GeoArch

Report 2020/06

Assessment of residues from Caerau hillfort, Cardiff

Dr Tim Young

27th May 2020

Assessment of residues from Caerau hillfort, Cardiff

Dr T.P. Young

Abstract

The submitted material comprised a collection of approximately 730 pieces plus 41 assemblages of sieved residues identified as either 'slag' or coal. Following assessment that reduced to a collection of approximately 560 pieces plus 39 assemblages with a total weight of 3.56kg, derived from 94 distinct contexts.

Less than 2.3kg of the assemblage derives from contexts that are currently phased to periods of early medieval or older. Most of this, a total of 1.85kg (slightly over half of the total assemblage), derives from Phase 5 deposits in trenches 3, 5 and 6, including 1.40kg from pit fills (603) and (607). The residues from these contexts were indicative of blacksmithing, mostly using coal as fuel, and the abundance of both micro- and macro-residues in the material from Trench 6 suggests a location close to this trench for at least some of the Roman activity.

A total of 168g of material was recovered from contexts assigned to Phase 4, fills of enclosure ditch H, in trenches 4 and 5. This material also contained some clinker and coal residues, suggesting a very similar origin to that of the assemblage from Phase 5, although the evidence was not conclusive. The use of coal as a fuel for blacksmithing has not been documented from before the Roman period, so any evidence here would suggest that this ditch fill is also of Roman age.

A single piece of residue (a tiny fragment of slag that had an embedded copper alloy prill) was derived from the phase 4/5 metalled surface (3016), suggesting that some limited copper alloy working was undertaken alongside the blacksmithing.

Deposits assigned to Phase 3 produced less than 5g of archaeometallurgical material (although additional, currently unphased, contexts should perhaps be counted here too).

Contexts of Phase 2 in Trench 3 produced 244g of residues (of which 208g were from the ring gully of Circular Structure 1 and possibly representative of just two fragmented slag pieces). These were indicative of blacksmithing but did not contain evidence for the use of coal (in agreement with an Iron Age date). Two fragments of flowed slag, just possibly, but not certainly, pieces of bloomery iron smelting slag, were recovered from Trench 3, one from the gully of Circular Structure 1. It should be noted however, that one sample from the ring gully of Circular Structure 1 also produced sherds of probably later (intrusive?) pottery.

A single piece of weathered vesicular slag, probably a fuel ash slag with a non-metallurgical origin, was attributed to a context placed in Phase 1.

Although the widespread distribution of a low level of comminuted archaeometallurgical debris across the site provides no close localisation for much of the ironworking, two sets of deposits of microresidues may provide closer evidence. The fills of pits in Trench 6 produced microresidues (not available for examination) and accretionary material attached to corroded iron pieces were rich in hammerscale, suggesting that pit fills were too. Secondly, in Trench 3, microresidues were recovered consistently, if in low density, from many features thus ironworking probably took place in this general area in Phase 2.

The residues suggest that a low level of blacksmithing was undertaken within the hillfort over considerable timespans, but that the activity should probably not be considered 'industrial'.

Contents

Abstract 1

Contents 2

Methods 2

Description of the assemblage
- General 2
- Smithing slags 2
- Concretions on iron 2
- Smithing microresidues 3
- Ceramic materials 3
- Non-metallurgical fuel ash slags 3
- Other archaeological materials 3
- Other non-archaeological materials 3

Distribution of the assemblage 3

Interpretation 4

Further work 4

References 5

Table 1. Summary Catalogue 6
Table 2. Residue types by trench/phase/context 19

Methods

All materials were examined visually, using a low-powered binocular microscope where required. As an assessment, 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.

This assessment was conducted in April/May 2020 and was commissioned by Dr Oliver Davis of Cardiff University.

Description of the assemblage

General

The submitted material comprised a collection of approximately 730 pieces plus 41 assemblages of sieved residues identified as either 'slag' or coal (Table 1) from excavations at Caerau Hillfort (Wessex Archaeology 2013; Davis and Sharples 2014, 2015, 2016). Following assessment that reduced to a collection of approximately 560 pieces plus 39 assemblages with a total weight of 3.56kg, derived from 94 distinct contexts.

All pieces capable of confident attribution to a particular process are from the working of iron (smithing). No pieces were certainly from iron smelting, although two small fragments were possibly so. Non-ferrous metalworking was supported by a single fragment bearing a prill of weathered copper alloy metal.

Smithing slags

All the identifiable metallurgical macro-slag within the assemblage (with the exception of one small fragment) was from the working (smithing) of iron.

The smithing slags included examples of smithing hearth cakes (SHCs), but these were typically fragmentary.

The only relatively complete SHC stratified in an early context is a 154g example from (5036). An incomplete SHC weighing 123g was recovered hillwash (8003) and unphased fill (5071) produced approximately two thirds of an SHC estimated at an original weight of 150g.

Much more fragmentary material from the fill of ring gully of circular structure 1 (3089) comprised 136g (36 pieces) of hand-picked material, possibly a single disintegrated SHC of similar size to the examples listed above. Similar fragments (total of 72g in 34 pieces) may possibly represent all or part of a second example from the same context.

Two fragments of clinkery slag masses (90g and 118g) attached to the hearth wall, probably parts of SHCs or equivalent masses, were recovered from pit fill (607)

A rather different type of slag cake is represented by slag pucks (sometimes termed proto-SHCs) from context (505) weighing c. 60g, from context (4023), 70g and from context (4025) of c. 58g.

These classes of material are probably the origin of much of the fragmentary material from other contexts, although coal-fuelled smithing, in particular, may have generated scraps of slag that were not part of a focused SHC or equivalent.

These SHCs and related cakes show a typical range of internal textures. The upper parts may be dark and glassy, locally with rich in partially melted hearth lining, and the lower parts may be rich in coal shale clasts. The slag masses are typically dense, with dimpled surfaces – often finely dimpled on the base and coarsely, but shallowly, so on the top. They show attachment onto n oxidised fired hearth lining in some cases.

The slag debris from the sieved samples is usually too fine to show many defining characteristics, but material is present with the whole range of textures exhibited by the coarser material. For material that is finely comminuted, it is not possible to distinguish between, for instance, a black glassy slag with partially melted quartz grains that is derived fragmentation fragmentation of slag from the hearth wall and an example of a fine fragment from the upper surface of a SHC. The fine-grained slag debris is lumped into a single category in Table 2.

Concretions on iron

Collections of metallurgical residues commonly contain fragments of concretion of 'rusty' appearance that have formed around pieces of metallic iron as it has corroded. A small quantity of such material is present in this collection. The assessment did not identify any pieces that would be worthy of X-radiography to ascertain the nature of the iron object.

One particular form such materials take is in the form sometimes described as 'smithing floor'. This material reflects the large amount of small pieces of iron lost

during forging and other smithing tasks. This means that deposits forming on smithy floors and contexts where smithy-floor accumulations have been swept or dumped, are particularly prone to developing these concretions – and that these concretionary materials will therefore also be rich in other classes of material that accumulate on the smithy floor such as hammerscale, slag particles and fuel debris The iron oxides mobilised during the diagenesis of such a deposit may result in its cementation.as a ferricrete.

In this study 'smithing floor' ferricretes have been noted from contexts (601), (603) and concretions containing coal fuel from (5020)

Smithing microresidues

Very small quantities of microresidues were recovered from sampled contexts in Area 3, with slightly more substantial collections from areas 4 and 5. The 'smithing floor' ferricretes from Trench 6 suggest that some contexts there (context (603) at least) were actually very rich in smithing microresidues but were not sampled for them.

When recovery levels are low, it is very common, as with this assemblage, that those particles observed tended to be some of the larger varieties, such as slag 'flats' (slag sheets spalled from the surface of worked metal) and 'spheroids' (mostly droplets of slag that cooled within the fuel bed of the hearth). Hammerscale (both flake and spheroidal) was widely recorded in Area 3, occurred sporadically elsewhere and may have been abundant in context (603).

Tapslag-like materials

Two fragments of material resembling slag produced from a slag-tapping iron melting furnace. The two are very small (a 0.96g lobe fragment from (3058) and a 10.27g fragment from (3146)). Both examples show flow lobes with a smoothly convex maroon (haematised) upper surface and a bluish-grey lower surface with slight dimples. Both examples show a microstructure sufficiently coarse to be seen with the naked eye in cross-section. Despite their appearance, the maroon-surfaced flow lobes are only indicative of flow of a high-iron slag in oxidising conditions (in air). Small quantities of such materials may also be formed during smithing. If they derive from smelting then a Roman or medieval age would be indicated.

Ceramic materials

Small amounts of ceramic hearth lining were recovered from contexts (866) and (1853). In both cases the materials were in association with residues interpreted as being from the contact area of SHCs with the hearth wall.

Non-metallurgical fuel-ash slags

Pale coloured, extremely low density, highly vesicular residues, of the class usually known as fuel ash slags (FAS), were recorded from three contexts. Such slags arise from the partial melting of cermaic materials, usually under the influence of alkali- and/or alkali earth- rich fuel ash. This can happen in localised areas of metallurgical hearths in the absence of metal contamination, but such slags may also be generated in non-metallurgical contexts, such as domestic hearths, corn driers and other forms of kiln (and may thus have been generated in the earlier prehistoric as well as later periods).

Other archaeological materials

The collection from context (1853) included a single small (3g) sherd of dark grey sandy pottery.

Other non-archaeological materials

Four classes of geological material were commonly present in the collection and are worthy of individual mention.

Firstly, weathered fragments of 'hollow-stone' derived from claystone ironstone are present in the form of concentrically zoned films and some oxidised and polished grains too. These materials will mostly have been derived from the Carboniferous Coal Measures strata.

Secondly, much of the coal retrieved, particularly where in the form of isolated tiny grains, away from other evidence for coal use, will also have been derived from Carboniferous strata by natural processes rather than by human activity.

A third class of geological material widely reported from the site is in the form of thin layers iron oxides present as pseudomorphs of sulphide minerals (probably mainly pyrite. These may have originated in a wide range of geological settings, but formation within the Carboniferous limestones is particularly common in the region.

The fourth form of geological material that is present on the site for probably natural reasons are examples of a quartz-bearing goethite/haematite iron ore that is found within the Carboniferous limestone-hosted ore bodies of the Bristol Channel Orefield, particularly of the Border Vale to the northwest of the site.

Distribution of the assemblage

The occurrence of classes of residues by context and trench is given in Table 2.

Trench 1 produced no pyrotechnological residues and Trench 2 was limited to a piece of FAS, probably not of metallurgical origin.

Trench 3 has produced (not withstanding some possible sample contamination issues described above) an assemblage of macroresidues from ironworking (smithing) from contexts associated with CS1 (assigned to Phase 2). Contexts of Phase 3, associated with CS3, 4, 5, and 6 have sporadically yielded tiny fragments of macroresidue and some microresidue. Some contexts (fills of postholes [3222] and [3201] marked as unphased on the supplied documentation but assigned to CS3 by Davis & Sharples (2105), contained slightly richer microresidue assemblages.

A group of features close to the west margin of Trench 3 (posthole [3254], posthole [3203] and pit [3303]), all unphased, also produced small quantities of microresidues. Pit [3144] produced a small fragment of probable clinker.

Later contexts (of Phases 4 and 5) in Trench 3 produced mainly small fragments of macroresidue, with a small overall quantity. Archaeometallurgical materials were all but completely absent from the midden deposits.

The two fragments of material resembling slag produced from a slag-tapping iron melting furnace were both from Trench 3: a 0.96g lobe fragment from (3058) and a 10.27g fragment from (3146). The assemblage from (3146), a phase 2 gully fill, is suspect because it also includes some apparently post-Iron Age pottery. The other fragment is from (3078) a medieval/post-medieval hill wash deposit.

Trench 4 produced a modest assemblage of macroresidues, mostly from the upper fills of Enclosure Ditch H. These comprised smithing residues. The fuel was uncertain on the evidence from the slag, but coke and probable clinker particles were observed from various contents. These materials are thus slightly more likely to be Roman than Iron Age, but the evidence is inconclusive.

In Trench 5 a small trace of archaeometallurgical residue was recorded from the fills of Enclosure Ditch H. A larger assemblage (total of approximately 430g) was recovered from the upper fills of pit [5019].

Trench 5a produced a significant quantity of residues from the fills (fills (5071) and (5090) most particularly) of minor cut features. These fills contained coal and are likely to be of Roman age.

Trench 6 (dug by TimeTeam) produced a significant assemblage of macroscopic archaeometallurgical residue. These residues were from coal-fuelled smithing, typical of Roman blacksmithing. Environmental samples taken by TimeTeam are described in their report (Wessex Archaeology 2013) as containing abundant hammerscale.

Trenches 7 and 8 produced some small scraps of residue, and each also produced a single incomplete example of a smithing hearth cake (that from Trench 7 from an unrecorded context, that from Trench 8 was from hillwash (8003)).

Interpretation

The archaeometallurgical residues from this site provide evidence for blacksmithing during at least two phases of occupation: during Phase 2 and Phase 4/5.

The amount of residue recovered is small. This suggests that no significant level of blacksmithing was undertaken within any of the excavated areas, although the pits fills in Trench 6 would appear to a primary dump of waste and thus probably immediately adjacent to the locus of at least some blacksmithing. The hillfort is large and there are likely to be foci of metalworking elsewhere within the site. However, the general impression on the basis of the present evidence is for a low level of activity, such as is commonly found when metalworking is undertaken to support the other craft and agricultural activities of a settlement rather than as an 'industrial' activity in its own right.

The limited nature of the assemblage also limits the degree to which the individual residue assemblages may be interpreted. For both the earlier assemblage in Trench 3 and the later assemblage from trenches 4 and 5, there is lack of evidence for smithing hearth cakes of much over 150g. There is evidence in several contexts for slag cakes in the form of small discs or 'pucks', with weights of 50-80g.

Assemblages of this general type have been recognised on a large number of Roman sites. Comparative Iron Age sites are much less well-known locally. A Roman site at Cleevelands (near Cheltenham, Gloucestershire; Young 2018) produced a large assemblage of 176 slag cakes covering a range of morphologies including classic SHC shape, all-attached clinker masses and pucks, with a range of weights from 44g to 530g, with a mean weight of 125g. Other smaller assemblages with comparable statistics are known from Roman rural settlements at Exminster (Young 2014), Uffington (Young 2015) and Ebrington (Young 2016). In contrast assemblages from more urban Roman sites tend to have larger SHCs (with mean weights of 225-500g).

The size of slag cake produced during an episode of smithing will depend on both the rate of iron loss to the hearth (approximately half the weight of a typical SHC will be iron; high rates of iron loss result from lossy processes, including those conducted at high temperature, such as welding) and on the length of the work period.

It is possible that rural smithies might undertake, on average, less 'lossy' work – such as perhaps might be seen in the post-medieval with the development of specialist farriers. It is more likely, however, that the dominant factor the continuity of the activity. Smiths in small settlements or individual farms may undertake forge work in response to a particular need as it arises, whereas those in larger settlements might need to work continuously to service the needs of the larger community.

The evidence from Caerau is too small for firm conclusions but suggests that the work may have been light and/or intermittent.

The presence of evidence for some working of copper alloys is typical for the Roman period. As is so often the case, the nature of the evidence does not permit discrimination between residues from a blacksmith undertaking a small proportion of work in copper alloy and the contribution of more specialist, perhaps itinerant, copper-alloy workers.

At least some of the blacksmithing in Phase 5 employed coal as fuel (as evidenced by material from trenches 5 and 6). This is an expression of a regional phenomenon, in which coal was employed at almost sites undertaking blacksmithing (the working of iron to produce or repair artefacts) as opposed to bloomsmithing (part of the *chaîne operatoire* of the production of raw iron). The economics behind this have not been investigated, but the widespread supplanting of charcoal as the preferred blacksmithing fuel at this period may indicate other pressures on sources of charcoal. Other local Roman sites producing evidence for smithing using coal include Cardiff Castle (Young & Kearns 2011), Trowbridge (St Mellons; Young 2009a, 2009b), Bulmore (Young 1999) and Caerwent (Young 2006).

The evidence from trenches 4 and 5a indicates a significant phase of late Iron Age or early Roman activity (Phase 4). There are hints in these areas for the use of coal as fuel, but this is not clear-cut and thus it is not possible to indicate a certain Roman age for this phase of the activity.

The significance of the smithing that is likely to be of Iron Age date in Trench 3 is harder to evaluate. Apart from the difference in fuel, the earlier residues appear to suggest smithing of a broadly similar character to that discussed above in the Roman period. Blacksmithing residues of the Iron Age have had almost no recent investigation within the region. Two sites, Kingstone (Young 2012) and Lockleaze (Young 2018b), have produced smithing slags of the latest Iron Age but, in both cases, these were bloomsmithing slags associated with iron production. Ironworking associated with undefended earlier Iron Age settlement has been claimed in South Wales at Merthyr Mawr. Within hillforts, geophysical survey followed by field walking indicated iron smelting, possibly of Iron Age date, in the entrance forecourt of Caerau hillfort (Llantrisant).

The two fragments of possible iron smelting tapslag are problematic; it is quite likely that neither is actually a tapslag since similar flowed materials may be generated in smithing hearths. On the other hand, despite the very small quantity of material it is worth noting that a single fragment of more convincing tapslag from Caerau was brought to the author's attention some twenty years ago. The area does have iron resources, with the nearest being a haematite/goethite orebody of the Bristol Channel orefield at Wenvoe Quarry less than 600m to the south of the site. Ore was also brought into Cardiff for smelting from the Lesser Garth orebody in the Roman period. Somewhat problematic evidence for iron smelting was recovered from the Ely Roman villa, with Ordnance Survey mapping marking a Roman iron furnace on the southern edge of the late enclosure there, for which there is no evidence provided in the various excavation undertaken. The steep wooded slopes of the Cardiff area provided a source for charcoal in the medieval period and isolated bloomery furnaces have been found away from the known ore sources. As a further potential link to the iron industry, a Morgan Mathew of Sweldon (500m WNW of the site) was the tenant of Mwyndy, a farm on the site of a very large late medieval bloomery and iron mine near Llantrisant, in 1542; it is not known if he was actually involved with iron there. In summary, although these two pieces might suggest a phase of bloomery iron smelting on the hill, without detailed analysis it cannot be confirmed whether these two flow-lobed pieces are indeed smelting slags.

Further work

The slags are, as described above, are rather sparse and only capable of yielding very limited further evidence if they were to be subjected to detailed analysis. On this basis, no further work is recommended at this time.

References

DAVIS, O. and SHARPLES, N. 2013. *Excavations at Caerau Hillfort, Cardiff, South Wales, 2014*. Cardiff Studies in Archaeology 34.

DAVIS, O. and SHARPLES, N. 2014. *Excavations at Caerau Hillfort, Cardiff, South Wales, 2015*. Cardiff Studies in Archaeology 35.

DAVIS, O. and SHARPLES, N. 2015. *Excavations at Caerau Hillfort, Cardiff, South Wales, 2016*. Cardiff Studies in Archaeology 36.

WESSEX ARCHAEOLOGY 2013. Caerau, Cardiff, South Wales; Archaeological Evaluation and Assessment of Results. Report Ref: 85201.01

YOUNG, T.P. 1999. Iron-working residues from Bulmore. GeoArch Report 1999/01. 2pp.

YOUNG, T.P. 2005. *Geophysical Survey of Caerau Hillfort, Llantrisant, Rhondda Cynon Taff*. GeoArch Report 2005/03. 7pp + 7 figures.

YOUNG, T.P. 2006. *Archaeometallurigcal residues from the Caerwent Forum-Basilica (provisional report).* GeoArch Report 2006/01. 33pp + 8 plates.

YOUNG, T.P. 2009a. *Archaeometallurgical residues from Crickhowell Road, Trowbridge, Cardiff*. GeoArch Report 2009/02. 11pp.

YOUNG, T.P. 2009b. Archaeometallurgical residues. 155-159. *In:* M. Brett, E. R. McSloy and N. Holbrook. A Roman enclosure at Crickhowell Road, Trowbridge, Cardiff. Evaluation and excavation 2005–06. *Archaeologia Cambrensis*, 158, 131-166.

YOUNG, T.P. 2012. *Archaeometallurgical residues from the Brecon to Tirley gas pipeline*. GeoArch Report 2012/18, 75pp.

YOUNG, T.P. 2014a. *Archaeometallurgical residues from Dwr-y-Felin School, Neath (GGAT 677 & 716).* GeoArch Report 2013/27. 53pp.

YOUNG, T.P. 2014b. *Assessment of archaeometallurgical residues from Milbury Farm, Exminster, Devon (ACD478).* GeoArch Report 2014-09. 16pp.

YOUNG, T.P. 2015. *Assessment of archaeometallurgical residues from Uffington, Oxfordshire*. GeoArch Report 2015-30. 12pp.

YOUNG, T.P. 2016. *Assessment of archaeometallurgical residues from Ebrington, Gloucestershire (EGE09 ex).* GeoArch Report 2016/21. 18pp.

YOUNG, T.P. 2017. *Ironworking residues from Kingswood, Gloucestershire (ACW451).* GeoArch Report 2017/06. 93pp.

YOUNG, T.P. 2018a. *Archaeometallurgical residues from Cleevelands, Bishop's Cleeve, Gloucestershire*. GeoArch Report 2018/12, 104pp.

YOUNG, T.P. 2018b. *Assessment of archaeometallurgical residues from Lockleaze (Ding Crusaders)*, GeoArch Report 2018/24, 24pp.

YOUNG, T.P. & KEARNS, T. 2011. *Evaluation of metallurgical residues from the New Interpretation Centre, Cardiff Castle, Cardiff [ST181765].* GeoArch Report 2011/02, 27 pp.

Table 1: summary catalogue of submitted materials. Assm = assemblage of small pieces. Weights in g.

context	sample	fraction	l wt	l no	notes
Trench 2					
203			1	1	bleb with grey ceramic passing into dark lobed FAS along its length
Trench 3					
3002			9.63	1	accretion containing curved iron fragment
			1.19	2	coke
			0.11	1	coal
			0.58	1	slag dominated by pale bloated ceramic material
			1.71	1	oxidised ceramic material
			11.6	6	vesicular dark slag
			10.46	9	clinkery slag with coal shale
3002			47.9	4	clinkery vesicular slag
			10.76	1	dense lobate slag
			9.4	5	slag scraps
3004			2.04	2	one Mn mottle, one iron-rich rock fragment
3009	<312>		7.23	2	stone
3016			0.44	1	prill of Cu-alloy subspherical, green soft, trapped in slag below
			1.21	1	slag, vesicular, contained object above as an internal prill, slag shows CuO colouration
3016			4.84	1	slightly worn conchoidally-fractured fragment of somewhat opaque blue laminated glass. Probably a blast furnace slag, but other (probably Ca-rich) interpretations are possible
3022	<303>		2.12	1	oxidised pyrite
3028			1.59	1	oxidised pyrite
3032	<309>		0.08	2	stone
			<	1	probable slag
3034	<304>		0.55	1	stone
3034	<305>		0.78	1	stone

context	sample	fraction	l wt	l no	notes
3054	<313>		4.69	1	oxidised pyrite
3058			0.96	1	fragment of lobe of maroon-surfaced dense tapslag-like material
3059	<314>		8.34	3	stone
3064	<317>		0.8	1	claystone ironstone
3065	<311>		5.25	3	oxidised pyrite
			0.66	1	claystone ironstone
3067	<318>		1.89	1	oxidised pyrite
3067	<318>		3.22	1	oxidised pyrite
3067	<319>		6.64	2	oxidised pyrite
	test pit 5		14.64	1	internally prilly slag with crude layering, partially melted rock/sediment clast
			6.22	1	slag prill, slightly lobate
			1.44	1	vesicular slag fragment
			3.05	1	vesicular clinkery slag
3074	<321>		2.19	5	partially-cemented probable ash
3074	<321>		3.7	1	oxidised pyrite
3089	<335>		72	34	multiple small fragments of probable SHC - unclear if this is a single highly fragmented cake
3089			136	36	abundant debris of fragmented vesicular SHC, strongly lining influenced, reduced-fired lining contact on one side, probably all from single piece
3094	<329>/320		1.35	1	iron slag fragment
3113	<337>		2.77	1	clinkery slag fragment
3113	<337>		1.28	1	clinker
			2.36	1	sandstone
3120	<349>		2.49	1	oxidised pyrite
3121	<342>		0.07	1	fine oxidised iron point- hobnail or similar?
3133	<343>		0.44	1	grey FAS

context	sample	fraction	l wt	l no	notes
3146			21.97	9	slagged and vitrified oxidised-fired ceramic hearth lining
			10.27	1	small fragment of flow lobed coarse-grained slag with maroon surface, possibly tap slag
			8.28	1	black-surfaced red sandstone
			22.69	1	sandstone
			9.91	2	two sherds of pottery, one thin orange sandy, second thicker buff, sandy, external green glaze
3171			0.73	1	appears to be very coarsely vesicular coke
3185	<083>		0.66	assm	stone, one possible FHS fragment
3186	<346>		4.62	1	sandstone
3190	<050>		16.98	assm	stone with rare slag
3190	<054>		6.22	assm	stone, tiny amount of slag and possible FHS
3202	<014>		1.41	assm	mainly stone, low levels of slag and FHS
3202	<014>		3.76	1	oxidised pyrite
			0.19	1	coal
3202	<029>		0.3	assm	stone moderate amount of slag fragments and some FHS
3204	<010>	coarse	0.89	assm	mainly stone, scarce possible slag fragments
		fine	0.71	assm	mainly stone, some droplets/SHS
3206	<015>		0.58	assm	stone, tiny amount of slag and FHS
3212	<011>		0.75	assm	stone with small amount of FHS and SHS
3214	<012>		0.57	assm	almost all stone, a few slag fragments
3219			20.84	1	SHC fragment, dished smooth top, base dimpled, c10mm thick
3221	<022>		1.16	assm	stone dominant, minor slag, clinker, FHS and SHS
3223	<024>		0.23	assm	stone with some very fine slag and FHS
3230	<034>		0.95	assm	almost all stone, a few slag fragments
3753	<0321>?		2.61	assm	stone, tiny proportion of FHS and SHS
3254	<039>		2.55	assm	stone, very rare spheroids/SHS

context	sample	fraction	l wt	l no	notes
3258	<036>		1.85	assm	stone, very rare slag grains
3264	<044>		1.24	assm	stone, no certain slag
	<051>		0.46	assm	stone, slag fragments, tiny amount of droplets/SHS
3279	<102>		0.24	assm	stone with a couple of possible slag grains
3289			3.52		coal
3304	<088>		1.8	assm	stone with tiny amount of scale-like slag
3320	<101>		0.17	assm	small assemblage but moderate dark. Possible slag grains
3338	<30001>	<2mm	0.18		coal, contains some charcoal
3351	<30004>	<2mm	0.26		coal
3351	<30004>	<4mm	0.59		coal, contains some charcoal
3382	30052	<2mm	<	1	burnt bone fragment
3382	<30036>	4mm	0.09		coal
3390	<30029>	4mm	0.06		coal
3395	30075	coarse	0.3	1	quartz-bearing iron oxide
3402	30073	coarse	0.22	1	grey FAS
3412	30079	coarse	0.11	1	claystone ironstone hollow-stone fragment
3441	30092	coarse	0.11	2	iron oxide 'rusty' material - peds?
3443	30080	coarse	2.22	5	rusty accretions, one possibly on slag grain
3458	30096	coarse	1.14	1	iron slag prill
spoilheap			11.01	1	polished fragment of iron ore, haematite with quartz
Trench 4					
4002			19.14	1	fragment from upper part of SHC, very sandy in places

context	sample	fraction	l wt	l no	notes
4006	<403>	2mm	<	2	slag fragments
4010	<419>	2mm	0.11	1	stone
			<	2	coke
			<	2	slag
			<	1	claystone ironstone
4010	<414>		0.45	1	stone
			1.38	1	stone
4012	<401>	2mm	0.06	3	stones
			0.23	1	oxidised pyrite
4012	<401>	2mm	0.06	3	probably all stone (1 just possibly tiny chip of slag)
4014	<402>	2mm	0.22	1	claystone ironstone
4014	<402>	2mm	0.16	7	6 fragments of stone, 1 of burnt bone
4016	<406>	2mm	<	4	tiny black grains, probably Mn-rich peds
4014/4019	<405>	2mm	0.24	1	bone
			<	1	stone
4019	<405>	2mm	<	1	probable coke
4019	<415>		2.63	2	claystone ironstone
4019	<405>		1.28	1	sandstone
4023			10.65	1	complex fragment of black glass, lining slag attached to grey lining
			70	11	fragmented slag disk, 65x40x13mm, base shallow dimples, top has deep fuel dimples
4023	<407>		0.22	2	stone
			0.05	1	rusty grain, probably stone
4025			48.56	1	40x50x20mm, small disc like slag lump, small piece c5g missing
			8.91	1	similar slag fragment to above, but doesn't fit gap in the above
4026	<408>		0.23	2	coal
			0.01	1	FAS droplet
			0.02	2	coke

context	sample	fraction	l wt	l no	notes
4026	<408>		3.26	1	rusted material, possibly slag
4029	<412>	2mm	0.01	2	stones
4029	<412>		1.65	1	worn fragment of dark lining slag
4030			20.17	3	fresh broken fragments of pale vesicular slag, elongate coarse olivine in some places, possible charcoal clast, orange ceramic attached or included
4030	<409>		2.19	1	claystone ironstone
			1.91	2	concretion from corroded iron
			0.97	1	lining slag
4030	<409>	2mm	<	3	slag fragments
			0.42	4	oxidised pyrite
			0.08	4	stones
4031	<410>	2mm	0.06	3	stone
			0.03	4	slag
			0.07	3	burnt coal?
4031	<410>	2mm	<	1	coal
			<	1	charcoal
			<	1	slag droplet?
			<	2	stone
4032	<416>		0.14	1	laminated stone ?coal
			3.88	2	slag fragments
4033	<411>	2mm	<	1	slag - spalled surface of a lobe
4036	<413>	2mm	<	3	clinker
			<	1	coal
			<	1	coke
			0.1	1	oxidised pyrite
			0.4	1	bone
4038	<420>	2mm	0.42	1	oxidised pyrite
			0.23	13	stone
			<	1	clinkery slag droplet
4038	<417>	2mm	<	1	slag fragment?
			0.15	12	stone

context	sample	fraction	l wt	l no	notes
4042	<416>		1.25	1	fired very fine clay - ?daub
4043	<416>		0.12	3	fired very fine clay - ?daub
4043	<416>	2mm	<	1	possibly slag
4046	<422>	2mm	0.11	5	stone
			0.06	1	claystone ironstone
			<	1	coke
4059	<424>		8.74	2	oxidised pyrite
4049	<419>		2.46	2	stone
4059	<424>	2mm	0.24	1	slag droplet
			1.58	1	stone
spoilheap			3.81	1	lining slag bleb
Trench 5					
505			56	1	clinker pad, smooth top, iron slag below, veneer of lining slag on top, no coke clasts, (40)x60x18mm
			6	1	fragment of glassy slag similar to pad, but apparently not joining it
			18	1	part of dimpled slag lump, no coke inclusions
			16	1	twisted? scrap of lining slag
5009	<512>	2mm	<	1	hearth ling?
			<	1	possible slag
5009	<512>		0.62	1	claystone ironstone
5009	<512>	2mm	0.22	3	stones
5015	<501>	2mm	0.05	2	stones
5015			<	1	claystone ironstone
5016			<	1	clinker
			0.03	2	stones
5017	<503>	2mm	0.08	3	stone

context	sample	fraction	l wt	l no	notes
5020	<505>	2mm	0.67	1	slag droplet
			0.11	6	films and fragments of clinkery slag
5020	<516>	2mm	0.19	1	lining slag bleb
			0.29	9	slag blebs and slag films (flats?)
5020	<505>	2mm	0.08	3	1 impacted slag droplet, 1 fragment lining slag, 1 fragment of slag
5020	<505>	2mm	0.09	5	slag fragments
5020	<505>	2mm	1.35	1	iron slag prill
5020	<505>	2mm	<	1	stone
			0.33	1	FAS bleb
			0.1	1	possible rotten slag grain
5020	<505>		0.11	1	claystone ironstone
			0.04	1	slag fragment
			0.04	2	clinker-like prills
5020	<505>		3.18	1	red cherty material
			1.42	1	maroon surfaced lining slag
			1.8	1	oxidised pyrite
5020	<516>		6.22	3	claystone ironstone
5020	<505>		0.71	1	dark glass blue-grey FAS, turning cream stony in some areas
			1.42	1	oxidised pyrite
5020	<505>		4.4	2	rounded blebby lumps of lining slag
5020	<505>		1.1	1	small dimpled slag fragment in concretion with coal
			2.78	1	lining slag
5020			20.81	1	small fragment of small SHC, dense clinkery slag in lower part, melted lining in upper
5022	<506>		<	1	probably stone
5022	<568> (?508)	2mm	0.01	1	clinker droplet
			<	4	coke
			0.01	1	coal shale
			0.01	1	stone

context	sample	fraction	l wt	l no	notes
5022	<506>		3.93	2	claystone ironstone as hollow stone fragments
5028	<510>	2mm	0.17	3	slag fragments, 1 vesicular, 2 small fragments
5028	<510>	2mm	0.09	7	small amorphous grains of granular material, probable slag, 1 fragment of probable claystone ironstone
5028	<510>		1.88	1	sheet of oxidised pyrite
5031	<511>	2mm	0.08	1	coal
5036			154	1	80x90x35(20)mm well-formed SHC, deeply dimpled planar top, fuel impressions are probably charcoal, the base is finely dimpled wth some irregular pendent lobes
			6	2	small fragment of dense slag with lining influence
5036			8.77	1	flowed prill of lining slag
			1.17	1	fragment of lobe of lining-influenced dark slag
5036			40	1	pillulous mass of maroon-surfaced lining slag, probably descended to hearth floor
			8	1	complex lobed flow of sandy grey lining slag
5036	<513>		6.71	3	vesicular, locally maroon surfaced, lining slag blebs
			0.87	1	oxidised pyrite
			0.53	1	slag flat
			0.41	1	slag blister
5036	<513>	2mm	0.01	1	slag fragment
5037	<514>	2mm	0.36	6	dense dark slag fragments
			1.05	4	vesicular lining slag
5037	<514>		16	2	concretions
			2	2	stone
			68	8	fragments of mostly vesicular slag
5038	<515>	2mm	0.3	6	small blebs of low density slag, probably mainly FAS/clinker
5038			3.65	1	sandy lining slag bleb
5038	<515>		2	1	dark prill of sandy lining slag
			2	1	fragment of claystone hollow stone
5040	<517>		<.01	2	lining slag chips
5043	<518>	2mm	0.31	6	slag fragments

context	sample	fraction	l wt	l no	notes
			0.03	2	chert
5043	<518>/578	2mm	<.01	1	slag fragment
Trench 5a					
5061	<50001>	4mm	0.17	assm	coal
5061	<50001>	<2mm	0.17	assm	coal
5071	<50002>		3.75	assm	coal
5071			8.2	assm	coal
5071	<50002>		13.29	assm	coal
5071	<50002>		10.33	assm	coal
5071	<50002>	<2mm	0.39	18	FHS
5071	<50002>		2.57	1	concretionary material
			0.99	1	clinker or coke
5071			138	15	fragments of exploded concretions bearing iron fragments
			30	4	dimpled slag prills
			100	1	large part (60-70%?) of flat sheet-like SHC, well formed, finely dimpled base not much less finely so on top which is slightly concave, lobes developed along margin
			10	4	small clinkery slag fragments
5074	<50004>	<2mm		<	coal
5076	<50003>	<4mm	0.08	1	rounded ball of weathered vesicular slag
5079	<50007>	<2mm	0.06	assm	coal
5081	<50010>	<2mm	0.1	assm	coal
5088	<50013>		1.69	1	?oxidised claystone ironstone
5090	<50014>		0.56	14	FHS
				6	slag
				1	lining
				1	slag droplet

context	sample	fraction	l wt	l no	notes
5090	<50014>		4.21	4	clinkery slag
			5.86	2	dimpled dense slag blebs
5090	<50014>	<2mm	0.07	assm	coal
5097	<50017>		11.65	1	oxidised pyrite concretion
			312	assm	coal
			1.74	assm	coal
Trench 6					
601			124	3	concretions on iron, one exploded, one definitely in smithing floor concretion with coal
603			13.29	1	vitrified and slagged oxidised fired hearth lining
603			188	5	multiple concretions, now exploded because of increased corrosion after excavation and washing, iron fragments (not recognisable objects) in smithing floor concretions rich in hammerscale
607			16	2	approximately planar fragments of vitrified oxidised lining
			44	8	clinker pieces cored on shale
			84	12	small smithing slag fragments
			178	5	dimpled dense slag nubs, rounded pieces not part of larger masses. One shows narrow rod as part, most show coked coal inclusions
			56	1	slab of vitrified oxidised lining, with flap of slag hanging below a slight in-turn, slag clinkery with shale
			90	1	transverse clinkery shale-bearing slag mass attached to oxidised lining
			118	1	dense clinker SHC attachment area attached to wall; indurated oxidised-fired wall, SHC main section not present
			22	1	small area of wall slag attachment, oxidised fired
			70	1	rough elongate mass of ferruginous material - part slag, part accretion, 75x50x20mm
			8	1	concretion rust spalled from iron object
			22	1	small pad of clinkery slag with shale
			18	1	highly vesicular dark FAS-like material but appears to be clinkery
			2	1	slagged pale grey ceramic from wall
			58	3	dimpled clinkery slag fragments
607	4		3	2	vitrified layer off front of oxidised fired lining
			6	2	corrosion around iron
			4	1	stone
			10	2	slagged shale
			1	1	coating of slag off circular substrate c8mm diameter
			392	92	dimpled slag lumps and fragments

context	sample	fraction	l wt	l no	notes
Trench 7					
7001			8.97	1	clinker
			1.46	1	charcoal
7001			1.17	assm	coal
7064	<091>	>10mm	0.31	1	blebby melted sandy lining slag
7064	<091>	>10mm	0.27	1	blebby melted sandy lining slag
7098	<70006>		2.54	1	pebble fragment
7114	<70012>		4.76	4	FAS, weathered
no context			80	1	part of dense slag SHC, base is dimpled with multiple large lobes bit not obviously tool marks, top very worn
			10	5	small fragments of clinker and slag
			1	1	linin slag
			1	1	claystone ironstone
			<1	1	coke
Trench 8					
8001			34.79	5	flow lobed clinker with brown/maroon surface
8001			9.52	1	clinker
8001			2.21	assm	coal
8002			22.36	1	weathered lump of dark slag
8002			3.4	1	vesicular slag/clinker
8003			123	1	part of deep SHC, dimpled base has multiple lobes, probably tool marks, vesicular but dense
8084	<80011>		0.05	assm	coal
8093	<80017>		0.05	assm	coal
8503			176	1	quartz-bearing haematite ore

context	sample	fraction	l wt	l no	notes
Trench 10					
10001			2.51	assm	coal
10001			2.12	assm	coal
10002			2.65	assm	coal
10002			3.92	assm	coal
10002			4	2	coke
10002			2	1	clinker
unknown					
unknown		2mm	0.13	1	vesicular clinker/FAS
unknown			0.14	assm	stone, some possible slag grains

Table 2: composition of assemblages, structured by trench and phase. Weights in g. Natural materials from samples not shown (except coal).

context	nature	notes	phase	FAS	blue FAS	Accn with Fe	Coke	coal	lining	clinker	dark slag	flow lobe cf tapslag	lining slag	SHC/ pad	Cu slag	ash	slag?	FHS	SHS and droplets	flats and blisters	*total*
		Trench 2																			
203	p/h fill	FP structure 4	3	1																	*1*
		Trench 3																			
3002		Relict ploughsoil	n/a	0.58		9.63	1.19	0.11	1.71	58.36	31.62										*103.2*
3058		hillwash	7/8									0.96									*0.96*
3214		hillwash	7/8														Y				
3094	p/h fill	rect. Structure 1	5/6								1.35										*1.35*
3230	?	poss p/h fil rect str 1	5/6														Y				
3121		inner rampart	5			0.07															*0.07*
3190	deposit	midden	5														y	y			
3382	deposit	midden	5					0.09													*0.09*
3212	deposit	seals metalling	5															Y	Y		
3219	deposit	seals metalling	5											20.84							*20.84*
3016		metalled surface	4/5		4.84										1.65						*6.49*
3032	p/h cut	four post str1	3														y				
3390	p/h fill	circular structure 3	3					0.06													*0.06*
3258	p/h fill	circular structure 3	3														Y				*0*
3074	p/h fill	circular structure 4	3													2.19					*2.19*

context	nature	notes	phase	FAS	blue FAS	Accn with Fe	Coke	coal	lining	clinker	dark slag	flow lobe cf tapslag	lining slag	SHC/ pad	Cu slag	ash	slag?	FHS	SHS and droplets	flats and blisters	*total*
3133	p/h fill	circular structure 4	3	0.44																	*0.44*
	p/h fill	circular structure 5	3														Y		Y		
3458	p/h fill	circular structure 6	3								1.14										*1.14*
3279	deposit	inner rampart	3														y				
3146	gully fill	circular structure 1	2						21.97			10.27									*32.24*
3089	rh gully	circular structure 1	2											208							*208*
3402	gully fill	circular structure 1	2	0.22																	*0.22*
3351	p/h fill	inner rampart	2					0.85													*0.85*
3443	p/h fill	inner rampart	2			2.22															*2.22*
3113	pit fill		unph.							4.05											*4.05*
3202	p/h fill	CS3?	unph.														Y	Y			
3204	p/h fill		unph.														Y	Y	Y		
3206	p/h fill	Void?	unph.														Y	Y			
3223	p/h fill	CS3?	unph.														Y	Y			
3253	p/h fill																	Y	Y		
3304	pit fill		unph.														Y				
3338	p/h	CS3?	unph.					0.18													*0.18*
3289		natural feature	n/a					3.52													*3.52*
test pit 5										3.05	22.3										*25.35*
3171		backfill	n/a				0.73														*0.73*
3185		cancelled																y			
3221		cancelled								y							Y	Y	Y		
3320		cancelled															y				

context	nature	notes	phase	FAS	blue FAS	Accn with Fe	Coke	coal	lining	clinker	dark slag	flow lobe cf tapslag	lining slag	SHC/ pad	Cu slag	ash	slag?	FHS	SHS and droplets	flats and blisters	*total*
		Trench 4																			
4002		relict ploughsoil	n/a											19.14							*19.14*
4038	p/h fill		7							<							y				
4031	pit fill		6				0.07	<									0.03		Y		*0.1*
4033	pit fill		6								<										
4046	pit fill		6				y														
4023	ditch fill	Enclosure ditch H	4										10.65	70							*80.65*
4025	ditch fill	Enclosure ditch H	4											57.47							*57.47*
4026	ditch fill	Enclosure ditch H	4	0.01			0.02	0.23													*0.26*
4029	ditch fill	Enclosure ditch H	4										1.65								*1.65*
4030	ditch fill	Enclosure ditch H	4			1.91					20.17		0.97				Y				*23.05*
4032	ditch fill	Enclosure ditch H	4					0.14			3.88										*4.02*
4036	ditch fill	Enclosure ditch H	4				<	<		<											
4042	ditch fill	Enclosure ditch H	4																		
4043	ditch fill	Enclosure ditch H	4														y				
4059	pit fill		unph.																0.24		*0.24*
4010	p/h fill		unph.				Y										Y				
4019	p/h fill		unph.				y														
4006		fill of natural feature	n/a														Y				
spoil													3.81								*3.81*

context	nature	notes	phase	FAS	blue FAS	Accn with Fe	Coke	coal	lining	clinker	dark slag	flow lobe cf tapslag	lining slag	SHC/ pad	Cu slag	ash	slag?	FHS	SHS and droplets	flats and blisters	*total*
		Trench 5																			
505	pit fill		5								18		16	62							*96*
5020	pit fill		5	0.33	0.71					0.15	2.87		8.79	20.81			Y		0.67	Y	*34.33*
5036	pit fill	pit	5								46		24.65	154						0.94	*225.59*
5037	pit fill	pit	5								68.36		1.05								*69.41*
5038	pit fill	pit	5							0.3			5.65								*5.95*
5040	pit fill	pit	5										<								
5009	ditch fill	Enclosure ditch H	4						y								y				
5016	ditch fill	Enclosure ditch H	4							Y											
5022	p/h/ fill		unph.				<	0.01		0.01											*0.02*
5028	p/h/ fill		unph.								0.17						y				*0.17*
5031	p/h/ fill		unph.					0.08													*0.08*
5043	p/h fill		unph.								0.31										*0.31*
		Trench 5a																			
5076	p/h fill		1								0.08										*0.08*
5061	p/h fill		unph.					0.34													*0.34*
5071	pit fill		unph.			138		35.57		10.99	30			100				0.39			*314.95*
5074	p/h fill		unph.					<													
5079	pit fill		unph.					0.06													*0.06*
5081	pit fill		unph.					0.1													*0.1*
5090	pit fill		unph.					0.07	Y	4.21	5.86						Y	Y	Y		*10.14*
Tp1								312													*312*
Tp2								1.74													*1.74*

context	nature	notes	phase	FAS	blue FAS	Accn with Fe	Coke	coal	lining	clinker	dark slag	flow lobe cf tapslag	lining slag	SHC/ pad	Cu slag	ash	slag?	FHS	SHS and droplets	flats and blisters	*total*
		Trench 6																			
601	topsoil		n/a			124															*124*
603	pit fill		5			188			13.29												*201.29*
607	pit fill		5			14			77	130	725			252							*1198*
		Trench 7																			
7001		topsoil	n/a							8.97											*8.97*
7001		topsoil	n/a					1.17													*1.17*
7064	p/h fill		unph.										0.58								*0.58*
7114		backfill	n/a	4.76																	*4.76*
none							<			10			1	80							*91*
		Trench 8																			
8001		topsoil	n/a					2.21		44.31											*46.52*
8002		relict ploughsoil	n/a							3.4	22.26										*25.66*
8003		hillwash	7/8											123							*123*
8084	ditch fill	Enclosure ditch D (3)	1					0.05													*0.05*
8093	ditch fill	Enclosure ditch D (3)	1					0.05													*0.05*
		Trench 10																			
10001								4.63													*4.63*
10002							4	5.57		2											*11.57*

GeoArch

geoarchaeological, archaeometallurgical & geophysical investigations

Unit 6, Block C,
Western Industrial Estate,
Caerphilly,
CF83 1BQ

Office: 029 20881431
Mobile: 07802 413704

E-Mail: Tim.Young@GeoArch.co.uk
Web: www.GeoArch.co.uk