Channel Tunnel Rail Link

London and Continental Railways

Oxford Wessex Archaeology Joint Venture

Small finds from Tutt Hill, Westwell, Kent

(ARC 430/99)

by Lynne Keys

CTRL Specialist Report Series

2006

TABLE OF CONTENTS

LIST OF TABLE

1 THE IRON SLAG

1.1 Methodology, quantification and description of terms

1.1.1 Quantification

Just under 3 kg of material was initially identified as slag. All was visually examined and categorised on the basis of morphology. Some material was not slag but each slag type from each context was weighed and recorded; details are given in the table below.

Table 1: Quantification table for the iron slag

Chainage	Context	Sample Number	Interpretation	Weight (g)	Comment
83+360	2	1	hammerscale sample	0	broken flake and one sphere
83+360	2	1	sample	0	broken slag and one sphere hammerscale
83+360	2	1	undiagnostic	42	
83+360	2	1	undiagnostic	78	poss. broken smithing hearth bottom
84+700	19		undiagnostic	142	possibly smelting
84+700	19		vitrified hearth lining	22	black, very glassy coating
84+100	32		tap slag	74	
83+900	36	6	hammerscale sample	0	large percentage of flake,some spheres
83+900	36	6	undiagnostic	146	Cu working also taking place?
83+900	36	6	vitrified hearth lining	76	
83+900	38		run slag	70	possibly smelting
84+320	103		undiagnostic	72	high temp. furnace fragment?
84+300	168	27	natural iron concretion	18	
84+100	327		furnace bottom frag.	748	
84+100	327		run slag	532	
84+100	327		undiagnostic	556	
84+100	329		tap slag	338	
			Total weight	**2914**	

1.1.2 Explanation of terms

Activities involving iron can take two forms:

1) the manufacture of iron from ore and fuel in a *smelting* furnace. The resulting products are a spongy mass called an unconsolidated bloom consisting of iron with a considerable amount of slag still trapped inside, and slag (waste).

2a) *primary smithing* (hot working by a smith using a hammer) of the bloom to remove excess slag. The bloom becomes a rough lump of iron ready for use and the slags from this process include smithing hearth bottoms and micro-slags, in particular tiny smithing spheres;

2b) *secondary smithing* (hot working by a smith using a hammer) to turn a piece of iron into a utilitarian object or to repair an iron object. As well as bulk slags including the smithing hearth bottom, this will also generate micro-slags: hammerscale flakes from ordinary hot working of a piece of iron, or tiny spheres from high temperature welding to join two pieces of iron.

Some types of iron slags are diagnostic of smelting or smithing, others are not. Slag may be said to be *undiagnostic* because it could have been produced by either process - which one can only be determined in the light of any diagnostic evidence from the site. Slags may be broken up during deposition, re-deposition or excavation and may have to be assigned to the undiagnostic category because their original morphology is not known. Other types of debris encountered in iron slag assemblages may be the result of various kinds of high temperature activities - including domestic fires - and cannot be taken on their own to indicate iron-working was taking place. This includes materials as fired clay, vitrified hearth lining, cinder, and fuel ash slags. However if they are found in association with iron slag - particularly diagnostic iron slag - they can be considered as possible products of the process which produced those slags.

Smelting

Tap slag is a dense, low porosity, fayalitic (iron silicate) slag with a ropey flowed structure. It is formed as the liquid slag is allowed to flow out continuously or intermittently through a hole in the side of the furnace into a hollow in the ground. This removal of the slag facilitated retrieval of the bloom after the smelting operation. It is believed furnaces with tap holes replaced earlier types as their efficiency was recognised early in the Roman period.

Run slag is produced during the smelting process as the slag reaches high temperatures. If fragments are small and damaged it can be difficult to distinguish between run and tap slags although there are slight morphological differences. Where the difficulties arises, particularly with small pieces from the late Iron Age or early Roman period, it is safer to use the term run slag.

Other slags produced by smelting are furnace bottoms. These resemble smithing hearth bottoms but are generally much larger. There may be large burnt-out charcoal voids although sometimes it is only through laboratory analysis that the process can be determined.

Smithing

The characteristic bulk slag of smithing is known as the smithing hearth bottom. None were recovered but the presence of hammerscale indicates smithing activity.

Iron smithing produces micro-slags (*hammerscale*) of two types: flake and spheroidal. Flake resembles silvery fish scales and is the product of the ordinary hot working and

hammering of a piece of iron where fragments of the oxide/silicate skin flake off from the iron and fall to the ground. Spheroidal are small solid droplets of liquid slag expelled from within the iron during the primary smithing of a bloom or the fire welding of two pieces of iron. Hammerscale is not visible to the naked eye when in the soil but is highly diagnostic of smithing activity, often remaining in the area around the anvil and near the hearth when macro-slags have been cleared out of the smithy and dumped elsewhere.

1.2 Discussion of the slag by period

1.2.1 Natural

The fragment of slag from context 19 was probably produced by iron smelting. A piece of vitrified hearth lining from the same context is covered both inside and out with a thick, black glassy glaze produced at extremely high temperatures.

1.2.2 Bronze Age

Context 103 from cut 102, part of the primary fill of ring ditch 90
The fragment from this feature may be from a furnace of some type. Originally ceramic, or made of clay, it had been highly fired.

Context 168, fill of cut 167, in ring ditch 156
The fragment is a natural iron concretion with a 'bubbly' appearance. The interior is a ferruginous sand.

1.2.3 Late Iron Age/early Roman

The slag from contexts 327 and 329, feature 336, represents smelting activity, the production of iron from ore in a furnace. Initially feature 336 was interpreted as a kiln or oven but in view of the slag recovered and the intense burning which appears to have taken place, it is more likely to have been a furnace for iron smelting. The two pits set inside a larger pit almost certainly represent two shaft furnaces close to each other within a larger cut. Unfortunately, both furnaces had been truncated by machine at ground level leaving nothing to indicate the thickness or height of the superstructure walls.

Two contexts in cut 39 produced slag: 36 and 38. The flake and spheroidal hammerscale in 36 represents ordinary and high temperature iron smithing. The run slag from 38 could be the product either of smelting – which was taking place within the area – or the smithing activity.

1.2.4 Medieval/ post-medieval

A spread of pottery (32) dated to between AD1300 and 1800 contained a small amount of tap slag. This may be residual material from earlier smelting activity not far way.

2 ASSESSMENT DATA

The following finds were examined during the post-excavation assessment and were not subjected to detailed analysis. Please refer to the post-excavation assessment report for further details (URS, 2001).

Material	Author
Metalwork	Valerie Diez

3 BIBLIOGRAPHY

ADS, 2006 CTRL digital archive, Archaeology Data Service, http://ads.ahds.ac.uk/catalogue/projArch/ctrl

URS, 2001 Tutt Hill, Westwell, Kent (ARC 430/83+800-84+900/99): Targeted watching brief assessment report, unpubl. report prepared by OAU for Union Railways (South) Limited, in ADS 2006