Evaluation of archaeometallurgical residues from the N7 Naas Road Widenings and Interchanges Scheme, Site 4, Steelstown, Co. Dublin (04E0858)
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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 a 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 
pl. 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 
Derrygirriff 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 smelting 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 
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) 
in and 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 principal 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.
References


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

<table>
<thead>
<tr>
<th>context</th>
<th>sample</th>
<th>label</th>
<th>weight(g)</th>
<th>notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C128</td>
<td>50</td>
<td>slag</td>
<td>18</td>
<td>small fragments of slag and lining</td>
</tr>
<tr>
<td>C129</td>
<td>52</td>
<td>slag</td>
<td>85</td>
<td>very small fragments and prills of slag and lining (some of the slag is mildly magnetic)</td>
</tr>
<tr>
<td>F128C23</td>
<td>69</td>
<td>slag at base of smelting pit</td>
<td>2900</td>
<td>large fragment of slag cake (180 x 150 mm) with lining attached to the upper surface - occasional small charcoal moulds</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>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 blebbby slag</td>
</tr>
<tr>
<td>F128C23</td>
<td>68</td>
<td>slag/bloom</td>
<td>1856</td>
<td></td>
</tr>
<tr>
<td>F26C25</td>
<td>62</td>
<td>slag</td>
<td>800</td>
<td>2 large, 9 small, worn fragments of lining with small amounts of slag attached</td>
</tr>
<tr>
<td>F26C25</td>
<td>65</td>
<td>slag/bloom</td>
<td>41</td>
<td>fragment of lining, oxidised on one side, vitrified on the other</td>
</tr>
<tr>
<td>F71C23</td>
<td>67</td>
<td>slag</td>
<td>1300</td>
<td>large accretionary piece of lining slag</td>
</tr>
<tr>
<td>F71C23</td>
<td>63</td>
<td>slag</td>
<td>19</td>
<td>4 fragments of lining, 1 of which is vitrified; 1 piece of flowed slag</td>
</tr>
<tr>
<td>Topsoil</td>
<td>61</td>
<td>slag</td>
<td>73</td>
<td>2 fragments of weathered limestone: natural</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>7092</td>
<td></td>
</tr>
</tbody>
</table>