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# Assessment of archaeometallurgical residues from the A31, Killyneese 1, Co. Derry (AE/15/31)

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## Abstract

*Archaeological investigations at Killyneese 1 on the A31 Scheme produced approximately 1kg of well-preserved archaeometallurgical residues. Most of the residues were from smithing hearth cakes (SHCs). The SHCs were small, and therefore may be interpreted as the waste material from blacksmithing. They were accompanied by a few pieces of other slag types, also waste from blacksmithing.*

*Although such material might strictly have a wide potential age, on balance this material is most likely to be late- or post-medieval in age. The morphology of the SHCs suggests a possible use of coal as fuel, but there was no independent evidence for the use of anything other than charcoal.*

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# Methods

The material described here derives from archaeological interventions at Killyneese 1 on the A31 scheme, 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. 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 1kg of materials was examined.

#### *Smithing hearth cakes*

The collection included four examples of complete smithing hearth cakes (SHCs) and four fragments of similar cakes. The SHCs show a range in morphology and density, from the densest example (a 271g example from context (38), with steep sides and approximately triangular in plan, measuring 70x80x50mm (length x width x height), to a flat, tongue-like (*sensu* Young 2012a), low-density, example (from context (134), measuring 100x55x35mm, and weighing 102g). There were two examples with an intermediate density and form (with weights of 74g and 120g).

The four fragmentary example also showed a similar range of form, density and structure.

All but the heaviest example (which did not permit observation of its internal structure) showed evidence for having been built-up through the amalgamation of slag prills, rather than there ever having been a puddle of fluid slag in the earth. In the densest fragments, the internal structure showed sections of prills formed of both coarsely- and finely-crystalline slag, as well as of glassy slag.

#### *Other slag*

The collections also include a small 'flap' of lining slag that would have formed below an overhang of the hearth lining or tuyère. There were also twelve fragments of low density, commonly gravelly, lining slags, either slag formed on the hearth ceramic or as part of low-density SHCs. There was also a single piece of similarly blebby/prilly slag, but of a much denser composition.

# Interpretation

The smithing hearth cakes show a typically low weight (the examples weigh 74g, 102g, 120g and 271g), they have a prilly internal structure and frequently show a maroon superficial colour to their upper parts. These features are all most common in Ireland in late medieval or post medieval SHCs that were formed during blacksmithing. It is also likely, although comparative material is much less well-understood, that small SHCs are also characteristic of Iron Age iron working.

Small SHCs became common from late medieval times onwards, for various reasons: firstly, iron was probably increasingly circulated in a fully refined state from industrial sources rather than as part-refined iron from bloomeries (see Young 2009g for a discussion of this), secondly, coal progressively replaced charcoal as fuel for blacksmithing in most areas of the country (the change in fuel changed the mechanisms of slag formation and tended to promote low-fluidity, clinkery slags and thirdly, the progressive replacement of ceramic tuyères by iron ones reduced the flow of silicate melt into the hearth, again changing slag chemistry and reducing slag volumes. Open-textured slags, such as some here, particularly where thy show a maroon surface, may commonly be interpreted as indicative of the use of coal as fuel – but there was no other evidence that this was the case here.

Comparative assemblages of small SHCs from the late medieval to post-medieval periods would include those from Ballykillaboy, Co. Kilkenny (Young 2010a), Carrickmines, Co. Dublin (Young 2006; Young & Kearns 2010b; Young 2011), Cuffsborough, Co. Laois (Young 2009b), Gorteens, Co. Kilkenny (Dabal & Young 2011), Greencastle, Co. Down (Young 2010b), Moyveela, Co. Galway (Young 2009c) and Owenbristy, Co. Galway (Young 2009d).

Iron Age SHCs also appear to be small, but there are few good assemblages of appropriate nature. Iron Age SHCs are, or may be, represented by fragments from smithing deposits at Ballydavis, Co. Laois (Young 2005), poorly dated material from Ballynacarriga, Co. Cork (Young 2009f), a few examples from Ballynamona, Co. Cork (Young 2009e), a single undated example from Carbury, Co. Kildare (Young 2012b), a few examples from Cuffsborough, Co. Laois (Young 2009a), a single example from Derrygarriff, Co. Clare (Young 2009d) and by fragments from Platin/Lagavoreen (Young & Kearns 2010a). Many of these sites were involved in iron production, and thuis small SHCs may be typical of the Iron Age for both blacksmithing and bloomsmithing (as is also true in North Wales, Crew 1991, 1998, 2009)

## Further work

The slags from Killyneese form just a small assemblage of smithing residues, apparently isolated from metallurgical structures. As such, they would not normally be given a recommendation for further investigation, but this collection does have significant research potential to yield additional useful information. There are has been no detailed analysis of blacksmithing slags from the post-medieval of Ireland, apart from some rather unusual examples from Carrickmines (Young 2011). As discussed above, post-medieval blacksmithing differs from medieval in changes to the nature of the iron, changes to the fuel and changes to the tuyère. Documentation and interpretation of such changes through the residues of the process would be highly desirable. The Killyneese residues are particularly fresh and thus suitable for such work. A small programme of chemical analysis and microstructural investigation on the SEM is recommended for the four SHCs.

Irrespective of the commissioning of any analysis, these materials should be deposited eventually with the site archive in an appropriate receiving institution.

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

| context | sample | sample wt. | item wt. | item no. | item notes |
|---|---|---|---|---|---|
| 1 | 209 | 462 | 122 | 12 | blebby slags, low density, strongly influenced by lining and include gravel up to 10mm made of mainly quartz; surfaces locally maroon, if not black glass with sand; but with some pale areas; many show charcoal inclusions |
| | | | 120 | 1 | SHC formed mainly of blebby lining influenced slags; had slightly brown dimpled base, blebby top and sides with mixtures of maroon surfaced and dark glasses, as in fragmentary material; 70x80x40mm, nice example of a poorly consolidated low density SHC |
| | | | 72 | 1 | fragment of low density SHC as above |
| | | | 72 | 1 | blebby slags like examples above, but slightly denser |
| | | | 86 | 1 | fragment of SHC formed of denser slag, shows mixture of very coarse fayalite, very fine maroon slag and patches of quartz-rich dark glass, dimensions of SHC not known - this would be a maximum of 35% |
| | | | 4 | 1 | small flap of dark lining slag |
| 38 | 1214 | 271 | 271 | 1 | dense triangular SHC with vertical sides, 70x80x50mm, top smooth maroon, internal top is black glassy, maroon smooth surface rolls over one lip; base finely dimpled, no visible fuel particles; again resembles coal fuelled slag but no evidence that is the case |
| 124 | 1 | 218 | 88 | 1 | fragment of dense SHC, concave top may not be original, but crust to 25mm |
| | | | 102 | 1 | low density SHC, tongue-like; dished top a little rusty but otherwise very pale; 100x55x35mm, probably transverse; deeply impressed charcoal in slightly prilly base; top mostly smooth but more dimpled in elongate extension to side of bowl, top grey to cream |
| | | | 28 | 1 | small blebby piece of low-density slag, very similar to that in the SHC/tongue above, and it may be a fragment from a similar example |
| 151 | 7 | 74 | 74 | 1 | mass of flow lobed slag, probably rolled into ball, some with maroon surface, other parts black glassy on fracture, probably a small deformed SHC.; the colour and texture suggest a coal-fuelled hearth- but here are no coal residues visible to confirm this |

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