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Assessment of archaeometallurgical residues from Cleevelands, Bishop's Cleeve, Gloucestershire

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Abstract

Approximately 60kg of macroscopic materials in 157 bags from 84 contexts were submitted for assessment, along with 112 bags (20.4kg) of residues from the wet-sieving of 49 samples from 43 contexts. 17 of the sieved samples (42 bags) were not pertinent to the present investigation, being from cremation deposits; just 9 samples (23 bags) from 4 contexts yielded metallurgical microresidues.

The macroscopic assemblage comprised approximately 53kg of slag, 5.0kg of hearth lining, 2.1kg of corroded iron, with minor quantities of coal and fired clay. There was also one broken fragment of crucible. The residues are probably mainly of later Roman (C3-C4) age.

The residues were almost entirely indicative of ironworking (blacksmithing) employing coal as fuel. 80% of the assemblage by weight was identifiable as complete or partial smithing hearth cakes (SHCs) and other similar slag masses. Indeed, the variety of slag masses challenges current criteria for the recognition of SHCs and it would appear that the smithing hearths at Cleevelands produced different morphologies of slag waste on different occasions. The large number of such slag cakes present makes this a very valuable assemblage in any such discussion.

Only 57 of the 176 smithing slag cakes were the typically-shaped, concavo- or plano- convex, cakes known as 'smithing hearth cakes' SHCs. Other similarly-sized cakes included (1) transverse and crescentic forms, (2) 'conical' and 'pyramidal' forms attached to the sub-blowhole wall, (3) sub-circular tabular puck-like forms, (4) burrs with no clear frontal detachment, (5) elongate irregular down-wall cakes and (6) other irregularly-shaped dimpled masses.

The SHCs ranged from 50g to 530g in weight, with an average weight of 176g, but the whole assemblage of smithing slag cakes ranged from 44g to 530g, with an average weight of 125g. The weight-frequency statistics of this overall assemblage bear very close comparison with some other examples of rural Roman blacksmithing residue assemblages.

The smithing slags showed inclusions of coal residue and the slagged ceramic around the blowhole was frequently rich in shale, presumably coal shale, fragments. There was no certain evidence for the use of charcoal as fuel.

The ironworking residues are strongly associated with the deposits of Group 11459, spot-dated to the 1st to 2nd century AD, which produced 86% of the assemblage by weight from 37 contexts. The use of coal suggests a post-conquest age. Sieved residues from Group 11459 were rich in coal residues and slag debris, but contained only lesser quantities of hammerscale, possibly suggesting that they represent dump or midden deposits, rather than a smithy floor. Another importance source of macroresidues was a series of fills of palaeochannels, which yielded a further 6% from 5 contexts. The remainder of the ironworking assemblage (7% by weight) was derived from sparse occurrences in a further 41 contexts, mainly the fills of various ditches, postholes and pits.

Three conjoining sherds of Roman crucible, probably for the melting of copper alloy, were derived from ditch [10755], which yielded no ironworking residues.

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Methods

The material described here derives from excavations at Cleevelands, Bishop's Cleeve, Gloucestershire, conducted by Cotswold Archaeology (Site Code CER14). This project was commissioned by Ed McSloy.

All materials were examined visually with a low-powered binocular microscope where required. As an evaluation, the materials were not subjected to any high-magnification optical inspection, not to any form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

This report replaces the version issued 18th July 2016, in the light of revised dating evidence.

Results

Description of residues

Approximately 60kg of macroscopic materials in 157 bags from 84 contexts were submitted for assessment (Table 1), along with 112 bags of residues from the wet-sieving of 49 samples from 43 contexts (Table 5). 17 of the sieved samples (42 bags) were not pertinent to the present investigation, being from cremation deposits, and were not examined in detail. Nine samples of residues (23 bags) from four contexts produced archaeometallurgical residues.

The macroscopic assemblage comprised approximately 53.0kg of slag, 5.0kg of hearth lining, 2.1kg of corroded iron, with minor quantities of coal and fired clay. There was also one broken fragment of crucible. The residues are probably entirely of Roman (C1-C4) age.

The residues were almost entirely indicative of ironworking (blacksmithing) employing coal as fuel. 80% of the assemblage by weight was identifiable as complete or partial smithing hearth cakes (SHCs) and other similar slag masses. Indeed, the variety of slag masses challenges current criteria for the recognition of SHCs and it would appear that the smithing hearths at Cleevelands produced different morphologies of slag waste on different occasions. The large number of such slag cakes present makes this a very valuable assemblage in any such discussion.

Smithing slag cakes

There were 176 more-or-less complete examples of smithing slag cakes, but only 57 of these were of the classic plano- or concavo- convex morphology of a typical smithing hearth cake (SHC). The entire group is categorised here as 'smithing slag cakes', with the SHCs as just one subgroup. The weight-frequency statistics for each morphology are presented in Table 3. The other major cakes also appeared to have formed as the sole or major slag piece within a smithing hearth, but they occurred in a variety of shapes:

- as isolated burrs
- as conical or pyramidal sub-blowhole slag pieces
- as crescentic and/or narrow transverse slag masses
- as elongate,down-wall, masses
- as irregular slag masses

The typical; SHCs were small and typically plano-convex, with fairly smooth tops and dimpled bases. In several cases the bases showed the development of irregular internal sheets or lobes, broadly concentric with the lower surface, but sometimes incorporating small extensions. Similar pieces commonly occurred as separate slag fragments. These are interpreted as having been formed as tool-marks, in which the smith has used a poker to agitate below the growing slag mass and the liquid slag has then infilled the void created by the passage of the poker through the fuel bed. More typical tool-marks show as ridges on the base of SHCs and may indicate the use of a poker to loosen or raise the slag from the hearth. The lateral movements suggested here, may be more likely to be associated with the smith encouraging the slag to settle deeper into the hearth to prevent obstruction of the area in front of the blowhole. The 57 examples of SHCs ranged from 50g to 530g in weight, with an average weight of 176g. Some of the SHCs showed a dense upper 'puddle' of slag, in which case some maroon surficial colouring was also visible. A sandy component was visible on the glassy slag upper surface of some, but few were gravelly and no slag cakes showed the overall gravelly structure seen in those from sites such as Neath (Young 2013, 2014a).

The irregular masses and the down-wall masses may simply be less regular accumulations of slag otherwise equivalent to SHCs. They typically have dimpled slag surfaces (from contact with fuel particles). The irregular forms may have either grown in an irregular shape, or perhaps more likely they have been disturbed into an irregular, often spikey, shape through use of the poker.

The isolated burrs, the crescentic masses and the pyramidal sub-blowhole masses may all have been generated close to (or in the case of the burrs within) the wall below the blowhole – with the crescentic masses forming away from the wall, the pyramidal masses forming touching the wall, and the burrs formed in an embayment within the wall. These reflect

different degrees of wall-slag interaction and also possibly the effects of partial slag removal during work.

The whole assemblage of smithing slag cakes ranged from 44g to 530g, with an average weight of 125g. The weight-frequency statistics of this overall assemblage bear very close comparison with some other examples of rural Roman blacksmithing residue assemblages.

The smithing slags commonly showed inclusions of coal residue. There was no certain evidence for the use of charcoal as fuel.

Other Iron Slag

Other slags in the assemblage were probably also from smithing, but are materials not incorporated into the main slag mass – either because they were isolated prills, blebs or nubs of slag within the fuel bed, or because they were associated with the hearth wall, rather than the central hot-zone.

The high-density slags in this group are mainly isolated pieces, but small fragments of dense slag that cannot be assigned to an origin within one of the main classes of smithing slag cake are also grouped here.

The low-density slags in the group are slags formed mainly from partial melting of the lining and may have solidified either still in contact with the wall, or as lumps at the foot of the wall or in the same location as a conventional SHC. For examples where the slags are still attached to surviving wall material, they have been accounted for in the following category of hearth lining.

Low density slags formed attached to wall around and above the blowhole were commonly rich in fragments of coal shale and formed particularly thick accumulations in this assemblage.

Hearth Lining

Some 2056g of hearth lining was present, mainly as oxidised fired pieces (so probably from close to the blowhole). Several pieces showed short sections of blowhole margins, but these were insufficient for any accurate determination of blowhole size.

Pieces from close to the blowhole commonly showed a thick accumulation of shale-rich slag, as described above.

Iron

There was a substantial quantity of ironwork present in the metallurgical samples. A total of 2.0kg of iron (146 pieces) was recovered from contexts of Group 11459 and 2 pieces with a total weight of 60g from palaeochannel fill (12313).

The ironwork included nails of various sizes (ranging from large flat heads down to tiny hobnails), sheet iron, bar fragments and fragments of a socketed tool (11440). Although many of the smaller scraps may have been smithy waste, it is possible that some of nails and other artefacts may have been general waste deposited alongside the archaeometallurgical residues, rather than being associated directly with them.

Crucible

A single sherd (from ([10755]), now fragmented into three pieces, represented a body sherd from a moderately-large crucible with a sacrificial external clay coat. The crucible itself may have been a greyware vessel; examples from elsewhere have typically been beakers. The sherds had (mostly) been over-cleaned, and there were no surviving traces of residues (apart from a thin white, chalky, layer on one fragment) on the internal surface. The external vitrified surface showed no characteristic inclusions or colours to its glaze. Crucibles formed from small beakers and vases with external applied clay coats are known widely from Roman Britain. Within the SW crucibles of this type include several largely complete examples from 4th century deposits within the *basilica* at Caerwent (Young 2007), examples from levels from as early as the 1st-2nd century at Caerleon (Zienkiewicz 1993; Evans & Metcalf 1992) and fragmentary examples from Cirencester (Bayley 1996). They are less-common finds on rural sites.

Microresidues

Small quantities of archaeometallurgical microresidue (hammerscale) were observed alongside comminuted slag debris and coal residues in sieved residues from contexts (11459) and (12040). In neither case did the rapid assessment of these samples suggest that the microresidues were present as a proportion of the sediment, although further magnetic separation of the samples would clarify this.

Distribution of residues

The stratigraphic distribution of the materials is summarised in Table 2.

The ironworking residues are strongly associated with the deposits of Group 11459, which produced 86% of the assemblage by weight from 37 contexts. Another importance source of residues was a series of fills of palaeochannels, which yielded a further 6% from 5 contexts. The remainder of the ironworking assemblage (7% by weight) was derived from sparse occurrences in a further 41 contexts, mainly the fills of various ditches, postholes and pits.

The three conjoining sherds of crucible were derived from ditch [10755], which yielded no ironworking residues.

The supplied background data permit no more detailed analysis of the geographical distribution of the macroscopic material.

The rapid assessment of the sieved samples located metallurgical residues in samples from just four contexts (11459, 12027, 12029, 12040). Although these samples contained significant amounts of coal residue, coal and comminuted slag debris, true microresidue (flake hammerscale) was only observed in two contexts (11459, 12040). In neither case was the hammerscale abundant.

The supplied spot-dating gives dates of 1st to 4th century AD for the contexts yielding ironworking residues, with a possibility of some of the material being late Iron Age. All available evidence from elsewhere, however, suggests that the use of coal as fuel for ironworking is post-conquest age; there in no confirmed use of coal for metallurgy in the pre-Roman period. The crucible was of a common Roman type.

Interpretation

The amount of archaeometallurgical waste recovered from the site is moderately high, with the 176 slag cakes being the most numerous smithing slag assemblage that has been described. The majority of the residues occurred in a series of very closely-related deposits that form Group 11459 and are likely to be of later Roman (C3-C4) age.

The weight-frequency statistics of the overall smithing cake assemblage (Table 4) show a close similarity some previously-described examples of Roman age, most notably from Uffington (Young 2015) and Exminster (Young 2014b; originally interpreted as being of medieval age). The morphological variability of the smithing slags is likely to be reflection of the use of coal as fuel. The ash content of coal is very high compared to that of charcoal, which means that slag may be generated readily within the fuel bed, rather than purely at the point of molten hearth ceramic into the hot-zone. The variation may also be at least partially associated with the mode of clearance of slag from the hearth. In cases when interaction with the wall was strong, a burr may have developed in an embayment in the wall, where the slag mass had reacted with the wall; complete removal of the slag within the wall would be unnecessary between work periods, so that the burr may be separated from the hearth slag. In cases where the wall and slag interacted little, a planar slag-wall contact may have resulted – such as that seen in the approximately conical or pyramidal sub-blowhole slag pieces. When the formation of slag in the hearth allowed formation of a regularly-shaped mass, then a conventional SHC would arise. When the hearth slag either formed irregularly, or was substantially disturbed by use of the poker, then an irregular slag mass would be formed. Removal of slag lumps from in front of the blowhole may have left behind slag in a more crescentic morphology along the wall.

The weight-frequency plot (Figure 1) clearly shows how the conventional smithing hearth cakes form to a wide range of weight, whereas the other morphologies of slag are typically smaller. This may suggest that irregular slag masses in the hearth may grow to adopt a more regular form with larger influxes of slag.

It may be significant that the closely comparative assemblages of probable Roman age such as those from Uffington and Exminster, as well as some of the later blacksmithing assemblages such as those from Moyveela and Ballykillaboy in Ireland (see Tables 4a and 4b) are from rural smithies. There are marked differences with the weight-frequency distribution of SHCs from other Roman sites such as Neath, Carmarthen, Bulmore, Caerleon and Cowbridge, all of which have mean SHC weights that are much higher (220-400g) than that of the present material, and all from more urban settings. The assemblage from Marsh Leys Farm is similar in profile to those of the urban group, but derives from a rural setting. What is unclear is whether the basis for counting of the various assemblages is strictly comparable. The exclusion from the count of SHCs in the older work of some of the smaller types of mass recorded here might lead to an apparently heavier assemblage.

One distinction from the smithing slags of the assemblages seen on many Roman sites (e.g. Neath, Young 2013b, 2014a; Caergwanaf author's unpublished data; Caerleon Priory Field, Young 2013a; Caerleon Endowed Schools, Young & Kearns 2010; Exeter, Young 2011c; Calstock, Young 2011a, 2012b), is the lack any the distinctly gravelly, low density slags. The precise control of these gravelly slags has yet to be identified but one possibility is that the gravel component is derived from the margins of floor-level, cut hearths, as opposed to the more sophisticated waist-level constructed hearths. If this is correct, then ti would suggest the presence of a more developed, perhaps permanent, smithy at Cleevelands.

Clearly further work, including the recording of slag formed in modern hearths under controlled conditions, will be required to improve the interpretation of such material. Care must be exercised in the comparison of assemblages described by different authors unless the criteria for inclusion in the measured assemblage are explicit.

Notwithstanding the uncertainty associated with the detailed comparison of assemblages and the current poor level of understanding of the variation in slag morphology with the way in which the hearth is used and cleared, the present assemblage may confidently be attributed to blacksmithing (the end-use of iron). The generally small slag cakes suggest a low amount of iron being lost to the hearth during each work period – in turn suggesting that either the work periods were short or that the work was light work, involving little high-temperature work such as forge welding (or both).

The use of coal is interesting, not so much for its use per se, but its use such at an apparently early period of the Roman occupation. The use of coal has been widely recorded on Roman smithing sites in the region: in Gloucestershire (Frocester Court, Thomas 2000), in Oxfordshire (Uffington, Young 2015) and in South Wales (Trowbridge, Young 2009a, 2009d; Caerwent, Young 2006; Caerau, pers. obs.; Cardiff, Young & Kearns 2011; Penmark, pers. obs.; Caerleon, Young & Kearns 2010; Bulmore, Young 1999). None of these recorded occurrences would appear on present evidence, however, to be as early as the 1st century AD.

The presence of a crucible for copper alloy work is not unusual amongst Roman assemblages and the single piece does not indicate that this was a major activity. That the crucible was of a form with an external applied clay coat is slightly unusual on rural sites.

Discussion

The ironworking assemblage provides an important and large collection of slag masses that formed in the smithing hearth, and demonstrates a wide variety of morphology. Although the assemblage as a whole is indicative of light smithing work and may be compared with other examples from rural Roman smithies, particularly that recently investigated from Uffington, there is uncertainty regarding the precise interpretation of the morphological variants of hearth slag. From an archaeometallurgical viewpoint, therefore, the assemblage has great potential for an investigation of the significance of variation in smithing slag morphology and composition (potential direct controls include hearth manipulation, interaction between the hearth slag and the wall and the nature of the coal impurities; these in turn would be influenced by the materials, the task, including the temperature required and the duration of the work-period).

The typically low weights of the hearth slags is in contrast with the assemblages recorded from urban smithies (towns, *vici* etc.). Much previous interpretation

has centred on the interpretation of such differences in terms of task; an alternative interpretation would be that they differed in terms of work-period, with the rural smithies operated to undertake specific tasks, but the urban ones providing a constant service.

The presence of a sherd of crucible is not unexpected on a Roman rural site, in which intermittent copper alloy casting is commonly encountered. It is unclear whether the work was undertaken by the estate smiths or, perhaps more likely, by itinerant founders. In

Further work

The material provides a very interesting assemblage of smithing slags with a variety of morphologies. To date no detailed examination has yet been made of such an assemblage. Detailed analytical investigation of the assemblage would certainly be of benefit to improved archaeometallurgical understanding of coal-fuelled smithing in the Roman period. Such analysis should investigate any potential link between slag composition and the variety of smithing slag morphology recognised, to investigate whether there is any determinable association between slag morphology evidence for process (e.g. are particular morphologies more likely during high temperature welding?).

Irrespective of the commissioning of further work at this stage, the assemblage is well constrained in terms of origin and age; it is therefore an assemblage with considerable future potential and should therefore be preserved in its entirety as part of the site archive, through deposition in an appropriate institution.

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Table 1: summary catalogue of macroscopic materials. All weights in g.

C	S	Sample wt	item wt	no	notes
10757		14	14	1	sherd of grey-ware crucible broken in three. Has external clay coat, now highly bloated, internally over-cleaned but shows thin pale skim on interior surface which has locally turned pink. This is an unusual colour, but may possibly indicate the extent of zinc diffusion into the ceramic after the melting of a zinc-bearing alloy (brass, gunmetal...)
11276		10	10	3	vitrified oxidised lining
11429		300	160	1	neat dense almost semi-circular SHC, 50x75x35mm, flat black top with slightly raised lip, base neatly inclined and dimpled, anteriorly slightly lobate and free
			72	1	fragment of dense SHC probably similar to above
			34	3	small prilly slag blebs
			32	2	slagged and vitrified lining
11430		8	8	1	vitrified oxidised lining
11431		886	248	1	large slag mass attached to sub-blowhole wall, 60x85x55mm
			278	1	55x90x55mm, slag mass attached to planar, probably overhanging wall
			132	1	slag mass, dimpled base, raised lobes on op
			72	1	irregular dimpled mass
			60	3	2 dimpled slag masses, 1 with ceramic contact and coal shale clast
11432		770	36	3	oxidised vitrified lining
			370	1	SHC, 95x100x45mm, plano-convex SHC with a couple of iron rich rusty blebs on upper surface, base irregular and finely dimpled, top planar but very slightly wispy
			116	1	rounded nub-like SHC, 45x55x35mm, base irregular prilly, top roughly planar but rusty
			22	3	shaley clinker
			20	1	irregular concretion on iron
			164	3	irregular fragments of dense slags with dimpled original faces
			38	1	fragment of dense slag attached onto oxidised wall
11433		418	104	1	irregular dimpled mass

C	S	Sample wt	item wt	no	notes
			282	1	small amount of dimpled slag attached to much wider burr and wall, attachment 95mm wide and embayed 30mm, c.45 deep, 75x95x50mm
			24	2	slag fragments
11434		540	294	1	prilly slag mass with dense curving sheet down inclined wall, slag in rounded lobes with white surfaces, shale clast on top, 80x70x65mm
			40	5	slagged oxidised lining
			28	3	scraps of lining/iron slag
			42	1	dimpled slag lump
			42	1	dimpled slag lump
			94	1	corroded iron mass, very irregular shape
11435		290	202	7	dense dimpled slag fragments
			16	1	low density bleb
			68	4	vitrified oxidised lining with deep build-up of clinkery shale-rich material
11436		1000	164	1	irregular dimpled mass,
			122	1	rounded dimpled mass, 65x45x50mm
			114	1	dimpled mass, ceramic attachment one end, smooth, slightly flowed and slightly maroon top
			112	1	irregular dimpled mass, almost sheet like, very pale, small shale clast on base, several small coke particles, 85x35x55mm, slag on top black glassy with large grains
			100	1	dense puck like plano-convex cake, shows iron corrosion on top, 50x50x30(20) mm
			68	9	gravelly lining slag, some with ceramic content
			14	4	oxidised fired lining
			28	2	slagged oxidised lining
			150	3	lobate/dimpled dense slag with reduced fired contact - none is whole cake
			108	6	dense dimpled slag fragments
			12	2	rusty fragments, possible iron fragments, one a small folded piece of iron strip
11438		438	38	13	organic tempered fired clay in buff colours
			48	7	slagged oxidised fired furnace lining, in orange fabric
			2	1	nail head
			2	5	coal fragments
C	S	Sample	item wt	no	notes

		wt			
			138	18	dense dimpled slag fragments
			30	5	lining slag fragments
			2	2	pottery (BB?)
			8	2	rusty lumps - corroded iron
			150	1	crude SHC in curved sheet. Dimpled surfaces, rounded vesicles, glassy slag, slightly incomplete
11438		700	144	6	slagged oxidised hearth lining, one piece with convex form cf tuyère, but also with shale clast
			20	1	pottery with handle
			128	9	low density blebby lags, dark glass, pale surface, some with coal and shale inclusions
			144	1	angular fragment of dense slag with high iron content
			252	9	fragments of dimpled dense slag
			4	1	fired clay
11438		318	260	1	dense irregular sub-blowhole mass aligned at 60 degrees to downwards wall, slightly black glassy top, base dimpled and slightly prilly 80x70x60mm
			32	3	slag scrap
			20	1	iron, bent bar?
11438		456	200	3	dense slag masses, unclear if\ any is complete
			20	1	slag fragment
			6	2	clinkery slag
			70	1	55x55x30mm porous cake formed of dense slag, base neat but top irregular
			154	1	dense slag mass, possibly missing some edges, 45x60x45mm, top obscured, base with dimples on lobes
11438		26	16	1	vitrified and heavily slagged oxidised lining
			10	1	lining slag
11439		48	46	3	vitrified oxidised lining
			1	1	slag prill
11439		1380	64	7	low density lining and shale-rich slags
			1	1	orange pottery
			68	6	oxidised fired lining
C	**S**	**Sample**	**item wt**	**no**	**notes**

		wt			
			76	6	iron objects (1 sheet, 1 nail shank? 1 double turn forging, 1 curved object, 1 domed object, 1 small sheet)
			232	1	SHC, 75x85x70(35) mm plano-convex SHC with 'blob' on otherwise smooth upper face, lower face slightly prilly, dense
			166	1	irregular, probably strongly transverse SHC, rather lobate
			100	1	dense prilly mass with wall attachment
			40	1	dense SHC fragment
			78	1	prilly mass with wall attachment
			94	1	prilly mass with wall attachment
			50	1	prilly mass with wall attachment
			44	1	prilly mass with wall attachment
			362	20	dense slag fragments, mostly dimpled
11440		324	20	2	corroded iron sheet fragments
			46	5	slagged oxidised lining
			2	1	iron scrap - horseshoe nail?
			120	1	dense slab like dimpled SHC, dense, 65x45x25mm
			38	1	lining slag
			90	5	dense slag fragments and blebs
			2	1	reduced fired pottery
11440		908	184	1	65x65x45mm, sub-blowhole mass with wide shallow burr, apparently formed on overhanging wall
			176	1	moderately well formed, medium irregular SHC, dimpled base formed against inclined side, lobate free edge, top smooth with attached corroded iron, 65x70x40mm
			70	1	35x45x35mm small sub-blowhole mass with burr attachment
			84	1	irregular transverse slag attached to wall, dimpled and lobate below, top smoothish with broad hollows
			48	1	40x40x35(25) mm small plano-convex puck, probably a sub-conical sub-blowhole mass
			36	1	burnt daub
			60	5	slagged and vitrified oxidised lining
			208	11	dense slag fragments
			26	1	concretion on sheet iron
			4	1	clinkery bleb
11440		242	30	11	vitrified oxidised lining
C	**S**	**Sample wt**	**item wt**	**no**	**notes**

			2	3	reduced fired oxidised clay with abundant organic temper
			1	1	coal
			6	3	pottery
			54	12	low density clinkery shale-rich slag
			62	14	dense slag scraps
			70	14	iron - one a hobnail
			1	1	bone
11440		872	90	5	iron - 1 piece socket, others more channel like - possibly a single fragmented item
			8	1	coal
			4	1	slagged stone
			146	8	slagged and vitrified oxidised lining
			296	15	dense slag fragments - mainly dimpled blebs
			82	1	55x50x25mm discoidal small dimpled dense SHC
			82	1	very irregular dimpled nub - probably a sub blowhole mass
			148	1	slightly incomplete slab-like SHC, top smooth with some broad shallow dimples, base irregular dimpled, 70x50x35mm
11440		8	8	1	slag lobe
11441		134	104	17	slagged and vitrified oxidised lining
			20	1	bloated stone
			6	1	trough shaped narrow iron fragment
11441		1450	380	12	fragments of dense dimpled slag
			184	1	very irregular dimpled mass - crudely SHC-like, 90x90x35mm
			98	1	dimpled slag mass, sheet-like
			182	1	60x75x50mm, dimpled slag mass with trough-like top attached to planar wall
			150	1	75x60x25mm, near oval concavo-convex SHC, one side deformed and folded over the top
			112	1	dense burr/mass on oxidised wall
			66	1	SHC fragment
			68	1	dense equant dimpled and lobed nub
			28	2	low density slag nubs
C	**S**	**Sample wt**	**item wt**	**no**	**notes**

			66	1	iron
			58	1	flow lobe of dense slag into oxidised ceramic
			32	1	planar unfired reduced ceramic with adhering clinker
11441		1030	554	37	dimpled and blebby slags - no piece here appears to be a complete item
			134	8	iron objects - only 1 nail recognisable
			94	10	shaley lining slags
			52	1	lobate flow from hearth floor
			72	1	arcuate dense beard, 120-140mm diameter attachment if not deformed, very dense, prilly below/in front, dimpled below/behind
			116	10	oxidised fired vitrified lining
			1	1	coal
11442		846	228	1	75x75x40mm, SHC, parallel top and base, base dimpled, top smooth with shale clasts
			90	7	slagged oxidised lining
			352	11	dimpled slag fragments
			80	2	very dense worn slag fragments from SHC crust
			28	1	pentagonal iron fragment 37mm across
			2	1	rusty concretion
			14	1	pale lining slag bleb
			44	1	dimpled/prilly slag attached to oxidised lining
11442		2	2	1	bloated rock fragment
11442		700	64	12	slagged and vitrified lining
			2	1	reduced fired clay
			124	16	rounded nubs and blebs of low density lining slag
			6	3	bloated coal shale
			1	1	pottery
			260	15	dense slag fragments, blebby or dimpled
			50	1	porous tiny SHC-like mass, finely dimpled base, deeply fuel-dimpled top
			44	1	equant mass, domed base, shale-rich top
			50	1	small SHC, 45x40x25mm, microprilly base, smoothish top
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			84	1	small dense mass attached to wall, prilly below, shiny surfaced lobes in upper part

C	S	Sample wt	item wt	no	notes
11442		362	98	6	iron and concretion- largest piece 50 g - probably end of bar with drifted hole
			4	3	pottery (1 Samian)
			46	9	vitrified lining
			2	1	fired clay
			100	13	pale blebby low density slags
			76	4	dense dimpled slag fragments
			4	1	coal
			22	7	slag scraps
11443		886	148	1	dimpled slag mass
			140	1	dimpled slag mass
			86	1	slightly lobate slag mass
			82	1	dimpled slag mass
			470	6	fragments of dimpled slags, incomplete masses
			8	1	vitrified oxidised lining
11443		94	94	9	iron objects
11443		936	148	1	probably most of rather dense prilly SHC
			132	1	small irregular mass, probably a deformed SHC, a dimpled base, a rusty top with prilly material folded back on top of this
			84	1	small concavo-convex mass, probably SHC, 50x70x20mm
			64	1	small pointed mass -SHC tip, two parallel tool-marks forming dimpled base, top smooth haematised centre with raised edges
			44	4	blebby lumps of low density slag
			40	4	fragments of lining slag
			32	3	vitrified and slagged oxidised fired lining
			18	1	twisted slagged lining on reduced grey backing
			48	1	very irregular spiky lump - probably coalesced dimpled tool casts
			320	10	dimpled dense slag fragments
11443		1005	32	3	iron - 1 piece a large square-headed nail
			2	1	prill of lead

			354	17	dense slag fragments
			102	1	incomplete dense SHC
			110	1	small SHC, flat top, dimpled base, with possible tool mark, 55x55x30 mm
			130	1	incomplete mass with possible burr, probably larger part of SHC
			2	2	coal
			88	9	slagged and vitrified oxidised lining
			106	15	blebby pale, lower density slag and lining slag
			4	1	coal shale
11443		588	110	1	small sub blowhole mass attached to wall, mainly dimpled, but one larger flowed lobe, hint of maroon surface on flowed lobe, 45x60x45mm
			122	1	55x50x35mm rounded dimpled lump, with attached fragment of shale (just possibly pottery)
			4	1	nail head
			4	1	coal
			44	4	slagged and vitrified oxidised lining
			286	12	dense slag fragments
11443		652	404	32	dense slag fragments, variably dimpled prilly and blebby
			48	4	iron three rounded lumps, one triangular fragment of bar
			58	11	fired and vitrified ceramic - most oxidised fired, 2 pieces reduced on surface
			58	1	small dimpled dense mass - finely dimpled below, open shallow dimples above, 40x60x25mm
			52	12	shale-rich clinker
			1	1	pottery
11443		716	74	6	vitrified oxidised lining, one piece with tiny section of blowhole margin
			370	15	dense slag fragments, nubs and prills
			58	2	iron
			54	1	dimpled nub of dense slag - probably coalesced flow-lobes into fuel bed
			44	1	small puck of low density slag, dimpled base smooth top - proto-SHC?
			110	9	clinkery low density shale-rich slag

C	S	Sample wt	item wt	no	notes
11443		814	192	1	broken in 3, 95% of moderately well-formed, broken SHC
			2	1	pottery
			10	2	vitrified oxidised lining

			126	4	dense dimpled slag fragments
			80	7	low density friable clinkery lining slags
			92	1	50x75x25mm small sub-blowhole transverse curved mass. Sheet-like, blown upper margin.
			82	1	irregular dimpled plano-convex mass with flattish porous top
			76	1	50x50x30(20) mm small plano-convex mass formed of coalesced lobes, smooth top with bleb of attached lining slag
			62	1	irregular elongate dimpled mass
			48	1	small semi-circular mass, dimpled base, variable top
			70	1	prilly sub blowhole mass, broken, but probably largely complete
11443		452	1	1	curved fired melted clay with hooked profile - possibly just FAS - or possibly a clay coat
			10	5	coal
			48	12	oxidised fired and vitrified ceramic -one piece with part of blowhole margin
			26	8	fired clay
			22	3	iron
			34	13	low density pale clinkers
			306	53	iron slag fragments
11444		532	92	4	iron - one piece a 'riveted sheet'?
			22	3	bloated stones
			30	4	shaley clinker
			46	5	slagged and vitrified oxidised ceramic
			82	8	pale lining slags
			274	18	dense slag fragments and prills
11444		696	382	43	dense slag fragments
			12	4	pottery
			4	4	coal
			28	3	iron
			56	13	low density clinkery slag
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			30	1	iron rich SHC fragment
			56	1	deformed but arcuate mass, lobate/prilly, not certain if complete
			108	20	slagged and vitrified lining - almost all oxidised fired

11444		714	384	20	dimpled slag pieces
			6	1	organic tempered pottery
			70	8	fragments of lining slag
			30	2	sandstone fragments
			112	11	oxidised fired ceramic with slagged surface
			70	1	small plate of dimpled slag with tear or partial hole
			46	1	large lump of lining slag
11444		844	120	1	60x50x40mm, asymmetrical sub-conical dense dimpled mass, top with pale vesicular patches
			196	1	85x75x50mm very irregular dimpled mass attached to reduced fired clay
			80	1	dimpled slag nub
			94	1	65x75x25mm thin irregular plano-convex SHC
			60	1	dimpled slag nub
			72	2	slagged reduced fired lining
			2	1	fired clay
			182	7	blebby and dimpled slag nubs and fragments
			22	1	slagged oxidised fired lining
11444		816	70	3	slagged oxidised lining
			156	4	dimpled dense slag fragments
			68	3	pale blebby low-density slag fragments
			142	1	irregular SHC with upper parts composed of maroon surface flow lobes, very slightly incomplete
			70	1	part of small SHC with very dense puddle-like thin crust
			60	1	irregular dimpled mass
			138	1	irregular, SHC-like dimpled mass with convex base
11444		1530	284	1	65x100x45mm, irregular SHC formed of coalesced smaller bodies
			92	4	low density dimpled nubs
			326	7	small dimpled slag masses, all very irregular, complete
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			96	5	oxidised fired lining with thick attached shaley clinker
			212	2	fragments of SHCs with dense slag layers (i.e. of somewhat conventional makeup)
			148	1	elongate, dense mass showing some flow
			206	2	fragments of dimpled dense slag masses
			156	1	extremely irregular lump of coalesced long spike-like lobes and surfaces

11444		368	82	25	slagged vitrified oxidised fired lining
			98	15	low density pale blebby dimpled slags
			6	3	shale rich clinker
			8	4	fired clay
			32	3	iron
			22	1	dense smooth SHC fragment
			112	12	fragments of dense dimpled slags
11444		10	10	3	vitrified oxidised lining
11444		726	32	1	iron lump
			54	1	folded iron tapering bar
			18	1	nail with very large rectangular head
			128	9	slightly indented nubs of pale surface lining slag
			80	1	dimpled sheet of dense slag
			46	1	equant nub of very dark dense slag - glazed stone?
			90	1	dense puck-like SHC (emphasised by missing edges)
			48	1	medium density prilly mass
			92	5	dense slag fragments
			132	13	slagged and vitrified lining, 2 pieces show concave faced reduced fired free of vitrification and slag
11445		184	38	3	iron pieces
			76	1	dense dimpled slag lump
			66	5	oxidised fired vitrified lining
11447		6	6	2	gravelly low density black slag

C	S	Sample wt	item wt	no	notes
11447		6	6	1	shale-bearing slag fragment
11447		166	84	6	vitrified oxidised wall - some very heavily-slagged with clinkery material
			24	1	dense dimpled slag fragment - possibly tool mark
			56	1	small mass attached to wall - essentially a single dense lobe attached like a flap, smooth top dimpled base, 45x50x25mm, wall attachment 35mm tall

11447		10	8	2	lobate slags
11448		668	90	10	vitrified lining with orange below, passing laterally into slightly dished grey unvitrified surface
			44	6	iron objects
			264	15	dense slag fragments
			60	1	dense-beard like crescentic mass, prilly below, lobate on top, some lining slag near margin, 60x30x30mm
			188	1	60x75x40mm, dense near SHC, black smooth (glassy?/blown) top and dimpled base, lobate margins
11449		392	92	3	slagged oxidised lining
			150	1	small transverse mass with wall attachment
			115	1	part of small dense dimpled SHC
			18	1	low density slightly lobate slag bleb
11450		406	108	1	55x45x55mm, irregular, equant dimpled mass
			120	1	dense mass with burr, 50x50x40mm, not complete
			14	2	slagged oxidised lining
			88	1	wide burr with oxidised ceramic, glassy gravelly slag
			76	3	dimpled slag fragments
11451		402	194	4	fragments of dense dimpled slag
			116	1	large block of very vesicular slag with dimpled base, upper parts very low density, incomplete
			70	3	slagged oxidised lining
			6	2	fired clay
			4	1	very low density clinkery slag
11452		220	116	1	broken dense SHC with dimpled base, probably 95%, in two parts
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			100	1	curved sub-blowhole transverse mass, dimpled/prilly below, top poorly developed, 40x70x40mm
11453		48	48	2	heavily slagged oxidised lining
11453		400	200	1	low density probable SHC, 70x100x50, pale, planar base, rather irregular top
			52	1	puck--like mass, smoothly dimpled base, top irregular
			34	1	low density slag nub

			46	1	small dense mass, 30x50x25mm, probably complete
			56	1	small sub-blowhole mass, somewhat separate finely dimpled lower section and more smoothly lobate upper plate
11455		1030	530	1	75x90x70(45) mm substantial SHC with wall attachment, base formed from multiple tool marks from RHS, wall contact overhanging and at 60 degrees, also slightly oblique to axis of SHC, top crudely lobate, base dimpled with 4 tool marks, tool marks extend to a point just behind line of wall above
			284	1	iron block, 60mm diameter, 30mm thick, with one upturned edge
			110	1	40x65x30mm, dimpled slag mass with almost planar wall attachment
			50	1	long thin slag complex rod, curved, might be from wall attachment or might be detached tool cast
			30	4	low density blebs
			10	1	oxidised fired vitrified lining
11456		670	266	1	80x80x55mm, well formed SHC, prilly base, dense, prills above flattened above into bowl
			250	8	dimpled slag fragments
			58	2	dense shallowly dimpled slags, fragments of tool marks
			58	7	low density, slag blebs
			10	1	vitrified lining slag
11457		96	6	3	grey clay
			78	1	broken sub-blowhole mass
			12	1	low dense lobes
11457		6	6	1	vitrified oxidised lining

C	S	Sample wt	item wt	no	notes
11458		10	10	1	fragment of dense smithing slag, void rich with glassy patches
11458		28	2	1	clinker
			24	4	oxidised vitrified lining
11458		16	14	1	angular dense slag fragment
11459	<140>	34	32	1	two joining pieces of vitrified oxidised lining

			2	1	reduced fired ceramic, one face is striated, with local bloating and glassy droplets, probably reduced fired wall - tiny possibility this is a clay coat
11459		324	324	1	slightly irregular large SHC, top uneven and rough, with black glass below blowhole, attachment to slightly convex wall, base irregular, dimple with poor tool marks, 80x150x50mm, deepest distally, wide because grown oblique to wall
11459	42	424	200	70	dense slag fragments
			118	48	low density shaley slags
			22	6	iron objects - one a hobnail
			6	3	oxidised lining
			2	2	pottery
			2	1	grey organic tempered clay
					remainder fine debris, stones etc.
11459	140	1530	184	74	low density shaley slag
			74	14	iron objects
			70	21	vitrified oxidised lining
			4	3	pottery
			1190	130	dense slag fragments
11459	137	950	160	170	low density shaley slag fragments
			60	31	vitrified oxidised lining
			506	66	dense slag fragments
			18	2	iron objects
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			6	3	grey fired clay
					remainder fine debris stones, coal, pottery
11459	141	1970	166	1	60x70x40mm, internally prilly complex SHC
			1525	400	dense slag including small debris
			222	138	low density slag and bloated clasts
			76	24	vitrified lining
					1525 includes c250g of debris

11459	140	1045	166	80	low density slag fragments
			2	2	vitrified lining
			842	200	dense slag and bits
11459	138	70	10	2	vitrified lining
			16	1	dense slag fragment
			38	18	clinker and coke
11459	141	<1	<1	35	slag droplets and tiny fragments
11459	140	<2	<2	8	2 slag droplets and fine slag debris
11459	137	<1	<1	7	5 slag droplets, 2 slag fragments
11459	138	32	32	2	dense slag pieces, one a small puck, slightly incomplete
11459	139	856	146	74	low density slag fragments
			450	40	dense slag fragments
			96	1	compact sub-blowhole mass
			10	5	iron objects
			60	15	vitrified lining
					rest bits
11459	140	32	32	40	lining fragments
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
11460		446	244	1	70x80x70(40) irregular SHC, dense bowl, plano-convex, dimpled base, slightly gravelly top, raised flap on one side
			148	1	very dense incomplete SHC - probably around 80%, rough top, dimpled base, dense puddle, maroon surface
			22	1	low density sheet - possibly proto tongue-like mass
			10	2	low density slag
			12	2	oxidised vitrified lining
			6	1	iron
11462		1120	222	13	dense slag fragments

			60	6	low density shale-rich clinkery slags
			8	1	iron hook or loop
			160	12	vitrified and slagged lining
			216	1	70x95x40mm, well developed concavo-convex SHC. Dished rusty top, dimpled base with offsets and blebs in basal sheet suggesting tool action
			56	1	45x60x25mm concavo-convex dimpled mass - deeply so on top
			120	1	50x70x35, neat but small, dense plano-convex SHC
			62	1	60x40x25mm elongate plano-convex mass
			96	1	80x40x30mm elongate mass, blown at one end, dimpled below, probably oriented down-wall
			76	1	50x70x30mm, slightly deformed porous transverse cake, 'V' profile
			48	1	prilly mass - might be entire incipient SHC, but might be fragment of larger mass
11463		1980	204	1	80x75x50mm, SHC with well-formed suspended dense bowl with some dimpled lobes descending below, one of lower lobes (intruding from right) may be tool mark, contact c55mm wide, though not all with adhering ceramic, top of dished bowl is very gently dimpled,
			92	1	contact 65mm wide, with tiny mass in front, quite dense with dimpled surfaces
			268	1	65x75x40mm, dished SHC with partial messy bowl fill, base shows 3 tool casts, extending in from right but possibly forming sheets extending to upper left - suggest RH poker use
			250	1	65x85x50mm, complex SHC formed of at least 3 dimpled sheets, good bowl, bottom just irregular sheet fragment
			86	1	small 65mm wide attachment with small transverse dimpled mass
			46	1	fragment of mass with attachment
			26	1	fragment of mass with attachment
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			54	1	small mass with attachment
			52	1	small dimpled dished irregular mass
			82	1	crudely plano-convex dense dimpled mass
			44	1	small plano-convex dimpled mass with pale surface
			110	1	irregular crudely plano-convex dimpled mass
			130	13	clinkery lining slag
			16	1	iron
			314	11	dense dimpled or lobate slag fragments
			176	11	vitrified lining, vitrification disappears on to convex grey surfaces- not unlike tuyère edges - but no sign of margin, or of face with blowhole

11464		612	8	1	low density slag
			4	1	vitrified lining
			146	4	dense slag fragments
			74	1	twisted dimpled mass
			22	1	30x40x15mm, rectangular mass with flat top and dimpled prills below
			50	1	35x65x30mm, transverse thin dimpled sheet
			176	1	70x65x40mm? pre-deformation, folded SHC
			132	1	irregular and slightly incomplete dense SHC, blown smooth and maroon at top, then very irregular down-wall mass, probably largely tool influenced, 70x60x40mm
11465		580	64	7	slagged and vitrified oxidised lining
			6	1	fired clay
			56	2	dense prilly slag fragments with indications of lining attachment
			102	2	small fragments of small SHCs with very dense bowl
			32	2	low density slag blebs
			228	6	fragments of dense prilly masses
			106	1	part of a small concavo-convex SHC with dimpled and locally prilly base and partially smooth dished upper surface
11466		546	252	1	70x80x50(30) mm biconvex dense SHC, well formed, top with glassy lining slag, base dimpled but rusty
			86	1	40x55x30mm, dimpled transverse dense slightly biconvex mass
			88	1	50x50x25mm, dense puck-like mass, top with probable unroofed voids, base dimpled
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			82	1	crescentic sub blowhole mass 45x80x30mm
			16	2	dense slag fragments
			16	2	vitrified lining
11467		22	12	1	dense slag fragment
			6	1	lining slag
11467		6	6	1	dense slag fragment
			1	1	vitrified oxidised lining
			1	1	grey fired clay
11468		382	34	3	slagged oxidised vitrified lining

			146	6	dimpled dene slag fragments and blebs
			198	1	biconvex SHC of dimpled slag, 60x75x50, rather planar contact on base
11469		28	30	1	dense SHC fragment with deep dished top blown smooth and maroon, base partially dimpled, remainder base sediment/stone contact
11469		1860	92	1	50x70x25mm, dimpled semi-circular incipient SHC
			80	1	45x70x30mm, dished dense SHC with dimpled base
			140	1	55x70x60mm, sub-blowhole prilly mass forming cascade down wall, lower slags paler than upper
			176	1	60x75x35mm, dense SHC, plano-convex
			56	1	prilly mass incorporating probable tool cast
			66	1	35x60x30mm, very dense small mass
			58	1	35x65x20mm, semi-circular sheet-like incipient SHC, top smooth, base dimpled
			68	1	SHC fragment
			76	1	dimpled small incipient SHC
			64	1	flap of lining slag
			58	1	small conical sub-blowhole mass
			748	24	dense slag nubs, fragments
			32	2	flow slag prills
			78	5	lining slag nubs
			64	4	vitrified fired lining, mostly reduced fired
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
11483		478	136	1	small dense dimpled sub-blowhole mass, axis at 60 degrees to wall (tilted?), mass also undercuts surviving wall face, extending 65mm in front and 10mm behind this line, 55mm wide maximum (close to wall), narrow dimpled in front and lobe behind, mass 30mm deep, with 35mm of wall preserved above
			234	1	axis 85mm long, reaches slightly sigmoidal wall face at rear 45mm deep and 75mm wide (very asymmetrical), 25mm of wall above, base dimpled and deepest close to wall, top rough and crudely ridged. Axis at 60 degrees to wall face
			44	1	small maroon shale containing mass, incomplete, attached to wall
			42	5	vitrified oxidised lining
			42	1	dense transverse burr-like fragment
11483		312	80	1	transverse crescentic block with maroon smooth blown top, dimpled base, lumpy wall-facing side, unclear if projected forward beyond preserved mass but probably not
			100	1	fragment of dense well preserved SHC with smooth blown maroon top, and dimpled base

C	S	Sample wt	item wt	no	notes
			96	1	irregular mass with dimpled surfaces and one smooth maroon one - unclear if complex object or deformed, quite possibly an entire SHC
			18	1	clinkery dimpled slag
			14	1	dense SHC fragment
11483		934	84	1	50x60x30mm small SHC-like mass, dimpled base smooth top
			70	1	dimpled mass of pale slag, very irregular
			74	1	irregular porous dense slag mass, probably sub-blowhole mass
			56	1	45x55x25mm triangular mass with dimpled base and porous top
			56	1	attachment of sub-blowhole mass, distal section fractured off
			74	1	irregular spikey mass, probably tool casts, lobate, partially dimpled
			52	1	small neat puck, 40x45x25mm
			42	1	small dense probable transverse mass
			378	17	dense slag fragments
			46	4	large blebs of low density clinkery slag
11483		24	24	4	low-density slags
11501		44	20	1	dense slag flow lobe
			22	1	contact between dense slag and wall, with a large shale clast
11506		70	2	1	slag fragment
			66	1	sub-blowhole mass, 35x55x40mm
11507		4	4	1	prilly dense slag
11508		1525	16	1	large headed iron nail
			10	1	concretion
			36	3	shaley clinker
			106	10	oxidised fired slagged lining
			70	8	blebs of low density slag
			64	1	part of dense SHC with probable basal tool marks
			406	13	dimpled slag lumps
			140	1	deep irregular slag mass, dimpled body, smoothly lobed top, crescentic lower spike with sandy material
			164	1	65x75x40mm dense regular formed SHC

C	S	Sample wt	item wt	no	notes
			56	1	dimpled slag lump
			66	1	dense lobed slag
			92	1	tiny SHC, dimpled base, smooth top, 60x65x25mm
			142	1	very irregular dimpled slag mass, deformed SHC
			66	1	puck-like mass, fine dimpled base, coarse fuel-dimpled top
			62	1	tiny SHC, 40x55x35mm, dimpled base, flat top
11508		936	424	1	75x110x50mm dense SHC, hemi-conical form, base dense finely dimpled slag, partially suggestive of coalesced margin parallel tool use, top dimpled with large open vesicles. Large rusty mass to one side
			128	1	50x80x35mm biconvex dimpled mass, effectively SHC
			74	2	oxidised lining, one with very thick clinkery surface\adhesion in wedge profile
			38	1	small tabular fragment of rusty, tap-slag like mass with very fine prills and rather dimpled base
			54	1	small attachment fragment of dense slag onto oxidised wall
			146	2	two fragments similar to 424g SHC above - in being made of coalesced slag lobes with dimpled surfaces
			66	2	slag fragments formed of coalesced prills
11508		920	350	1	150x80x35mm strange transverse? dimpled mass, not SHC-shaped, but probably just very transverse, dimpled base irregular top
			60	1	55x45x25mm small sub-conical mass, crudely plano-convex, dimpled base
			58	1	55x45x25mm small plano-convex mass
			38	1	small lobate arcuate mass with dimpled base
			134	1	probably incomplete small irregular SHC
			228	6	irregular dimpled masses and SHC fragments
			8	1	rounded low density mass - coated bloated stone?
			4	1	coal shale
			34	2	slagged vitrified oxidised lining, one shows small section of probably 25mm diameter blowhole margin
11508		660	50	3	iron lumps
			62	1	probably SHC piece rather than entire cake
			96	11	vitrified lining, much heavily slagged with shaley material
			312	24	dense slag fragments
			120	13	low density slags - both lining and shaley and mixed
11513		48	48	1	dense SHC fragment

C	S	Sample wt	item wt	no	notes
11513		24	6	1	vitrified oxidised lining
			16	1	bloated vitrified stone
11534		864	90	1	dimpled dense slag mass, with well-formed burr, fractures distally
			76	1	dimpled dense slag mass
			58	1	dimpled dense slag mass
			74	1	dimpled dense slag mass
			76	1	dimpled dense slag mass
			120	1	dimpled dense slag mass
			176	1	dense irregular dimpled mass with flow lobe on one end
			150	1	irregular mass, partially dimpled and partially lobed, possible hot fracture in centre
11534		828	346	7	dimpled dense fragments
			18	1	shale-rich clinker
			74	1	low density lobate mass
			50	1	low density lobate mass
			102	1	dense irregular dimpled mass
			196	1	SHC, 70x85x40mm, dimpled base, large voids on top, sub-conical, semi-circular in plan
11534		592	184	1	SHC, 75x65x35, dense slag, dimpled base, variably lobate top largely obscured
			166	4	dense irregular dimpled slag fragments
			80	1	dense dimpled lag mas, highly irregular with long 'prong' possibly a tool cast
			50	2	oxidised fired lining with adhering shale-rich clinker
			94	4	low dense blebby slags, some shale-rich
			24	1	iron scrap
11534		660	208	14	low density blebby and clinkery slags
			42	7	iron debris
			34	8	slagged oxidised vitrified lining and associated slag debris
			2	1	coal
			62	2	dimpled slag fragments
			106	1	shallow, dense conventional-appearing SHC, 60x50x20mm
			38	1	dimpled dense slag nub

			26	1	prilly slag attached to burr-like contact
			80	1	prilly dense irregular slag mass
			44	1	low density pale slag mass
11534		902	92	2	heavily slagged oxidised fired vitrified lining
			42	1	dimpled slag fragment
			128	1	very dense slag lobe/puddle, probably from floor below SHC, possibly folded
			74	1	dimpled slag mass, with possible poker hole
			32	1	dimpled slag lobe
			132	1	irregular flat dimpled slag mass
			238	1	very irregular SHC with somewhat lobate base, 95x65x40mm
			124	1	irregular wedge shaped dimpled mass
11534		314	70	5	slagged and vitrified oxidised lining
			22	3	blebs of low density lining slag/clinker
			88	5	small dimpled dense slag blebs and fragments thereof
			46	3	iron objects - one a triangular/hexagonal 'washer'
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			82	1	dense dimpled slag tool-marks - four parallel but oblique to length of piece - detached from any overlying cake
11928		24	24	1	dimpled slag nub
11974		78	78	1	small sub blowhole maroon dense slag mass, top smooth blown, 30x55x35mm, top angled down at c45 degrees to wall
12017		44	16	1	dense slag fragment
			26	1	lining slag
12027	146	2	2	45	coke/coal
12027	146	<2	<2	20	slag droplets and slag fragments
12027	146	274	24	2	vitrified lining
			108	15	dense slag fragments

			140	200	low density slag and its debris
12029	145	<1	<`1	2	1 slag droplet 1 slag fragment
12033		4	4	1	lining slag
12035		34	34	1	irregular dimpled dense slag mass - possibly twisted
12036		66	1	1	vitrified lining
			62	5	dense slag fragment and blebs
12040		16	6	1	dense prilly slag
			10	1	lining slag
12040	147	<1	<1	2	slag droplets <1mm (not hammerscale as labelled)
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
12040	147	136	48	2	dense slag fragments
			8	3	vitrified lining including a tiny fragment of blowhole margin
			78	120	low density slag and coke
12044		16	16	1	dense dimpled fragment
12045		92	92	1	disintegrated sub-blowhole mass, in pale low density slag, lobate, slightly dimpled
12047		54	44	3	dense slag fragments
			10	1	lining slag
12060		160	10	1	vitrified lining
			62	1	dimpled rounded slag nub
			84	1	irregular slag mass with small rounded base and probable tool casts
12062		26	26	2	low density slag with blebby form and brown colour
12076		78	34	1	heavily slagged vitrified oxidised lining

			40	1	dense slag fragment
12079		186	92	4	dense slag fragments
			94	1	very irregular mass, many protrusions, dimpled base, smooth channel down centre of top
12081		6	1	1	lining slag
			4	1	dense slag prill
12081		4	4	1	vitrified oxidised lining
12083		1	1	1	slagged oxidised lining
12089		2	2	1	dense slag fragment - probably a dense lining slag
12090		104	32	1	fragment of very dense sub-blowhole mass
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			64	3	lower density iron slags in prilly masses
			8	1	vitrified oxidised lining
12100		8	6	1	vitrified oxidised lining
12106		92	92	1	dense dark well preserved transverse mass, dark glassy top, irregular dimpled base, 35x75x40mm
12106		124	120	2	heavily slagged oxidised lining with slag forming hood around blowhole position
12132		126	126	1	very low density tongue-like mass, glassy pale top, base shows flow lobes, 95x70x30mm
12140		126	26	4	lining slag blebs
			40	3	dense slag fragments
			6	1	slagged oxidised lining
			50	1	small dense SHC, rounded base with broadly dimpled lobes, upper face of more deeply impressed moderate dimples
12167		12	10	1	lining slag lump

12204		84	82	1	broken fragment of a very large glassy SHC
12309		252	226	5	dense slag (SHC) fragments, one with strong tool marks
			20	2	vitrified oxidised lining
12310		570	168	1	weathered preservation, worn, this piece part of semi-circular SHC, dimpled base, raised lip on upper rim, very conventional
			8	1	reduced fired lining
			386	18	dimpled slag nubs and fragments
12313		1170	166	1	60x80x40(30)mm well formed SHC, V profile suggests formation in angle of wall with flat top at 45 degrees to wall, free base side of V is dimpled
			134	1	irregular arcuate mass, probably deformed transverse SHC
			72	1	45x55x35mm, small mass of dimpled shale-rich slag
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
			82	1	60x60x25mm shallow SHC, with discrete pale prills within basal surface
			42	1	SHC-like piece - either deeply and neatly concave top or unroofed large vesicle
			42	1	folded low-density nub
			386	5	fragments of dense SHCs
			78	6	nubs of low density shale-bearing clinkery slag
			90	5	smaller dense slag fragments
			70	3	fragments of dense slags in flow lobes
12313		744	60	2	iron
			62	8	vitrified oxidised lining
			66	8	blebby lining slags
			408	17	dense slag fragments, blebs etc.
			142	1	60x74x45mm concavo-convex SHC, rough wall-facing side, dimpled base, dished top, outward facing at 45 degrees to wall
12313		378	18	2	friable lining slag
			32	4	slagged and vitrified oxidised lining
			2	2	pale fired clay
			322	13	dense slag fragments

12317		104	102	1	prilly and dimpled sub-blowhole mass, 45x65x35
12318		112	112	3	dense slag pieces, weathered, 2 prilly, one most of sub-blowhole mass
12387	151	6	6	1	degraded coal
12393		52	50	1	SHC fragment
12640		26	26	1	deeply vitrified oxidised wall
12643		8	6	7	fragments of low density lining or fuel ash slag, very pale
12649		66	66	9	fuel ash slag, grey sandy friable, foliated, all the pieces may be fragments of one original block
C	**S**	**Sample wt**	**item wt**	**no**	**notes**
12665		1	1	1	friable sheet of lining slag
12655?	152	4	4	13	low density slag blebs and fragments
12710		380	352	6	dense slag lumps - some may be SHCs, but very weathered so original surfaces not determinable
			24	1	slagged and vitrified oxidised lining
12810		372	94	1	irregular slag mass - surfaces obscured
			132	1	very neat dense SHC with very tight surfaces, 60x60x30mm, plano-convex
			146	1	biconvex dimpled mass - unclear whether biconvex SHC, or folded, 60x70x45mm

Table 2: archaeometallurgical residues by context and facies. Weights in g.

Context		Crucible	SHC	Other SHC-like masses	Other dense slag	Other low density slag	Hearth ceramic	Iron	Other clay	Coal	*total*
10757	2nd fill of RB? ditch 10755	14									*14*
11276	Fill of ditch 11275, C1-C2						10				*10*
11429	Dark soil spread. Group 11459.		232		34		32				*298*
11430	Dark soil spread. Group 11459.						8				*8*
11431	Dark soil spread. Group 11459.			730	60						*790*
11432	Dark soil spread. Group 11459.		486		198	22	36	20			*762*
11433	Dark soil spread. Group 11549. LIA - C1			384	24						*408*
11434	Dark soil spread. Group 11459.			294	84	28	40	94			*540*
11435	Dark soil spread. Group 11459.				202	16	68				*286*
11436	Dark soil spread. Group 11459. LC1 - C2			762	108	68	42	12			*992*
11438	Dark soil spread. Group 11459. LIA - C1		150	484	786	174	218	30	42	2	*1886*
11439	Dark soil spread. Group 11459.		438	366	363	64	114	76			*1421*
11440	Dark soil spread. Group 11459.		526	468	664	100	282	208	38	9	*2295*
11441	Dark soil spread. Group 11459.		400	532	1044	142	252	206		1	*2577*
11442	Dark soil spread. Group 11459.		308	228	754	246	200	128	4	4	*1872*
11443	Dark soil spread. Group 11459.		832	1776	2312	471	380	258	26	16	*6071*
11444	Dark soil spread. Group 11459.		944	906	2558	606	750	256			*6020*
11445	Dark soil spread. Group 11459.				76		66	38			*180*
11447	Dark soil spread. Group 11459.				8						*8*
11448	Dark soil spread. Group 11459.		188	116	296	12	174	44			*830*
11449	Dark soil spread. Group 11459.		303	266	314	12	266				*1161*
11450	Dark soil spread. Group 11459.		120	228	163		14				*525*
11451	Dark soil spread. Group 11459.				310	4	70		6		*390*
11452	Dark soil spread. Group 11459.		116	199							*315*
11453	Dark soil spread. Group 11459.		200	154		34					*388*
11455	Dark soil spread. Group 11459		530	110	50	30	10	284			*1014*
11456	Dark soil spread. Group 11459.		266		308	58	10				*642*

Context		Crucible	SHC	Other SHC-like masses	Other dense slag	Other low density slag	Hearth ceramic	Iron	Other clay	Coal	*total*
11457	Cut for pit 11457			78	12		6		6		*102*
11458	Fill for pit 11458				24	2	24				*50*
11459	Dark soil spread. Group 11459.		490	96	2576	950	350	124	8		*4594*
11460	Clayey soil. Group 11459.		392	22		10	12	6			*442*
11462	Dark soil spread. Group 11459.		336	338	222	60	160	8			*1124*
11463	Dark soil spread. Group 11459.		722	571	314	130	176	16			*1929*
11464	Displaced material from 11459.		308	74	218	8	1				*609*
11465	Displaced material from 11459.		208	228	56	32	64		6		*594*
11466	Displaced material from 11459.		252	256	16		16				*540*
11467	Displaced material from 11459.				18	6	1		1		*26*
11468	Displaced material from 11459.		198		146		34				*378*
11469	Displaced material from 11459.		244	626	780	142	64	0	0	0	*1856*
11483	Refuse material around RB surface 11482		114	1054	420	142	42	0	0	0	*1772*
11501	Fill of ditch 11500, MC1-LC1				42						*42*
11506	2nd fill of ditch 11504			66	2						*68*
11507	3rd fill of 11504, plough-soil in ditch top				4						*4*
11508	Part of 11459		1418	834	1104	238	310	76	0	0	*3980*
11513	Subsoil settling around masonry 11512		48			16	6				*70*
11534	Same as 11508, part of 11459		724	1386	1036	710	246	112	0	2	*4216*
11928	1st fill of ditch 11927				24						*24*
11974	1st fill of ditch 11973			78							*78*
12017	Fill of pit 12018				16	26					*42*
12027	Fill of shallow feature 12026				108	140	24			2	*274*
12029	Fill of shallow feature 12028				<1						*0*
12033	Fill of pit 12032					4					*4*
12035	Fill of pit 12034				34						*34*
12036	Dark soil spread. Group 11459.				62		1				*63*
12040	Fill of pit 12040				54	88	8				*150*
12044	1st fill of pit 12043				16						*16*

Context		Crucible	SHC	Other SHC-like masses	Other dense slag	Other low density slag	Hearth ceramic	Iron	Other clay	Coal	*total*
12045	2nd fill of pit 12043			92							*92*
12047	Fill of pit 12046				44	10					*54*
12060	Fill of pit 12059				62		10				*72*
12062	Fill of ?posthole 12061					26					*26*
12076	Cut of posthole				40		34				*74*
12079	Fill of pit 12080				92						*92*
12081	Fill of pit 12079				4	1	4				*9*
12083	Alluvial deposit						1				*1*
12089	2nd fill of ditch 12087				2						*2*
12090	2nd fill of pit 12092			32	64		8				*104*
12100	Fill of posthole 12099						6				*6*
12106	2nd fill of pit 12095			92			120				*212*
12132	2nd fill of ditch 12130					126					*126*
12140	Fill of ditch 12139			50	40	26	6				*122*
12167	2nd fill of ditch 12165						10				*10*
12204	Fill of ditch 12203		82								*82*
12309	1st palaeochannel fill 12308		226				20				*246*
12310	2nd palaeochannel fill 12308		168		386		8				*562*
12313	2nd palaeochannel fill 12311		566	72	1375	204	94	60	2		*2373*
12317	1st palaeochannel fill 12316			102							*102*
12318	2nd palaeochannel fill 12316				112						*112*
12387	3rd fill of pit 12390									6	*6*
12393	Fill of pit 12412 LC1-C2		50								*50*
12640	2nd fill of ditch 12642						26				*26*
12643	Fill of ditch 12644					6					*6*
12649	Fill of ditch 12648					55					*55*
12655?	Fill of posthole 12654					4					*4*
12665	Cut of gully					1					*1*
12710	Ditch cut				352		24				*376*

Context		Crucible	SHC	Other SHC-like masses	Other dense slag	Other low density slag	Hearth ceramic	Iron	Other clay	Coal	*total*
12810	Error for 12310?		132	240							*372*
	totals	*14*	*12717*	*14390*	*20593*	*5250*	*4953*	*2056*	*139*	*42*	*60153*

Table 3: Comparison of the weight-frequency distribution of the various morphologies of smithing slags. Weights in gram. For detailed descriptions of forms see text.

	Sub-oval concavo-convex and plano-convex SHCs	Irregular dimpled masses	Transverse and crescentic forms	Sub-blowhole 'conical' and 'pyramidal' forms	Sub-circular tabular puck-like forms	Burrs with no clear frontal detachment	Elongate irregular down-wall cakes	*Total non-SHC cakes*	*total*
Count	57	67	13	26	9	2	2	*119*	*176*
Minimum	50	44	50	56	44	120	96	*44*	*44*
Maximum	530	184	350	278	100	282	294	*350*	*530*
Mean	176	92	106	115	69	201	195	*101*	*125*
<100	11	41	10	14	8	0	1	*74*	*85*
<150	25	61	11	21	9	1	1	*104*	*129*
<250	56	67	13	26	9	2	2	*119*	*175*
<500	56	67	13	26	9	2	2	*119*	*175*
%<100	19%	61%	77%	54%	89%	0%	50%	*62%*	*48%*
%<150	44%	91%	85%	81%	100%	50%	50%	*87%*	*73%*
%<250	98%	100%	100%	100%	100%	100%	100%	*100%*	*99%*
%<500	98%	100%	100%	100%	100%	100%	100%	*100%*	*99%*

Table 4: Comparison of the SHC weight-frequency distribution with that of other comparable assemblages. Weights in gram.

a. Roman sites in Britain

Site:	Cleevelands		Uffington	Neath	Carmarthen	Bulmore	Caerleon Priory Field	Marsh Leys Farm	Cowbridge
	SHC	all							
Reference:	This study		Young 2015	Young 2013b, 2014a	Crew 2003	Young 1999	Author's unpub. data	Young 2005 & 2011b	Barford 1996
	coal		coal	charcoal		mixed	charcoal	charcoal	coal?
SHC count	57	176	57	47	136	?	18	30	?
SHC min. wt	50	44	36	74	100	127	146	60	175
SHC max. wt	530	530	614	630	820	770	600	824	700
SHC mean wt	176	125	137	244	227	270	294	333	403
% <150g	44%	73%	72%	32%	?	?	11%	23%	?
% <500g	98%	99%	98%	89%	94%	?	83%	77%	?

b. medieval and post-medieval sites in Britain and Ireland

Site:	Exminster	Worcester	Worcester	Moyveela	Ballykillaboy	Gorteens
		35 Mill St	Willow St	Galway	Kilkenny	Kilkenny
Reference:	Young 2014b	Young 2009b	Young 2007	Young 2009c	Young 2010	Dabal & Young 2011
Age:	13th-14th	12th	12th	17th-18th	16th-17th	17th-18th
	charcoal	charcoal	charcoal	charcoal	charcoal	mixed
SHC count	107	23	28	15	106	27
SHC min. wt	32	74	86	44	50	52
SHC max. wt	482	782	770	388	478	748
SHC mean wt	127	233	327	134	134	206
% <150g	77%	39%	18%	73%	70%	44%
% <500g	100%	91%	82%	100%	100%	93%

Table 5: summary list of subsamples of sieved residues

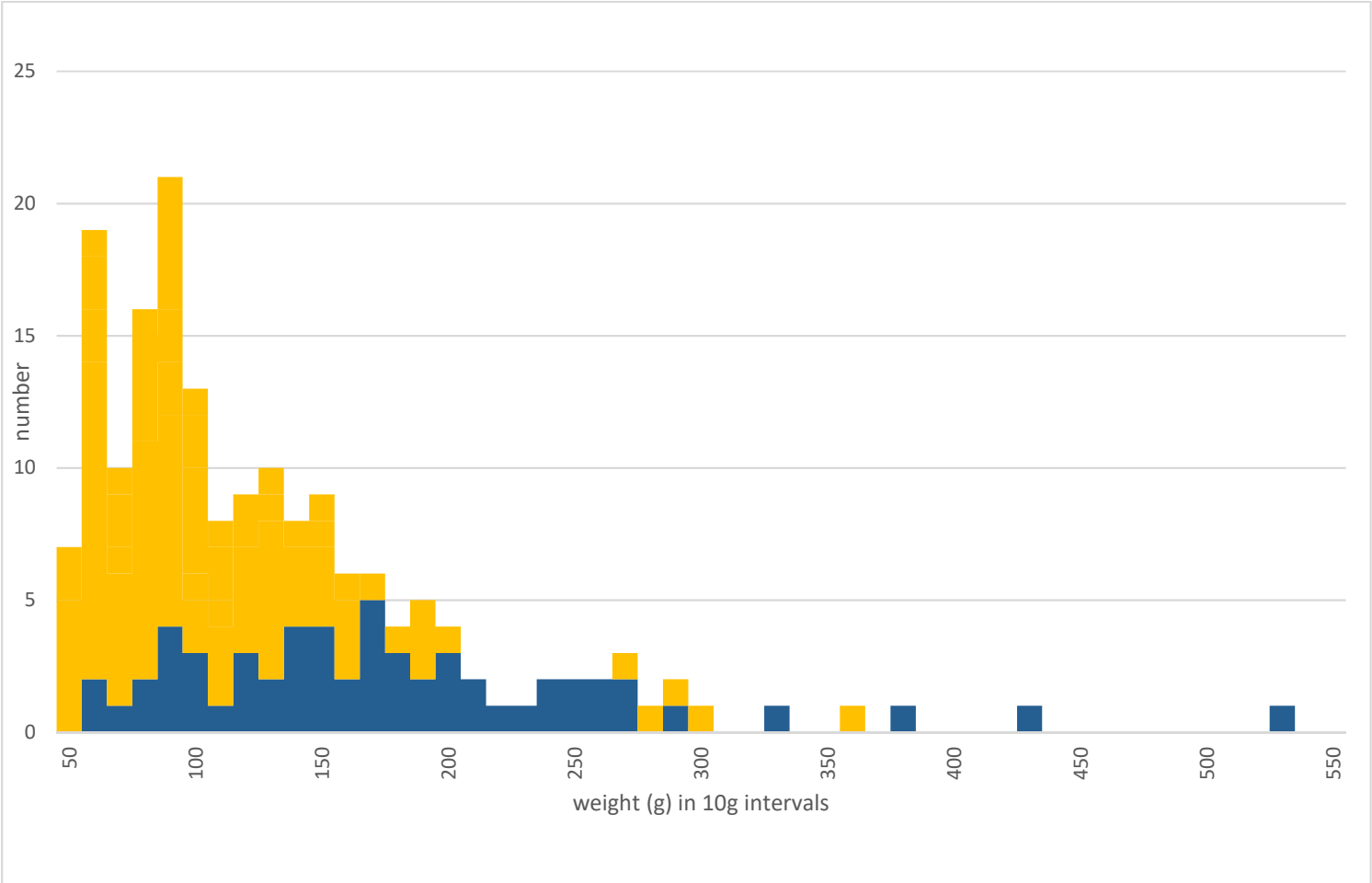
C	S	fraction	wt (g)	label	notes
10026	115	0.5mm	2	residue	charcoal, stone
10026	115	1mm	32	residue	charcoal, stone
10036	116	0.5mm	2	residue	charcoal, burnt stone, fired clay
10036	116	1mm	100	residue	stone, charcoal, ?pottery
10138	101	0.5mm	299	residue	sand, charcoal, burnt clay
10138	101	1mm	298	residue	sand, burnt bone in small amounts, charcoal in small amounts
10139	100	0.5mm	550	residue	stone, charcoal, burnt bone
10139	100	1mm	986	residue	stone, burnt stone, fired clay charcoal
10140	102	0.5mm	12	residue	stone, burnt stone, charcoal, fired clay, minor burnt bone
10140	102	1mm	356	residue	stone, burnt stone, charcoal, fired clay, burnt bone
10187	104	0.5mm	70	residue cremated bone	
10187	104	1mm	134	residue cremated bone	
10188	107	0.5mm	52	residue cremated bone	
10188	107	1mm	80	residue cremated bone	
10189	108	0.5mm	34	residue	
10189	108	1mm	76	residue cremated bone	
10189	108	2mm	254	residue cremated bone	
10200	105	0.5mm	110	residue cremated bone	
10200	105	1mm	152	residue cremated bone	
10201	100	0.5mm	84	residue	lime sand
10201	100	1mm	136	residue	lime gravel, rare burnt bone
10202	109	0.5mm	42	residue	
10202	109	1mm	50	residue cremated bone	
10203	110	0.5mm	162	residue cremated bone	
10203	110	1mm	264	residue cremated bone	
10203	110	2mm	926	residue cremated bone	
10206	111	0.5mm	86	residue cremated bone	
10206	111	1mm	144	residue cremated bone	
10207	112	0.5mm	58	residue cremated bone	

C	S	fraction	wt (g)	label	notes
10207	112	1mm	108	residue cremated bone	
10208	113	0.5mm	14	residue	stone, fired clay, burnt bone
10208	113	1mm	26	residue	stone, fired clay, burnt bone
10209	114	0.5mm	114	residue cremated bone	
10209	114	1mm	158	residue cremated bone	
10209	114	2mm	302	residue cremated bone	
10233	117	0.5mm	24	residue	
10233	117	1mm	28	residue cremated bone	
10234	118	0.5mm	90	residue	sand, minor burnt bone
10234	118	1mm	120	residue	stone, fired clay, burnt bone
10286	103	0.5mm	50	residue	
10286	103	1mm	120	residue cremated bone	
10286	103	2mm	342	residue cremated bone	
10450	119	0.5mm	54	charcoal rich	charcoal, fire clay, burnt stone
10450	119	1mm	978	residue charcoal rich	fired clay, stone, charcoal
10452	120	0.5mm	156	residue	
10452	120	1mm	158	residue	
10454	121	0.5mm	218	residue	
10454	121	1mm	202	residue	
10454	121	2mm	326	human bone rich	
10510	122	0.5mm	24	residue	stone, charcoal
10510	122	1mm	314	residue	stone, burnt stone, charcoal
10510	123	0.5mm	4	residue	stone, charcoal, burnt stone, fired clay
10510	123	1mm	82	residue	stone, burnt stone, fired clay
10542	124	0.5mm	1	residue	stone, sand
10542	124	1mm	18	residue	stone
10740	126	0.5mm	10	residue	stone, burnt clay, burnt bone
10740	126	1mm	442	residue	clay, stone, bone, vole teeth
10778	125	0.5mm	16	residue	burnt stone
10778	125	1mm	406	residue	stone, fired clay, bone, dark fired clay (pottery?)

C	S	fraction	wt (g)	label	notes
11045	127	.0.5mm	58	residue	stone, possible fired clay
11045	127	1mm	526	residue	limestone gravel, fired clay?, sparse charcoal
11083	128	0.5mm	20	residue	fired clay, vole teeth
11083	128	1mm	504	residue	almost all fired clay - bright oxidised
11459	137	0.5mm	12	residue	sand, charcoal, coal, coke, slag, burnt bone
11459	137	1mm	400	residue	burnt stone, slag, slag droplets, FAS, bone, burnt bone, charcoal, FHS
11459	137	2mm	354	residue charcoal/coal rich	stone, coal, coke, slag fired clay, only minor charcoal, bone
11459	138	0.5mm	26	residue	burnt stone, charcoal, minor slag, lots of ?calcite films
11459	138	1mm	676	residue	fired clay, charcoal, burnt stone, bone, burnt bone, possible FAS
11459	139	0.5mm	24	residue	stone, coal, calcite? films, charcoal, slag
11459	139	1mm	542	residue charcoal rich	stone, burnt stone, charcoal, coal, coke, slag, burnt bone, bone
11459	140	0.5mm	38	residue	slag, charcoal, stone, FHS, calcite films
11459	140	0.5mm	12	residue	burnt stone, coal, slag, charcoal, calcite films
11459	140	1mm	554	residue	dominantly slag and coke, with coal, fired clay and minor stone
11459	140	1mm	220	residue	dominantly slag and coke, with coal, fired clay and minor stone
11459	140	2mm	524	residue industrial waste rich	stone, slag, coal, coke
11459	141	0.5mm	12	residue	coal, calcite? films, slag, charcoal
11459	141	1mm	466	residue	slag, burnt stone, FHS, FAS
11459	141	2mm	606	residue industrial waste rich	stone, slag, coke
11459	142	0.5mm	22	residue	stone, fired clay, coal, calcite? films
11459	142	1mm	514	residue	stone, charcoal, coal, slag, bone
11485	129	0.5mm	34	residue	
11485	129	1mm	42	residue	
11486	130	0.5mm	38	residue cremated bone	
11486	130	1mm	50	residue cremated bone	
11486	130	2mm	50	human bone rich	
11487	131	0.5mm	70	residue	
11487	131	1mm	58	residue	
11487	131	2mm	74	residue cremated bone	
11488	32	2mm	66	residue cremated bone	

C	S	fraction	wt (g)	label	notes
11488	132	0.5mm	46	residue cremated bone	
11488	132	1mm	48	residue cremated bone	
11525	133	0.5mm	20	residue	sand charcoal
11525	133	1mm	32	residue	charcoal, burnt stone, fired clay
11526	134	0.5mm	18	residue	sand, charcoal
11526	134	1mm	26	residue	charcoal, burnt stone, fired clay
11527	135	0.5mm	14	residue	sand, charcoal
11527	135	1mm	22	residue	charcoal, burnt stone, fired clay
11528	136	1mm	36	residue	charcoal, stone, black sandy ceramic
11528	136	2mm	30	residue charcoal rich	charcoal, burnt stone, fired clay
11528	136	0.5mm	24	residue	sand, charcoal, coked organic material
12021	143	0.5mm	122	residue	fired clay, charcoal
12021	143	1mm	1995	residue	fired clay, charcoal, burnt stone
12027	146	0.5mm	14	residue	burnt clay, coal, coke
12027	146	1mm	146	residue	charcoal, coal, coke, burnt stone, slag
12029	145	0.5mm	6	residue	stone, fired clay, coal, charcoal,
12029	145	1mm	56	residue	stone, fired clay, slag droplets, coal
12040	147	0.5mm	16	residue	stone, FHS, coal, coke,
12040	147	1mm	160	residue	stone, charcoal, slag, coal , coke
12387	151	0.5mm	6	residue charcoal rich	abundant charcoal, fired clay
12387	151	1mm	66	residue charcoal rich	burnt stone, abundant charcoal
12655	152	0.5mm	46	residue	stone, charcoal
12655	152	1mm	432	residue	stone, charcoal, burnt bone, burnt stone

Figure 1: weight-frequency distribution of hearth slags. Conventionally-shaped SHCs shown in blue, other morphologies in yellow.



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