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Assessment of industrial residues from Greyfriars, Gloucester (GFG/26/EV)

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Abstract

This report details a small collection of 21 hand-picked items with a total weight of 4.6kg and a total of 9.5kg of residues from two bulk samples.

The majority of the residues (and all those from the more superficial contexts) were waste from the burning of coal, probably in boilers. The material is very fresh and likely to be relatively recent.

Some of the material from lower contexts in Test Pit 4 is slag from ironworking (smithing) using charcoal as fuel. Although not strictly dateable, this is likely to be pre-industrial. This includes two large intact iron-rich smithing hearth cakes (SHCs) with weights of 772g and 1384g. If medieval or later, these may be from blacksmithing (as are likely to be two fragments from smaller SHCs). If as early as Roman, they might instead be indicative of bloomsmithing (the working of raw blooms into finished iron).

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Methods

Background

This assessment was commissioned by Rhiannon Philp of Archaeology Wales. The materials described and assessed here arise from field evaluation undertaken at Greyfriars, Gloucester. The site code is GFG/26/EV.

Assessment

All submitted materials were examined visually in May 2026, using a low-powered binocular microscope where required. They have been examined and assessed (Tables 1 and 2). No instrumental analysis has been undertaken.

Results

General

The submitted assemblage comprised 21 hand-picked items with a total weight of 4.6kg and the residues from two bulk samples (sample <1>, (205), 5.1kg; sample <2>, (404), 4.4kg). The materials all derive from two of the test pits of the evaluation: test pits 2 and 4.

The samples contain three suites of materials. Almost the entirety of the bulk samples from contexts (205) and (404) comprises clinker and other fuel waste, probably from boilers.

The hand-picked materials from Test Pit 2 (contexts (205), (206) and (207)) were also elements from the assemblage of clinker.

Test Pit 4 also produced hand-picked items of clinker (from contexts (407) and (412)) but, in addition, there were examples of charcoal-fuelled smithing slags from contexts (407) and (408), and vitrified hearth lining materials from context (411). Context (408) also yielded a small fragment of sheet iron contained in concretionary material.

Details

Iron smithing slag: two intact dense smithing hearth cakes (SHCs) and fragments of two others were hand-picked from contexts (407) and (408) in Test Pit 4.

The two intact examples (both from context (407)) are large (772g and 1384g). Their density and rusty surfaces suggest a high iron content. Although medieval and later SHCs from blacksmithing may attain such a size, if these examples were to be as old as Roman, they would possibly indicate bloomsmithing (the working of raw blooms into finished iron). The density and high iron content could also potentially support such an origin, but do not positively confirm it.

The two partial examples (one from (407) and one from (408)) appear likely to derive from smaller SHCs and would be compatible with an origin in blacksmithing.

Hearth Ceramic: three fragments of bloated reduced-fired ceramic with a slagged surface from context (411) with a total weight of 126g are compatible with derivation the wall of a smithing hearth or bloomery iron furnace.

Iron: a small (18g) piece from (408) represents a thin mineralised piece of sheet iron. One surface shows residual material suggesting the concretion had formed in contact with a piece, or pieces, of oolitic limestone.

Residues from coal-burning: almost the entirety of the bulk samples <1> and <2> from contexts (205) and (404) respectively comprises clinker, coke, coal shale and unburnt coal. Some of the shale fragments were very large (>110mm), indicating the burning of an impure coal in large pieces. Much of the clinker is fine-grained (including droplets from mm to cm scale) and fragmented, but some pieces are large. These indicate accumulation of a flat, or slightly concave surface. Some coke fragments are large, but the fresh coal is mostly very fine-grained, potentially dust that has been dropped or which has fallen through a fire-grate.

There is no indication of a metallurgical origin, and the material is too coarse for typical domestic waste. Deposits such as these are typically waste from the fire-boxes of boilers. It is not possible to differentiate the waste from boilers used as power in industrial works, in motive power, or in heating facilities

Natural materials: small pieces of stone were very minor components of bulk samples <1> and <2>. In particular, sample <2> produced two small hard brown rounded pebbles of quartzite or meta-sandstone, probably derived from local river gravels.

Interpretation

The material suggests derivation from two sources: some items from contexts (407), (408) and (411) are all compatible with ironworking (smithing) using charcoal as fuel and are likely to be ancient. The two intact SHCs are sufficiently large and iron-rich that they may possibly (but not certainly) be indicative of bloomsmithing.

Other materials (all those from Test Pit 2, plus some of those from context (407) and all from contexts (404) and (412) in Test Pit 4) are derived from the high

temperature burning of coal, mostly likely within a boiler. Such materials might have an origin from the 18th century to the present, but the material appears extremely fresh and an age towards the younger end of that spectrum is likely.

Both the nature of the clasts (Table 2) and the size distribution across the various fractions (Table 3) is very similar for samples <1> and <2> and they may therefore potentially derive from different parts of the same deposit.

Further work

No further work is therefore recommended, unless any specific archaeological questions are raised about the origin of the material.

Table 1: catalogue of submitted hand-picked materials. Weights in g.

Context	Item wt.	Item No.	Notes
205	37	1	large piece of coke
	232	1	large complex block of clinker, very irregular, contains coke and very large pieces of bloated rock
206	214	6	clinker, locally with large shale fragments, some well flowed material with coke fragments between lobes,
207	77	1	irregular fragment of clinker, rusty, coarse sand accreted to surfaces, contains some coke, unclear if a single particle, one piece is a glassy slag
407	1110	1	large slab of clinker, top shows abundant coke particles, brownish; lower surface with more shale than clinker, but clinker shows lobes; 240x140x70mm.
	772	1	very dense, rusty, SHC. 95x105x45mm, plano-convex, charcoal fragments in basal accretion, top too rusted for details,
407	3	1	small ashy clinker fragment
	1384	1	130x130x80(55)mm; large dense biconvex SHC; some charcoal visible on base; heavily accreted, bone and burnt bone in upper accretion, unclear if upper convex part is slag or just rusty accretion; one margin shows somewhat flowed lobes; most rather too accreted to show details; base has pale grey accreted ceramic.
407	230	1	fragment of a smallish conventional SHC; slightly irregular; rusted top shows abundant mineralised plants from the burial environment; the base and fracture show abundant internal charcoal; 35mm thick
408	133	1	part of a small conventional SHC, probably fractured during excavation; 35mm thick; plano-convex; indurated reduced sandy ceramic attached to one side of bowl, some sandy lining slag on top; section shows highly vesicular but dense and rusty slag bearing large charcoal clasts
	18	1	flat concretion containing thin sheet of iron; one side in contact with oolitic limestone, the other side sandier concretion; iron 30x50mm x 1-2mm? thick
411	52	1	flowed inflated lobe of lining slag, variable brown to blue on surface, surface has accreted charcoal within basal dimples; highly bloated interior.
411	74	2	fragments of sandy lining slag; rather complexly flowed in places, lifting off probable wall face; some areas look clinkery, but probably standard lining slag
412	200	1	slab of clinker, base carries large pale shale fragments; top brown, smooth; locally lobate, locally glassy, has attached fine debris include ash, coke and clinker spherules
	76	1	thin slab of clinker, one brown smooth surface, one darker surface with embedded debris of shale and lacy FAS derived from shale

Table 2: catalogue of submitted bulk residues. Weights in g.

context	sample	fraction	weight	notes
205	<1>	less than 2mm	1176	shale fragments, clinker fragments, clinker droplets, fresh coal, coke
		2mm to 5mm	559	shale fragments, clinker fragments, clinker droplets, fresh coal, coke
		5mm to 10mm	623	coke and clinker mostly, lesser coal and shale
		greater than 10mm (1)	926	shale to 110mm, mostly clinker, some coke
		greater than 10mm (2)	1784	shale to 110mm, mostly clinker, some coke
404	<2>	less than 2mm	934	shale fragments, clinker fragments, clinker droplets, fresh coal, coke
		2mm to 5mm	744	shale fragments, clinker fragments, clinker droplets, fresh coal, coke
		5mm to 10mm	593	shale fragments, clinker fragments, clinker droplets, fresh coal, coke
		greater than 10mm	2132	larger pieces of burnt (or even almost fresh) shale, mostly clinker and smaller coke pieces; 2 red/brown quartzite(?) pebbles

Table 3: comparison of the grain size of the bulk samples. Weights in g.

Fraction	% of fraction	
	<1> {205)	<2> (404)
greater than 10mm	53%	48%
5mm to 10mm	12%	13%
2mm to 5mm	11%	17%
less than 2mm	23%	21%

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