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Assessment of pyrotechnological residues from AC93, Grangegorman Lower, Dublin (CCLC14)

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Abstract

This small collection (58 pieces; 971g) includes a sparse assemblage of coal burning residues, together with a few concretions, some of which were on a corroded iron nucleus but others apparently are not.

Washing of one of the larger fragments of clinker produced a single example of a minute spheroidal particle, possibly spheroidal hammerscale, but similar spheroidal particles may result purely from the combustion process.

The materials are not necessarily indicative of metalworking. The single spheroidal particle is suggestive of a residue from blacksmithing residues, but is not conclusive. Clinker of this general type may arise from a variety of activities involving the combustion of coal, including heating boilers as well as 'industrial' processes. The association of the charnel trenches with the railway, may suggest an ultimate origin in railway steam boilers.

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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 Carmelita Troy, of Rubicon Heritage. The materials described here originated in the Luas Cross City Main Infrastructure Civil and Track Works, site AC93.

Results

Description of residues

The submitted materials amounted to an overall total of approximately 971g. Of this total, 854g (88% by weight) was forty two pieces of clinker. Coal use was also represented by one piece of coal (4g) and two piece of coke (<1g). The other component of the assemblage was provided by concretions and fragments of weathered iron (total 13 pieces weighing 113g).

Clinker

Clinker is the product of partial melting of the inorganic component ('ash') of coal. It may be formed by the combustion of coal at high temperatures. It may be formed during metallurgical processes, particularly blacksmithing when the iron lost from the workpiece is a relatively minor component of the partially melted residue in the hearth. The most frequently-encountered clinker deposits are those from coal-fired boilers.

The clinker in this assemblage is mainly in very small pieces and demonstrates little diagnostic morphology. It is rich in fragments of coal shale, and very pieces approach a texture suggestive of a fully molten state.

The material from context 24 s83 was washed and picked magnetically. One possible spheroidal hammerscale particle was recovered from amongst the

coal shale debris. Although true spheroidal hammerscale would be indicative of blacksmithing it is usually subordinate to the more common flake hammerscale. Spheroids may also be generated through the dripping of molten material within the hearth.

Other coal residues
There was one piece of fresh coal and two fragments of coke (the organic material residual from the partial combustion of coal).

Concretionary material
The collection contained thirteen pieces of concretionary material with a weight of 113g. Some of this material appeared to be simple corrosion deposits from iron (i.e. 'rust'), with at least one of the elongate concretions probably having formed around a corroded nail. Other concretions were certainly cored on iron (determined by testing with a small metal detector), but some were not, with at least one probably being cored on a ferruginous clinker fragment.

Distribution of residues
The stratigraphic distribution of the residues is illustrated in Table 2.

Most of the clinker derives from charnel trenches [16] and [22], with only very minor quantities from other deposits.

Interpretation

This clinker within this collection is of uncertain origin, but is likely to be non-metallurgical in origin, perhaps deriving from a coal-fired boiler or similar use of coal. An origin in blacksmithing cannot, however, be entirely excluded (and might be supported by the single particle suggestive of spheroidal hammerscale). If the residues are from blacksmithing then they might be of any period from the late middle ages. If they derive from a boiler, then they are most likely to be later post-medieval in date. The clinker was dominantly recovered from the two charnel trenches, which may suggest an origin either from the upper layers into which those trenches were cut (perhaps the 'cinder path', which itself only contributed a single coke fragment to the studied assemblage) or perhaps as waste from the railway itself (as waste material from steam boilers). Because railways produced so much clinker, it is common material in constructions related to railways (line formation, tracks, paths, drainage…).

The concretionary materials derive from the weathering of iron-bearing precursors, probably including both small iron objects (nails?) and clinker. The preferential occurrence of the concretionary material in grave fills may reflect on origin in the corrosion of coffin fittings.

Further work

Unless there are strong archaeological reasons for pursuing further testing of the clinker, then no further analysis is recommended.

The residues are not of sufficient interest to require submission as part of the physical site archive, unless there are specific archaeological reasons (such as derivation from context of medieval or earlier date) that increase their significance.

Table 1: summary catalogue. Weights in g.

context	sample	s wt	item wt	item no	notes
3	107	<1	<1	1	coke
17	86	52	52	2	dense clinker pieces
17	105	3	3	1	shale-rich clinker
21	77	21	21	3	concretionary material-possibly on clinker, probably associated with a (missing) iron object
24	78	24	24	1	corrosion on iron object
24	79	193	186	4	dense shale-rich clinker. Rather lobate form, dense slag lobes with large shale inclusions.
24	83	200	128	9	shale-rich clinker
			58	1	dense slaggy clinker, brick red lobed surface on one side (probably downwards), the other is dense and more planar. Possible reaction with ceramic to give the dense gravelly/sandy clinker?
			8	1	iron rich concretion
24	84	218	210	6	shale-rich clinker - some with very large inclusions of shale up to 50mm across
24	108	2	2	1	shale-rich clinker
24	109	<1	<1	1	coke
24	110	<1	<1	1	clinker
24	111	<1	<1	1	clinker fragment
24	112	5	5	1	shale-rich clinker
24	113	14	14	3	shale-rich clinker

context	sample	s wt	item wt	item no	notes
24	114	<1	<1	1	clinker fragment
24	115	4	4	1	coal
24	117	100	95	4	clinker and shale-rich concretion, probably fragments of a single item
24	223	17	15	1	shale-rich clinker
24	224	10	10	1	dense vesicular grey vesicular slags
24	266	3	3	1	variegated clinker, with shale clasts and some probable sandstone
25	116	7	7	1	shale-rich clinker
38	88	29	29	1	dense glassy gravelly clinker, dark glass grading pale yellow-green around partially melted inclusions; maroon surface, with an invagination containing a coke lump
38	106	5	5	1	clinker
40	89	16	16	2	ferruginous concretion with an irregular curved contact face, must have formed in contact with an impermeable object. Possibly a stone, concretion contains fine plant material (twigs or straw??)
88	63	3	3	2	ferruginous concretion, including clinker
101	57	14	12	3	fragmented concretion on elongate piece of iron-nail shank?
130	69	67	29	1	irregular concretion on iron
			32	1	clinker on shale fragments, largest 65mm across

Table 2: summary of distribution of material types. Weights in g.

context	coke		clinker		concretion		coal		nature
	no	wt	no	wt	no	wt	no	wt	
3	1	<1							garden soil
17			3	55					fill of charnel trench 016
21					3	21			interface of garden soil and subsoil
24	1	<1	35	726	2	32	1	4	fill of charnel trench 022
25			1	7					cobbled path within penitentiary garden
38			2	34					fill in drainage channel
40					2	16			deposits where channel truncates charnel trench
88					2	3			fill of grave cut 100
101					3	12			fill of grave cut 088
130			1	32	1	29			fill of grave cut 129
									garden soil
total	*2*	*<1*	*42*	*854*	*13*	*113*	*1*	*4*	

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