

APPENDIX 1 SLAG AND METALWORKING DEBRIS

By Lynne Keys

Introduction

- 1.1.1 A total of 77.234 kg of material initially identified as iron slag was presented for assessment and all was examined. The majority of the material assessed had been retrieved during hand excavation, but fragments recovered during the processing of environmental samples are also included in this assessment. Although most of the soil samples had been processed and were available for examination, those from flotation were still in progress, so certain types of slag - in particular hammerscale spheres which often float - may have been recovered but are not represented in the data set for this report. None of the slag had been washed before assessment.

Methodology

- 1.1.2 All the slag presented for assessment was visually examined and categorised on the basis of morphology and colour. A magnet was used during examination to detect iron-rich slags, hammerscale, and potential roasted ores. Each slag type from each context was weighed and recorded and, in addition, smithing hearth bottoms were individually weighed and measured to obtain length, breadth, and depth. Table 5.1 present the total quantification of all slag and metalworking debris assessed by context.

Quantification

- 1.1.3 The assemblage included both smelting and smithing slags. The identifiable smelting slag consisted principally of tap slag, a dense, low porosity, fayalitic (iron silicate - $2\text{FeO} \cdot \text{SiO}_2$) slag with a ropey flowed structure. It is formed as the liquid slag that is allowed to flow out through a hole at the bottom of a smelting furnace. It is generally believed this tapping of slag from the furnace was introduced to Britain at about the time of the Roman invasion. The amount of tap slag was not sufficient to suggest any large-scale smelting activity.
- 1.1.4 A smelting furnace could have a pit below to collect the slag, rather than its being tapped out of the furnace. The distinct slag produced by this furnace is called a slag block. A possible example was recovered from context (1080).
- 1.1.5 Some material which may be ore was also recovered but requires positive identification. In any case the amount is not large and some (as in the case of context (258)) may be locally occurring fragments which accidentally found their way into the fill.
- 1.1.6 Slags diagnostic of iron smithing take two main forms: bulk slags and micro slags. Of the bulk slags the smithing hearth bottom is the one least likely to be confused with slags produced by smelting. Its characteristic plano-convex-shape (which can sometimes be quite large) was formed as a result of high temperature reactions between the iron, iron-scale and silica from either a clay furnace lining or the silica flux used by the smith. The evidence for the micro-slags consisted mainly of flake hammerscale with the occasional sphere. It may be, however, that many of the spheres are still with flotation samples.
- 1.1.7 One type of material which was noticeably absent from the data set was vitrified hearth lining. If both smelting and smithing were taking place one would expect more of this debris to be present. Amounts, not large, of lightly fired clay were present amongst the slag but this is not indicative of either high temperature smelting or smithing.

Provenance

- 1.1.8 The most significant groups for iron slags were from ditch sub-group 1022 (enclosure 1972) and, to a lesser extent, ditch sub-group 1020 in enclosure group 3006. A likely use of these enclosures for craft activities, such as pottery and salt production is primarily suggested by other artefactual evidence. Both smelting and smithing slags were mixed together in some of the features present in the enclosures. Several of these features had been broadly described as 'furnace pits' during excavation (group 3004), but insufficient evidence for furnaces, including vitrified hearth lining, have so far been noted. Therefore one can conclude that slag was actually dumped into these pits. This interpretation is supported in the way the material is mixed together: none of the features contains large amounts of any particular type of slag, suggesting that they may have been deposited together at random. It would therefore be useful to attempt to plot the occurrence of the material in respect to a particular structure or features within it, which may indicate the location of ironworking and occasional iron making.
- 1.1.9 The slag may have been used for its heat retaining qualities. Such a suggestion is supported by the recent discovery of slag on several sites of different periods in features such as hearths and driers where heat retention may have been required.
- 1.1.10 The possible ores - all of which require a positive identification - came from scattered contexts, one tentatively dated to the Late Bronze Age. The fragment from context (201) which resembles haematite is from the subsoil in Area C. Context (259) (fill of furnace pit cut [260] in group 3004) is the only fragment from a group with other evidence for ironmaking/working activity. The possible fragment of iron bloom (context (783)) was recovered from ditch sub-group 1022 enclosing pit group 3004.

Conservation

- 1.1.11 Iron slag, being fayalitic, requires no special storage conditions and is unlikely to be affected by further analysis. Decisions as to whether the assemblage can be discarded should only be made after more detailed work has been carried out and assemblages from other relevant CTRL sites with slag, particularly from the work in progress from excavations at Leda Cottages, near Beechbrook Wood, have been examined and assessed.

Comparative material

- 1.1.12 Sites with dump deposits of iron slag are common, particularly for the Early Roman period, so comparanda will be most relevant from sites close to Beechbrook Wood. During the assessment preparation, a further site with similar evidence for a variety of industrial activities was discovered along the CTRL route at Leda Cottages, although possibly of a slightly later date. Comparison between both assemblages may allow further interpretation and understanding of the deposition and anomalies of the Beechbrook Wood material.

Potential for further work

- 1.1.13 A more detailed analysis of spatial distribution of the material, especially with regard to any possible related structures should be attempted, although this approach is limited by the location of the features near the edge of the site, and the likely truncation of much material during the building of the Ashford-Maidstone railway line. A further line of enquiry with good potential lies in the comparison with the forthcoming data from the site at Leda Cottages.

Table 5.1.: Quantification of slag and metalworking debris by context

Context	Small Find No	Description	wt. (g)	len. (mm)	br. (mm)	dep. (mm)	Comments
100		pot/glass vitrified ceramic	66				
201		ore?	144				haematite?
201		smithing hearth bottom	582	115	80	35	
201		smithing hearth bottom	1036	120	85	75	
201		tap slag	864				
201		undiagnostic	144				
212		smithing hearth bottom	1106	100	80	85	
214		smithing slag	230				
214		tap slag	212				
214		vitrified hearth lining	60				
221		vitrified hearth lining	462				
227		vitrified hearth lining	156				slag runs into fabric
229		smithing hearth bottom	2170	145	130	90	
232	201	fired clay	80				
232	201	hammerscale - flake	1				
232	201	ore?	38				two frags. - magnetic
234	209	fired clay	0				with hammerscale inclusions
254	209	fired clay	146				includes flake and occ. spheres
254	209	hammerscale - flake	0				
254	209	sand, fired clay	336				v. little flake hammerscale
254	209	undiagnostic	58				
256	207	ferruginous concretion	92				
256	207	fired clay	620				
256	207	non-iron slag	44				yellow-green in colour
256	207	undiagnostic	1270				
257	207	micro-slugs and hammerscale	410				mostly flake and lots runs
257	207	vitrified hearth lining	20				
258		dense	188				
258		ore?	164				sandy - roasted?
258		undiagnostic	658				one lump - smelting?
258		undiagnostic	294				
259	202	cinder	4				
259	202	hammerscale - flake	1				one large sphere
259	202	iron rich slag	50				
259	202	mixed fired clay etc.	792				
259	202	roasted ore?	1				
259	202	smithing slag	314				
259	202	undiagnostic	558				
259	202	undiagnostic	208				smithing hearth bottom?
259	202	undiagnostic	149				runs
259	202	vitrified hearth lining	768				

259		fired clay	36				
261	203	broken flake hammerscale	0				
261	203	dense	68				
261	203	fired clay	18				
261	203	hammerscale - flake	0				
261	203	sand and fired frags.	550				
261	203	smithing hearth bottom	336	120	70	40	
261	203	smithing slag	110				
261	203	tap slag	4614				
261	203	undiagnostic	3010				
261	203	undiagnostic	174				runs
261	203	undiagnostic	354				fragments of smithing hearth bottoms?
261	203	vitrified hearth lining	116				
272		smithing hearth bottom	668	100	80	45	
272		undiagnostic	810				
275		smithing hearth bottom	552	115	60	35	
275		smithing hearth bottom	3750	180	150	90	
275		undiagnostic	654				smithing slag?
277	261	undiagnostic	112				
277		vitrified hearth lining	210				
279	204	micro-slags and hammerscale	364				flake, some tiny spheres, sand etc.
279	204	undiagnostic	386				
280	205	micro-slags and hammerscale	390				flake-not much, sand, fired clay, charcoal
280	205	undiagnostic	723				runny
285		vitrified hearth lining	18				
302		smithing hearth bottom	302	85	65	35	
302		undiagnostic	66				
302		undiagnostic	646				poss. part of smithing hearth bottom
505	208	fired clay	340				
505	208	micro-slags and hammerscale	62				
505	208	smithing hearth bottom	208	80	55	50	
505	208	tap slag	124				
505	208	undiagnostic	900				
505		undiagnostic	376				poss. part of smithing hearth bottom
505		undiagnostic	520				parts of smithing hearth bottoms?
511		undiagnostic	84				
511		vitrified hearth lining	158				35mm thick
514		fired clay	51				
516	210	micro-slags and hammerscale	389				flake and one sphere

516	210	undiagnostic	408				runny frags.
517	211	micro-slags and hammerscale	368				flake, some tiny spheres, sand etc.
517	211	undiagnostic	1230				
517	211	vitrified hearth lining	90				
518	219	concreted hammerscale	254				
518	219	fired clay	2280				
518	219	micro-slags and hammerscale	616				flake and fired clay
518	219	mixed fired clay etc.	1049				no hammerscale
518	219	tap slag	128				
518	219	undiagnostic	342				
518	219	undiagnostic	378				smithing slag?
518	219	undiagnostic	190				runny slags
518	219	undiagnostic	132				
713		smithing hearth bottom	188	75	45	40	incomplete
713		undiagnostic	206				
725		tap slag	456				
725		undiagnostic	914				unwashed context - dirty
727	217	micro-slags and hammerscale	1				
727	217	tap slag	16				
727	217	undiagnostic	1				
729	216	micro-slags and hammerscale	1				
729	216	undiagnostic	16				
735	215	undiagnostic	1				runs
735		undiagnostic	420				
748		smithing hearth bottom	948	115	100	50	
748		undiagnostic	220				
768		cinder	16				
768		fired clay	74				
768		smithing hearth bottom	148	75	55	30	
768		smithing hearth bottom	150	70	60	25	
768		smithing hearth bottom	382	100	80	35	
768		smithing hearth bottom	674	120	90	50	
768		undiagnostic	1606				large lumps - high temper.
768		undiagnostic	146				silica-like slag
768		undiagnostic	368				
768		vitrified hearth lining	262				
776	220	micro-slags and hammerscale	422				flake, some tiny spheres, charcoal, sand etc.
776	220	undiagnostic	90				runny dribbles
776	220	vitrified hearth lining	84				
783		bloom fragment?	322				
783		iron lump	20				
783		tap slag	1312				

783		undiagnostic	874				large lump
783		undiagnostic	3574				
783		vitrified hearth lining	228				
792		smithing hearth bottom	1334	145	135	55	
801		smithing hearth bottom	112	50	50	30	
801		undiagnostic	294				
801		undiagnostic	70				runny frags.
801		vitrified hearth lining	694				includes fired clay
894		undiagnostic	140				
929		smithing hearth bottom	1344	160	140	70	
943	242	undiagnostic	1				
968		undiagnostic	122				
968		vitrified hearth lining	200				
969		undiagnostic	140				smelting?
1008		smithing hearth bottom	1116	150	100	55	
1019		undiagnostic	702				smithing slag?
1063		cinder	16				
1063		undiagnostic	134				
1065		undiagnostic	53				
1080		slag block?	4000	160	160	120	
1193	267	undiagnostic	9				
1345	276	tap slag	106				
1345	276	undiagnostic	8				
1406		undiagnostic	94				runny frags.
1458		tap slag	50				
1458		undiagnostic	362				poss. smelting slag
1459		smithing hearth bottom	420	100	75	45	
1469		undiagnostic	252				
1481		undiagnostic	16				
1500		tap slag	894				
1507		smithing hearth bottom	458	100	70	65	
1507		smithing hearth bottom	62	70	40	30	
1507		tap slag	146				
1507		undiagnostic	594				
1512		smithing hearth bottom	414	90	80	50	
1512		smithing hearth bottom	3800	150	140	90	
1512		tap slag	92				
1512		undiagnostic	320				
1517		smithing slag	18				
1517		tap slag	224				
1517		vitrified hearth lining	1				
1524		undiagnostic	2				
1529		undiagnostic	46				
2233		undiagnostic	8				

2241		undiagnostic	16				
total			77234				

