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Assessment of archaeometallurgical residues from N of Culmstock Road, Hemyock (880160)

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Abstract

This small collection (approximately 14.8kg of macroscopic residues and 6.9kg of sieved residues from flotation) from a field evaluation included abundant slag from the basal pit on a non-slag tapping iron smelting furnace. The residues were all compatible with an origin within this single technology.

In detail, the slags were mainly flow slags Some pieces showed amalgamation both against the wall of the pit (where there were indications of reaction with the material of the pit wall) and around large moulds of the wood pit-packing. Others were in form of small individual flow slag prills. Several pieces showed the formation of a slag 'puddle' in the base of the pit. Some pieces were large fragments, rich in finer charcoal, that typically form what is known as the 'furnace bottom' slag in such furnaces.

Magnetic separation of subsamples of the supplied sieved residues showed much fine-grained slag debris, fired clay, burnt stone and possible ore. No hammerscale was observed.

Non-tapping furnaces were employed both in the Iron Age and early medieval periods. The present material shows closer affinity to early medieval assemblages. It can be compared with the two nearby excavated early medieval smelting sites, Churchills Farm and to the south of Culmstock Road. The latter contained furnaces with rather deep pits, with wood pit-packing and straight blowing walls, the former had (alongside slag-tapping furnaces) non-tapping furnaces with medium sized sub-circular pits, with basal puddles and cereal packing. The present material, whilst in the same broad technology, is thus different from both.

The assemblage (and therefore the site) is highly significant, both for its potential to inform of the development of iron smelting in early medieval Hemyock, but also for its potential to provide further evidence for development of iron smelting in Wessex.

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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 Archaelogy.

Results

Description of residues

The submitted materials amounted to an overall total of approximately 14.8kg of macroscopic residues and 6.9kg of sieved residues from flotation.

The identifiable materials are all from iron smelting in a non-tapping furnace.

The catalogue of the residues is presented in Table 1.

Ironworking residues

Much of the assemblage comprises varieties of flow slag. These range up from small-scale individual prills to coarse flow slag amalgamations surrounding wood moulds and to the charcoal-rich amalgamated material typical of so-called 'furnace bottoms' (FBs). FBs tend to be very dense near the blowing wall and some of the largest blocks (e.g. the 3.5kg block from context (906)) show the interaction with the pit wall as is common in the part of the furnace. This whole range of variation is exhibited by the material from context (906).

In addition to these flow slags, pieces from both contexts (806) and (906) show evidence for the formation of 'slag puddles' in the base of the furnace pits. These puddles show elongate fayalite crystals extending across the entire thickness of the puddle (up to almost 25mm), suggesting a well-fluxed composition at least as siliceous as fayalite.

Other slag materials include vesicular slag with a lobate/prilly basal surface (context (1101)) and some low-density and charcoal-rich slags from context (906); both are probably variants of the flow slag textures mentioned above, although neither has criteria enabling definite attribution to an origin in smelting.

The fine-grained debris in the sieved sample <2> from context (906) included small prills and angular fragments of slag, alongside particles of fired ceramic and concretion. The slag fragments in samples <1> (from context (804)) and <3> (from context (907)) were rather more rounded and therefore presumably reworked. The identification of the more worn very fine-grained material in these two samples is less certain, with the distinction between concretionary material, slag and fired clay difficult to make on the basis of visual inspection.

Sample <3> (from context (907)) included a small proportion of haematite-rich material, some containing chert, that was probably roasted iron ore.
The macroscopic material also included a small proportion of fired ceramic, including reduced-fired material from context (906) and a piece of bloated cermaic from context (1101). It is possible that these pieces may include heat altered material from the pit margin, rather than necessarily being from the constructed furnace superstructure. No large pieces of oxidised fabric from the upper structure were observed.

Distribution of residues

Small quantities of residues were recovered from undated ditches 402 (T4) and 803 (T8), as well as from the colluvium in T11. The majority of the recovered materials, however, was derived from the deposits overlying the stone surface in T9.

Interpretation

The residues are indicative of iron smelting in a non-tapping bloomery furnaces. Non-tapping furnaces were typically employed in the Iron Age and early medieval periods, whereas slag tapping (in which the slag is encouraged to largely flow out of the furnace) was practiced in the Roman period, in some areas in the early medieval and more widely in Britain from the late 9th century onwards until bloomeries were replaced by the production of iron in blast furnaces in the early post-medieval period.

Certain discrimination of the residues from non-tapping furnaces of these different periods is not currently possible, but the present assemblage more closely resembles early medieval examples than collections of Iron Age date.

In detail, the presence of well-fluxed slag puddles provides a close comparison with the non-tapping furnaces of Churchills Farm, Hemyock (Young 2015b; Smart *et al*. in prep.). These furnaces had relatively shallow circular basal pits (0.4 to 0.5m diameter and mostly less than 300mm deep, one example being 450mm deep), which were packed with cereal steams prior to smelting. These furnaces show close similarity with examples in the Forest of Dean at Clearwell Quarry (Pine *et al.* 2009) and Yorkley (Young 2015c). These occurrences are all probably mid-8th-mid-10th century in age. It is possible that the cereal packing may indicate an Irish influence on the technology (Young 2011, 2012).

The present material does not show evidence for cereal packing, but rather the more usual wood packing (as was also probably present at Yorkley).

Wood packing was normal on a second group of sites, with larger basal pits to the furnaces, including those on the S side of Culmstock Road (Young 2014; Rainbird & Young in press) and at Burlescombe (Devon) (Reed *et al.* 2006), as well possibly as those at Ramsbury (Wiltshire) (Haslam 1980) and Millbook (Sussex) (Tebbutt 1982). These furnaces may include a few examples at around 0.5m diameter, but most are larger, ranging up to 1m diameter and have a broadly splayed prolife and a planar blowing wall. These examples also have given 8th-10th century dates, but are possibly just slightly earlier than the cereal packed examples.

At broadly the same period there are also examples of slag-tapping furnaces. These occur late in the sequence at Ramsbury, where the furnace has a splayed profile and a planar blowing wall, and contemporaneously with the cereal-packed non-tapping furnaces at Churchills Farm, where they are formed at one end of a small but elongate pit, as seen on 11th-13th century examples.

The history of iron-smelting technology through the 8th to 11th centuries in Wessex is clearly very complex. The present material does not precisely resemble the material from any known site, but fits within the range of variation of 8th-10th century examples.

The location of the site adds to understanding of the topography of early ironmaking in Hemyock. The productive area of T9 lies immediately NE of an area in the same field flagged by Smart (in prep) as a potential clay extraction pit (medieval clay extraction occurred alongside early medieval iron production at Churchills Farm). The 7th-9th century site S of Culmstock Road (just west of the SW corner of the present development area) was also of limited geographical extent. The 9th-10th century site of Churchills Farm lay to the SE of the castle. Waste disposal into medieval clay pits also suggested that a later (11th-12th century?) iron smelting site also lay close to Churchills Farm.

The samples produced no evidence for hammerscale. The site therefore parallels the two known early medieval sites in Hemyock in showing a remarkable lack of evidence for smithing. The raw iron produced must have been worked into usable iron elsewhere. A model of dispersed iron smelting (perhaps dependent on woodland resources) with centralised bloomsmithing seems likely. No centralised smithing facility has yet, however, been discovered in Hemyock,

Such a model is perhaps particularly significant given the likelihood that Hemyock was a royal estate in the late Saxon period. The abundant evidence for iron production, employing different and at times innovative smelting technology may hint at a specialised role for this estate. Although the evidence for iron smelting across the Blackdown Hills, drawing on the rich iron resources of the clay-wth-flints (Reed 1997; Young 2015a) is well established, this focus of early medieval activity at Hemyock appears unusual. Elsewhere in Wessex, there is evidence for iron production on other royal estates, for instance at Ramsbury (Haslam 1980) and Pucklechurch (Young & Young 2013).

Summary

This material provides evidence for an additional focus of early medieval iron smelting on the margins of Hemyock. Detailed further investigation of this site would be highly desirable, as would scientific dating of the deposits.

The collection of material is not tied to structural evidence for iron smelting and is not currently independently dated. Indeed, if the suggestion of clay extraction from immediately to the SW of T8 and T9 is correct, there would be possibility that the slag occurrences have been reworked during overburden removal. Further scientific investigation of the residues is therefore not advised at this time.

Nonetheless, the materials are of great importance and should be deposited with the site archive in the appropriate receiving institution.

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Table 1: summary catalogue.

c	s		c wt	l wt	l no	notes
403			70	70	1	broken slightly lobate dense slag, probably flow lobed
804	1	>1	496		assm	dominated by coarse sand grains, slag is little rounded
804	1	>0.5	52		assm	stone-rich assemblage, even in magnetic fraction there is no hammerscale
806			344	344	1	fragment of basal puddle with prilly base, lobed at one end where flowed under strange wood fragment with scaly surface
906			3055		16	fragments of dense FB and related material; two pieces show basal puddle, or perhaps burr, with lots of fine included charcoal higher in the sections; largest block 1315g has possible basal flow with interaction with ceramic and probable clay clasts; one of the smaller basal puddle fragments shows crystals extending across whole thickness 20-25mm (close to eutectic?).
906			4205	718	6	small fragments of FB-like material - including one probably conjoining a piece in the sample above; includes unusual basal flow wood-like surface texture
				3470	1	weathered and rounded large FB block,
906	2	bag 1	3655	1098	48	dense slags ranging from large coarse flow slag block to small individual prills
				2565	190	low-density and charcoal-rich slags
906	2	bag 2	3130	1044	72	dense slags
				2033	215	low-density vesicular and charcoal-rich slag
				58	14	reduced fired clay and slagged similar material
906	2	>0.5	80		assm	fine slag ceramic and charcoal debris, no observed hammerscale in magnetic fraction
906	2	>1	898	898	assm	dominated by angular slag fragments, some ceramic, mostly magnetic
906	2	>2	1795		assm	dominated by angular slag fragments, some ceramic, mostly magnetic
906	2	>5	2090		assm	mixed chert gravel, slag frags, prills, ashy concretions, dark charcoal bearing concretions, rust
907	3	>0.5	23		assm	some fine slag, charcoal, quartz/chert, orange ceramic etc, much lower proportion of slag than <2>
907	3	>1mm	236		assm	stone-dominated - with wide variety of lithologies, lots of charcoal, some slag, some red fragments that might be roasted ore
907	3	>2	380		assm	stone rich; plenty of charcoal, red particles possibly ore - soft haematite attached to hard chert?
907	3	>5mm	814	814	assm	assemblage of mainly small dense slag fragments, very little low density material

c	s	c wt	l wt	l no	notes
1101		332	22	1	bloated ceramic with lightly slagged surface
			286	3	vesicular slag with some charcoal, resting on dense basal layer with slightly reddened lobate base
			16	1	dense thin slag sheet, with wood mould contact, passing into highly vesicular material

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