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Assessment of archaeometallurgical residues from Hinkley Point (HINK16 9216)

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Abstract

This was a small assemblage (2.5kg of residues, from 37 distinct contexts), with just 4 contexts yielding more than 100g of archaeometallurgical residues.

Although the precise of technological origin of many of the small fragments could not be determined with any certainty, the only process for which there was certain evidence was blacksmithing (the end use of iron in the making and repairing of artefacts) and all the recovered materials were compatible with an origin in blacksmithing.

The smithing residues were mainly (perhaps entirely) of latest Iron Age to Roman age; the small amount of macroscopic smithing hearth cake material was of a size similar to examples from other blacksmithing assemblages of this period.

The low density of the collections comprising the assemblage suggests that the material had been dispersed across the site, and that the focus of the blacksmithing was not in the investigated area.

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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 Katie Marsden, of Cotswold Archaeology.

Results

Description of residues

This was a small assemblage (2.5kg of residues, from 37 distinct contexts), with just 4 contexts yielding more than 100g of archaeometallurgical residues.

Although the precise of technological origin of many of the small fragments could not be determined with any certainty, the only process for which there was certain evidence was blacksmithing (the end use of iron in the making and repairing of artefacts) and all the recovered materials were compatible with an origin in blacksmithing.

The summary catalogue of the material is presented in Table 1.

Smithing slags

There was just one complete example of a smithing hearth cakes (SHC), but several substantial fragments were also recovered:
60069, 202g complete SHC
70528, two fragments close to half of original SHCs, total weight 266g
70562, 326g incomplete SHC (60%?)
70683, 126g incomplete SHC (40%?)

The evidence from those pieces is supplemented by that from a small number of small fragments:
60069, 44g fragment
60228, 20g fragment

70053, 37g fragment
70057, 48g fragment
Several of the pieces indicate a structure in which the lower part of the SHC was formed of fine-grained slag, but with much coarser-grained olivine present in the upper part, where it formed a honeycomb structure in one instance.

These general observations are typical of small SHCs (a size range of 200g to 600g is likely for the original cakes from which the present fragments derive).

Evidence for the fuel employed was poor, but favours the use of charcoal.

Other iron slags that were not identifiable as SHC material were also recorded, including 477g of mostly blebby slags from (60096) suggestive of slags cooling with the hearth bed outside any SHC, and 168g of somewhat similar slags from (70562) which had dimpled external surfaces. Small amounts of non-diagnostic, but dense iron slag, occurred across many contexts, with many of these pieces probably being fragments of SHCs that are too comminuted for identification as such.

Some extremely fine grained material, provisionally identified as a fine-gained iron slag, was derived from contexts (71379) and (71442). One of these contexts has been placed in Phase 4, the other remains undated. The nature of this material remains uncertain.

The assemblage was remarkable for containing little or no evidence for smithing microresidues (hammerscale). This may be dependent upon the sampling regime, but may also be a genuine reflection of the material in the sampled contexts.

Hearth lining and associated residues
In addition, there was a total of 283g of vitrified hearth or furnace ceramic and 112g of slag derived mainly from the melting of the wall, with little input of iron. Neither group could be attributed to a process with any certainty and most of this material occurred in very small fragments. All was compatible with an origin in the lining of ironworking hearths.

Fuel ash slag
Small particles of fuel ash slag were identified. There were no large collections, such as may commonly occur from clearance of a cereal-drying kiln. The material was all non-diagnostic and probably shared its origin with the ironworking residues.

This material may, in some cases, be gradational with pieces classed as bloated ceramic. Intense bloating is not normally seen in the hearth lining of ironworking hearths, but small amounts of such material may occur where small fragments of clay become lost in the hearth bed, or when some types of clay coating are applied during metal processing, or may arise from the heating of non-metallurgical ceramics, such as daub. The present examples are all too small to determine their origin.

Other
The macroscopic collections included, in addition to the material described above, a few minor fragments of coal and some concretions (probably mostly cored on decaying iron metal, probably artefacts).

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

Contexts provisional assigned a Bronze Age (Phase 3) date yielded just three residue fragments (from (60222), (60228) and (60240), all ditch fills). Of these, one is extremely small (from [60222]), one appears likely to be a fragment of SHC (and therefore likely to be Iron Age or later; from (60228)) and one is a small fragment of clinker-like appearance (if a true clinker, then likely to be Roman or later, but if a 'normal' iron slag then Iron Age or later). There is a possibility that at least some of these specimens, therefore, are intrusive.

Contexts attributed a Phase 4 date ((71440) and (71442)) yielded only a tiny amount of material. This included an example of an unusual very fine-grained material, provisional identified as an iron slag, but of uncertain nature.

Most of the moderately large collections in the assemblage (apart from the material from undated context (60069) in area 6) derives from Phase 5 contexts in Area 7. Several of these contexts are currently spot dated more specifically as late Iron Age to first century AD Roman.

Post-medieval contexts account for a very small part of the assemblage, and this material is very likely to be residual

Interpretation

The amount of archaeometallurgical macroscopic waste recovered from the site is low, and little or no hammerscale was recovered. It is likely, therefore, that any ironworking as undertaken outside the investigated area.

The assemblage, taken as a whole, is indicative of iron working (smithing). The small size of the recorded SHCs (the estimated weights range from approximately 200g to 540g) lie within the range shown by typical Roman period blacksmithing assemblages (see Young 2013 Table 3 for a compilation of weight-frequency statistics for SHCs from Roman smithing assemblages). Typical assemblages include examples with a range of c40-600g with a mean of 130g to 240g. such assemblages occur in both rural and urban settings and presumably reflect the residues from general-purpose work. Sites rarely show SHC weights that range up to above 800g, presumably reflecting a proportion of larger, more complex tasks, or longer work periods. There is some slight evidence that urban sites may typically produce larger SHCs (a feature also seen in the medieval period), perhaps reflecting a greater continuity of work in an urban setting.

The SHCs produced during the working of raw iron as part of the *chaîne operatoire* of iron production (bloomsmithing) are typically much larger, almost always in excess of 1kg and often heavier than 2kg.

Discussion

The material from Hinkley Point is compatible with a dispersed assemblage from blacksmithing in the late

Iron Age or Roman periods. No focus of activity was identified and the collection was extremely small. The residues may have been dispersed by means of their primary disposal, or potentially be secondary dispersal during manuring.

Further work

The assemblage would provide very few opportunities to further understanding of either the materials or the site through additional scientific analysis. No further work is recommended therefore.

Rural blacksmithing assemblages of the latest Iron Age into the early Roman period are not well represented amongst studied assemblages. It worthwhile, therefore, that despite the modest nature of the collection, it be deposited in its entirety with the site archive in an appropriate institution.

Reference

YOUNG, T.P. 2016. Assessment of archaeometallurgical residues from Ebrington, Gloucestershire (EGE09 ex). *GeoArch Report 2016/21*. 18pp.
[http://www.geoarch.co.uk/reports/2016-21%20Assessment%20of%20residues%20from%20Ebrington.pdf]

Table 1: summary catalogue. Assm = assemblage, FHS = flake hammerscale, FAS = fuel ash slag, SHC = smithing hearth cake. All weights in gram.

Context	sample	sample wt	item wt	item no	notes
60001		6	6	1	coal
60001		14	14	1	lump from dimpled mass of dense sandy lining slag
60062		41	41	1	fragment of tongue-like, mainly khaki, opaque glass; locally dark and sandy; somewhat lobate on both surfaces
60069		258	202	1	SHC, 85x90x40mm, sub-triangular in plan; top has raised rounded lobes, base with charcoal-rich slag
			44	1	very porous slag, many small rounded vesicles as well as tubular vesicles; presumably an SHC fragment; top of fragment shows small area of coarse honey-comb structure
60096		248	20	8	vitrified lining fragments, mainly with originally dark glass showing a buff surface
			192	20	blebby small slag lumps, mostly rather glassy and lining related; no obvious fuel inclusions but charcoal-rich material adhering
			4	1	sandstone pebble
			2	1	small iron fragment with surrounding concretion rich in charcoal
			10	1	glazed fragment of detached lining
			4	1	dense iron slag, in blebby material coating small pebble
			4	1	highly bloated ceramic with small area of slightly slagged surface (dark/maroon), the rest pale grey, highly vesicular; comparable with brazing shroud fabric
60096	6005	4	4	1	vitrified oxidised lining
60096	6005	62	62	assm	small slag fragments (selected for being obviously vesicular??)
60096	6005	3	3	42	slag droplets, sub-4mm, some reddened, all dull, some dimpled, no convincing hammerscale
60096	6005	493	16	8	vitrified lining
			477	assm	iron slags, mostly in the form of individual blebs or prills or fragments thereof; density variable - most dense are some of the finest prills; no certain evidence for any of the debris, even the most angular, being derived from SHCs; some blebs are attached to gravel grains
60096	6005	2	2	1	charcoal-rich iron slag fragment

Context	sample	sample wt	item wt	item no	notes
60120		<1	<1	1	dark, dull, highly vesicular and coarsely sandy lining slag
60136		3	3	1	small rounded lobe surface spalled from the surface of a larger dense slag piece
60136	6006	29	29	8	nub of vesicular iron slag 28g, plus fragments of similar material
			<1	1	iron cemented siltstone
60136	6006	<1	<1	7	coal
			<1	2	charcoal
			<1	1	spall of dark rock
60173		44	44	1	fragment of slag sheet, base dimpled, top irregular, charcoal clasts, maximum of 15mm thick
60204		<1	<1	1	vitrified lining
60222	6014	<1	<1	1	sandy dark lining slag
60228		20	20	1	dark vesicular dense slag with small stone clast, probably SHC fragment
60240		4	4	1	complexly-shaped fragment of dark glassy slag with slightly resinous lustre
70001		8	8	1	vitrified coarse sandy ceramic, grading into deep steely-blue glass
70048	7002	2	2	1	small fragment of altered iron slag with charcoal inclusion
70053			1	1	vitrified lining fragment
		38	37	1	exploding thin SHC fragment, moderately large iron inclusion involved, slag poorly preserved
70057		82	32	1	complex mass of partially-melted lining and lining slag, pale ceramic and dark slag
			48	1	dimpled, and slightly flow lobed, base of SHC; higher slag formed of coarse platy olivine; worn
70075		8	2	1	rounded bleb of dark sandy slag, one side rough, the other very smooth and maroon
			4	1	grey charcoal-rich vesicular slag fragment

Context	sample	sample wt	item wt	item no	notes
			1	1	grey iron slag fragment
70123		<1	<1	3	wood
70528		266	266	2	fragments of dense small SHCs; one appears fairly conventional in shape, the other has planar base. Fuel clasts problematic - charcoal present adhering, but clasts unclear
70528		47	13	1	lining slag, sandy, dense; vesicular near original surface
			11	1	small pad of dense fine dark slag, with lobate/dimpled base
			14	1	sandy lining slag in dimpled mass; with narrow veins of coarse, olivine-rich, green eutectic slag
			8	1	crude prill of dense but sandy slag
70529		17	<1	1	grey FAS bleb
			4	1	small slag prill, moderately dense bleb forms widest part
			4	1	lump of highly vesicular FAS, pale
			7	1	pale FAS coating on red oxidised wall material
70536		4	4	1	blebby prill of dense but sandy slag
70562		482	124	5	irregular fragments of dimpled, rusty, magnetic slag
			44	3	tiny fragments of non-magnetic slag
			326	1	fragment of large dense SHC, fractured, with rusty accretion on break; dimpled dense surface probably on or close to burr, charcoal moulds on another side
			16	1	pebble fragment, coarse red sandstone, possibly heat altered and fractured
70660		2	2	1	vitrified lining fragment
70671	7014	<1	<1	1	tiny fragment of coke
70679		7	5	1	lobate fragment of variable sandy khaki/dark lining slag
			2	1	variably fired, buff/dark grey, fine clay with both sand and fine organic temper - different from other furnace/hearth lining materials in this collection

Context	sample	sample wt	item wt	item no	notes
70682		2	2	1	fragmented sandy and glassy iron slag fragment
70683		156	126	1	central part of small/medium SHC, 2 layers, lower fine, thin, filling lobes seen on base, upper is thicker with coarse olivine plates, grading into greenish silicate-rich surface layer; 25-30mm thick; base partly lobate, partly dimpled with open fuel moulds, top slightly rusty with upstanding areas of pale olivine-rich slag
			2	1	small rusty bleb of slag with charcoal inclusion
			6	1	greenish prill of largely fayalite slag
			14	1	slag like material, and may contain some slag, but probably spall from exploded iron, contains charcoal fragment
70683	7015	<1	<1	6	sandy lining slag
70683	7015	1	1	c25	magnetic slag fragments
			<1	1	possible flake hammerscale
			<1	3	possible rust spalls
70903	7008	<1	<1	1	tiny fragment of dark coarse coked material - uncertain precursor
71052	7022	<1	<1	2	one bleb of sandy lining slag, the other a fragment of frothy textured slag attached to lining
71108	7027	8	8	assm	FAS, about half is pale, half brownish; pale mainly internal fragments; brown shows gradation to brown soft sandy ceramic
71109	7026	3	2	4	coal-rich concretionary material
			1	1	lining slag on reddish ceramic
			<1	1	black shaley material
71226		12	<1	1	charcoal (wood?)
			12	1	fragment of hollow claystone ironstone nodule
71286		38	4	1	small fragment of dense fine amalgamated flow lobes, uppermost with maroon surface; resembles very small-scale tapslag
			23	4	slagged and/or vitrified oxidised-fired lining fragments
			7	1	sandy lining slag
71349		4	4	1	grey vesicular iron slag fragment

Context	sample	sample wt	item wt	item no	notes
71354		44	44	1	irregular sheet fragment; dense slag with clasts and impressions of charcoal
71379		74	74	1	irregular lump of very dark, fine grained iron slag; some slight traces of a smooth surface in places; probably a smithing slag fragment on basis of texture, but not certain
71429		4	4	1	coal
71440		3	3	1	partially bloated pale grey sandy ceramic with rusty (presumably slag) coating on one side
71442		<1	<1	1	very dark, fine grained iron slag fragment (cf that from 71379)
71453	7033	6	6	1	lump of FAS with some fine debris, internally pale and frothy, externally locally grey/maroon and shows sandy surface in places (but no sand internally); probably some slight signs of viscous flow
71541		6	6	1	poorly preserved slag attached to vitrified lining
71666	7036	<1	<1	1	tufa-like calcareous precipitate around organics
			<1	1	rusty mass of secondary iron oxides
71667		2	2	1	highly bloated fuel ash slag, size of vesicles varies through thickness; dense; lilac side has fragments of a green-glazed surface surviving; possibly a vitrified stone clast from a hearth, but other possibilities exist

Table 2: summary of residues from Hinkley Point by context. All weights in gram. Phasing: 3: Bronze Age, 4: Iron Age, 5: Roman, 8: post-medieval. Phasing followed by available spot-dating. ? indicates non-deposit context. Up = undated pit

	Ph.	SHC	other iron slag	lining slag	lining	FAS	coal/ coke	iron/ conc	bloated	FHS	*total*
60001	8			14			6				*20*
60062	up			41							*41*
60069	up	246	486	254	50			2	4		*1042*
60120	up			<1							*<1*
60136	up		32				<1				*32*
60173	up		44								*44*
60204	up				<1						*<1*
60222	3			<1							*<1*
60228	3	20									*20*
60240	3			4							*4*
70001	s/s			8							*8*
70048	up		2								*2*
70053	5	37			1						*38*
70057	5	48		32							*80*
70075	5		5	2							*7*
70528	5; LIA-C1	266	8	38							*312*
70529	5; RB		4			11					*15*
70536	5; ?cut		4								*4*
70562	up	326	168								*494*
70660	5; C2-C4				2						*2*
70671	5; RB						<1				*<1*
70679	5			5	2						*7*
70682	5; ?skeleton			2							*2*
70683	5; LIA-C1	126	9	6				14		?	*155*
71052	up			<1							*<1*
71108	5; RB					8					*8*
71109	5; LIA-C1				1			2			*3*
71286	5; LIA-RB		4	7	23						*34*
71349	up		4								*4*
71354	5		44								*44*
71379	up		74								*74*
71429	8						4				*4*
71440	4								3		*3*
71442	4		<1								*<1*
71453	5; LIA-C1 RB					6					*6*
71541	5; C11-C14				6						*6*
71667	5; LIA-C1								2		*2*
total		*1069*	*888*	*413*	*85*	*25*	*10*	*18*	*9*	*?*	*2517*

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