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Assessment of archaeometallurgical residues from Knockhouse Lower phase II, Co. Waterford (15E215)

Dr Tim Young
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Abstract

Archaeological investigations at Knockhouse produced approximately 5.8kg of archaeometallurgical residues, together with some fragments of iron ore that may have reached the site by natural means.

The residues are indicative of smithing and are compatible with the early medieval date for the site, but are slightly ambiguous as to whether that smithing was production/maintenance of artefacts (blacksmithing) or smithing for the refining of raw bloom iron (bloomsmithing). It is likely that the range of smithing hearth cake types and weights represented suggests both activities.

The total weight of residues recovered is, however, very small so it is unlikely that the excavated area was close to any main focus of metalworking activity in or around the ringfort.

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Methods

The material described here derives from Phase II of excavations at Knockhouse Lower, Co. Waterford, conducted by IAC Ltd. This project was commissioned by Maeve Tobin.

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

Results

Description of residues

A total of approximately 6.6kg of materials were supplied, which reduced to approximately 6.5kg after rewashing, of which approximately 5.8kg were archaeometallurgical residues. Most of these were from iron working (smithing).

Smithing slags

Certain smithing slags include material from contexts (26), (128) and (290). These materials are examples of (or fragments of) smithing hearth cakes (SHCs). Complete examples of SHCs include a complete example from (128) with a weight of 594g, and two almost complete examples from context (290), with weights of 1115g and 1285g. All these three are dense cakes, they have finely dimpled bases, lower parts of low vesicularity (with one of the examples from (290) possessing tubular vesicles), and with upper parts of a more porous, charcoal-bearing slag.

Three fragments of rather similar SHCs occurred in context (26) and one in context (128). The three fragments show a variety of internal structure, but were all dense. The example from (128) shows a thickness of greater than 50mm, multiple tool-marks on its base and shows some slightly flowed lobes on its steep margin.

Indeterminate iron slags

Context (25) produced a total of 1720g of very friable decomposed slag, in four large pieces forming part or all of a charcoal-rich slag mass, apparently with a thin basal crust, with dense slags infilling probable tool-marks on the base and probably approximately 100mm in thickness. This slag cake is likely to have been a large SHC. Given the badly decomposed state of the slag, the measured weight is likely to be much less than the original. The presence of large tool-marks provides a link to the better-preserved SHC fragment described above.

A 42g fragment of slag from context (238) was also probably, but not certainly a fragment of SHC.

There were three fragments of flow slag: two tiny pieces from context (83) and a 42g piece from context (128). The two tiny pieces showed a maroon colour to the shiny upper surface. This is a character that is commonly seen in tapped iron smelting slags (including those from the nearby site of Woodstown; Young 2014). However, the superficial oxidation of flowed slags may also occur in smithing hearths. The large piece of flow slag did not have oxidised surfaces; again, this is compatible with an origin in either iron smelting or smithing.

Context (26) also produced two small pieces of iron slag of indeterminate origin – a puck-shaped piece of low density lining slag and a tiny (5g) fragment of iron slag. Both are probably residues from iron smelting or smithing.

Geological materials

Geological materials included two iron-rich rocks. One was a 593g rounded block (pebble) of haematite-rich rock from context (57). The haematite showed a patchy texture of anastomosing blebs, with individual blebs show a sub-angular outline. The haematite has interstitial coarse red sandstone (perhaps suggesting an origin within the Carrigmaclea Formation, which crops out in the area. The morphology of the haematite suggests that this may be an oxidised concretion of iron sulphide (marcasite or pyrite). Such materials were not normally used for iron-making (because of the relict sulphide content) and the morphology of the piece suggests it may be of natural origin.

Context (126) produced a small fragment of bog iron ore. Taken on its own, it is not possible to determine whether the ore grew within the host archaeological deposit or was a clast within it. However, since only this single piece was collected, it would appear likely that this was a clast, rather than a post-depositional formation. Such materials formed the basis of most early iron-smelting in Ireland, but there is no evidence this particular piece was present on the site for this purpose. It may relevant however, that iron ores recovered from a site at Adamstown 2 (just 5km SW) were visually similar (Young 2006).

The small fragment (6g) of rock from context (478), included as a 'possible slag', contains fossils indicating a potential origin in the Campile Formation. It appears to have no archaeological significance.

Iron

The collections included two small concretions – one weighing 19g from context (15) and one fragmented example weighing 40g from context (129). Both

concretions had formed around small pieces of iron of unknown nature.

Interpretation

The assemblage is likely to have been entirely produced during iron working (smithing), as there are no pieces certainly formed during iron smelting.

The relatively large size of the identified SHCs (594g, >1115g, >1355g and >1720g) almost certainly precludes an Iron Age date for the material, with the advent of large SHCs probably occurring at or around the start of the early medieval period. The style of iron production and working established in that period (approximately in the 6th century AD) gave rise to a tradition that persisted well into the post-medieval period, so close dating on SHC size or morphology is not possible. The assemblage is therefore compatible with the mainly 7tth-8th century radiocarbon dates from the ringfort.

In pre-industrial periods smithing was undertaken not only in the course of the fabrication or repair of artefacts (blacksmithing), but also as part of the transformation of raw smelted blooms into usable iron (bloomsmithing). In general, the processes of bloomsmithing typically produced larger SHCs than those produced from blacksmithing, because they involve the maintenance of larger amounts of iron at higher temperatures for longer, leading to a greater loss of iron to the hearth.

Distinguishing SHCs from the different processes is not easy, but several analytical programmes have attempted to clarify their separation on early medieval and medieval sites in Ireland (e.g. Clonfad, Young 2012; Woodstown, 2014). At Woodstown, most analysed SHCs weighing less than 1kg showed chemical properties indicative of an origin in blacksmithing, whereas SHCs of more than 1.3kg showed characteristics suggestive of an origin in bloomsmithing. Analysis of the assemblage from Clonfad suggested that SHCs above 2kg in weight were mainly from bloomsmithing, whereas lighter ones were mainly from blacksmithing.

The situation may, however, be somewhat more complicated than this simple dichotomy. Many sites that have produced no evidence for a direct association with iron production produce examples of SHCs that are larger than one might expect from purely blacksmithing and it has been argued that iron was circulated in a less than fully refined state during the early medieval period, requiring the end-user smith to work (refine) the iron further before use (see Young 2009 for a fuller discussion of this).

In the case of the Knockhouse assemblage, any conclusion must be very tentative given the very small assemblage, but it would appear likely (although not certain) that the site was engaged with the processing of raw blooms smelted elsewhere, as well as with some blacksmithing. A differentiation in the work undertaken at particular sites in these periods was common –driven potentially both by the need to exploit a variety of charcoal sources and also perhaps by the desirability of maintaining a fixed forge (perhaps for both bloomsmithing and blacksmithing) whereas the smelting operation could move in the landscape following either charcoal or ore sources.

The assemblage from Knockhouse is very small, suggesting perhaps that the area excavated was not close to the centre of the metallurgical activity and that the slags may be 'background scatter' rather than foci of deliberate deposition/disposal.

Further work

The slags are associated with clear indications of metallurgical activity, nor are they numerous. They are therefore unlikely to be able to yield further useful information upon detailed analysis; consequently, no further analysis is recommended at this stage.

Any further work on the site may need to bear in mind the likelihood of encountering metallurgical activity and allowance should be made for appropriate sampling of macro- and micro- residues should that arise.

References

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

context	sample	sample notes	sample wt.	item wt.	item no.	item notes
15	2	s 3	19	19	1	small concretion on iron object
25	5		1720	164	1	friable block - essentially charcoal bound by this pale films - probably intensely weathered ash-rich slag
				330	1	friable charcoal rich slag
				288	1	fragment of basal sheet attached to piece below, shows 25mm highly porous crust, with denser slag, possibly resting in tool-marks
				946	1	margin of 100mm thick slag block, then highly-weathered crust (with probable tool-marks) overlain by friable charcoal-rich material
						(all these fragments probably one single block)
26	6		437	36	1	low density puck of lining slag, 50x40x25mm
				40	1	small porous SHC fragment
				5	1	iron slag fragment
				166	1	fragment from margin of medium SHC, top slightly lobed and glassy, interior largely spongy, weathered, lower part has 5mm crust but base obscure, has a few descending lobes /prills attached to base
				188	1	fragment of large SHC, dense lower crust with rough base to 15mm, deeply dimpled upper surface overlying some large voids. Original dimensions not known.
57	8	q 3 s 3	593	593	1	rounded block of iron ore, patchy texture, with a hint of angularity - suggest this haematite rock may be an oxidised sulphide mineral, matrix where seen is a coarse red sandstone
83	20		2	2	2	fragments of dense slag prill, flow slag, maroon smooth upper, dimpled lower
126	81		31	31	1	broken piece of good quality bog iron ore, rich in voids, many of which are tabular, but these are surrounded by dense iron oxides in anastomosing blebs and sheets
128	80		1265	594	1	100x100x55mm, neat SHC, biconvex, good bowl with slightly displaced down central area, micro-dimpled, upperpart I rough charcoal rich to 20mm, with just hint of lobes, bowl fill slightly porous with an occasional large charcoal clast
				546	1	fragment from >50mm thick SHC, base well-formed dense micro-dimpled, with multiple large tool-marks, dense seen to 30mm, charcoal-rich and finely porous above, top rough. A few protruding flowed lobes on steep margin; fragment measures 80x80x80mm

				42	1	irregular elongate flow lobe in dense slag, dimpled base, slightly rough top, no maroon surface
				18	4	fragments of concretion onto former iron object, sheet like
129	82		40	40	4	fragments of concretion, probably originally formed around thin iron object
238	83		40	40	1	porous iron slag with abundant fine charcoal, base dense hard dimpled, smooth upper surface is maroon, probably but not certainly an SHC fragment
290	84	1 of 2	1115	1115	1 (2)	120x170x65mm, incomplete large SHC, at least 15% missing, overall shape resembles outline of dished part of the other SHC from this context; probably 25% missing; hard rough micro-dimpled base well-formed, overlain by 15mm crust with tubular vesicles; then bowl fill of charcoal-rich material, only finely porous, top charcoal-rich irregular
290	89	2 of 2	1355	1285	1	complex slightly incomplete SHC - either a double SHC (with the earlier one pushed to one side), or more likely a concavo-convex SHC with raised lip attached to a burr almost in the same plane; rusty; concavo-convex section has flow lobes in top (almost tap slag like), but most of surface obscure; overall dimensions 180x190x65mm
478	123		6	6	1	fossiliferous mudstone (rottenstone) with crinoids and brachiopods

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Unit 6,
Western Industrial Estate,
Caerphilly,
CF83 1BQ

Office:	029 20881431
Mobile:	07802 413704
Fax:	08700 547366
E-Mail:	Tim.Young@GeoArch.co.uk
Web:	www.GeoArch.co.uk