ASSESSMENT OF METAL WORKING DEBRIS FROM NUMBER 1 POULTRY, CITY OF LONDON, 1994-6

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Introduction

Excavations at the site of No.1 Poultry in the City of London were undertaken by the Museum of London Archaeology Service between 1994 and 1996. An area of approximately 3,400 square metres was excavated. The total weight of metalworking waste recovered has not been recorded, but is of the order of several hundred kilograms. At the time of assessment the bulk ironworking waste and some material extracted from environmental samples was packed in 17 large, "skeleton" boxes, 53 smaller, "shoe" boxes, and 2 large plastic bags. 2 Stewart boxes contained hammerscale and other material recovered (using a magnet) from the 1mm sieve residues during the processing of environmental soil samples. 8 large plastic tubs contained "industrial" soil samples retained for further study. Lead/lead artefacts comprised a further 7 boxes.

The site extends westwards from the main channel of the Walbrook and was cut by its small tributaries, giving rise to numerous waterlogged deposits. Roman settlement of the area followed the construction c50 AD of a major E-W aligned road, the Via Decumana, and a series of associated revetments and drainage schemes. Timber buildings to either side of the road were to the south replaced by, and to the north supplemented by, stone structures by the third century. Excavation showed little occupation from the Roman until the late Saxon period at which date a range of sunken buildings were constructed. A "boxed hearth" was dated archaeomagnetically to 1060-1150AD at 95% confidence level. Good documentation is available for the area in medieval times. It is notable that records of about 1300 AD show the intersection of Poultry and Bucklersbury to be fronted by numerous ironmongers shops and some smithies. The extent to which the ironmongers engaged in the manufacture or repair of goods is not known.

Dating of metalworking activities

At the time of assessment detailed dating of the debris deposits was not available. Some preliminary ceramic-based dates for contexts have been included in the tabulated data presented in this report, although these may be subject to revision. A "fair amount" of the evidence of industrial activity was suggested to be associated with the late Saxon Period (Rowsome pers comm.).

Context number allocation by site area

Eval	1,000	-	1,499
Area 1	1	-	999 & 1,500 – 2,179
Area 2	2,180	-	2,499
Area 9	2,500	-	4,499
Eastern O+R Area 3	4,500	-	5,999
Service Yard Area 5	6,000	-	6,999
Area 8	7,000	-	10,999
Area 10	11,000	-	13,999
Western O+R Area 4	14,000	-	14,999
Area 11	15,000	-	17,999
Area 7 & 12	18,000+		

Policy for assessment of slags and ferrous metalworking debris:

Ironworking debris

Approximately 160kg *i.e.* about 30% of the bulk debris, comprising 9 "skeleton" boxes and 11 "shoe" boxes was examined visually. The classes of materials present, and the total weight of the debris in each context, was recorded (Table 1).

All the remaining material was then rapidly scanned visually for material that was diagnostic of specific activities; ironsmithing, ironsmelting or non-ferrous metal casting (Table 3).

The contents of one of the Stewart boxes of sieve residues was examined to confirm the identification of hammerscale, distinguish between flake and spheroidal varieties, and note other material present (Table 4).

Lead

All material in the 7 boxes was visually examined to identify waste products diagnostic of lead working (Table 5).

Examination of 30% sample of ferrous metalworking debris: Results

Table 1 presents a list of the contexts examined as part of the 30% sample of the bulk assemblage together with provisional dates, supplied by MoLAS, based on early examination of ceramics. Approximate weights of debris from each context are given (including any attached soil) together with the categories of debris identified. Categories used vary slightly between specialists and the terms used by the Ancient Monuments Laboratory are explained below.

Table 1 Assessed sample of metalworking debris from No.1 Poultry.

Context	**Ceramic date earliest**	**/ latest**	Weight (kg)	Debris interpretation
2393			0.65	run slag(20g), undiagnostic ironworking slag, cinder, vitrified hearth lining
2510			0.15	dense slag, undiagnostic ironworking slag, cinder, run slag(1g), Niedermendig lava (1g)
2512			0.01	iron object
2537	50	100	0.5	run slag(100g), undiagnostic ironworking slag, cinder
2537	50	100	0.05	vitrified hearth lining
2548			0.45	ferruginous concretion, vitrified hearth lining, undiagnostic ironworking slag
2550			0.5	undiagnostic ironworking slag, cinder, dense slag, run slag(2g)
2558			0.3	undiagnostic ironworking slag
2561			1.35	tabular slag(340g), flake hammerscale, smithing hearth bottom/s
2569			0.04	undiagnostic ironworking slag, cinder
2570			0.02	coal
2577			0.15	undiagnostic ironworking slag, cinder
2588	50	400	2	ferruginous concretion, undiagnostic ironworking slag, cinder, smithing hearth bottom/s, crucible fragment(heavily vitrified, no metal traces or distinct colours
2605			0.2	undiagnostic ironworking slag, ferruginous concretion
2620	50	160	0	run slag
2630			1.4	ferruginous concretion, undiagnostic ironworking slag; iron object
2632			7	ferruginous concretion, dense slag, undiagnostic ironworking slag (generally very dense), fired clay

2637			0.75	smithing hearth bottom/s(cindery), iron-rich cinder
2644	50	160	0.5	undiagnostic ironworking slag, ferruginous concretion
2654			0.25	undiagnostic ironworking slag, ferruginous concretion
2664			0.1	ferruginous concretion
2668			2.75	ferruginous concretion, undiagnostic ironworking slag
2680	120	400	0.35	smithing hearth bottom/s, undiagnostic ironworking slag
2685	120	90	16	vitrified hearth lining, undiagnostic ironworking slag, ferruginous concretion
2686			0.45	smithing hearth bottom/s
2687			0	iron object
2694			5	?
2720	90	160	0.03	vitrified hearth lining
2721			0.2	undiagnostic ironworking slag, run slag(5g), cinder, vitrified hearth lining
2730	120	400	0.03	vitrified hearth lining
2742			0.1	crucible frags. (50g, heavily vitrified, little blue on outer)
2750	240	400	0.4	?tap slag(300g), cinder, run slag(5g)
2750	240	400	5.7	smithing hearth bottom/s(very cindery), undiagnostic ironworking slag, flake hammerscale
2766			8.6	ferruginous concretion, flake hammerscale
2766			3.7	vitrified hearth lining, dense slag, undiagnostic ironworking slag, flake hammerscale
2772			0.03	fired clay
2778	270	400	0.45	undiagnostic ironworking slag, ?smithing hearth bottom/s
2785			0.25	?undiagnostic ironworking slag
2786			0.25	undiagnostic ironworking slag
2790			3.3	undiagnostic ironworking slag, ferruginous concretion
2800	70	400	0.3	undiagnostic ironworking slag, cinder, ferruginous concretion
2821			0.9	vitrified hearth lining, cinder, ferruginous concretion, undiagnostic ironworking slag
2821			0.35	?fired clay (probably not metallurgical)
2821			1.5	smithing hearth bottom/s, ferruginous concretion, undiagnostic ironworking slag, flake hammerscale
2823			0.02	vitrified hearth lining
2825	50	100	2	undiagnostic ironworking slag, ferruginous concretion, spheroidal hammerscale, flake hammerscale
2839			0.6	burned stone, charcoal, fired clay
2847			5.5	ferruginous concretion, undiagnostic ironworking slag, smithing hearth bottom/s
2847			5	ferruginous concretion, undiagnostic ironworking slag, smithing hearth bottom/s, flake hammerscale
2858			0.01	uncertain
2868			0.25	flake hammerscale+spheroidal hammerscale(50), vitrified hearth lining, cinder, ferruginous concretion
2870			3	smithing hearth bottom/s (very cindery), flake hammerscale
2872			0.55	undiagnostic ironworking slag
2885			0.8	ferruginous concretion, undiagnostic ironworking slag
2901			0.35	?ferruginous concretion
2902			0.25	ferruginous concretion
2908			11.3	undiagnostic ironworking slag, ferruginous concretion, vitrified hearth lining, run slag(50g), ?tap slag(150g), flake hammerscale
2912			0.2	?undiagnostic ironworking slag
2917	120	200	0.1	ferruginous concretion
2922	200	400	0.02	run slag

2922	200	400	0.1	smithing hearth bottom/s
2991			0.04	undiagnostic ironworking slag
3000			0	fuel ash slag
3033			2.1	fired clay, undiagnostic ironworking slag, vitrified hearth lining, dense slag
3044	350	400	0.03	ferruginous concretion
3054	350	400	0.04	undiagnostic ironworking slag
3060			0	iron object
3068	270	400	0.15	dense slag (check for litharge), cinder, fired clay
3097	50	140	0.8	ferruginous concretion
3403	350	400	0.45	unusual hearth/furnace/pit bottom
3662	70	100	0.05	undiagnostic ironworking slag
3821			0.1	flake hammerscale, spheroidal hammerscale, run slag(10g), vitrified hearth lining, undiagnostic ironworking slag, dense slag
3907			0.05	cinder, fuel ash slag
3917			0.05	cinder, fuel ash slag
6020			0.3	iron object, undiagnostic ironworking slag, vitrified hearth lining
6031			0.85	smithing hearth bottom/s
6040			1	?ferruginous concretion
6075			0.15	?ferruginous concretion
6080			0	iron-rich cinder
6142			0.01	?cinder
6220	90	100	0	uncertain
7018			0.02	iron object
7029			0.8	undiagnostic ironworking slag, fired clay
7031	1000	1100	0.35	iron object
7053	900	1050	0.01	iron object
7064	900	1050	0.04	undiagnostic ironworking slag
7093	250	400	0.95	dense slag, ?smithing hearth bottom/s(cindery), flake hammerscale
7093	250	400	0.75	tap slag(500g small frags) run slag(50g), undiagnostic ironworking slag, vitrified hearth lining, iron object
7230			1	uncertain
7232			0.5	smithing hearth bottom/s, ferruginous concretion
7293	250	400	0.1	undiagnostic ironworking slag
7392	150	250	2	smithing hearth bottom/s(very dense), ferruginous concretion, undiagnostic ironworking slag, cinder, flake hammerscale
8424			0.05	smithing hearth bottom/s
8442			0.04	ferruginous concretion
8499	350	400	0.01	cinder
8791			0	iron object
11477	50	100	1.1	?undiagnostic ironworking slag
11580	50	100	0.04	iron object/ferruginous concretion
11686	200	250	0.1	undiagnostic ironworking slag
11712	270	400	0.2	undiagnostic ironworking slag
11716	380	400	0.3	undiagnostic ironworking slag
11893			0.03	mostly uncertain, blue/green glassy slag (too irregular for modern blast furnace)
11894	900	1050	0.35	smithing hearth bottom/s

12360	250	400	0.25	undiagnostic ironworking slag
12405			0.07	iron object
12454	50	100	0.05	ferruginous concretion
12560			0	cinder
12638	287	293	0.15	?ferruginous concretion
12645	50	160	0.35	smithing hearth bottom/s
12657	60	70	0.5	ferruginous concretion
12829	240	300	0.1	undiagnostic ironworking slag
13004	365	400	0	iron object
16055			0.9	undiagnostic ironworking slag, smithing hearth bottom/s
16068			2	smithing hearth bottom/s
16102			6	undiagnostic ironworking slag , tap slag (700g), smithing hearth bottom/s
16107			0.4	smithing hearth bottom/s
16130			1	undiagnostic ironworking slag, smithing hearth bottom/s
16161			0.2	undiagnostic ironworking slag
16314			0	undiagnostic ironworking slag
16565			0	cinder
16566			0.2	iron object, cinder, flake hammerscale
16587			0.35	undiagnostic ironworking slag, dense slag
16598			0.15	cinder
16651	50	400	0.5	smithing hearth bottom/s, undiagnostic ironworking slag
16677			0.75	undiagnostic ironworking slag, ferruginous concretion, flake hammerscale
16731			0.3	stone, ferruginous concretion
16736			2.55	smithing hearth bottom/s, ferruginous concretion, cinder, undiagnostic ironworking slag, flake hammerscale, spheroidal hammerscale
16737	900	1050	6.2	ferruginous concretion, undiagnostic ironworking slag, flake hammerscale
16747			1.5	smithing hearth bottom/s, undiagnostic ironworking slag, cinder, ferruginous concretion
16748			1	undiagnostic ironworking slag
16765	250	400	2.8	smithing hearth bottom/s(cindery), ?ferruginous concretion
16775			0	undiagnostic ironworking slag
16780			7.2	smithing hearth bottom/s, ferruginous concretion, undiagnostic ironworking slag, flake hammerscale
16798			0	cinder
16812	50	400	1.5	flake hammerscale+spheroidal hammerscale(100g), tap slag(50g), run slag(50g), vitrified hearth lining, undiagnostic ironworking slag
16887			0.35	undiagnostic ironworking slag, dense slag
16916	50	250	8	smithing hearth bottom/s, undiagnostic ironworking slag, ferruginous concretion, flake hammerscale, spheroidal hammerscale
16927	50	250	3	vitrified hearth lining, cinder

The most frequent category of material in the 30% sample was that identified as **undiagnostic ironworking slag.** This material is of largely fayalitic (iron silicate) composition, is relatively dense, having low to medium vesicularity and is of amorphous shape. Because similar material can originate from either the smithing (hot working) or smelting (extraction from the ore) of iron this material is not considered to be diagnostic of anything more specific than ironworking. Another undiagnostic material, **iron-rich cinder,** is similarly undefined in shape but is distinguished by the presence of a high proportion of iron hydroxides within its structure.

Diagnostic material was found as **smithing hearth bottoms.** These are recognisable by their characteristic plano-convex form, having a rough underside and a smoother, vitrified upper surface often hollowed as a result of downwards pressure from the air blast through the tuyère. Compositionally, hearth bottoms are also largely fayalitic and result from high temperature reactions between the iron, iron scale and silica from the hearth lining or possibly from sand used as a flux. The dimensions of the smithing hearth bottoms (Table 2) show a typical spread for either the Roman, Saxon or Medieval periods.

Table 2 Smithing hearth bottom dimensions, No 1 Poultry

	range	mean	std dev
weight (g)	50-1250	452	318
length (mm)	50-170	105	29
width (mm)	10-120	77	28
depth (mm)	20-80	43	15

Further evidence for the smithing of iron was provided by widespread distribution of **hammerscale.** This had been systematically collected from environmental soil samples, but further quantities were found, by testing with a magnet the soil adhering to the uncleaned slag. An important feature of hammerscale is that it often survives in the immediate vicinity of any blacksmithing, whereas the bulk slags are commonly removed elsewhere for disposal or for uses such as road hardcore.

These micro-slags can be divided into two types. The first, **flake hammerscale**, consists of fish scale like fragments of the oxide/silicate skin of the iron dislodged during hot working. **Spheroidal hammerscale** results from the solidification of small droplets of liquid slag expelled during working, particularly when two components are welded together or when blooms of iron are first consolidated. Hence the relative quantities of these two types may provide an indication of the type of work being carried out. However, biases in collection strategy should be noted. When hammerscale is collected only from the sieve residues a proportion of the spheroidal slag will float off due to high porosity within their structure.

Perhaps surprisingly for an urban context, diagnostic evidence for iron smelting was also identified, although in much smaller quantities that the iron smithing debris. Of the 160kg of carefully sorted slag 1.7 kg was classified as **tap slag.** This dense, fayalitic slag shows a ropey flowed structure on its upper surface and little porosity. It forms when molten slag is run off from a smelting furnace and is normally considered to provide clear evidence of iron smelting *i.e.* the primary production of metallic iron from the ore. Most of the smaller runs and dribbles, classed as **run slag**, probably also derive from iron smelting, but as such slag can occasionally be formed during smithing, this interpretation is less certain. **Dense ironworking slags** lack the characteristic flowed surface but are of similar consistency to tap slags and there is a high probability that some of these also derive from iron smelting. No **iron ore** was identified in the assessed material from No.1 Poultry.

A small (30g) fragment of blue/green **glassy slag** (Context 11839) shares some similarities with post-medieval blast-furnace (iron smelting) slags. However, the heterogeneity of the material tends to suggest small scale, more technologically primitive origins. This material could be an accidental product an over-blown iron smelting furnace, but little significance can be attached to such a small quantity of material.

Another frequent component of the assemblage was the **vitrified hearth/furnace lining**; strictly, this may derive from either iron smelting or smithing structures. The material forms as a result of a high temperature reaction between the clay lining of the hearth/furnace and the alkali fuel ashes or fayalitic slag. The material normally shows a compositional gradient from unmodified clay on one surface to an irregular cindery material on the other. An associated material, classed as **cinder,** comprises only the lighter portion of this, a porous, hard and brittle slag formed as a result of high temperature reactions between the alkali fuel ashes and either fragments of clay which had spalled away from the hearth/furnace lining or another source of silica, such as the sand used as a flux during smithing.

Ferruginous concretions form as a result of the redeposition of iron hydroxides, similar to the natural phenomenon of iron panning, although the process is likely to be enhanced when the surrounding archaeological deposits contain much iron-rich waste.

Much smaller amounts of material were classified as **fuel ash slag,** a very lightweight, light coloured (grey-brown), highly porous material which results from the reaction between alkaline fuel ash and silicates from soil, sand or clay at elevated temperatures. The reaction is shared by many pyrotechnological processes and the slag is therefore not diagnostic.

A single fragment of **coal** was identified from context (2570). The use of this fuel for metallurgical purposes is well attested in the Roman period, but no metallurgical debris was found in the same context as this fragment.

Crucible fragments in two contexts (2588 & 2742) derive from the melting of copper based alloys.

Summary of scanned material

Rapid visual analysis of the remaining boxes and bags of bulk slags confirmed that the majority of the diagnostic material relates to iron smithing (Table 3). Occasional fragments of run slag were also noted. More significant evidence of smelting was provided by 750g of tap slag from context 7035. This context also contained a lump of slag which, could be either an unusual very dense hearth bottom or an indistinct small smelting furnace bottom or the contents or a tapping pit (context 7035). Heavily vitrified ceramic sherds from context 2821 bore no visible traces of metallic residues.

Table 3 Interpretation of scanned debris from No.1 Poultry.

context	**ceramic date earliest**	**/ latest**	interpretation
1203			smithing hearth bottom, large hearth frags
1331			smithing hearth bottom (very cindery)
1514	0	0	smithing hearth bottom
1842	250	400	?smithing hearth bottom
1902	250	400	smithing hearth bottom
2021	120	250	smithing hearth bottom
2046	250	400	?smithing hearth bottom
2372	0	0	smithing hearth bottom
2537	50	100	smithing hearth bottom
2540	0	0	smithing hearth bottom
2589			run slag
2625			run slag
2671	0	0	smithing hearth bottom
2678			dense slag
2697			?smithing hearth bottom
2714	50	170	smithing hearth bottom
2760			smithing hearth bottom
2766			smithing hearth bottom
2770	0	0	smithing hearth bottom
2779			?smithing hearth bottom
2803			smithing hearth bottom
2821			heavily vitrified sherds, process unknown
2834	0	0	?smithing hearth bottom
2841			smithing hearth bottom
3013	50	160	smithing hearth bottom
3033			smithing hearth bottom
3038	0	0	smithing hearth bottom
3218	270	400	smithing hearth bottom
3554	270	400	smithing hearth bottom
3611	350	400	double smithing hearth bottom
6023			smithing hearth bottom
6135			blue coloured hearth lining; non ferrous
7008	1050	1150	smithing hearth bottom
7018			tuyère fragment
7035	970	1100	tap slag(750g), dense hearth/furnace/pit bottom
7096	0	0	smithing hearth bottom
7387	120	250	smithing hearth bottom
7721			smithing hearth bottom (very cindery)
8283	120	250	blue pigment/vivianite
11009	1050	1150	smithing hearth bottom
11326	0	0	smithing hearth bottom
11626	1050	1150	hearth lining with copper corrosion products, blue & red colouration
11660	1000	1150	smithing hearth bottom

11852	270	400	blue cindery material
12646			smithing hearth bottom
15566	50	100	?smithing hearth bottom
16014			smithing hearth bottom
16115	0	0	smithing hearth bottom
16131			smithing hearth bottom
16171			?smithing hearth bottom
16325	0	0	smithing hearth bottom
16594			smithing hearth bottom
16780	0	0	smithing hearth bottom
16870	120	160	smithing hearth bottom
16877	0	0	smithing hearth bottom
16882	900	1050	smithing hearth bottom
16916	50	250	smithing hearth bottom
16993	100	200	smithing hearth bottom
17046	270	400	smithing hearth bottom
17136			smithing hearth bottom
17175			smithing hearth bottom
17278	50	300	?smithing hearth bottom
17356	120	250	smithing hearth bottom
17529	0	0	smithing hearth bottom
17539	0	0	smithing hearth bottom
17540			smithing hearth bottom
17828	0	0	smithing hearth bottom
18337	0	0	?crucible fragment

Examination of sieved material

Visual examination of the smaller box confirmed the identification of hammerscale and showed spheroidal hammerscale to be a frequent, if less numerous component of the residues (Table 4).

Table 4 Hammerscale from sieve samples, No.1 Poultry.

Context	Weight (g)	Components
2697	100	fired clay, flake hammerscale, spheroidal hammerscale
2712	20	flake hammerscale, spheroidal hammerscale
2797	20	fired clay, flake hammerscale, cinder
2821	20	flake hammerscale, fired clay, spheroidal hammerscale
3013	200	flake hammerscale, spheroidal hammerscale, fired clay
16536	50	flake hammerscale, spheroidal hammerscale, unidentified ironworking debris
16566	30	flake hammerscale
16596	40	flake hammerscale, spheroidal hammerscale, fired clay
16677	80	flake hammerscale, spheroidal hammerscale
16737	40	flake hammerscale, fired clay
16887	20	flake hammerscale, fired clay

Examination of lead / lead alloy

The seven boxes of lead objects included a large proportion of spillages. These may be either waste created during casting or the remains of accidentally melted artefacts or building components. Much firmer evidence for the casting of lead was provided by a small number of sprues and pieces of partly used ingots. A heavy mineral, previously listed as "lead ore", did not visually resemble the most common ore, galena. Identification might be confirmed by analysis but the probability that lead smelting took place in an urban context so far from ore sources must be considered extremely unlikely. A piece of "litharge cake", indicative of the refining of silver, had previously been identified by Justine Bayley but was not available for further examination as part of this assessment. A further lump of dense material from context 6104 could also have been waste from this process but was not diagnostic on visual grounds alone.

The assemblage also included fragments of lead sheet offcuts and possible scrap material, indicative of lead working, if not necessarily of workshops. The good condition of most of the material on site suggested it was metallic lead of reasonable purity, rather than pewter or other lead alloys which are more prone to deterioration. However, this conclusion is limited by not knowing the burial conditions of individual artefacts.

Table 5 Lead working waste from No.1 Poultry.

Context	Find No.	Ceramic date early / late		Interpretation
3405	878	350	400	offcuts
6104	3328			dense, lead-rich material, possible litharge cake
7143	3144			ingot
8263	2017	200	400	possible sprue
11179	1696	1050	1150	small ingot offcut
11372	4908	1080	1200	dense mineral, possible lead ore
15501	4817	50	70	larger ingot
18077	4653	80	100	sprue

Contextual distribution

Full contextual information was not available at the time of assessment. However context numbers were supplied for several potentially relevant structures; a boxed hearth (16682), two further hearths (16647 & 16603) and a number of contexts closely associated with these features. When matched with the assessment data it was found that none of these contexts contained any diagnostic evidence or iron smithing, iron smelting, copper alloy melting or lead working.

Dating of metalworking

As mentioned above, only provisional dating, based on ceramics within individual contexts, was available at the time of assessment. A large proportion of contexts contained no datable material and of the remainder by far the greatest proportion gave Roman dates. The latter may reflect the relatively widespread use of pottery (or readily datable pottery) in the Roman period. Therefore the value of any temporal analysis of metalworking activity will be limited. However, it may be significant that no tap or run slag was found in any context containing Saxon or later pottery in the 30% assessed sample and only for one context in the remaining scanned material. Thus iron smelting would appear to be associated with early activity on the site. By contrast, bulk and micro-slag evidence from assessed, scanned and sieve residues would appear to indicate that ironsmithing was certainly being carried out in the late Saxon period. The quantity of diagnostic lead working debris is probably too small to be meaningfully compared to the presently incomplete set of dating evidence.

Conclusions

The full interpretation of metalworking on the site will require more detailed examination of the whole assemblage and careful analysis of the archaeological contexts from which it derived. However, on the basis of the sample of material examined, some suggestions can be made regarding the role of metalworking on the site. The assessment of the metalworking slag assemblage from No.1 Poultry showed the presence of a wide variety of debris. Of the diagnostic slags, those associated with ironsmithing, *i.e.* hot working of iron, greatly predominated and it is therefore likely that most of the undiagnostic slags also derive from this process. The widespread presence of hammerscale provided further evidence for ironsmithing and this will probably give a much more precise location and dating of the actual metalworking than the bulk slags.

Evidence for iron smelting in a central London location was unexpected. However, the material identified as “tap slag” undoubtedly derives from iron production and it is likely that the “run slag”,“dense slag” and probably some of the “undiagnostic ironworking slag” also results from smelting. Preliminary analysis of the contexts producing smelting debris suggest that this material is linked to earlier contexts on the site. Care should be taken at this preliminary stage not to overstate the importance of this small quantity of material. Iron smelting can be expected to produce large quantities of debris so the limited amounts found at No1 Poultry are more likely to have been deliberately or accidentally transported to the site, whilst the smelting took place elsewhere in the vicinity. On the other hand the relatively common occurrence of hammerscale, compared to smithing hearth bottoms suggests that the bulk smithing slags were being removed from the site.

Contextually, no association between the bulk diagnostic ironworking debris or lead working waste and the three excavated hearths was identified. It was also noted that no hammerscale was reported from environmental sieve residues from these or associated contexts. However, the policy for taking environmental samples was not known to the assessor and therefore lack of positive identification cannot be assumed to be evidence of absence. It is only possible to say that at this stage there is no reason to believe that these hearths have been used for iron smithing or other metal working.

Small quantities of copper alloy debris were identified during this assessment. These were separated so they could be examined by the relevant specialist when other similar material is assessed. The quantity of lead recovered from the site is relatively meagre, but certainly included some debris which indicates the melting and casting of lead or lead-based alloys.

Potential for further work

Whilst the assessment suggests that links between the slag assemblage and any surviving metalworking facilities at No1 Poultry may be limited, there are a number of features of the site and material that suggest that further examination and analysis of the metalworking debris would contribute significantly to the interpretation of the site. Further work on the assemblage is therefore recommended. In particular, detailed classification of all bulk material and hammerscale should be undertaken and the data analysed with reference to the contextual record, the completed site phasing and final dating evidence. Much of the stored material is unwashed and heavily caked in soil. Cleaning of this material before examination by a specialist would considerably speed up the classification process, provide a more reliable interpretation and cut down on the volume of material to be stored. However, if there are contexts for which industrial or environmental samples were not saved, the adhering soil should be checked for hammerscale before disposal.

Limited qualitative analysis would clarify the nature of several unusual pieces of debris such as the possible lead ore, possible litharge cake etc. A technique such as X-ray fluorescence (XRF) analysis would provide a rapid, non-destructive method.

Six boxes of industrial soil samples require examination. Magnetic susceptibility would provide a rapid means of quantifying hammerscale within all samples. The method has been described by Mills and McDonnell (1992).

Topics which deserve close scrutiny include the possibility of iron smelting and the extent to which the excavated evidence of smithing matches the documented high density of smiths and ironmongers on the site by 1300.

The lead assemblage needs to be examined by an appropriate specialist. Qualitative analysis such as XRF would enable lead alloys, such as pewter, to be distinguished from un-alloyed lead.

No systematic assessment of the copper-alloy debris was made as part of this report and
no advice can be given on its potential for analysis.

Storage of slag

It is recommended that all the slag should be saved. Ironworking slag, being predominantly fayalitic, is not prone to deterioration and requires no special treatment. The No.1 Poultry material is currently stored in a wide range of boxes and bags which range from very full to almost empty. Some rationalisation of the current boxing, together with exterior labelling of context numbers and removal of adhering soil would improve future storage and access.

References

Mills, A and McDonnell, JG (1992) *The Identification and Analysis of the Hammerscale from Burton Dassett, Warwickshire,* (Ancient Monuments Laboratory Report 47/92)