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Evaluation of archaeometallurgical
residues from Parc Cybi, Holyhead
(GAT project No. 1701)

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Abstract

The submitted samples include a variety of archaeometallurgical materials, including approximately 3.6kg of identifiable smithing hearth cakes (SHCs), 1.5 kg of iron slag probably from smithing, 4.9kg of hammerscale and other smithing microresidues and 0.6kg of vitrified hearth lining. Materials that were probably not of metallurgical origin included 16.8kg of fired clay and much of the 0.8kg of 'fuel ash slag' (FAS).

The macroscopic smithing slags and the hammerscale together provide evidence for iron working (blacksmithing) in three distinct locations: in Area E associated with a pit and circular gully, in Area K7 associated with a stone-lined feature, some pits and with residues in the adjacent grave fills and in an area of B2 in which residues occur dispersed in various post-medieval features. The smithing in areas E and K7 was charcoal-fuelled, whereas that in area B2 was mainly coal-fuelled. The occurrences in areas E and K are not dated, but the moderately large size of the SHCs would suggest a Roman or younger date. If the features identified in the field as hearths in areas E and K7 are confirmed, then a post-medieval age would be less likely, since a tradition of late floor-level hearths is not known in Britain (although is common in Ireland). In Area K7 the smith also worked with copper alloy objects. A small quantity of residue is associated with various "Iron Age" roundhouses (e.g. in Area B2), but is not indicative of any particular focus and re-evaluation of the contexts may be required to determine whether these occurrences are in-situ or possibly contamination.

The low density fuel ash slag resembles material produced in long-lived fires, particularly where the hearth is cut into a calcareous substrate. These slags are not indicative of metallurgical activity and the contexts in which such slags have been found on other sites includes corn-drying ovens and long-lived domestic hearths (particularly of Iron Age date).

It is likely that there is no one single origin behind the large quantity of fired clay. The most common type of fired clay was a coarse, dense, silty clay, with abundant gravelly temper and occasionally organic temper, which occurred in blocks often showing a single well finished, smooth, planar face. The opposing surface of the blocks appeared to grade into less well-fired material. This material seems likely to have been employed structurally, possibly as flooring and possibly often within hearths and kilns. This facies of fired clay occurred within many areas of Iron Age occupation.

One source of the fired clay debris will have been the repair and destruction of a variety of low temperature hearths, including domestic hearths, corn dryers and the 'furnace' in the Romano-British roundhouse [80527]. This hearth appeared to have been used at only a rather low temperature and was constructed in an unusual way, with a massive hearth-surround of granite boulders, lined with the clay. There was no evidence for this structure reaching the temperatures required for most metallurgical operations and it is tentatively suggested that it the base of a dyeing apparatus, with the boulders carrying the weight of the dye vat, either of lead, as is normal in Roman dyeing, or of stone like the small bowl found adjacent to the structure. Another source of fired clay debris is suggested by the large rounded fired clay artefact from Roundhouse E, which is tentatively suggested to have been a very large loom weight.

In summary the residues provide very slight evidence for iron smithing in the Iron Age (but for which no focus has been located), for a variety of low temperature processes in the Roman period, for two smithies of uncertain age (areas E and K7) and for smithing again in the post-medieval period, but without an identified focus (Area B2).

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Methods

All materials were examined by visual inspection and with a low powered binocular microscope. Samples were individually weighed, described and recorded to a database. The summary catalogue is given in Table 1.

As an evaluation, the materials were not subjected to any high-magnification optical inspection, nor to any form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

Results

Description of Residues

Fired clay

Approximately 16.8kg of mainly lightly oxidised-fired clay was recovered from the site. The clay was present in a variety of shapes and sizes from small rounded pebbles to larger more angular chunks.

Although a variety of forms of fired clay were present, the majority of the material is a gravelly fired clay, with a single, well-finished smooth surface. This type occurs widely in the area of the Iron Age roundhouses and also is associated with the Romano-British structures.

Most of this facies appears not to have been noticeably tempered with organic inclusions (although organic inclusions of various types were noted locally), nor does most of it show diagnostic surviving form, beyond larger pieces showing a single. None of this material has been fired to the point of vitrification (unlike the hearth lining described below).

Fragments of fired clay were recovered from all areas within the site in varying quantities, however a number of areas yielded particularly large amounts. In some cases the clay from those different areas shows different properties, suggesting different origins for the various assemblages:

- Approximately 4.8kg were recovered from Iron Age contexts (mainly [92073] [92075] [91321] [91666] [92112]) within area B2 (the passageway). A further 0.5kg was retrieved from area B2-RHB, 1 kg from B2-RHC, 0.5kg from B2-RHD. 0.5kg from F1-Fe, 0.6kg from F1-FE and 0.8kg from area I. 1.8kg was also found in B2-RHE, where the principal occurrence was a broken block of fired clay with a form suggesting that it comprises about 70% of a discoidal body, with a diameter of 200mm and a maximum thickness of about 70mm, a regularly curved cross section with the two sides rather asymmetrically arranged, one reaching 15mm off the plane of maximum diameter and the other 55mm (all measurements made without reassembling the object, and dimensions may vary slightly when it is properly reassembled). The surviving section of the object weighs 1.7kg.

- Approximately 4.8kg of fired clay were recovered from the interior of a Romano-British round house [80527] in the south eastern section of area K9. Much of this material (1.9kg) came from a series of linings and fills [80840] [80866] [80869] of a possible furnace [80839] and a further significant quantity (1.7kg) came from the immediately surrounding areas [81166]

[80843] [8910]. The material from the Romano-British contexts was in general perhaps slightly more dominated by coarse sand inclusions than for the Iron Age material.

Smithing Hearth Cakes (SHC)

SHCs were mainly identified from three areas of the site, with just small fragments found elsewhere:

1. Approximately 3.3kg of fragments of SHC were recovered from post-medieval contexts - area B2 ([90002] & [90036]) and area B2 Laneside ([90323], [90437] & [90501]). Of the 12 SHCs apparently represented by these fragments, at least 4 have flat tops, 3 at least have reddened tops, 3 contained good evidence for the use of coal fuel of which one showed both coal and charcoal and a further cake showed charcoal alone.

These cakes are dense and mainly roughly sub-circular, although there is variation. The recorded weights (or estimated reconstructed weights) of 6 fairly complete SHCs are 175g, 300g, 350g, 595g, 600g and 600g.

2. in area E ([31384] and [31163]) 1.3kg (5 pieces) were associated with deposits with microresidues. One reasonably complete cake (750g) was estimated as roughly 90% of the original – giving an original weight of around 830g. This cake and a second partial cake contained charcoal.

3. area K7 yielded about 8 small SHC fragments totalling approximately 170g from deposits dominated by microresidues. These fragments provide little information on the morphology of the original SHCs.

Apart from these concentrations of material there were single small fragments from B1 [11021], B2-RHC ([91926], Area F1-E [92862] and Area F1 RHG 21g fragment [92633]). These fragments add little to the understanding of the SHC morphology.

Indeterminate iron slag

Approximately 2kg of material has been classified as indeterminate slag, meaning that the process(es) from which it is derived is not certainly identifiable. The majority of this was retrieved from post-medieval contexts and so is very likely to be derived from smithing and may include less diagnostic fragments of SHC and slag which formed within the hearth but outside the main SHC. It may potentially include slag from within the fuel bed, slag from around the blowhole and also lining slags generated from melted ceramic.

Smithing microresidues

The site yielded approximately 4.9kg of smithing microresidues, predominately flake hammerscale, although a moderate quantity of spheroidal hammerscale was also present. Also within these microresidue assemblages are large quantities of slag flats (this slag films from the surface of the workpiece that are distinctly thicker than flake hammerscale), slag blisters (as flats, but with a blister-like morphology) and slag spheroids (larger than spheroidal hammerscale and probably mainly slag droplets from within the fuel bed).

The majority of the micro-residues were recovered from area K7, which was the site of a small early medieval cemetery. Approximately 550g was recovered from the fills of a series of grave cuts [80020, 80043, 80050, 80052, 80063, 80078, 80091 and 80094] within the early medieval cemetery. A further 3.3kg were recovered from the fill [80013] of a partially stone lined feature [80044], with much of this showing secondary cementation into the concretionary material known as “smithing floor”. Such concretionary material is commonly associated with smithy floors (hence the name) where it builds-up around the anvil. It is not however restricted to such an origin, but may form wherever accumulations of smithing debris contain decomposing fragments of iron.

Two further pits in the same area (Pit c80055, fill c80054; pit c80104, fill c80103) produced 0.186kg and 0.537kg of microresidues respectively.

The fill [31153] of a pit [31152] in area E, supposedly of post-medieval age, yielded approximately 650g of hammerscale. This assemblage was again dominated by flake hammerscale and included many pieces cemented into “smithing floor”.

A small assemblage of flake hammerscale and blisters, with a little spheroidal hammerscale and amorphous particles was recovered from post-medieval ditch fill [90036] in area B2.

'Fuel Ash Slags' (FAS)

Approximately 650g of 'FAS' were recovered from two contexts (92622 & 92624) in area F1 RHG. The majority ([92622] 550g) of these were composed of large chunks of highly vesicular, pale grey to pale green material which was brittle and sharp to touch at broken edges. The remainder ([92624] c.100g) was in the form of smaller lumps which were more rounded in appearance and slightly more friable.

Smithing Hearth Lining

Some of the fired clay was much more highly fired than the bulk and had a vitrified, sometimes slagged surface. This material can be identified as vitrified hearth lining –and indeed more specifically almost all the fragments come from the lining immediately adjacent to the blowhole. The impingement of the hotzone of the hearth on the wall around the blowhole results in maximum damage to the hearth wall occurring here, resulting in the need for frequent repair.

One piece (find #2, from c90002; probably of post-medieval date) showed the blowhole to be at least partially surrounded by a “boss” of clay applied to the surface of the hearth wall. This fragment, like several others, showed an abundant organic temper, in contrast to the organic-poor nature of the Iron Age fired clay materials.

Copper alloy residues

The evidence for the working of copper alloy is in the form of three pieces of copper alloy contained within the “smithing floor” concretions from fill [80013] of pit [80044], area K7. One of the copper alloy pieces (missing – just present as a mould in the concretionary material) was a small curved piece of strip, 18x9mm. The other two were tightly folded pieces of tiny copper-

alloy strip. One was badly broken and the other incomplete – but possibly a bifurcated rivet.

The only other possible copper-alloy residue was a small droplet of brownish glassy slag from area K7, deposit [80334] of probable Iron Age date.

Coal residues

Small scraps of coal were found in many contexts, mainly but not entirely of post medieval age. Earlier contexts containing coal may need to be checked, although all coal particles were very small and therefore easily capable of being moved by worm action.

Residues from coal burning include the cindery, porous material left after incomplete combustion, classified here as coke. Organic materials other than coal that have been partially burned may also produce very similar material and some occurrences of coke in pre-Roman horizons may be other burnt organic materials,

The inorganic coal residues that have been heated to melting are termed clinker. These may be produced by non-metallurgical processes (such as in the fireboxes of the boilers of agricultural steam engines) and may therefore be widespread in modern soils. However they also grade through into the residues formed in coal-fuelled smithing hearths. Clinker particles are often grey to black glassy slags, with inclusions of vitrified sandstone and shale, often bleached white, with the dark slag typically having a maroon surface colour.

Miscellaneous materials

Approximately 235g of an obsidian-like material was recovered from areas H (“Neolithic” pit fills c2070, 47g and c2093, 63g) and K1 (medieval corn drying kiln [21052], 125g and posthole [18172], 0,2g). Some of this was seen as an even-texture black glass, but two specimens show evidence for a flow lobed upper surface and several show relict clasts, possibly of quartzite.

Despite the superficial similarity of this black glass with obsidian, the texture of the clast-bearing material is unlike natural obsidian (and the presence of obsidian would be extremely unusual on British sites as there are no known obsidian deposits in the southern UK). This material is therefore interpreted as a slag, but its precise nature is currently uncertain. One possibility to be investigated is that these may be slags generated during lime-burning- this might even imply that the medieval “kiln” could have been for lime-burning rather than corn drying. An alternative interpretation might be that these are post-medieval or modern industrial materials and therefore evidence for contamination of their contexts.

The two pieces from area H were from pits interpreted as Neolithic, which is incompatible with the various possible interpretations of this unusual material.

Pottery was identified in two contexts: 80900, R-B pottery in oxidised fabric with the junction of a strap handle onto the body of a pot, and 19100, reduced fired prehistoric pottery.

Distribution of residues

In **Area B1** Iron Age contexts 14028 and 14038 both yielded very small amounts of coke, with 14038 yielding a small collection of fresh coal too. Prehistoric context 8046 yielded a piece of probable coke. Contexts of unknown age 4001, 5054, 7054 also yielded coke. Context 1044 produced a small fragment of probable clinker as did 13014.

Prehistoric? context 11021 produced a probable part of a smithing hearth cake

In **Area B2** a series of pit fills of post-medieval date produced small quantities of slag and coke, with a large collection of both micro- and macro- smithing residues coming from ditch fill 90036. The plough-soil produced further examples of smithing slags, with evidence for both coal and charcoal as fuel.

B2-LS produced further SHC material from post-medieval contexts, with an assemblage of smithing slags from undated posthole fill c90501.

B2-PW produced a large quantity of oxidised fired clay from Iron Age contexts, including 1 piece of vitrified hearth lining (probably from a smithing hearth) from c90479 (possible demolition debris).

B2-E yielded just tiny quantities of coal residue and hammer scale from post-medieval pit fills (91691, 91657).

RHA produced no significant residues (beyond a couple of spheroids and some possible fuel ash slag) apart from fired clay.

RHB produced no significant residues apart from fired clay.

RHC likewise produced only one significant piece of hearth lining and one piece of iron slag besides a moderate quantity of fired clay.

RHD also yielded just traces of iron-working with some vitrified hearth lining and a very small number of microresidues, but again a moderate quantity of fired clay.

RHE yielded no certain metallurgical residues, but did contain a significant quantity of fired clay which may have been a loom weight.

Area B3 yielded only a few slag spheroids from c3027 and c22156.

Area D3 yielded no significant residues

Area E yielded some ashy material from Neolithic contexts.

Post-medieval pit fill c31153 (1000g), gully c31163 (1152g), ditch c31384 (134g), pit fill c31172 (212g) and undated pit fill c30083 (43g) produced large quantities of smithing residues. The material from the gully c31163 included a moderately large SHC with an original weight of between 800 and 900g. Pit c31152 is likely to have been a smithing hearth or a closely associated pit. None of this supposed post-medieval material contained coal or coal residues.

Area F produced a single tiny slag fragment from a prehistoric context (c92862).

Area F1 – RHG yielded a quantity of fuel ash slags, some in large blocks, from contexts c92612, c92622 and 92624. Context c92633, also prehistoric, yielded a small scrap of iron slag.

F1 – RHH yielded no residues.

Area H. Pit c50400 yielded a small amount of residue from coal burning. Various Neolithic features in the same area produced burnt organic matter. More problematic is the occurrence of lumps of a black glass in c2070 and c2093 which are surely intrusive here.

Area I yielded no metallurgical residues, but a moderate quantity of fired clay.

Area Ia yielded some metallurgical microresidues from c21224 (undated pit), c21216 (2 fragments in Late Neolithic pit – probably intrusive).

Area J yielded some possibly slag and coal in a probable Neolithic pit fill c70182.)

Area J3 yielded no significant residues.

Area K1 produced more of the black glass seen in area H, within the medieval(?) corn drying kiln [21052] (125g) and posthole [18172] (0,2g).

Area K7 produced significant evidence for iron working:

Grave [80043]: tiny amount of flake hammerscale.
 Grave [80050]: tiny amount of slag and spheroids
 Grave [80052]: tiny amount of slag and spheroids
 Grave [80063]: 330g of spheroid rich residues
 Grave [80078]: 346g of residues, mainly spheroid rich
 Grave [80083]: possible clinker fragment
 Grave [80091]: tiny quantity of spheroids
 Grave [80094]: tiny amount of flake and spheroidal hammerscale
 Grave [80020]: spheroids plus some flake in small amounts

Associated pits contained more material, and may include the primary metallurgical features:

Pit [80044] fill [80013]: 3.45 kg mainly microresidues
 Pit [80055] fill [80054]: 0.186kg of microresidues and other debris.
 Pit [80104] fill [80103]: 0.537kg of microresidues with abundant spheroids

In the same area

Pit c80056 fill 80058 nub of fuel ash slag in corn dryer
 Pit c80116 fill 80115 yielded coal burning residues and slag

A piece of SHC was found in 80266 (possible RH wall). A tiny piece of smithing concretion was recovered from posthole 80200 fill 80201.

Area K9 produced no significant residues

Area K9B produced mainly a large quantity of fired clay, 4 occurrences of coke (but all very small) and one tiny piece of indeterminate slag (c81172)

Area L3 produced a single piece of vitrified hearth wall (c22172) and a single spheroid (c22181) – both contexts are provisionally identified as prehistoric.

Area M3 produced no residues.

Area M4 produced coke from several post-medieval contexts and tiny smithing microresidue assemblages from c40001 (undated pit), 40022 (BA ditch), undated pit fill c40118,

Interpretation

The above data show several concentrations of different materials in different areas, but also a low background level of occurrence of archaeometallurgical residues across the site. Such low level occurrences are hard to interpret. Finds of hammerscale in Bronze Age features (e.g., the single spheroid from [40022]) can be reasonably certainly be due to contamination. In particular spheroidal hammerscale is often of just the preferred diameter to be selected by earthworms for lining their aestivation burrows, carrying the particles down from their original stratigraphic occurrence. The spreading of ash on fields may also ensure a wide geographic spread of micro-residues from the original source.

The pyrotechnological residues from Parc Cybi can be resolved into three groups: (1) oxidised fired clay, (2) low density fuel ash slag and (3) smithing residues (macroscopic and microscopic):

Fired clay - As described above, the oxidised fired clays (excluding the certain hearth lining) do not include vitrified material (indicating that the firing temperature was well below that encountered in most metallurgical structures) and do not occur together with any other class of metallurgical residue. This argues strongly against an association of these fired clays with metallurgy.

There are a number of possible origins for the fired clay. Small quantities are clearly the result of *in-situ* burning in hearths (operating at lower temperatures than metallurgical hearths) and the material from the Romano-British round house [80527] in area K9B has a clear association with the 'furnace' [80839] and associated hearth, in part forming a lining to the granite boulders which provide the framework for the "furnace" and with loose material possibly being either the remains of a superstructure, or debris resulting from relining of the structure. The same area also has evidence for other clay-built structures, including corn dryers.

Rather similar material from the Iron Age contexts may also represent the remains hearth or 'furnace' lining and superstructure. The lack of a 'reverse' to this material, perhaps suggests that this clay was applied to produce floors of some kinds too. At least some of the Iron Age fired clay shows carbonaceous residues on the planar surface – perhaps indicating that the floor of hearths was the most usual use of this clay.

Several mentions are made in the stratigraphic summary of clay floors. Such floors might become fired to the grade exhibited by this assemblage when fires occurred upon them – either deliberately or accidentally.

Another possibility is daub, however very few of the fragments (from any context) bear the impressions of wattle to which it would have been attached, and very few contain evidence of significant use of organic temper which is common in daub. Daub is not therefore considered to be a major contributor to the assemblage.

The material from RHE includes what appears to be part of dense fired clay body of discoidal shape, perhaps 200mm in diameter and 70mm thick. Although this might be part of a 'pad' to support a hearth, an alternative explanation is that this object is an artefact – for which the most likely interpretation would be a large loom weight (although large discoidal loom weights are more commonly associated with the Middle Saxon period than the Iron Age).

Discussion of the origin of the fired clays requires discussion of the purpose of the unusual Romano-British 'furnace' in area K9B. The fired clay lining to the so-called 'furnace' [80839] forms a lining to the supporting framework provided by a series of granite boulders. The remaining *in-situ* clay is mainly oxidised fired on the sides, but is barely, if at all, fired and white on the base of the structure. The firing temperature was fairly low, so the term 'furnace' is itself probably misleading and inappropriate. The narrow upright form of the structure is unlike any normal domestic hearth, and the presence of the boulders suggests that they were intended to be load-bearing. The structure might have served some purpose such as support for a water vat. Various possibilities exist in which such a heater might be required, but the most similar structures seem to have been employed for the heating of a dye vat – the weight of such a vat could be carried by the boulders and the temperature of the fire in a reconstruction of a Roman dyeing apparatus was only around 600°C (Hopkins 2007, 2008, 2010; Hopkins *et al.* 2005). The associated stone bowl would also potentially fit into a reconstruction of this fire as part of a dyeing apparatus, although it is probably too small to have been the vat itself, this is not impossible.

The second class of residues, the **low density fuel ash slags**, are not attributable to any particular process with certainty. They are formed through the fluxing actions of the alkali elements, usually derived from the fuel (wood) ash, but also possibly from a calcareous substrate into which a hearth has been cut, allowing the partial melting of the hearth substrate, or of soil material introduced with the fuel. Some of the fuel ash slags recorded in this project (e.g. in Area K7) are associated with smithing hearths, but some recently-described examples of such slags have been associated with corn drying kilns (Young 2005, 2010a), and similar materials have been described as 'Iron Age grey slag' and were possibly generated in continuously-burning cooking hearths.

Materials such as these are commonly (although probably frequently erroneously) described as being fuel ash slag which is one in which the slag is dominated by material derived from the inorganic component of the fuel.

The interpretation of FAS within archaeological sites has long been problematic. Chemical analysis of similar material from other sites has suggested that the dominant elemental input may actually be from material closely related to the local substrate. Analyses indicate that a high content of alkali elements such as potassium and calcium have acted as a flux to permit melting, fusion and sometimes flow of the precursor material at relatively low temperatures (possibly well below 1000°C). These elements may be contributed by wood ash, but are also locally major components of soils.

The intensely vesicular nature of the material is suggestive of significant gas release from the precursor material, rather than just the inclusions of

burning fuel particles. The volatiles most likely to be involved are water (from a wet precursor or more likely from structural water within the minerals) and carbon dioxide (from breakdown of carbonate minerals such as calcite).

Some recent work into similar material has shown that it may be derived from processes such as corn drying (Young 2010), however the FAS from Parc Cybi has no clear association with a corn dryer although the remains of corn drying structures are present on the site.

Similar materials may also be generated during cooking in pits, particularly in situations where the fire is maintained for long periods of time (such as may be the case particularly in some mid- to late- Iron Age settlements).

There is no structural evidence to provide additional support for either of these interpretations here, and the origins of the FAS therefore remain uncertain, although it is extremely unlikely to be of metallurgical origin.

The third group of residues are from true metallurgical activities and include both the **macro- and micro-residues from iron working** (blacksmithing). The evidence from within the Iron Age roundhouses hints at smithing in this period, but the amount of material involved is very small, so contamination might be an issue and review of the context of these finds would be desirable.

Smithing is well attested in area K7, with most residues being recovered from pits, but some also from the adjacent grave fills. Various scenarios of relative dating could be considered here, so review of the grave fills yielding significant residue would be desirable (to ascertain whether contamination is possible – e.g. by sagging), as, of course, is direct radiometric dating of the smithing residues. Review of the pits is also important, in order to determine whether they were smithing hearths, or merely depositories of waste from the smithy. The occurrence of such large amounts of hammerscale in the grave-like pit, and the associated 'smithing floor' concretion would be unlikely within a hearth.

The occurrence of copper-alloy waste in the "smithing floor" concretions is important, and relatively unusual. The occurrence of tiny scraps of folded copper-alloy strip is suggestive of the bifurcated rivets commonly used in the construction and repair of sheet metal vessels. The occurrence of deposits like this (dominantly smithing remains, with evidence for some use of copper alloy, including as rivets) is recorded elsewhere, with that at the 15th-17th century site at Ballykillaboy, Co. Kilkenny, Ireland, being of particularly similar character (Young 2010b). The use of bifurcated rivets has a long history from the early medieval to post-medieval periods.

The second smithy of the site is in area E, where a pit contains abundant microresidues and macroscopic slags also occur in related features. The occurrence of the slags in "circular gullies" is suggestive of an early medieval or earlier age for this activity, rather than the post-medieval date proposed. Direct dating of the hearth deposits is clearly desirable. The provisional description of the contexts implies that fill [31153] is within a hearth. If this is confirmed, it would also suggest an earlier date, since floor level hearths are not generally found in British smithies after the Middle

Ages (although they do persist in Ireland: Young *in prep.*; Stevens forthcoming.).

Post-medieval smithing is more positively suggested by finds of macro- and micro- residues in area B2. Unlike the smithing in areas K7 and E, this activity appears to have mainly employed coal as fuel. The utility of the comparison of the size of the SHCs from Parc Cybi with those from other sites is limited by the very small size of the present assemblage. The size of the probable post-medieval SHCs from Area B2 (175g, 300g, 350g, 595g, 600g and 600g) is compatible with what little is known of SHC assemblages from late medieval and post-medieval blacksmithing undertaken in a hearth with a ceramic tuyère (as evidenced here). The closest comparisons of assemblages are those from sites such as Moyveela, Ballykillaboy, Garryleagh and Mucklagh in Ireland (see Table 3); there are no British assemblages which have been described in a comparable manner. After the introduction of iron tuyères (18th – 19th centuries) the slagging processes in the hearth were changed and smithing residues are generally unconsolidated masses of clinkery slag.

The single SHC from the undated smithing activity area E (830g) is larger. It is larger than SHCs recorded from Iron Age sites, even those from bloomsmithing (300-400g is reported from Crawcwellt by Crew, 1998, for bloomsmithing slags). It lies (Table 3) at the very maximum end of the size spectrum for Roman sites such as Carmarthen and Marsh Leys Farm and also for medieval smithies at Cricklade and Worcester (Mill Street/Willow Street), but lies well within the range of late medieval (13th century and later) sites in Worcester and Burton Dassett. The evidence from Ireland is somewhat different, with earlier medieval sites producing large SHCs (e.g. Coolamurry, Navan and Moneygall; Table 3) even on blacksmithing sites, probably because raw iron was circulating in the form of incompletely refined blooms. Since nothing is known about the nature of iron distribution in Anglesey, therefore, although the English evidence would suggest that a late medieval or younger age is likely for the Area E SHC, the evidence from Ireland would suggest a wider age range is possible. The occurrence of the smithing in Area E in association with circular gullies may be an indication of a much earlier age for these deposits than currently envisaged.

Evaluation of potential

The various types of fired clay and the fuel ash slags probably have little potential for the generation of useful information through further analysis.

Light might be shed on the purpose of the 'furnace' in Area K9B through investigation of the chemical composition of drain residues in the area, but if the suggestion of a dye works is correct, then archaeobotanical investigations would probably be more likely to produce useful results.

The smithing residues do have potential for further analysis to help illuminate the changes to smithing over a considerable time period. Such interesting information is partly dependent on the dating of the various areas of smithing activity, and on a reassessment of the security of the stratification of the residues from Iron Age contexts. At best the data from Parc Cybi might allow snapshots of approaches to smithing from the Iron Age through to the post medieval period, which would be a very useful contribution to the understanding of regional practice.

The work that could be done on the residues is to some extent limited by the paucity of the macroscopic slag assemblages, compared with the rich assemblages of microresidues, particularly in Areas E and K7. Understanding of microresidue assemblages is improving markedly at present, and the investigation of these assemblages would be a useful addition to that process.

Detailed definition of a programme of work involving the analysis of the smithing residues should however ideally follow the determination of the age of the various occurrences and also a thorough reappraisal of the site records to identify the possible nature of the archaeometallurgical features (hearths, postholes, gullies, waste pits...) in Areas E and K7. Investigation of excavation records to help determine whether the residues from the grave fills in Area K7 represent likely contamination from younger deposits or residual material from an earlier smithing phase is also very important.

A likely scheme of work would involve chemical and microstructural comparison of both macro- and micro-smithing residues from the distinct phases of smithing activity.

An additional area in which further laboratory analysis would aid understanding of the site would be in the identification of the black glass residues from areas H and K1, which may be a modern industrial contaminant.

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Table 1: Summary catalogue by area and context

area	context	find	label	weight (g)	description
B1	1044	1475	cinder	9	fragments of coke – probably, but not certainly coal residue
B1	1044	5632	magnetic residue	12	stone and small indeterminate fragments of slag, at least one possible clinker
B1	4001	1474	cinder	0.4	coke
B1	4012	5549	slag	44	bag of small fragments of burnt organic material occasionally magnetic, probably coal residues
B1	4018	5761	metal working res	2.5	fragments of reduced- fired clay
B1	5029	1219	slag	0.5	coke
B1	5052	1531	Burnt clay	1	Oxidised fired clay
B1	5054	1327	slag? Clinker	0.3	coke
B1	5067	5550	hammerscale	0.3	1 droplet of glassy slag – very fresh
B1	5067	5595	magnetic residue and hammerscale sphere	2.5	one sphere of hammerscale and a slag bleb, but most is stone
B1	6033	5684	magnetic residue	5.5	stone with a few possible slag spheroids
B1	6115	1481	Burnt clay	18	8 pieces of fired clay, 3 natural stones
B1	6120	5634	magnetic residue	3.6	stone with a few slag fragments and one broken spheroid
B1	7054	1311	slag x 2	0.7	2 fragments of coke
B1	7056	5605	metal res hammerscale	0.3	one sphere of hammerscale or slag
B1	7065	5925	hammerscale	0.5	stone, coke or burnt bone and natural iron crust
B1	8046	6090?	cinder	1	coke
B1	9031	5629	magnetic residue	2	stone
B1	10010	5939	metal working res	1.5	a few slag fragments and one droplet
B1	11018	5751	slag?	0.2	Vesicular slag – probably clinker
B1	11020 + 11021	1529	slag?	0.6	small fragment of fired clay or possibly natural concretion
B1	11021	5986	slag	64	dense slag with gravelly top and prilly base, probably from proximal part of an SHC
B1	13005	1498	slag? Iron	0.5	oxidised pyrite concretion - natural
B1	13008	5660	metallic residue	1.5	stone
B1	13008	5666	magnetic residue	4.5	stone
B1	13012	1333	slag	1	clinker
B1	13014	5630	magnetic residue	5	mainly stone, one clinker-like irregular slag bleb
B1	13016	1483	Burnt clay	35	Ashy concretions with charcoal sand and a little clay
B1	14028	1329	slag	0.3	fired clay
B1	14028	1473	slag/cinder	0.8	3 pieces of coke
B1	14038	1339	slag	13	3 small fragments of coke, one of clinker
B1	14038	2032	slag, some metal	5.7	Mainly small fragments of coal, some coke, 2 flakes of clinker

B1	14038	5622	magnetic residue	1.5	stone
B1	14050	4024	Burnt material	1	Possibly burnt fine gravel – 4 grains
B2	90002	2	slag	11.5	partly devitrified rounded and dimpled nub of dark green glass
B2	90002	10	Fired clay	50	Quarter round piece of vitrified clay in the form of a boss, rear face planar oxidised, front vitrified, 30mm thick, outline suggests 100mm diameter. Not a tuyere, but possibly a blowhole repair?
B2	90002	13	slag	1.6	very small fragment of slag, lobate maroon surface, probably clinker
B2	90002	74	Pot sherd	4	Scrap of fired clay with coarse rounded gravel temper
B2	90002	91	slag	36	concretion around corroded iron object , iron approx. 15x8x40mm, slightly curved
B2	90002	97	?furnace	3.9	Fragment of fired clay with one reduced-fired surface, remainder oxidised
B2	90002	169	iron slag	175	indeterminate slag with possible attached lining shale clasts and reddened upper smoothly lobate surface. Probably part or all of a deformed coal fuelled SHC.
B2	90002	170	iron slag	150	wall attachment area of small SHC, top smooth reddened, base strongly prilly with enclosed probable coal shale fragments
B2	90002	177	iron slag	111	indeterminate slag with attached lining, possible SHC fragment, contains charcoal
B2	90002	178	iron slag	300	probable fragment of SHC, dimpled/prilly texture enclosing fuel fragments (probably both charcoal and coal) on base, top rusty, iron rich, but obscured by accretion.
B2	90002	184	iron slag	600	1 plano convex SHC (12.5 x 8 x 4.5 cm), top smooth blown, haematized with slightly wrinkled surface, base mainly smoothish – probably in contact with hearth floor.
B2	90002	191	slag?	44	3 fragments of (a single?) gravelly concretion with outer dense iron oxide coat. Iron pan.
B2	90002	303	slag	5	fragment of low density slag
B2	90002	345	slag x 4	15	1 fragment of lobate dense clinkery slag and 1 piece of coke, broken into 3
B2	90036	600	slag and baked clay	1325	3 large fragments of SHC, 1 of which roughly sub-circular and plano convex in form, measuring 9x8x4cm (350g), the other two are similar in shape, the largest = 13x8x5 cm (650 g) has a gravelly base while the other measuring 12x6x3.5 cm (300g) has a dimpled base texture. There is also 1 small fragment of SHC.
B2	90036	5547	slag	50	C50 very small pieces including small fragments of slag, clinker, slightly slagged coal shale, concretions (1 large one cored on sheet iron with adhering charcoal dust-rich deposit.) and some fuel ash slags similar to material adhering to coal shale
B2	90036	5736	slag?	12	small fragments of fired clay: 6 small fuel ash slag beads in ashy concretion, 1 sandy black glassy lining slag with charcoal inclusion
B2	90036	5907	hammerscale	5	small assemblage of flake hammerscale and blisters, with a little spheroidal hammerscale and amorphous particles
B2	90056	437	slag/cinder	2	coke
B2	90056	440	slag	2	small fragment of slag, black glassy surface, lining slag or more likely clinker
B2	90056	450	burnt clay	3	fired clay – pale, probably with organic temper
B2	90056	481	coal (anthracite)	5.3	coal
B2	90101	5750	spheroid metal	0.2	one hollow sphere of slag or clinker
B2	90121	111	burnt clay	26	fired clay (plus 26g natural stone)
B2	90128	6346	slag	15	c.25 small fragments of coke and fresh coal
B2	90145	6354	slag	19	vitrified stone, well glazed on one surface with black to maroon colour surface, possible clinker
B2	90213	435	slag x 3	3	3 fragments of coke
B2	90213	439	slag x 4	1	4 small fragments of coke
B2	90213	1761	porous material	0.2	2 pieces of coke

B2	90213	5608	magnetic residue	0.2	stone and possible fuel ash slag grains
B2	90248	606	pot?	3.7	fragments of fired clay
B2	90260	4281	slag	0.5	very small fragment of highly vesicular black fuel ash slag or coke
B2	90267	605	burnt clay	20	fired clay – 9 rounded lumps
B2	90288	145	burnt clay	0.4	fired clay
B2	90288	146	iron slag	15	fragment of clinkery, maroon-surfaced slag with fragments of probable coal residue
B2	90331	6192	slag x1	5	fragment of slag
B2	90339	166	iron slag	42	rounded slag nub with accreted sediment
B2	90429	5942	coal/coke fragments	4.3	5 small fragments of coke
B2	90479	231	furnace lining	39	partially vitrified lining, just showing margin of blowhole
B2	90479	241	?furnace	12	2 pieces of gravelly fired clay
B2	91344	6349	slag	32	6 fragments of iron pan on angular gravel
B2	91444	540	slag	80	Weathered arcuate lump of slag with dense lining burr attached
B2 E Area	91518	502	Burnt clay/pottery fragments	7	3 pieces of well tempered oxidised fired clay, 2 with concave surface
B2 E Area	91653	5578	Burnt clay	<1	Tiny scraps of oxidised fired clay
B2 E Area	91657	5619	magnetic residue	0.3	stone plus a couple of spheroidal hammer scale particles
B2 E Area	91691	1999	kiln lining	6.5	2 pieces of clinker
B2 E Area	91691	4192	slag	2	3 very small fragments of slag - occasionally magnetic, 2 pieces of coal, 1 charcoal fragment
B2 E Area	91691	4212	Pot fragments	1	3 pieces of mainly reduced fired clay, 2 probable concretions
B2 - LS	90299	451	Burnt clay	47	C35 scraps of fired clay with gravelly temper, some with planar surface
B2 - LS	90323	174	slag	92	small SHC fragment, with dense crust and upper maroon lobes
B2 - LS	90437	446	slag/kiln liner	300	17 fragments of slag, 1 piece of vitrified lining and one probable SHC fragment, plus bits and concreted gravel
B2 - LS	90501	221	slag and stone	75	5 very small fragments iron pan, 1 fragment of natural rock with thin layer of pan material at one end
B2 - LS	90501	230	slag	475	large fragment of dense well formed SHC, at least 80% present, flat top has impressed coal particles
B2 - LS	90629	5685	magnetic residue	0.3	stone, charcoal
B2 - LS	90708	456	Burnt clay	7	Gravelly fired clay
B2 - LS	90708	460	Pot crumbs?	8	6 scraps of fired clay
B2 - LS	91047	4395	Burnt clay	85	Gravel grade highly abraded fired clay debris
B2 - PW	90794	293	2 x pot sherds	9.4	2 fragments of oxidised fired clay, coarse inclusions of angular grit to 5mm, smooth faces, possibly daub
B2 - PW	91059	4025	burnt material	1	fragment of fired clay
B2 - PW	91233	6369	burnt clay	26	small fragment of oxidised fired clay
B2 - PW	91321	663	burnt clay/pot?	52	fragments of oxidised fired clay
B2 - PW	91331	5610	metallic residue	0.2	stone
B2 - PW	91333	5809	burnt clay	0.3	2 tiny fragments of oxidised fired clay

B2 - PW	91501	4007	burnt clay	2	1 small piece of oxidised fired clay
B2 - PW	91666	529	Daub	28	5 small fragments of oxidised lightly fired clay
B2 - PW	91666	1728	burnt clay	125	small fragments of oxidised lightly fired clay
B2 - PW	91666	4237	burnt clay	275	c30 fragments of oxidised lightly fired clay as above with occasional charcoal inclusions
B2 - PW	92047	593	coal	10	coal
B2 - PW	92073	1732	burnt clay	30	small fragments of oxidised lightly fired clay
B2 - PW	92073	1740	burnt clay/hearth	450	c50 fragments of oxidised lightly fired clay in small irregular lumps, larger pieces show smooth planar face
B2 - PW	92073	1741	burnt clay	1000	c100 fragments of worn oxidised lightly fired clay ranging in size and shape from irregular chunks to small pebbles. Pieces from here have few clasts and occasional planar surface.
B2 - PW	92073	1970	burnt/baked clay	6	5 small pieces of fired clay
B2 - PW	92073	2053	burnt clay	62	small worn fragments of oxidised fired clay
B2 - PW	92073	2076	burnt clay	475	c150 pebble shaped fragments of oxidised lightly fired clay
B2 - PW	92073	2077	burnt clay	400	c50 fragments of oxidised lightly fired clay in small random shaped lumps
B2 - PW	92073	2078	burnt clay	400	c17 fragments of oxidised lightly fired clay, some pieces with smooth planar surface. In general these pieces become more reduced away from the surface. Some show indication of possible fine organic temper, most sparsely gritted.
B2 - PW	92073	2079	burnt clay	250	15 fragments of oxidised lightly fired clay in the form of small random shaped lumps
B2 - PW	92073	2085	burnt clay/hearth	900	c150 fragments of oxidised lightly fired clay ranging in size and shape from irregular chunks to small pebbles
B2 - PW	92073	3046	burnt clay	25	small fragments of oxidised lightly fired clay
B2 - PW	92073	4051	burnt clay	30	small pebble like fragments of oxidised lightly fired clay
B2 - PW	92073	4198	baked clay/hearth?	23	5 small pieces of fired clay
B2 - PW	92073	4292	burnt clay	69	tiny fragments of oxidised fired clay
B2 - PW	92075	1746	pot?/burnt clay?	39	small fragments of oxidised lightly fired clay
B2 - PW	92094	1760	burnt clay	2.5	tiny quantity of burnt clay fragments
B2 - PW	92112	6371	baked clay	81	small fragments of oxidised lightly fired clay
B2 - PW	92190	1767	pot?/burnt clay?	6.5	4 small fragment of reduced fired clay, 1 contains quartz inclusions
B2 - PW	92211	5689	magnetic residue	0.3	stone
B2 - PW	92232	4228	burnt clay	16	small fragments of oxidised lightly fired clay
B2 - PW	92232	5864	burnt clay	7	tiny fragments of oxidised fired clay
B2-RHA	90474	197	Furnace / pot	17.5	4 pieces of apparently fired clay bound by secondary iron crust (iron pan)
B2-RHA	90474	607	Burnt clay	76	C40 pieces of very gravelly fired clay, several have planar surface
B2-RHA	90474	685	Burnt clay	19	C50 pieces of oxidised fired clay
B2 RHA	90479	445	slag	200	concretions with iron rich crust on gravel, iron panning
B2 RHA	90479	5678	magnetic residue	0.3	Stone plus a few grains of spheroidal hammer scale
B2 RHA	90514	444	metal residue	3	stone
B2-RHA	90577	611	Burnt clay	20	10 small sandy silt concretions
B2 RHA	90580	443	slag?	2	concretions with iron rich crust on gravel, iron panning

B2 RHA	90586	5664	magnetic residue	3.5	stone
B2 RHA	90596	5673	magnetic residue	2.5	stone
B2-RHA	90608	4299	Burnt clay	5	C50 tiny chips of fired clay
B2 RHA	90619	5679	magnetic residue	0.5	stone
B2-RHA	90632	667	Baked clay?	9	3 pieces of unfired micaceous kaolinite clay
B2 RHA	90632	5663	magnetic residue	2	stone plus a few pieces of reddened material that may be weathered slag
B2-RHA	90632	6372	Burnt clay	33	C25 fragment of oxidised fired clay, several pieces with smooth planar surface
B2-RHA	90632	6374	Burnt clay	6	11 scraps of mainly reduced crumbly fired clay, 2 pieces of charcoal-rich ash
B2 RHA	90638	438	slag	24	Mottled iron pan gravelly concretion
B2 RHA	90638	441	slag? Not magnetic	4	probable natural concretion in coarse sand
B2 RHA	90638	442	from residue, slag?	1	probable natural concretion in coarse sand
B2 RHA	90638	5698	magnetic res	2.5	mainly stone, some possible slag but it may just be panning
B2 RHA	90638	6347	slag	83	concretions with iron rich crust on gravel, iron panning (see 90002, 191)
B2 RHA	90639	5863	slag	2	broken iron concretion – not clear if panning or corroded metal
B2 RHA	90639	6348	iron slag	16	concretions with iron rich crust on gravel, iron panning
B2 RHA	90639	6358	iron slag	275	concretions with iron rich crust on gravel, iron panning
B2-RHA	90656	711	Burnt clay	2	Possible fired clay or concretion
B2 RHA	90658	5662	magnetic residue	2	iron oxide coated stone
B2 RHA	90833	5686	magnetic residue	1.5	stone and iron pan
B2 RHA	90863	5671	magnetic residue	7	mainly concreted clay
B2-RHA	90921	5835	Poss burnt clay/daub	7	C20 tiny pieces of oxidised fired clay
B2-RHA	91004	4406	Burnt clay	1	Scrap of probable fired clay
B2 RHA	91931	5642	magnetic residue	0.2	stone
B2 RHA	91936	5644	magnetic residue	0.1	stone
B2 RHA	92018	5626	magnetic residue	0.5	stone and possible fuel ash slag
B2-RHA/E	90949	610	Burnt clay	2	2 pieces of clay with possible organic temper probably from small rounded lump with pale outside and dark grey reduced interior
B2 RHB	90883	3098	burnt clay/pot	25	small worn fragments of fired clay
B2 RHB	90922	401	prehistoric pot x 6	10	6 fragments of very worn fired clay, appears to contain dark inclusions – possibly manganese oxide growths?
B2 RHB	90922	5648	metallic residue	0.5	stone
B2 RHB	90956	724	slag	1	2 very small fragments of lining slag
B2 RHB	90956	5616	magnetic residue	2.5	stone
B2 RHB	90986	6359	deposit - slag, stone	550	4 stones, 6 fragments of gravelly concretions, concretions are calcareous, have charcoal fragments and fuel ash microspherules – so probably an ash.
B2 RHB	90990	416	pot? Furnace lining	24	fragments of fired clay artefact with coarse inclusions, curved like neck of jar, but very crude, oxidised fired with slight buff tint to interior
B2 RHB	90990	5627	magnetic residue	1	stone

B2 RHB	90991	4238	clay fragments	20	fragments of fired clay
B2 RHB	91015	1921	baked clay	39	fired clay - much darker in colour to the other examples
B2 RHB	91024	601	burnt clay	400	irregular fragments of oxidised fired coarse clay
B2 RHB	91024	3029	baked clay	125	pebble shaped fragments of oxidised clay
B2 RHB	91158	5670	magnetic residue	1.5	stone possible fired clay and concretions
B2 RHB	91240	4097	burnt clay	18	fired clay
B2 RHB	91239	5681	magnetic residue	0.1	stone
B2 RHB	91450	5614	magnetic residue	0.3	stone
B2 RHB	91620	4176	baked clay	16	fired clay (oxidised)
B2 RHB	91620	4369	burnt clay	4	fragments of fired clay
B2 RHB	91622 + 91623	710	burnt clay	100	fired clay (oxidised)
B2 RHB	91664	4215	burnt clay/brick?	1	fired clay
B2 RHB	91786	5625	magnetic residue	0.3	possible fired clay with stone
B2 RHB	92044	587	pot x 2	10	2 worn fragments of reduced- fired clay
B2 RHB	92069	5645	magnetic residue	0.1	Stone, possible piece of fuel ash slag
B2 RHB	92119	1730	burnt clay	6.4	small fragment of fired clay, one with charcoal inclusion
B2 RHB	92201	5697	magnetic residue	0.1	concretion or possible weathered slag bleb
B2 RHB	92320	1749	burnt clay/pot?	31	worn fragments of fired clay (oxidised)
B2 RHC	90849	5537	Burnt clay	145	C37 pieces of fired clay with gravel, one shows a planar surface
B2 RHC	90849	5538	Burnt clay	213	C100 small pieces of fired clay with gravelly temper
B2 RHC	91155	2095	iron panning x2	65	iron rich concretion developed on unknown core
B2 RHC	91161	5947	Baked clay	3	14 small fragments of oxidised fired clay
B2 RHC	91163	5624	magnetic residue	3.5	stone
B2 RHC	91434	4099	Clay/kiln lining	18	9 pieces of fired clay with grit. Not strongly altered, possibly concretions; 4 pieces of strongly altered clay with convoluted crust – hard to distinguish iron pan from heat alteration; 7 pieces of reduced fired clay with abundant charcoal – probably a hearth residue ; 1 natural stone fragment
B2 RHC	91516	1786	poss kiln lining	5	1 piece fired clay, 2 pieces of vitrified lining, 2 slag blebs
B2 RHC	91516	1788		32	lining, oxidised on one side, vitrified on the other
B2 RHC	91603	1744	slag	33	fragments of vesicular iron slag with occasional charcoal
B2 RHC	91603	3030	furnace liner	5	1 piece fired clay, 1 dense slag bleb, 2 pieces of fuel ash or lining slag
B2 RHC	91603	4341	slag	2.5	9 low density slag blebs or fragments thereof
B2 RHC	91648	542	slag x 4	10	weathered fuel ash slag
B2 RHC	91734	1774	Burnt clay	4	Reduced fired clay fragments
B2 RHC	91734	5641	magnetic residue	0.2	stone
B2 RHC	91738	2049	slag	1	1 slag bleb, 1 piece of fuel ash or lining slag
B2 RHC	91738	5621	magnetic residue	0.3	stone, possible slag fragment
B2 RHC	91745	5540	Burnt clay (3) magnetic (1)	2	4 tiny fragments of well-fired clay

B2 RHC	91748	5611	slag	0.3	tiny fragments of magnetic material, apparently slag blebs
B2 RHC	91887	5946	Burnt clay	8	c.30 tiny blebs of fired clay
B2 RHC	91926	741	slag	66	Deeply weathered grey vesicular slag, with thin lining slag layer on top, probably most of a small SHC
B2 RHC	92040	1745	Burnt clay/hearth	324	Fired clay with coarse grit/gravel temper, c100 pieces. Large pieces commonly show slightly reduced planar surface. 2 fragments appear to show two surfaces so may be pot c 9mm thick.
B2 RHC	92040	1905	Baked clay	26	2 pieces of hard fired clay, brown colour, gritted, slightly darker planar surface; 3 pieces similar, amorphous, greyer; 1 piece reduced fired internally, pale planar surface, gritted.
B2 RHC	92248	4028	burnt material/kiln liner	1.5	tiny iron-rich concretions, possibly fired clay
B2 RHC	92257	4218	Burnt clay	35	C21 pieces of oxidised fired gravelly clay; 1 piece naturally concreted gravel
B2 RHC	92257	4225	furnace lining	8	fragment of vitrified clay probably classifiable as a fuel ash slag
B2 RHC	92257	4252	clay	55	Natural concreted gravel
B2 RHC	92473	5623	magnetic residue	0.3	stone
B2 RHC	92514	1971	Burnt clay/hearth	186	Fired gravelly clay, largest piece has very smooth planar surface with reduction and probably adhering organic residue
B2 RHD	90465	453	Burnt clay and ceramic	107	6 fragments of very low fired, extremely gravelly clay, with rather varied degree of oxidation/reduction. One piece shows a reduced planar surface.
B2 RHD	90465	457	Burnt clay and ceramics	83	35 pieces of soft gritty/gravelly fired clay, variably oxidised/reduced with several pieces showing planar reduced surface
B2 RHD	90465	4245	Burnt clay	11	11 tiny fragments of fired clay
B2 RHD	90465	4273	Burnt clay	8	C25 small fragments of fired clay
B2 RHD	90465	4305	Burnt clay	16	C50 small fragments of fired clay
B2 RHD	90473	609	Burnt clay	2	Fired gravelly clay
B2 RHD	90621	5687	magnetic residue	0.2	mainly stone, but a few slag fragments and spheroids
B2 RHD	90719	5607	magnetic residue	0.2	stone, fired clay
B2 RHD	90747	612	Burt clay	27	5 pieces of gravelly fired clay, largest piece shows planar smooth surface
B2 RHD	90748	599	Heat degrading stone and burnt clay	292	Any pieces of rounded fired clay, some with planar surfaces. Marked lack of temper in most pieces. Some fine grained clays show some colour banding from streaking of original clay.
B2 RHD	90859	5636	magnetic residue	0.3	Stone, fired clay
B2 RHD	90953	5667	magnetic residue	0.4	3 possible small slag fragments
B2 RHD	91030	2097	furnace lining slag x 1	3	fragment of vitrified lining, possibly from blowhole margin
B2 RHD	91127	3032	Burnt clay	3	2 fragments of oxidised fired clay, one with one reduced surface
B2 RHE	91304	1780	slag?	4.5	small fragments of indeterminate low density slag
B2 RHE	91337	5659	metallic residue	0.3	stone, one possible flake hammerscale piece
B2 RHE	91403	598	burnt clay	1725	large and small fragments of fired clay - major parts form the equivalent of most of a rounded unequally-biconvex mass with a 200mm long axis, at least 120mm preserved perpendicularly (possibly originally 200mm in this axis too?, and the lump was 80mm thick. Object cut by vertical work burrows (or just possibly roots). Possibly large loom weight?
B2 RHE	91722	1734	burnt clay	22	fragments of fired clay
B2 RHE	91722	5606	hammerscale	0.3	stone, fired clay, burnt organic material and possible slag grains
B2 RHE	92085	664	burnt clay/pot?	22	fragments of fired clay
B2 RHE	92085	2071	burnt clay	2	small fragments of fired clay

B2 RHE	92145	2066	burnt clay	6	fragments of fired clay, including vitrified hearth lining
B2 RHE	92145	4087	furnace lining/slag	4	1 small fragment of fired clay, 7 pieces burnt organic material, 1 small fragment of charcoal
B2 RHE	92147	1784	burnt clay	15	fragments of fired clay (oxidised)
B3	3027	5617	Magn residue	2	Stone, 3 slag/clinker spheroids
B3	22156	5635	magnetic residue	4	stone, possible fuel ash spheroid
B3	22157	3001	Baked clay?	44	Clay with charcoal and sand – possibly ashy concretions
B3	22164	2096	Burnt clay	20	Gritty masses – probably natural concretions
D3	60100	4047	cinder	1	8 tiny fragments of coked organic material – probably coal residue
D3	60136	4242	furnace lining	11	natural quartz rich stone with iron veining
E	30083	5428	Burnt clay/kiln lining	61	1 large and 7 small fragments of fired clay from heath wall beside blowhole, has delicately vitrified face, with rapid thickening of slag layer towards likely blowhole position. Has oxidised fired clay behind vitrified face and this bears abundant ?straw tempering. Remainder is 20 small pieces of fire clay without vitrified face. 1 small isolated slag fragment and one probable tubular concretion. One of the fired clay fragments has a curved face rather similar to tuyère margin, but too small for proper identification.
E	30083	5546	kiln liner?	41	small fragments ashy/charcoal-rich concretion, some pieces with flake hammerscale, one piece of vitrified lining
E	31025	5968	cinder	0.6	coked organic material – probably coal residue
E	31040	6357	slag	0.5	fuel ash slag containing charcoal
E	31153	917	furnace lining	4.5	fired and vitrified clay with adhering residue of ash – including fuel ash microspherules
E	31153	917	Blast furnace - mainly iron ore	125	12 fragments of “smithing floor” with flake hammerscale inclusions, 2 fragments of vitrified lining
E	31153	5500	slag/heat fused material	217	122g 6 pieces of dense smithing slag, 82g 18 pieces of low density fuel ash/lining slag, 12g 8 pieces of smithing floor concretion plus 3 slag flats
E	31153	5511	heat affected metal + yellow substance	7	1 small piece of vitrified lining, 1 piece lining or fuel ash slag, 4 pieces of corrosion from iron? object
E	31153	5551	hammerscale	550	good assemblage of hammerscale, majority is in flake form, also small fragments of slag, lining and fuel ash slag spheroids, corroded iron fragments and smithing floor concretions
E	31153	5822	hammerscale	34	Hammerscale – good assemblage of flake and spheroidal hammerscale with slag flats
E	31153	5911	hammerscale	63	Hammerscale – good assemblage of flake and spheroidal hammerscale with slag flats
E	31163	918	vitrified 'furnace' lining	52	5 pieces of vitrified lining
E	31163	919	Burnt material	193	5 pieces of rather blebby/lobed hearth slag. One good fragment from margin of SHC
E	31163	922	iron ore, slag	750	2 halves of dense well formed plano-convex SHC (100x100x50mm) 90%? complete, charcoal inclusions
E	31163	922	iron ore, slag	350	proximal end of SHC with deep burr and slightly prilly base, probable charcoal inclusions
E	31172	920	furnace lining	200	fragment of furnace lining vitrified on one side
E	31172	921	furnace lining	12	fragment of lining (high fired on one side)
E	31384	4486	slag	134	2 lumps of slag, probable fragments of SHC
E	31510	5417	slag	0.5	natural rock grains
E	31596	5426	Burnt/baked clay	7	16 tiny scraps of fired clay
E	31632	5487	slag	1	2 pieces of burnt organic material – probably charcoal

F1 FE	92862	833	slag	11	indeterminate fragment of worn slag – probably basal crust from an SHC or flow
F1 FE	92948	5510	Baked caly	19	Stone attached to yellow sand by iron rich slaggy charcoal bearing concretion
F1 FE	93366	5675	Pottery/clay	81	5 pieces of oxidised fired clay with a slightly reduced surface, smooth, with very coarse gravel temper.
F1 FE	93524	5570	Burnt clay	436	Amorphous large lumps of fired gravelly clay, just two smaller ones show planar surface
F1 FE	93524	6338	Burnt clay	10	5 small pieces of variably fired clay with coarse temper
F1 FE	93554	5732	Burnt clay	46	21 scraps of mainly oxidised fired clay with gravel temper
F1-FW	92904	4239	Burnt clay	593	Large assemblage (c200 pieces?) of fired gravelly clay. C10 pieces show good evidence for a planar surface, in most cases with slight reduced firing. In one case at least an ashy charcoal rich (very fine – straw/twigs) residue rests on the surface. Also 1 tubular iron pan concretion.
F1 RHG	92612	788	slag	37	2 small indeterminate lumps of slag with incorporate lining slag
F1 RHG	92622	786	Slag	550	3 chunks of highly vesicular frothy pale grey to pale green fuel ash slag, largest block contains angular pieces of vitrified stone
F1 RHG	92624	787	slag	56	3 small chunks of vesicular fuel ash slag
F1 RHG	92633	797	Fe object?	20.5	highly weathered iron slag in sheet form – probably the lower crust of an SHC
F1 RHG	92687	796	Burnt clay	29	8 pieces of dense gritty fired clay
F1 RHG	92895	817	slag x 7	50	5 small chunks of fuel ash slag
F1-RHH	92829	4478	Burnt clay	3	2 pieces of natural stone/concretion
F1-RHH	92875	4319	Clay with holes	7	2 pieces of tubular iron pan concretion
H	02070	1008	vitrified material	47	black glassy material with occasional vesicles - resembles obsidian/pitchstone, but contains enclaves of coarse pale crystalline material and also dark foliated clasts which may be coal shale.
H	02093	1017	vitrified material	63	black glassy material, original surface with flowed structures on one side - resembles obsidian/pitchstone, but contains pale crystalline clots and also angular white clasts, probably of quartzite.
H	02102	1028	Burnt clay	2	Fine fired clay with organic temper
H	20048	1328	Burnt clay	1	Very well foliated fine oxidised fired clay with organic temper
H	50011, 50012	4304	slag, clinker	0.2	burnt organic matter – probably coal residue
H	02100, 50045	5647	magnetic residue	0.5	stone
H	50053, 50100	5646	magnetic residue	0.1	stone with one slag fragment
H	50055	5640	magnetic residue	0.4	stone
H	50064	1471	Burnt clay	2	Burnt clay or concretion?
H	50083	3045	slag/charcoal	0.6	small fragment of burnt material - possibly charcoal, but pore structure suggests burnt bone
H	50106	1605	Burnt clay	6	3 concretions, 1 possible fired soil
H	50110	1200	daub	17	Fired silty clay with coarse organic temper – possibly daub
H	50111	1439	daub	19.5	Natural stone
H	50115	1647	Burnt clay	29	Very fine fired clay lump

H	50117	1434	Burnt clay	22	Concretions?
H	50117	1609	Burnt clay and stone	9	Burnt soil?
H	50117	5682	magnetic residue	0.2	stone
H	50118	1610	Burnt clay	34	Concreted silt, probably not burnt
H	50118	1612	Clinker	0.3	Coke, fuel ash, stone
H	50118	2099	Burnt clay	27	Concreted silt, probably not burnt
H	50118	5637	magnetic residue	0.3	stone
H	50124	1384	clay	10	Coarse silty clay with charcoal fragments
H	50135	4477	Pot fragment (rim)	1	Reduced fired clay piece with ?organic temper
H	50150	5867	hammerscale	0.3	stone
H	50163	3037	Burnt clay?	7	3 concretions and 9 pieces of charcoal-rich burnt soil
H	50163	4055	Burnt clay	8	7 pieces of concretion (with charcoal fragments) and 3 pieces of charcoal
H	50163	5955	Baked clay	7	Probable concretions
H	50168	5539	magnetic residue	0.5	stone
H	50170	5620	magnetic residue	0.2	stone
H	50275	2094	Daub? Pot?	134	Fired clay tempered with abundant coarse grit/gravel and some possible organic temper. Many pieces show a flat surface, which is very well smooth and locally reduced fired (everything bar surface 2mm oxidised fired)
H	50401	5756	metalwork residue	0.5	6 pieces of coal, 2 clinker droplets and 2 stones
I	18087	6373	Burnt clay	420	Fired clay with coarse gravelly temper, many pieces have planar surface, some moderately convex, with reduced fired surface
I	19066	5661	metallic residue	0.3	magnetic – probably burnt stone
I	22009	1040	daub	386	Fired clay fragments, many with a single planar to slightly convex surface with a slight reduced fired, or at least pale, surface. Clay is tempered with coarse rounded gravel.
I	22014	1221	Burnt clay	1	Oxidised fired clay with coarse temper
I	22014	1309	Burnt clay	20	Oxidised fired sandy clay with some possible organic (hair?) temper
I	22014	1319	slag	1.6	weathered natural concretion
I	22014	1468	Burnt clay	15	5 fragments of oxidised fired clay with coarse temper, and paler smooth planar surface
I	22014	1479	slag? Furnace lining?	2	3 fragments of natural mineral vein
I	22014	4243	Burnt clay	2	10 rounded fragments of oxidised fired clay
la	21209	1441	slag? clinker	3	stone
la	21209	5658	metallic residue	0.3	stone
la	21211	5618	magnetic residue	0.2	stone
la	21216	5668	magnetic residue	0.3	stone with one piece of flake hammerscale and one slag fragment
la	21220	1587	coal	0.3	7 tiny fragments of coal
la	21222	5692	magnetic residue	0.4	stone with possible slag fragment
la	21224	1589	clinker	0.5	burnt material

la	21224	5638	magnetic residue	0.2	stone
la	21224	5674	magnetic residue	0.2	mainly stone with two spheroids
J	70089	5799	Burnt clay	1	2 fragments of fired clay
J	70092	4074	Burnt clay	5	3 pieces of silty and sandy material, possibly very low fired
J	70125	5700	hammerscale	0.4	one fleck of possible hammerscale
J	70129	5798	hammerscale	0.2	stone
J	70172	5804	metalwork residue	0.2	stone, fired clay?
J	70182	3095	slag	3.5	11 small fragments/blebs of slag, 1 of coal
J	70227	1883	Baked clay	42	9 fragments of fired clay
J	70267	4468	slag	0.5	minute fragment of fuel ash slag, one of fired stone
J	70291	5690	magnetic residue	0.3	stone
J3	70536	6498	burnt clay	0.3	oxidised fired clay
J3	70530	6467	burnt clay	0.4	1 fragment of oxidised fired clay
J3	70537	6479	burnt clay	4	1 fragment of oxidised fired clay
J3	70437	6447	possible clinker	0.4	coke
K	80190	6375	clinker? Not bone	1	small fragment of fired clay/fuel ash slag
K1	18173	1340	slag	0.2	specks of black glassy material, possibly related to 6092
K1	19100	1496	Pottery fragments	4	Pottery sherds
K1	19108	5628	metallic residue	0.2	stone
K1	20153	1283	pos slag fragment	0.1	tiny bleb of sandy black glass
K1	21053	1304	Burnt clay?	1	Mainly fired clay fragments, 1 piece is natural
K1	21053	5633	magnetic residue	6.2	stone
K1	21053	6092	vitrified material	125	3 fragments of black glass bearing angular clasts of white rock. Related to the "obsidian-like" material seen elsewhere. Has dimpled, slightly flown surface with maroon tint.
K1	23016	1484	Burnt clay	7	Natural silty concretions
K7	80009	5695	magnetic residue	8.5	small amount of hammerscale with some natural stones
K7	80011	5760	metalworking fragments	6	One small fragments of iron rich slag , 2 spheroids, remainder stone
K7	80013	2041	slag	50	broken slag piece, coarsely crystalline interior around large voids, probably lower part of hearth slag or small SHC
K7	80013	4472	furnace lining?	475	c. 200 pieces of smithing floor concretion, includes 1 Cu-alloy piece (missing, mould only) 9x18, slightly curved, some slag blebs, 1 piece of fired slate(?)
K7	80013	4514	vitrified burnt material/slag	568	378g c120 pieces of smithing floor concretion with hammerscale and charcoal and one fragment of cu-alloy, 104g 7 pieces of dense slag, all in dimpled nubs – largest may have been squeezed by tongs. 86 g
K7	80013	4516	metal	825	c35 pieces of low density, partly flowed blebs, ranging down to fuel ash slag good assemblage of hammerscale, majority is in flake form

K7	80013	5548	slag	100	very small fragments of slag , mainly blebby materials ranging from fuel ash slag to dense varieties, also some coarse flake hammerscale, one tiny chip of oxidised fired lining, several small pieces of smithing floor concretion, including 3 pieces (probably from a single original) of folded thin Cu-alloy strip.
K7	80013	5596	hammerscale	15	hammerscale - majority spheroidal – but possibly mainly slag droplets than true hammerscale
K7	80013	5598	hammerscale	400	good assemblage of hammerscale, majority is in flake form
K7	80013	5599	hammerscale, metal residues and slag	450	good assemblage of hammerscale, majority is in flake form
K7	80013	5600	hammerscale	39	Spheroidal hammerscale, slag droplets, slag flats and small fragments of slag. Also possible bifurcate Cu-alloy rivet fragment
K7	80013	5787	metalworking debris	525	good assemblage of hammerscale, majority is in flake form
K7	80015	4470	slag? Furnace lining?	1	Natural iron ore concretion
K7	80016	5597	metallic residue	2.5	small fragments of slag, 1 sphere
K7	80018	808	Surface slag	17	4 pieces of dense slag – possibly fragments from an SHC?
K7	80018	809	kiln lining	41	lining, vitrified and well slagged
K7	80018	810	slag	125	8 small fragments of indeterminate dense slag, largest appears to be tool mark from base of small SHC
K7	80018	811	kiln lining	25	1 fragment of slagged lining, 1 concretion on iron
K7	80018	4353	metal working frags	5	large spheroids – many of lining slag
K7	80018	4358	slag?/nail heads	1	2 small spherical droplets of lining slag
K7	80018	5602	metal working residues and hammerscale	22	spheroids of slag and hammerscale
K7	80018	5603	hammerscale	7	stone, slag, flake and spheroidal hammerscale, 1 piece of coal
K7	80018	5910	hammerscale	3	slag droplets, slag fragments and ?coarse spheroidal hammerscale
K7	80018	5983	slag	50	6 small lumps of slag: 1 dense, dimpled, 2 complex gravelly lining slags, 3 droplets of lining slag
K7	80018	6350	slag, kiln lining, vitrified material, some metal	50	small fragments of blebby slag from dense to fuel ash slag and a few stone fragments
K7	80020	5824	metal frags/slag/spheroids/hammerscale	3.5	Mainly spheroidal hammerscale, 1 flake of slag, plus other more amorphous material
K7	80035	4544	vitrified kiln liner	0.5	maroon slaggy surface on white porcellaneous vitrified substrate, possibly clinker
K7	80054/80055	823	slag	26	Gravelly fuel ash slag in rounded, slightly lobate nub
K7	80054	4469	slag	5	small fragment of lobate and dimpled lining slag
K7	80054	4515	burnt vitrified material/slag	75	19 small pieces of gravelly fuel ash slag, 5 small fragments of burnt organic residue, 1 corroded iron piece, possibly nail point
K7	80054	5418	slag and hammerscale	30	small fragments of mainly fuel ash slag and coarse hammerscale (spherical and flake), also a small amount of burnt fuel residue resembling, but not conclusively, coal residue in very tiny pieces
K7	80054	5956	metal working debris	50	small broken fragments of slag, flake and spheroidal hammerscale, occasional small pebbles
K7	80058	5860	metal working residue	2.8	stone and slag spheroids
K7	80065	4434	vitrified kiln lining/waste slag	50	broken blebby slag, mainly vitrified and slagged stones, giving a clinkery, maroon coloured material – but some is clearly a granite precursor, others sandstone. Slag is mainly a black glass.
K7	80065	4473	slag/manganese	50	18 pieces of concreted hearth floor deposits with charcoal dust and fuel as spheroids, 6 pieces of fuel ash slag of variable density
K7	80065	5593	hammerscale and metallic residue	57	small fragments of slag, flake and spheroidal hammerscale, dominated by slag fats, blisters and large spheroids
K7	80065	5957	metalworking debris	175	Coarse hammerscale containing good proportion of large spheres along with flake, slag flats and fuel as droplets
K7	80077	4523	kiln liner?	21	iron pan - gravelly concretion

K7	80077	5825	metal frags/slag/spheroids/hammerscale	2	spheroidal hammerscale or clinker droplets, slag fragments stone
K7	80096	5826	hammerscale/spheroids	1.5	spheroidal and flake hammerscale, slag stone
K7	80103	4517	burnt/coalesced material/furnace lining/slag	187	12g 1 piece glassy black lining slag, 82g 30 pieces of concretion around iron, with charcoal and hammerscale, 4g 2 stones, 42g 29 pieces of low density fuel ash slag, 47g 20 pieces of dense slags in blebs and fragments
K7	80103	4550	slag	100	Mainly broken prills and blebs of slag. Some corroded iron, some coarse flake hammerscale, some slag flats, one slag sheet with re-entrant right angle, probably from tool
K7	80103	5928	hammerscale	250	Coarse flake hammerscale, slag flats and small fragments of slag, together with a very high proportion of spheroidal hammerscale
K7	80115	5944	metalworking residue	2	2 fragments of slag , 2 of coal and 2 of coke
K7	80126	5856	Burnt clay	1	6 tiny blebs of fired clay
K7	80126	5876	hammerscale	2.5	stone
K7	80127	4443	Burnt clay	2	stone
K7	80201	5936	metalworking residue	3	thin slag and corroding iron fragment, small piece of smithing floor concretion, other concretions
K7	80266	4494	possible ore x1	77	very dense, but highly weathered slag, slightly vesicular, probably piece from centre of an SHC
K7	80268	5943	metalworking debris	0.1	tiny magnetic specks of ?concretion – not hammerscale
K7	80326	4424	Burnt clay	66	Fine grained fired clay. 1 piece shows curved surface – withy or hole margin?
K7	80334	4459	Burnt clay	5	4 pieces soft fine fired clay
K7	80334	4552	slag	1.7	small fragment variegated black/red glass resting on sandy interface – possibly a Cu-alloy slag
K7	80388	5540	Burnt clay/kiln liner?	63	Low density friable material, grey in fracture, but orange –coated. Possible ochre precipitate in drain. Not necessarily anything to do with burning!
K7	80406	5498	kiln liner/degraded stone	9	Siliceous residue from decalcified limestone
K9	80553	6313	clinker	0.5	coke
K9	80601	5976	furnace lining?	2	fired clay, possibly fragment of lining
K9B	80831	6013	daub	5	oxidised fired clay
K9B	80831	6014	daub	5	oxidised fired clay
K9B	80837	6361	burnt clay	1	2 fragments of fired clay
K9B	80840	6042	burnt clay	33	small fragments of oxidised fired clay
K9B	80840	6228	burnt clay	39	small fragments of oxidised fired clay
K9B	80840	6448	burnt clay	6	tiny fragments of oxidised fired clay
K9B	80843	6038	burnt clay	5	fragments of oxidised fired clay
K9B	80843	6048	slag x 3	19	3 small fragments of black glassy slag with white inclusions and slightly purple surface
K9B	80844	6031	burnt clay	120	fragments of oxidised fired clay
K9B	80845	6017	burnt clay/furnace lining	20	oxidised fired clay
K9B	80845	6018	burnt clay	21	1 fragment of fired clay, partially oxidised, 1 small quartz inclusion
K9B	80848	6027	daub	2	oxidised fired clay
K9B	80848	6028	daub	4	oxidised fired clay

K9B	80848	6029	burnt clay	7	small fragments of oxidised fired clay
K9B	80848	6032	burnt clay	5	2 small fragments of oxidised fired clay
K9B	80849	6153	burnt clay	11	oxidised fired clay
K9B	80850	6033	burnt clay	10	1 fragment of fired clay
K9B	80866	6229	Burnt clay	241	Oxidised fired gritty clay. Larger pieces show flat to slightly concave surface with a browner colour than the red body
K9B	80866	6230	burnt clay	205	fragments of oxidised fired clay
K9B	80866	6364	burnt clay	10	small fragments of fired clay
K9B	80866	6366	burnt clay	10	small fragments of oxidised fired clay
K9B	80866	6438	burnt clay	17	small rounded fragments of oxidised fired clay
K9B	80866	6473	burnt clay	19	small rounded fragment of oxidised fired clay
K9B	80869	6237	burnt clay	360	fragments of oxidised fired clay, some organic temper, but not abundant compared to grit.
K9B	80869	6443	burnt clay	125	fragments of oxidised fired clay. Larger pieces show brown surface. Lots of small cavities indicative of organic temper
K9B	80869	6455	burnt clay	42	small fragment of oxidised fired clay
K9B	80869	6458	burnt clay	22	small fragment of oxidised fired clay
K9B	80869	6460	burnt clay	998	c70 fragments of oxidised fired clay. Variable in detail. Some larger bits of included organics, but mostly just coarse sand temper
K9B	80869	6474	burnt clay	15.5	4 small fragments of reduced fired clay
K9B	80869	6487	burnt clay	50	small rounded lump of oxidised fired clay
K9B	80874	6049	burnt clay	200	c20 small fragments of oxidised fired clay
K9B	80893	6060	daub	1	oxidised fired clay
K9B	80893	6293	slag	1	small fragments of iron rich material (magnetic)
K9B	80900	6058	burnt daub	10	attachment of handle onto pot
K9B	80900	6468	burnt clay	<1	tiny fragment of oxidised fired clay
K9B	80901	6062	burnt clay	2	oxidised fired clay
K9B	80910	6136	burnt clay	4	oxidised fired clay
K9B	80921	6135	coke	1	coke
K9B	80939	6410	burnt clay	1	fired clay
K9B	80939	6431	burnt clay	2	fragment of oxidised fired clay
K9B	80943	6234	burnt clay	9	3 fragments of oxidised fired clay
K9B	80949	6360	burnt clay	2	1 fragment of fired clay
K9B	80963	6142	burnt clay	22	partially oxidised fired clay
K9B	80978	6232	burnt clay	20	fired clay
K9B	80978	6363	burnt clay	2	5 small fragments of oxidised fired clay, 1 piece slightly blackened
K9B	80978	6365	burnt clay	7	oxidised fired clay
K9B	81006	6236	burnt clay	3	1 fragment of oxidised fired clay
K9B	81029	6150	slag and burnt clay	105	3 fragments of oxidised fired clay - inner surfaces more highly fired (approaching vitrification)
K9B	81034	6239	burnt clay	5	2 small fragments of oxidised fired clay, 1 has small stone inclusion

K9B	81042	6158	burnt clay	7	1 fragment of fired clay
K9B	81042	6167	burnt clay	54	4 fragments of fired clay
K9B	81042	6454	burnt clay	1	fired clay
K9B	81043	6437	burnt clay	2	6 tiny fragments of oxidised fired clay
K9B	81048	6160	burnt clay	12	1 fragment of fired clay
K9B	81053	6439	clinker	1.5	coke
K9B	81073	6472	burnt clay	5	fired clay
K9B	81079	6312	clinker	1	coke
K9B	81144	6470	burnt clay	1	2 tiny fragments of oxidised fired clay
K9B	81166	6428	burnt clay/possible lining	710	c100 fragment of oxidised fired clay. Rather variable clay, sometimes with pebbles. Has good smooth, slightly brown surface.
K9B	81166	6428	burnt clay/possible lining	800	c200 small worn fragments of oxidised fired clay
K9B	81166	6428	burnt clay	225	small rounded fragments of oxidised fired clay
K9B	81166	6461	burnt clay	47	bag of small rounded lumps of oxidised fired clay
K9B	81171	6179	burnt clay	10	small fragment of oxidised fired clay
K9B	81171	6478	burnt clay	60	small fragments of fired clay partially oxidised and reduced
K9B	81172	6311	slag	11	2 fragments of ferruginous concretion, 1 small quartz rich stone; all natural
K9B	81172	6450	slag	1	tiny fragment of clinker, with shale and maroon surface
K9B	81205	6476	burnt clay	10	oxidised fired clay
K9B	81206	6475	burnt clay	10	1 fragment of oxidised fired clay
K9B	81264	6469	burnt clay	2	fired clay
K9B	81287	6471	burnt clay	5	1 fragment of oxidised fired clay
K9B	81287	6477	burnt clay	4	fired clay
L3	21191	5615	magnetic residue	3.5	stone
L3	21193	1289	Burnt clay? Daub?	53	4 pieces of very hard fired clay with angular gravel, varies from orange to dark brown
L3	21193	1297	Pot? Burnt clay	45	Probable fired clay fragments, harder than most of the material, bears large grit and small voids
L3	21197	4241	Burnt clay	12	C50 tiny fragments of fired clay
L3	21205	1321	Burnt clay?	30	Fired clay fragments
L3	22139	1251	Burnt clay	3	7 tiny fragments of fired clay with coarse temper
L3	22172	1365	slag	16	Gravelly lining slag with lining attached
L3	22181	2057	coal?	0.5	coal
L3	22181	2058	Slag?	1	Natural chert
L3	22181	5613	hammerscale	0.2	one large sphere of hammerscale
M3	19123	4032	poss furnace lining or slag, some metal	20	gravel and iron pan
M4	22058	1303	burnt clay	0.4	burnt clay

M4	22073	1301	slag?	2	coke
M4	22073	1355	residue - slag	2.7	4 fragments of coke/coal
M4	22092	5669	magnetic residue	0.2	stone
M4	22117	1318	slag?	1.5	8 natural grains
M4	22117	5665	magnetic residue	3.5	stone
M4	40001	5683	magnetic material	0.2	stone, coke, probable slag and spheroid
M4	40019	5890	hammerscale	0.3	Stone and slag or rust crusts
M4	40022	5847	hammerscale	0.3	Stone, slag fragment and a single spheroid of hammerscale
M4	40026	4366	cinder	2	4 pieces of coke
M4	40037	5846	clinker	0.4	5 pieces of coke
M4	40075	5882	metalwork residue	0.4	stone
M4	40077	5837	hammerscale	0.2	iron-rich crusts - but probably not hammerscale
M4	40080	5888	metalworking residue	0.3	stone
M4	40112	5878	metal work residue	2.5	coke
M4	40118	5594	ferro mag	5	mainly stone, 2 fuel ash spheroids, 2 possible slag fragment
M4	40120	5688	magnetic residue	0.3	stone
M4	40136	3075	furnace lining x1	1.8	Natural rock concretion
M4	40167	5884	Burnt clay	1	1 piece natural concretion, 2 pieces of stone
M4	40181	6368	vitrified kiln lining/slag	4	natural haematite-bearing chert
M4	40198, 40199, 40200	5694	magnetic residue	4.5	stone
M4	40200	5849	metal residue	0.4	fragment of coke

Table 2: Residue classes by area of excavation.

area	coal & coal residues	smithing slags: indet. and charcoal	smithing slags: coal	smithing microresidues	hearth lining	glassy slags	FAS	gravelly fired clay	other fired clay	total smithing residues	total residue
B1	89	64		13					22	77	188
B2	134	2163	625	5	89	12	5	16	69	2882	3117
B2 E Area	9							7	1	0	17
B2 LS		392	475					47	93	867	1007
B2 PW	10							4791		0	4801
B2 RHA								346	19	0	365
B2-RHA/E									2	0	2
B2 RHB						1		525	304	0	830
B2 RHC		99			37		22	950	21	136	1129
B2 RHD					3			549		3	552
B2 RHE					6		5	1790		6	1801
B3				2						2	2
D3	1									0	1
E	1	1549		825	337	18	1		7	2711	2737
F1 FE		11						548		11	559
F1 FW								593		0	593
F1 RHG		57					656	29		57	742
F1 RHH										0	0
H	1					110		134	59	0	304
I								844		0	844
la										0	0
J	4						1		46	0	50
J3									5	0	5
K							1			0	1
K1						125			5	0	130
K7	1	711		4038	66	7	131		72	4815	5025
K9	1				2					2	3
K9B	24								4760	0	4783
L3	1				16				143	16	160
M3										0	0
M4	10			5						5	15
total	282	5046	1100	4889	556	273	820	11168	5628	11590	29761

Table 3: comparative occurrences of similarly-sized SHCs

Ireland								
	Moyveela	Ballykillaboy	Garryleagh	Mucklagh	Coolamurru	Navan	Moneygall	
	P-med.	C16-17	13 th -14 th	18 th -19 th	10 th -12 th	E. Med.	E.Med- Med.	
count	15	113	25	66	41	17	22	
min	44	50	84	98		60	114	
max	388	478	802	1206	2588	2990	1800	
average	134	139	331	373	386	507	527	
<500	100%	100%	76%	77%	83%	82%	55%	
<1000	100%	100%	100%	95%	95%	88%	95%	
>1000	0%	0%	0%	5%	5%	12%	5%	
Modal class	0-100	100-200	100-200	100-200	100-200	100-200	200-300	
	Young 2009a	Young 2010b	Young 2009c	Young 2008c	Young 2008a	Young 2007a	Young 2008d	
Britain								
	Marsh Leys Farm	Carmarthen	Worcester 35 Mill Street	Worcester Willow Street	Prior Park Cricklade	Worcester Deansway	Worcester Deansway	Burton Dassett
	Roman	Roman	12 th C	12 th C	11 th -15 th C	11 th – 13 th C	13 th -15 th C	14 th - 15 th C
count	30	136	23	28	17	61	32	60
min		100	74	86	156	168	144	130
max	824	820	782	770	794	1490	1800	1670
average	333	227	233	327	329	492	499	550
<500	77%	94%	91%	82%	82%			
<1000	100%	100%	100%	100%	100%			
>1000	0%	0%	0%	0%	0%			
>3000	0%	0%	0%	0%	0%			
Modal class	100-200	100-200	100-200	(100-300)				
	Young 2005a	Crew2003	Young 2007a	Young 2009a	Young 2008b	McDonnell & Swiss 2004	McDonnell & Swiss 2004	McDonnell 1992

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