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Assessment of possible residues, Dublin (13E238)

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Abstract

Assessment of material from this site covered two classes of material: a gritty calcite-cemented conglomerate that appears to have been generated by groundwater flow above an impermeable interface accompanied by calcite precipitation, and a sparse assemblage of residues from various coal-burning processes, including, but not necessarily limited to coal-fuelled ironworking (blacksmthing).

The use of coal for smithing suggests a late medieval or post-medieval age for those materials.

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Methods

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.

The examined materials are listed in Table 1.

This project was commissioned by Paul Duffy of Grassroots Archaeology.

Results

The calcite-cemented grits

All the fragments from the five collections of specimens were inspected and almost all fragments were of an identical lithology. The sediment comprises a clean (i.e. no matrix), well sorted, grain supported rock of mainly very coarse sand to small pebble grade, but with a few clasts ranging up to the large pebble grade (c. 30mm maximum dimension) and with some interstitial medium sand. A wide range of lithic clast lithologies were present, but most clasts were siliceous. The grains were moderately well rounded, although a degree of angularity was present in some of the larger clasts. A small proportion of the larger clasts were of a soft dark fissile shale.

The grains were cemented by a variably coloured pore-lining cement of carbonate, probably calcite. In many instances the cement has a surface formed of a milky-coloured smooth layer of appearance like ‘flowstone’. In a few instances a more persistent layer of this cement coats one surface of the sheet-like fragments preferentially.

Within the generally rather resistant grain types, there are a few grains which show a degree of rusting and reaction. Although the possibility of some anthropogenic input cannot be excluded, these generally appear to be oxidising natural materials apparently rich in iron sulphides.

The fragments were typically suggestive of occurrence in a sheet-like bed or beds, of up to approximately 30mm thickness, but probably mostly very much less. The sheets appear to show a gradation from a base (?) of well-cemented, well sorted grains, with otherwise large porosity where not occluded by the carbonate cement, to a top with indications of contact with a fine-grained sediment, with possible charcoal flecks in one or two instances.

One fragment was rather different from the others in comprising a large (40mm) angular piece of soft, fine, yellow brown material blotchy material, with a very smooth hard thin surface crust coated in calcite. This may either be a clast of a pyritic sedimentary rock, or perhaps a fragment from the base of the pit. If the material is from the pit base, then it may indicate that discolouration of the clay on the base may not necessarily be due to heating, but may be due to diagenesis.

Other materials

Other submitted materials were mainly a variety of materials associated with the burning of coal. These included two pieces of dense, flowed, black glassy clinker (the melted or partially melted, inorganic residue from the burning of coal), a collection of fragments of coke (partially burnt organic residue-probably true coke from the burning of coal) and two pieces of slag from coal-fuelled blacksmithing (iron-working). There were also two fragments of a manganese-rich concretionary material – probably natural mottling.

The clinker pieces are dense and fairly large (the larger fragment derives from a sheet at least 25mm in thickness). Although such clinkers might be produced in coal-fuelled iron working, they are perhaps more likely to have been generated in a larger coal-fired hearth – such as a boiler.

The coke fragments are less diagnostic, and although probably coal residues (and potentially from any use of coal as fuel), there is a small possibility they are coked organic materials with some other origin.

The ironworking residues are from coal-fuelled work, almost certainly blacksmithing. The deep glassy upper surface and the streak of glassy inclusion bearing sand grains, are suggestive of the incorporation of silicate material from a technical ceramic, rather than simply from the fuel.

Interpretation

The calcite-cemented grits

The grain-supported nature of the sheet material suggests it has formed as a ‘sieve deposit’, in which groundwater flow (apparently confined by whatever impermeable the deposit rested on) has removed any original matrix the sediment, leading to formation of a highly porous layer, into which a calcite cement has been precipitated. The smoothly re-entrant lower surfaces present on some pieces suggests they may have formed above a cobble-rich layer or surface.

Other materials

The other submitted materials are indicative of the use of coal for fuel, both for metallurgical purposes (ironworking) and potentially other purposes (such as coal-fired boilers). In the latter case, then clearly the date of the material would be from modern period (late 18th century onwards). The early use of coal has not been studied in a comprehensive manner for this area.

Although local use of coal developed on the Irish coalfields in the medieval period, it is likely that much of the coal use on the east coast was provided by seaborne trade from the British coalfields. This trade may have started as early as the 13th or 14th centuries in the Dublin area (poorly dated medieval coal use for smithing was documented at Carrickmines Castle, Young 2006, Young & Kearns 2010).

The presence of a partially melted ceramic component in the iron-working slag suggests that the forge may have employed a ceramic tuyère. In Ireland, the use of ceramic tuyères, introduced in the early medieval period appears to have lingered very late, possibly locally into the 19th century (for 17th century evidence see Dabal & Young 2011,for 18th-19th century see Young 2008, 2009). It is likely that the use of iron tuyères (at first of wrought iron, later of cast iron) would have penetrated the Dublin area relatively early (iron tuyères had been used in Britain since the medieval period) and a very late survival of the use of an Irish ceramic tuyère would be unlikely in this area. It might appear therefore, that the ironworking slag is likely to date from between the 14th and 18th centuries if coal-fuelled. The iron slag shares preservational state and colour with the later piece coal-fuelled material but is not entirely diagnostic in itself and could possibly be a piece of earlier material. Unlike the larger piece, it has no actual inclusions of coke - so it could be a charcoal fuelled slag but preservation in a similar environment has resulted in it having a similar colour to the more identifiable later piece. It is possibly small enough to be intrusive - but an early medieval date cannot be excluded.

Summary

In summary, there is no evidence for the direct involvement of any pyrotechnological processes in the formation of the gritty cemented deposit; rather it is the result of confined fluid flow producing a sieve texture, into which has precipitated a carbonate cement.

The heat cracked limestone overlying the deposit would be a potential source for the lime - but the wood ash (and perhaps even the shells) might have contributed too. Indeed, the limestone might have helped the sieve deposit develop by inhibiting downward movement of fine grained soil material. The lime, probably derived from these layers above, formed as a fresh precipitate out of the pore-waters in the basal gravel - so preserving no indicator of its ultimate origin.

The clinker indicates probable late medieval to modern activity – with the low density of finds indicating that any metallurgical activity was unlikely to have been within the excavated area. The small fragment of iron slag is of uncertain significance.

The material would probably not yield further useful information on detailed analysis, so this assessment recommends no further analysis. Unless there are strong archaeological reasons for doing so, the purely metallurgical significance of the material would not suggest a high priority for retention

References

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Table 1: Summary of supplied material

Context	Find	Weight (g)	Number	Notes
1	15	58	1	Smithing slag: fragment of slag sheet approximately 30mm thick. Base irregular with deep fuel dimples, some still containing coke (?) fragments. Basal part of sheet shows thin elongate crystals in pale glassy slag. Sheet gets glassier upwards, although partially devitrified near upper surface. Shows irregular inclusions of sand –grade grains in a darker glass – probably representing a ceramic (lining) inclusion. At least one large internal fuel (coke) clast.
2	10	16	1	Clinker: bleb of black vesicular glass with variegated brown/maroon/black surface with viscous swirls and crinkles. Some adhering clinker fragments and spheroids.
c3 c5		6	2	Manganese mottles associated with fine gravel.
4	3	2	1	Probable smithing slag: pale glassy vesicular slag fragment. Very similar to texture of slag from c1.
21	1	64	1	Clinker: dense black vesicular glass with slightly maroon surface and some partially melted rock fragments.
19, 21		4	7	Small pieces of coked organic matter, probably true coke.
<6> 8		712g,	49	This and following four items are sandy lime-cemented conglomerate, rounded clasts to 25mm,
<6> 8		600g	17	
<6> c57		724g	27	376g largest piece
<6> c58		502g	9	As others but some curved surfaces suggestive of cobble contacts. One curious angular piece of oxidised fine clay rich material, probably originally sulphidic.
<51> c45		180g	6	attached soil has flecks of possible charcoal

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