GeoArch

Report 2010/16

Evaluation of archaeometallurgical residues from Toureen Peakaun, Co. Tipperary (05E0257)

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6th August 2010

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Abstract

Excavations at Toureen Peakaun have produced a small assemblage (23.9kg) of archaeometallurgical residues (together with approximately 9kg of material, including fired clay and burnt stone, not necessarily of metallurgical origin). In general, slag preservation on the site was poor, with intense chemical weathering of most of the assemblage. All of those residues which may be identified to a specific process are from iron-working. The most abundant residue type is the smithing hearth cake (SHC). Just 16 examples were sufficiently well-preserved to provide meaningful evidence of original weight; these had a range of 104g – 1160g with a mean of 479g. Fragmentary material suggested the occurrence of some larger SHCs too.

Although the assemblage of SHCs is small, it provides evidence that the site was involved with the end use of iron, rather than its production, and broad comparison may be made between the assemblage and other sites of early medieval blacksmithing. The smithing employed ceramic tuyères for supplying the draft to the hearth

Trench B yielded no residues, while Trenches E and F yielded tiny quantities. Most of the residues were recovered from trenches C and D. As is common in such settings, the distribution of macro-residues may be a poor guide to the location of the focus of the iron-working activity. The distribution of microresidues may be a better guide and the limited evidence from Trench D suggests that the pit c463 may have been a smithing hearth, with spreads c320 and c340 possibly being hearth waste redeposited into hollows on adjacent floors. The rectilinear shape of c320 suggests that it might represent a hollow below the anvil base. Hammerscale was also observed in adjacent dump c378. In general the macroresidues also show a preferred distribution around the western side of the platform, with a particular concentration of material dumped within abandoned kiln c682, although much material was also deposited within the incompletely-filled enclosure ditch and in pit c161/c387 towards the E side of platform.

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Methods

All investigated materials were examined visually using a low powered lens where necessary. All materials were summarily described and recorded to a database (Table 1). As an evaluation, the materials were not subjected to any high-magnification optical inspection, nor to any form of instrumental analysis. The identifications of materials in this report are there necessarily limited and must be regarded as provisional.

Results

Description of the residues

Smithing hearth cakes

The smithing hearth cake (SHC) assemblage from the site included a range of morphologies. The cakes vary from almost slab-like to well-developed plano-convex forms. They vary in internal texture from strongly prilly cakes through to cakes with a more homogeneous, vesicular slag, often with a dimpled (or "microdimpled" base). The variety of tasks undertaken by a smith, with the hearth operating at a range of temperatures, together with the variation with varying degrees of damage to the tuyère and other factors, inevitably leads to such variation. Detailed description of surface features is not possible for most of the assemblage, because the poor preservation (with both leaching and accretion) does not permit such observations in most cases. None the less, the material clearly resembles typical SHC material.

There are 16 cakes for which an overall weight can be measured or estimated. The weathering of the material will have affected the weight of the SHCs, but probably not so much that a general comparison with other assemblages cannot be made. Those 16 SHCs have a range of weights from 104g to 1160g, with a mean of 479g. Fragmentary material suggests that, as at many other sites, the range of weights was rather larger than this, with significantly larger SHCs present as fragments.

One very unusual piece from c730 was a dense lobate, partially flowed mass, 220mm long, 110mm high (one end curves up) and 125mm wide, weighing 1715g. There are two possible interpretations of this piece: firstly it could be a flow from the basal pit of a slagpit iron smelting furnace. Alternatively, its asymmetric shape and haematised margin may indicate that this is the partly flown lip of a large SHC, which has been torn and deformed during removal from the hearth. The second interpretation is favoured, particularly in the absence of any other evidence for iron smelting, but this is a very unusual fragment.

Other smithing slags

Material group here includes a small collection of dense slags with a dimpled surface, broadly resembling the SHCs described above, but lacking their overall morphology. These pieces may be broken SHCs or slag lumps that have formed in the smithing hearth outside the main SHC.

Indeterminate iron slags

This category includes all the iron slags that are not identifiable to a specific process or slag category. The group is likely to be dominated in this context by fragments from SHCs, but the pieces lack attributes that would make that assignation certain. Most of this material is in the form of dense, vesicular slag, but some is charcoal-rich.

Lining slags

Lining slags are slags dominated by input from melted hearth ceramic – in this instance the face of the tuyère. Many of these materials were probably directly attached to or associated with, the end of the tuyère. Slags of this type are gradational in composition with the fuel ash slags, where silicate materials have been fluxed by the alkali elements of the fuel ash. The lining slags are typically of dark glass, often containing inclusions of unmelted material (particularly quartz grains) from the tuyère fabric, whereas the fuel ash slags are often pale, highly vesicular, pale glasses with abundant sediment grains. Given the poor state of preservation of this assemblage the two groups have been placed together here.

Tuyères

Ceramic tuyères are well represented in the assemblage, with particularly large fragments of material from c185 in Trench C and c290, c378, c634, c726 and c730 in Trench D. Tuyère sherds make up over 3kg of the total metallurgical assemblage (13%) by weight.

Material from Trench c, c185, shows the lower part of a tuyère of about 180mm in diameter, with a pad of clay to locate the cylindrical tuyère and to stop it from rolling.

A large block of tuyère from c378 was also approximately180mm diameter. The blowhole was not seen, but a deep cavity approximately 70mm in diameter and reaching to within 20mm of the margin, had been worn in the face of the tuyère. A similar hole was seen in the front of a large block from c634, which was from a tuyère that was probably approximately 200mm in diameter, with its face oriented at c.70 degrees to its axis.

Such cavities are somewhat unusual, but might possibly represent use of the tuyère at relatively low temperature, so that only a small part of the tuyère face becomes sufficiently hot for a significant degree of melting.

Ten fragments of tuyères from c726 includes one piece which shows part of a 22mm diameter blowhole, half occluded by a slag screen descending over it.

Iron-working microresidues

Only a very small number of samples had been taken for microresidues and these were small. Accordingly few firm observations may be made about the distribution of microresidues, particularly hammerscale. Both flake and spheroidal hammerscale are mainly generated at the anvil as the smith works the iron (flake hammerscale representing the surface oxidation of hot iron, which falls from the workpiece when it is worked and when it is cooled; spheroidal hammerscale is formed from droplets of molten oxide and slag expelled from the workpiece, particularly during forge welding).

Flake hammerscale was, however, observed in samples from fills c319 and c428 of pit c463, together with adjacent spread c320. Small quantities were also observed in samples from c378, a dump of industrial waste just to the SW of the above features.

As well as containing hammerscale, the sample from c320 contained larger slag droplets that are likely to indicate slag that has fallen through and solidified within the fuel bed. This suggests that the charcoal-rich material of c320 is derived partly from waste from a smithing hearth rather than being simply floor material that have accumulated near the anvil.

Concretions on iron (not included in residue total)

There were just a few pieces of secondary concretion which had formed around pieces of iron. One piece might have been around a corroded nail (from the sondage below c209), but the cores of other examples were not determinable.

Other materials (not included in residue total)

Approximately 9kg of the assemblage comprised materials that were not necessarily of metallurgical origin. This included a large stone (5.7kg) with adhering charcoal-rich material from Trench C, c185. This stone is likely to have formed part of a hearth, but there was no indication whether that was a metallurgical hearth. Similarly, Trench D, c361, produced a large block (2.1kg) of probably lightly fired pale clay with stone inclusions. This clay mass showed a charcoal rich lower face, and may have been a block from a relining of a hearth – but again, there was no indication that this hearth had been for metallurgical purposes.

Other materials in this class are mainly indeterminate fired clay.

Distribution of residues

The distribution of the various residue classes by context and trench is given in Table 2.

In Trench C, the major accumulations (in c39 and c185) are backfills of pits that are probably unrelated to pit use.

In Trench D, the microresidues are concentrated in and around c463, the possible smithing hearth and although small quantities of macro-residues are found through a large number of contexts, there does seem to be a preferential occurrence in deposits towards the SW of the platform. There was a particular concentration of material dumped within abandoned kiln c682; such an occurrence need not, of course, require that primary dumping of slag occurred directly into the kiln – the kiln may have been backfilled with available, pre-existing, dumped smithing waste. Abundant residues also occur within the various fills of pit c161/c387, towards the E of the platform, and also from the latest fills of the Phase 2 enclosure ditch. All of these locations indicate that the metalworking was mainly undertaken during Phase 3.

Metallurgical features

The principal feature that may have been of metallurgical origin is pit c463. The dimensions (0.87m NW-SE x 0.54m wide x 0.14m deep) may be compared with those of other medieval hearths from recent projects (Figure 1). The shape is relatively elongate compared with most other examples (the ratio of the major to minor axis is 1.61; for the other 28 examples shown in Figure 1 the range is 1.00 to 2.33 with a mean of 1.29). However, the feature is likely to have been somewhat truncated and had gently inclined sides.

This feature yielded smithing microresidues from two fill contexts. However, the amount of material recovered (and sampled) was very small and some qualification must be attached to the identification of this feature as a smithing hearth.

Two small, similar, features also yielded microresidues: c320 and c340. These two deposits of charcoal-rich material were both rectilinear and measuring 0.5m SW-NE x 0.4m NW-SE x 0.06m in maximum depth and 0.33m E-W x 0.27m N-S x 0.06m thick respectively. Neither deposit was found to fill a significant cut. Although the possibility exists that these deposits were originally contained within some bounding structure (of wood or stone) as suggested in the excavation report, it is also possible that they represent, instead, worn hollows. Particularly in the case of c320, which lies just 0.7m E of possible hearth c463, one possible interpretation might be that these hollows indicate the location of the wooden blocks forming anvil supports. A distance of 0.7m from hearth to anvil would be about right for floor- level working (the early medieval smith is likely to have worked sitting or kneeling on the floor) and a block 0.5 x 0.4m would provide a good stable base for the anvil (which itself would be likely to have been a rather small object).

Interpretation

The archaeometallurgical residues are all compatible with the end-use of iron – blacksmithing (or secondary smithing), rather than any part of the production of raw iron. The materials, including both the tuyères and the waste (macro- and micro-residues), are similar to those from other early medieval sites engaged in similar activities.

Pit c463 is of appropriate dimensions and contained appropriate residues, to be a smithing hearth. There were several deposits of dumps of macro-residues close to the hearth, at least one of which (c378) also contained microresidues. Feature c320, a thin rectilinear spread of charcoal-rich material containing microresidues, lay 0.7m E of the possible hearth and might be a contender for an anvil location.

Within Trench D direct evidence for smithing derives mainly from Phase 3, including from the final backfills of various Phase 2 features.

The general assemblage is indicative of the end-use of iron for production and/or repair of artefacts. There were few SHCs for which a weight could be assigned with confidence; those 16 SHCs have a range of weights from 104g to 1160g, with a mean of 479g. Although this number is small, a general comparison (Table 3) may be made with sites such as Coolamurry, Co. Wexford (Young 2006a), Navan, Co. Meath (Young 2007), Moneygall, Co. Offaly (Young 2008a) and Blackchurch (Young & Kearns 2010) – all of which are interpreted as being involved with blacksmithing rather than iron production. There is no direct evidence for the types of artefact being produced.

Evaluation of potential

The material does not have great potential for the production of useful data with further analysis. Blacksmithing residues rarely yield useful data on the source of the iron being worked, and when they do, they require well-preserved material for study. That is unfortunately not the case with this assemblage which is mainly rather badly leached.

No further analysis of the assemblage is recommended at the present time.

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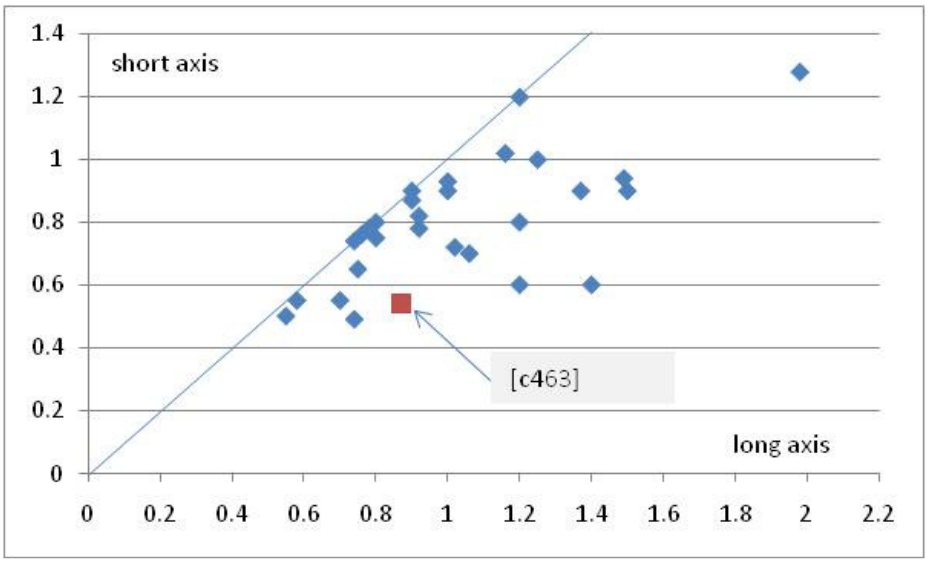

Figure 1: dimensions of possible smithing hearth c463, compared with those of other early medieval hearths (comparative data from Young 2009c)

Table 1: Summary catalogue by trench and context

context	weight	no	notes	SHC %	orig wt
TRENCH B					
102	40	1	natural concretion of gravel onto stone		
TRENCH C					
1	66	1	weathered slag fragment, probably part of small SHC		
15	58	3	slag fragments indeterminate		
30	130	1	vesicular slag piece - all or part of small low density SHC, irregular shape makes proportion indeterminate		
39	204	1	90x60x35mm SHC with a somewhat 'mushroom' shape	100	204
	266	2	sheets of slag, probably lower crusts of small SHCs		
	24	1	tuyère sherd		
	120	3	irregular piece of lining slag		
90	76	1	microprilly slag in concretion		
	6	1	fragment of iron slag		
	696	1	slab-like SHC with pale homogenous interior, microprilly base flat slightly granular top, 110x125x55mm piece, sheet mainly 30mm thick, possibly around 60% of original SHC	60	1160
	68	2	weathered slag fragments		
116	246	1	irregular slag block in concretion - uncertain nature		
	1115	1	well formed plano-convex SHC almost entirely covered in gravel concretion, 140x140x45mm	105	1062
128	220	1(2)	part of a small, internally prilly, dense SHC with an extremely well developed top glassy layer of green glass with the impressions of charcoal fragments		
129	116	2	very weathered slag fragments, probably SHC crusts		
	24	1	Mn-rich concretion		
134	124	1	fragment of dense SHC, probably slightly flowed, has slightly lobate lower surface, large voids and probably smooth wavy top		
176	310	1	very irregularly-shaped piece - probable two fused dense SHC fragments - but might be hot deformed example		
	32	1	charcoal-rich slag fragment		
	40	1	concretion		

context	*weight*	*no*	*notes*	*SHC %*	*orig wt*
177	96	3	weathered slag sheet fragments - probably basal crusts from small SHCs		
185	5715	1	large slab of stone with concretionary mass of charcoal and ash adhering. No particular evidence that this is metallurgical - though it may well be so		
	348	1	large block from base of c.180mm diameter tuyère, curved base has pad of fired clay below tuyère giving overall flat base of piece. Lower part of face of tuyère curves outwards and is covered with dark, almost prilly, slag with just a hint of underflow. If flat base of piece was horizontal then tuyère base dips into the hearth at 10 -11 degrees.		
	104	3	3 concretionary lumps of the matrix - no residue		
	248	1	SHC-like mass of slightly flowed slag, top is very blebby, base finely prilly, 85x80x50mm	100	248
	324	14	slag lumps mainly coated in accreted material		
	18	1	concretion around decomposed object, possibly Mn-rich (i.e. dark purple/black) with a zone of specularite-like material around margin of bleb		
	258	bulk	bag of slag fines and accretionary lumps		
186	56	4	pale weathered lining or fuel ash slag in ashy concretion. Concretion has a little flake hammerscale		
202	48	1	sherd from edge of tuyère tip		
	40	1	burnt stone		
	38	1	fragment of weathered grey vesicular slag		
	72	1	concretion containing weathered slag - the slag is lobate with both white lining slag glass and grey iron slag lobes intermingled		
205	324	1	70x110x50mm, microdimpled base - probably an SHC - may even be essentially complete	100	324
TRENCH D					
ploughsoil tr d ext	508	1	150x100x45mm triangular-shaped SHC with slightly dished top	100	508
1b /16	16	1	dense slag in irregularly curved sheet with slightly haematised surface - possibly the lip of SHC on blowing side		
	4	1	blebby fuel ash slag		
below c209 sondage	120	1	small fragment from crust of small dense SHC, almost no vesicularity, has pinkish clay adhering to base like a burr, top appears blown smooth but mainly flaked off to reveal a very thin charcoal-rich layer		
	18	1	fragment of badly decomposed glassy sheet, possibly a fragment of a small tongue; one flat surface, one with slight protrusions		
	2	1	tubular concretion with tapering, roughly rectangular hole - so may have been cored on nail?		
275	106	c20	pale fired clay		
275	50	1	foliated pale fired clay in rounded lump, quartz grains sparse and small		
		micro	contains red sheets of possible slag flats - but this is not certain, they are very even and may be a red shale		

context	weight	no	notes	SHC %	orig wt
284	156	1	sandy concretion with some charcoal and small slag fragments, core unknown		
285	16		oxidised-fired clay reduced almost to powder		
	102	1	thin slag crust, highly weathered, covered in charcoal impressions, edge of SHC		
	30	2	very highly weathered slag fragments		
289	36	2	scraps of very highly weathered probably slightly prilly slag		
290	8	1	soft red oxidised fired clay		
	1305	7	pieces of SHC in substantial concretions, the crust ranges up to 20mm and they are generally dense		
	398	1	concretion containing tuyère tip, lower edge with attached tongue-like material, details obscure		
	200	17	weathered slag scraps with adhering concretion		
293	64	6	scraps of low density vesicular weathered slags, pale		
	272	8	fragments of dark, highly weathered iron slag		
		micro	no hammerscale visible in sample		
318	962	1	weathered SHC with small bowl and quite thick upper charcoal layer below inclined top with slight hint of remaining glass, 125x150x70mm (of which bowl 40mm deep)	100	962
	106	8	fragments of deeply weathered slag		
332	114	1	very highly weathered slag piece - probably from a thick crust SHC since it has 30mm long olivine crystals below a slightly vesicular top		
		micro	no hammerscale visible in sample		
336	276	1	very highly weathered an accreted SHC fragment, cake at least 50mm thick		
	148	1	vesicular SHC-like slag fused to pebble		
	24	2	highly weathered slag fragments, vesicular		
	96	1	weathered slag fragment with tubular vesicles		
	186	c20	unwashed small weathered slag fragments		
349	402	2	rounded pieces of pinkish, probably fired, clay. This is a very sandy mixture with little clay, with some fairly coarse quartz, one has gently curved surface, the other has a c15mm hole - suggesting possible wattle - but on the edge of the piece so might be damage		
		micro	coarse sample has slag fragments, finer sample is mainly probable concretions		
356	34	3	weathered fuel ash fragments, pale but with black secondary material filling vesicularity in one of the pieces		

context	weight	no	notes	SHC %	orig wt
361	2070	2	concavo-convex bowl of very dense sand and kaolinitic clay, pale with faint pink in places, probably 60% of the bowl if regular, contains pebbles of angular dark chert, granite and sandstone, lower face less regular than upper smooth one, and has clasts of orange fired clay charcoal etc. in grey matrix, suggesting this is a relining of a hearth		
372		micro	sample shows no hammerscale		
	68	10	small pieces of soft brown weathered material probably originally slag		
	88	1	very weathered vesicular slag in half of a plano-convex form - suggesting this is around half of a small SHC		
	44	1	gravelly lining slag		
	24	1	oxidised fired clay with slag attached		
378	596	1	large block of tuyère c.180mm diameter, blowhole not seen, but deep cavity is worn in the slag of the centre of the piece (as with that from c634, which has an identical pattern) - the cavity is approximately 70mm in diameter and reaches within 20mm of tuyère margin		
	190	1	90x90x35mm irregular tongue-like SHC, top glassy fresh, base very rusty and accreted		
	730	1	dense SHC, 165x130x45mm plano-convex , surfaces too weathered to describe	100	730
		micro	samples contain a small amount of flake hammerscale		
392		micro	sample appears to comprise mainly slag fragments		
	76	c20	fired pale buff clay with organic temper, one piece with planar fracture, outside of some pieces appears convex - this could this just possibly be poorly preserved mould material.		
403		micro	small amount of flake hammerscale in sample		
	260	1	95x80x50 charcoal -rich slag with microprilly base, possibly complete SHC, but irregular so proportion not determinable	100	260
	234	1	extremely gravelly tongue - glassy slag with gravel, very low iron 80x90x40mm		
	886	23	dense weathered slag material - mostly in rather amorphous shapes so possibly hearth slags		
	104	1	plano convex lump of lining slag - probably an SHC	100	104
	138	20	fuel ash / lining slag		
	86	1	slab of gravelly lining slag - probably slump from tuyère tip		
	24	1	vitrified ceramic in rounded bleb with green glaze - probably from around edge of tuyère		
419	82	1	oxidised vitrified lining fragment, 80x50mm		
420	38	1	small fragment of crust from small SHC, very weathered		
	68	1	red cherty micaceous sandstone		
	6	1	weathered fragment of highly vesicular slag		
634	419	1	large block from tuyère, no blowhole seen but curvature suggests c.200mm diameter, large cavity worn near blowhole shows pendent slags, face probably c.70 degrees to axis		
	526	7	tuyère sherds, none really diagnostic, one shows roughly same curvature as major piece above, tuyère fabric is finely sandy with abundant coarse angular quartz temper		
	120	11	pale lining slag fragments		

context	weight	no	notes	SHC %	orig wt
	650	1	SHC, 105x120x50mm, dense bowl shaped, top irregular and possibly uppermost parts missing	80	813
	322	1	SHC, 100x80x30mm, plano-convex, dimpled top, well formed rough-surfaced base	100	322
	382	1	SHC, 80x110x35mm, base rough, top with impressed charcoal	100	382
	250	1	SHC, 100x80x35mm, top dished and smooth, has he overall form of two overlapping discs, base microdimpled	100	250
	202	1	SHC, 95x80x30mm, tongue-like SHC with gravelly glassy top, lots of pale weathering lining slag, some largish charcoal inclusions	100	202
	260	1	SHC, central part of cake with well-separated dense bowl and lining slag slab on top, bowl to 45mm of which crust 15mm		
	80	1	SHC? Highly accreted and weathered tongue-like piece, too weathered for detailed interpretation		
	58	2	weathered thin sheets of slag - possibly from margins of SHCs?		
661	54	3	lobate lining slag fragments, pale		
	8	1	oxidised vitrified clay with black glassy surface - probably from tuyère		
667	8	2	vesicular grey slag fragments		
685	116	1	weathered slag block - probably a rounded dense SHC fragment - probably from a fairly small SHC		
701	240	1	very weathered SHC with good distinct lining slag top at angle to bowl, thickness to c.45mm, cake rather charcoal -rich		
	190	1	very weathered SHC as above but only small amount of lining - it is possible they are parts of same cake		
	78	2	weathered vesicular and charcoal-rich slag fragments		
705	36	1 (2)	fired clay varying from white to pink, curved outer surface, has fine (hair??) organic temper in fine matrix, quartz grains rare		
	18	1	fragment of weathered vesicular slag - probably SHC crust as has slightly tubular vesicles		
	6	1	weathered slag like material but has brown inclusions - just possibly a rock fragment		
726	196	10	fragments possibly from tuyère, shows abrupt end to slagging and unvitrified grey surface beyond, though location of change relative to tuyère morphology is unclear. One piece shows part of 22mm diameter blowhole half occluded by slag screen descending over it		
730	1715	1 (2)	very unusual dense lobate flow, 220mm long, 110mm high (proximal end curves up) and 125mm wide, one side shows strong haematisation as if it were SHC lip - if so, then the SHC melted and was pulled out to one side; the alternative explanation is that this is a foot-of-wall smelting furnace flow, but the smooth haematised area and general asymmetry would argue against this.		
	2255	13	large pieces of weathered dense slag, probably all from medium sized SHCs		
	362	2	tuyère fragment with attached glassy slag within concretion, tuyère shows a sharp angle possible passing onto flat face?		
	148	1	burnt stone		
782	126	5	rounded fragments of ashy charcoal-rich material around pieces of brown weathered slag. Where freshest these show pale decomposed glass films between vesicles and so may be fuel ash slags.		
783	24	2	small nubs of black glassy lining slag with abundant grains of quartz, quartzite and sandstone		
825	294	1	small fragment from large thick crust SHC, crust to 35mm, crust has vesicles throughout on fine scale, and has microdimpled base		

context	*weight*	*no*	*notes*	*SHC %*	*orig wt*
893	122	1	small fragment from crust of small SHC		
	22	1	concretion, spherical in sandy sediment - presumably on iron artefact, but core not seen		
959	94	1	ochreous pear-shaped concretion, core not seen but magnetic so presumably iron artefact		
974	28	1	badly decomposed slag, probably lining slag, irregular with charcoal inclusions on top , microdimpled base, oval		
	28	1	lining slag with sand and gravel in black glassy matrix forming irregular "bunch of grapes" texture		
	12	1	small fragment of badly decomposed lining slag		
998	130	1	small flat slag sheet with dimpled base with charcoal, smoother, but accreted top, probably small SHC, 70x60x25	100	132
	30	3	rounded blebs, probably lining slag		
	16	7	scraps of highly vesicular, probably lining slag		
TRENCH E					
626	14	1	highly vesicular grey slag fragment		
653	50	1	highly vesicular and charcoal-rich slag fragment, now very low density		
TRENCH F					
497	66	1	highly weathered piece from basal crust of small SHC		
area !					
?	124	1	slightly prilly slag fragment from base of SHC		
			microresidue samples from contexts without slag		
TRENCH D					
291		micro	no hammerscale		
291		micro	no hammerscale		
308		micro	no hammerscale		

context	*weight*	*no*	*notes*
308		micro	no hammerscale
319		micro	no hammerscale
319		micro	trace hammerscale
319		micro	no hammerscale
320		micro	abundant slag droplets, with some hammerscale
320		micro	no hammerscale
340		micro	trace hammerscale
340		micro	no hammerscale
366		micro	no hammerscale
366		micro	no hammerscale
385		micro	no hammerscale
385		micro	no hammerscale
399		micro	no hammerscale
428		micro	trace hammerscale
428		micro	no hammerscale
428		micro	no hammerscale
522		micro	no hammerscale
319a		micro	trace hammerscale
319b		micro	trace hammerscale
TRENCH F			
522		micro	no hammerscale

Table 2: residue classes (and non-archaeometallurgical materials) by context

context	***context notes***	***SHC***	***other smithing slag***	***indet. iron slag***	***fuel ash slag***	***lining slag***	***tuyère***	***Conc. on iron***	***other fired clay/ stone***	***natural***	***total met. residue***
TRENCH B											
102										40	***0***
TRENCH C											
1	topsoil	66									***66***
15	spread at NE of trench - spill over from pit c30 possibly			58							***58***
30	fill of pit c74 at N of trench	130									***130***
39	upper fill of first cut of pit c75 at N of trench	470				120	24				***614***
90	upper fill of linear feature c76/c114 to the east of pit c75	696		150							***846***
116	fill of fissure in materials used to consolidate river bank	1115		246							***1361***
128	spread of material into almost-full large linear c231, truncated by c76/c114	220									***220***
129	main fill of c231; deliberate backfilling, stone lined pit c204 cut into this	116								24	***116***
134	furrow fill in W ext.	124									***124***
176	fill of large linear c231 under c128 and overlying c129	310		32				40			***342***
177	dumped occupation deposit in top of pit c224 and linear c237	96									***96***
185	basal fill of c204 under c181, metalworking dump	248		582			348	18	5715	104	***1178***
186	fill of posthole c201					56					***56***
202	dumped occupation deposit in lower part of pit c224 and linear c237			110			48			40	***158***
205	fill of c231 along E side underlying recut c204, overlying c129	324									***324***
		3915	*0*	*1178*	*0*	*176*	*420*	*58*	*5715*	*168*	*5689*
TRENCH D											
Pl.soil ext		508									***508***
1b /16		16			4						***20***
below c209	c209 is fill of top of pit c448 (a late feature)	120		18				2			***138***
sondage											
275	fill of posthole, N wall of small rectilinear builidng								156		***0***
284	phase 2 stave fences at E end of trench (outer)							156			***0***
285	Fill of S-most stretch of W fence (cut: c297).	102		30					16		***132***
289	late stony deposit at W of platform			36							***36***
290	layer over much of W and N side of trench built up against platform.	1305		200			398		8		***1903***
293	upper fill of pit with superstructure c161/c387, phase 2 or phase 3			336							***336***
318	fill of pit c161/c387 below c 293, phase 2 or 3 - possibly cess	962		106							***1068***
332	layer extending over N and E trench and into NE corner extension, late	114									***114***
336	layer to W of platform cut by drain c393	520		210							***730***
349	fill of posthole N wall of phase 2 rectilinear structure in SE								402		***0***

context	*context notes*	*SHC*	*other smithing slag*	*indet. iron slag*	*fuel ash slag*	*lining slag*	*tuyère*	*Conc. on iron*	*other fired clay/ stone*	*natural*	*total met. residue*
356	fill of pit c161/c387 below c 293, phase 2 or 3				34						***34***
361	fill of pit c448 - has odd alternating burnt fills; phase 2								2070		***0***
372	?	88		68		44	24				***224***
378	dump of industrial waste at SW corner of platform phase 3/4	920					596				***1516***
392	lower fill of posthole, E wall of phase 2 rectilinear building								76		***0***
403	fill of pit c161/c387 below c 356, phase 2 or 3; 1x 0.6 x 0.5-0.12m	598	886			248					***1732***
419	phase 3/4 thin deposit at S side of platform SW of posthole c400						82				***82***
420	uppermost fill of phase 2 enclosure ditch c474 at west of trench	38		6						68	***44***
634	upper fill of kiln c682 phase 3/4	2204				120	945				***3269***
661	alluvial deposit built up against E side of platform					54	8				***62***
667	final dumped deposit in pit c723 phase 3/4			8							***8***
685	fill of posthole c744, west wall of central phase 2 rectilinear building	116									***116***
701	phase 2 dump of industrial material, filling enclosing ditch in NE ext	430		78							***508***
705	large burnt deposit in pit c723 phase 3/4	18							36	6	***18***
726	occupation layer prior to surrounding pits, phase 2 rectilinear building						196				***196***
730	fill of enclosing ditch phase 2	3970					362			148	***4332***
782	deposit in N ext relating to industrial activity, overlies c825				126						***126***
783						24					***24***
825	deposit in N ext relating to ind. activity below c782 - uppermost fill of ditch	294									***294***
893	brownish grey banked against c726 on W and cut by c843	122						22			***122***
959	deposit in square cut for gate, phase 2 bridge							94			***0***
974	basal fill of kiln c682 phase 3/4					68					***68***
998	early partition post in phase 2 rectilinear building	130				46					***176***
		12575	*886*	*1096*	*164*	*604*	*2611*	*274*	*2764*	*222*	*17936*
TRENCH E											
626				14							***14***
653				50							***50***
TRENCH F											
497		66									***66***
area !											
?		124									***124***
	overall total	***16680***	***886***	***2338***	***164***	***780***	***3031***	***332***	***8479***	***430***	***23879***

Table 3. Comparative SHC statistics from other Irish smithing assemblages.

	Coolamurry	Navan	Moneygall	Carrigoran	Parknahown 5	Blackchurch (site 48)	Trumra 4	Clonmacnoise (NG)	Ballykilmore	Woodstown 6	Clonmacnoise (WWS)	Clonfad	AR36 Borris	Lismore/ Bushfield 1
date	C10-12	E. Med.	E.Med-Med.	C9-11	C5-C10?	C5-10?	C5/6	C7-10	C10-15?	C9-10	C10?	C7-9	C7-9?	E. Med?
SHC count	41	17	22	18	89	70	57	258	30	140	38	381	88	23
SHC min. wt		60	114		86	108	92	54	94	68		60	154	426
SHC max. wt	2588	2990	1800	3866	2898	2450	3163	7815	4033	6310	5540	11000	7440	4390
SHC mean wt	386	507	527	553	567	629	727	762	1022	1060	1087	1302	1618	1737
% <500g	83%	82%	55%	72%	70%	53%	47%	52%	47%	40%	39%	30%	22%	4%
% <1000g	95%	88%	95%	89%	84%	81%	75%	78%	73%	71%	68%	61%	41%	39%
% >1000g	5%	12%	5%	11%	16%	19%	25%	22%	27%	29%	32%	39%	59%	61%
% >3000g	0%	0%	0%	6%	0%	0%	2%	3%	10%	7%	8%	9%	16%	13%
Modal 100g interval	100-200	100-200	200-300	100-200	400-500	200-300	100-300	200-300	200-300	200-300	300-400	300-400	200-300	500-600

Assemblages ordered by mean weight.
Coolamurry from Young, 2006a; Navan Site 1 from Young 2007; Moneygall from Young 2008a; Carrigoran from Young 2005a; Parknahown from Young 2009a; Blackchurch, from Young & Kearns 2010; Trumra 4 from Young 2008d, Clonmacnoise New Graveyard site from author's unpublished data Ballykilmore from Young 2009b; Woodstown from Young 2006b; Clonmacnoise Waste Water Scheme from Young 2005c; Clonfad from Young 2005b; Lismore/Bushfield 1 from Young 2008b.

The assemblages from Coolamurry, Navan, Moneygall, and Carrigoran are interpreted as being dominantly blacksmithing residues. The assemblages from Trumra, Clonmacnoise, Ballykilmore, Woodstown, Clonfad and Lismore/Bushfield are interpreted as including bloomsmithing residues.

The Toureen Peakaun assemblage (n = 16, range 104g to 1160g, with a mean of 479g, 63% <500g, 88%<1000g) compares closely with sites with smaller SHCs, interpreted as being involved solely with the use, rather than the production, of iron.

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