Evaluation of metallurgical residues from Marsh Leys Farm

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Abstract

The assemblage from Marsh Leys Farm comprises a total of 37.7kg of metallurgical residues, including slag and furnace lining. Of the total some 77% derives from the northern part of Farmstead 7, 15% from the same area of Farmstead 5 and 5% from Farmstead 3, also mainly from the same area. Less than 1% of the assemblage was recovered from Area 1 (Farmstead 4).

The slags are dominated by material produced during iron-working (blacksmithing). The characteristic smithing slags, smithing hearth cakes (shc), are well represented, with at least 40 examples. These slag cakes are very variable, often being rather irregular in shape, particularly in examples with large amounts of chert on the upper surface. Large amounts of chert inclusions also characterise the more irregular smithing hearth slags. The shcs have a very irregular distribution of size between 60 – 824g. The abundance of chert suggests deliberate introduction into the hearth, and it is tentatively suggested that this was to control slag fluidity, rather than as a welding flux. The evidence from the lining fragments suggests that the blowing wall of the hearths was planar, and may have been steeply inclined towards the hearth, with a slightly inclined blowhole. The material gives no evidence for the use of a tuyère. There is a relatively high abundance of pieces of metallic iron, which are suggestive of stock iron, rather than finished artefacts.

It is remarkable that almost all the metallurgical residue from the site occurs in the same area, the northern half of Area 2, irrespective of phase. In Phase 3 the residues are associated with enclosure L27 and adjacent features. A small amount of material is in primary contexts and some in secondary, but the total quantity of material is very small. Of the material recorded from Farmstead 5.1, 65% (by weight) is from tertiary contexts and 32% from secondary. It seems quite possible therefore that much of this material might be contemporary with the Farmstead 7.1 assemblage. The substantial deposits of slag from Farmstead 7.1 (L43.3, G220.3) include micro-residues dominated by flake hammerscale. This fine grained material strengthens the likelihood that this deposit represents a primary dump from a nearby forge. The material is dominantly from the northern side of L44.3 (22.8kg, of which 18.8kg from G220.3) with a significant quantity (4.0kg) from the adjacent L45.3.

Only one single piece (from Farmstead 5.1) was indicative of copper-alloy working. This piece is likely to be from a hearth used to melt copper alloy for casting.

Contents

Methodology

The collection examined comprised some 37.7kg of metallurgical residues, distributed amongst 92 bags from 52 individual contexts.

The material was examined using a low-powered binocular microscope. Material was identified within the limits of the textural and compositional identifications possible at low magnification. In the case of context 8060, the fine residue in the bags was washed, sieved and magnetically separated to investigate the occurrence of hammerscale. Nomenclature of residues follows the Historical Metallurgy Society datasheets (Crew 1996; Starley 1995).

Where weights of assemblages are discussed, the weights are for material in the “as-supplied” state; some may have some residual adhering matrix. Weights of assemblages are taken as including any pieces of metallic iron, not in the form of artefacts, that they may contain.

Summaries for site narrative

Phase 3

In Phase 3, metallurgical residues have been recovered only in northern part of Area 2. The enclosure L27 seems to be the focus of activity. The ditch of the enclosure yielded an assemblage including a medium-sized (574g) smithing hearth cake, together with some smaller slag debris and vitrified hearth lining in its primary fill (L27.1); its secondary fill (L27.2) yielded a single slag piece. A pit of L27.2 yielded a similar assemblage of debris, including a 480g irregular smithing hearth cake. Outside the enclosure to the northeast, a single smithing hearth cake was recovered from a pit of L26.2, to the southwest of the enclosure L29.2 yielded an assemblage of hearth-lining fragments, probably also from iron-working and to the northwest, L28.3 yielded a single vitrified lining fragment.

The material from Phase 3 is indicative of blacksmithing. Despite the relatively coherent nature of the distribution around the area of L27, the total weight of metallurgical residues from Phase 3 is only 2.2kg. This is insufficient to indicate the scale or frequency of the activity. Assemblages containing smaller pieces of vitrified lining as well as the larger smithing hearth cakes, are unlikely to have been reworked or transported far from source

Phase 4

Metallurgical residues from Phase 4 (as in Phases 3 and 5) occur mainly in the northern part of Area 2 (Farmstead 5). 5.8kg of residues were recovered from Farmstead 5, with just 245g from Farmstead 4.

The residue distribution is centred on the area of field L33. This area is bounded to the south by ditch L31, which yielded sporadic metallurgical residues in its secondary and tertiary fills along its length, but multiple finds adjacent to field L33 (G377.2). The pits and quarries within L33 yielded residues, but particularly from the tertiary fills (L33.3; G287.3, G286.3, G295.3). To the east, the band of more continuous quarrying (L35) also yielded residues from a tertiary fill (L35.3; G370.1).

Away from this core distribution, metallurgical residues comprised mainly isolated finds, including material from L48.3 and L52.3 together with L19.3 and L53.1 from Farmstead 4. L49.3 (G273.1) yielded the only small fragment from the site of residue from a copper alloy-working process.

Apart from the single fragment of copper alloy slag, all of the residues from Phase 4 are indicative of iron-working (blacksmithing).

Phase 5

Metallurgical residues occur in a wide variety of contexts in Phase 5 but, as in earlier periods, almost all the material was recovered from the northern part of Area 2 (Farmstead 7).

28.9kg of metallurgical residue was recovered from deposits of Phase 5, 77% of the total from the site.

Geographically, the material is dominantly from the north-eastern boundary of L44; with 0.1kg from L44.1, 7g from L44.2 and 22.8kg from L44.3 (of which 18.8kg from G220.3), with a significant quantity (4.0kg) from the adjacent L45.3. 442g of material came from pits of L44.2. Just 260g of material came from L70.2 (G247.2), 950g from L42.3 and 278g from L43.3. These figures reveal that little metallurgical material was recovered from primary or secondary contexts, but almost all from tertiary contexts.

The substantial deposits of slag from the late fill of the bounding ditch of Farmstead 7.1 (L43.3, G220.3) include micro-residues dominated by flake hammerscale. This fine grained material strengthens the likelihood already suggested by the large volume of macroscopic slag material, that this deposit represents a dump from a nearby forge.

Phase 7

A single piece of slag from Phase 7 deposits is very likely to be residual.

Interpretation

Description

The Marsh Leys Farm metallurgical residue assemblage as a whole is remarkably homogeneous, with the material almost entirely being the product of iron-working in a clay lined hearth, with charcoal fuel. There is little indication of technological variation within the assemblage. Iron-working (blacksmithing) was a routine part of the activities of most rural settlements from the Pre-Roman Iron Age until well into the last century. In this instance, there is little direct evidence of what work was being undertaken, but the variability in the smithing hearth cakes suggests a variable workload.

A summary listing of the material examined is given in Table 1.

Blacksmithing slags are, in general, rather poorly understood in terms of their detailed origin and relationship to different types of smithing activity. The variability of the slags in this assemblage, as noted above, suggest a variability in the work undertaken, but there are some features of the assemblage which do allow some more detailed consideration of the technology in use.

Slag description

The slags comprise a mixed assemblage including smithing hearth cakes (**shc** on Table 1; also known as plano-convex bottoms, **pcbs** or smithing hearth bottoms, **shb**s; Crew 1996) together with more amorphous smithing hearth slag lumps.

The shcs range in weight from 60 – 824g. Some of the larger cakes are amalgamations of slag generated in different work periods. The mean weight of the 30 reasonably complete cakes is 330g. In addition there are at least 9 other moderately complete cakes. Several of the cakes differ from the normal elliptical plan, in being rather more traverse, with a straight proximal margin reflecting the straight blowing wall (see below).

A characteristic of most of the amorphous slags as well as some of the shcs is the inclusion of fragments of chert. These fragments are mainly in the form of rounded pebbles and range from mm-scale up to

pieces of 40mm maximum diameter. When present in the shcs these chert pebbles are found mainly within the uppermost level of the cake or in slags attached to the upper planar surface.

The mode of formation of shcs and the origin of the siliceous component is still a matter of debate. The Marsh Leys Farm material adds new evidence to this discussion, because the siliceous materials are unusually coarse-grained (chert gravel) and demonstrably absent from the hearth lining.

On some sites it is possible that rock fragments enter the slag during partial melting of the hearth wall adjacent to the tuyère. The smithing hearth cake, which forms below the tuyère, is a product of reaction between iron/iron oxides and the hearth wall. In hearths where the wall contains large siliceous grains, it is possible for them to be carried downwards by melt generated from the smaller, more rapidly reacted, particles. In the furnace lining material from this site however, there is no indication of coarse, gravel grade, material forming a significant part of the hearth wall. It is therefore unlikely that the large chert grains are derived from the hearth wall.

The use of chert and other forms of silica as a flux in fire welding is well-known. The smith may throw a fine grained flux (usually a silica sand) into the area to be welded. This silica reacts with the oxidised surfaces of the metal to form a liquid silicate melt, which is then expelled during hammering of the weld, allowing the two iron surfaces to pressed into a clean contact. However, the flux used in this process is usually fine grained, since it must penetrate across the surface of the workpiece and react quickly to form the silicate melt. The chert seen in the slag cakes here is far too coarse-grained to have been used in this way.

Another use of siliceous material within the hearth is to protect the workpiece from oxidation or carburisation. The introduction of clay to protect carbon steels from oxidation (Serneels & Perret 2003), or to protect low carbon iron from becoming carburised during steeling of an artefact (Crew *pers. comm.*) have both been proposed, but neither would be an appropriate interpretation of the coarse-grained siliceous material at Marsh Leys Farm.

In the Marsh Leys slag assemblage the chert pebbles must therefore have entered the hearth via a route other than degradation of the wall, or deliberate introduction as a welding flux. Accidental introduction of gravel grade material with fuel does occur, but mainly with mineral coal rather than the charcoal used at Marsh Leys Farm. Accidental inclusion of stones is much less common with the use of charcoal. This leaves the possibility that the chert was introduced deliberately, not as welding flux, but to flux the hearth slags. It is tentatively suggested that under some circumstances the reaction with the wall is insufficient to form a slag fluid-enough to drop though the hearth and away from the workpiece and tuyère. The addition of silica (in the form of the chert gravel) may have been required to make the slags more fluid.

Platy slags

Within the Phase 5 assemblage are a significant number of small pieces of a platy slag of unusual nature. These slags are typically about 5mm thick and form sheets of sand-rich glassy slags, very similar to the surficial layer on the vitrified lining. On one surface however, shows a smooth, sometimes slightly wrinkled, surface of fayalitic slag, which has clearly been extremely fluid.

These slags can interpreted as having been formed by the contact of the sandy ceramic slag with a smooth iron surface. Such a situation might arise if the slag has been formed from a clay coating over an iron workpiece. The circumstances for using a deliberate clay or slag coating on the work piece have been described above, but include the control of carburisation and oxidation.

It is conceivable, however, that such slags might arise from the accidental placement of the workpiece into a slag mass in the hearth. The find of an shc with a piece of bar iron passing through the slag (Phase 4, G200.2) shows that such events happened. It is unlikely that manipulation of the slags with tongs or a poker would produce such a slag, since the tool would not attain a high enough temperature to react.

The hearths

The vitrified lining fragments are commonly planar, suggesting a planar blowing wall for the hearth. Three large pieces of vitrified lining show possible evidence for blowholes (G203.2, G220.3 two examples). None of the examples is certainly from a blowhole, for they are all rather incomplete. They suggest use of a simple blowhole. The bore suggested by the fragments is, however, rather large (40-50mm, rather than the 15-25mm normally seen), and it is possible that the clay wall was pierced by a hole contain a fine tuyère. No remains interpretable as tuyères were, however, recognised.

The lining fragments bearing the probable blowholes also indicate an inclination of the blowhole at 30-45° to the perpendicular to the wall face. Although blowholes are commonly gently inclined inwards towards the hearth, this angle is rather large. If this fragments are indeed blowholes, then they suggest the blowing wall was inclined inwards at an angle of 45-70° to horizontal, rather than being vertical.

Distribution

Almost all the metallurgical residues recovered from the site came from the northern part of area 2. An area of 0.3ha extending from E=502330 to 502390 and from N=245590 to 245040 represents just 7% of the excavated area, but yielded 87% of the metallurgical residues in Phase 3, 73% in Phase 4 and 90% in Phase 5.

Given the sweeping changes to the landscape across these phases of occupation, the persistence of the distribution of the metallurgical remains is remarkable. It seems most unlikely that this distribution is purely coincidental.

Various possibilities might be invoked to explain the distribution:

1. The distribution might be able to be taken at face value, as suggesting that metallurgical activities were focussed on this part of the site, despite the changing patterns of land division, and despite the identification of this area, probably in Phase 4 and possibly in Phase 5, as an agricultural enclosure.

2. The distribution indicates a pattern of deposition of smithy waste, despite changing patterns of land division, because external factors favoured this. Perhaps, for instance, a long-lived smithy lay at a

location just outside the excavated area to the northwest, and disposal of waste into negative features in the adjacent area occurred over a long period of time.

3. The distribution does not reflect a long-lived activity, but degradation of a waste dump from an earlier smithy over a long period of time.

4. The distribution can not be taken at face value, but is biased by metallurgical residues which occur in final disuse contexts, which may be much younger than the cut/use of the feature. In this model the distribution of material from Phase 3 would remain the same, but the 65% of material from Phase 4 disuse contexts might be interpreted as being from Phase 5. The remaining 37% is much less focussed on the area described above, with at least 45% of the assemblage occurring outside it.

Of these possibilities, the first seems rather unlikely. There is little evidence to support the idea of a long-lived smithy in the area of L27 – L33 – L44. The idea of a long-lived pattern of waste disposal – perhaps produced by a smithy outside the excavated area which remained in a constant position for a long time is attractive, but given the multiple reorganisations of the landscape it is unclear how likely this might be. The relative permanence of a smithy, despite other reorganisations has been documented, albeit in an urban context, at Sandy (Dawson 1995). The occurrence of most of the Phase 5 slags in a possible trackside ditch might support this idea, however. The long-term degradation of an early slag dump might produce a similar pattern of distribution, but one might have expected to see the majority of the reworking occurring earlier rather than later. The final possibility, that the observed pattern might be produced by most of the slag entering the area in Phase 5, but being deposited in a wide variety of feature sags, with ages dating back much earlier than just Phase 5, seems likely to be at very least a contributing factor to the pattern, even if not the whole answer.

The occurrence of most of the metallurgical residues in Phase 5 disuse contexts suggests that the main period of iron-working is very late in the history of the Roman-British settlement.

Scale of activity

The relatively low-level of sampling of the slag-bearing deposits leaves some room for doubt over the scale or the activity on the site. The amount of metallurgical residue recovered from Phases 3 and 4 is small, suggesting either that the focus of slag deposition lay elsewhere, or that smithing was an infrequent activity. The material from Phase 5 is much more abundant and the hammerscale evidence supports this being a primary dump. The total material recovered, even from Phase 5, is modest (Phase 5 has 28.9kg of residues of which 7.2kg comprises 23 shcs), but represents only a small sample of the deposit. This quantity is compatible with the iron-working being a part of the normal activity of the rural settlement, rather than being an industry.

Comparison with other sites

The site lies just south of the extreme southern limit of the East Midlands zone of iron production (Schrüfer-Kolb, 2004; Fig 25b). Within North Bedfordshire she lists evidence for iron-working at a number of sites to the NW of Bedford, mostly determined by field walking evidence. These include several apparently domestic, rather than industrial, sites, many with evidence for iron smelting as well as smithing, in the area between Knotting and Turvey, 10-15km NW-NNW of the Marsh Leys Farm site (Harrold SP915565; Felmersham TL005575; Knotting TL005635; Milton Earnest TL035565; Odell SP951589; Souldrop SP985625; Stevington SP985535; Turvey SP955515). None of these sites has well-dated iron-working activity, so it is not yet possible to determine whether smithing formed a long-term component of settlement activity.

Schrüfer-Kolb (2004) comments that in general in the East Midlands the more market-oriented smithing was undertaken in towns, with the evidence, even within the iron-production zone, suggesting that the rural settlements were undertaking smithing for purely local needs.

Evidence for the nature of rural settlements outside the iron production zone comes from several sites in the Milton Keynes area, to the SW of Marsh Leys Farm. Although iron-working is present on some of these sites, it does not appear to be a significant activity, at least within those parts of the settlements that have been investigated. The Wavendon Gate site (Williams et al. 1996) apparently produced evidence for small-scale iron smelting, but the description of the material is very brief, and there was uncertainty over whether this was of Iron Age or Romano-British date. The Bancroft site (Williams and Zeepvat, 1994) produced evidence for late Roman iron-working, perhaps during demolition of the villa.

On a broader scale, it is clear that iron smithing was a part of the regular activity of rural settlements and estates across Roman Britain, even well-away from areas of primary iron production. The evidence for associated iron-working may not be forthcoming unless sufficient area of a settlement has been investigated. An example, although not from the East Midlands, of a Romano-British rural settlement with long-lived small-scale smithing activity is Frocester Court, Gloucestershire (Price 2000 and pers. obs.). This site has ditched enclosures, similar to those of Marsh Leys Farm, ranging from the later Prehistoric through to the 3rd Century AD, followed by a late 3rd – 4th century villa, with occupation extending at least into the 5th century. All phases of this site yield iron smithing residues in quantities comparable with those from Marsh Leys Farm, although at Frocester some iron smelting was undertaken as well in some periods.

Evaluation of potential and future work

The Marsh Leys Farm metallurgical residue report was commissioned late in the project cycle, so the evaluation and final reporting stages have become condensed.

The nature of the assemblage as a fairly homogeneous collection of blacksmithing waste means that little additional analysis would be recommended. This has allowed the presentation of a final report at this stage.

The only two areas in which further investigations might be beneficial would be:

1. an investigation of the nature of the iron pieces within the collection, in order to determine the nature and composition of the material being employed.

However, given the lack of a firm tie between structures and waste material, the detailed investigation of the metal fragments might not be fully justifiable.

2. an investigation of the occurrence (if any) of hammerscale in any environmental samples from the site, in order to help determine the focus of the iron-working activity.

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Context	Sample/ Find	Feature	Group	Group type	Landscape	Farmstead	Phase	Weight (g)	Description
Phase 3									
Farmstead 3									
4231		4229	217.1	D	27.1	3	3	810	574g shc, 12 other pieces of vitrified lining and slag, some of which is chert rich
8647	sf 132		411		63	3	3	0.3	fragmented bleb of dark vesicular slag
7926		7925	296.2	P	26.2	3.1	3	286	broken shallow shc with high vesicularity and charcoal inclusions, base prilly, 70x90x30, disc like
8122	sf 219	8120	217.2	D	27.2	3.1	3	4	badly altered piece of blue fuel ash slag with included chert
8883		8882	292.2	P	27.2	3.1	3	566	very irregular shc, 100x90x45, 480g, upper surface with some chert; two other pieces of dimpled slag with charcoal
8348		8347	283.1	S	28.3	3.1	3	8	platy fragment of vitrified lining
8261		8259	375.2	P	29.2	3.1	3	538	c17 pieces of lining-rich slags, but most show crusts, dimples or lobes suggesting these are smithing hearth slags
Phase 4									
Farmstead 4									
2307		2306	420.1	D	53.1	4	4	14	slag with abundant chert
6214		6213	174.1	D	19.3	4.1	4	232	ball shaped hearth slag, starting to "explode" indicating iron inclusion(s)
Phase 4									
Farmstead 5									
8581		8580	324.1	P	48.1	5	4	162	weathered dense vesicular coarse iron slag, slightly dimpled lower face with charcoal, upper face smothered in chert pieces of up to 10mm
7082		7080	200.2	D	31.2	5.1	4	408	single shc - looks conventional from outside, broken to reveal 55x20mm piece of iron sheet inside oriented vertically.
7318		7317	203.2	D	31.2	5.1	4	160	3 pieces of thick vitrified lining
7102		7100	377.2	D	31.2	5.1	4	134	3 small pieces; plus planar slab possibly with blowhole at 60° to face, but not certain
7102		7100	377.2	D	31.2	5.1	4	276	136g, half a deep rusty charcoal-rich shc; 104g glassy-topped Fe-slag with much chert; plus 7 small pieces
4225		4224	202.3	D	31.3	5.1	4	110	shc fragment
8186		8180	287.3	P	33.2	5.1	4	76	4 small pieces of smithing slag; 1 piece vitrified lining; 2 pieces of moderately thick vitrification
8222		8220	371.2	Q	33.2	5.1	4	14	corroded vitrified lining with slag attached
8141		8138	286.3	Q	33.3	5.1	4	602	large piece 510, multiply stacked shc - but incomplete; 2 small lining pieces; plus 38g piece probably iron (plate 40mm square?)
8353		8352	286.3	Q	33.3	5.1	4	550	468 block of probable shc, broken on removal? Slightly rusty 75x85x60mm, 56g tiny chert-rich shc?, couple of broken slag fragments
8264		8262	295.3	P	33.3	5.1	4	98	broken piece of shc
8264		8262	295.3	P	33.3	5.1	4	234	probable corroded iron
8493		8492	295.3	P	33.3	5.1	4	24	2 pieces of vitrified lining , dark glass very quartz rich, 1 piece shows possible flake hammerscale inclusion

Context	Sample/ Find	Feature	Group	Group type	Landscape	Farmstead	Phase	Weight (g)	Description
7951	sf 121		370.32		35.2	5.1	4	1	chert to 8mm in some melt
8118		8117	370.1	Q	35.3	5.1	4	182	2 pieces of extensively vitrified thick lining, quite rich in chert grains on the vitrified surface
8118		8117	370.1	Q	35.3	5.1	4	1320	156g shc with lobate top, 80x70x40mm but twisted; 216g block of corroded iron approx 35mm cube; 278g shc, rusty 90x70x40mm; 284 shc, 95x75x35mm; 290g deep shc 90x85x50mm; several small broken slag fragments.
8512	248	8511	401.2	Q	41.2	5.1	4	250	block of iron
8583		8580	324.3	P	48.3	5.1	4	334	90x90x40mm small shc, charcoal inclusions, planar top, very coarse distally, chert not prominent
7060		7059	273.1	D	49.3	5.1	4	16	Cu-alloy slag fragment - pieces of stone and shale bonded in mixed metal slag
8093		8090	294.3	P	52.3	5.1	4	256	tiny lining chip; most is a slab from a shc, well flown top with high chert content, basal crust well developed with large bubbles between two
7674	110	7671	304.2	P	75.2	5.1	4	168	1 large and six small pieces of smithing slag in fragments and nubs
7674		7671	304.2	P	75.2	5.1	4	384	75x110x50mm, 364g shc in two pieces; 10 piece of vitrified lining

Phase 5
Farmstead 7

L42.3

7768		7764	263.3	D	42.3	7.1	5	946	558g 100x110x40mm rather irregular rusty shc; 360g broken shc (flow on broken edge?) 75x95x50mm; plus small fragments, all v rusty
7872		7871	352.4	P	42.3	7.1	5	4	quartz-rich vitrified lining

L43.3

7555	sf 197	7554	393.1	P	43.3	7.1	5	102	part of very small smithing hearth cake - maybe 50%, charcoal well preserved
7555	sf 198	7554	393.1	P	43.3	7.1	5	22	corroded iron disc
7555	sf 200	7554	393.1	P	43.3	7.1	5	154	irregular, possibly contorted small smithing hearth cake, 80x60x40mm

L44.1

8074		8059	220.1	Y	44.1	7	5	100	large pieces of thickly vitrified lining, together with small blebs of lining slag

L44.2

7146		7145	246.2	D	44.2	7.1	5	7	lining, partially vitrified and\with Fe-slag coating, some sky blue glass interstitially and reddy-brown glass bubbles on one surface
8391		8389	288.2	P	44.2	7.1	5	94	7 pieces of highly weathered shc, 1 small piece of corroded iron
8106		8104	291.2	P	44.2	7.1	5	54	very dense piece - probably a burr from a large shc
8445		8443	317.2	P	44.2	7.1	5	42	v dense slag, weathered, slag matrix has pale weathering laths in dark glass, contains large pebbles, some chert - some v dark
8842		8840	338.3	P	44.2	7.1	5	252	"exploded" piece of corroded iron - large flared object

Context	Sample/ Find	Feature	Group	Group type	Landscape	Farmstead	Phase	Weight (g)	Description
L44.3									
8016		8015	219.3	D	44.3	7.1	5	1.9	slagged lining with possible hammerscale fragments in lining
8098		8096	219.3	D	44.3	7.1	5	664	large piece is an almost complete shc, plano-convex, 110x85x45mm with further 10mm raised above flat proximally, oblique break at proximal end means c5% missing, 542g; also c6 small pieces, all probably smithing slags
8098		8096	219.3	D	44.3	7.1	5	70	c13 pieces of vitrified lining or pieces of lining slag
8112		8111	219.3	D	44.3	7.1	5	26	2 pieces of lining-rich smithing slag
7422		7421	219.4	D	44.3	7.1	5	430	iron bar, triangular cross-section?
7422		7421	219.4	D	44.3	7.1	5	1495	at least 4 moderately complete small shcs, 122g, 172g, 150g, 66g?; 36 other pieces of other more amorphous material; plus a piece of flat sheet slag with 1 sandy face and one very fluid-looking fayalitic face.
7422		7421	219.4	D	44.3	7.1	5	148	7 pieces of vitrified lining
8486		8483	220.2	Y	44.3	7.1	5	9	two small nubs of lining slag, 1 has bright green glass included
7418			220.3		44.3	7.1	5	2	vitrified lining
7418	sf 94		220.3		44.3	7.1	5	170	c113 small pieces of slag and lining
7418	sf 94		220.3		44.3	7.1	5	8	7 pieces of vitrified lining
7936			220.3		44.3	7.1	5	25	fused chert pebbles with abundant blue glass, attached to small area of more Fe-rich vitrified lining with sand-sized quartz
8485		8483	220.3	Y	44.3	7.1	5	1155	v nice shc at 824g, 110x130x40, proximal with ?flow on wall then free distally, very slightly concave top, charcoal; 6 fragments of Fe object - curved sheet?; 7 pieces of irregular vesicular slag lumps with brown glass; 2 larger and denser but similar twisted lumps; 1 small (100) incipient shc with v smooth top (40x55x45)
8485		8483	220.3	Y	44.3	7.1	5	146	7 pieces: largest irregular dimpled lump with large chert to 22mm in Fe-slag matrix, some bright glass; 1 small piece of vitrified lining; others are highly vesicular iron slag with large chert pieces and patches of bright glass
7883		7881	221.3	D	44.3	7.1	5	1080	758g large deep shc, 90x130x85mm; tall narrow shc, with lots of included charcoal, probably multilayer; other fragments from 1(?) additional shc with basal tubular vesicles
7874		7873	222.3	D	44.3	7.1	5	40	3 pieces: 1 sand grade quartz in dark glass, other 2 pebble grade chert with very little melt, locally dark flowed surface, locally bright blue glass
7879		7878	222.3	D	44.3	7.1	5	58	3 pieces of vitrified hearth wall. Two larger show hammerscale in clay, some chert
8539		8538	389.11	S	44.3	7.1	5	10	1 piece vitrified lining, 1 piece vitrified lining with fe-slag, 1 ammonite fossil
8060	sf 125	8059	220.3	Y	44.3	7.1	5	20	broken piece of slag with partly melted chert gravel, with some specks of blue glass
8060		8059	220.3	Y	44.3	7.1	5	1680	c85 pieces of dominantly lining, but also some slag dominated by chert/flint fragments
8060		8059	220.3	Y	44.3	7.1	5	1455	c39 pieces of vitrified lining, some large (max 130x110mm). Mainly planar. Lining is sandy and red, and has no chert
8060		8059	220.3	Y	44.3	7.1	5	1655	c140 pieces of lining and lining slag: 1 piece iron; 2 possible blowhole fragments, each suggestive of 40-50mm diameter hole at 45-55° to planar surface; at least 10 of the pieces of a sand-rich material forming slabs a few-mm thick with angular re-entrants, with a finish like hammerscale on one surface
8060		8059	220.3	Y	44.3	7.1	5	1815	80 pieces dominantly vitrified lining, 5 pieces dominantly slag. No particularly indicative material except one large piece of probable supra-blowhole damage

Context	Sample/ Find	Feature	Group	Group type	Landscape	Farmstead	Phase	Weight (g)	Description
8060		8059	220.3	Y	44.3	7.1	5	1470	c200 pieces plus small detritus. 6 pieces of thin flat material. Ranges from burnt chert through to small shc fragments, not sorted in detail as pieces too small for reasonable identification
8060	125	8059	220.3	Y	44.3	7.1	5	164	c99 small fragments of slag and lining blebs
8060		8059	220.3	Y	44.3	7.1	5	28	7 pieces of variably vitrified hearth lining
8060		8059	220.3	Y	44.3	7.1	5	604	60 pieces (including 1 sheet piece as above), mainly small blebs, couple of prills, also bag with 30g of magnetic separates, mainly flake scale (a separate collection of scale has been made from the dust in the context 8060 bags)
8060		8059	220.3	Y	44.3	7.1	5	2080	18 pieces of smithing slag; 558g very irregular cake with chert; 382g transverse cake without chert; 306g very irregular lump; 136g small transverse sheet, probably incipient shc
8060		8059	220.3	Y	44.3	7.1	5	2015	150g corroded fe object/billet 50mm long, 15x25mm at one end wedging to edge at other; rest 24 pieces, very irregular smithing hearth slags in moderately complete pieces
8060		8059	220.3	Y	44.3	7.1	5	2130	280g transverse shc, 60x120x40mm; part of c200g shc, total 45 pieces
8060		8059	220.3	Y	44.3	7.1	5	2060	approx. 75 pieces of broken smithing slags and lining, mostly rather irregular, cherty tops, some well flowed, one very dense burr, 1 piece of possible smithing floor
8060	221	8059	220.3	Y	44.3	7.1	5	104	irregular runnel of slag. Probably not true tap slag, but an in-hearth flow from a smithing hearth.
L45.3									
7289		7288	209.1	D	45.3	7.1	5	310	complete hemispherical shc
7291		7290	210.1	y	45.3	7.1	5	894	478g large part of thin but well formed shc, wide flat v smooth top; 214g iron-rich irregular smithing slag; 12 other pieces of smithing slag and lining
7297		7296	210.1	y	45.3	7.1	5	254	136g, small shc; plus three other bits, all rusty
7297		7296	210.1	y	45.3	7.1	5	78	4 lining fragments plus 3 pieces (6g) of vitrified lining attached to iron slag with abundant blue glass
7297		7296	210.1	y	45.3	7.1	5	343	304g almost complete triangular cross-sectioned shc, Fe -rich, no chert; plus 2 pieces of lining
7297		7296	210.1	y	45.3	7.1	5	212	25 small pieces of lining and smithing slag, chert rich
7297		7296	210.1	y	45.3	7.1	5	96	6 pieces of broken Fe-slag - varying from v dense to chert rich
7297		7296	210.1	y	45.3	7.1	5	144	12 pieces of vitrified lining plus 1 piece chert-rich Fe-slag
7297		7296	210.1	y	45.3	7.1	5	102	broken Fe-slags, 4 main pieces, 1 extremely dense
7297		7296	210.1	y	45.3	7.1	5	7	vitrified lining
8029		8028	210.1	y	45.3	7.1	5	930	106g small highly dimpled cake; 258g dense cake with large central upper vesicle slightly dimpled lower; remainder nubs and fragments of smithing slags, some with large cherts
8029		8028	210.1	y	45.3	7.1	5	4	irregular piece of vitrified lining
8036		8035	210.1	y	45.3	7.1	5	348	many small pieces (max 20mm) of lining, vitrified lining slag, and iron slag with chert gravel. Gravel associated with blue glass.
8040		8039	210.1	y	45.3	7.1	5	86	small piece of weathered shc broken into three
10107	sf 85		210.1		45.3	7.1	5	4	2 small nubs of part vitrified lining slag
8832		8831	210.1	y	45.3	7.1	5	230	small piece vitrified wall material, with Fe-slag and large chert pieces. Larger block probably near burr of deep shc (>45mm)

Context	Sample/ Find	Feature	Group	Group type	Landscape	Farmstead	Phase	Weight (g)	Description
L70.2									
7137		7136	247.2	D	70.2	7.1	5	260	146g small shc; plus 10 pieces lining and associated material
Phase 7									
8926	md22	8925	396.1	Q	46.3	8.1	7	568	110x75x45 looks like shc but "exploding" & very dense. May be block of iron or shc with big metal content