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Lincoln, Flaxengate: Crucibles and associated materials from 9th-10th century levels

Justine Bayley
Ancient Monuments Lab

A large number of crucible fragments from the 1974 and 1975 seasons' excavations were submitted to the laboratory for examination with the intention of identifying the process or processes being carried out at the site. Preliminary visual sorting indicated that some of the crucibles had been used to melt copper alloys and some to melt glass. Others showed no signs of use. These two processes are sometimes difficult to tell apart as both can produce eg. deep red coloured glassy deposits. In the case of glassworking this is the desired end product but where the main process was copper alloy melting the "glass" is an accidental by-product caused by the fluxing of the siliceous material of the crucible fabric or the surrounding soil with the fuel ash and the inclusion of traces of coppper or its oxides to give the red colour. It is in fact a type of slag.

In order to differentiate between these two visually similar but technologically separate materials tests were made with the Laboratory's Milliprobe (an X-ray fluorescence spectrometer). It was found that the concentration of lead present was a good indicator. Deliberately made glasses gave signals at least an order of magnitude greater than the accidental "glasses" associated with metalworking. Tables 1 and 2 list which fragments fall into which categories.

Metalworking

This term is used here to imply the melting of copper alloys. One metal "blob" in bag F74 AON 1441 P25 was found on Milliprobe analysis to be a copper/zinc/lead alloy. Another group of metal blobs from the 1974 excavations are at present awaiting atomic absorption analysis which will give accurate percentage compositions of the metal.

Many of the metalworking crucicles contained small blobs of corroding copper alloy. These are a good but not infallible indication that the crucible was used for metalworking as small specks of copper corrosion products were also noted on two of the glassworking crucible fragments.

Glassworking

There appear to be basically two different types of glass being worked here. One is the clear yellow or green glass which was used to make the rings and beads found on the site. The second group are the opaque "sealing-wax" red glasses which are also found as brown, yellow, green and often mixed deposits due to the failure to maintain sufficiently reducing conditions in the crucible. No artifacts utilising this material have yet been found but a possible use would be for enamelling copper alloy objects. Exceptions to this bipartite classification are a single crucible sherd containing opaque yellow glass (F75 E6 P158) and a single bead of opaque orange glass (F74 AOM P16).

The lead levels in the clear and opaque glasses are not significantly different.

The Crucibles

Although most of the crucibles are very fragmentary there are a number of points that can be made about their form and fabric. It seems that certain types were used only for glassworking and others only for metalworking.

The majority of the clear yellow and green glasses are found in crucibles made of a fairly coarse, oxidised (red) fabric, usually with "shell" gritting. They vary in thickness from 5-10 mm and one nearly complete crucible (F75 G72 P190) had a diameter of about 8 cm and a depth of 1 cm. This red fabric is not used for metalworking crucibles nor apparently for the red glass. The only outsider was the one sherd with opaque yellow glass.

The red glass, and attempts at red glass, are found in two types of fabric. One is an equally coarse fabric to that described above but is, as expected,

reduced fired (grey) and without the "shell" gritting. It is also 5–10 mm thick (eg F75 H11 P152). The second fabric is a rather harder fired ware, also reduced. These crucibles are rather thinner, say 3–5 mm, and occur in two forms, a flat disc of up to 5 cm diameter (eg F75 B99 P133) and a similar sized disc with a raised rim (eg F75 E11 P75). There are a number of sherds without rims which may belong to crucibles of one of these two shapes or may come from more ordinary dish shaped crucibles. It has been suggested that these "palette" shaped crucibles were used to test the glass, for once it was molten it would be impossible to see its colour. A small amount transferred to one of these would cool rapidly and so allow changes to be made to the fire if necessary to produce the desired colour in the bulk of the glass.

The metalworking crucibles are all of the hard-fired fabric and are mainly reduced (grey) although there are a few oxidised (buff) sherds. They are mainly 2–3 mm thick, although the rims are sometimes a little thicker. Many of them appear to be of the shapes sketched in fig 1.

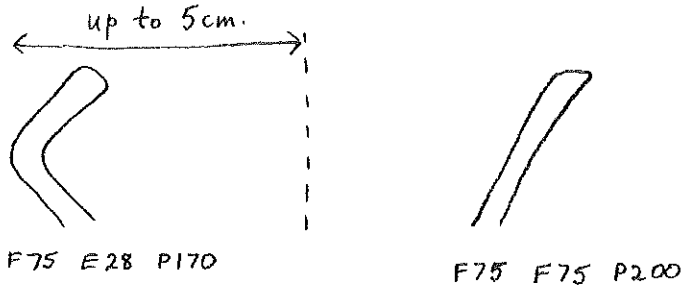

Fig 1. Metalworking crucibles

These crucibles also have pouring lips on some of the rim pieces.

Other material

One crucible (F74 AUZ 2116 P30) contained lead that had apparently been heated to produce lead oxide, possibly to be incorporated in the glass found on the site. The crucible had a pouring lip.

A thin strip of metal (F75 B105 Ae438), thought to be solder, was submitted for examination. Milliprobe analysis showed it to be lead with no other metals present in detectable quantities.

Two sherds (F74 ARW  P72 and F74 AXU  P68) included with the crucibles had been used to contain a haemetitic powder. This could have been used as a red ochre pigment or alternatively as jewellers rouge for polishing metalwork or enamels.

Table 1: Flaxengate 1975 crucible fragments

Metalworking				Glassworking	
F29	P111	BAZ	P202	E9	P151
E6	P82	E54	P146	G72	P190
E72	P123	E28	P153	E6	P158
D8	P88	C6	P84	B104	P78
C8	P79	B105	P139	B99	P133
F50	P186	F74	P201	E6	P77
F75	P200	F5	P83	E85	P166
E4	P86	B104	P128	A104	P149
E8	P81	F32	P160	B100	P137
C7	P80	C4	P85	G31	P199
D8	P76	E28	P170	B105	P110
E47	P180	B100	P138	H11	P152
G28	P179	F50	P187	B105	P142
AVI	P74	E28	P175	E9	P157
F28	P161	E8	P90	E5	P89
		F28	P168	E5	P150
		E49	P131	B105	P141
		G48	P178	E72	P118
				E11	P75
				G12	P198
				F29	P112

Note:- The second column under 'metalworking' were not checked by the Milliprobe, but all the others were.

Table 2: Flaxengate 1974 crucible fragments

Metalworking

AON	1389	P28
AVZ	2133	P56
AON	1391	P23
AON	1531	P19
AXN	2251	P39
AON	1441	P25
AUX	2092	P26
ARW	1620	P60
AVT	1595	P18
AON	1068	P12
AZX	2150	P47
AV1	1395	P58
AON	1274	P4
AON	1262	P3
AVV	2239	P52
AVV	2197	P66
AUG	1294	P27
AON	1982	P29
AON	1516	P48
AVI	-	P232
AUV	1801	P22
AOK	972	P14
BAB	-	P240
ART	-	P228
ARS	1397	P42
AVV	2128	P50
ARZ	1399	P20
BAB	2401	P43
AVI	2228	P67
AUG	1387	P24
AJP	-	P219
ABE	-	P230
AON	1608	P59
AIO		P218
AUI	1983	P31
AIO	817	P13
ART	1534	P21
AVV	2305	P69
BAB	-	-
AON	1458	P17
AVZ	2132	P45
AVZ	1988	P44
AVI	-	P233
AOM	951	P11
AOU	1169	P6
AON	-	P225
AIO	-	P217
BAB	-	P237
AON	1307	P5
BAB	-	P239
AVI	1995	P65
AON	1100	P7
ARW	1716	P63
AON	-	P220
BAB	2400	P40
AON	1304	P37
AZX	-	P236
AXU	2255	P68
ARG	-	P226
ARX	1596	P49
AXU	2252	P61
AXW	2258	P41
AVF	-	P231
AON	-	P221
ASE	-	P229
AON	-	P223
AON	973	P15
AON	-	P224
AON	-	P222
AVI	-	P234
AVV	2005	P64
AVF	1192	P10
AON	1081	P8
AXA	2127	P55
ASO	2233	P38

Glassworking

AVZ	2133	P56
ARO	-	P277
AZX	2160	P46
AZN	2047	P57
AON	1237	P9
AZX	-	P235

Note:- The Milliprobe was only used to check the glassworking crucibles and the more dubious metalworking ones