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Assessment of archaeometallurgical residues from Portumna Castle (E004828)

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Abstract

A small collection of archaeometallurgical residues (2.36kg; 14 pieces) was recovered from a single context (22) associated with the 'courtyard building' at Portumna Castle, Co. Galway.

The majority of the collection comprised examples of smithing hearth cakes (SHCs). Six examples of SHCs were complete (or approximately so) and had a range of weights from 136g to 384g (mean 247g). The SHCs all contained inclusions indicating the use of charcoal as fuel. The slag was commonly rather pale in colour, vesicular, commonly with a glassy, sometimes gravelly, upper layer.

The remainder of the collection comprised probable fragments of further SHCs.

All the residues required further washing, so the deposits washed from the specimens were collected, sieved at 100µ and then picked with a magnet. The material so collected was rich in both flake and spheroidal hammerscale.

The archaeometallurgical residues were associated with an assemblage of twenty-four pieces of ironwork. These include an iron key and three nails, but the other pieces were all indeterminate fragments, probably scrap.

The assemblage can be interpreted as the residues from blacksmithing. The presence of iron scrap in association with both micro- and macro-residues suggests the deposit is, or includes, primary dumping of forge waste. The slag texture suggests a composition strongly influenced by the hearth ceramic. In the context of Irish ironworking this probably indicates the use of a ceramic, rather than an iron, tuyère.

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Methods

All materials were examined visually, using a low-powered binocular microscope where required. As an assessment, the materials were not subjected to any high-magnification optical inspection, not to any form of instrumental analysis.

The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

All the residues required further washing, so the deposits washed from the specimens were collected, sieved at 100µ and then picked with a magnet.

This assessment was conducted in November 2017, and was commissioned by Fiona Rooney.

Results

General description of the assemblage

The assemblage comprised a small collection of archaeometallurgical residues (2.36kg; 14 pieces) that was recovered from a single context (22). The majority of the collection comprised examples of smithing hearth cakes (SHCs), and the remainder of the collection comprised probable fragments of further SHCs. The archaeometallurgical residues were associated with an assemblage of twenty-four pieces of ironwork.

Ironworking residues

Smithing hearth cakes

Six examples of SHCs were complete (or approximately so) and had a range of weights from 136g to 384g (mean 247g). The SHCs all contained inclusions indicating the use of charcoal as fuel. The slag was commonly rather pale in colour, vesicular, commonly with a glassy, sometimes gravelly, upper layer. The lower parts of the SHCs were variably slightly lobed, and mostly showed a basal surface dimpled by contact with fuel.

The remainder of the assemblage comprised fragments of iron slag that were probably derived from fragmentation of similar SHCs.

Micro-residues

The material collected from the washing of the macroresidues was rich in both flake and spheroidal hammerscale.

Iron objects

The archaeometallurgical residues were associated with an assemblage of twenty-four pieces of ironwork. These include an iron key and three nails, but the other pieces were all indeterminate fragments, probably scrap.

Distribution of the assemblage

The collection was recovered from a single context (22) associated with the 'courtyard building' at Portumna Castle

Interpretation

The assemblage comprises a collection of waste (macroresidues, microresidues and scrap iron) from blacksmithing.

The microresidues included both flake hammerscale (from the oxidation of the surface of the hot workpiece) and spheroidal hammerscale (produced from violent expulsion of molten scale, typically during closure of forge welds) (Young 2011b). The two classes tend to accumulate in different areas of the smithy, with flake scale falling around the hearth or anvil, but the spheroidal scale flying further. The occurrence of both classes suggests derivation of the deposit from the floor of the smithy, either directly or through sweeping of the floor.

There are very few SHCs, but their weights are closely comparable with those from other sites interpreted as being locations of blacksmithing (the end use of iron for the creation and repair of artefacts) rather than from any stage of iron production (for which the smithing tends to produce SHCs of much greater weight, typically over 1kg).

In the earlier medieval period, it is believed (e.g. Young 2009b) that some final processing of iron was also undertaken by the blacksmiths, leading to a proportion of larger SHCs occurring on blacksmithing sites (see, for instance, the 12th – 13th century assemblage from Coolamurry, Young 2008b; Table 2). During the medieval period, the distribution of only partially finished iron was replaced by the distribution of iron in fully finished form. This resulted in a drop in the average weight of SHCs from blacksmithing sites to the range of 200g – 400g. Such assemblages have been seen at sites such as Garryleagh (Young 2009b), Gorteens (Dabal & Young 2011) and Mucklagh (Young 2008a). The Portumna Castle assemblage is small, but appears to fit into this group. Some sites have produced SHC assemblages that are much lighter (e.g. Ballykillaboy, Young 2010, and Moyveela, Young 2009a). These assemblages of very small SHCs may be associated with rural smithies only undertaking intermittent or particularly light work, rather than more typical or more continuous forge work.

The presence of well-formed SHCs with clear evidence for a high silicate content (as opposed to a high iron oxide content) indicates that a high proportion of hearth ceramic was involved in their formation (SHCs are produced from a reaction between iron and iron oxide lost from the workpiece with melted hearth cermaic and with fuel ash). For charcoal-fuelled blacksmithing (as indicated by the abundant charcoal inclusions in all the SHC pieces), there is little silica supplied by the fuel ash (unlike coal-fuelled smithing, in which much silica and alumina may be supplied by the impurities in the fuel).

The ceramic input into the slag may derive from the partial melting of either a clay wall (as seen in Iron Age smithing) or a ceramic tuyère. In Ireland the use of a cermaic tuyère appears to have been introduced during the early medieval period and to have continued well into the post-medieval. In Britain, the use of an iron tuyère commenced in the medieval period and became widespread in the post-medieval (e.g Moxon 1703) replacing the use of a simple blowhole. The iron tuyère spread to Ireland, apparently in the post-medieval period. When used in combination with charcoal fuel, the resultant SHCs will be poor in silicate material.

A lack of actual fragments from ceramic tuyères has been noted elsewhere in post-medieval smithing assemblages (e.g. Mucklagh, Co. Offaly, Young 2008a; Moyveela 3, Co. Galway, Young 2009c). Young (2009c) suggested that it is possible that the light forge work causes less damage to the tuyère, so they were thrown-away less often, but it is equally possible that differential patterns of residue disposal may account for the observed lack.

The use of coal as a fuel replaced the use of charcoal only very slowly in Ireland. There is some evidence for use in the Anglo-Norman areas of the east coast from the 13th century, probably relying, at least initially, on coal imported from England and Wales. Coal was widely moved along the coast of North Wales during the major period of castle construction in the late 13th century from the coalfields of NE Wales, and the same sources appear as major documented exporters to Ireland by the 16th century (Nef 2013, 364-5). Coal use developed particularly in the areas of the coalfields, such as in Co. Kilkenny. Coal was listed amongst taxable items at Fethard in 1292 (Cosgrove 1987, 238; although this is unclear whether the coal was being imported or exported and in 1322-3 a ship carrying coal was detained in Dublin (O'Neill, 1987). The sources at Coalisland, Co. Tyrone, were being exploited by the mid-17th century (Bardon, 1991, p. 203). Coal has been noted from archaeometallurgical assemblages from Carrickmines Castle, Co. Dublin (Young 2006; Young & Kearns 2010; Young 2011a) and Greencastle, Co. Down (Young 2010b), but in neither case was the date of introduction of coal certainly within the medieval period.

The 17th – 18th century assemblage from Gorteens Castle, Co. Kilkenny (Dabal & Young 2011) showed the use of charcoal (dominantly) but also coal, but I otherwise rather similar in character to that from Portumna. An 18th-19th century assemblage from Mucklagh, Co. Offaly (Young 2008a), was also rather similar to the present material. It would appear likely that in areas such as Co. Offaly, the introduction of coal as fuel did not occur until after the advent of the canal system at the end of the 18th century.

The present material would therefore appear to rest within a somewhat conservative tradition of Irish blacksmithing technology (employing a ceramic tuyère and charcoal fuel) in which an essentially medieval style of hearth technology survived well into the post-medieval period in certain areas.

Further work

The limited assemblage means that the research potential for the assemblage is reduced. The pale slags are unusual in appearance, and their analysis to shed light on their origin would be desirable, but might shed little additional light on the site.

The collection of iron artefacts and scrap would be worthy of routine X-radiography.

The analysis of the potential iron stock in an attempt to determine its origin would also be desirable, but again the limited assemblage might reduce the utility of this (unless the age of the deposit is particularly well-constrained).

In view of the potential utility of the collection, but the uncertain rewards to the current investigation, no further analytical investigation is advised at the present time, unless the archaeological context raises particular research questions that should be addressed. The entire collection should, however, be deposited with the site archive to facilitate future investigation.

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Table 1: summary catalogue. SHC = smithing hearth cake, FHS = flake hammerscale. Weights in grams.

context	sample	item wt.	item no.	item note
22	#1-6	216	1	90x70x40mm; irregular SHC, quite possibly deformed; large rounded mass of lining slag on one end may be crude burr, dense slag sheet extends forward of this more thinly; base slightly dimpled; inclusions of charcoal.
		136	1	65x75x40mm; small pad like dense SHC, with slightly lobate base; raised lobes of lining slag on top.
		124	1	fragment of lining-rich SHC; two surfaces slightly reddened; internally vesicular, very coarse olivine forming networks around voids; dimpled base.
		74	1	fragment of slag with finely fuel dimpled base and fractured charcoal rich top.
		46	1	small ferruginous concretion, probable with iron core; accretion contains charcoal and FHS.
		236	1	one end of long bone probably horse humerus.
22	#7-11	224	1	80x95x35mm, crudely triangular slab of dense slag; presumed base shows small charcoal inclusions above almost planar basal surface; top shows rusty irregular surface, with pale blebs (probably weathered lining material); ashy adhering accretion contains FHS.
		82	1	small fragment of iron slag; base formed of small prills with charcoal inclusions; small area of upper surface rough, rusty, lots of small charcoal inclusions.
		42	1	small angular fragment of charcoal-rich slag; slag pale grey, with limey (?) coatings on non-wetted fuel dimple contacts.
		312	1	80x90x60mm deep, irregular, probably almost complete SHC, wedge-shaped in profile; thick upper dark glassy layer, basal layer of crude pale flow lobes with dimpled surfaces, between is vesicular pale slag with charcoal inclusions; all of slag is pale lining slag, carries very coarse olivine in glassy matrix, carries clasts of gravel (sandstone) and blebs of highly bloated ceramic; small areas of upper surface were not covered by glassy slag.
		54	1	small ferruginous concretion, abundant charcoal, rare FHS.
22	#12-14	178	1	60x75x55mm deep, somewhat globular SHC; thick upper pad of lining slag, lower inverted pyramid of charcoal-rich material; some limited smooth rusted surface on proximal side may be indicative of original wall contact.
		254	1	70x100x45mm, small dense but charcoal rich SHC with oblique (forward-inclined) proximal fracture, central band is very lime-rich.
		384	1	90x110x45mm, dense plano-convex SHC, with oblique proximal fracture; rough base with charcoal, top mainly covered in accretion.
22		262	14	indeterminate tabular iron fragments.
		176	1	small iron bar fragment, approximately 20x25mm and 60mm long, either irregular or slightly twisted.
		80	1	iron key, 90mm long, 10mm thick, and 45mm high, rotary, probable trefoil bow, ward L-shaped?
		72	1	curved iron plate, 95x30x5mm, just possibly a horseshoe fragment.
		56	1	18x4x105mm iron strip folded over.
		46	1	iron rod or ferrule.
		44	1	narrow iron strip, turns through 90 degrees to point. Just possibly a dog.
		48	2	iron nails, 60mm long, possibly 7mm cross section, square, head c. 15mm square but irregular.
		94	1	nail, tapering shank 65mm long, 15mm square below head, head 25x28mm, 5mm thick, 6x6mm 5mm above tip.
		116	1	30x115x5mm plate, turns right angles at one end and narrows to 15mm, after 35mm doubles back for55mm, final 35mm turns back to main plate and narrows to rounded point.

Table 2: comparison of the weight-frequency distribution of smithing hearth cakes from blacksmithing sites in Ireland.

	Coolamurry Co. Wexford	Garryleagh Co. Cork	Ballykillaboy Co. Kilkenny	Gorteens Co. Kilkenny	Portumna Co. Galway	Moyveela Co. Galway	Mucklagh Co. Offaly
Date	12th-13th	13th-14th	15th-17th	17th-18th		Post-medieval	18th/19th?
Reference	Young 2008b	Young 2009b	Young 2010	Dabal & Young 2011	(this study)	Young 2009a	Young 2008a
SHC count	41	25	113	27	6	15	66
SHC min. wt	62	84	50	52	136	44	98
SHC max. wt	2588	802	478	748	384	388	1206
SHC mean wt	386	331	139	206	247	134	373
%<500g	83%	76%	100%	93%	100%	100%	77%
%<1000g	95%	100%	0%	100%	100%	0%	95%
%>1000g	5%	0%	0%	0%	0%	0%	5%
%>3000g	0%	0%	0%	0%	0%	0%	0%

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