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Evaluation of archaeometallurgical residues from three sites on the N11, Rathnew to Arklow (A022/027, 065, 073)

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Abstract

Material was evaluated from three sites on the Rathnew-Arklow N11.

Site 27 yielded a small quantity of bog iron ore from context 1. This material may be present through entirely natural processes.

Site 65 produced a single tiny fragment of probable iron-smelting slag.

In contrast, Site 73 produced a more significant assemblage from context 21 (a fill of corn drier C67). The collection includes two substantial blocks of slag of which one is almost certainly from iron smelting in a slag-pit furnace. The second block might possibly also be an atypical smelting slag, but is probably more likely to be a moderately large smithing hearth cake, perhaps produced during bloomsmithing. The same context also yielded a collection of smaller slag pieces, mainly fragments of small smithing hearth cakes and tuyère debris, representing residues from iron-working (blacksmithing).

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Methods

All the material has been inspected using a low-powered binocular microscope. This allows a provisional attribution of residue to process. The catalogue of the collection is presented in Table 1.

Results

Site 27

The material from this site comprised 40g of bog iron ore, in several fragments, perhaps a single original lump. It is not possible to determine whether this material has reached the site through human agency or whether it is entirely natural.

Site 65

A single small (22g) slag bleb was found at this site. The bleb is not strictly identifiable, but is very likely to be a prill from the basal pit of the slag-pit iron-smelting furnace. Material such as this is very durable, and a single piece should not be taken as indicative of smelting in the immediate area. If it is from a slag-pit furnace, then it is not particularly indicative of age, for such technology survived from the early Iron Age well into the post-Medieval period.

Site 73

Description
The two large blocks of slag from C21 are similar, but not identical. Find A022/073:21:1 shows a well-developed upper crust with a smooth proximal area, but hollowed and covered with rusty accretion distally. The wall attachment comprises a small area of

reduced fired clay attached to the proximal margin of the slag. This margin comprises a moderately strongly curved (approximate radius of the preserved part is 120mm) probably sub-vertical bounding surface, within which the descending slag lobes appear to interacted little with the furnace/hearth wall, apart from the very small area of clay. The descending prills form a layer up to 80mm deep below the upper crust of the cake. They penetrate between moderately large moulds of the charcoal fuel.

Find A022/073:21:2 is crudely plano-convex with a slightly dished top. Like A022/073:21:1 it bears a large quantity of rusty concretion bearing good plant moulds within its slightly dished upper surface. The lower zone of prilly slag comprises both smaller prills and smaller charcoal moulds.

The associated material bears a strikingly different darker brown more friable matrix, but is apparently from the same context. The collection comprises slags of a very different texture to the two large blocks. The slags are, in general, highly porous, and bear abundant tiny charcoal fragments. These slags are dark and more markedly magnetic than the two large blocks. The collection comprises about 930g of such slag in six pieces, together with a small quantity of broken slag debris. The largest piece can be interpreted as being about 85% of a small smithing hearth cake (SHC), which would therefore have weighted approximately 520g originally. Four of the other five significant slag pieces are also SHC fragments, but the original size of the SHCs is not determinable.

Together with the slag there is one certain sherd of tuyère and several small fragments probably from tuyères. The best preserved piece shows the angle between the tuyère margin and its face. The fabric is a pale, reduced-fired material bearing a temper of angular chert gravel ranging up to about 3mm. The face of the tuyère shows the ceramic fabric to ve overlain by a green, partially devitrified glaze. The curvature of the exterior of the tuyère suggests an external diameter of 120-140mm. The bore is not seen.

Interpretation

The smaller material from C21 provides an assemblage typical of blacksmithing (the working of iron into artefacts, together with the repair and maintenance of artefacts). The range of SHCs appears to be restricted to examples of relatively small size. The technology of iron working using a ceramic tuyère and producing rather dark, iron-rich slags, appears to have originated in the early medieval period (although Iron Age smithing slags remain rather poorly known at present). Most examples of fairly small tuyères of the size represented here would also appear to be of earlier medieval age, although the development of the tuyère is not yet well-documented. Large assemblages of tuyères of the size of the present example are known from early medieval assemblages from Clonfad (Young 2006a), Clonmacnoise (Young 2005a) and Woodstown (Young 2006b).

The two larger slag blocks from C21 are rather more difficult to ascribe to a particular process. Find A022/073:21:1 shows a well-developed lower prilly zone and a sub-vertical lobate wall contact. These features are characteristic of iron -smelting slags, produced in the basal pit of a slag-pit furnace. Slag-pit furnaces are a form of shaft furnace in which the shaft terminates in a pit, into which the slag drains during the smelt, typically descending into a bed of coarse charcoal or wood (Young 2003b, 2005b). If the curvature of the contact with the pit wall, suggestive of a diameter of 240mm, is representative, then it would have been produced in a very small furnace. Small diameter furnaces are not common, but have been recorded at Celbridge (where the furnace pits ranged from 280-300mm diameter; Young 2003a, b), Ballydavis (280-340mm; Young 2005) and Cappakeel (one example was 260mm diameter; Young 2005). None of these examples is securely dated at present.

Find A022/073:21:2 is superficially similar to find A022/073:21:1, and given the co-occurrence of the two within a single context it is possible they have a common origin; indeed they might even be separate parts of a single slag cake. However, A022/073:21:2 has a more distinct bowl-like morphology and less well-developed prills on its base. It is more likely therefore that this specimen is an example of a moderately large smithing hearth cake. It possesses a size, texture and morphology markedly different from those of the small blacksmithing SHCs from the same context, and may therefore perhaps be an SHC produced during bloomsmithing (the process of compact a raw bloom down to a billet).

In summary, C21 contains blacksmithing slags with associated tuyère fragments, a slab almost certainly from a furnace bottom from a small slag-pit iron smelting furnace and a problematic slag block which might be a smelting slag but is probably more likely to be large SHC, perhaps from bloomsmithing.

The occurrence of iron slags within the backfill of a corn drying kiln is not unusual. A parallel can be found for instance at Cherryville (Co. Kildare; Young 2006c), also with a figure-of-eight kiln, but with at least one of the accompanying smelting furnaces dated to the Iron Age (3rd – 4th century BC).

Evaluation of potential

The assemblage is very small and apparently not associated with features of metallurgical origin. These factors limit the potential of the assemblage. None-the-less the occurrence within a single context of slags probably deriving from iron-production (iron-smelting and bloomsmithing) and iron-working (blacksmithing) is interesting. Accordingly, limited chemical analysis of representative material from the assemblage would be recommended. Such analysis would be aimed at clarifying the uncertainties in process attribution (particularly for A022/073:21:2) and facilitating comparison with material from other sites. It is recommended that single chemical analyses are made of examples of slag from the two large blocks, plus one of the small SHCs, to facilitate comparison with each other and with material from other sites.

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Site	Context	Find	Weight	Notes
A022/027	1	25	40g	bog iron ore
A022/065	4	1	22g	small fragment of probable iron smelting slag
A022/073	21	1	992g	Slag block with dense upper crust and slag prills descending from base between large charcoal moulds. 150x110x90mm. Upper surface has smooth, slightly lobate surface near wall, becoming hollowed with attached rusty charcoal-rich material distally. The wall-facing side so a poor degree of wetting from the descending prills, but it has a small area of attached lining near the top. The upper crust is typically less that 15mm thick. Also small fragment (18g) fractured from main piece.
	21	2	1114g	Crudely plano-convex block of slag with slightly dished top. The top is rusty and has much accreted organic material, including some fern. 150x140x75mm. The lower part of the block comprises descending slag prills
	21	unlabelled bag with 2	*186g*	small piece of highly vesicular iron slag, probably part of a small SHC, almost clinker-like texture, bearing small pieces of charcaol, (75)x(65)x40. Has a small piece of corroded iron attached to the outside of the bowl.
			444g	85% of small charcoal rich SHC. (95)x95x60 (of which bowl 40mm)
			140g	part of lip of small SHC with smooth top, internally highly charcoal rich (70)x(55)x30
			18g	sherd from margin of tuyère, surviving part suggests c120-140diam, side pale grey, tip glazed greenish, internally pale grey reduced fabric with angular chert gravel temper to 3mm
			22g	Iron slag fragment similar to186g piece
			80g	fragment of small charcoal rich SHC, showing a poorly developed curst with very long tubular vesicles, microprilly base, v fine charcaol
			56g	irregular fragment from charcoal rich SHC
			8g	fragment of curved glaze, probably broken from a tuyère
			20g	c8 slag fragments
			4g	3 tiny sherds , two oxidised one strongly vitrified , oxidised materials shows straw? Impressions
			978g	Total weight of bag

Table 1: Summary catalogue

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