GeoArch

Report 2010/33

Evaluation of archaeometallurgical residues from St Elizabeth's Church, Dundonald, Co. Down.

Dr Tim Young & Thérèse Kearns
November 22nd 2010

Evaluation of archaeometallurgical residues from St Elizabeth's Church, Dundonald, Co. Down

Dr T.P. Young & T. Kearns

Abstract

The assemblage comprises 128g of material. The collection includes dense, grey, slags of clinker-like appearance (from c102), but with no clear traces of coal residue and a very high iron content. Indeed, the high degree of cracking being exhibited by two of the three particles of this type suggests that they contain metallic iron inclusions. This material is associated with 5 large pieces of coke. The slags from c102 are probably slags from a coal-fuelled smithy.

Material from c226 comprises a single small fragment of pale grey, vesicular, fayalitic iron slag. This is a well-fluxed slag which must have been fairly fluid, but must be classed as being of indeterminate origin.

A single unstratified fragment is a glassy slag with abundant quartz-rich inclusions of coarse sand to grit grade. The slag is likely to have been generated through melting of a coarsely-grit tempered ceramic, such as is commonly seen in ceramic tuyères. The rear face of the slag shows two elongate concave zones, with open vesicles suggesting chilling of the slag, largely in a non-wetting manner, against a surface with two raised areas and a cleft between. Such a slag might be generated in a variety of settings, but chilling of a slag (perhaps generated by the melting of the face of a ceramic tuyère) against a stone-faced wall of a smithing hearth would be one possible scenario.

Contents

Methods

All investigated materials were examined visually using a low-powered binocular microscope where necessary. All materials were summarily described and recorded to a database (Table 1). As an evaluation, the materials were not subjected to any high-magnification optical inspection, nor to any other form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional. It should be noted that after washing, the overall weights of materials were considerably lower than those originally recorded.

Results

The assemblage comprises 128g of material from two stratified contexts plus one fragment of unstratified material.

A collection from context c102 (rubble deposit below the floorboards) includes dense, grey, slags of clinker-like appearance. These slags are heavily rusted and two are showing substantial cracking, suggesting that they contain corroding metallic iron. One piece has corroded onto a mass of ashy/sandy residue with burnt stone and moulds of possible plant material. None of this material shows clear traces of coal residue (such as shale fragments), but the specimens most closely resemble iron-rich clinkers from a coal/coke fuelled smithing hearth.

Also from c102 were five large pieces of coke. Such coke might be associated with the metallurgical residues from the same context, but might equally be

unconnected fuel (for a heating system or a domestic hearth for instance).

Material from context c226 (a grave fill, probably of early 17th or late 16th century date) comprised a single small fragment of pale grey, vesicular, fayalitic iron slag. The lower surface shows adhering ashy deposits contain a small amount of charcoal. The upper surface shows a slight red tint in places, but otherwise the slag has an unusual pale grey-green colour, suggesting that it cooled under reducing conditions within the fuel bed of a hearth or furnace. This is a well-fluxed slag which must have been fairly fluid, but must be classed as being of indeterminate origin. Such slags are likely to be from iron working, but it is not possible distinguish with certainty between bloomery iron smelting and smithing on such a small fragment.

A single fragment of a glassy slag with abundant quartz-rich inclusions of coarse sand to grit grade was unstratified. The glass appears black in bulk, but in areas of thin glaze over quartz inclusions on the front face, the glass is shown to be green. The colour suggests an influence of wood ash in the generation of the slag. The slag resembles material formed during partial melting of technical ceramic in a metallurgical hearth. The rear face of the slag shows two elongate concave zones, with open vesicles suggesting chilling of the slag, largely in a non-wetting manner, against a surface with two raised areas and a cleft between. Such a slag might be generated in a variety of settings, but chilling of a slag (perhaps generated by the melting of the face of a ceramic tuyère) against a stone-faced wall of a smithing hearth would be one possible scenario.

Interpretation

Material from the rubble layer (c102) includes coke and probable coal/coke fuelled smithing waste. The dating of such material is problematic. Large pieces of coke are likely to represent material that was produced deliberately (as opposed to accidentally partially burnt coal). Coke was not used as a fuel prior to the early 18th century, and its use was not widespread until the end of that century.

The unstratified fragment of partially fused ceramic is of uncertain origin, but if it was also produced by smithing it is likely, but not certain, to indicate the use of a ceramic tuyère. Such tuyères were widely used in Ireland from the early medieval well into the post-medieval period. The onset of the use of wrought iron tuyères was late medieval in Britain and certainly widespread there by the early 18th century. There is some evidence for the continued use of ceramic tuyères in Ireland into the 18th and possibly the 19th centuries. The use of wrought iron tuyères in Ireland is currently unknown, although likely, and perhaps particularly so in urban areas. Cast iron tuyères supplant other forms in smithing hearths during the 19th century.

The small fragment of slag from grave fill c226 is difficult to date, but it appeared to be associated with the use of charcoal not coal/coke and this is in keeping with the likely early 17th to late 16th century date for the context containing it. The piece strongly resembles the colour and texture of unusually calcic medieval iron smelting slags from Ballykilmore, Co. Westmeath (Young 2009, in press), but the similarity may be purely fortuitous and other origins for slag cooling within the fuel bed are possible.

Evaluation of potential

The material has little potential for producing further useful information upon additional analysis. Accordingly, no additional investigation is recommended.

References

Young, T.P. 2009. Archaeometallurgical residues from Ballykilmore, Co. Westmeath, E2798, *GeoArch Report 2009/16*, 81 pp.

Young, T.P., in press. Chapter 10. Exploiting the bog: iron production and metalworking *In.* NRA Scheme Monograph for the N6/N52

Table 1. Summary Catalogue

context	weight	number	description
102	37	5	coke
102	40	2	iron rich grey slag of clinker-like appearance. Showing incipient explosion from iron corrosion.
102	39	1	iron-rich grey clinker-like slag attached to ashy/sandy residue with burnt stone, and moulds of possible plant material.
226	6	1	fragment of fayalitic slag, in grey lobes. One side shows contact on to ashy sediment, other shows some slight traces of red tint.
u/s	6	1	black glassy slag with quartz inclusions. Could be from a hearth wall/tuyère .

GeoArch

geoarchaeological, archaeometallurgical & geophysical investigations

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

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