AML REPORT

1825

Ancient Monuments Laboratory Report No. 4763

Examination of the Hearth and Furnace Lining from Mantles Green, Amersham, Buckinghamshire

Paul Wilthew

January 1986

Introduction

The material examined (AM851145) comprised the hearth and furnace lining from the excavations at Mantle's Green, Amersham. The total weight of hearth and furnace lining was about 32.5kg. This material was associated with large quantities of iron smithing slag and iron smelting slag, including tap slag, which has been reported on by J.G. McDonnell (J.G. McDonnell, Amersham Mantles Green Slag Report) and the present report should be read in conjunction with his report. All comments below on the iron slags are based on that report.

Hearth and furnace lining consists of the vitrified clay lining of hearths and furnaces which have been raised to high temperatures and is usually associated with metalworking activity. It is not usually possible to determine from the lining alone for what process the original hearth or furnace was used, but the presence of other waste material such as slag may, as here, give a good indication. In some cases parts of tuyeres (the clay ends of the tubes between the furnace and bellows) are present, but very few were found in the material from Mantles Green. Where tuyeres were present they are described in the text below.

Two types of hearth or furnace lining were identified :

1) A good quality, fairly refractory lining which included a substantial proportion of sand in the clay. The vitrified samples examined were quite dense and strong. It was probably used exclusively in iron smelting furnaces (see below) and is referred to below as furnace lining.

2) A clay lining containing little refractory material, which produced a low density, vesicular structure after vitrification. Much of the material (but not necessarily all of it) was probably from blacksmithing hearths. It is referred to as hearth lining below.

The weights of hearth and furnace lining found in each context are listed in

the appendix below together with the weights of iron smithing slag (including hearth bottoms) and iron smelting slag (including tap slag and slag cakes) found. The figures for the slag are taken from the Amersham Mantles Green Slag Report.

The significance of the hearth and furnace lining is discussed by phase below.

Discussion

Phase I

The vast majority (about 90%) of the furnace lining occured in this phase, which was also the major period of ironworking activity (see slag report). The furnace lining was concentrated in 3 contexts, 714, 819 and 878, but smaller quantities (less than 500g in each case) were found in contexts 774, 779, 833 and 954. Apart from 833, which only contained 20g of furnace lining, every context which contained furnace lining also contained at least 5kg of smelting slag (mainly tap slag). Conversely, contexts which did not contain furnace lining contained at most 245g of smelting slag. The close correlation between the distribution of the smelting slag and the furnace lining strongly suggests that the latter was from furnaces constructed specifically for smelting iron. The deliberate use of a fairly refractory lining was probably intended to prolong the useful life of the furnace. Unfortunately, few of the larger pieces of furnace lining gave any indication of the size or shape of the furnace as they were generally slabs which showed little curvature. A few pieces, however, appeared to have come from parts of furnaces ranging in diameter from about 15cm to 25cm. No evidence for features such as tuyeres was found.

There was some correlation between the distributions of hearth lining and of smithing slag, and it is therefore probable that most of the hearth lining was from iron smithing hearths. One example of a tuyere of about 3cm internal diameter was found in context 652.

Phase II

A total of only 315g of hearth and furnace lining was found in this phase. Such a small quantity of material is not significant, and may all have been residual from phase I.

Phase III

This phase produced larger quantities of hearth lining than any other phase, and also contained substantial amounts of iron smithing slag. Both were concentrated in contexts 653 and 783. Some blacksmithing took place during this phase (see slag report) and the hearth lining was almost certainly associated with it.

Some furnace lining was also found in two contexts, 783 and 937, both of which also contained tap slag. It was almost certainly either residual material from phase I or material from phase I reused as cobbling.

Phases IV - VIII

A similar pattern of hearth lining distribution was observed throughout phases IV - VIII. Small quantities (at most 700g in any one context) were found in area VII during each phase, in area I in phases IV - VII and in area II in phases V and VII. Possible examples of tuyeres ranging from 2cm - 4cm in internal diameter were found in the material from phase VII, context 307 and phase VIII, context 650.

Furnace lining was found in only one context which represented an area of cobbling. The furnace lining was almost certainly reused material from phase I.

Conclusions

Two types of hearth/furnace lining were present, a good quality, refractory, sand rich, clay lining used only in iron smelting furnaces during phase I, and a much less refractory clay lining found throughout phases I - VIII which was generally associated with iron smithing slag.

The distribution of the hearth and furnace lining supports the conclusions about the nature of ironworking activity on the site drawn by J.G. McDonnell in his slag report. In particular, it suggests that iron smelting was only carried out during phase I, but that a low level of blacksmithing activity was probably taking place on or near the site during much of the period covered by phases I-VIII.

Appendix - the weight of hearth lining, furnace lining, iron smithing slag and iron smelting slag found in each context.

Phase	Area	Context	Hearth Lining (g)	Furnace Lining (g)	Iron Smithing Slag (g)	Iron Smelting Slag (g)
I	VII	652	1000	0	11690	0
		714	0	7500	1840	43000
		774	200	400	0	13895
		779	0	100	0	7950
		782	40	0	200	0
		819	700	1800	2450	9110
		827	35	0	1975	70
		833	0	20	0	0
		878	15	9300	400	67300
		881	15	0	550	245
		904	10	0	0	60
		926	30	0	190	190
		954	250	150	80	5525
II	II	393	150	0	1775	0
	VII	751	5	0	0	0
		755	5	0	0	0
		795	0	120	0	0
		886	5	0	0	790
		900	0	25	0	1260
		919	5	0	75	0
III	I	170	175	0	0	0
	VII	653	1800	0	18150	1350
		663	5	0	0	4235
		726	60	0	0	0
		734	300	0	520	260
		783	2000	600	28300	7510
		796	30	0	340	0
		905	215	0	1300	0
		937	0	700	0	1025

Phase	Area	Context	Hearth Lining (g)	Furnace Lining (g)	Iron Smithing Slag (g)	Iron Smelting Slag (g)
IV	I	49	10	0	10	90
		55	5	0	0	0
		56	200	0	0	400
		80	5	0	0	0
	VII	674	10	0	1925	180
		721	20	0	290	0
		821	150	0	760	240
		931	15	0	1100	0
V	I	9	25	0	0	0
		39	400	0	0	2790
		42	60	0	2235	0
		51	20	0	240	0
		53	5	0	500	60
		63	25	0	1555	0
		72	75	0	950	0
	II	308	500	0	0	0
		325	50	0	775	0
		366	50	0	480	0
		370	10	0	0	0
		376	120	0	0	0
	VII	669	50	0	1075	0
		786	20	0	0	0
		789	50	0	0	20
VI	I	28	100	0	160	1075
	VII	675	15	0	3240	0
		716	250	500	23505	2650
		764	5	0	0	80
		784	60	0	0	105
		785	25	0	0	0
VII	I	30	5	0	0	30
	II	305	700	0	0	0
	VII	660	10	0	260	0
		684	300	0	0	2200
		690	50	0	675	260
		719	30	0	0	0
		728	10	0	250	0
		788	30	0	550	0
VIII	VII	650	400	0	2435	400
?	I	73	5	0	0	0
	VII	705	10	0	0	0
		903	0	305	0	775