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Assessment of materials from the Beorma Quarter, Birmingham (BQBD20/23)

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Abstract

The submitted materials comprised approximately 33.6kg (199 pieces) from 22 archaeological contexts.

The assemblage as a whole suffered from poor preservation, including the weathering and leaching of slags, concretion formation (obscuring details of the materials) and the formation of secondary minerals, including jarosite. Accordingly, much of the material is either unidentifiable or only identifiable with some qualification and/or uncertainty.

Approximately 11kg (one third) of the assemblage was only identifiable as 'concretion', with uncertainty as to what constituted the core of the concretion (e.g. slag or iron) or indeed if there was a specific core.

A further one third (12kg) of the assemblage was slag from iron working, in the form of smithing hearth cakes (SHCs). This material spanned across the medieval and post-medieval periods, including some examples where the fuel was identifiable as charcoal (mostly in the earlier material), whereas where the fuel was determinable in the later material it was typically coal. For most of the SHC material, however, the fuel was not determinable.

Some 7.8kg of the assemblage was provided by fragments of crucibles from copper-alloy working (with several crucibles still containing a substantial volume of slag) and by slags with copper-alloy staining, possibly from the crucible furnace. These were of a form compatible with a date in the 18th or 19th centuries.

The assemblage also included approximately 1kg of material that was mainly concretionary or weathered, but that had been ferrous metallic objects. Amongst these were fragments of thin sheets of mineralised iron with a pale surface coat, possibly indicating the iron had been tinned, although this would require verification. One sheet metal object appeared to be a fragment of a small vessel with a small external loop handle.

Other materials included fragments of coal and clinker, brick/tile and some fuel ash.

Contents

Abstract 1

Contents 1

Methods 1

Results 1
- General nature of the assemblage 1
- Copper-alloy melting residues 2
- Iron smithing residues 2
- Other materials 2

Interpretation 2

Further work 3

Table 1: summary catalogue 4
Table 2: residue types by context 10

Methods

All materials were examined visually, using a low-powered binocular microscope where required. The identifications of materials in this report, as an assessment during which no instrumental analysis was undertaken, are necessarily limited and must be regarded as provisional.

This assessment was conducted in October 2023 and was commissioned by Julie Franklin of Headland Archaeology. The materials derive from excavations in the Beorma Quarter, Birmingham, by Headland Archaeology.

Results

General nature of the assemblage

The submitted materials comprised approximately 33.6kg (199 pieces) from 22 archaeological contexts.

The assemblage as a whole suffered from poor preservation, including the weathering and leaching of slags, concretion formation (obscuring details of the materials) and the formation of secondary minerals, including jarosite. Accordingly, much of the material is either unidentifiable or only identifiable with some qualification and/or uncertainty.

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Other materials included fragments of coal and clinker, brick/tile and some fuel ash.

Copper-alloy melting residues

The melting of copper alloys is represented principally by several fragments of moderately large crucibles. The crucibles are formed of a fine, hard fabric that is a pale cream colour in a possibly unused example, passing through grey and commonly with a lilac colour in the well-used pieces (from metal, possibly particularly zinc, absorption in the ceramic body.

Several fragments are well used but show clean interior surfaces with only mild slagging. Others show a large amount of internal residues, with examples of both dross and a green glassy slag. One example shows the meniscate base of a slag layer.

The cleaner sherds show horizontal lines on the exterior surface, possibly suggesting they were wheel-turned rather than mould formed. None shows a manufacturers mark.

There are a few clinkery slags with a greater or lesser degree of copper alloy corrosion products showing on their surfaces. These are likely to have been produced through slight spillage inside the crucible furnace.

The crucibles are not closely dateable but are a high quality industrial product of the period before the introduction of new materials for crucible manufacture in the late 19th century. These examples are probably 18th – 19th century in date.

Iron smithing residues

Iron smithing is represented by an assemblage of material that is identifiable as smithing hearth cakes (SHCs). The slag masses form in front of and below the blow hole in the side-blast smithing hearth from the reaction of fuel ash, iron/iron oxides from the workpieces and cermaic from the hearth wall. They typically show a plano-convex or concavo-convex form, although the form may be more amorphous in examples formed in a hearth with an iron tuyère (not a ceramic wall/tuyère) and with coal fuel. In this situation the slag produced may form less compacted prilly masses.

In many cases in this assemblage the SHCs are heavily accreted, obscuring details of their morphology, hiding indicators of the fuel employed and, in some cases, creating uncertainty over whether the enclosed slag is even a SHC.

Both coal and charcoal fuelled examples are present. Table 2 attempts to separate the SHCS by fuel employed as far as is possible. One of the charcoal-fuelled SHCs is from a context spot-dated as medieval and this may provide a hint that the medieval smithing was not exploiting the regions coal resources. Most of the later SHCs are coal fuelled.

Two examples of SHCs from context (6182) show the moulded imprint of a 90mm diameter tip of a tuyère, probably of cast iron.

The SHCs are typically quite large, but detailed treatment of their weight is not possible because of the poor preservation and the small number of examples from any single period. The sizes (with a range of 200-700g for most examples) do however indicate that they were produced dung blacksmithing.

Other materials

The materials also include a number of iron artefacts, most notably those from context (6064). With highly corroded fragments, such as those present in the assemblage, it is not possible to discriminate between manufacturing waste and domestic waste. The occurrence of multiple fragments of thin mineralised sheet iron, mostly with a pale-weathering surface coating (perhaps remnants of tinning) might possibly suggest production waste in this instance, but this is far from certain.

Some of the iron artefacts, particularly the small handled vessel fragment from (6064) would benefit from review by an appropriate artefact specialist.

The metallurgical residues are accompanied by fragments of brick, coal and coal residues, together with pottery and clay pipe indicative of broader waste disposal.

Interpretation

The residues represent a rather small assemblage given the extent of the excavations and the wide age range of the deposits encountered. This suggests that metallurgical activity was probably not a prime concern within the limits of the site, but that material had been deposited into the area over a long period of time.

There appears to be a long-lived background of iron working that intensified in the post-medieval period. Waste from a nearby works casting copper alloys was deposited on the site in a later phase.

Further work

This material is an indication of metallurgical activity in the vicinity of the site, but the relatively low volumes suggest that it may not have been within the bounds of the site.

The iron slags are poorly preserved and there would be little additional archaeologically useful information to be gained from their further analysis. The crucible residues are sufficiently well-preserved that they could yield valid analytical data, but if they derive from an off-site source then further details may have little archaeological benefit for the understanding of this site.

Accordingly, no additional detailed work on the residues is recommended at this stage.

As noted above, the ferrous artefacts may be worthy of inspection by an appropriate specialist.

Table 1: summary catalogue, weights in g.

Context	item wt.	item no.	notes
6020	64	1	slightly exploding lump of rusty material - may be iron fragment rather than slag
	254	3	pale sandy concretionary lumps, core not seen, no MD response - so possibly slag
6056	136	1	crucible base, 48mm int. diameter; 27mm thick; Cu-alloy green staining inside out and on breaks, lilac fabric
	1555	2	joining sherds of upper 120mm of crucible; c150mm in ext diameter at rim, but not circular; interior bears large quantity of Cu-alloy dross, external surface just thin clinkery film; wall 12-15mm at fracture; wall inwardly inclined, slight with just hint of everted rim, wheel marks on inside
	120	1	body sherd 22-26mm thick; pale greenish interior slag, external surface shows thin film,
	390	3	similar sherds of crucible rim, slightly everted on inturned wall; c150mm diameter, wall 14mm to 20mm at rim
6056	2180	1	half of base of crucible, extending to max height of 135mm, approx 120mm diameter at that height; wall 14mm; base 120mm ext diameter, 40mm? Internally, 22mm thick, walls 20mm thick 70mm up; external clinkery film, slightly patchy dimpled clinker in small areas of base, slag fill 80-90 mm thick (meniscus rises on margins); mainly green and glassy; smooth slightly dimpled top, internally much weathered drossy material.
	2070	1	slag filled half a crucible, rim and base missing; base of slag fill is a neat glassy surface which presumably rested on metal below; slag 90-100mm thick, top very iron rich and with coke, bottom glassy green; over this thickness the diameter increases from 100 to 120mm, wall thins 22-18mm
6056	166	7	dark dense slag with abundant green corrosion products
	188	1	dark dense clinkery slag with a few specks of green corrosion; bears abundant shale clasts,
	144	1	110-120mm diameter, vesicular slag, locally prilly, white corrosion products, slag greyish, descends in slight lip on flat base - probable metal contact; some green corrosion products, outer face shows slight prills
6062	52	1	nub of dense clinkery slag, abundant coal in accretion
6084	478	1	85x95x65mm deep SHC heavily accreted but dense upper slab over prilly probably
	56	1	vitrified face from hearth ceramic
	66	2	stones
	8	1	slagged coal shale
	26	1	brick/tile fragment
	6	1	mortar?
	132	1	small SHC or probably fragment of SHC
	132	1	SHC-shaped rounded mass of dense slag
	122	1	crudely SHC shaped mass of clinkery pale grey slag
	302	4	fragments of grey clinkery slag, fractured, showing some flowage in most cases
	26	1	palmate horizontal flow of dense slag

	184	2	fragments of small prilly SHCs
	62	1	accreted corroded iron ring c. 50mm external diameter
	14	1	iron ring, section 10x2 mm, 30mm diameter
	222	1	curved very dense mass, unclear if slag or corroded iron
	60	1	accretion covered iron fragment, probably trough-shaped, 60mm long and 30mm wide
	58	1	50mm length of iron bar 15x12mm section
	14	1	side of small metal object (vessel) with loop handle on exterior 30mm wide, 15mm tall, 5x3mm section; wall section just 1mm thick, mostly appears as iron, but has one area of green corrosion
	44	1	65x16x3mm (approximate) iron object in corrosion
	76	4	accretions with 50mm long nail-like objects
	38	1	iron fragment
	410	17	concretionary fragments, some certainly on iron
	34	3	weathered slag fragments
6165	10	1	dimpled irregular lobed bleb of dense dark slag
	202	1	rounded red-coated lump pf probable SHC, charcoal in accretion
6165	104	1	irregular lump of iron, accreted and starting to explode
	414	2	rounded concretions, no MD response, core uncertain
6165	22	1	concretion on iron fragment, square, c20mm across, 10mm thick
6178	660	1	weathered rusty, almost purple in places, rounded mass; 115x85x90mm; shows a brick contact and sulphidic weathering with yellow powder (probably jarosite)
	44	1	rounded weathered slag lump
6178	738	1	curious rounded mass, probably slag, adhering to part of a firebrick?, yellow weathering products and coal embedded in slag. Probably an SHC, but unclear
6178	188	1	crucible fragment; 130-140mm external diameter at rim, rim appears everted but outside planar, inner slightly funnelled; 15mm wall to about 8mm below rim. Interior flesh-coloured glaze, locally pinker, locally greener, wall inner section grey, red brown outer part,
6182	526	1	crucible base in white/cream fabric; no internal residues; lightly sooted base; base 77mm external diameter; rounded interior, 60mm diameter 50mm above base; base c35mm thick; wall 20mm at 50mm above base, profile curves in very slightly towards base
	92	1	crucible body sherd, purple near interior, lilac in body; thin slag skin externally, internal small amount of iron rich slag; wall varies 15-18mm, darker and greyer towards outside

6182	478	1	large ovoidal block of dimpled slag, slightly exploding, 110x85x65mm
	208	1	100x60x50mm pear shaped highly weathered decomposed slag, probably an SHC
	236	1	angular block of prilly grey slag, minor shale clasts
	248	1	angular fragment of grey, friable, slightly exploding, highly weathered slag; one face shows a planar smooth surface, probably a decomposed thin sheet of iron
	1	1	coal
6182	732	1	badly decomposed piece, appears to have finely prilly slag mass attached to probable decomposed hearth ceramic
	34	2	fragments of decomposed material probably broken from above
	780	1	65x70x50mm; small exploding very rusty SHC concreted to part of a 40mm thick red brick.
6182	24	2	coal
	150	1	concretionary block with slag, coal and sheet of iron with fold at one end, surface of iron pale film; so potentially tinned (see also two spalled pieces below and 248g piece above)
	170	1	rounded mass of slag, or slag containing concretion, includes length of roundwood 8mm in diameter
	76	1	rusted microprilly slag, in biconvex shape triangular in plan
	92	1	small concavo-convex high Fe SHC, pendent slag prills on base - just possible that top is curved iron sheet not just dished slag
	22	1	curved rusted and concreted sheet iron up to 3mm thick
	4	2	spalled fragments of surface of material from 150g piece
	8	1	concretion on weathered iron fragment
	28	1	weathered slag fragment
	12	1	weathered slag fragment
6182	608	1	large exploding concretion, one end is slag, but remainder is coal-bearing concretion
	14	1	coal shale
	96	1	angular lump of prilly clinkery slag
	64	1	ferruginous concretion
	420	1	concretionary mass at least 70% of which is a finely prilly slag
	54	2	concretion
	214	1	concretionary mass, but probably most a single SHC
	308	1	100x90x60 prilly SHC in concretionary mass
	510	1	concretionary mass with stone and coal, but with microprilly lump on one side
	190	1	80x80x40mm dense SHC or flow lobe? Coal accreted onto top obscuring the details
	128	1	weathered and hollowed finely prilly SHC, part missing

6182	388	1	dense large concretion
	148	1	rusty concretion
	154	1	rusty concretion, probably mostly slag
	98	1	elongate rounded piece of pale glassy clinkery slag
	36	1	concretion fragment mostly finely prilly slag
	160	1	dense concretion, not certainly slag
	20	1	curved piece of corroded iron, outside radius c35mm, subtends 160°, mineralised layer shows approximate oval cross section 10x7mm
	20	1	curved mineralised iron in concretion; radius is 20mm, piece is thin and 20mm wide, subtends 160°
	70	3	small ferruginous concretionary fragments
6182	58	12	coal, coal shale and coke
	50	1	concretion, mainly stone
	30	1	dense slag flow, probably a flap down hearth wall
	34	11	fragments of iron and white-coated material
	46	1	probable dense slag flow, but so rusty on one surface it might contain some iron
	38	1	concretion containing a further 180° of the handle-like piece above, more heavily accreted to little to add - except probably a circular piece
	766	1	concretionary mass, probably a large SHC with a basal spike, but very altered if so, 120x120x95mm
	90	1	lump of amalgamated prilly slag
	44	1	rounded concretion
	20	1	concretion fragment
	68	1	stone
	16	1	concretion fragment
6182	626	1	concretionary mass including large stone. Concretion contains clay pipe with narrow bore (probably late 18th/19th century)
	276	1	concretionary mass, some possible slag
	270	1	concretionary mass, wood contact on one side, possible metal contact on opposite
	34	bits	debris
	270	1	100x70x60mm, cuboidal SHC with coal attached to top; dimpled base; proximal end shows part of an annular impression with a curved cross section of an iron tuyère tip 90mm in diameter
	646	1	140x120x70mm, probable badly weathered prilly SHC with some distal areas rising above other planar top
	642	1	130x150x180mm, large weathered SHC; 90mm diameter tuyère tip imprint, prilly slag with abundant coke
	484	1	concretion, possibly prilly SHC, but slag only visible on two faces of concretion
	446	1	incomplete SHC with deep prilly bowl and denser upper plate with flow; irregular shape - possibly displaced SHC in lower part
	504	1	dense prilly mass in concretion, probably SHC but on details visible

6262	28	1	dense vesicular iron slag fragment in sandy accretion
6287	302	1	worn rounded lump of highly weathered charcoal-bearing slag - potentially an SHC, but no detail preserved
	50	1	finger of iron slag with smooth top (flowed) and dimpled base
6365	130	1	concreted sand, core uncertain
	26	1	stone
	98	1	stone
	510	1	dense rounded lump of concretionary material, shows some prills on surface, so may have a core of slag
	8	1	small fragment, same as 120g piece
6598	928	1	dense pear shaped, plano-convex dense mass concretion with prills appearing in various places, so probably a large prilly SHC inside
6677	298	1	small SHC, preservation good (slag dark), but hollow; 100x85x55mm; prilly, small amount of coke, rusty
	604	1	horseshoe-shaped SHC, with gap presumably where tuyère blew; 130x130x60mm; notch 40 mm deep; prilly iron slag, microprilly on base; better preserved than most of the slag from the site
6745	196	2	slabs of white porous probably calcareous material with charcoal and impressions of wood/charcoal; possibly indurated ash rather than a fuel ash slag
6798	254	1	irregular block of flow-lobed slag in several layers dipping away from margin?; covered in yellow weathering products (?jarosite)
6839	984	1	large, 130x130x60mm, rounded concretionary block; it is plano-convex so it suggests being an SHC, but no slag is showing; it might need a very aggressive clean to remove the outer layers of concretion for confirmation
6942	44	1	L'-shaped fragment of concretionary red sand - core if any is unclear
	104	1	round lump of accretionary red sand, some rust on surface, core uncertain
6946	112	1	concretion of red sand with charcoal, core unknown
6958	130	1	rounded accretion of red sand with both coal and charcoal, core not seem
6966	252	1	slightly lilac partly-conical slag lump; clinkery slag; probably SHC, 50x90x55mm
7155	790	1	highly weathered rounded iron slag mass; 80x90x110mm; slag microprilly/granular; coal fragments in accretion
	678	1	130x120x75mm, highly weathered crudely plano-convex slag block

	276	1	sub-triangular tabular fragment of highly weathered iron slag
	160	1	rounded lump of highly weathered iron slag
7155	176	1	small SHC, 55x85x35 p-c, grey, not brown as other 7155 material, probable charcoal clasts
	652	1	weathered brown rounded mass, 100x90x80mm biconvex, dimpled base
7410	320	1	irregular mass with several protruding spikes, could be rodded SHC, but slag details visible through accreted red sand
7418	1	1	fragment of pale green glassy prill
7418	132	1	dense dark prilly slag with pale material on root, viscous, melted brick? adhering sediment contains hammerscale

Table 2: weight in g of slag classes by context.

Context	concretion	ferrous artefact	clinker slag	SHC coal	SHC charcoal	SHC fuel indet	other Fe slag	crucible	Cu slag	hearth ceramic	coal etc	other	total
6020	254	64											*318*
6056								6451	498				*6949*
6062			52										*52*
6084	410	588	392	122		926	60			56	8	32	*2594*
6165	414	126				202	10						*752*
6178						738	704	188					*1630*
6182	7892	296	430	1230		3172	1466	618			97		*15201*
6262							38						*38*
6287					303		50						*353*
6365	648												*648*
6598						928							*928*
6677				298		604							*902*
6745												196	*196*
6798							254						*254*
6839	984												*984*
6942	138												*138*
6946	112												*112*
6958	130												*130*
6966						252							*252*
7155				790	176	1330	436						*2732*
7410							320						*320*
7418							133						*133*
total	*10982*	*1074*	*874*	*2440*	*479*	*8152*	*3471*	*7257*	*498*	*56*	*105*	*228*	*35616*

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