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Evaluation of archaeometallurgical  
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Waterford  
(Woodstown 6, Adamstown 1,2,3)

# Evaluation of archaeometallurgical residues from sites on the N25, Co. Waterford (Woodstown 6, Adamstown 1,2,3)

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## Abstract

*This report provides an evaluation of archaeometallurgical residues from four sites on the N25 in County Waterford.*

*Woodstown 6 yielded an assemblage of approximately 291kg of residues, dominantly from iron-working (smithing; 181kg), but with a smaller suite (9.5kg) of materials from iron-smelting, mainly found in-situ in the base of a furnace and a small quantity of material, mainly crucibles from non-ferrous metalworking. Most of the metalworking residues derive from levels currently interpreted as pre-Viking. The iron-smelting furnace was not able to be fully interpreted at the time of excavation, but retrospective interpretation based on serial plans of the complex suggest that it may have been a shaft furnace constructed within a broader working hollow. There was probably a furnace arch to allow tapping of slag. This type of furnace is otherwise unknown in Ireland. The smithing slags included 140 smithing hearth cakes (SHCs) for which the weight could be measured or estimated. The SHCs had a weight distribution very similar to other major early medieval assemblages from Clonfad and Clonmacnoise, where it is interpreted that iron was being worked from raw blooms into finished bar iron and not just being forged into artefacts. Thus much of the smithing being undertaken was part of the process of iron-production. The Woodstown assemblage also included a number of crucibles, mainly small rounded forms, with dross from copper alloy handling, but also several fragments of what are probably ceramic cupels for silver assaying.*

*Adamstown 1 yielded a broken, but otherwise complete furnace bottom slag weighing approximately 18.6kg, apparently in-situ in the slagpit of a non-tapping iron-smelting furnace. The slag cake closely resembles an example from Tullyallen 6, Co. Louth, also probably of prehistoric date. A small quantity of slag, all probably from iron smelting, was recovered from other contexts. Adamstown 2 produced only a very small slag assemblage with two pieces of smithing hearth cake and one fragment of probable iron smelting slag. Adamstown 3 had no archaeometallurgical residues, but did yield two blocks of goethite iron ore, which may shed light on the ore available for smelting at the other sites in this scheme.*

## Contents

Abstract .....	1	Adamstown 2	
Methods .....	2	Results .....	6
Woodstown 6		Interpretation.....	6
Results		Evaluation of potential.....	6
Iron-working residues .....	2	Adamstown 3	
Iron smelting residues .....	2	Results .....	6
Structural evidence .....	3	Interpretation.....	6
Non-ferrous metalworking .....	3	Evaluation of potential.....	6
Interpretation		References .....	7
Iron-working .....	4	Tables	
Iron-smelting .....	4	1 Woodstown 6 – distribution of crucibles .....	4
Non-ferrous metalworking .....	5	2 Woodstown 6 – catalogue by context .....	9
Evaluation of potential .....	5	3 Woodstown 6 – residue classes by context ....	26
Adamstown 1		5 Woodstown 6 – comparison of SHC statistics.	27
Results .....	5	6 Adamstown 1-3 – catalogue by context .....	28
Interpretation .....	6		
Evaluation of potential .....	6		

## Methods

All the materials were examined by eye, handlens or low-powered binocular microscope as appropriate. All materials were weighed and recorded to a computer database. All complete, and substantial fragments of, smithing hearth cakes were also measured, and the proportion of the original cake estimated, so that original weights could be estimated wherever possible.

All materials that might be useful for Stage 2 of the archaeometallurgical investigation were separated from the main collections during the inspection process. This material included representative slag material, all the crucible material and all the tuyère sherds, as well as washings of significant slag collections which might contain useful microresidue assemblages.

The catalogue for Woodstown 6 is presented in Table 2, those for Adamstown 1-3 in Table 6.

## Woodstown 6

### Results

#### Iron-working residues

The majority of the Woodstown collection (181kg out of 272kg) comprised residues from iron-working (smithing). Of this 170kg was material from smithing hearth cakes (SHCs) and 11kg from "pro-tuyère tongues". A further 63kg of unidentifiable slags was probably dominated by small fragments of smithing hearth cakes, together with a limited quantity of small smithing hearth slag lumps.

The SHCs which were either complete, or sufficiently so that original size could be estimated, number 140, with an estimated original total weight of 148kg.

The weight of SHCs varied from 68g up to 6.31kg. At the lower end of the range certain distinction of SHCs and the masses referred to here as pro-tuyère tongues becomes difficult (see below).

The smithing hearth cakes are very variable in morphology and texture. In general the SHCs are rather conventional in form with moderately dense crusts to the bowls and commonly infills of more charcoal-rich material. There are examples of large bowl-shaped cakes with almost no crust at all, but most do show crust development. The deep cakes of extremely dense, fluid slags recorded at Clonfad (Young 2006c) do not appear to be common at Woodstown. The details of the internal structures of the cakes require further examination in stage 2 of the investigation by cutting.

The weight distribution of the smithing hearth cakes (Tables 3 and 4) shows a minimum recorded size of 68g, a maximum of 6310g, with a mean for the 140 measurable SHCs of 1060g. The modal 100g class is the 200-300g interval, and 40% of the SHCs are less than 500g, with 71% less than 1000g. 7% of the SHCs weigh over 3000g.

The tuyères from the site have a total weight equivalent to about 7% of the weight of the SHCs. This is comparable with the proportion from the New Graveyard excavations at Clonmacnoise and slightly

higher than that at Clonfad or the Clonmacnoise wastewater scheme. The detailed study of the tuyères will form part of the stage 2 work, but it would appear that examples with a diameter of approximately 110mm and a bore of 18-26mm are most common, although both larger and smaller examples appear to be present. These dimensions appear similar to the material from Clonfad and Clonmacnoise, although further work is required.

The tuyères are accompanied by a characteristic form of slag cake, to which has here been given the name "pro-tuyère tongue". These cakes appear to extend forwards and possibly slightly downwards from the lower part of tuyère face. They therefore form in a similar position to conventional interpretations of SHCs. They have a distinct morphology however, separating them from the accompanying SHCs. They typically have an elongate shape, typically up to 150x80mm, with a smooth silicate-rich glassy top, a lobate margin, and a prilly, iron rich lower surface. Well-developed examples weigh 160-200g. A total of 10.8kg of this class of slag was recovered, corresponding to 6% of the identifiable smithing slags.

The indeterminate iron slags were generally small pieces likely to have been derived from SHCs but not demonstrably so, together with small pieces of slag that may have formed in the smithing hearth outside the main SHC. It is unlikely, given the distribution of the identifiable slags, that the indeterminate group actually includes a very high proportion of iron smelting slags.

In Stage 1 of this project no micro-residue assemblages have been examined, however, several pieces of "smithing floor" were present in the slag collections. So-called smithing floor is a concreted mass of smithing fines, dominantly flake hammerscale, but also including spheroidal hammerscale, other slag fines and charcoal, which has accumulated either on the smithy floor, or within a dump of fines. The Woodstown assemblage includes some rather exceptional pieces of smithing floor that have the form of elongate lengths of irregular "T"-shaped section (up to 40mm deep and 20mm wide). These appear to have accumulated either in a gap in the smithy floor, or most likely (given the overall appearance of the pieces to wood) by accumulation of hammerscale into the void created by a rotting piece of wood within the floor.

#### Iron-smelting residues

Iron smelting residues were very limited in distribution and quantity, with most of the 9.6kg identified being associated with the base of a furnace, as discussed in further detail later (F2370, 2402, 2406, 2408). Some smelting slag was recovered from the later, post-furnace, fills of ditch F2174 (F2297). The distribution of the few specimens not from the furnace area may provide some useful evidence (F2320, 2359, 2375).

The identified smelting slags are all dense, and show good textural evidence for having been very fluid. Most of the isolated pieces in the form of descending or horizontal prilly masses, closely resembling tapped slag. The rough nature of most of the pieces, together with their apparent intimate embedding in ash, suggests that they are flows from the floor of a furnace. At the heart of the smelting complex within context F2330 lies what appears to be the base of a free-standing shaft furnace (see detailed discussion below). The base of this structure is filled with an in-situ mass of slag (context 2406). This mass closely resembles

tapped slag in appearance (despite being constrained within the probable furnace base). The total amount of slag from c2406 is approximately 4.5kg. The slag mass shows flows covering an earlier deposit of spheroidal droplets, with flows moving over and against several large stones which apparently form the edges of the base of the furnace. These slag flows show no included moulds of wood or charcoal, and the surface of the flows has a maroon tint, suggestive of some surficial oxidation. In the respects the slags are different from other slag pit furnace slags, and show more similarity with tapped slags.

## Structural evidence

The iron-working structures in the butt of the ditch (F2174) are complex and unusual. The unusual nature of the features meant that they were not fully interpretable at the time of investigation, but the following account is based on the serial plans taken during excavation. Since the interpretation is retrospective, there is necessarily some uncertainty. Further detailed examination of the photographic record would be desirable to assist in confirmation of the following interpretation.

The starting point for the following discussion is the *in-situ* slag flow shown on the mid-ex plan 4 of F2330. This flow largely coincides with the later stone feature within a circular area of charcoal and burnt clay.

The structure comprises an oval cut (F2330) approximately 1.4m wide across the ditch and 1.1m along the ditch, with a slight protrusion on its NW side above the centre of the ditch. A furnace appears to have been constructed upon the base of the cut, with a pair of large stones on the NE side of the furnace base with a gap of approximately 120mm between. The slag and charcoal deposit in the base of the furnace (F2406) lies between and to the SW of the stones, but upwards also apparently partially covered the stones and had an extent of 350mm NE-SW by 250mm NW-SE. Slag flows are indicated as extending from the furnace towards the NE (i.e. above and beyond the gap between the stones in the furnace base. The difference in elevation of the base of the cut within the furnace and the base of the cut outside it is unclear from the plans, but seems the cut base seems to dip to the N. It is clear from the plans that the base of the furnace was not cut deeper than the rest of F2330.

At a slightly higher level, burnt clay (part of context F2370) forms a circular structure (interpreted as the base of the furnace shaft), approximately 550mm in external diameter and 300mm internally. The interior of the shaft was tightly sealed by a group of 3 or 4 tightly fitting stones. Deposits immediately over the stone surface appear to have included some charcoal, but rather little slag. The final fill of the complex, F2171, is recorded as being an approximately circular deposit, containing some 20kg of mainly smithing slag, but also a piece of crucible and some copper-alloy dross.

The surface of the stones within the probable shaft lay at 6.2m, the surface of F2406 below the stones at 6.03m, the top of the internal slag flow at 5.97m and the base of the cut in this area at 5.96m. To the west of the F2330 cut was a cluster of stakeholes, which may have formed a component of the complex. To the north of F2330 a line of stakeholes may suggest some containment of the complex across the line of the ditch.

The interpretation of this structure is crucial to the understanding of the associated residues. The presence of the flows of slag in the base must either indicate a pit for slag-tapping, or slag entrapped in the furnace base. Given the location of the apparent fired clay shaft above, and the geometric position within the overall complex, there seems little doubt that these slags are in the furnace bottom. However, the normal structure for Early Medieval furnaces in Ireland is to have a basal slag-pit dug for 200-300mm (and occasionally more) below the shaft (Young 2003b,c,d, 2005c, 2006d). This is not the case here, where the shaft appears to be entirely above ground (although low down in a ditch). The pair of stones near the base and the apparent slag flows outside the fired clay ring to their NE strongly hints at the presence of an arch – either a proper tap arch or an arch for furnace cleaning (cf. those described by Crew 1989, 1998 at Crawcwellt, N, Wales).

It would be expected that the air supply to the furnace would be through a blowhole 200-300mm above the furnace base (whether a tapping or non-tapping furnace). This would imply blowing at, or just above the level of the later stone filling. Stone or clay fillings such as this have been employed during experimental archaeological investigations to allow the conversion of a smelting furnace into a smithing hearth. Little remains above this level to confirm this interpretation, but it is interesting that the final dump of smithing debris into the complex on its eventual disuse, included large SHCs with unusually polished-appearing bases, which might be taken as indicative of contact with a chilling stone floor to the smithing hearth.

In summary the smelting furnace is unique in the author's experience in Ireland in being entirely constructed above a basal surface, rather than having a basal pit, and it seems likely that this was allow for the presence of an arch. Some slags may have been tapped, although at least on the final use of the furnace much of the slag appears to have solidified inside the furnace base. The surficial oxidation of the slag may also indicate the use of an open arch. On disuse the lower part of the shaft of the smelting furnace was blocked with large stones to close to the original blowhole level, possibly to allow conversion into a smithing hearth.

## Non-ferrous metalworking

The evidence for non-ferrous metalworking is provided mainly by a large collection of crucibles and cupels. Full description and discussion of the crucible assemblage will form a part of the second stage of the metallurgical investigation. The following account is therefore a provisional statement.

The crucibles form a rather uniform assemblage, being typically small and of open, rounded, "bag-shaped" form. Most of the sherds are indicative of small crucibles. Many crucibles are associated with residues indicative of copper alloy. One single fragment (from F2365) was suggestive of a crucible handle. Most fragments are small, but F2188 yielded a single complete rounded crucible.

The cupel sherds are from two different forms, one almost disc-like (F1083) and the other a flat-bottomed cupel (sometimes known as a "heating-tray" in the literature).

Context	No. of sherds	Notes
600	8	Unstratified
885	11	Tr. 87, Fill of pit F1391
887	2	Tr. 87, Fill of pit F1347
1083	1	Tr. 65, Fill of pit F1425
2007	1	Culvert 1, post-med field bank
2096	1	Culvert 1, main enclosure ditch
2170	1	Culvert 1, late ditch cutting F2171
2171	1	Culvert 1, main enclosure ditch
2188	2	Culvert 1, main enclosure ditch
2297	34	Culvert 1, main enclosure ditch
2365	3	Culvert 1, main enclosure ditch

Table 1: Woodstown 6 - Stratigraphic distribution of crucible and cupel sherds. All material crucibles except single sherds from F1083, a disc-like cupel, and F2297, a low cupel.

## Interpretation

### Iron-working

The evidence detailed above indicates iron-working using a free tuyère (rather than a blowhole in the hearth wall), with the production of large smithing hearth slag cakes of up to 6.3kg, with a mean weight of 1.06kg. This population compares closely with assemblages from Clonmacnoise and Clonfad (Table 5), for which an interpretation of the large cakes as residues from bloomsmithing has been proposed (Young 2005b, 2006d.). This implies that the iron-working waste can be considered, at least in part, as waste from iron production. This provides a rather larger body of evidence than the evidence for iron smelting itself, which is almost entirely restricted to the slag left from the last smelt in the furnace in F2330.

The maximum weight of the SHCs may be a significant observation. It has been suggested (Young 2006c) that these large SHCs may represent the waste from the working-down of an individual bloom. The large SHCs of up to 11kg at Clonfad were linked by Young (2006c) to the unusual requirements of producing large (5kg) wrought iron sheets from which to forge Class 1 handbells. The possible production of rather smaller blooms, as might be suggested by the smaller maximum SHC size at Woodstown (6.3kg), potentially suggests a scale of smelting more in line with other more conventional sites (e.g. Clonmacnoise).

Only a very few consolidated blooms are known from Ireland. Pleiner (2000) and Scott (1990) list an example from Carrigmuirish (3.6kg) and one from Brother's cave, in Co. Waterford. However, the illustration of the Carrigmuirish Bloom given by Tylecote (1986 fig. 133; and attributed to Co. Cork) is of the same specimen as the photo of the Brother's Cave bloom given by Scott (1990; plate 6.5.5) and therefore these two records may relate to a single bloom. There are also examples from Ballyhenry, Co. Antrim (a 250g fragment) and Lough Faughan Crannog, Co. Down (Tylecote 1986). Three undated split blooms weighing about 5.5kg are known from Dernaglug and Drumaa, Co. Fermanagh (Evans 1948). There is also a 13<sup>th</sup> century 0.6kg bloom fragment from Downpatrick, Co. Down (Tylecote 1977). In general most Early Medieval consolidated blooms recorded by Pleiner (2000) from across Europe lie in the range of 1.6 to 3.3kg, with a few examples up to 6kg, although larger (probably only very slightly consolidated) blooms from Viking Norway range up to 14kg.

The extent to which the iron-working may have also been producing artefacts from the raw iron is uncertain. It may however, be noteworthy that the modal 100g interval for the SHC weight distribution is 200-300g, somewhat lower than for the other iron production sites of Clonmacnoise (waste water scheme) and Clonfad, although still higher than on the dominantly blacksmithing sites of Carrigoran and Coolamurry. The association of the smithing debris with the evidence for non-ferrous metalworking, which was certainly on a small scale may provide circumstantial evidence for craft use of the iron.

### Iron-smelting

The furnace within F2330, a metalworking feature constructed with the butt-end of the main enclosure ditch (F2174) adjacent to an entrance, provides evidence for a furnace type possibly so far unique in Ireland. The furnace appears to have had a frontal arch, which was probably, though not certainly, to allow slag-tapping. A furnace arch has been tentatively suggested for furnaces at Morrett and Cappakeel West (03E0461 and 03E0603 respectively; Young 2005c), although both of these examples appear to be purely non-slag tapping.

Although revision of the absolute dating evidence is expected, the current radiocarbon date for the furnace is cal. 420-620 (Russell 2005), with cal. 620-690 for the overlying dump of smithing waste. A seventh century age therefore seems likely.

The construction of a shaft furnace within a working hollow, which provides the tapping area, is a common feature. The Woodstown example does bear some particular comparison with the pair of small slag-tapping furnaces, situated in working hollows within a building, recently discovered at South Hook LNG Terminal, Dyfed, Wales (Young 2006g). These furnaces are presently dated to cal. 650-840. Woodstown is incidentally currently the nearest known Early Medieval iron-smelting site to South Hook at approximately 120km. The nearest known contemporaneous British site to South Hook is Blacklake Wood, Dulverton, dated to cal. 415-650, but details of this site are not yet published.

One interesting aspect of the Woodstown smelting furnace will be identification of the ore being smelted. In Britain, Iron Age usage of non-slag tapping furnaces is closely, but not entirely associated with exploitation of Britain's rather limited bog iron ores. With increased exploitation of rock ores by the late pre-Roman Iron Age a transition to slag tapping furnaces occurs, which is almost universal by the Roman period. In contrast, Ireland has had a much more plentiful supply of bog ores and usage of the Iron Age-style of non-slag tapping furnace appears to have continued, with modification until the 18<sup>th</sup> century. The presence at Adamstown 3 of large pieces of what appears to be a goethitic rock ore, suggests the possibility that Woodstown might have employed such an ore; it is just possible that the exploitation of a different resource may have been associated with the adoption of a different furnace technology.

## Non-ferrous metalworking

Full investigation of the crucible assemblage will form part of the stag 2 work, so only limited discussion can be made here. Although much of the assemblage is in very small fragments, the material currently suggests that most of the crucibles are of rounded rather than a pyramidal or triangular shape. One single fragment suggestive of a handle was found, but otherwise the evidence (particularly the single complete crucible) suggests the crucibles did not have handles. Rounded crucibles without handles (sometimes known as "bag-shaped crucibles or Tylecote Type B1) are not common in Ireland, although an assemblage of probably 8<sup>th</sup>-early 9th century date from Scotch Street Armagh (Quinn 1981) was apparently dominated by this form, and a few examples are known from Lagore (Hencken 1950; Comber 1997, 2004) apparently from late contexts (10<sup>th</sup> century?). Further clarification of crucible form at Woodstown will be important.

Cupels of the forms seen at Woodstown are for the assaying of silver (Bayley and Eckstein 1997; Söderberg 2004). A flat cupel like that from F1083 is known from the 8<sup>th</sup> century at Moynagh Lough (Craddock 1989, No. 160). The slightly stouter example from F2297 can be more widely paralleled in Ireland at Lagore, where 23 examples of "flat-bottomed crucibles" were found (Hencken 1950; Craddock 1989, no 171; Comber 1997, 2004), Clogher (Warner 1986), Ballinderry No2 Crannog (Hencken 1942), Cathedral Hill Armagh (Gaskell Brown & Harper 1984; Quinn 1981) and Dunnyneill Island (Young 2006c). These occurrences seem to have a wide span of age from 7<sup>th</sup> to 10<sup>th</sup> centuries.

The rather limited range of morphology exhibited by the crucibles may reflect a rather limited stratigraphic range of the present examples. Of the 65 pieces, 56 derive from stratified early medieval contexts, of which 41 derive from the upper levels of the early main enclosure ditch and 11 sherds from a single pit (F1391) in Tr. 87. Only 1 sherd was from a context certainly post-dating the main enclosure ditch, and this was from the primary fill of ditch (F2170) which was cut through the upper levels of the main enclosure ditch which contain crucible sherds, so it may be residual.

## Evaluation of potential

The evidence for metalworking derives mainly from the earlier part of site's history, although clarification of the age of some of the isolated contexts may change that picture.

The archaeometallurgical residue assemblage is dominated by the products of iron-working. The apparently rather primary nature of the dumps of smithing waste means that they have the potential to provide a representative cross section of the residues from the iron-working. Interpretation of smithing hearth cake assemblages is problematic, with several quite distinct textural variants being present. Detailed analytical investigation of the smithing debris has enormous potential to further understanding of the technology, to enable comparison with other sites, and ultimately to provide a more detailed level of understanding of the activities being undertaken.

The iron smelting operation at Woodstown appears to have been using a technique and a furnace structure unique in the record of Irish ironworking. Full analysis

of the slag from the smelting furnace has the potential to aid understanding of the nature of the structure, provide information on the ore being employed, provide evidence for the efficiency and yield of the furnace, and to enhance the possibility of comparison with iron-smelting elsewhere.

The non-ferrous metalworking activities which apparently accompanied the iron smithing at Woodstown may be investigated through full typological and analytical study of the crucibles and their residues. The evaluation study suggests that both copper alloy and silver were involved, that metals were typically handled in very small volumes and that there is a narrow typological range of crucibles represented. These provisional interpretations need clarification and elaboration to allow full interpretation of the nature of the non-ferrous metalworking.

## Adamstown 1

### Results

The identifiable slags from Adamstown 1 are probably all residues from iron smelting in a non-slag tapping slagpit furnace.

The isolated material from F100, F102 (except #4), F195, F229 are all not particularly diagnostic, but are entirely compatible with the processes evidenced by the main slag cake from F194 (plus F102 #4). This slag cake requires careful reassembly and recording before analysis, but a preliminary description is offered here.

The total weight of material from the cake found in F194 and F102 is approximately 18.6kg. The main slag mass forms a plano-convex cake, the lip of which appears to undercut the side of the furnace. The bowl seems to have been about 450mm diameter and a maximum of 150mm deep. The cake appears to extend approximately 60% of the way across the bowl, and is thus not circular in plan. A possible blowhole location suggested by one area of attached highly vitrified furnace wall that would have been 80mm above the cake top and 50mm inside the maximum diameter. A second group of preserved vitrified wall fragments hint that there may have been 2 blowholes, but this cannot be confirmed without restoration. The top of the slag cake appears to have been overlain by the higher lining of the shaft, thus appearing to have undercut the shaft, but it is possible that the slagpit dug into the substrate was of larger diameter than the shaft erected over it. There is no obvious suggestion that the protrusion into the shaft is the remains of a tuyere.

The centre of the upper face has a layer of adhering red clay, and much more was washed away, suggesting collapse of furnace material onto this surface.

Much of the cake is formed of extremely charcoal-rich material (now mainly void rather than charcoal), but the slag is well-flown and lobate around the margins. Some of the wood/charcoal is very large, but it does not appear to have been formed into a regular pit packing.

## Interpretation

The slag cake appears to be the *in-situ* main slag block (furnace bottom) in a non-slag tapping slag pit furnace. The preservation of such fragile “furnace bottoms” is not common. Few large fragments are known from sites where the furnaces were abandoned after cleaning, but occasionally furnaces were not cleaned out before abandonment.

The closest parallel to the Adamstown 1 slag cake is an example from Tullyallen 6, Co. Louth (Young 2003d) where a slag cake was found extending 60% of the way across a 470x500mm slag pit, 180mm deep. The cake at Tullyallen weighed 11.2kg, but additional slag fines not forming part of the main block occurred below the main slag cake, bringing the total weight of slag in the slagpit to 17.5kg. The Tullyallen slag exhibits very similar texture and structure to the Adamstown example, with much less evidence for well-flowed slags than is normally seen on slagpit furnaces of historic age. At Tullyallen there were also two zones in which the wall appears better preserved (although not as well indurated as at Adamstown), with the zone of maximum flowage in between them. These two zones are approximately 90 degrees apart – they may simply, however, be zones of similar induration either side of a central blowhole, rather than being indicative of two blowholes. Unfortunately the Tullyallen 6 example currently remains at evaluation stage and no detailed analysis has yet been commissioned.

The Middle Bronze Age radiocarbon dates (10-13<sup>th</sup> century BC) for the structure surrounding the furnace are extremely early for any suggestion of iron-making. Similar controversial 10-11<sup>th</sup> century BC dates exist for a site at Hartshill Copse, Berkshire, UK; Collard 2004, Young 2004, where considerable doubt still exists over the possibility of an intrusive origin of the residues. None the less, they do raise the likelihood that this smelting furnace is prehistoric. No radiocarbon dates have yet been obtained for Tullyallen 6, but the furnace was associated with a ringditch containing struck flint. Another site on the N25 has also given evidence for prehistoric iron smelting (Newrath site 35, Co. Kilkenny), with radiocarbon dates of 2<sup>nd</sup> – 4<sup>th</sup> century BC.

The presence of a shallow pit with finds of smelting slag adjacent to the furnace is worthy of further investigation. The site records should be re-examined to determine the nature of this structure if possible.

Of the isolated pieces of slag from the site only a piece from F229 was stratified in direct association with the MBA roundhouse. This piece weighed on 3.23g and an intrusive origin for this might be possible.

## Evaluation of potential

This material has enormous potential for furthering understanding of the early development of iron smelting in Ireland. The early date, coupled with complete recovery of the entire smelting slag cake make this an ideal opportunity to investigate the technology, construct a mass balance, and examine issues of yield and efficiency. The similarity and distinctiveness of the Adamstown 1 and Tullyallen 6 slag cakes raises the possibility that it might become possible to differentiate prehistoric slagpit furnaces from later examples on the basis of slag morphology and texture.

## Adamstown 2

### Results

Three pieces of slag were recovered from this site. The first (from F1) was probably a smithing slag with a thin crust, the second (from F2) had a cooling surface against some large charcoal/wood and was therefore probably a slag from slagpit smelting furnace. The third was a vesicular slag, probably from a smithing hearth cake. This piece may possibly contain coal residues.

### Interpretation

All three are iron slags, but two are likely to be from smithing and third from smelting. The pieces are not particularly diagnostic of age. If the presence of coal can be confirmed by further examination, then the piece from F48 would be likely to be post-medieval

### Evaluation of potential

The pieces have limited potential to provide further information, and the small quantity of material involved may raise doubts over the archaeological significance of the specimens. It may be useful to analyse the smelting slag specimen for comparison with the smelting slags of Woodstown 6 and Adamstown 1.

## Adamstown 3

### Results

This site did not yield any archaeometallurgical residues in the strict sense, but did provide two large blocks of goethite (hydrated iron oxide) ore. In both cases the blocks show a fragmental texture, overlain by additional goethite.

### Interpretation

These two blocks are not necessarily indicative of deliberate collection or use. The two pieces appear to be ore-grade material, but may not have been present on site for that reason.

### Evaluation of potential

These two blocks are potentially indicative of the type of iron ore available in the region. Their analysis may provide information for comparison with the analytical data to be produced from iron smelting slags from Adamstown 1 and Woodstown 6. Efforts should be made to try to constrain the geological origin of this ore.

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context	Sample	weight	Material	SHC <i>prop</i>	<i>estimate</i>
479	6 to 8	0.25	chip of lining slag		
	6 to 8		2 pieces of bone		
600	495	174	2 exploding pieces of corroded iron		
	26		not yet exploded iron object		
	496	14.5	shale bearing clinker		
		8.5	lining bleb		
	497	36.1	Coke		
	498	21	lining slag lump		
	499	9.6	dense flowed slag nub		
	500	13.3	lining slag bleb		
	501	13.3	Stone		
		43.8	tiny SHC-like piece 50x45x20, dimpled dense base. Black glassy lining-dominated top		
	502	16	indeterminate iron slag		
	503	910	SHC, broken slightly at proximal end, wide bowl with slightly raised lining slag patch at proximal end, (110)x130x50, base dimpled, top fairly smooth	97	938
	504	2.7	lining slag bleb		
	505	120	exploded slag fragment containing piece of iron		
		106	pro-tuyère tongue		
	506	8.2	Coke		
	507	11.3	shale-bearing clinker		
	508	142	14 pieces of lining slag - 3 of these are probably clinker		
		158	large vitrified stone		
		366	86 tiny pieces of indeterminate slag		
		388	8 larger pieces of iron slag		
		14	3 pieces of iron debris		
		40	possible piece of bog ore		
		186	basal part of porous SHC with lots of stone clasts		
		206	8 pieces of tuyère		
	509	4	Clinker		
		66	3 indeterminate iron slags		
		154	3 iron objects		
	510	1300	complicated compound SHC. Base gravelly, rough, top covered in a gravelly lining slag, 175x140x60	100	1300
		24	3 small pieces of mixed dense and lining slag		
	511	72	small piece of slag starting to explode		
		100	3 small exploding concretions		
		42	concretion exploded to show nail		
		402	dense slag exploded to reveal amorphous iron lump		
		200	possible bog ore lump		
	512	110	concretion - may have iron inside?		
		466	dense lump of iron slag, once contained iron, now exploded into many fragments		
		74	10 pieces of indeterminate fe-slag		
		0.9	coffee bean		
	535	7.5	Clinker		
		12.5	concretion around iron object		
		11.11	bog ore		
	539	1	dense hollow prill		
	540	1.9	dark glass prill - probably not iron slag		
	543	376	38 pieces of indeterminate iron slag		
		3.8	Nail		

context	Sample	weight	Material	SHC prop	estimate			
600	543	48	3 pieces of lining-dominated iron slag					
		8	1 stone					
	544	50	small piece of exceptionally dense vesicular fe-slag					
		546	17.2			lining influenced iron slag nub		
		547	76			shale, burnt till vitrified on one end		
			776			44 pieces of indeterminate slag		
			1095			143 indeterminate iron slag fragments		
			36			2 pieces corroded iron		
			88			6 pieces of lining dominated slags		
			104			6 pieces of lining slag		
			388			large rounded pebble of possibly mineralised rock - but if anything looks like Mn mineralisation		
			24			2 stones		
			50			2 stones		
			8			?bog ore?		
			298			3 SHC fragments		
		548	1			burnt coal measures shale		
			20			concretion?		
			8			2 fragments of smithing floor		
			10			2 tiny indeterminate slags		
			76			3 corrosion balls around iron		
			24			bog ore fragment		
			66			pro-tuyère tongue with burnt bone on upper surface		
		549	48			dense iron slag nub		
		550	516			2 possibly burnt sandstone pieces		
		551	1.4			coke		
			322			22 pieces of iron-slag		
			5.6			lining slag		
		553	56			6 pieces of lining slag		
			8			2 stones		
			2			2 bog ore fragments		
		554	0.67			coke		
			656			68 small pieces of slag		
			2.8			iron-slag		
			7			2 pieces of iron		
			428			10 stones		
		1388	276			small SHC with dished blown top, very dense, now exploded, (80)x(80)x35 - probably about 25%???	25	1104
		2085	2.9			oxidised fired clay		
		2212	10.1			rounded crucible base with Cu alloy on inside		
		2501	1.8			2 coke pieces		
	2962	5.67	oxidised fired clay					
	3009	12.1	object?					
	3010	10.3	object?					
	3011	86	object?					
	3020	215	small exploding SHC 80x60x30	100	215			
	3045	46	object?					
	3046	50	slag?					
	3063	9.6	indeterminate iron slag					
	3071	13.6	fe object?					
	3072	21.2	slag indeterminate - but very magnetic					
	3073	15.2	slag or object, very magnetic					

context	Sample	weight	material	SHC prop	estimate
600	3077	58	dense slag with exploding iron lump		
	3087	27.3	tuyère		
	3088	29.8	tuyère		
	3090	4.12	oxidised fired clay		
	3191	34	object?		
	3597	26	irregular bleb of dense slag		
	3818	56	concretion around iron object? Might be very dense slag		
	4034	6.55	coal		
	4039	4.2	highly slagged crucible sherd		
	4057	4.28	thick crucible sherd		
	4110	288	burr part of large irregular SHC		
	4164	0.58	sherd of pot or probably crucible		
	4165	1.1	fired clay		
	4173	15	vitriified lining / tuyère		
	4210	1.61	vitriified lining - probably not crucible		
	4214	1.8	lightly vitriified clay - hearth/tuyère?		
	4232	3.6	vitriified lining - probably tuyère		
	4370	682	SHC with some edges knocked off, very dense, 120x(100)x50	70	974
	4479	3	oxidised fired clay		
	4480	8.4	clinker		
	4531	2.3	half reduced half oxidised fired clay		
	4541	21.5	fired clay		
	4552	3.6	fired clay		
	4574	7.4	glazed pebble/lining slag		
	4718	128	c80% of tiny SHC? 65x75x25	80	160
	3155to3157	26.6	3 pieces of coal		
	3309&3310	96	2 pieces of indeterminate dense iron slag		
	4144 to 4146	1.85	possible crucible sherd		
	4144 to 4146	6.5	deeply vitriified pale ceramic		
	4144 to 4146	4.5	coarse vitriified ceramic		
	4505 & 4506	4.3	fired clay		
4529, 4530	11.2	fired clay			
4559 to 4564	94	6 pieces of fired clay			
4601 to 4605	27.61	5 pieces of burnt / fired clay			
f4225	0.66	slag fragment			
f4253	6.16	crucible base			
f4517	4.29	lining slag			
f4709	1.3	thin rounded crucible			
757	1,2,3	58	three small slag fragments, one dense, other two lining influence - of which one may be slag from a tuyère tip		
	4,5	2.5	rust		
	4,5	4	lining slag		
798	4,5	7	slagged lining or tuyère		
	2	5.5	charcoal rich slag embedded in bright red fired clay		
	4	17.4	rounded flown slag bleb, quite dense		
821	8	3.8	bleb of lining slag		
	1,2,3	6	3 small pieces of lining rich slag		
885	1	1.35	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
	2	1.65	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
	3	1.16	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
	4	1.52	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		

context	Sample	weight	material	SHC prop	estimate
885	5	1.43	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
	6	0.27	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
	7	3.8	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
	8	0.38	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
	9	0.25	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
	10	0.41	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
	11	0.44	crucible - rounded, thin, small, greenish clear external glaze, internal dark deposit		
887	6	0.52	2 pieces of thin crucible rim		
	9	3.32	small piece of vitrified lining		
	10	9.01	well flown maroon slag with some sediment inclusions - might just be clinker		
	11	148	small piece from large thin crust cake		
920	1	2.32	nail		
941	1,2,3	11.2	fragmented corroded iron objects		
999	1	6	flown bleb		
1040	1	1.02	stone		
1083	1	5.06	cupel, low disk like form, reduced to slightly oxidised on base, upper surface dark		
1083	2	0.3	broken hollow slag sphere		
1111	6,7	322	broken contorted piece of thin crust slag, highly deformed on extraction		
1214	7	6	rusted lining influenced slag bleb flowing around small charcoal pieces		
	12	40	small pro tuyère tongue - lining on top rusty below		
1233	12	5.5	8 pieces of irregular slag blebs		
	12	0.08	hollow sphere		
1407	none	3.8	small scrap - probably corroded iron rather than slag		
1464	1,2	116	2 small SHC fragments		
1468	1	84	iron slag lump - charcoal rich		
1488	3	9.2	concretion		
	4	22	lining slag lump		
	2,3,4	34	indeterminate iron slags		
1499	2,3,4	2	stone		
	163	9	iron object		
1511	9	376	very dense conventional SHC, 110x75x35	100	376
	10	750	slightly incomplete SHC with a curiously polygonal shape. 145x(95)x45. Slightly dished top with adhering charcoal rich material, bowl, coarse grained thick crust, base gravelly	80	938
1999	5,6,7,8	232	4 fragments, all probably from very small SHCs		
	5	28.8	5 pieces of fired clay, one with dense slag attached - probable tuyère material		
	14	3.18	vitrified lining/tuyère		
	473	96	14 indeterminate slag fragments		
2003	26	4	lining slag fragments		
	545	30.5	indeterminate iron slag		
2006	233	36	5 pieces of lining slag (1 might be clinker)		
	2		bog ore		
	542	14.5	glazed pebble		
2007		11.8	indeterminate iron slag		
	465	2.46	base of crucible		
		42	8 small scraps of iron-slag		
		18	2 concretions around possible nails		
		254	33 other lining slag fragments		
		12	stone		
	276	3 dense SHC fragments			
	106	probable pro-tuyère tongue,			

context	Sample	weight	material	SHC prop	estimate
2007	465	52	probable pro-tuyère tongue,		
		50	probable pro-tuyère tongue,		
		78	probable pro-tuyère tongue,		
		32	7 fragments of glazed lining or tuyère		
2019	474	12	blebby piece of iron slag		
2034	469	52	3 indeterminate slag pieces		
		12	2 nails		
		24	Mn coated pebble		
		84	3 pieces of vitrified lining or tuyère		
2036	472	22	Fe object		
2067	475	242	5 pieces of indeterminate iron slag		
		968	well formed SHC, with elliptical bowl and purple bloomed lining slag raised up on one end, overall 140x115x60 of which bowl 35	100	968
		350	distal 30%? of cake as above, fairly thick crust internally with 25mm thickness	30	1167
2095	466	388	9 pieces of misc. slag.		
		640	compact dense SHC with odd shape - deepest part at one end. Flat to very slightly dished top in charcoal-rich but very fine slag, 100mm in diameter, deepest point lies 50mm below one end of this, the cake then extends out 30mm beyond deepest point to give 110 length. base smooth	100	640
		252	irregular mass of slag, charcoal rich, probably very irregular SHC, but very different from others in this context. Base has adhering fired clay, 120x65x40		
		350	small slightly corroded SHC in charcoal bearing vesicular slag. 100x70x35. Base with some prilly extensions around charcoal moulds distally, rough charcoally proximally	100	350
		230	rather like miniature version of 640g cake above. 65x80x40, top 60x70 flat neat subcircular, base with charcoal impressions	100	230
		210	central part of small dense conventional SHC - edges missing all the way round	85%	247
		40	2 pieces of vitrified lining - one certainly tuyère		
2096	467	10	crucible sherd		
		64	small slag mass - just possibly a miniature version of 198g cake above		
		1290	12 pieces of dense worn slag - presumably all SHC material but form not certain. All vesicular		
		20	5 pieces slag debris		
		376	10 worn indeterminate slag pieces		
		1	lining slag bleb		
		198	small irregular charcoal rich low density SHC, 90x70x45 almost perfectly biconvex	95	95
		362	rather wide flat SHC broken in 2. Top very vesicular including large ones at one (proximal?) end, base rough 110x90x25	100	362
		398	probably the major part of a wide flat charcoal rich SHC, but form not certain		
		1475	rather worn slag mass forming part of a very large wide shallow cake. Original cake probably has bowl c65 deep and about 230mm across, with c 25mm upstanding lumps, surviving piece is 150x130x90. Slag quite dense, conventional, uniformly coarsely vesicular to base	c35?	4214
		142	lining slag tongue - extremely gravelly with larger quartz grains than seen in tuyère		
		364	slab with base of tuyère attached to pro-tuyère tongue. tuyère has low curvature across base and may curve in other direction too. Base of b/h only 45mm above base, appears to be c 27mm diameter. Tongue extends 75 and curves up in front of b/h - probably bent during extract. upper smooth lining-dominated layer overlies more iron-rich prills.		
		86	slab of vitrified tuyère face, probably about 120 mm diameter		
		18	2 small vitrified lining / tuyère fragments		
		76	3 pieces of vitrified tuyère		
2100	437	7.7	3 small pieces of indeterminate slag/concretion		
		32	fired clay lump with gravel grade quartz inclusions		
2102	438	50	indeterminate iron slag piece		
		140	piece from small very dense puddle type SHC. Top smooth, but may be interior of large vesicles. Crust to about 22mm	?	
2104	439	10	charcoal dominated slag lump		
2105	440	290	concretionary rusted lump		
		20	indeterminate iron slag		
		34	gravelly lining rich irregular lump		

context	Sample	weight	material	SHC prop	estimate
2131	441	46	fine charcoal dominated slag attached to sintered sediment		
		30	small blebby slab of lining-dominated material		
2151	442	76	5 pieces of lining-dominated slag, variable colour glass, with superficial purple tint		
2154	443	22	corroded nail		
		6	lining-dominated slag bleb		
		144	5 worn pieces of slag - at least three from dense SHCs		
2165	385	3.48	lining slag with maroonish colour - possibly pale internally		
2165	445	10	3 pieces of concretionary material		
		6	small glazed pebble		
		128	9 pieces of dense prilly slag flowing between charcoal moulds		
		46	14 indeterminate small pieces of generally rather low density slag		
		14	4 pieces of lining slag		
		4	tiny chip of rock from mineral vein with acicular quartz growing into vein with tips overgrown by botryoidal iron oxides. All very small scale, not obvious if this could be an ore		
2166	446	264	24 small pieces of undiagnostic slag, or very small SHC pieces		
		24	corroded iron object		
2168	447	20	corroded iron sheet		
		4	low density slag bleb		
		82	part of small SHC with fluid top with blebs of slag sticking up between deeply impressed charcoal	?	
		16	tuyère sherd		
2170	1	2.82	round-bottomed crucible sherd		
2170	3	11.09	probable tuyère shaft		
2170	448	472	6 concreted pieces, probably cored on slag		
		758	small bits of indeterminate slag and debris c80 pieces		
		484	11 larger pieces of indeterminate slag, probably mainly SHC fragments		
		106	10 pieces of dense slag in prills and blebs with small charcoal moulds		
		26	lining slag ball		
		834	small SHC, but very well formed just like the larger one. Has lower bowl, 130x95x30 overlain and filled by more charcoal rich material then has lining influenced slab (broken?) at top. Overall 65 thick. Top burger slab 85 wide.	100	834
		382	another smaller piece from same type of cake. Large vesicles have an imbricate structure and apparently a smooth blown top. Away from these top is raised much higher in rough piles of material. Base smoothly dimpled		
		84	fine debris, mainly from thin crust material		
		354	irregular dense slag lump. SHC material, possibly one cake compacted during extraction, possibly only a part		
		188	4 dense slag pieces from crusts of SHCs or similar		
		122	90x60 thin slabby tongue of slag with variable pale - purple top, smooth top rough rusty base		
		210	9 pieces of lining-dominated slag, mostly rather blebby textures suggesting these are pro-tuyère tongue fragments		
		120	3 pieces of tuyère , two joining. Not particularly helpful for size - may have low curvature edge.		
		324	15 pieces of vitrified lining/tuyère		
2171	1	4.51	round-bottomed crucible sherd		
2171	4	2.5	cu alloy dross? (put in with crucible material)		
2171	5	56	tuyère		
2171	332	9.62	4 pieces of dense flown slags		
2171	419	0.47	burnt bone chip with slaggy droplet attached		
		2	lining slag		
2171	515	468	highly accretionary piece- probably conceals small SHC		
		156	8 pieces of dense shiny metallic well flowed slag in sheets		
		45	5 pieces of dense metallic slag in prills and blebs		
		296	part of a coarsely prilly mass, appears to be originally 100x100x50, but not clear what it is		
		3680	c100 pieces of indeterminate iron slag		
		610	35 pieces of dense metallic slags as charcoal moulds etc		

context	Sample	weight	material	SHC prop	estimate
2171	515	21	5 nails		
		580	21 pieces of lining-dominated slags - probably mainly from tongues		
		1300	block of granite		
		738	SHC, 120x115x65. Base microprilly, cavernous, distally digitate, top has charcoal moulds but coated in organic rich concretion	100	738
		420	SHC, 110x100x45, base rough with fine charcoal, top very irregular	85?	494
		366	SHC, 110x100x45, base and top both coated in fine organics,	100	366
		218	elongate SHC, bowl 100x60x25 with raised lump 20 high at one end. Base and top seem quite rough	100	218
		362	small burger style cake sitting on top of prilly mass. Burger 70x80x20, whole piece 110x80x50	100?	362
		972	classic SHC, gently concavo-convex bowl filled distally with charcoal material, proximally open and smooth. Base rough and deepest at proximal end where becomes a little microprilly. 160x130x45	100	972
		822	classic SHC, flat top with small blown hollow, suggesting cake may be transverse. Small pile of slag blebs to one side of the hollow. Base microprilly, with slightly large prills below hollow. 140x110x55 (of which bowl is 45)	100	822
		444	part (or all if one side is simply squashed in) of SHC with open bowl with smooth top, has separate blebby slag collapse onto it at one end - possibly originally a higher pro tuyère piece. Base mainly rather smooth 100x (95)x70	100	444
		266	extremely dense slag cube - probably broken from a burr, but may be from an extremely thick crust cake		
		280	dense arcuate piece of slag - might be burr or a section of a very thick crust cake		
		160	part of small SHC, probably originally about 90x70x35, conventional	40?	400
		138	very rusty small semi-circular mass- probably half of a very dense small SHC but not certain		
		174	basal part of a fairly thin crust cake - but not clear what original size was		
		1445	12 pieces of densish slags from SHCs		
		168	small pro-tuyère tongue in two lobes, upper lining rich, lower more iron rich and slightly more distal		
		84	small pro-tuyère tongue fragment, has particles stuck to upper surface		
		2172	514	1380	18 pieces of tuyère . Shape mainly unclear but flattish base on at least two
746	9 pieces of smithy floor, forming irregular ridges, possibly as replacement of wood or infill between wood (similar material also in 513)				
300	nine pieces of dense prilly slags, well flown				
38	lining-dominated slag, possibly from tuyère tip				
5200	230x190x100. Very large SHC. Crudely concentrically structured top with slab of lining-dominated material in centre, bearing stone/lining fragments. Lower surface fairly even although rough, with faulted line across centre.			100	5200
1025	SHC with dish top. 130x160x50 (also has stone stuck to base). Has slight flowage from lip on one side. Top obscure. Base charcoal rich			100	1025
832	neat, flat topped SHC, with prilly flowage from base 140x100x40 bowl + 25 prills			100	832
1620	proximal side of large cake with lots of flowage in blown area. Basal part more charcoal rich. Not clear how much is missing, this could be from a very big cake. Top with pillulous lobes and charcoal impressions plus areas without flow just charcoal rich				
1230	130x110x60 SHC with dense lower and upper layers with more charcoal rich material in between. Base seems rough, top largely obscured by debris in hollow			100	1230
576	SHC of similar size to many of the others but with main section hollow down to a thin crust. 145x120x55, hollow 70x80x35deep			100	576
1055	pro-tuyère tongue and tip of tuyère . Has curious lobe of extremely dense slag below in the form of a rounded lobe, almost a biconvex SHC			100	1055
1220	part of an elongate SHC with some concretion attached (160)x120x85. Basal crust seems quite dense and has prilly base. Top obscured by concretion			60?	2033
2295	large flat-topped SHC with slightly raised centre and upturned section on one margin - not clear if this is proximal or distal, but may simply be deformed on extraction. It is ignored from measurement 210x160x85 (of which bowl is 70)			100	2295
2040	slightly irregular SHC with a charcoal rich prilly texture throughout 180x180x110			90	2267
990	small SHC with deep bowl shape. Has prilly leakage on proximal side, which terminates in well-flown material apparently in contact with a wall dipping at 60 degrees below the cake. Bowl 130x105x80 with hollow 30 deep. whole block 145x115x90			100	990
1125	elongate cake probably comprising two separate cakes with lateral displacement. 180x110x70. Bases rough, upper cake seems to have smooth top below accretionary material			100	1125
832	small flat topped SHC with some accretion including stone stuck to top. 130x130x40 . Details obscured			100	832
396	small dense SHC - or just possibly part of a larger one (75)x(115)x(35)	90?	440		
850	hollow topped SHC 130x140x45base rough, locally charcoal rich. Top smooth especially in hollow. Crust 10-20 thick, thickening proximally, fairly vesicular, conventional looking material, no great internal differentiation	100	850		
716	highly accreted slab - presumably all or part of a standard SHC is enclosed				

context	Sample	weight	material	SHC prop	estimate
2172	514	454	irregular rather worn piece probably representing most of a small SHC. Lots of adhering organics etc		
		2350	slag debris and indeterminate pieces, or pieces not specifically identifiable although generally of SHC origin		
		402	part of a small conventional thick crust dense SHC. Top dished, smooth with lip showing signs of flowage. Base fairly smooth and even. Probably just over half of the cake but difficult to be certain 120x(70)x40, crust 20 fairly uniform	60	670
		348	rubbly block from charcoal rich SHC		
		296	small piece from part of a large thick crust cake. This is the only true piece here. It has several generations of elongate olivines. Slag steely grey with a lustre like galena. Upper couple of millimetres is a sand-rich glass		
		424	2 pieces of SHC with an almost thick crust quality - but more conventional		
		146	tiny dense SHC, has deeply charcoal impressed top and prilly base 85x60x35	100	146
		68	possible tiny spoon shaped SHC, 70x50x20. Could be part of something larger	100?	68
		458	4 assorted dense SHC fragments		
		162	lining rich tongue, smooth top with some rusty charcoal rich material centrally		
		154	typical tongue, lining rich, smooth top and lobate base		
		106	mass of moderately dense tongue material - in spheroids and dominated by lining		
		124	low density tongue material, charcoal rich base		
		110	low density tongue material, charcoal rich base		
		74	slag tongue - lining-dominated		
		122	slightly unusual deep tongue - possibly folded. Has purple sheen to top and prilly base		
		72	small blebby tongue		
		68	tongue fragment		
		234	a strange lining-dominated SHC rather than a tongue? (100)x(70)x40. Highly vesicular. Looks like tuyère tip slag, but has bowl shaped back/base with some rusty material attached		
		1060	20 pieces of tuyère		
2173	381	64	6 pieces of lining influenced iron slag		
2173	449	90	concretionary material around animal jaw		
		1176	c150 small slag pieces		
		860	double layer SHC, with upper not above lower component, 130x120x70 overall. All rather charcoal rich	100	860
		124	slag tongue, upper layer of lining rich material, lower material iron rich, some slight explosion suggesting iron present		
		210	4 pieces of vitrified lining- 1 from a 120mm diameter tuyère, others not certainly tuyère		
2173	541	1	indeterminate slag piece		
		12	dense thin sub-tuyère slag flow, or flown smelting slag		
2180	450	17	various indeterminate slag fragments		
		42	two pieces of vitrified lining, not clearly tuyère		
		1160	double layer conventional SHC. Overall 150x110x70, each of two components more like 120x100x40, but offset centres, base concreted but seems rather prilly, top covered in fine charcoal rich material	100	1160
		242	piece from small irregular very dense SHC, top blown smooth with purple sheen, but very "lump", probably a single cooling unit, rather brecciated on extraction		
		90	slab of tongue with smooth top surface, grey, with patches of black glass. This top layer has a lot of glass internally and is about 8mm thick. It rests on top of material mainly comprising vertical prills of slag, weathering khaki		
		66	blebby mass of coarse gravelly lining slag with purple bloom on surface, probably a pro-tuyère mass, top appears blown		
2181	487	6	small concretion - possibly iron inside?		
		102	2 charcoal rich fragments, probably from SHCs, one quite coarse grained		
2182	451	36.5	vitrified tuyère face		
2188	1	39.55	rounded bottom crucible, elliptical in plan, well used with colourful external glaze		
		2	approx quantity of crucible contents		
		1	crucible deposit		
2188	2	4.25	round bottomed crucible base		
2188	452	480	5 pieces of broken SHC or other charcoal-rich material		
		128	strange block - prilly one end and yellow accretionary the other - probably a cake fragment but may be a pro-tuyère piece		
		6	slagged lining, broken from above?		

context	Sample	weight	material	SHC prop	estimate
2188	452	32	probable slagged tuyère piece		
2191	463	3.5	charcoal in concretion - probably not slag		
2200	453	260	9 varied pieces of charcoal and/or lining rich smithing slags		
		450	slab of curved crust - probably around half an SHC cut on extraction - but details not clear		
		220	top part of a charcoal rich cake with slab of lining material, presumably just the top layer from a large structure		
		176	fragment from a small but rather thick crust type of cake, crust only to 20mm, but very dense		
		362	piece of large tuyère		
2201	325	0.88	double slag bleb - like cottage loaf		
2201	454	48	2 rather weathered fragments of probable SHC material		
2203	527	148	156 small pieces of indeterminate iron slag - at least two possibly from smelting?		
		6	2 pieces of iron - one conjoins with piece in sample 523		
		22	5 pieces of lining slag		
		30	stone		
		42	piece of bog ore like material		
		248	probably most of small SHC, proportion not strictly determinable		
2204	455	14	dense slag indeterminate		
		6	lining slag bleb		
		550	slightly incomplete SHC, 75%, slightly double structured with dense top and base but soft lenticular material between. 125x(90)x55	75	733
		48	5 fragments of possible tuyère		
2205	456	74	2 pieces of indeterminate iron-slag		
		144	lining rich, possible pro-tuyère cake - but quite dense for one of those, very strange looking piece		
		6	highly glazed lining		
2210	457	400	24 pieces of indeterminate iron slags		
		32	4 lining fragments		
		370	fragment of small thick crust SHC, crust to 35 thick, probably around 25%, originally 140 diameter, charcoal and possibly raised lobes on top	25	1480
		998	slightly odd cake with conical basal part and elevated upper smooth topped burger. Probably complete. 110x110x90	100	998
		422	probable SHC fragment with deeply prilly base		
		282	crust with slightly lobate top		
		924	elongate SHC, 160x105x40, smooth top with accreted organics, base roughly dimpled, top slightly hollowed at one end	100	924
		1665	c60%? of deep dense SHC. 170x(100)x95, all rather rusty and surfaces not clear	60	2775
		380	3 fragments of small conventional SHCs		
		194	low density pro-tuyère slag mass		
		160	4 large pieces of lining dominated material (pro-tuyère?)		
2225	458	13.4	many pieces of iron-corrosion, 1 possible nail, small fragment of copper corrosion. Not slag		
2244	459	88	part of cake of gravelly lining rich material		
		474	small dense SHC of conventional bun form, 105x90x40, base abraded, top charcoal scatter on hard surface, internally vesicular	100	474
		350	9 pieces, probably all from SHCs		
2246	460	136	broken small highly vesicular SHC - not possible to identify proportion		
2247	461	38	4 amorphous pieces of lining slag		
2248	3	1.9	glazed pebble		
2279	462	102	charcoal rich slag piece broken into 4		
2291	333	8	2 pieces of thin narrow iron strip/blade		
2297	1	30	8 crucible sherds-probably a single round bottomed form with copper alloy evidence		
	6	67	15 crucible sherds, mainly large round bottomed forms (as complete one?), plus a Dunneill type cupel		
	8	26	8 crucible sherds, mainly round bottomed		
	341	7	5 small bleb fragments of iron slag		
		6.3	two fragments of glazed ceramic with reddish glaze suggestive of copper oxides		
		56	small fragment from thin crust SHC		
		22	slagged lining/tuyère		

context	Sample	weight	material	SHC prop	estimate
2297	513	4210	21 concretionary masses, most probably slag-cored		
		356	accretionary lump - dense slag core		
		860	smithing floor material with moulds of ?timbers		
		460	16 pieces of dense flowed slags in lobes and sheets		
		38	4 small pieces of dense well flown slag		
		168	5 pieces of probable flow lobes in ashy matrix		
		104	9 dense flow lobes in ashy matrix - may be smelting slags		
		1145	10 slag pieces not certainly SHC		
		666	25 small pieces of slag		
		5675	small slag debris- many hundred pieces		
		296	2 pieces of charcoal rich slag, probably from SHC with attached lining rich slags		
		3195	sub 5cm slag material, either indeterminate or not separated		
		274	chunk of a slag cake made of dense microprills in open texture		
		1265	27 pieces of indeterminate iron slag		
		852	c110 small pieces of indeterminate slag		
		98	17 small indeterminate slag pieces		
		4045	22 lumps of slag with substantial pale accretion such that original slag not determinable		
		718	6 pieces of homogeneous granular dense SHCs, very weathered with onion-skin weathering developing		
		6840	indeterminate slag fragments in several hundred small pieces		
		238	indeterminate slag fragments		
		4	nail shank		
		282	accretionary lump - starting to explode so may have iron inside		
		160	lining-dominated lobe - not clear if pro-tuyère or from top of large SHC		
		76	lining-dominated slag - possibly a tiny SHC		
		810	17 pieces of lining dominated slag - some probable pro-tuyère tongues, others from SHCs		
		290	coarse sandstone - may possibly be quern fragment		
		22	2 stones		
		1255	SHC, flat top with central hollow, 155x130x80	100	1255
		1055	SHC with concretionary overgrowth therefore details uncertain	110?	959
		662	SHC with flat top overlain by pile of blebby slags, either dripped from tuyère or squeezed on extraction, transverse, 80x120x50+40 pile of blebs	100	662
		1740	SHC with lower bowl and upper burger shaped slab, bowl 130x140x50 total height 95, burger 90x80x25.	100	1740
		1070	most of very irregular thin crust type of cake 180x110x80	90?	1189
		330	100x80x55, deep small SHC	100	330
		760	slightly double layer SHC 110x90x55	100	760
		2100	double layer cake with basal bowl supporting upper layer with flat top, overall 125x140x85 of which bowl is 60, top burger 90x75, bowl seems fairly thick crust	95	2211
		1430	deep thick crust bowl with flat top of charcoal-rich material, (100)x140x75, crust to 50 centrally	85?	1682
		510	rather irregular small SHC, 100x110x50	100	510
		154	tiny SHC, 60x70x30	100	154
		250	small SHC with smooth base and lobate top. Internally rather gravelly, (70)x80x45	75	333
		428	small SHC with scalloped lobate edges (90)x90x35	95	451
		236	small SHC with flat top, lobate with smooth deeply impressed charcoal moulds, 90x70x30	100	236
		242	small SHC with internal v coarse sugary texture, (50)x90x440, may just be part of something larger	65	372
		210	small part of SHC with smooth blown, slightly flown top (unusual!). Crust 23 with prominent tubular vesicles, flown layer distinct, lenticular in hollowed top, piece 80x60x40 proportion unknown		
		928	large slice through cake with fairly thick crust bowl overlain by more charcoal-rich material	??40	2320
		2650	10 substantial SHC pieces		
		1580	10 SHC pieces		
		2060	10 SHC pieces		

context	Sample	weight	material	SHC prop	estimate
2297	513	338	probably an irregular small SHC, 105x70x40	100	338
		686	irregular mass of charcoal rich slag - may be SHC, 110x90x70	100	686
		732	concreted SHC, 115x95x50, very dense	100	732
		490	probably a concreted SHC, flat top, 130x125x40, very low density	100	490
		446	3 SHC fragments with lining rich tops		
		760	8 pieces of variably dense lining rich ?SHC with a curious texture of interlocking spheroids		
		3985	240x180x130, large SHC. Base rough distally, microprilly centrally and prilly beneath proximal end. Proximal lip shows some flow. Bowl 70 deep. Top fairly flat in 90 from proximal end, then vertical rise to top. This edge is very sharp and may be a tool cut?. mounded material on top of bowl all very charcoal rich	100	3985
		846	segment (maybe 1/5) of large SHC. Has moderate crust probably (rather obscure) with internal quite dense slags as prills between charcoal moulds.	20	4230
		914	segment of large SHC with smooth blown interior to bowl. Crust only 15 thick in bowl up to 80 deep. Piece is probably very deformed on extraction so original dimensions not certain		
		1605	bowl shaped SHC 180x150x70 base obscured by lots of accreted organics, bowl hollow c27 deep.	100	1605
		2185	dense SHC, biconvex, possibly with one edge missing 155x(150)x100 of which 80 is dense bowl	90	2428
		6310	large SHC, almost plano-convex just very slightly mounded top. All coated in fine organics, so no details really visible	100	6310
		1115	odd SHC with slag puddle on top at proximal end, base correspondingly shows multiple prills near proximal end and microprills elsewhere. 140x150x75. A very unusual piece	100	1115
		378	slab of thin crust material coated in fine organics, nature uncertain		
		766	very dense SHC of extremely irregular shape, 155x110x65 of which bowl 35, very elongate, may be two small cakes with lateral displacement	100	766
		302	irregular piece - possibly small SHC with smooth flowed top almost rolled up on extraction	?100	302
		852	v odd SHC in which one end is smooth raised lobe of slag with hollow interior suggesting drainage. Base prilly. 2/3 of top covered by this odd raised lobe, other 1/3 is smooth with deep charcoal dimples, covered in fine organics. 140x100x110 of which bowl 70	100	852
		420	small SHC, 125x105x30, very shallow, top with smooth charcoal impressions, base microprilly	100	420
		392	slab from a shallow SHC, cant be more than 60%	60?	653
		334	very different sort of SHC, small and very dense. Has some gravelly lining blebs around edge of top, purplish surface, microprilly base, a bit rusty.c60%?	60	557
		286	slab of thin crust shallow cake similar to 392 item above		
		332	small dense SHC with raised blebs of lining slag on top, . 80x80x70 of which 35 bowl	100	332
		366	small neat conventional SHC 90x95x30 slightly dished top, smooth with charcoal impressions, base obscured by accreted organics	100	366
		160	probably most of thin low density SHC, 90x60x30 smoothish top, microprilly base		
		1065	7 pieces of dense SHC with smooth maroon tops, no cake sizes indicated, maximum crust is 17mm		
		5680	complete SHC, has several small chisel like tool marks on upper face, seems base may have been hammered. 235x210x110. Top charcoal-rich slightly rusty, small central patch of lining slag dented by one of the toolmarks. Proximal side shows gravelly surface to bowl, extending out about 100mm at half height. central part of base flat with dark shiny slag - either hammered or this may be a stone contact. distal part of bowl is charcoal covered.	100	5680
		664	v badly deformed SHC torn on extraction. May be all of it but not entirely certain. Top hollowed with raised blebs, base charcoal rich, v deformed so figs after deformation 170x100x60	100	664
		244	base of a large SHC with perfectly planar surface in shiny dense slag. Compares with 5680g example above - from same hearth?		
		446	chink of thin crust cake with lots of accreted organics		
		398	slab of thin crust from a large cake, partly microdimpled, cracked, with some flowage		
		1075	probably around 30% of a deep dense cake. (120)x(90)x90. Dense part up to 60 thick, but not typical thick crust, has finely granular olivine with small rounded vesicles abundant throughout	30	3583
		648	small section of very large cake. Cake uniformly microprilly, but has some denser lobes on top, cake 90 thick		
		424	double layer SHC with 2 small cakes, each 70-80 diameter x20thick, with large displacement between	100	424
		542	6 small SHC fragments		
		3710	thin crust SHC, very symmetrical , 195x195x100 of which bowl 70	100	3710
		734	broad SHC with raised slag lobes on upper surface, base fairly smooth, 130x(160)x55	60	1223

context	Sample	weight	material	SHC <i>prop</i>	<i>estimate</i>
2297	513	656	complex SHC with raised upper thick crust type bowl with blown top, sitting on top of more porous material, dimensions of original unknown, very deformed on extraction		
		756	oval conventional SHC, with additional slag to one side, all obscured by organics accretion	100	756
		1705	11 SHC fragments		
		800	substantial chunk of an originally very large thick crust SHC, 90 deep (crust 50) radius 100?		
		794	SHC with charcoal rich slag adhering to base, cake 100x75x30 all 120x110x80	100	794
		268	small SHC with accreted material to side 110x70x35	100	268
		446	dense piece of well-flowed slag. Like tap slag with dimpled lower face, but top shows hints of contact with overlying ?wood		
		92	dense shiny crust, with charcoal impressions on one side - probable smelting slag?		
		256	tongue of slag (pro-tuyère tongue or SHC?) with lining rich top and rusty charcoal-rich base		
		264	similar item to above, but slightly more gravelly on top 110x90x35		
		244	3 pieces of vitreous to purple low density slag probably pro-tuyère tongues		
		86	pro tuyère tongue - small with lumps of stone on top		
		242	slag tongue from pro-tuyère area. Has lining rich top overlying some rather dense inclined slag prills		
		948	24 pieces of lobate lining slag probably derived from tongues		
		172	3 pieces of slag tongue		
		406	curious tongue of well flown dense slag, in ashy matrix, with lining debris accumulated on upper face		
		132	smaller version of 406 piece - again, has well flow lobe in ash, with one edge bent abruptly upwards		
		166	pro-tuyère tongue		
		450	8 fragments of similar tongues		
		52	pro-tuyère tongue fragment		
		208	very platy form of pro-tuyère tongue		
		440	4 pro-tuyère tongue fragments		
		606	13 pro-tuyère tongue or other lining slag fragments		
		1235	11 pieces of tuyère , shape unclear, one seems 140x180, another seems slightly small, both possibly slightly angular, largest piece has finger hole in side		
		142	low density pro tuyère purple low density slag, which has tracked back up lower side of tuyère		
		62	2 pieces of slagged tuyère side		
		54	dense well flown slag with one planar side - possibly a sub-tuyère slag		
		232	7 pieces of vitrified ceramic, probably tuyère associated		
		490	9 pieces of tuyère - one shows very large radius		
		200	highly slagged tuyère tip		
		52	fragment of tuyère tip with slag		
		446	12 tuyère fragments		
		42	tuyère fragment		
2299	464	30	concretion around possible iron		
		86	corroding iron		
		434	80%? of small SHC, very dense shallow bowl with slab of lining material on top, (85)x(85)x50	80	543
2317	476	24	concretion		
		46	indeterminate iron-slag		
2318	477	556	stone		
		448	small SHC, very rusty with concreted gravel. 100x80x40	100	448
		70	tuyère fragment		
2320	352	60	4 pieces of tap slag like material. Largest one has lobes closely associated with/penetrating fired clay		
2350	350	2.33	9 spheroids/coffee beans		
		22.27	19 pieces of rough or blebby slags (a continuum)		
2353	516	1430	smaller and indeterminate slag pieces, mainly SHC fragments and charcoal rich material		
		522	worn and weathered mass of charcoal rich slag		
		78	just possibly a tiny SHC. 45x70x35, dished slag sheet with slightly prilly base	100%	78
		238	small conventional SHC with a fairly dense crust, probably mainly complete? 90x(60)x30	95?	251

context	Sample	weight	material	SHC <i>prop</i>	<i>estimate</i>
2353	516	500	weathered thin crust cake. Charcoal rich bowl fill, top probably missing 120x100x55 of which bowl 40	100	500
		1330	slightly incomplete thin crust SHC with well developed concentric rings. 160x(115)x100. Largely coated in organics but base is slightly prilly proximally, elsewhere just charcoal rich	100	1330
		910	dense compact SHC, slightly biconvex. Top has raised lumps - though details obscured 130x120x60 of which bowl 50. Some slightly lobed margins. Base prilly to microprilly	100	910
		276	dense fragment of large burr. Has curious horizontal line on rear - does this indicate base of tuyère ??		
		434	charcoal rich SHC, slightly biconvex. 110x80x55 of which bowl 35	100	434
		3610	large charcoal-rich thin crust type cake - well no real crust at all. 240x220x130 of which bowl 100. 1 end is raised up in spike - otherwise top is planar.	100	3610
		290	rather weathered burger type cake sitting on inclined cone of charcoal rich slag. 100x75x60, burger part 75x75x10 at one end of top	100	290
		184	small possible SHC. Flat circular top 50 diameter on prilly spiky mass. Total 75x55x40	100	184
		142	small irregular mass, might just be small SHC, 65x80x40		
		280	slag tongue attached to tuyère tip. Smooth lining rich top, dense prilly base		
		164	3 pieces of lining-dominated slags probably from tongues		
		414	irregular tongue of lining slag on iron rich base. Base has corroded onto accretionary material with burnt bone chips		
		102	lining slag tongue		
		322	tuyère tip attached to tongue, which seems to lie directly on charcoal rich slag. Layered, dipping into SHC. This is a fresh break		
		2355	480	1850	61 sherds of tuyère
244	5 fragments of charcoal-bearing slag				
574	9 pieces of vesicular and charcoal-bearing slag, mostly in the form of a basal crust. These are really not determinable to smelting/smithing				
636	30 pieces of charcoal bearing iron slag, some rich in lining material, probably all smithing debris				
24	6 pieces of slagged ceramic				
2725	SHC with curious stepped profile on the proximal side - suggests large stone placed across hearth on this side? 160x175x90. Top dished, fairly smooth some adhering charcoal. Concretion on proximal side probably not slag - so not included in dimensions, base smoothish (but accreted proximally) and probably charcoal -rich distally			100	2725
544	possibly complete, but very irregular SHC, very charcoal rich, with thick ashy charcoal layer on top, sides and base somewhat microprilly. 110x75x60			100	544
2356	350	240	charcoal rich but dense block of slag - probably just less than half of an SHC		
		40	oxidised fired fragment of smallish tuyère		
2356	483	4.54	13 irregular blebby slags		
		3.23	39 spheroids		
2357	358	102	15 small fragments of charcoal rich slags, some with lining dominated lobes, some sintery. Resembles basal smelting material but probably broken and poorly consolidated smithing material, in view of the open nature of the above SHC		
		402	possibly complete SHC. Has thin crust bowl filled with voids, charcoal and raised slag lobes on top. 110x120x40. Because so porous, difficult to determine if complete	100	402
		174	lobate lining slag - presumably a pro-tuyère mass. Very slightly rusty prilly base - all low density		
2357	479	2.65	4 irregular pieces of thin slag sheet		
		20.7	11 irregular blebby pieces of slag		
2359	479	0.16	1 hollow coffee bean		
		26	8 pieces of sinter or concretion?		
2364	481	2	2 small burnt stones		
		58	7 pieces of rough flowed material - some quite filmy, not good prills but probably basal smelting slag		
2365	420	80	5 pieces of vesicular and charcoal-bearing slag - presumably smithing debris		
		21	rounded crucible base, very slight red glazing on exterior		
		22	red glazed cuboid, possibly crucible handle		
		23	crucible - grey fabric, thin, clear ext glaze		
		25	mixture of various iron rich materials - at least one small iron fragment but most are crusts of uncertain origin		
		53	curved fired clay - piece of tuyère ?		
		418	2 pieces of slag, originally a single piece of digitate lining slag		
		18	4 tiny scraps of iron-slag		

context	Sample	weight	material	SHC prop	estimate
2365	420	36	4 pieces of lining slag		
	482	42	small round cake of curious vesicular cream material - presumably devitrified glass. May be vitrified ash also has vitrified sediment, ash and charcoal and one possible piece of hammerscale		
		1410	17 large lumps of concretion - based on slag, type unknown		
		232	possible concreted SHC with smooth bulbous top, most of rest hidden by concretion		
		732	concreted mass probably enclosing an SHC		
		1545	5 dense concreted slag pieces		
		652	2 very dense pieces of concretion with rust - may be dense slag or may have pieces of iron inside		
		76	3 dense lobes of flowed slag		
		202	small dense mass of flow lobed SHC material resting on grey sediment		
		16	5 pieces of dense material and a thin scale piece. All could be sub tuyère but not certain		
		1765	small slag pieces, mainly concreted and indet. C. 150 pieces		
		156	5 larger slag fragments		
		204	may be small SHC, but may just be charcoal rich slag strengthened around iron inclusion as rather rusty		
		11200	small and indeterminate slag pieces		
		120	small fragments, 6, of dense well flown brittle slag, some thin so may be sub tuyère, but at least one seems to be flown material from cake		
		1965	8 lumps of concretion cored on dense pieces of SHC crust		
		2745	incomplete large thin crust cake, with upper band like a crust at top. Top smooth, fairly well blown, most of material charcoal rich. (210)x(160)x(100), base prilly, one small patch seems to have baked clay, could be 70%, but very uncertain	70?	3921
		1990	hollow-topped SHC with top marked by lobes of fairly fluid slag, base seems fairly smooth. 140x160x70, hollow 90x55x25 deep. Cake deepest on proximal side, where also most obvious flowage on lip	100	1990
		1145	slightly incomplete charcoal rich cake. Has shallow basal bowl, then thick charcoal layer then slight denser upper dish. Overall 135x110x75 of which basal bowl 35	95	1205
		942	dense pear shaped SHC. Slightly concreted hiding the dished top. Seems fairly dense. 150x110x60 of which bowl = 45, only small area upstanding but this is inflated smooth topped lobe	100	942
		792	dense subcircular SHC with slightly dished top 120x110x45. Dish is close to one end. Base microprilly, top texture obscured	100	792
		288	small dished SHC, some low-density concretion. 90x90x30 triangular in plan	105	274
		584	extremely dense small SHC 100x80x50. Rather obscured and may be related to the dense material below. It is possible this is not the entire SHC it seems to be	100	584
		156	fragment of thin dense crust with adhering grey sediment		
		472	fragment of very dense thick crust/burr material with adhering grey sediment		
		628	fragment of very dense thick crust burr material. Crust to 45 thick		
		352	majority of small weathered SHC with dense crust with adhering grey sediment	70?	503
		566	central small part of a thick crust cake with crust to at least 30, proportion of cake unknown but fairly moderate		
		638	strange SHC with basal dense bowl, possibly on sediment, topped with flat surface of lining dominated material (80x110x50)	100	638
		530	(90)x110x55 dense but charcoal rich SHC, fairly conventional, base smooth, top obscure	75	589
		398	probably 25-40% of small dense SHC, encrusted so few details, probably around 45 deep and 100 across	30	1327
		292	small irregular SHC, rather encrusted so not clear, but top appears charcoal rich and base prilly	100	292
		260	irregular small SHC with hollowed top 120x90x40 - but long axis may be stretched out on extraction	100	260
		446	rather worn extremely dense SHC 120x70x35, probably almost complete	95	469
		208	small mass, probably an irregular SHC 110x70x25, top slightly dished, smoothish, base charcoal rich	100	208
		174	probably most of small SHC, but broken so hard to be certain. (60)x80x40, mainly charcoal rich but firm rusty flat top, base slightly prilly, some cracks so probably includes iron	65	268
		3260	12 dense heavily concreted slag fragments, probably bits of thickish crust SHCs?		
	1980	17 pieces of less dense concreted SHC			
	196	rather weathered but probably small dense conventional SHC, 70x60x25	100	196	
	430	double layer SHC 100x100x50. Dimpled base on lower burger, then charcoal rich between, then obscure top on upper burger	100	430	
	210	small open textured SHC (or just heart of larger thin crust cake, 75x80x30)	100	210	
	190	small dense SHC, some concretion 80x60x25	100	190	
	512	large slab from side of very big SHC			

context	Sample	weight	material	SHC prop	estimate		
2365	482	1565	18 assorted slag pieces, probably all SHC fragments				
		260	small SHC, slightly bent on extraction, 95x80x30	100	260		
		282	90x70x45 biconvex small SHC, rather similar to bulbous lobe seen below tongue on another example	100	282		
		2025	8 pieces of dense slag from SHCs				
		250	small SHC, slightly bent on extraction, 85x85x30	100	250		
		128	very small slag disc - presumably a tiny SHC 55x55x25	100	128		
		118	fragment from end of cake with charcoal rich slag SHC with lining-dominated smooth top				
		390	5 pieces of lining-dominated SHC tongue - all may essentially be entire pieces				
		152	circular mass, probably a tongue with lining dominated gravelly top with raised spikes on edge and somewhat prilly base				
		436	9 pieces of lining-dominated slag, probably all from tongues				
		242	either tongue or compound cake (fragment?) - has lobe of lining rich material resting on top of dense charcoal rich slags				
		138	typical tongue with smooth upper surface with slightly raised lobes on edges, over prilly, low density base				
		64	three pieces of vitrified lining/tuyère				
		3335	tuyère fragments, 48 large pieces and 86 small fragments				
		2367	484	78	10 small slag fragments, mainly thin sheet material, one piece seems to have a small flake adhering		
				4	nail		
		2369	354	48	stone		
0.34	accretion						
9.73	15 pieces of dense flown slag including 2 spheres						
2370	2	34.1	12 pieces of rough dense slag in mainly sheet form				
		0.27	reduced fired clay - 1 piece				
		34	11 slag fragments of irregular dense flown material, could be smelting material most likely				
		486	48	5 pieces of prill/flow			
		6	film of slag with ashy material adhering, flake like material stuck on but may just be surface from a slag lobe				
2373	355	190	smelting slag in lobate accumulation. Appears to be constricted between some fired clay and some other surfaces - so might just be from a basal pit rather than from a tapped flow				
		152	well flown slag overlain by material with charcoal moulds - could be a furnace slag or a basal pit slag				
		2.08	irregular slags				
2375	485	0.52	8 spheroids				
		90	9 pieces of well-flown slag in prills and very thin sheets. Sheet material could be sub-tuyère, but could equally be basal smelting furnace				
		12	stone				
2402	356	86	rough lobe of slag with charcoal ash adhering and some drip like blebs. Probably a basal smelting furnace material				
		470	7 blebs of lining slag				
		1	reduced fired clay				
2403	357	24	17 lower density slag fragments				
		14	6 small stones				
		112	24 piece of dense prill - smelting slags				
		10.14	6 pieces of flown bleb in ashy matrix				
2404	361	13.79	11 pieces of blebby or spiky slag				
		0.25	thin slag sheet				
2406	359	4	reduced fired lining				
		82	10 pieces of dense tap slag like material some with maroon bloom, some multiple fine prills				
2406	468	2340	stones with some iron-coatings - 2 large pieces				
		634	42 pieces - probably originally 2 (1 quite small), of a basal flow, a sheet of well-flown slag diverging into rivulets and horizontal prills. Show well developed lobes with some charcoal contact. Not clear if over-melted smithing slag, but quite possibly from a smelting furnace				
		2920	complex mixture of broad taps slag like flows and narrower prills, and occasional thin sheet (almost like large hammerscale). Clearly a smelting assemblage. All pieces appear coated in ash - so may be basal flows in a pit rather than tapslag. C260 pieces				
		1245	large block of tap slag like flows, apparently dropped over a large vertical surface.				
		224	10 fragments of associated material, including flows passing over spheroid rich accumulation, as seen in sample above. All of this smelting material.				

<b>context</b>	<b>Sample</b>	<b>weight</b>	<b>material</b>	<b>SHC prop</b>	<b>estimate</b>
2406	468	3035	tap slag like flows and prills. Some spheroid accumulation material. All smelting debris. 75 pieces. One important facet of this smelting material is the maroon bloom on surface - suggests cooling on contact with air. One pieces shows stalagmite-like material at foot of convex vertical side - just like vertical side on the large block above		
2408	431	220	55 pieces of dense prilly smelting lags, including some pieces like good tapslag, all very ashy		
2422	533	38	22 indeterminate slag fragments		
2203/2204	523	8	concretion		
		68	2 pieces of iron-slag		
		15	2 pieces of iron		
		94	2 pieces of lining slag balls		
		4	iron rich rock		

Table 2: Woodstown 6 – Catalogue – arranged by context and sample number

Contexts Subtotals									Contexts Subtotals								
Smithing	Smelting	Indet	slag	Lining	Tuyère	Crucible	smithing	pan Tot. res.	Smithing	Smelting	Indet	slag	Lining	Tuyère	Crucible	smithing	pan Tot. res.
479	0	0	0	0.3	0	0	0	0	2172	28174	0	300	38	1060	0	746	30318
600	4524	0	5172	560	267	30	8	11074	2173	984	0	1177	64	222	0	0	2447
757	0	0	58	4	7	0	0	69	2180	1558	0	17	42	0	0	0	1617
798	0	0	23	4	0	0	0	27	2181	0	0	102	0	0	0	0	102
821	0	0	0	6	0	0	0	6	2182	0	0	0	0	37	0	0	37
885	0	0	0	0	0	13	0	13	2188	0	0	608	6	32	47	0	693
887	148	0	0	3	0	1	0	161	2191	0	0	0	0	0	0	0	0
920	0	0	0	0	0	0	0	0	2200	846	0	260	0	362	0	0	1468
941	0	0	0	0	0	0	0	0	2201	48	0	1	0	0	0	0	49
999	0	0	6	0	0	0	0	6	2203	248	0	148	22	0	0	0	418
1040	0	0	0	0	0	0	0	0	2204	550	0	14	6	48	0	0	618
1083	0	0	0	0	0	5	0	5	2203/2204	0	0	68	94	0	0	0	162
1111	322	0	0	0	0	0	0	322	2205	0	0	218	6	0	0	0	224
1214	40	0	6	0	0	0	0	46	2210	5395	0	400	32	0	0	0	5827
1233	0	0	6	0	0	0	0	6	2225	0	0	0	0	0	0	0	0
1407	0	0	0	0	0	0	0	0	2244	824	0	0	88	0	0	0	912
1464	116	0	0	0	0	0	0	116	2246	136	0	0	0	0	0	0	136
1468	0	0	84	0	0	0	0	84	2247	0	0	0	38	0	0	0	38
1488	0	0	0	22	0	0	0	22	2248	0	0	0	0	0	0	0	2
1499	0	0	34	0	0	0	0	34	2279	0	0	102	0	0	0	0	102
1510	0	0	0	0	0	0	0	0	2291	0	0	0	0	0	0	0	0
1511	1358	0	0	0	0	0	0	1358	2297	69987	538	26084	1052	2977	123	860	101621
1999	0	0	96	29	29	0	0	154	2299	434	0	0	0	0	0	0	434
2003	0	0	31	0	0	0	0	31	2317	0	0	46	0	0	0	0	46
2006	0	0	12	36	0	0	0	62	2318	448	0	0	0	70	0	0	518
2007	562	0	42	254	32	2	0	892	2320	0	60	0	0	0	0	0	60
2019	0	0	12	0	0	0	0	12	2350	0	0	25	0	0	0	0	25
2034	0	0	52	0	84	0	0	136	2353	8952	0	1952	0	2172	0	0	13076
2036	0	0	0	0	0	0	0	0	2355	3509	0	1454	24	40	0	0	5027
2067	1318	0	242	0	0	0	0	1560	2356	579	0	107	0	0	0	0	686
2095	1682	0	388	0	40	0	0	2110	2357	0	0	23	0	0	0	0	24
2096	2939	0	1750	1	180	10	0	4880	2359	0	58	0	0	0	0	0	58
2100	0	0	8	32	0	0	0	40	2364	0	0	80	0	0	0	0	80
2102	140	0	50	0	0	0	0	190	2365	28335	0	13761	38	3400	6	0	45582
2104	0	0	10	0	0	0	0	10	2367	0	0	78	0	0	0	0	78
2105	0	0	20	34	0	0	0	54	2369	0	0	44	0	0	0	0	44
2131	0	0	46	30	0	0	0	76	2370	0	376	54	0	0	0	0	430
2151	0	0	0	76	0	0	0	76	2373	1	0	2	0	0	0	0	3
2154	144	0	0	6	0	0	0	150	2375	0	86	90	0	0	0	0	176
2163	0	0	40	0	0	0	0	40	2402	0	112	0	37	0	0	0	149
2165	0	0	174	17	0	0	0	197	2403	0	0	10	0	0	0	0	10
2166	246	0	264	0	0	0	0	510	2404	0	0	14	0	0	0	0	14
2168	82	0	0	4	16	0	0	102	2406	0	8140	0	4	0	0	0	8144
2170	5749	0	1348	26	455	3	0	7581	2408	0	220	0	0	0	0	0	220
2171	10427	0	5753	582	1436	7	0	18205	2422	0	0	38	0	0	0	0	38
total									180805	9590	63002	3320	12965	247	1614	272129	

Table 3: Simplified summary of distribution of residue classes by context. All weights in g.

100g class	count	500g class	count	1000g class	count
0-100	3				
100-200	8				
200-300	18				
300-400	12				
400-500	15	0-500	56		
500-600	9				
600-700	7				
700-800	9				
800-900	7				
900-1000	11	500-1000	43	0-1000	99
1000-1100	2				
1100-1200	6				
1200-1300	4				
1300-1400	3				
1400-1500	1	1000-1500	16		
1500-1600	0				
1600-1700	2				
1700-1800	1				
1800-1900	0				
1900-2000	1	1500-2000	4	1000-2000	20
2000-2100	2				
2100-2200	0				
2200-2300	4				
2300-2400	1				
2400-2500	1	2000-2500	8		
2500-2600	0				
2600-2700	0				
2700-2800	2				
2800-2900	0				
2900-3000	0	2500-3000	2	2000-3000	10
				3000-4000	5
				4000-5000	3
				5000-6000	2
				6000-7000	1

Table 4: Woodstown 6 - Summary of distribution of smithing hearth cakes (SHCs) by weight. Each weight class is inclusive of its lower limit and exclusive of its upper limit.

	Woodstown 6	Clonmac1	Clonmac2	Clonfad	Ballykilmore	Coldfurrow	Carrigoran	Coolamurry	Carmarthen	Marsh Leys
count	140	38	117	513	35	14	18	41	136	30
min	68	124	100	60	204	176	124	100	100	56
max	6310	5540	7815	11000	4033	2077	3866	2586	820	824
mean	1060	1087	843	1153	1099	564	553	388	227	333
<500	40%	39%	50%	29%	43%	64%	72%	83%	94%	77%
<1000	71%	68%	78%	64%	69%	86%	89%	95%	100%	100%
>1000	29%	32%	22%	36%	31%	14%	11%	5%	0%	0%
>3000	7%	8%	3%	7%	11%	0%	6%	0%	0%	0%
modal class	200-300	300-400	400-500	300-400	300-400	200-300	100-200	100-200	100-200	100-200

Table 5: Comparison of summary statistics of SHC weight from Woodstown 6, with other sites in Britain and Ireland.

Clonmac1: Clonmacnoise Wastewater Scheme, Co. Offaly, data from Young 2005b (c9-10?)

Clonmac2: Clonmacnoise New Graveyard Excavations, , Co. Offaly, author's interim incomplete unpublished data (c8-10?)

Clonfad: Clonfad 3, Co. Westmeath, data from Young 2006c (c7-10?)

Ballykilmore: Ballykilmore 6, Co. Westmeath, data from Young 2006d (c14-18?)

Coldfurrow: Coldfurrow, Lyonshall, UK, data from Young 2006f

Carrigoran: Carrigoran, Co. Clare, data from Young 2006e

Coolamurry: Coolamurry, Co Wexford, data from Young 2006a

Carmarthen: Carmarthen Roman Town, data from Crew 2003

Marsh Leys: Marsh Leys Farm, Bedfordshire, data from Young 2005a

<i>context</i>	<i>feature/ find</i>	<i>weight</i>	<i>description</i>
<b>Adamstown 1</b>			
100	1		60well flown dense slag abutting mould of large charcoal piece, smelting slag
102	3		130vitrified lining
	4		796block of slag with almost tap slag like upper surface, inclined bowl like side with adhering clay ,and main body containing very large wood pieces. The top of the lobate surface has adhering grey clay, as does the inclined side - this piece adjoins the material in 194
	5 & 6		282 pieces of vitrified lining
194	1	8505	large mass in 18 pieces. Forms a poorly compacted furnace bottom
	2	3770	
	3	1245	
	4	882	(top of cake near blowhole)
	5 to 16	3380	
			<i>18578 total surviving weight of slag cake (including material from c102 and c194)</i>
195	1	44	small lobe of flown slag
195	28a	24	10 tiny fragments of dense slag, some rough films some smooth blebs
229	1	3.26	delicate fragment of iron slag as films around charcoal pieces. Resembles material from top of cake in 194
<b>Adamstown 2</b>			
1	f1	254	piece of shc with 10mm crust overlain by voids with large crystal terminations, probably a thin crust type - but really too little to be certain of morphology
2	f1	210	dense slag with cooling surface, including some against fairly large charcoal, but a mainly granular microstructure. Probably a smelting slag, but not completely certain
48	f1	132	fragment of a low-density vesicular smithing hearth cake. A couple of fragments are possible, but not certain coal residue
<b>Adamstown 3</b>			
1	f6	434	block of brecciated yellowish ore cemented and overlain by dark botryoidal goethite, very dense
341	f1	376	block of fragmental goethite ore

Table 6. Catalogue of material from sites Adamstown 1-3

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