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Assessment of archaeometallurgical residues from Dean Forest Farm, Unlawater Lane, Newnham, Glos.

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Abstract

This site produced a large assemblage, almost entirely of bloomery iron smelting slags, with a total weight of approximately 238kg. Less than 1% of the assemblage was possibly derived from ironworking (smithing). No metallurgical features were encountered, so the residues remain divorced from direct evidence for the originating furnace construction.

The slag assemblage from Dean Forest Farm is characterised by a low proportion of conventional dense tapslags (25% of the residue assemblage), but high proportions of slag in thick, often massive, cakes, sometimes preserving traces of flow lobes, often with clasts of ore and moulds of fresh roundwood charcoal (24%), slags in narrow channels (6%) and in the form of rods (5%). A further 29% of the assemblage in the form of slags that probably cooled inside the furnace (charcoal-rich slags and slag bowls), together with slags that cooled in the tapping hole area, with their complex transitional textures. The precise role of the 'massive' slag facies remains uncertain, but it is clear a substantial .part of the slag generated in a smelt was retained within the furnace.

These materials indicate a smelting technique that requires considerable intervention from the smelter. The slag rods represent slag infills to poker holes made by rodding through the tapping hole to encourage slag flow through the ash and cooled slag in the base of the furnace. The mobilised slag often flowed from the furnace in narrow channels (perhaps below hot fuel). The tapped slags often contained or trapped small iron ore particles, presumably picked up when the slag flowed over the surface near the furnace that had accumulated material lost during charging.

This slag assemblage is of the so-called 'Cardiff Castle-type', after the locality where it was first recognised. This smelting technology is now recognised from many smelting sites of Roman age within the Bristol Channel orefield, but somewhat similar assemblages occur elsewhere. The only site where such an assemblage has probably been found in association with furnaces is the Chesters Villa at Woolaston (also on the west bank of the Severn, 15kms SW of the present site), but residues from that site require re-appraisal.

It appears likely that the furnaces that produced the 'Cardiff Castle-type' assemblage were moderately large. Early examples of the assemblage (pre-mid-3rd century) have been linked with state-controlled industry, but the status of the later examples found in association with villas is not clear.

The small particles of ore associated with some of the slags and the larger pieces recovered as individual fragments, were all indicative of the use of iron ores from the Bristol Channel orefield. The nearest outcrops of ore within the Forest of Dean sector of the orefield lie just 3.5km NW of the site, near Cinderford. However, other sources are possible because it is likely that ores from a wider area passed Newnham on the way across the Severn to Arlingham, beyond which smelting of Forest of Dean ores was undertaken on a large scale across a wide hinterland in the Severn Vale and Cotswold escarpment.

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Methods

This assessment was commissioned by John Valentin of AC Archaeology Ltd. The materials arise from two phases of work (evaluation and excavation) of a site at Forest Dean Farm, Unlawater Lane, Newent, Gloucestershire (ACA0074).

All submitted materials were examined visually in September 2025, using a low-powered binocular microscope where required. The summary catalogue is presented as Table 1. No instrumental analysis was undertaken.

Results

General

This site produced a large assemblage, almost entirely of bloomery iron smelting slags, with a total weight of approximately 238kg. Less than 1% of the assemblage was possibly derived from ironworking (smithing). The assemblage derives from 59 archaeological contexts. No certain metallurgical features were encountered, so the residues remain divorced from evidence for the originating furnace construction.

Residues from bloomery iron smelting

Residues from bloomery iron smelting were catalogued and the subdivided into thirteen categories (Table 2). The nature of iron smelting residues is such that individual fragments may embrace more than one textural type. This is particularly true of the residues that cooled inside the furnace structure (massive slags, slag bowls and charcoal-rich materials may all be intimately associated here, and those which formed around the tapping area as various slags passed through the tap hole to become more freely-flowing and more oxidised outside the structure. Individual pieces of residue were therefore classified according to their dominant texture (most classes) or on the property of demonstrating passage between textures (slags from tapping arch area).

Tapslag: these materials were flow lobed with individual rivulets building up amalgamated masses and into larger tapslag cakes. They were mostly formed of dense with little fine vesicularity (probably an indication that these materials were thoroughly degassed) but may contain large tubular pore spaces formed by marginal cooling of moving flow rivulets. All the materials showed a maroon oxidised upper surface or show a slight reddening. Larger tapslag cakes were noticeably rare in the assemblage. Tapslags commonly formed narrow amalgamations that may mark flow out of channels or the holes now represented by the slag rods. In some cases, tapslags showed evidence for a vertical build up from a basal channel into more conventional tapslags.

Overall, tapslags made up 25% of the assemblage. Small fragments of tapslags are both very durable and easily recognisable, so they tend to appear disproportionally abundant in highly residual assemblages (such as those from ploughsoils).

Grey-surfaced tapslag: a small proportion (1% of the overall assemblage) of material with a morphology identical to conventional tapslags lacked the maroon surface colour and were greyish. This probably indicative of flows which cooled with a covering of charcoal, excluding oxygen.

Isolated prills: this category was for individual prills of slag without a maroon surface, that probably cooled with the fuel bed of the furnace or tapping arch. These pieces commonly show dimpled surfaces from contact with fuel particles. They were rare and constituted less than 1% of the total material.

Massive slags: the facies of residue contained a high proportion of material that was massive (i.e. contained no indication of any internal foliation or clasts). Typically, these massive slags pass into material with in indications of cryptic internal flow lobes, and rare internal or external lobed surfaces. They may also contain clasts of largely unreacted ore and the moulds of large fuel particles, particularly roundwood or split roundwood. These materials comprised 24% of the overall assemblage. Their precise location of cooling is uncertain and is discussed further below. The facies may pass laterally or vertically into porous slags with a fine vesicularity and/or fine charcoal particles or their moulds. Blocks dominated by massive slags may be up to 100mm in thickness. These materials typically have a brownish-grey colour quite different from that of, for instance, the tapslags in section. They may be slightly reddened around iron clasts and commonly show secondary reddening (secondary oxidation of

such slags typically has a brick-red colour quite distinct from the maroon primary oxidation colour of the surface of tapslags.

Charcoal-bearing slags: two possibly distinct types of slag are included here. Firstly, slags porous slags with fine charcoal particles or their moulds and secondly, dense slags, with little vesicularity, surrounding the moulds of large fuel particles (both cuboidal fragments of up to 45mm and roundwood fragments of up to 45mm diameter, tough typically less, and 55mm in length). Charcoal-rich slags with rather fine charcoal/moulds commonly form bowl-shaped bodes with a minimal basal crust. These materials provided 7% of the overall residue assemblage.

Slags from tapping arch area: larger pieces of slag from the tapping arch area may show a combination of features. Their bases may take the form of a 'U'-shaped channel, often filled by quite porous slag. This may grade into more massive material, commonly show a flow lobed upper surface, and on the inside of the likely arch location, grade into dense slags with large fuel moulds. Some 6% of the overall residue assemblage fell into this category.

Burrs: this class of slag includes typically bulbous zones of slag with intimately associated surfaces of indurated furnace/hearth wall. In smithing slags, they usually form an integral part of a smithing hearth cake, but in smelting systems they may be a more isolated item. In either case they form where the hot-zone impinges on the wall ceramic just below the air blowhole. In the present assemblage, there is a likelihood that at least some of these burr-like items were formed by interaction between very hot slag and the margins of a tapping channel, rather than at a higher level in the furnace. These items were uncommon, providing less than 1% of the overall assemblage.

Channelled slags: these slags provide evidence for slag through neatly rounded channels with widths of between 60mm and 100mm. These channels are likely to have been deliberately formed to conduct tapped slag away from the furnace. The upper surfaces of the channelled slags resemble tapslags, with which they intergrade through loss of the basal channel form. They may also grade into the 'slags from tapping arch area', through loss of the upper tap-slag-like structure. The basal surface is often granular or dimpled, commonly with abundant small fragments of reduced-fired furnace ceramic. The channelled slags typically have a prominent vesicularity, unlike the low vesicularity of the tapslags. They provide 6% of the assemblage.

Slag rods: slag rods a typically smaller in diameter than the channel slags and mostly show a dimpled contact surface around their entire circumference (just occasional locally missing and a free slag surface visible on the top). They range from about 20mm to 45mm in diameter, frequently narrowing along their length. Although some previous authors have referred to this facies as 'slag tubes', a persistent hole along their lengths is very rare. Short elongate voids are present sometimes (resembling the voids inside tapslag flow lobes), but typically the slags have an abundant fairly fine vesicularity. These rods grade into raised protrusions on the slag bowls, and are often continued as tool marks on their bases. The tool marks may become detached from the bowl through breakage – and such items have been classified with the rods here. Slag rods make up approximately 5% of the assemblage by weight, but are common and abundant components of the 'Cardiff Castle-type' assemblages.

Slag bowls: dense basal slag bowls are not common, but individual examples may be very heavy – and they this make up 16% of the slag assemblage. They form as a range of materials from dense plano-convex bowls up to 35mm or so in thickness (such types may be difficult to distinguish from smithing hearth cakes, see below), to thinner concavo-convex crusts, often with a fill of charcoal rich slag, which is turn grade into bowl-shaped masses of charcoal rich slag with little or no basal crust.

Lining Slags: slags dominantly formed of melted furnace cermaic were surprisingly rare in the assemblage (1% of the total). This is possibly associated with the secondary nature of the slag accumulations; the fragile lining slags are rapidly degraded by transport and reworking.

Furnace ceramic: as with the lining slags (and probably for the same reason) there was little (just 2%) furnace ceramic in the assemblage. Both oxidised and reduced fired material was present, but one provided any useful structural information.

Indeterminate slags: this category (7% of the total) embraces fragments of slag that are too small to be convincingly identified, together with some other material that it is not possible to identify with certainty (e.g. where the piece is thoroughly coated in accretion).

Residues from iron smithing

There was rather little material total 2155g; 1% of the assemblage) that was probably or certainly from iron smithing). These slags are listed on Table 2 as smithing hearth cakes (SHCs).

Smithing hearth cakes: the material from context (2041) provides the most certain examples of SHCs. These include a more-or-less complete example of a plano-convex, medium-sized SHC (383g; 110x90x45mm (l x w x t)) with a slightly dimpled top (with impressed charcoal) and a base that also shows moulds of charcoal fuel particles. The is also a slightly incomplete (90%?) much larger example (1500g; 120x150x75mm (main bowl 50mm) that is slightly biconvex. This context also produced a 147g section of a slag cake with a planar but rough base; long bladed olivine crystals with tubular vesicles to 30mm and large unroofed shiny voids in upper 10mm - probably from large SHC

Context (2195) yielded a 71g piece of dense slag with curved burr-like surface at one end, perpendicular to a highly lustrous, fayalite-rich, surface that is likely to be, but is not certainly, an SHC fragment.

Context (2034) produced a 54g concavo-convex sheet fragment, that may be from an SHC, but is equally possibly from a furnace slag bowl.

Iron ore

The assemblage included a total of 2.7kg of iron ore. The ore particles include small pieces of a size ready for charging (e.g. a 13g particle from (407), a 30g particle from (2085), and a 6g particle from (2111)). Other large pieces may have also been good, but lost, ore (e.g. the 283 and 271g blocks from (2272) or the 71g piece from (2150). Some of the larger fragments appeared of low grade and may have been discards (e.g. a 438g piece from (2000) and a 201g piece from (2034)).

Some of the largest pieces (pieces weighing 1126g and 283g from (2045)) have rounded to sub-rounded pebble shapes and are likely have arrived at the site via natural means.

The various pieces display a range of microstructures, from layered textures, stalactitic textures, botryoidal textures and combinations of these. Some show areas of a pale yellow country rock, which in the case of the large rounded lumps, is cut by a network of iron-rich veinlets. Some pieces show the presence of a soft red 'ruddle' between the harder goethite components. This range of microstructure is typical of ores from the Forest of Dean.

Iron and concretions

Much of the residue assemblage described above carries coatings of secondary iron minerals formed in the burial environment. Although some of this remobilised iron will come from weathering of the slag, a more reactive source will be metallic iron – either as inclusions with the slag, or as discrete particles or objects. Where the core of a concretionary mass is readily determinable to have been metallic iron (for instance because of expansion cracking), the item appears in the **iron** category on Table 2, but if the core is concealed, or there is on obvious core, then the item will appear in the **concretions** category. The two categories are therefore closely related and summarised together here.

Discrete iron artefacts were noted in contexts (2034) (a small iron fragment and a short length of iron bar), (2040) (3 concretions, 2 of which are large nails), (2101) (a probable nail shaft), (2142) (2 concretions probably cored on iron), (2153), (2186), (2225) and (2247) (all the last four producing concretions apparently cored on iron.

A 594g piece from context (2084) possessed a granular texture with all the components coated (and possibly bound) by dark secondary iron mineralisation. Such material probably represents either a deposit within the furnace containing much metallic iron from secondary reduction (typically reduction films on charcoal particles) or an accumulation of partly reduced primary ore and other materials (such material, in the form of a sinter, is often found in non-slag tapping furnaces, but may also occur in a salg tapping furnace where partly-reacted fines descend to the furnace base).

Other examples where concretions may have developed from metallic iron in slag include those from (2041) and (2150). Examples from (2041), (2046), (2060), (2101), and (2104) may be indicative of a more general redistribution of iron in slag-rich environments.

Interpretation

The assemblage of iron smelting slags forms an example of so-called 'Cardiff Castle' type, named for the first locality where a substantial assemblage of this type was described. This style of residue assemblage is known from several Roman sites in the region, including Cardiff Castle (Young & Kearns 2011; Young 2021a), but also more locally from the Lydney North B, Phase 2 project (Young 2019, 2021b; Hart & Cook 2025), Lydney Lakeside Avenue (Young 2024), Moat Farm, Newent (Young 2023), Alvington (Young 2009, 2013b), Weston under Penyard (Jackson 2012; Young 2015b) and Cannop (Young 2011, 2013a).

Slightly less certain examples of this assemblage have also been recorded at Caerwent (Young 2006), Dymock (Young & Kearns 2010), Kingswood (Young 2017), Frocester Court (Thomas 2000; Price 2000), Thornbury (Young 2015a) and Worcester (McDonnell & Swiss 2004).

These furnaces that produced these residues are, however, only known, with some qualification, from The Chesters villa Woolaston (Fulford & Allen 1992). For other, poorly-preserved, furnace in the area (e.g. Bridgewater 1965), the technology is uncertain. The description of the residues from this site is not conclusive and the material would repay modern re-appraisal, but the furnaces are believed to have been moderately large structures probably of 'bottle' shape.

The materials indicate a smelting technique that requires considerable intervention from the smelter. Recent work (Young 2022) has clarified that the slag rods represent infills to poker holes, made by rodding through the tapping hole to encourage slag flow through the ash and cooled slag in the base of the furnace. The mobilised slag often flowed from the furnace in narrow channels (perhaps below hot fuel).

The channel-filling slags showed an association with bundles of rods, suggesting that the liquid slag with the furnace bottom required considerable effort to free from that already chilled there.

The relationship of the various slag facies that apparently formed with the furnace base are much less clear. The bowl-shaped slags with a dense basal crust, appear to form one end of a spectrum with the porous slags rich in fine charcoal moulds which may overlie the denser bowls or replace them. Amalgamated flow slags with moulds of large, apparently unburnt fuel pieces appear to have formed on the inner side of the tapping area, above and behind both denser slags and porous ones rich in fine charcoal.

The thick accumulations of the 'massive' facies can be less certainly placed within the system. They contain zones that are not truly massive, but contain cryptic flow-lobed surfaces, they may pass into more vesicular horizons, and they commonly contain moulds of almost unburnt fuel and fragments of only partly reacted ore. These are all characteristics that provide links with the various other facies of internal slags. They also commonly show a degree of secondary reddening, which would suggest a location where, after solidification, they continued to receive a blast of air (not necessarily from the artificial air blast, but from the air drawn through the furnace in a chimney effect at the end of the smelt). The upper surface of these massive slags is commonly flow lobed, but is never reddened to the extent of the tapslags.

One possibility is that the massive slags were generated during smelts with a low degree of tapping, whereas if the tapping was effective in draining a higher proportion of the slag, then the charcoal rich deposits may have been generated.

It is unlikely that the finer details of the furnace will be understood without the discovery of new reasonably well -preserved examples.

Discussion

The archaeometallurgical residues are suggestive of a particular iron smelting technique that was employed around the Bristol Channel area, particularly in association with the exploitation of the Glamorgan and Forest of Dean sectors of the Bristol Channel orefield. Here, the assemblage was not linked with structural evidence for smelting and the actual focus of smelting was presumably outside the investigated area.

Such an assemblage was also recovered from the Lydney B Phase II site (Young 2019, 2021b; Hart & Cook 2025), where the slags were commonly associated with construction and levelling for the Roman buildings. At the Chesters Villa, Woolaston (Fulford & Allen 1992) the smelting activity occurred at some distance from the villa, but with residues incorporated into a variety of deposits.

On a broader scale, the smelting activity forms a part of a zone of iron production outside the Forest of Dean, that extended not only a long both banks of the River Severn between Gloucester (arguable Worcester) and Cardiff, but also eastwards from the Severn Vale onto the Cotswold escarpment (Allen 1988, 2009, 2010; Allen & Fulford 1987, 1990a, 1990b, 1992; Fulford & Allen 1992; Price 2000; Thomas 2000; Young 2006, 2009, 2013b, 2014, 2015a, 2017, 2019, 2021b, 2023, 2024,),

The iron ores of the Forest of Dean form just one part of the Bristol Channel Orefield (Young 2000; Young & Thomas 1998, 1999) and the distal parts of this sphere of influence may overlap with smelting based on other sources (e.g. those of the Iron Acton area in South Gloucestershire and of Border Vale sources in Glamorgan). However, the Forest of Dean was the volumetrically most important source and its ores were widely distributed. That distribution was largely overland, but transport along (and across) the Severn was also important. The rich iron ore sources within both the western and eastern outcrops in Dean were very localised, and so transport to permit the smelting of the ores from a much broader range of woodland resources would have been highly desirable (Young 2014).

Comparison of the significance of iron smelting to the economies of the various sites within this zone is very difficult to assess. The amount of slag recovered from the various sites is a poor tool. The direct observation of the smelting facilities (as at Woolaston) would be a much more reliable method but lacks comparators. Although the amount of slag recovered in the present project was fairly large, and was not a 100% sample, the quantities are still modest (compared, for instance, with the 10,000 tonnes of slag estimated to be present at Caergwanaf, a probable ‘state’ smelting operation in the Glamorgan sector of the orefield).

It has been suggested (Young 2014) that much of the earlier Roman iron smelting in and around the Forest of Dean was associated with state activity, but from the early third century onwards there is a significant rise in iron smelting apparently associated with villas. It is unclear, given the redeposited nature of the assemblage at Forest Dean Farm whether it is also part of the villa estate-based iron smelting (like Woolaston, for instance), or whether the lag is redeposited from some earlier, pre-villa activity.

Further work

These materials would be capable of providing further information of archaeological significance through detailed laboratory analysis (for instance the likely source of the iron ores and clarification of details of the process). However, the utility of that information is greatly reduced by the residual and/or redeposited nature of the assemblage. Several recent investigations have already examined rather similar suites of residues from the same smelting technology.

Accordingly, a very restricted programme of laboratory analysis is proposed, solely to address the question of ore provenance.

The iron ore section above lists the following as likely ore fragments that were introduced to the site:

- a 13g particle from (407),
- a 30g particle from (2085),
- a 6g particle from (2111),
- 283 and 271g blocks from (2272),
- a 71g piece from (2150).

Elemental analyses of the 5 larger pieces (i.e. without the 6g fragment from (2111)) would provide a useful set of comparative data, particularly when tied to descriptions of their structures (cutting the 3g piece would not allow enough for retention of a fragment for structural description). These data can be compared with a reasonably extensive database of materials held by GeoArch. Analyses should be undertaken by XRF and ICP-MS to obtain as full a suite of elements to add provenancing as possible.

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Table 1: catalogue of submitted materials.

C	bag	l wt	l no	notes
surface		38	1	maroon-surfaced dense tapslag
207		287	1	charcoal-rich slag topped by irregular bulbously lobate maroon surface with pale indurated ceramic between lobes, one side shows right angled re-entrant suggestive of large wood/charcoal piece 40x35mm
		188	1	prilly slag with pale ceramic inclusions; imprint of 40x60mm fuel/wood fragment
		267	9	dense tapslags with maroon surface in very worn smooth pieces
		12	1	slag bearing large fuel imprint
208	1 of 2	2984	1	large mass of slag rich in fine charcoal, no certain original surfaces; block starting to crack - so presumably contains a significant piece of iron
		624	1	broken large bock of flow slag; presumably tap slag, but surfaces worn/etched so now greenish rather than red
		725	3	angular blocks of slag with abundant coarse fuel moulds (coarser than the large block)
208	2 of 2	1191	1	large block of charcoal rich slag; apparently foot of wall as shows attached reduced fired clay on two faces, with roll-like bulbous lobe extending along angle; the vertical side shows straw impressions; if all grey clay was from wall, then it was very irregular and somewhat overhanging
		626	1	block similar to 1191g piece, but no straw and has prominent basal tool mark; internal lobes maybe slightly better developed too
		466	1	another porous furnace slag block, probable tool mark, very irregular piece
		41	1	angular piece of bloated reduced-fired furnace wall
		727	10	tap/flow slags and prills - all have green surfaces, but probably originally red - smooth dense
		56	2	flow slags from inside fuel bed
218		15	1	maroon-surfaced dense tapslag
313		618	9	tapslag with maroon surface
		61	1	slag rod 20w by 30 deep
		67	2	flow lobed? vesicular slag
		9	1	prill from within fuel bed, surface not preserved well
314		54	3	maroon-surfaced dense tapslag
321		6	1	vesicular iron slag fragment
323		66	3	tap slag with maroon surface
		95	1	pumiceous slag sheet; 10mm; slightly dimpled surface

404		2278	6	dense slag, massive fine, locally lobing, all extensively secondarily reddened
		85	1	ferruginous concretion on iron
		410	1	channel passing into narrow tapslag flow; shows marked down curve; channel 55mm wide
		153	7	pumiceous iron slag, one piece secondarily reddened
		152	4	tap slag; mostly worn green surfaces
		67	1	brown slag rich in charcoal moulds
		158	3	slag sheet, mostly to 10mm, with columnar fayalite, sand; locally smooth red interior surface, areas more than 10mm from outside is vesicular
404	<2>	378	assm	>4mm slag debris, needs washing
407	<3>	623	assm	>4mm slag debris, needs washing
407		842	22	maroon-surfaced dense tapslag
		13	1	probably roasted iron ore
		390	4	apparently massive slags, but with all with some lobing on surfaces
		300	1	pad of very dense coarse, granular slag - probably a furnace slag, but just possibly SHC
		34	2	vesicular iron slags
		40	1	dense iron slag with fuel moulds
2000		30	1	small exploding piece of iron
		438	1	dense iron ore, yellowish country rock overlain by dark goethite, locally with reddish zones near contact; latest part is fibrous botryoidal goethite
		512	1	very rough texture slag with multiple rods/tool marks on base; vesicular and charcoal-bearing internally - tpyical runner/rod texture
		131	2	tapslag fragments, one red, one less so
2022		17	1	tapslag fragment
2027		33	1	fractured nub of highly vesicular slag
		38	1	tapslag with maroon surface
		23	1	slag covered pebble
		305	1	dense massive fine slag, larger piece has hint of upper smooth dished urface
2028	<65>	37	1	narrow slag rod in very pale green olivine-rich slag with some rusty paches
2028		83	1	slightly slagged oxidised fired lining

		5052	1	slightly maroon, rough surfaced highly vesicular tapslag; interspersed with highly vesicular slags without flowed surfaces through top 90mm; lower 80mm dense on one side, with gravelly inclusion near edge; passes into open slag formed of brown charcoal moulds (which appear unburnt), 20x25x40-60mm, many of them are roundwood; basal 40mm vesicular slag with a few fuel fragments.
2030		37	1	brown slag with charcoal//wood moulds, organics are brownish,
2032		18	1	vitrified oxidised fired lining; surface slag is very dark forming hard layer that is strongly dished
2032	bag 1	447	7	reduced fired lining - mostly rather altered bloated and locally slagged
		71	2	similar to reduced lining above but includes patches of oxidised fired material
		285	8	tapslag with reddened surface
		207	1	irregular dense rounded block of rusty slag rich in charcoal
		686	1	large channel slag 80mm wide by 60mm deep; upper surface partly reddened lobes but overlain by material with coarse fuel moulds; very dense; asymmetric channel
		126	1	amalgamated flow slag; brown with large moulds of round and split wood
		451	2	angular blocks of dense massive slag; one with flow lobes on top (not reddened)
		190	2	fragments of amalgamated flow slags; variegated pale to dark, and reddish brown; the later lobes are associated with large pieces of partly-reacted ore; in one area, the slags forms veins into a charcoal or wood piece. Strongly non wetted, vertical? Face
		123	1	unusual flow slag in low density pale grey slag; presumably a very odd melted wall
		139	1	dense slag with a rock, top?; granular and blown
		28	1	small fragment of tapslag-like material but with dark lobe surfaces
		48	1	channel slag fragment
		7	1	pale dimpled within charge flow slag
		6	1	possible nail?
2032	bag2	1046	9	tapslags with reddened surfaces; largest 596g
		319	7	variable oxidised wall, locally shows bloated lining slag and very rusty adhering slag
		41	1	pale green flow slag containing abundant roundwood moulds
		77	1	pale green flow slag with fuel dimpled base
		119	1	slag sheet; very gently curved; top not reddened; smooth dish with vesicles penetrating to surface in places; base non-wetted lobes; 10mm thick; unusual piece
		159	3	miscellaneous flowed slags; grey surfaces
		237	4	small pieces of massive but vesicular slag
		112	1	thin sheet/crust mostly microdimpled base but with a few lobes; top rough with abundant charcoal moulds
		345	1	massive slag; shows lobes near/on base; reddened fracture surfaces
		1043	1	massive slag; flow lobes on top just slightly reddened; steep, planar, non wetted surface at 30 degrees to vertical; probable ore; large, striated fuel or wood mould
2032	bag3	791	5	tapslag with reddened surface
		156	6	variable oxidised fragments of furnace wall - fine clay
		109	1	brown flow slag with abundant roundwood moulds
		811	4	massive slags; locally with flow lobed surface; surfaces locally reddened

		8	1	fragment of iron
		371	1	large complex block of amalgamated flow slags; shows one partially non-wetted contact with pale reduced clay, but the orientation of this is uncertain, probably vertical; top has slightly reddened flow lobes; interior (away from direction of flow) shows moulds of large split and roundwood particles; important piece for locating these
		215	1	slag in thin wide sheet with raised flow lobes on one margin; base mostly non-wetted and continues beneath lobes; most likely the 45-degree side of large tapping channel; had been slightly over topped by flow, but that moved on, deflating the channel fill to a thin skin
		135	1	fragment from dense sheet; base irregular; body has some vesicles; upper surface shows unroofed small vesicles and is strongly reddened - fragment from basal crust in furnace?
		167	5	indeterminate dense slag fragments
		2	1	small pale prill
2032	bag4	747	28	tapslag with reddened surface
		320	11	variably oxidised fragments of furnace wall - fine clay
		147	1	pale flows sloughing off wall
		179	1	particularly pale flow slags with dark, but not red, surfaces; otherwise like tapslag
		73	1	block of ‘plastic-like’ lustre wall with some viscous movement of slag layer; on reduced fired gravelly clay
		120	1	rough slag with a possible rod fragment; but also containing a smooth ‘Y’-shaped flow - potentially emanating from a rod
		186	1	probable burr in rather worn porous slag, large, but unclear if SHC; if SHC could be well developed lower crust rather than burr; not very dense
		90	1	conventional tapslag; probably lying on rod
		26	1	highly vesicular slag with small ceramic clasts; detached tool mark
		205	1	dense vesicular slag with tool mark or runner on base; >40mm wide
		69	1	rusty slag with charcoal moulds and a partial roundwood mould
		173	3	dense slags with dimpled bases; possible runner fragments
		200	2	highly vesicular massive slag fragments - almost pumice like
		164	1	dense, locally prilly slag; shows a partial roundwood mould
		107	2	dense slags with internal rough surfaced flow lobes
		29	7	small indeterminate slag fragments
		74	1	very dense tapslag-like flow; fuel dimpled base; some lobes on top but only minor reddening; both base and top have large inclusions of iron ore
		80	1	very worn dense slag, uncertain origin
		17	1	rusty lobate indeterminate slag
2034	bag1	2095	35	tapslags with reddened surfaces
		41	1	tapering rod fragment
		136	1	channel slag - possibly as expanding into tapped cake, 45mm w x 35mm t including raised flow lobes (reddened)
		259	1	deep rod/toolmark on the base of dese rusty slag; probably intersection of rod with dense slag bowl, and rusty stuff above
		374	4	angular blocks of dense massive slag (apart from some large vesicles)
		49	1	dark dimpled lobate slag prills in contact with oxidised fired lining

		156	7	smaller pieces of indeterminate smelting lag
2034	bag2	1522	1	part (half?) of a large slag cake. Basal 40mm forms a good bowl, them overlain by 35 of dense, possibly prilly slags in a wedge 160x110x80mm overall, probably basal furnace bowl, but could just be interpretable as SHC
		161	4	indeterminate iron slag fragments
		54	1	concavo-convex sheet fragment; possibly from an SHC
		20	1	ORS pebble
		201	1	layered iron ore - probably low grade
		76	1	slag rod 25x20x80
		1726	34	tapslags with reddened surfaces
		19	1	bleb - of iron?
		138	3	fragments of channel slags
		692	3	angular blocks of massive facies, one with unusual blown granular surface, 1 with 60mm length of 20mm roundwood would
		179	1	irregular lump comprising a pile of lobes/prills - origin unclear
2034	bag3	1734	31	tapslags with reddened surfaces
		254	1	‘Y’-shaped piece formed by convergent slag rods
		381	3	misc. tapslag like materials but with dark not red lobes
		459	3	angular fragments of massive dense slag (some parts with large vesicles)
		273	3	dense brown slag with abundant moulds of 25mm diameter roundwood
		64	1	channel fragment 40mm w x 25mmt
		141	1	channel fragment 50mm w x 30mm t; dark tapslag like top
		36	1	iron poor pale grey flow slag lobes around charcoal moulds
		31	1	oxidised fired clay
		94	1	thick bock of lining slag
		22	5	small indeterminate slag fragments
2034	bag4	1966	42	tapslags with reddened surfaces
		167	1	curving slab of vitrified, bloated and slagged reduced fired clay
		156	1	concretion formed of slag and what appears to be short length of iron bar
		1380	8	dense massive slags, some with minor vesicles, some with flow lobed top
		57	1	fragment of channel slag
		105	2	fragments from small slag rods
		230	1	length of large diameter slag rod 40x30mm; some slag adhering to outside, both original and from concretion
		17	1	small length of tiny channel (or half filed rod)
		105	1	short length of rod attached ot base of massive slag (rod/toolmark)

		20	2	greenish fayalitic slag prills
		446	1	unusual slag in dense dark slag, with very dark microprilly surface; has bowl like form with possible tool mark; broken in half and with more similar slag piled on top of bowl; probably furnace bowl but maybe SHC
		159	5	indeterminate smaller iron slag fragments
		91	1	very worn vesicular pale grey slag - nature uncertain but possibly a highly worn channel fragment
2036		211	11	tapslag with maroon surface
		626	1	large complex thick block of tapslag with steep, curved non-wetted surfaces
		1482	2	large angular fragments of massive slag; upper part shows slightly maroon flow surfaces and some steep non-wetted surfaces, but not as strongly marked as in tapslag
		336	1	very thick dense crust - probably from within furnace, grades into rusty areas
		71	1	rough-surfaced tapered slag rod
2037		210	3	tapslag with maroon surface
		56	2	highly vesicular slag fragments
		57	1	ferruginous concretion
2040		1269	15	tapslag with maroon surfaces
		271	5	fragments of vitrified/slagged mostly oxidised fired lining
		262	1	massive fine slag with vesicles in small zones
		109	3	concretions on iron - 2 are large nails
		346	4	fragments of pale grey highly vesicular slags; some have hints of possible smooth, probably lobed, surfaces, but all are worn
		10	1	fired and slagged very pale fine clay
		160	1	probable runner piece, crudely rounded base and flow lobed top
		65	7	slag debris
		54	1	narrow irregular rod
		337	1	probable channel margin piece; several rough curved surfaces with some flow lobes on top
		440	1	complicated piece - channel on base, very irregular dark surface flow slags above; probably a short rod fragment incorporated amongst flow slags
2041	1 of 3	2900	17	dense slags, typically with some flow lobed surface either on top or internally, but in either case they are unreddened; inclusions of iron ore and large fuel particles, also possible stone inclusions
		147	1	section of slag cake; planar rough base; long bladed olivine with tubular vesicles to 30mm and large unroofed shiny voids in upper 10mm - probably from large SHC
		105	1	dense flow lobed sag showing irregular steep non-wetted contact; maybe over stone in tapping area??
		75	1	prilly slag apparently in contact with long round object- most likely roundwood of 10-20mm diameter; other faces show large charcoal contacts
		95	1	greenish prilly slag with flow around fuel voids; grades into vesicular slag with very large saccharine olivine
		856	9	Tapslags; mostly grey surfaced, only some very thin sheet material shows reddening

		769	2	dense slags or iron in rusty concretionary material, also involving stone
		89	2	indeterminate slag fragments
		438	1	elongate piece - rod at one passing into flowed slag at the other
		245	1	concave bock of lining slag apparently resting on top of dense slag; this seems to be part of a dense crust, maybe below furnace blowhole?
		1777	2	rusty blocks with dense crust apparently overlain by charcoal rich slags, presumably smelting furnace slags
		169	1	2 fused lengths of rod, 20-30mm diameter each, 60mm long
		90	1	short length of channel, 55mm w x 35mm t upper part is flowed lag
		632	1	angular block of dense slag with flow lobed surfaces with large amount of iron ore inclusions
2041	2 of 3	383	1	highly weathered plano-convex SHC; top slightly dimpled and has impressed charcoal; base shows charcoal moulds; 110x90x45mm
		1338	25	tapslag fragments
		248	1	rather irregular semicircular plano-convex piece, probably the tip of a slag flow rather than an SHC
		323	1	fragment of curving dense crust, perhaps overlain by lining-influenced material and with very rusty patch; probably furnace slag rather than an SHC fragment but this is uncertain
		938	1	large block, probably of massive facies, but concealed largely by accreted material
		352	1	rounded lump of slag with fine charcoal, very rusty
		315	1	irregular lump of charcoal rich slag
		15	1	single slightly sinuous rounded prill
		53	1	slag rod fragment; 22x18 by 50mm long; rough on one side, smooth on the other
		53	1	40x25mm channel; appears possible this is 3 superimposed rods slag dense with tiny peripheral vesicles; top larger vesicles
		314	1	accreted mass with tapslag attached to large iron-rich part, which is both rusty and gravelly
		131	3	small slag fragments with fine charcoal debris
		65	assm	fine slag and charcoal
2041	3 of 3	300	1	foliated oxidised fired clay
		1740	21	fragments of tapslag; mostly with reddened surface but not all
		1500	1	slightly incomplete (90%?) slightly biconvex SHC; 120x150x75mm (main bowl 50mm)
		600	1	slab like piece; probably flowed; 130x100x40mm (25mm main slag)
		700	1	breccia of slag fragments cemented by corrosion from a piece of iron (itself unseen)
		79	1	15mm by up to 30mm; slightly curved rod 85mm long
		100	1	rod/channel 35x25mm; smooth base and flow lobes on top
		74	1	rusty charcoal rich slag
		300	1	very dense slag lump; some charcoal moulds; one edge particularly coarse; presumably from near burr
		293	2	dense slag with horizons of vesicles, but no lobes
		90	3	thin, somewhat low density sheets of slags; probably tapslags
		45	1	slightly lobate slag with moulds of charcoal
		66	1	dense slag with fine vesicles, and fine charcoal debris

	11	3	small slag fragments
2042	2600	1	large slab; 190x160x60mm; crudely triangular; top? Rusty; base with grey ceramic chips; planar, no real bowl form
	853	6	tapslags with reddened surfaces
	105	1	slightly irregular rod fragment, 30x25h x70mm
	100	1	irregular and indeterminate slag with large vesicles
	30	1	dense dark slag with an internal dark surfaced flow lobe
2045	1126	1	water worn boulder/cobble of low-grade ore - has reticulate veins penetrating yellow-brown rock
	946	1	somewhat rounded large block of low density highly porous slag with vesicles and fine charcoal moulds; base shows large toolmark/channel
	283	1	second block of veined ore - some of the yellow seen here is botryoidal
	660	1	broken in 2, very unusual slag sheet, inner face partly smooth, brown and strongly reddened; surface curves into hole - so potential blowhole, below this there is a slumped? mass of dense slag; sheet is granular, rear is very rough and has a prominent ridge, like a tool mark - if the front shows the blowhole and sub-blowhole mass, then this ridge would be vertical. if this orientation is correct the sheet curves strongly in the embayment,
	1016	1	angular block suggestive of section of internal bowl 100 mm thick; top slightly lobed but mainly highly vesicular slag with fine slag, some lobing 40mm below, then massive down towards what appears to be a prilly base; lower part has angular facets - unclear if these are the prills forced to be polygonal or actual inclusions of ore/gravel?)
	1292	1	four parts of a broken slab of charcoal rich slag, up to 60mm thick, faint suggestion of smooth lower laminae (barely a crust)
	267	1	irregular fragment of massive facies slag
	295	1	fragment from 40mm thick tapslag, appear siliceous, flows wrinkled
	170	1	angular fragment of vitrified and bloated wall. Wall is fine but rich in pale fine pebbles
	596	1	rusty irregular fractured block of very dense slag; but in places grades into slag with fine charcoal moulds
	18	2	indeterminate slag scraps
	127	1	fractured into 3, probably channel fragment
2046	244	1	Rod-shaped piece, exploding, so contains iron - maybe should be sampled
	2110	61	tapslag, mostly very worn
	162	15	small indeterminate slag fragments
	435	1	broken piece, appears to be 70mm wide channel after slag has passed through; mostly smooth concave surface but one side overhangs, the other largely missing
	148	1	probable worn channel piece
	728	20	fragmented porous slag, both vesicles and fine charcoal
	15	4	coal
	117	1	slagged and vitrified lning
	28	1	bloated reduced fired lining
	555	7	rod pieces
	2	1	prill

		442	1	fragment from 40mm thick dense concavo-convex crust, rusted surface, no details visible
		69	1	channel fragment
		405	4	fragments of massive slag, local hint of lobing
		79	1	dense granular ion rich slag, possibly blown, possibly some fine charcoal debris
		139	1	rounded rusty lump - unclear if rounded slag with iron or simple concretion
		152	1	moderately dense slags with some concave fractures - indeterminate?
		50	1	10mm vesicular slag sheet - indeterminate
2060	1 of 3	2808	33	tapslags, mostly greyish; several pieces show a large inflated lobe c40mm in diameter
		225	7	prills and flows with heavy encrustation - presumably therefore formed in fuel bed not free
		135	3	small fragments of rods
		781	6	fragments of channels and/or toolmarks from base of bowls
		171	1	probable channel fragment, has very bulbous tapslag-like material on top (cf. bulbous material in tapslag collection)
		805	12	slags that are not identifiable but which contain clear signs of flow; maybe chaotic tap, internal or tapping arch
		493	36	small indeterminate slag fragments
		26	3	pale weathering pieces, sandy, probably weathered lining slags
		395	1	fragment of dense flow or bowl crust with smooth top, grey, vesicular near top, irregular base
		54	1	reddened irregular slag with probable partial roundwood moulds
		265	1	slab-like slag lump; could be from channel or even SHC; dimpled top, smooth side
		863	1	dense slag in crude channel-like shape
		629	1	rounded slag mass, biconvex; SHC or furnace slag? No identifying features
		178	1	exploding massive slag, with some fine charcoal preserved
		90	2	slag in form of curved sheets - one possibly bulbous hollow flow fragment, the other may be deflated flow
2060	2 of 3	444	9	tapslags, mostly not strongly reddened
		1256	4	fragments of channel slags, one piece is tip of channel with tapslag-like top
		891	1	large channel fragment; 75mm wide to 120mm wide; narrow end is single channel, but in section is 3-4 amalgamated rods; these diverge towards wide end and part around a void with steep faces and secondary reddening
		284	1	small rod or channel with flow lobed (not really reddened) top
		381	1	weathered block of multiple amalgamated rods
		132	2	rod fragments
		1104	1	part of very dense plano-convex slag cake; 130x95x65mm; dense basal crust to 30mm; base covered in small slag fragments and rough; upper part rough and rusty weathered slag; furnace basal cake
		382	1	dense massive angular slag block
		1087	7	probable tapslags; variety of textures and structures but not conventional dense tapslag
		959	4	ferruginous concretion, binding slags with minor stone
		740	2	dense slags with smooth tops (possibly dished flowed top or unroofed very large vesicles)

		200	5	low density porous slags; dimpled surfaces in places; possible charcoal contacts
		340	3	very dense massive slags with rare vesicles; some rough surfaces provide hint of being blown (texturally but not reddened)
		200	1	tap slag block with grey ceramic clasts on base, grey surfaced tapslag
		180	1	dense slag some fuel dimpled prills near base; top? is rough and covered in fine gravel; stone clast
		82	6	small slag fragments
2060	3 of 3	1700	7	tapslag pieces; mostly not very reddened surfaces; bases differ little from channels in some cases
		663	1	very dense block of slag, but covered in accreted material and identification not possible
		330	1	probable channel fragment, but 'U' looks almost over tightened, so may be deformed; has wispy tapslag-like material piled on top
		163	1	dimpled rusty slag in contact with dark flow lobed material, it is unclear if this is concretion or a complicated slag piece
		1158	3	massive dense slag in angular fragments; some inclusion of altered clay, possible ore and one has a few vesicles
		1895	3	angular fragments of dense slag with clay inclusions locally, all show some signs of flow lobes, either on surface or in section
		371	1	reddened tapslag on top of 90mm wide channel with rough base
		538	1	possibly 5 amalgamated rods in one large rough block
		400	1	fragment from channel fill with very irregular base (i.e. not normal channel) and apparently very fragmental top; dense slag
		439	1	curious stack of irregular flow lobes - possibly flow slags emanating from rod or channel?
		549	4	various dense flow slags, with colours and some textures matching the massive materials
		300	1	irregularly rounded lump of low density slag with vesicles and fuel moulds
		289	1	piece with tool mark on base, but above is breccia of flow slag fragments - unclear if primary or purely concretionary
		42	8	fine slag debris
2072		44		indeterminate small slag fragment; reddened fracture hints at former iron inclusion; rough surface with overall twisted appearance
2074		711	23	tapslag
		509	1	substantial block of massive facies, large rounded vesicles near base, dark flow lobes in top
		96	1	complex dark surface flow lobes overlying slag with abundant fine charcoal moulds
		100	1	flow slag - like tap slag, very olivine rich, no reddening
		61	1	small fragment of a gravelly channel fill
		7	1	vesicular slag fragment
2076		2137	48	tapslags
		185	2	somewhat like tapslags but full of large fuel moulds
		326	1	tapslags flowing out above and in front of a pair of fused rods - root of tapslag cake
		387	1	block of massive lag with dark blown top
		553	1	apparently massive slag flow lobed on top; secondarily reddened; base of piece is lobate and is over the top of lobate highly vesicular slag
		395	1	massive slag passing into polygonally-fracturing prilly facies, top slightly lobed and rough

		139	1	rod, with possible part of second attached
		193	1	tapering rod; narrow end simple; wide end coated in dense prilly filmy slags - presumably around fuel moulds - so perhaps widening into main charcoal mass?
		43	1	lower part of enormous wide flow lobe of a pale green fayalite slag - presumably a large unroofed vesicle
		161	1	large flow lobe with dimpled base - probably an odd tapslag
		282	5	variably vesicular, mostly dense slag with some lobes, probably rather messy internal slags
		56	1	rusty concretion on iron
		48	1	deeply dimpled pale slag sheet base, internally very vesicular
		84	1	poorly flow lobed fragment - probably tapslag but could be internal; massive top
2084		594	1	irregular mass, could be simple concretion but resembles sinter; bound by secondary oxides
		118	2	rather pale tapslags with fine lobes
2085		30	1	angular fragment of brush
		231	8	tapslags
2092		600	2	tapslags, larger piece seems to have tool mark on base
		109	1	maroon surfaced amalgamated flow slags around large fuel moulds
		408	1	side of dense massive cake, sloping side, top poorly preserved but flow-lobed; side shows concave embayment with non-wetted lobes; internally massive
		70	1	pale mass, probably a rather granular lining slag
		50	8	small slag fragments
2101	1 of 3	1208	1	185mm long; complicated block of 4 amalgamated slag rods; base of cluster is rough, top is charcoal bearing apart from central top rod, the narrowest, which has a smooth top; this rod shows some fused fractures; in general, the top gets more charcoal rich towards one end and overall block is wider at that end (increases from 60w x 65h to 85w x 65w)
		1863	16	tap slag with maroon surface
		77	1	small fragment of slag rod; 35x25mm section; vesicular
		117	1	95mm long flow slag; probably emanating from a rod tip
		1056	1	large piece of plano-convex slag, unclear what this is: could be a large SHC fragment, part of a furnace bottom slag, or even an odd tapslag.
		508	1	concretion with multiple slag fragments
		14	1	iron - rod/nail shaft
		473	1	dense, massive slag with reddened flow-lobed top and strongly lobed base at 45 degrees to top; unclear if this was a primary massive slag or more likely flow slag that has homogenised
		78	1	loosely amalgamated prilly slag
		373	1	concreted lump, main part is a section from a slag cake with a flat reddened top and a probable tool mark on base, probably a tapslag, but could be from a large SHC
		250	1	slightly chaotic set of flow slags, possible runner forming base
		130	4	angular fragments of dense slag, indeterminate

2101	2 of 3	1328	1	large fragment of tapslag cake; 170x100x40mm
		1649	1	curious large dense block; slightly biconvex; top has some blown hollows but also rough surface that neatly curves into lower rough surface, which is sweepingly curved; an important piece
		1780	21	tapslag with maroon surface
		122	1	lump of reduced-fired furnace clay
		173	1	root of slag rod, possible flow slag on top
		387	2	dense slag, probably massive
		263	1	rusty concretion, probably has iron inside
		164	4	indeterminate dense slag fragments
2101	3 of 3	1927	21	tapslag with maroon surface
		286	1	rusty sag with abundant large charcoal moulds up to 40mm
		622	1	block with irregular, blown top with open vesicles and reddening; plano-convex; quite angular below, shows possible tool mark along angle; probably formed at meet of rear wall with flat floor of furnace; shows narrow tubular vesicles
		108	1	bulbous single flow lobe; potentially slag flow from rodding hole?
		340	1	side of bowl with single large protruding lobe; presumably from rodding into basal slag
		726	1	large angular block of massive slag - no original surfaces
		49	1	fragment of flowed slag sheet? top perfectly flat; maroon; base is lustrous and dimpled
		77	1	irregular sheet fragment; unclear if flow structures or multiple rods
		251	9	indeterminate fragments; all dense slag
		767	5	dense slags; mostly rather massive, but surface unclear for identification
		110	1	possible tapslags; highly rusty - possibly contains iron
2104		595	1	part of convex topped slag flow, fractured into 4; possibly a large single vesicular flow lobe; 40mm thick; base also convex, slightly lobate mostly rough base, top has large unroofed vesicles. Could possibly be SHC, but unlikely
		458	8	tapslags with reddened surface
		1005	1	large block of apparently massive slag, internally prilly/lobed
		300	1	accretion on block of vitrified lining, backed by reduced fired clay, not quite the same degree of induration as a burr
		178	1	corroded elongate piece; might be purely iron inside or potentially a slag rod just with iron on the end
		353	1	very irregular iron/rock concretion
		117	1	vesicular slag - potentially FB type material
		38	1	highly bloated and vitrified lining/lining slag
		55	3	small fragments of lobate slag
		418	1	amalgamated rods/channels - probably at least 4 rods with some attached flow lobes
		218	1	25-30mm diameter stout slag rod mostly has rough coating, in places broken away to reveal flowed smooth surface
		159	4	fragments of small rods c20-25mm diameter

2111		1006	41	tapslag fragments with reddened surface
		15	1	tiny fragment of probable burr
		89	4	various bloated lining/ lining slag material
		675	4	dense slags with localised evidence for lobes
		568	1	massive slag block; some hint of internal lobing on one end; top above this has reddened flow lobes, then there is a stripe of attached oxidised clay, behind which there is an odd rounded shape - like trough shape - but presumably in roof of tapping arch
		200	12	small pieces of variable dense slags
		6	1	small fragment of goethite ore in open foliated structure
2121		59	1	long sigmoidal prill like piece, one end is straight - so slag flowing from rod into fuel bed just possibly; 15-20mm diameter, 105mm long
		70	1	flowed dense slag with red surface; shows lip on margin against side of channel?
2137		290	1	dense slag lump; some lobes on base; includes vesicles and charcoal fragments, one long tubular mould could just be roundwood mould - but this is uncertain
2142		649	11	tapped slags with grey surface
		513	4	tapped slags with red surface
		145	1	2 fused slag rods, each 20mm diameter and 90mm long
		11	1	slag rod 15x10mm; or just possibly a dull-surfaced prill
		200	1	concretion on iron object
		565	1	ball of rather messy rusty furnace slag lying on top of tapped slag; lateral contact with oxidised-fired lining (i.e. side of tapping arch/channel?)
		651	1	very dense slag block with internal and top flow lobes; grey; steep to undercut non-wetted side 70mm tall
		580	1	angular block of dense slag with upper and internal flow lobes in paces, small inclusion of lining slag near base, 75mm deep, base also shows 15mm fuel inclusions
		135	1	lump of slag with abundant fine charcoal
		143	1	lump of slag with coarse charcoal fragments; one shows shrinkage cracks suggesting it may have been wood
		106	1	low density slab with slight expansion cracks - unclear if really iron inside
		287	1	rounded block of slag with charcoal-bearing accreted material; suggests some weathering iron involved
		37	2	small fragments of slag; one probably lobed; one probably with charcoal
		148	1	slag with lobate top but high lining content probably; despite that dense
2150	1 of 3	938	5	fragments of amalgamated rods
		1049	17	tapslags with reddened surface mainly, some show rod/channel-like under surfaces
		1232	2	massive slags, variable vesicularity, variable amounts of rust
		848	2	massive slags, variable vesicularity, some internal flow lobing
		1121	1	appears like massive slag, variable vascularity, but curious bundles of lobes, often with non-wetted surfaces in complex orientations

		88	1	vesicular slag, arc of vesicles suggests this is channel fragment, but no surfaces preserved
		125	1	rusty slag with large fuel moulds
		66	3	small fragments of dense lobate slags
		237	1	mass of flow lag and lining - probably a concretion rather than primary
2150	2 of 3	2160	40	tapslags with reddened surface mainly, some show rod/channel like undersurfaces
		1400	5	rods, mostly in amalgamated pieces - largest may have 5 individual rods but hard to count with certainty
		505	5	fragments of incompletely filled rods/channels with flow slag tops
		613	1	slag block, grades from massive into slightly vesicular
		571	1	irregularly angular massive lag block, locally vesicular
		267	1	dense amalgamated flow slags around part roundwood pieces, up to 40mm
		71	1	iron ore with ruddle between finer components
		566	1	130x80x50mm, fragment of bowl or channel with slag rich in fine charcoal debris; just slightly denser along basal surface
		448	1	margin of plano-convex bowl; 50mm deep; filled with slag rich in fine charcoal, slight hint of basal crust
		1684	1	dense massive slag with one dimpled surface - dimpled part may be side rather than base - if so 90mm thick; if base 80mm thick
		1863	1	very rusty accretionary mass - appears to be cored on plano-convex piece - which is presumably what bears the iron, but details not determinable
		82	6	slag debris
2150	3 of 3	1506	23	tapslags with reddened surface mainly; one shows non-wetted planar base
		785	4	fragments of amalgamated rods - one with an associated flow slag
		608	2	vitrified lining with variable oxidation; small piece is gravelly; larger looks more like grog than gravel temper
		894	1	angular fragment of very dense massive slag with numerous internal flow lobed surface
		1749	2	dene slag massive with flow-lobed surfaces only near top
		1415	1	massive dense slag, thick, grades up into slag with fine charcoal and at least one large fresh roundwood mould
		1325	1	fragment from bowl or channel in porous granular slag with fine charcoal; some poor flow lobes buried at very base
		312	1	finely prilly charcoal rich slag
		430	1	very low-density slag highly vesicular with fine charcoal too; possible upper surface is smoothly dimpled
2153		209	5	flow slag; probably grey surface, but worn
		636	11	tapslag with maroon surface; some are very highly worn
		1912	3	ferruginous concretion; dense slag largely, but must be included iron
		290	1	arcuate irregular slag lump; possibly part of a curved rod/tool mark
		191	1	indurated block; probably part of a gravelly burr, with lining fragment included or accreted
		160	1	complicated block with grey flow-lobed slag in contact with gravel; cut by strongly secondarily reddened and blown face - presumably from tap arch area
2156		45	1	fragment of conventional tapslag

2161		27	1	very worn tapslag fragment
		10	1	small fragment of iron slag sheet
2162		189	3	amalgamated rods - largest 35mm, other two much smaller
		495	1	large block of massive slag, one inclusion of charcoal, unusual smooth sigmoidal surface
		166	8	probably single block fractured; partially melted gavel in siliceous matrix
		316	1	charcoal bearing sheet; flat on top; rounded and possibly tool marked on base
		212	1	rounded, probably dimpled, slag lump
		182	2	very dense pale grey slags with internal flow lobes
2183		282	7	worn tapslag fragments
2186		2843	49	tapslag with maroon surface
		682	1	curving sheet of slag; rough rear surface; front surface shows wedge of rough slag with probably blown surface; slag reaches 30mm at maximum; slag is dense, rough-surfaced; sheet probably comes from surface of side just above the base
		300	1	angular block of very dense slag with blasted oxidised surface on several faces; presumably blown furnace bottom
		251	3	slag rods, 2 of 3 have smooth flowed top
		41	1	rod or channel; surface rough; very neat, straight rod, smooth concave top - so presumably open
		84	1	deep tool mark/channel 25mm wide, overlain by tapslag
		90	1	bulbous rounded margin to slag mass, unclear what type of slag this is
		74	1	exploding concretion on iron - rounded so may be process waste
		738	5	rounded rusty slag lumps - probably very weathered and origin is uncertain
		143	1	elongate long piece of tapslag, just possibly channel related
		145	1	elongate tapped/flow slag in a form suggesting it is flow forward of a channel; double layer structure
		100	1	highly vesicular slag, pale, possibly lining related
		306	5	flowed slags, all probably tapslags, but not good examples - perhaps through weathering
		216	1	Low-density flow slags; forming a pile of flow-lobed slags
		248	1	rather chaotic slag; probably a deformed channel slag; very disturbed
2189		44	1	tapslag fragment
2190		1559	1	rather heavily accreted bock; probably chaotic furnace slag; small prills, charcoal moulds, ore debris and, given rusty accretion, probably iron also
		162	1	probable channel, expanding from 70mm to 90mm wide; rough base and rough top with oblique ridge but no flow lobes; vesicular; lots of pale grey ceramic
2193	1 of 2	625	1	tapslag with maroon surface

		2315	1	massive slags with slightly pink colour; prilly base in places; flow lobes on the top; some red areas may include ore
		245	2	pieces of c50mm wide channel slags, tops of items not preserved, so unclear if these are discrete channels or from base of larger blocks
		655	6	porous slags - both vesicles and charcoal moulds present; the more charcoal, the more rusty the slag, typically
2193	2 of 2	811	1	channel approximately 75mm wide and c40mm deep; very dense fill to channel; overlain by highly vesicular slags, forming a chaotic layer 25-30mm thick, with crude surface ridges; lots of reduced ceramic crumbs
		1057	1	fragments similar to 811g piece; mostly the low-density facies, lots of moulds of round wood
		368	5	tapslags with reddened surface
		515	1	margin of channel as 811g piece; very dense slag; channel base covered in fragments of grey ceramic; 60mm deep, probably 90mm wide or more
		330	1	60mm wide, 40mm deep channel; tapering to rounded point over 80mm
		109	1	possible channel fragments
		154	1	angular fragment from margin of large channel
		331	2	dense slags passing up into vesicular slag rich in fine charcoal moulds (cf upper parts of channel)
		215	2	angular fragments of dense massive slags
2195	1 of 2	2566	1	large irregular slag block with angular fractures, now broken in 4; 170x120x100mm, possible ceramic contact at one end, upper part has poor lobes on top (and a few internally), these are poor and dark except for an area of secondary reddening; basal part has some very large vesicles; internally carries some iron?, side away from possible wall shows some large fuel moulds
		1310	1	angular block of dense slag showing passage into slags rich in large fuel class, oxidised ceramic fragment near base
		934	1	dense slag with some large vesicles, thins from 70 to 40mm as the top passes from charcoal-rich veneer into large tapslag lobes - indicates very fluid slag
		147	1	abraded channel fragment
		93	1	tapslag-like fragment
		100	1	small fragment of dense slag with reddened flow lobes on top and mould of large fuel clast
		141	1	low density weathered rod
		84	2	bloated and vitrified reduced-fired wall
		195	1	fragment from side of plano-convex lump of charcoal-rich slag
		125	6	small indeterminate slag fragments
2195	2 of 2	2028	57	tapslags, several pieces show large amount of ore on lower surface
		650	5	massive slag or amalgamated flow slag around large fresh fuel clasts; largest 45mm diameter roundwood, 50mm long (potentially split); some strange non-wetted curving faces
		1716	13	angular fragments of massive slag with cryptic flow lobe surfaces
		178	1	massive slag with large rounded vesicles; top sculpted into large viscous looking flow lobes
		29	1	narrow rod fragment
		265	2	rusty slags with abundant fuel remains (preserved in brown), with individual clasts of up to 45mm
		461	9	small fragments of dense massive slag related to the above classes
		275	7	dense vesicular slags, probably tapslag-related, but not classic tapslag

		71	1	dense slag with curved burr-like surface at right angles to highly lustrous fayalite surface - uncertain, but possibly an SHC fragment
		462	3	indeterminate dense slags; rusty; one suggests plano-convex form, one has burr-like form; indeterminate origin
		11	1	oxidised fired fine clay
		19	1	isolated straight prill
		261	3	worn slags, probably from channels
		120	6	stones
		100	9	indeterminate smaller slag fragments
2197	1 of 3	1230	1	block of furnace slag; slight crust on bowl side (piece is probably steep not basal) with lobes of lining material; interior has lots of charcoal (and moulds) with one piece showing a >50mm x >60mm split wood (?) surface
		1243	1	very rusty slag fragment, suggests one corner of a rounded cake with a slightly raised rim 40mm wide and approximately 200mm across (this one quarter), details obscure
		5119	1	large, massive, slag locally lobed, two areas show indurated gravel mass, gravel and clay less altered on base; shows part of a large wood/charcoal fragment as 1230 block
2197	2 of 3	4359	1	large block of basal furnace slag; appears to form zone typically 70mm thick around one quarter or so of basal mass; almost 300mm in diameter at 140mm above flat base; maybe 200mm diameter, but orientation not certain; finer charcoal in fill; outer 30mm probably denser
		3089	1	angular bloc of slag; has massive layer ?minor local concealed lobing; and rustier charcoal bearing part - probably 160mm thick, equally divided
2197	3 of 3	192	1	fissile oxidised fired clay coated with a thin veneer of flow slag - not strongly altered
		518	1	fragment from tap slag cake; possibly slightly biconvex; shows basal crust to about 15mm in core, before central voids appear in flows; probably the very distal tip of a tapslag cake
		1422	4	angular fragments of apparently massive grey slag, just a few vesicles and extraneous inclusions locally
		1069	5	fragments of fine grey slag with grey surfaced flow lobes
		300	1	rusty charcoal rich slag in the form of a large tool mark, probably cleaved off the base of a large slag mass
		310	1	multiple rods fused together, one very large, others smaller
		482	4	Charcoal-rich slag
		513	1	irregular slag mass, includes at least 3 amalgamated rods within the basal crust
		1012	1	irregular mass of rusty slag; apparently part of the basal crust of furnace slag but must include a substantial quantity of metallic iron
		231	1	fragment of slag inside a channel - but may be complicated by rods? 45mm wide x 25mm deep, possible rod above - main channel slightly bilobed
2218		112	3	tapslag
		68	1	worn bock of 2 fused rods
2225		109	1	concretion on iron
		30	1	vesicular slag, rich in fine charcoal
2228		35	1	flowed slag, finely complex, reddened

2231	34	1	curious piece, denser flow lobes are dark blue, but crossed by vein of glass in duck-egg green, vesicular, top is rusty
	176	1	dense burr with indurate sediment on curved margin, internally has some large vesicles, lobed top, clast of oxidised fired clay; unclear if true burr or interaction between hot flow and side of channel
	320	1	thick flow slag in very large lobes on top (with large voids), but homogenised in thickness of cake, 50mm thick total
	286	1	complex tapslag mass with abundant ore fragments, both internally and on base between prilly lobes
2233	93	5	tapslag
2247	111	3	tapslag with maroon surface
	291	1	dense lag, worn, multiple narrow roundwood moulds on one side
	266	1	irregular slightly rusty slag with fuel moulds, including some split roundwood
	43	1	heat altered reduced fired clay/pale lining slag
	10	1	greenish olivine rich slag with large vesicles
	121	2	concretions on iron
2259	430	1	block of massive appearing slag that is amalgamated tapslag; on some faces lobing is entirely cryptic; base prilly with lots of ore inclusions; some oddly curved sub-vertical non wetted surfaces
	189	1	conventional dense tapslag
	2223	1	dense block of slag covered in rusty layer, includes transition from channel at one end to 140wide 70 deep margin of slag bowl at the other; cannel slightly upturned with respect to bowl, so probably, but not certainly, is the channel to tapping pit transition rather than from internal bowl to channel - but would be worth cutting to examine this
2270	105	1	dense slag, curved base and concave reddened top, channel? SHC?
2272	375	1	slag bowl with dense crust and charcoal-rich interior, exterior appears to show stub of rod
	224	1	large block of lining slag
	439	1	irregular slag block with curving margins; suggests piece is from base of slag bowl; with large rod?
	917	4	large blocks of conventional tapslag
	283	1	iron ore - large block with dense fine sheets bounding more granular areas
	271	1	iron ore - mostly rather granular material
	1072	5	dense slags with some internal lobing, one shows flow lobing on top that may be reddened but not certain
	778	2	dense angular massive slag locks
	366	6	vesicular slags with variable, usually abundant charcoal - likely to be furnace slags, some possible rounded and dimpled surfaces
2272	5828	1	250x170x130mm, large p-c block, microprilly slag, dimpled basal surface, some adhering reduced fired clay, no substantial crust, vesicular and charcoal rich - curvature hints this may sit against wall of furnace rather than in bottom of base - if so 170mm deep,

2288	341	1	broken in 3; finely vesicular slag with abundant charcoal and very coarse olivine; slight burr like margin in one area - could be highly worn SHC
	46	1	Charcoal-bearing indeterminate slag fragment
	1418	1	broken in 2; part of 80mm cake; lobate inclined margin on one side; massive internally, some cryptic and slightly reddened lobes, one large fuel mould

Table 2: distribution of archaeometallurgical materials (and selected other materials) by class and context.

C	tap	tap grey	prill	massive	charc	taparch	burr	channel	rod	bowl	lining slag	ceramic	SHC	indet	ore	iron	conc	res sum	
u/s	38																	*38*	surface
207	267				200	287												*754*	Fill of ditch F206
208	1351		56		5992							41						*7440*	Fill of ditch F206
218	15																	*15*	Wall structure
313	618		9						61					67				*755*	Fill of ditch F312
314	54																	*54*	Fill of ditch F312
321														6				*6*	Fill of ditch F324
323	66															95		*66*	Layer
404	152			2278	67			410						311		85		*3218*	Fill of pit F403
407	842			390	40					300				34	13			*1606*	Fill of ditch F406
2000	131							512							438	30		*643*	Topsoil
2022	17																	*17*	Upper fill of ditch F2020
2027	38			305										56				*399*	Fill of pit F2025
2028						5052			37			83						*5172*	Rubble layer
2030					37													*37*	Rubble layer
2032	2959	366	83	3348	664	371	186	1122	351	135	343	1331		818		14		*12077*	Rubble layer at SW corner
2034	7521	381	56	2905	273			536	1102	2044	310	31	54	677	201	19	156	*15890*	Deposit across north building
2036	837			1482					71	336								*2726*	Fill of pit F2035
2037	210													56			57	*266*	Deposit over rubble layer in SE corner of structure
2040	1269			262				937	54			281		411		109		*3214*	Fill of pit F2039
2041	3416	856	15	4763	816	350		143	839	2495		300	2030	1007			1783	*17030*	Slag rich deposit over cobbles
2042	853			30					105	2600				100				*3688*	Cobble surface SW of building
2045	295			863	2238			127		1016	660	170		18	1409			*5387*	Fill of ditch F2044
2046	2110		2	405	728			652	799			145		885			139	*5726*	Fill of ditch F2044
2060	6478	200	182	4504	532	805		4917	1470	1499	26			3204			1411	23817	Fill of pit F2059
2072														44					Fill of pit F2070
2074	711	100		509	96			61						7				*1484*	Fill of gully F2073
2076	2298			1335		793			332					175		56		*4933*	Fill of pit F2146
2084	118																594	*118*	Charcoal deposit in pit F2146
2085	231														30			*231*	Deposit in pit F2146
2092	709					408					70			50				*1237*	Fill of ditch F2091
2101	7233			1586	286			250	1458	2611		122		2945		14	771	*16491*	Layer
2104	1053			1005	117				973			338		55			353	*3541*	Fill of ditch F2103
2111	1006			675		568	15				89			200	6			*2553*	Layer
2121			59					70										*129*	Fill of ditch F2120
2137				290														*290*	Deposit north of building
2142	513	927		1231		565			156					472			306	*3864*	Fill of pit F2142
2150	4715			8509	1134			1159	3123	3457		608		1945	71		237	*24650*	Slag deposit in SW corner
2153	636	209				160	191		290								1912	*1486*	Fill of ditch F2103
2156	45																	*45*	Fill of ditch F2155
2161	27													10				*37*	Upper fill of ditch terminus F2160
2162				495	316				189		166			394				*1560*	Fill of ditch terminus F2160
2183	282																	*282*	Fill of ditch F2182
2186	3365							536	376	982		100		828			74	*6187*	Layer
2189	44																	*44*	Fill of pit F2188
2190				1559				162										*1721*	Fill of pit F2188
2193	993			2530	655	1057		2495	0									*7730*	Fill of posthole F2192
2195	2396		19	3005	265	2344		408	170	2761		95	71	687				*12221*	Fill of posthole F2194
2197	518			10699	482			531	823	7844		192						*21089*	Fill of posthole F2196
2218	112								68									*180*	Spread
2225					30											109		*30*	Lower fill of ditch F2224
2228	35																	*35*	Truncated deposit - feature unknown
2231	606													210				*816*	Primary fill of ditch F2230
2233	93																	*93*	Fill of ditch F2230
2247	111				557							43		10			121	*721*	Fill of coombe F2246

2259	619					2223												*2842*	Upper fill of coombe F2258
2270														105				*105*	Fill of ditch F2268
2272	917			1850	366					6642	224		0		554			*9999*	Slag deposit
2288					46					1418								*1464*	Upper fill of ditch F2286
total	58923	3039	481	56813	15937	14983	392	15028	12847	36140	1888	3880	2155	15787	2722	531	7914	238293	
	25%	1%	0%	24%	7%	6%	0%	6%	5%	15%	1%	2%	1%	7%					

Table 3: comparison of the composition of the slag assemblage from Forest Dean Farm with related assemblages from the region.

Site	tapslag	massive/ furnace slag	channels	rods	lining/ lining slag	indeterminate slags	maximum total of internal slags	total weight (kg)
Forest Dean Farm	26%	52%	6%	5%	2%	7%	65%	238.3
Weston under Penyard (Young 2015b)	27%	19%	42%	2%	5%	5%	66%	19.9
Kingswood (Young 2017)	29%	45%	0%	3%	2%	21%	66%	43.3
Lydney B Phase II (Young 2021b)	33%	38%	19%	0%	2%	9%	65%	179.3
Moat Farm Newent (Young 2023)	28%	43%	8%	7%	2%	12%	64%	37.8
Cardiff Castle (Kearns & Young 2011; Young 2021a)	45%	33%	0%	0%	6%	16%	49%	94.9
Cannop 37920 (Young 2011)	50%	35%	5%	0%	6%	4%	44%	109.1

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