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Summary

Technological debris from Late Iron Age and Romano-British contexts included fragments of Iron Age crucibles used for copper alloy and silver working, Romano-British piece moulds used for copper alloy casting and slags, ores, hearth structure etc. from ironworking. The total weight of technological material was 103kg.

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The material submitted for examination (AM Lab No. 868786) included fragments of crucibles, clay moulds, slag and ceramics. All the material was carefully examined. The crucibles and mould fragments were studied under low magnification (x10) and analysed qualitatively by energy dispersive X-ray fluorescence (XRF) in an attempt to identify the metals or alloys being worked.

The Crucibles

A number of fragments of crucibles from non-ferrous metalworking were identified. Most of the pieces were small and it is difficult to suggest the forms the vessels may have had. Two fragments (DR 65 ULb and DR 69 KT) were the corners from triangular shaped crucibles. These are common late Iron Age forms in lowland Britain (Bayley 1989). Some of the crucibles (DR 65 ULa and DR 67 DF) had a heavily-vitrified added outer layer of clay fused onto the exterior wall of the crucible. Although the Dragonby examples are not datable, this feature is common on Roman and later crucibles (*ibid*). One of these outer layers (DR 67 DF) showed tong marks within the vitrified layer where it was handled. One crucible (DR 67 LU) had a small pouring lip in the rim. All the crucibles appeared to be hand made. The crucibles were all made from fine, sandy fabrics and were reduced fired. Melting metals under reducing conditions prevents oxidisation of the charge.

Some of the crucibles had traces of metal remaining within them (*eg* DR 67 LU). These were usually associated with the melting of copper alloys and this was confirmed by XRF analysis. However it was not possible from the qualitative analyses of the crucible walls to determine the particular copper alloys being melted. Traces of copper, zinc, lead and tin are common in the majority of the analyses.

Some of the crucible fragments had particularly high levels of zinc detectable (*eg* DR 65 ULa and DR 65 OS). Zinc has a very high vapour pressure. Once inside the crucible fabric, zinc forms stable compounds with the clay minerals. Hence it is likely that zinc will be detected in crucible fragments in deceptively high concentrations. However the zinc levels in some of the Dragonby crucibles are high enough to suggest that they have been used for the melting of brass. Only one of the fragments on which zinc alone was detected at a significant level (DR 65 MN) was found in a context which is thought to be pre-Roman (50BC-50AD), making this an early example of the melting of a zinc-containing copper alloy in Britain (Bayley 1984).

Three crucibles (DR 70 APL, DR 65 GL and DR 65 BD) were found to have been used for the melting of silver. These crucibles had small corroded droplets of silver adhering to the surface of the crucible which were visible under the microscope. The identification was confirmed by XRF analysis. The shapes of the crucibles used for melting silver were not clear from the small fragments available.

The crucible fragments come from Iron Age, early and late Romano-British contexts. There is no obvious correlation between period of deposition and metals detected on fragments.

The Moulds

Two items (DR 69 TB and DR 69 YG) were identified as fragments of clay piece moulds. Both pieces are dated to the Romano-British period, when piece mould technology was well established. XRF analysis showed that the moulds had been used as they had metallic traces on the surface, however it was not possible to establish the alloys involved, though they were probably copper based.

The Slag

Two items (DR 67 GW and DR 64 JT) were identified as fragments of hearth lining from iron working. The clay lining of the hearth has fused with the slag to form a vitrified block. Vitrification is not normally produced in domestic hearths as the temperatures are not high enough. Analysis of the slag showed a high iron content and it is likely to be associated with iron smithing. Phasing for these pieces is inconclusive.

A variety of other slags from ironworking were examined and catalogued (Table 2). The material comes from contexts dating from the late Iron Age to the late Romano-British. Large deposits of slag and hearth structure (ie over 2 kg) were found in contexts dated to the period of the Conquest (Feature 2251) and from the second century AD (Features 149, 150) and from deposits dated to the Romano-British phase in general (eg Features 193, 228, 527 and 704). The majority of the other deposits were small (less than 200g) and may be considered as scatter. The total weight of slag etc. was 103kg.

Ceramic material, not associated with metalworking

Four other items submitted (DR 65 ABW, DR 65 IZ, DR 65 IX and DR 65 JZ) were ordinary ceramics with no evidence of use in industrial processes. They were all oxidised fired with large inclusions of shell that would have caused them to break up at high temperatures.

References

Bayley J 1984 "Roman brass-making in Britain", JHMS 18/1, 42-3.

Bayley J 1989 "Non-metallic evidence for metalworking", Proceedings of 25th Symposium on Archaeometry, Athens, 1986 (ed Y Maniatis); 291-303

Table 1: CRUCIBLE, MOULD AND ASSOCIATED FRAGMENTS

Item number	Date	Additional id	Elements
a) Crucibles			
DR 69 AUT	late 1st C	Frag	-
DR 67 LU	US	Frag - Copper alloy	Cu Zn Sn
DR 69 KT	US	Frag - Copper alloy	Cu Zn Pb Sn
DR 70 APL	RB	Frag - Silver	(Ag)
DR 67 DF	US	Frag - Copper alloy	Zn
DR 65 GL	50BC-50AD	Frag - Silver	(Ag)
DR 65 MN	"	Frag - Copper alloy	Cu Zn
DR 65 OS	2nd C AD +	Frag - Copper alloy	Cu Zn Pb
DR 65 ULa	ND	Frag - Copper alloy	Cu Zn Pb
DR 65 ULb	ND	Frag - Copper alloy	Cu Zn Pb Sn
DR 65 BD	US	Frag - Silver	(Ag)
DR 66 FJ	3rd C AD +	Frag	Zn
DR 69 AUE	late 1st BC	Frag	-
DR 69 ANC	"	Frag	-
b) Moulds			
DR 69 TB	RB	Frags - copper alloy?	(Pb)
DR 65 YG	RB	Frags - copper alloy?	(Zn)
c) Hearth lining from iron working			
DR 67 GW	US		
DR 64 JT	ND		
d) Others			
DR 65 ABW	} late 1st BC	Complete ceramic pot	
DR 65 IZ	} - early	Ceramic fragment	
DR 65 IX	} 1st AD	Ceramic fragment	
DR 65 JZ	}	Ceramic fragment	

RB = Romano-British
IA = Iron Age
US = Unstratified
ND = not dated

Table 2: METAL WORKING EVIDENCE LISTED BY FEATURE

All the material descriptions and weights in this table were undertaken by Paul Wilthew. The weights are rounded to the nearest five grammes. The phasing codes are as in Table 1. The material codes used are as follows:

FAS	-	Fuel Ash Slag	VC	-	Vitrified Clay
IRS	-	Iron Rich Sand	NB	-	Niedermendig Basalt
SS	-	Iron Smithing Slag	FC	-	Ferruginous Concretion
IO	-	Iron Object			
IS	-	Ironstone	C	-	Crucible
HL	-	Hearth Lining	S	-	Sandstone
HB	-	Hearth Bottom	M	-	Mould
BC	-	Burnt Clay	I	-	Iron
BS	-	Burnt Sandstone	B	-	Bone

Hearth lining is ceramic material from the hearth structure. A hearth bottom is an accumulated block of smithing slag, which often forms a plano-convex bun, in the bottom of the smithing hearth.

Feature	Date	Weight (g)	Material
?		43,395	Various
1	0 - 50 AD	310	HL,FAS,IS,SS,?SS
2	earlier than F1	10	FAS
3	50 BC - 50 AD	585	FAS,?SS,C,SS,?B,?M,?C
4	Flavian	90	FAS,HL
5	RB	5	FAS
11	RB	20	FAS
45	Mid 2nd - 225AD	10	BC
47	IA but RB contam	30	FAS
50	Late R	45	FAS
57	RB	200	FAS,HL
58	RB	5	FAS
59	RB	15	FAS
75	IA	165	SS
80	Mid 2nd - 225AD	60	FAS
87	RB	70	FAS,BC
93	IA	30	FAS
108	ND	<5	IO
115	ND	130	SS
122	RB	130	HL
125	RB	80	FAS
143	RB	145	FAS,SS
146	Late RB	20	FAS,HL
148	Late RB	<5	HB,FAS
149	2nd C AD	2,045	SS,NB,FAS,HL,HB
150	2nd C AD	240	SS,FAS
151	ND	240	FAS,SS,C
154	IA	75	FAS
156	RB	200	FAS,SS,HL
158	IA	30	?SS

Table 2, cont

Feature	Date	Weight (g)	Material
159	?IA	125	FAS
160	RB	50	FAS,HL
161	IA	40	FAS
163	ND	15	FAS
164	RB	5	FAS,?M
181	RB	300	SS,HB
188	RB	35	FAS
193	RB	10,830	SS,HB,HL,FAS
197	IA	85	FAS,SS
202/3	RB	1,910	SS,FAS,HB
212/362	RB	65	FAS,HL
222	RB	65	FAS
228	RB	2,735	FAS,SS,HB
229	RB	250	FAS
231	RB	325	SS,FAS,?SS
232	Early 3rd or later	30	FAS
234/491/	RB		
712/720	RB	250	FAS,SS,?SS
236/289/	?		
295	RB	35	FAS
238	ND	30	SS
242	RB	70	FAS,?SS,BC
264	Late 2nd or later	40	SS
274/942	RB	770	SS,HL,FAS
284	IA	75	FAS,?BS,IS
298	IA	10	FAS
300	Late 2nd or later	160	SS,FAS
302/310	IA	50	FC
303	IA (RB contam)	25	FAS
306	RB	120	FAS
315/1270	IA/RB	10	FAS
318	Early to mid 3rd C	160	SS,FAS
322	IA	70	SS,FAS
332	RB	275	HB
334	Late 2nd - early 3rd	70	?SS,FAS
416	IA	60	FAS
420	RB	120	FAS
427	Early - mid 3rd	55	FAS,BC,?SS
435	RB	5	FAS
442	Early - mid 3rd	200	SS
443	3rd C	70	FAS
447	ND	490	SS,FAS
501	Mid 2nd C (taq)	210	HL,FAS,SS,BC
527	RB	7,640	FAS,SS,HL,BC
534	ND	30	FAS
541	Early 3rd	200	FAS
545	Pre 3rd	5	FAS
572	3rd C	1,500	HL,FAS
583	IA/RB	60	FAS
625	IA	15	FAS
700	RB	970	FAS,HL,SS
701	RB	290	FAS,SS,HL
704	RB	10,105	FAS,SS,HL

Table 2, cont

Feature	Date	Weight (g)	Material
705	RB	145	FAS,HL,I
706	RB	330	FAS,SS
707	RB	20	BC
708	RB	5	FAS
710	RB	10	FAS
712/720	IA?	280	SS,FAS
714/808	0 - 50 AD	175	FC,FAS,HL
716	RB	1,060	FAS,SS,HL
723	RB	15	?SS
724	IA	5	FAS
734/776/	?		
785	IA	5	FAS
781	RB	120	FAS
789	RB	90	FAS,HL
800	RB	65	HL,FAS
809	RB	70	NB,FAS,?M
812	RB	40	I
827	RB	55	FAS
834	RB	50	FAS
858	IA/RB	<5	FAS
893	50 - 0 BC	375	SS,?SS,FAS
918	ND	15	FAS
933	IA	30	FAS
944	RB	20	FAS,BC
966	RB	280	FAS
1215	RB	140	SS
1304	RB	15	IS
1319/1811	RB	15	FAS
1323	Late 2nd-early 3rd	1,095	FAS,SS,HL,BC,?SS
1329	Pre-Conquest	10	FAS
1336	?IA	35	IRS
1340	Early 3rd or later	305	FAS
1346	RB	185	FAS
1358	RB	50	FAS
1368	RB	680	SS,FAS
1374	Late IA	20	FAS
1391	IA	10	FAS
1400	IA	5	FAS
1403	RB	140	FAS,SS
1404	Late 2nd onwards	15	FAS,IRS
1407	RB	140	SS
1414	ND	90	?S
1424	RB	70	SS
1426	RB	180	SS
1429	RB	10	FAS
1430/1452	RB	190	FAS,BC,?SS
1431	RB	5	FAS
1438	RB	40	SS,FAS
1440/1444	RB	70	FAS,HL
1448	RB	25	FAS
1449/1450	RB	130	FAS
1456	ND	40	BC
1461	Early-mid 3rd	215	FAS,SS
1461/1478	Late 2nd-early 3rd	5	FAS
1478	"	280	SS,FAS

Table 2, cont

Feature	Date	Weight (g)	Material
1496	IA	15	?S
1537	Claudian	10	FAS
1550	2nd C AD	15	SS
1570	50 BC - 50 AD	60	SS
1604	0 - 50 AD	45	FAS
1605	0 - 50 AD	15	FAS
1613	RB	105	?SS,FAS
1621/1364	IA	5	FAS
1650	RB	20	FAS
1658/1700	75 - 25 BC	30	IS,FAS
1666	0 - 50 AD	5	FAS
1675	RB	410	FAS
1740	IA	5	FAS
1749	RB	510	FAS,SS
1777	IA	10	FAS
1786	RB	100	SS,C
1965/1304	RB	60	HL,?SS,I
2001	IA	20	S
2016	ND	20	SS
2026	RB	50	FAS
2086	0 - 50 AD	5	VC
2100etc	50 BC - 50 AD	55	FC
2112	0 - 50 AD	15	FAS
2121	RB	5	SS
2127	25 - 75 AD	150	IS
2138/2100	IA	45	BC
2251	Conquest	4,250	SS
2301b/2229	50 - 0 BC	25	FAS
2307a	Early RB	25	FAS
3021	ND	<5	BC
TOTAL WEIGHT		103,045	