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Evaluation of archaeometallurgical residues from the N7, Castletown to Nenagh (Derrinsallagh to Ballintoty), Contract 1, Drumbaun 2 (E3912)

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Abstract

The assemblage includes a total of 2.8kg of archaeometallurgical residues, mainly or possibly entirely, from the working of iron (smithing). Residues were contained with a small feature (c201), which may have been the smithing hearth, a larger feature (c199) which contains material possibly from the smithy floor and a third pit (c211) which contains isolated slag blocks. The material from c204, the fill of c211, includes some pieces which may possibly (but not certainly) be from iron smelting.

In summary the site appears to have had some small-scale iron working, probably blacksmithing (the end use of iron), with the activity dated by C14 to the 11th-12th centuries.

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Methods

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

Results

Description of the residues

Iron slag

The iron slags were mainly represented by rather small pieces of flow lobes and other droplets, suggestive of material that had flowed with the fuel bed of a hearth or furnace. Such materials are not particularly variable between those formed in smelting furnaces and those formed in smithing hearth, but associated material demonstrates the latter is the case here.

Unusually for a site involved in iron-working there are no certain smithing hearth cakes (SHCs). An example from c203, weighs 156g and shows a two-layered slag piece, 50 by 70mm and 40mm deep. The surface shows considerable accreted material and it is unclear what lies below this surface. It is possible the entire piece is accreted material with a form just fortuitously resembling an SHC.

A second possible SHC (394g) comes from c204 and is a sub-circular dense piece of slag about 80mm in diameter, from which descend some obliquely-oriented dense descending prills of slag, 70mm deep, between which are the remains of large charcoal pieces. Such a piece most closely resembles part of the large slag cake formed in a slagpit iron smelting furnace (sometimes termed a furnace bottom).

If either of these possible examples is an SHC, then the weights are well within the typical size of SHCs

from early iron blacksmithing in Ireland and are not indicative of age.

Smithing "floor"

Much of the material, particularly from pit c199, was in the form of accreted deposits bearing slag blebs and prills (sometimes apparently crushed), much fine scale charcoal and possibly other mineralised plant remains (twigs, straw...?), together with variable amounts of hammerscale. Such accretionary material is commonly found within the floor deposits of smithies, or waste deposits formed from the clearing of such floors. Often the accretionary fragments have formed through localised cementation around pieces of weathering iron metal, and so may be merely the large fragments, retrievable by hand-picking, within deposits which may be rich in these components in an unconsolidated form.

Oxidised fired clay

A single fragment of oxidised-fired vitrified ceramic from c204 is probably a sherd from a tuyère. The two original faces of this fragment are oriented at 80 degrees, with one surface being slagged, the other merely vitrified and pale (probably representing the influence of the workpiece generating an iron-rich slag on the face of the tuyère, whereas the side is glazed under the influence of the charcoal ash). In this instance the vitrified face is planar – suggesting the use of a tuyère of semi-elliptical cross section, as appears to have been the case with many medieval tuyères (although good complete examples of this form have yet to be documented).

Microresidues

The samples contain small quantities of hammerscale bound into the accretions. The observed hammerscale is dominantly of the flake variety, with little or no certain spheroidal hammerscale. The small spheroids that were found all showed imperfections suggesting they were drips within the hearth rather than air-chilled spatter. Flake hammerscale forms readily through the oxidation of the workpiece when the hot iron is exposed to air, and becomes detached from the workpiece either because melting slag films within the oxide layer break its link to the underlying metal, or by through the stresses of differential cooling or differential plasticity when the smith hammers the iron. Flake hammerscale falls from the workpiece and so accumulates close to the anvil or within the hearth.

Context c200 also contained examples of slag flats, which are thin films of slag that form on the surface of the workpiece. They are characteristic of the working of iron in a hearth with a ceramic tuyère or blowhole and were also abundant at Coolamurry (Young 2006).

Distribution of the residues

The material derived from three closely adjacent pits: c199, c201 and c211.

Pit c201 was had an irregular cut, measuring 0.6m by 0.3 by 0.15m deep. It was described by the excavators as a hearth. It had a lower deposit of loose red sand (c206), overlain by an upper charcoal-rich fill, c200, which contained approximately 270g of slag. This assemblage comprised probable hearth slags, slag flats, coffee bean spheroids and rare hammerscale.

This material would be consistent with an origin within the fuel bed of a smithing hearth.

Pit c199 was rectangular in plan, 1.1m by 0.44m by 0.1m deep. It had three fills c198 (with 830g of archaeometallurgical residue), c203 (with 415g of residue) and c208. The residue from both c198 and c203 was mainly a rather unusual accreted mixture of slag particles, fuel debris and hammerscale. Although described by the excavators as a hearth, there was no evidence for burning of the subsoil and the residues more resemble deposits from a smithy floor than deposits from within a hearth.

Pit c211 lay close to the end of pit c199, and was irregular, 0.65m by 0.50m by 0.22m deep. The residues in its fill (c204) had a total weight of over 1.1kg and were in the form of discrete lumps of slag (or other residue) rather than the large quantity of fines seen in the other pits in this group. One of blocks resembled a piece of furnace bottom (FB) from a slagpit smelting furnace, but had a circular shape in plan – so may just have been an unusually fluid SHC. Whatever the origin of the pit, the residue assemblage suggests individual pieces of waste from elsewhere became deliberate or accidentally incorporated into its fill. Besides the possible FB fragment, the other slag fragments from this pit are largely of indeterminate origin and might potentially be smelting residues. The sherd of tuyère and the hammerscale pieces adhering to some of the slag blocks, argue that the material in the pit is either from smithing or is of mixed origin. There is a slight possibility, given the mixed nature of the assemblage and the size of the pit, that c211 might just present the basal pit of an iron-smelting furnace of the slagpit type. The bases of such pits do not always show burning (although they usually do).

Interpretation

The evidence suggests that pit c201 may have been a smithing hearth. The overall form of this pit is very small for a smithing hearth (although for some purposes this might suffice), and it is likely that it comprises the truncated base of a slightly larger feature. The adjacent pit c199 may either be a pit filled with waste from the smithy floor, or the floor waste accumulated in it *in situ*, either because the pit was dug contemporarily with the smithy or possibly because the pit represents wear in the smithy floor (shallow pits were recorded below the smithy floor deposits at Ballykillaboy, Co. Kilkenny, and may have represented hollows worn by use; Young 2010). Pit c211 has accumulated individual larger pieces of residue, probably suggesting it did not form a long-lived open feature during the use of the smithy. It is not certain whether these fragments are all from smithing, and at least one piece might be from smelting (for which any other evidence is currently lacking on this site). This pit has probably just accumulated occasional pieces of waste, but its size is compatible with the basal pit of a slagpit smelting furnace and that possibility cannot be discounted, even in the absence of indications of in-situ heating.

Despite identification of these pits as representing activity during the smithing of iron, there are two types of evidence normally found on such sites that are missing: smithing hearth cakes (SHCs) and hammerscale in any significant quantity. Two possible SHCs were found – one possibly just concreted hammerscale and slag fragments, the other just possibly a fragment of smelting slag. Hammerscale was found at Drumbaun, but only in circumstances

where it had become incorporated into concretionary material.

At Coolamurry, Co. Wexford (also of approximately 11th century date; Young 2006) the residue assemblages were of two types: within-hearth assemblages seen in the sites three smithing hearths and dumps adjacent to the hearths with the majority of the smithing hearth cakes. At Drumbaun the lack of preservation outside the cut features, due to truncation, means that any equivalent dumps of SHCs might have long been removed from the site. The lack of hammerscale at Drumbaun is likely to be due to the sampling; it is not clear whether environmental samples from the contexts yielding metallurgical residues were processed in such a way as to facilitate hammerscale retrieval.

In summary, the evidence suggests that a limited quantity of iron smithing was undertaken at Drumbaun, most likely in the 11th-12th centuries. The closest comparison with the site is probably to be found at Coolamurry, Co. Wexford, where smithing was undertaken at the same period; the preservation of the the smithing deposits at Coolamurry was somewhat better than at Drumbaun and may have been on a slightly larger scale. Unlike Coolamurry, the medieval activity at Drumbaun was demonstrated as a zone of various pits extending NE of the smithy for at least 80m. Interpretation of the non-metallurgical features on the site may help shed considerable light on other sites where, as at Coolamurry, apparently isolated medieval smithing features have been found. More locally, iron working was undertaken, probably intermittently, at Moneygall, Co. Offaly (Young, between the early medieval and possibly early post-medieval periods. At Moneygall, as at Drumbaun, the dominant evidence for smithing was associated with inconclusive evidence for iron smelting.

Evaluation of potential

Although there are individual aspects of the assemblage that could be clarified with further analytical work (including determination of whether the possible smelting slag from c204 was indeed from smelting or rather from smithing), any such further work is unlikely to change the broad interpretation of the material. It is also believed that further analysis of the smithing materials would be unlikely to provide significant further understanding of the smithing undertaken at Drumbaun. Further investigation of the residues is not, therefore, recommended at this stage.

The assemblage is not of high priority for retention.

References

- YOUNG, T.P. 2006. Archaeometallurgical residues from Coolamurry 7, 04E0323. *GeoArch Report 2006/10*. 46pp.
- YOUNG, T.P. 2008. Evaluation of archaeometallurgical residues from Moneygall, Co. Offaly, 06E0321. *GeoArch Report 2008/10*, 15pp.
- YOUNG, T.P. 2010. Evaluation of archaeometallurgical residues from the N9/N10 Waterford-Kilcullen, Site AR015, Ballykillaboy, Co. Kilkenny (E2502) *GeoArch Report 2010/10*, 31 pp.

Table 1: summary catalogue by context. Weights in gram.

context	sample	notes	weight	no	description
198	3		830	c80	large assemblage of dark material, comprising mainly organics (including charcoal) and slag fragments (many of smooth surface lobes), but also with significant flake hammer scale, rare spheroidal hammer scale and one sky-blue fuel ash slag glass bleb. Larger slag fragments tend to be smooth surfaced rather than the spiky material of other contexts here, but both are present. The material also includes some concretion around weathering iron and natural stone. The uncemented sediment would probably have appeared very charcoal-rich.
200	1		134	12	variably dense slags, mainly in tabular lobes with accreted sand and gravel, including small sub-spherical slag pieces. Probably hearth slags.
200	1		1	2	natural stone
			26	3	blebby irregular contorted(?) slag fragments. Dense vesicular slag, very dark with rough surfaces. Adhering material includes both probable spheroidal hammer scale and flake hammer scale.
200	71		226	bulk	about half of this sample is metallurgical - the remainder is gravel. Residue is mainly small spiky slag particles, but with smooth blebs, coffee bean spheroids, slag flats, rare flake hammer scale, and small spheroids - but none perfect - so appears to be a within-hearth smithing assemblage - but that is not certain
203	2		259	39	small pieces of very unusual material. Includes blebby slags - at one extreme with smooth maroon surface flow lobes, at the other rough, speckled (through sand incorporated in the slag?) irregular blebs. Many of the blebs have broken surfaces, between the blebs is much organic material - at least some of which is charcoal fragments, but there was possibly fresh straw/twigs too, also plenty of hammer scale and slag flats. Appears to be a trodden floor, but the proportion of slag material is unusually high.
			156	1	small block resembling tiny two layered SHC - 50x70x40mm, but top has hammer scale and lots of charcoal and it might just be a fortuitously shaped piece of the above floor material. Most likely an SHC though, but would require fresh surface to confirm.
203	76	slag retent	170	bulk	rather more weathered than other samples. The material is mainly slightly flowed blebby slags, ranging from dense iron slag to lining slag with gravelly clasts. Some pieces are just concretions- and these bear charcoal and hammer scale. Largest slag pieces are dimpled lumps of very coarse grained slag - suggestive of within hearth smithing remains
204	4		208	8	indeterminate slag fragments bearing charcoal fragments. All show very black surface accretionary film
			42	1	piece of oxidised-fired vitrified ceramic, probably tuyère sherd, 2 faces at 80 degrees, less vitrified one is planar - so could this be a flat sided tuyère?
			104	9	ferruginous concretion and natural stones
			394	1	large slag block with dense upper sheet and pendulous dense stalactitic prills with large charcoal between - looks like upper section of a furnace bottom from smelting, but it might be an unusual SHC - the upper block is certainly sub-circular as seen.
			136	1	dense thin slag sheet, 80x60x<15mm with irregular concretion wrapped around one end. Concretion difficult to interpret but might just be sintered furnace fines.
			46	1	dense slag forming coating to end of cylindrical void, now filled with ash and charcoal - object might have been a piece of charcoal, a poker - or maybe just a void. 40mm length, void circular cross-section 20mm diameter
			202	1	dense irregular slag fragment with small charcoal inclusions, internally lobate, has a possible curved basal or lateral contact. Has one piece of flake hammer scale in accretion on surface.

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