

Arch Report 3984  
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EXAMINATION OF TECHNOLOGICAL MATERIAL FROM SILVER STREET, LINCOLN

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Material from Silver Street sites AI, BI, BII and CI was examined and comprised slag, hearth lining, stone, ceramics and glass (AM 739085-087, 739096-9100, 739103, 7310335-36, 7310338, 7310344, 7310346-10402, 7310437-440, 740995 and site nos. BI 1605-1608). Some of the samples were analysed qualitatively by energy dispersive X-ray fluorescence.

The bulk of the material was ironworking waste, and both iron smelting and smithing slags were found. Most of the slag was tap slag, although some of it was unusually porous, but some pieces (e.g. AM 7310381 and 7310382) were almost **certainly smithing slags**. There were also several samples of ironstone but as the ironstone had not been roasted, a preliminary step carried out before it could be smelted, it is not possible to say whether it was the ore being smelted or if its presence was coincidental. A few pieces of hearth lining which may have formed part of iron smelting or smithing hearths were also found. Although most of the ironworking material was found at site BI, some ~~was~~ found at AI, BII and CI so little can be deduced from its distribution. From the quantity and type of finds, it seems most likely that iron working was carried out near the Silver Street sites, but probably not at any of the sites excavated.

Several crucible fragments were found at BI, on the internal surfaces of which various combinations of copper, lead, zinc and silver were detected which can be interpreted as evidence for the melting of brass (AM739103), leaded brass (AM739097) and debased silver (AM739098-739100). The silver may have been debased by the addition of brass as both copper and zinc were detected on crucibles AM739098-739100, as well as silver and lead. One group of fragments (AM739099) probably did not come from a single crucible, as the elements detected on different fragments varied. All the crucible fragments consisted of two ceramic layers, a completely vitrified, fairly unrefractory outer layer and a refractory inner layer. The inner layer was slightly vitrified on some fragments, but in all cases it had a pale grey, fairly coarse fabric and had been reduced fired. No significant differences were observed between the fabrics of fragments from different crucibles. Most of the fragments were too small to give much indication of the original sizes and shapes of the crucibles. However, the rim fragments all had lips overhanging the crucible mouth, and one fairly typical fragment (AM739098) was from a crucible with an internal diameter at its mouth of about 9cm. One sample (AM739085) was, apparently, scrapings from inside a crucible and the analytical results were consistent with it being from a crucible used to melt leaded brass. The only evidence from the working of copper alloys containing tin was two samples of hearth lining both from site AI (AM7310400 and 739087). Bronze or gunmetal, possibly containing lead, may have been melted in the hearths of which the fragments were part as tin was detected on them as well as copper, lead and (on AM739037) zinc.

One further sample was also connected with metalworking (AM7310344). This small crucible was reduced fired and vitrified on its inner surface and small globules of gold were visible in the glassy layer. The sample was almost certainly used in some capacity in gold working, but the fact that it was reduced fired suggests that it was not used as a cupel. Lead was however, the major element detected, though probably not in as high a concentration as would be expected in a cupel.

Several samples of fused glass from AI (AM7310437-7310440) each had areas of transparent, natural, glass (i.e. tinted green, but only due to the presence of small amounts of iron) and opaque white regions. The differences in composition found between the natural glass and white areas could be explained in terms of the

opaque white appearance being the result of weathering of the natural glass. The samples were probably accidentally fused glass objects, originally made from natural glass which had partially weathered to opaque white.

The remaining samples were of no direct technological significance and included sherds, fired clay, and vitrified ceramic fragments.

Overall it appears that the samples with technological connections are examples of metalworking debris. Iron smelting, blacksmithing, melting of various copper alloys and gold working all probably took place on or, more likely, near the Silver Street site. However, as the material examined probably only comprises a small proportion of the total waste from these activities it is not possible to comment on the likely scale of the metalworking operations.

Glossary of terms as used in this report:

- Tap slag:           The slag run off when molten from an iron smelting furnace.
- Smithing slag:     The slag which collects in the bottom of blacksmith's hearth.
- Brass:             A copper-zinc alloy.
- Bronze:            A copper-tin alloy.
- Gunmetal:         A copper-tin-zinc alloy.

## APPENDIX- Analysis and Identification of the Finds.

AM No.	Site	Site No.	Elements Detected by XRF	Identification and Comment.
7310346	AI 8	20		Vitrified ceramic, refractory and coarse fabric. Possibly part of tuyere of 1-2 cm diameter.
7310347	BI 9	134		Tap slag.
7310348	BI 8	135		Tap slag.
7310349	CI 11	136		" "
7310350	BI 15a	220		" "
7310351	BI 21	266		" "
7310352	BI 15B	267		2 pieces of tap slag (one very porous) and one piece of ironstone.
7310353	BII 3	268		Porous tap slag.
7310354	BI 10	269		Iron slag + vitrified hearth lining.
7310355	CI 249	270		Tap slag.
7310356	BI 26	339		Ironstone.
7310357	BII 6	340		Tap slag.
7310358	BII 4	341		Ironstone.
7310359	BII 4	403		Tap slag.
7310360	BI 35	404		Iron (? Smithing) slag.
7310361	BI 28	405		Hearth lining.
7310362	BI 15	406		Porous tap slag.
7310363	BI 39	623		Ironstone.
7310364	BI 31	624		Tap slag.
7310365	BI 35	625		Tap slag.
7310366	BI 35	626		? glassy slag.
7310367	CI 72	627		Ironstone.
7310368	BI 39	628		Tap slag.
7310369	CI 36	686		Tap slag.
7310370	BI 40	687		Fired clay.
7310371	CI 71	688		Ironstone.
7310372	BI 88	639		Tap slag.
7310373	BI 15B	690		Tap slag.
7310374	BII 8	774		Hearth lining.
7310375	BII 8	775		Ironstone.
7310376	BI 36	776		Tap slag.
7310377	CI 68	777		Ironstone.
7310378	AI 51	856		Tap slag.
7310379	BI 106	873		Ironstone.
7310380	CI 89	952		Iron slag + wood/charcoal.
7310381	CI 98	953		Smithing slag.
7310382	CI 87	954		Smithing slag.
7310383	AI 48	955		? Smithing slag + wood/charcoal.

AM No.	Site	Site No.	Major Elements Detected by XRF	Identification
7310384	CI 32	1021		Ironstone.
7310385	CI 33	1022		Ironstone.
7310386	BI 47	1023		Tap slag.
7310387	BI 41	1024		Tap slag.
7310388	BI 50	1062		Ironstone.
7310389	CI 106	1167		Ironstone.
7310390	BI 52	1168		Ironstone.
7310391	CI 116	1169		Hearth lining.
7310392	CI 107	1170		Smithing slag.
7310393	BI 15B	1171		Tap slag.
7310394	CI 92	1270		Ironstone.
7310395	BI 112	1385		Tap slag.
7310396	CI 119	1386		Smithing slag.
7310397	CI 113	1387		Hearth lining and Smithing slag.
7310398	BI 112	1388		Ironstone.
7310399	CI 83	1389		Ironstone.
7310400	AI 125	1435	Cu, Pb, <u>Sn</u> , Fe, Ca.	Hearth lining + wood/charcoal.
7310401	BI 52	1537		Tap slag + wood charcoal, fired clay and ? Smithing slag.
7310402	BI 31	1538		Ironstone.
739085	AI 81	1391	Cu, Zn, Pb, Ca, Fe.	? Scrapings from crucible.
739086	BI 28	657		? Fired clay.
739087	BI 54	872	Pb, Cu, Zn, Fe, Ca, Sn.	Hearth Lining.
739096	BI 15B	344	Cu, Zn, (trace Pn).	Crucible.
739097	BI 31	399	Cu, Zn, Pb, trace Ag.	Crucible.
739098	BI 31	609	Cu, Zn, Pb, Ag.	Crucible.
739099	BI 41	610	Cu, Zn, Pb, Ag.	Crucible.
739100	BI 40	680	Zn, Cu, Pb, Ag.	Crucible.
739103	BI 40	790	Zn, Cu.	Crucible.
7310335	CI 81	1385		Base sherd.
7310336	CI 63	869	Fe, Ca (traces Cu, Zn, Pb).	Base pot sherd, reduced fired.
7310338	CI 81	959		Pot sherd.
7310344	BI	1278	Pb, Au, Cu (? Zn).	Gold working vessel.
7310437	AI 1	57	Si, K, Ca, Fe, Pb, Mn.	Fused and weathered clear green glass.
7310438	AI 1	58	Si, K, Ca, Fe, Pb, Mn.	Fused and weathered clear green glass.

AM No.	Site	Site No.	Major Elements Detected by XRF	Identification
7310439	AI 1	59	Si, K, Ca, Fe, Pb, Mn.	Fused and weathered clear green glass.
7310440	AI 1	60	Si, K, Ca, Fe, Pb, Mn.	Fused and weathered clear green glass.
740995	BI 116	1707		Smithing slag.
-	BI 31	1605		Ironstone.
-	BI 85	1606		Iron (? tap) slag.
-	BI 52	1607		Ironstone.
-	BI 75	1608		Ironstone.