context 106

A highly heterogeneous mix of metallurgical residues and demolition material. Sampling was restricted to a few more unusual clasts, including a 17mm diameter section of wrought iron rod, a piece of probably only partly reacted iron ore and some dense iron oxide-rich slags.

### Context 108

Unconsolidated and uncemented loose accumulation of blast furnace slags. The slags vary from a pale/mid grey crystalline material, through to dark, usually greenish glass. Rare patches of bright blue glass are seen in some specimens. The texture and colour of this material would indicate that it is hot-blast slag.

## Discussion

The metallurgical residues recovered, together with those observed in-situ, suggest a broadly two-fold division of deposits. The earlier deposits are almost entirely from iron smelting, whereas the younger deposits have a dominant input from the secondary processes of puddling and forging.

The major deposit seen in context 108 suggests that a large body of blast furnace slags may underlie that part of the site. It may be significant for the development of the site that these slags are loose and uncemented with a high bulk porosity. Cranstone has suggested that the stratified slag dump may preserve a history of changing blast furnace technology, but it is not possible to indicate where within that story the present material lies. The close proximity of trench 1 to the blast furnaces, and the location of the trench in front of the northern furnaces may suggest that these slags are likely to be relatively early within the site development.

Also presumably early in the site history is the structure seen in trench 1, where context 310 (and its secondarily cemented top, 311) is likely to represent the base of the casting sand, within a casting house. This is located in the “gap” between the northern two furnaces (Nos. 3 and 4), but apparently associated with the northernmost furnace (because it lies to the north of the “partition”). This association is strengthened by the apparent skew seen on the line of the dam on the northernmost furnace in trench 5.

Both the casting floor material in trench 3 and the unconsolidated blast furnace slags in trench 1 are overlain by an extremely hard, cemented, dark sandy layer (305, 306). The residues from this are mixed, but bear significantly more material associated with the secondary processes than the earlier deposits. This includes small fragments of dense slag, likely to be from puddling hearths, but particularly the large amount of spheroidal spatter in context 305. Whether that spatter arrived in the deposit directly, or by some secondary process of redeposition, cannot be determined on the present material. This concretionary dark layer is therefore likely to represent usage of the site, not demolition, but under a very different organisation than in the earlier period. The evidence is compatible with the layout seen on the 1875OS, by which time the northern furnaces do not appear to have a casting house. The investigated area appears as open ground between the northern blast furnaces (possibly not then in blast) and the processing sheds, possibly partially covered by an open sided building, and crossed by several tramways.

## Figure Caption

Figure 1. Photomicrograph of an area of approximately 8mm x 11mm of a sample of concretionary material from context 305. The photograph shows the abundance of spheroidal hammerscale.