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Small Finds from Leda Cottages, Westwell, Kent (ARC 430 01/83+200)

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1 THE IRON SLAG

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1.1 Introduction

Almost 225 kg of iron slag and related material was recovered - most of it redeposited in pits, ditches and other cut features across the site - but also from a cluster of furnaces in the north-west area. The slag types indicate smelting and smithing were taking place on the site although the furnace area was the only focus of both smelting and smithing which was detectable.

Smelting activity appears to have begun in the late Iron Age or early Roman period and may have continued at least into the second century AD. The problems of dating many of the features containing slag makes the beginning and end of iron production on the site difficult to ascertain. At the present time, however, it appears that three different smelting techniques are represented amongst the slag: slag blocks, furnace bottoms, and tap slag. The first two are pre-Roman and the latter is generally thought to have been introduced at about the time of the Roman invasion. It would have been extremely useful to have been able to refine the periods when each of these was in use across the site and when they were concurrent since it would certainly tell us a great deal more about the development of the iron industry in pre-Roman and early Roman Kent.

Despite the difficulties with dating, an examination of the distribution of smelting slags revealed a tendency for types likely to be Iron Age to be found in the south-eastern area of the site, in enclosure or boundary ditches, tree throws and other features, rather than in the area where the furnaces clustered. This, however, was not a hard and fast rule since even in that area some furnaces may have utilised a different technology from others during their period of use. Here the lack of dating was a real problem.

Unfortunately no metallurgical analysis of slag block fragments, furnace bottoms and other slags had taken place by the time of publication. However the smelting slag from Leda Cottages is considered significant enough to form part of a EH research project in the near future.

There was a significant absence of evidence for iron ore from the site. Only a very small amount was recovered. One would have expected more to be present with possibly some evidence for roasting in preparation for smelting but this was not the case. Perhaps it was being carried out elsewhere.

Some secondary smithing was taking place but no secure foci could be located beyond the furnace areas. One would expected the amount of spherical hammerscale to have been

larger than was recovered if iron blooms were subjected to primary smithing after being removed from the furnace. The quantity was very small. Flake hammerscale, however, was recovered, although not in large amounts.

The question of whether blooms were smithed elsewhere, possibly not on the site at all, has been raised for this site and for several other late Iron Age/ early Roman sites in the Kent and north Weald area. The English Heritage research programme will hopefully bring the evidence together and allow an answer to be found. We may yet learn much about the organisation of the iron industry in the late Iron Age and early Roman period in Kent and the way in which it operated.

1.2 Provenance

The following sections detail the breakdown of slag provenance by feature type and number.

1.2.1 Furnace Cluster

Pit 8019, shallow cut for feature possibly associated with furnace.
Undated
Context 8020
1,144 g
Tap/run slag and possible ore (?), undiagnostic slag.

Furnace 8648 with truncated base
BC50-AD50?
Context 8012
10,205 g slag. Tap slag, and other smelting slag including a possible fragment of furnace bottom, undiagnostic slag, some of it probably smelting; flake hammerscale and some spheres (21 g), vitrified hearth lining.

Furnace 8649 circular cut showing evidence of recutting.
BC50-AD120? (one sherd). Possibly late Iron Age or early Roman phase.
Contexts 8022, 8026
23,847 g slag
Tap slag, lots broken flake in 8022 (14 g); in 8026 flake and a couple of tiny spheres; five smithing hearth bottoms in 8022, two (one quite large which requires analysis) in 8026.

Furnace 8650 small truncated base. Surrounding soil baked and heat discoloured.
No dating evidence
Contexts 8010
19,758 g slag
Tap slag, one furnace bottom, pieces of what may be slag pit smelting slag (awaiting analysis), one broken smithing hearth bottom, a little hammerscale flake and some spheres.

Furnace 8651, circular furnace pit. May be second phase of furnace 8649
Dating tenuous (dating from final backfill) AD170-300
Contexts 8015 and 8017
7,764 g
A quantity of tap slag, dense slag, undiagnostic runs, fired clay, an iron stud; in 8017 flake hammerscale and some spheres, a small amount of tap slag.

1.2.2 Enclosure areas

Post-built structure 8403
Contexts 8163, 8388, 8380, 8381
A small amount of tap slag, some broken flake hammerscale, a smithing hearth bottom, fired clay, iron rich cinder and some undiagnostic.

Pit 8573 and tree throw 8494.
Early and middle Roman
Contexts 8569, 8570 and 8572 (fills of 8573); 8495, 8498 and 8499 (fills of 8494)
Possible furnace bottoms. The tree throw also has two other pieces which may be pieces of furnace bottoms.

Furnace pit 8300
Late Iron Age(?)
Contexts 8336, 8337, 8338, 8340, 8343 and 8347
12,840 g of slag including two possible furnace bottoms or smithing hearth bottoms and a significant quantity of runs.

Boundary ditch 8624
Late Iron Age/early Roman
Contexts 8184, 8192, 8231, 8353, 8357, 8358, 8405
12,053 g. Two furnace bottoms.

Boundary ditch 8626
Late Iron Age/early Roman
Contexts 8514, 8519, 8520 and 8544
15,661g. a fragment of slag block and one furnace bottom.

Boundary ditch 8628
Late Iron Age/early Roman
Contexts 8389, 8577, 8578, 8579, 8582, 8584, 8585, 8590, 8598
13,1654 g, including four possible furnace bottoms and a possible fragment of slag block.

Boundary ditch 8629
Early Roman
Context 8315
One furnace bottom and some tap slag.

Boundary ditch 8639
Contexts 8510, 8540 and 8560
Early Roman
50,236 g. five furnace bottoms and one possible slag block or furnace bottom.

Boundary ditch 8668, recut of ditch 8628.
Early Roman
3,630 g. Fragment of slag block with a run surface which resembles tap slag.

1.3 Methodology, description of terms and quantification table

1.3.1 Methodology

The material was visually examined and categorised on the basis of morphology alone. Each category of slag in each context was individually weighed to 2 g but in the case of the smithing hearth bottoms each was also measured to obtain its dimensions. Additionally a magnet was run through the soil in bags to detect micro-slags such as hammerscale. Quantification details are given in the table appended to this report (Table 2).

1.3.2 The ironworking debris and discussion

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 on a stringhearth, usually near the smelting furnace, 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 spheres (often no larger than a small pin head);

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, micro-slags are produced: 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, while 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, redeposition or excavation and may have to be assigned to the undiagnostic category because their original morphology is not known.

The fragmentary state of the Leda slag assemblage often hampered identification and led to much of it being described as undiagnostic slag. Sometimes pieces which may have originated from slag blocks or lumps of tap slag could only be described as either ‘undiagnostic’ or ‘run slag’ the pieces was so broken their morphology was uncertain. It was also difficult at times to be sure that some categories, based on morphology, which have been until now have been used to describe slag, could be used confidently for the Leda Cottages assemblage. A notable example is the slag from context 8580 where material which, if it had been detached, would be described as tap slag, was actually the flowed upper layer on a large

slag block fragment. This should be kept in mind when looking at contexts where the only smelting evidence is described as tap slag.

1.3.3 Smelting

Three fragments of what may be ore, were recovered, one of them roasted. The contexts concerned were 8020 in the furnace cluster and 8322, the fill of a pit. The absence of quantities of ore may mean it was roasted elsewhere in preparation for smelting.

Tap slag (18.75 kg recovered) 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 along a specially made channel 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 bowl furnaces early in the Roman period.

Dense slag is of low porosity, rather like tap slag but without the flowed surface. Very little of this material was recovered (584 g).

Furnace bottoms (60.4 kg identifiable as such) are plano-convex and resemble smithing hearth bottoms. They are generally much larger than the latter although on a site such as Leda with both smelting and smithing taking place, they may overlap in size and only analysis can resolve the identification.

Another type of smelting furnace had a pit below in which the slag was allowed to collect, rather than being tapped out of the furnace. The distinct slag produced by this furnace is called a slag (pit) block (*Schlackenklotz* in German). Slag blocks are common in southern Scandinavia, north Germany and Poland during the pre-Roman Iron Age and until recently examples found in England were believed to be of early Anglo-Saxon date. It is now becoming clear that slag blocks here are Iron Age in date since several sites with late Iron Age and early Roman smelting but no later activity have produced them. The currently identifiable examples from Leda account for 60.4 kg.

Some broken up slag, although not strictly diagnostic of either smelting or smithing, tended more to the smelting end of the scale. These have been flagged up in the spreadsheet and represented 6.6 kg of the assemblage. The run slags which are also probably smelting slags accounted for 2.2 kg.

A fragment of very magnetic slag was recovered from context 8510 and may be a piece from a bloom. This too requires analysis to confirm an identification.

1.3.4 Smithing

Slags diagnostic of iron smithing take two main forms: bulk slags and micro slags. The smithing hearth bottom is the most characteristic bulk slag, plano-convex in shape, 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 predominantly fayalitic (iron silicate) material produced by this reaction dripped down into the hearth base during smithing and, if not cleared out, developed into the smithing hearth bottom. When removed from the hearth they were usually taken outside and deposited in the nearest pit or ditch. The proximity of cut features or dumps with amounts of smithing hearth bottoms to a building is often a good indication the structure may have been a smithy. Many smithing hearth bottoms may have been broken up before examination but by weight the securely identified smithing hearth bottoms (i.e. those which can be differentiated from furnace bottoms) account for 10.6 kg of the assemblage.

Table 1: Smithing hearth bottom statistics - Leda Cottages (twenty four recovered)

Range	**Mean**	**Std.**	**Dev.**
weight (g)	90 - 1246	443	318
length (mm)	60 - 150	96	25
width (mm)	45 - 115	74	19
depth (mm)	20 - 90	47	17

The contexts with smithing hearth bottoms with the most smithing hearth bottoms were 8006 (six examples) and 8022 (five examples). Generally the examples from 8006 were larger than the 8022 examples.

Iron smithing also produced 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.

As has been discussed in the main text, the amount of hammerscale was limited but spherical hammerscale was almost absent. It is not known whether this dearth should be attributed to recovery from samples or not but there was more flake hammerscale present than spheres.

1.3.5 Non-diagnostic debris

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 ironworking was taking place. This includes such 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.

Vitrified hearth lining is produced in the part area nearest the tuyère region (the region of highest temperature) of the hearth or furnace. By itself it is not diagnostic of smelting or smithing activity - it can be produced by a number of other high temperature activities - but its association with other diagnostic material provides support for the process. The clay lining further away from the tuyère may be only slightly baked or burnt but not vitrified; it can be difficult to ascertain whether such material really does constitute debris from iron production or working. The ash-gray fired clay seen amongst the assemblage is produced under reduced conditions (absence of air) in smelting furnaces rather than smithing hearths. Hearth/furnace and vitrified hearth lining made up just over 14.7 kg.

Cinder (1111 g) is a very porous, highly vitrified material formed at the interface between the alkali fuel ashes and siliceous material of a hearth lining.

Fuel ash slag (84 g) is a very lightweight, highly porous, light coloured (grey-brown) residue produced by a high temperature reaction between alkaline fuel ash and siliceous material such as a clay lining or surface. It can be produced by any high temperature activity where these two constituents are present including domestic hearths, accidental fires, and even cremations.

Ferruginous concretion (2992 g) is made up of a redeposition of iron hydroxides (rather like iron panning) but is enhanced by surrounding archaeological deposits, particularly if there is iron-rich waste present as a result of ironworking.

Table 2: Quantification of iron slag and related debris by context

(all weights in g.; all measurements in mm)

Context	Sample No	Identification	Weight	Length	Width	Depth	Comment
8006	800	cinder	8				
8006	800	dense	160				
8006	800	fired clay/hearth lining	150				
8006	800	hammerscale	14				flake & some sphere
8006	800	smithing hearth bottom	218	90	70	60	
8006	800	smithing hearth bottom	390	90	70	50	
8006	800	smithing hearth bottom	502	150	75	35	
8006	800	smithing hearth bottom	526	100	90	60	
8006	800	smithing hearth bottom	648	125	90	55	
8006	800	smithing hearth bottom	1246	140	115	60	may be furnace bottom
8006	800	undiagnostic	6940				very vesicular with charcoal
8006	800	vitrified hearth lining	286				
8008	801	fired clay/hearth lining	28				
8008	801	undiagnostic	714				tiny bits
8010	802	fired clay/hearth lining	324				
8010	802	furnace bottom	6620				

Context	Sample No	Identification	Weight	Length	Width	Depth	Comment
8010	802	hammerscale	1				flake & some spheres
8010	802	smithing hearth bottom	868	110	90	90	broken
8010	802	tap slag	2428				
8010	802	undiagnostic	2724				poss. smelting slag
8010	802	undiagnostic	6793				some poss. "slag pit" type
8012	803	cinder	2				
8012	803	fired clay/hearth lining	220				
8012	803	hammerscale	21				flake & some sphere
8012	803	tap slag	2072				
8012	803	undiagnostic	2				very magnetic
8012	803	undiagnostic	14				smithing slag?
8012	803	undiagnostic	98				runs
8012	803	undiagnostic	2142				
8012	803	vitrified hearth lining	744				
8012		cinder	4				
8012		fired clay/hearth lining	6				
8012		furnace bottom	4880				or other smelting: very large chunks
8015	804	dense	144				
8015	804	fired clay/hearth lining	733				
8015	804	iron stud	2				
8015	804	tap slag	2066				
8015	804	undiagnostic	176				smithing slag?
8015	804	undiagnostic	4590				
8017	806	hammerscale	5				flake & some spheres
8017	806	tap slag	20				
8017	806	undiagnostic	28				
8020	805	fired clay/hearth lining	604				
8020	805	ore	6				requires geolog. i.d.
8020	805	roasted ore?	8				requires geolog. i.d.
8020	805	undiagnostic	1144				broken up tap slag?
8020	805	undiagnostic	1284				
8022	809	charcoal	1				
8022	809	cinder	84				
8022	809	fired clay/hearth lining	49				
8022	809	hammerscale	14				lots broken flake
8022	809	smithing hearth bottom	90	60	50	20	
8022	809	smithing hearth bottom	108	70	60	20	
8022	809	smithing hearth bottom	116	60	55	35	
8022	809	smithing hearth bottom	170	80	60	35	
8022	809	smithing hearth bottom	376	90	60	60	
8022	809	tap slag	714				
8022	809	undiagnostic	4				very magnetic - roasted ore?
8022	809	undiagnostic	10800				
8022	809	vitrified hearth lining	90				
8026	807	fired clay/hearth lining	979				
8026	807	hammerscale	4				flake & couple tiny spheres
8026	807	iron objects	22				
8026	807	smithing hearth bottom	208	95	65	35	
8026	807	smithing hearth bottom	960	125	110	65	
8026	807	tap slag	3883				
8026	807	undiagnostic	86				runs

Context	Sample No	Identification	Weight	Length	Width	Depth	Comment
8026	807	undiagnostic	4681				
8026	807	vitrified hearth lining	408				
8032	810	undiagnostic	24				
8050	812	tap slag	84				
8051	813	undiagnostic	4				
8051	813	undiagnostic	24				runs
8097	814	undiagnostic	34				
8099		undiagnostic	24				
8102	834	undiagnostic	16				
8117		undiagnostic	656				
8137		hammerscale	0				broken flake; not lot
8137		smithing hearth bottom	591	110	90	55	
8137		undiagnostic	364				
8137		vitrified hearth lining	86				
8138		undiagnostic	13				
8163	818	fired clay/hearth lining	8				
8163	818	hammerscale	0				some broken flake
8163	818	iron rich cinder	4				
8163	818	smithing hearth bottom	122	70	45	20	
8163	818	undiagnostic	1158				vesicular
8184	816	fired clay/hearth lining	48				
8184	816	sample	0				a little broken hammerscale
8184	816	tap slag	1042				
8184	816	undiagnostic	90				
8184	816	undiagnostic	416				runs
8184	816	vitrified hearth lining	10				
8184		cinder	44				
8184		ferruginous concretion	16				
8184		fired clay/hearth lining	492				
8184		smithing hearth bottom	268	80	55	40	
8184		smithing hearth bottom	340	120	80	40	
8184		tap slag	9				
8184		undiagnostic	296				
8184		vitrified hearth lining	366				
8192	817	fired clay/hearth lining	84				
8192	817	fuel ash slag	84				
8192	817	iron	4				
8192	817	undiagnostic	320				
8192	817	vitrified hearth lining	148				
8192		fired clay/hearth lining	220				
8192		undiagnostic	38				
8192		undiagnostic	66				iron rich slag
8192		undiagnostic	116				smithing slag?
8192		undiagnostic	272				smelting?
8205	823	undiagnostic	54				
8231		fired clay/hearth lining	84				
8231		undiagnostic	804				
8243		fired clay/hearth lining	946				
8243		iron	6				
8243		smithing hearth bottom	234	70	60	35	
8243		smithing hearth bottom	1042	100	100	70	

Context	Sample No	Identification	Weight	Length	Width	Depth	Comment
8243		undiagnostic	86				
8243		undiagnostic	560				runs
8248		cinder	16				
8248		undiagnostic	16				
8281		tap slag	852				
8302		ferruginous concretion	86				
8302		undiagnostic	524				one lump; smelting?
8303	835	tap slag	430				
8303	835	undiagnostic	78				
8309	836	fired clay/hearth lining	24				
8309	836	hammerscale	0				broken flake & 1 sphere
8309	836	undiagnostic	88				
8313	839	tap slag	28				
8313	839	undiagnostic	64				
8313	839	undiagnostic	72				runs
8313		burnt stone	10				from furnace structure?
8313		fired clay/hearth lining	74				
8313		tap slag	378				
8313		undiagnostic	798				possibly smelting
8313		vitrified hearth lining	44				
8315		tap slag	118				
8315		undiagnostic	216				
8315		undiagnostic	410				furnace bottom?
8320		undiagnostic	88				
8322	837	stone	1				ore?
8322	837	tap slag	64				
8322	837	vitrified hearth lining	60				
8324	838	tap slag	158				
8324	838	undiagnostic	118				
8324	838	vitrified hearth lining	6				
8336	845	ceramic furnace	0				thickness 40-45mm
8336	845	hammerscale	0				some broken flake
8336	845	undiagnostic	1598				heterogenous
8336	845	vitrified hearth lining	1788				
8336		cinder	98				
8336		fired clay/hearth lining	236				
8336		undiagnostic	116				runs
8336		undiagnostic	330				broken SHB/furnace bottom frag?
8336		vitrified hearth lining	820				
8337	846	hammerscale	0				1 sphere
8337	846	sample	0				charcoal & tiny silica runs
8337	846	sample	0				hammerscale: broken flake and 1 small sphere
8337	846	undiagnostic	278				
8337	846	undiagnostic	668				runs
8338		fired clay/hearth lining	46				
8338		undiagnostic	98				
8338		vitrified hearth lining	12				
8340		hammerscale	0				1 tiny sphere

Context	Sample No	Identification	Weight	Length	Width	Depth	Comment
8340		undiagnostic	182				
8340		undiagnostic	4930				large runs
8343	847	hammerscale	0				some flake & sphere, not lot
8343	847	undiagnostic	156				
8343		undiagnostic	34				
8343		undiagnostic	522				large runs
8345		tap slag	524				
8345		undiagnostic	1666				smelting?
8347		undiagnostic	928				
8353		tap slag	326				
8353		undiagnostic	16				
8357		furnace bottom	1940	150	80	70	broken (to be analysed)
8358		cinder	6				
8364		cinder	106				
8364		undiagnostic	74				run slag
8364		undiagnostic	210				
8369	849	hammerscale	0				some broken flake
8369		cinder	8				
8369		undiagnostic	104				
8370	850	hammerscale	0				very little
8370		fired clay/hearth lining	1				
8370		undiagnostic	104				
8380		tap slag	206				
8380		undiagnostic	28				
8381	853	hammerscale	0				virtually none
8388		undiagnostic	16				
8389		ferruginous concretion	220				
8405		furnace bottom	1836			110	
8405		smithing hearth bottom	292	100	60	45	half
8405		smithing hearth bottom	372	105	75	40	
8405		tap slag	176				
8405		undiagnostic	1386				
8405		vitrified hearth lining	26				
8426		tap slag	16				
8426		undiagnostic	212				
8445		undiagnostic	576				
8447	859	undiagnostic	144				
8477		undiagnostic	1				
8484		tap slag	8				
8493		tap slag	46				
8493		vitrified hearth lining	18				
8495		undiagnostic	124				
8495		vitrified hearth lining	58				
8498	861	cinder	1				
8498	861	run slag	62				broken tap slag?
8498	861	undiagnostic	2				
8498		cinder	6				
8498		fired clay/hearth lining	88				
8498		furnace bottom	292				
8498		iron lump	46				analyse?
8498		tap slag	474				
8498		undiagnostic	244				broken SHB or furnace

Context	Sample No	Identification	Weight	Length	Width	Depth	Comment
							bottom
8498		undiagnostic	2486				
8498		vitrified hearth lining	34				
8499	860	cinder	2				
8499	860	run slag	38				broken tap slag?
8499	860	undiagnostic	68				
8499		run slag	278				
8499		smelting slag	550				furnace bottom/slag block
8499		tap slag	244				
8499		undiagnostic	1860				
8499		vitrified hearth lining	10				
8505		undiagnostic	94				
8510		dense	260				
8510		fired clay/hearth lining	268				grey: furnace lining
8510		furnace bottom	3708	190	160	110	dirty
8510		furnace bottom	9979	250	200	140	
8510		furnace bottom	14520	310	270	180	dirty
8510		hammerscale	0				some broken flake
8510		iron lump	300				very magnetic; bloom fragment?
8510		tap slag	568				
8510		undiagnostic	5508				
8510		vitrified hearth lining	152				
8514		ferruginous stone	190				
8514		furnace bottom	6395	190	180	130	
8514		smithing hearth bottom	314	60	60	40	
8514		smithing hearth bottom	620	110	80	55	
8514		undiagnostic	544				smithing slag?
8514		undiagnostic	1782				heterogenous makeup
8514		vitrified hearth lining	874				
8519		undiagnostic	68				
8520		fired clay/hearth lining	10				
8520		undiagnostic	44				
8523		undiagnostic	228				
8528		undiagnostic	492				
8530		undiagnostic	13				smithing slag?
8539		fired clay/hearth lining	6				
8539		tap slag	50				
8539		undiagnostic	90				
8540		cinder	204				
8540		fired clay/hearth lining	234				furnace?
8540		undiagnostic	282				
8540		undiagnostic	1014				smelting?
8540		undiagnostic	2508				*analyse; furnace bottom/slag block
8544		fired clay/hearth lining	130				
8544		smelting slag	2124				slag block?
8544		undiagnostic	2566				
8560		furnace bottom	3500	230	190	120	dirty
8560		furnace bottom	5453	280	220	100	dirty

Context	Sample No	Identification	Weight	Length	Width	Depth	Comment
8560		run slag	318				
8560		undiagnostic	1338				heterogenous
8560		vitrified hearth lining	122				
8563		undiagnostic	2				
8569		tap slag	54				
8569		undiagnostic	6				run
8569		undiagnostic	30				analyse; black, solid, tar like
8569		undiagnostic	2244				
8570		vitrified hearth lining	16				
8572		undiagnostic	322				
8572		undiagnostic	798				*analyse; furnace bottom/smithing hearth bottom
8577		ferruginous concretion	2050				
8577		undiagnostic	76				
8578		ferruginous concretion	140				
8579		undiagnostic	138				runs
8579		undiagnostic	618	112	105	70	*analyse; furnace bottom/smithing hearth bottom
8579		undiagnostic	1062	125	100	85	*analyse; furnace bottom/smithing hearth bottom
8579		undiagnostic	1496				furnace bottom/slag block/smithing hearth bottom
8579		vitrified hearth lining	84				
8580	864	fired clay/hearth lining	90				
8580	864	run slag	1498				poss. broken tap slag
8580	864	sample	0				hammerscale flake
8580	864	sample	0				small runs
8580	864	smelting slag	3906				broken tap slag/dense slag/run slag
8580	864	undiagnostic	1752				
8580	864	vitrified hearth lining	546				
8580		tap slag	1238				
8580		undiagnostic	144				broken smithing hearth bottom?
8580		undiagnostic	168				possibly smithing: flake HS adhering
8580		undiagnostic	834				
8580		undiagnostic	3360				*analyse; tap surface, slag block conglom.beneath
8580		vitrified hearth lining	410				
8582		ferruginous concretion	198				
8582		vitrified hearth lining	6				
8584		smelting slag	32				tap or dense slag
8584		undiagnostic	24				
8584		vitrified hearth lining	18				
8585		ferruginous concretion	92				
8585		tap slag	150				
8585		undiagnostic	126				

Context	Sample No	Identification	Weight	Length	Width	Depth	Comment
8585		vitrified hearth lining	52				
8590		cinder	20				
8590		tap slag	90				
8590		undiagnostic	78				
8595		undiagnostic	24				
8597		undiagnostic	136				
8597		vitrified hearth lining	2				
8598		cinder	502				
8598		fired clay/hearth lining	258				
8598		furnace bottom	1308				half; very regular
8598		undiagnostic	1896	160	110	95	furnace bottom/smithing hearth bottom
8598		undiagnostic	2420				
8601		tap slag	240				
8601		undiagnostic	2394				possible smelting
8601		vitrified hearth lining	996				
8608		dense	20				
8608		undiagnostic	30				
8611		undiagnostic	34				
8611		vitrified hearth lining	16				

2 THE WORKED STONE

by Ruth Shaffrey

2.1 Introduction

The worked stone assemblage is small but comprises six rotary quern fragments: two upper stones, one lower stone and three indeterminate. All the stone retrieved from the site was extremely weathered but a number of much smaller fragments of lava are probably also the remains of querns. In addition to the querns, there is a possible tessera (8426), two blocks of stone which were probably used for building: SF 802 (8137) and SF 805 (8098), and a sling shot or marble (SF 804, 8281).

The following table gives a summary of worked stone artefacts identification and provenance.

Table 3: Quantification of worked stone small finds

SF Number	Context	Feature Number	Px Interpretation	Phase*	Object Identification	Material	Record ID
802	8137	8646	L-shaped pit	Early Roman	Slab	Stone	Y-5
804	8281	8359	Industrial feature	Middle Roman	Slingshot	Flint	Y-4
805	8098	8647	Rectangular shaped pit	Middle Roman	Architectural Fragment	Stone	Y-18
808	8498	8494	Waterhole	Middle Roman	Unknown	Stone	Y-17
809	8498	8494	Waterhole	Middle Roman	Rotary quern	Stone	Y-15
814	8572	8573	Pit	Middle Roman	Rotary quern	Stone	Y-16
841	8499	8494	Waterhole	Middle Roman	Rotary quern	Stone	Y-10
	8097	8647	Rectangular shaped pit	Middle Roman	Rotary quern	Stone	Y-6
	8204	8402	Post-built structure	LIA-ER	Rotary quern	Stone	Y-3
	8322	8321	Pit	Early Roman	Rotary quern	Stone	Y-2
	8343	8300	Furnace	LIA-ER	Rotary quern	Stone	Y-7
	8417	8627	Ditch boundary	Early Roman	Rotary quern	Stone	Y-9
	8426	8642	Ditch	Middle Roman	Tessera	Stone	Y-8
	8499	8494	Waterhole	Middle Roman	Quern	Stone	Y-11
	8520	8626	Ditch boundary	LIA-ER	Rotary quern	Stone	Y-12
	8539	8537	Pit	Middle Roman	Rotary quern	Stone	Y-13
	8584	8628	Ditch boundary	LIA-ER	Rotary quern	Stone	Y-14

* based on site phasing; LIA-ER: Late Iron Age/Early Roman

2.2 Methodology

All the stone was examined with the aid of a x10 magnification hand lens. The following fields were then recorded: dimensions, weight, lithology and description. A single object was thin sectioned. All the finds have been entered into the CTRL Small Finds database.

2.3 Context and date

The worked stone was largely found in pits or ditches (see Table 3) except for one structural item found in the debris of a pit with structural remains possibly associated with industrial use (8098). The six rotary querns (including SF 809, 811 and 814) were found in contexts 8498, 8572, 8097, 8322 and two from 8499. These varied in date from AD 90 - 300. The smaller weathered fragments of lava were from six different pits or ditches (8204, 8343, 8417, 8520, 8539, 8584) varying in date from AD 100 - 270. No pattern could be discerned in the use of different lithologies over time as relatively few specimens were found.

The possible tessera is made of a purple coloured, limonite cemented sandstone known to have been used for tesserae, but it does not have any worked surfaces and can occur in square shapes naturally. The two possible blocks of building stone were both recovered from pits. The first of these is not worked but has one worn face suggesting use in a possible floor; the pit in which it was found dated to AD 175-300. The second chunk probably originated as a river boulder but appears to have been roughly shaped; its exact function is unknown but it was found amongst structural debris (8098). A flint sphere which may have been a sling shot or marble was retrieved from the fill of a pit (8281).

2.4 Discussion

The assemblage contains a broad variety of stone types including local stones such as Lower Greensand and ferruginous sandstone, and imported materials such as Neidermendig Lava, Hertfordshire Puddingstone and an unidentified sandstone. The ferruginous sandstone used for a possible tessera would have been available nearby from bands in the Lower Greensand such as those seen at Folkestone.

Of the stone types used for querns at Leda Cottages, the Hertfordshire Puddingstone (HPS) is the most unusual for a site in Kent. There are only a limited number of sites which have produced querns of it and these are mostly in the western and Greater London region, for example Keston (Philp et al 1991), Springhead (Roe 1999) and Thurnham Villa (Shaffrey 2006). The incidence of HPS decreases towards the east with only three known finds spots currently to the east of Leda Cottages - Wingham, Canterbury and Whitfield (Dowker 1882; Rudge 1966). None of these sites have produced more than 2 examples of HPS querns. Interestingly, nearby Westhawk Farm which produced a much larger assemblage of rotary querns, did not include any of HPS (Roe in prep) and the pattern seems to suggest that it was principally used on smaller sites.

HPS is a difficult material to work and would have required more skill than finer grained and non pebbly sandstones; it is therefore likely only to have been used when there was no alternative. It tends to occur on early Roman sites and is thought to have been mainly exploited during the early Roman period, from around the turn of the 1st century to possibly

the mid 2nd century (Major 2004, 4). The HPS querns at Leda Cottages were both found in pits (8322 and 8097); the first dated to 120-190 and the other undated but reused.

The lava querns found were extremely weathered and with the exception of SF 809 were reduced to fragments so small as to be unrecognisable as querns; this is typical of sites with acidic soil conditions. SF 809, of which a quarter survived, was successfully lifted on site despite being extremely friable and surviving only as many adjoining fragments. This example was found in a waterhole dated to 100-270 AD (8494). Despite the very poor survival of lava querns in many parts of Kent, enough examples have survived to show that approximately 70% of sites with querns include some of lava (Roe 1999, 29). The apparent importance of lava as a quern material in Kent is no surprise given that the East Coast would have been the landing point for supplies brought in from the continent. Most sites in the vicinity of Leda Cottages have produced querns of lava including Canterbury (Blockley et al 1995, 1206); Westhawk Farm which had two good examples and many weathered fragments (Roe, in prep); Thurnham Villa which produced four obvious rotary querns and over 50 weathered fragments (Shaffrey 2006) and Church Field, Snodland where one fragment was found (Ocock and Sydell 1967, 213-214).

Despite the fairly local availability of Lower Greensand at Copt Point, Folkestone, where a quern production centre was known to have been operating in at least early Roman times (Keller 1989), only a single quern of this lithology was recovered. This quern (SF 814) was recovered from the fill of a pit (cut 8573) which was part of the middle Roman enclosure (c. 120-175 AD). Although complete, it is very badly weathered so that little can be determined about its typology. Greensand occurs on a number of sites across Kent although only limited numbers have been provenanced to a specific source. Lower Greensand from Copt Point is known to have been used at Westhawk Farm, Ashford (Roe in prep) and is thought to have been used at a number of sites to the west including Eastwood, Fawkham (Philp 1963, 72); Hayes Baston Manor (Philp 1973, 90 and Black 1987, 117) and two sites in West Wickham (Elm Farm and Fox Hill, Philp 1973).

The quern of unknown material is a highly compacted poorly sorted, medium to coarse-grained pink sandstone; it is slightly pebbly. In thin section it is seen to contain mainly quartz with some altered feldspars and sedimentary rock fragments. There is occasional muscovite mica and some clay cement. It is not typical of Millstone Grit and may be a Triassic sandstone, possibly German. The latter could easily have been imported at the same time as querns of lava and probably with greater ease than Millstone Grit from Derbyshire.

2.5 Conclusions

Although the number of objects is small, the range of materials exploited at West of Leda Cottages is comparable with other sites across Kent and fits well into the general pattern of stone supply.

2.6 Catalogue

The number (Y-) visible at the end of each catalogue entry refers to the unique record ID which can be found in the database.

Probable rotary quern fragment. Two tiny fragments so no details but made from lava. Cxt 8499. Y-11.

Probable quern fragments. Lava. Cxt 8204. Y-3.

Rotary quern fragment. The grinding surface is flat and burnt where it has been reused in the kiln. No edges remain and not enoughsurvives to measure thickness. Hertfordshire Puddingstone. Cxt 8097. Y-6.

Lava fragment - very weathered but probably from rotary querns originally. In final collapse of furnace structure and silting. Cxt 8343. Y.7.

Tessera. Small piece of granular ironstone which is roughly square and which might have been a slightly incomplete tessera. This stone was certainly used for making tesserae. Cxt 8426. Y-8.

Fragment of upper rotary quern. Flat grinding surface and sloping top into edges. Fairly thin for an HPS style quern, certainly not a pronounced beehive style. Less than 10% remaining. Hertfordshire Puddingstone. Cxt 8322. Y-2.

Chunk of lava so may have been from rotary quern although no worked faces survive. Cxt 8417. Y-9.

Rotary quern fragment. Lava. 8 very small weathered fragments so no details. cxt 8520. Y-12.

Possible rotary quern fragment but tiny fragment so no details survive. Lava. Cxt 8539. Y-13.

Possible rotary quern fragment but tiny fragment so no details survive. Lava. Cxt 8584. Y-14.

SF 802. Roughly shaped thick rectangular slab with one slightly worn face. May have been used in construction or intended for such use. Brown ferruginous sandstone. Cxt 8137. Y-5.

SF 804. Sling shot or marble. Small sphere. Could have been used as a sling shot but its white colour may have made it appropriate as a marble. Cxt 8281. Y-4.

SF 805. Very large architectural stone. Very smooth on main two faces and on one edge which also has a slight dimple in it. A river boulder which probably explains smoothness. Has been shaped into roughly rectangular shape. Cxt 8098. Y-18.

SF 808. arge squarish chunk of very fine grained quartzite. Has 2 smooth sides suggesting it's from a boulder and 1 smooth face. Possibly used for grinding but no particular evidence. Quartzite. Cxt 8498. Y-17.

SF 809. Probable upper stone of rotary quern. Extremely weathered quern - friable. Lava has been very badly degraded into many pieces but has been retrieved and kept together. Almost 1/4 of the stone remains. Lower surface grooved. Not possible to lift as too broken. Cxt 8498. Y-15.

SF 814. Lower stone of rotary quern. Almost complete stone which has been very heavily weathered. Most of the grinding surface has been weathered away by 13 mm (only 20% remains). All the edges are also very weathered so no details can be recorded. Under surface is convex. Partially perforated socket is 22 mm diameter x 40 mm deep, round and cylindrical. Greensand. Cxt 8572. Y-16.

SF 841. Probable rotary quern fragment. Slightly burnt, one worked surface and an edge. From thin disc style quern. Only small edge fragment so it is not possible to determine the dimensions of the quern. MG or possibly german Triassic sandstone? This is being thin sectioned for a closer look. Cxt 8499. Y-10.

3 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, 2003).

Material	**Author**
Glass	Valerie Diez
Metalwork	Valerie Diez

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