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Evaluation of archaeometallurgical residues from the N7 Naas Road Widenings and Interchanges Scheme, Site 4, Steelstown, Co. Dublin (04E0858)

Dr Tim Young & Thérèse Kearns

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Dr T.P. Young& T. Kearns

Abstract

Archaeometallurgical residues from Steelstown were predominately composed of large fragments of heavily vitrified furnace lining and one fragment of a large slag block derived from iron smelting in a non-slag tapping low-shaft furnace. The morphology of the furnace remains suggests that the furnace was constructed with an arch connected to the basal pit and an external working hollow. The charcoal fill of the furnace has been ascribed a 14C date indicative of a 5th-6th century AD age, placing the furnace in period in which there are relatively few known furnaces. Comparative examples of this furnace morphology are presented. The total amount of material was rather small (c. 7kg) and probably represents just part of the residue remaining in the furnace after its final smelt.

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Methods

All materials were examined by visual inspection and with a low powered binocular microscope. Samples were individually weighed, described and recorded to a database. The summary catalogue is given in Table 1.

The conclusions reached in this report are therefore limited by the nature of the evaluation inspection. No chemical analysis or high-powered microscope work is attempted during an evaluation.

The assemblage was supplied unwashed; the macroscopic slags were therefore all washed before inspection.

Results

The archaeometallurgical residue assemblage from Steelstown has a total weight of 7kg. The most abundant components of the assemblage were large fragments of lining (c.4kg), much of which was slagged on their inner surfaces. One fragment (sample 68) appeared to have failed during use and was subsequently repaired by the addition of clay. Slag was present in the form of one large fragment (180x150 mm, 2.9kg) of a circular, plano-convex block with small charcoal moulds in the base and topped with a concretion of lining and possibly ore; also present were small runs, prills and “coffee bean” spheroidal slag droplets.

The majority of materials were recovered from contexts 128 (4.7kg), 71 (1.3kg) 129 (85g), all of which fill C23 which was identified by excavators as a furnace. The remains of the furnace measured 0.22 m deep, 0.35 – 0.95 m wide and 1.8m long and had a ‘figure of eight’ form.

Approximately 800g of predominately lining material was retrieved from context 26, an infill of a furrow [25] which truncated the upper part of the furnace [23].

The charcoal fill [129] of the furnace [23] was dated by 14C dating to AD 435-536 (1 sigma calibration) placing it in the early medieval period.

Interpretation

The materials are indicative of iron-smelting in a non-slag tapping low-shaft furnace. The low quantity of furnace remains does not, however, allow for reconstruction of the superstructure.

The fragment of a plano-convex slag cake corresponds to part of what is commonly termed a "furnace bottom" (FB), although it would actually have formed above the base of the furnace, with the small slag prills and blebs found representing slag which has descended below the main slag cake into the lower part of the furnace pit. The cake fragment is dense and compact compared to equivalent material from other sites, but the general form and the accretionary top of rusted appearance can be paralleled on sites such as Tullyallen 6, Co. Louth (Young 2003d) and Adamstown 1, Co. Waterford (Young 2006).

The 'figure of eight' form may indicate the presence of an arch which connected the basal pit of the furnace to an external working hollow which extends west (visible in field photographs, Plate 11). Although arched furnaces are commonly associated with slag tapping, arches were also employed for clearing out non-tapping furnaces and possible the removal of the bloom.

Furnaces such as these are widely known outside Ireland (e.g. Crew 1987, 1989, 1991, 1998; Pleiner 2000), however increasingly evidence is appearing for their use in Irish contexts. One good example was recovered from Derrinsallagh 4, Co. Laois ([c397]; Young 2008d).

Suggestions of arches have been made at several sites of Iron Age date: Derrinsallagh 3, Co. Laois (Furnace C819 and working hollow C640; Young 2008b), Derryvorrigan 1, Co. Laois (C064/C169, C065/C216, C085; Young 2008c), Cappakeel West and Morrett, Co. Laois (Young 2005a) and possibly Derrygarriff 2, Co. Galway (Young 2009c). All of these sites are dated to between 3rd Century BC and 1st Century AD and are therefore considerably earlier than the example seen here.

An early medieval example of a furnace with an arch was found at Knockbrack, Co. Kerry (with a 14C date from hazel of cal. AD 570-670; Hull & Taylor 2006), although the excavators interpreted this furnace as having been tapped. Another possible early medieval example, interpreted as a smithing hearth by the excavators, is a structure at Killickaweeny, Co. Meath (Carlin *et al.* 2008, Illus. 5.7) which bears a strong resemblance to the current example. Some, mainly later medieval, iron smelting furnaces seem to be relatively large, with a frontal arch, but without a deeply-sunken basal pit. Problems exist with the interpretation of such furnaces, but there are probably similarities between the furnaces at Derrinsallagh 1 (14th-15th Century; Young 2008a), Farranastack (11th-13th Century; Dowd & Fairburn 2005), Ballykilmore (14th- 15th Century; Young 2009a) and possibly also the rather earlier furnace at Milltown/Ballynamorahan (7th-9th Century; Young 2009b)

The length of the furnace [23] is given as 1.8 metres long which includes the actual furnace and the external working hollow. From this it is difficult to infer with any certainty the dimensions of the furnace itself, however possible similar examples have diameters somewhere in the range of 300-450mm at the level of truncation. Unfortunately due the relative scarcity of furnace wall its thickness is unknown.

Non-slag tapping low-shaft furnaces producing residues of the type seen here appear first in continental Europe (Pleiner 2000), but have spread to Britain by the 6th century BC (e.g. Young 2005b) and possibly rather earlier. They become widespread in Britain during the Iron Age (e.g. Clogg 1999; Crew 1987, 1989, 1998; Halkon 1997) where their morphology has been studied in detail and their operation and their operation modelled experimentally (Crew 1991). In Ireland, their truncated remains have usually been misidentified as so-called bowl furnaces (e.g. Scott 1990). Data from the many recent road-schemes (e.g. Young 2003a, 2003b, 2003d, 2005c) as well as from more research-oriented excavations (e.g. Young 2005b) are beginning to allow revised interpretation of the Irish examples (e.g. Young 2003c) and in particular those with evidence for the use of non-tapping arches (e.g. Young 2008d). The furnace type is rarely found in Britain after the Roman conquest, but survives in Ireland, possibly as late as the 18th century. The reason for this survival in Ireland seems to be the furnace type's suitability for smelting the widespread bog iron ores.

In summary, it appears that the assemblage represents the partial remains of a collapsed non-tapping, low-shaft furnace with an arch and external working hollow. The quantity of slag is very small and probably represents only some of what remained of the residues of the final smelt before the furnace was abandoned.

Evaluation of potential

The prinicipal interest of this occurrence is the evidence for the furnace morphology, discussed at length above. Unfortunately the amount of residues remaining in the furnace was very small. Although chemical analysis of the slag block would confirm the type of ore used, little further detail would be provided on the furnace operation since the slag suite is so incomplete.

Accordingly, no further analysis is recommended for this material.

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Table 1: Summary Catalogue
Steelstown (O4E0858) - N7 Naas Road Widening Scheme

Steelstown (O4E0858) - N7 Naas Road Widening Scheme

context	sample	label	weight(g)	notes
C128	50	slag	18	small fragments of slag and lining
C129	52	slag	85	very small fragments and prills of slag and lining (some of the slag is mildly magnetic)
F128C23	69	slag at base of smelting pit	2900	large fragment of slag cake (180 x 150 mm) with lining attached to the upper surface - occasional small charcoal moulds
F128C23	68	slag/bloom	1856	3 large fragments of slagged lining, the largest may have been formed near to the tuyère, the smaller 2 are mildly magnetic in places; the remainder of the material is comprised of small fragments of clay, burnt/fired to varying degrees and 1 piece of blebby slag
F26C25	62	slag	800	2 large, 9 small, worn fragments of lining with small amounts of slag attached
F26C25	65	slag/bloom	41	fragment of lining, oxidised on one side, vitrified on the other
F71C23	67	slag	1300	large accretionary piece of lining slag
F71C23	63	slag	19	4 fragments of lining, 1 of which is vitrified; 1 piece of flowed slag
Topsoil	61	slag	73	2 fragments of weathered limestone: natural
		Total	7092	

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54 Heol y Cadno,
Thornhill,
Cardiff,
CF14 9DY.

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