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Ancient Monuments Laboratory
Report 10/91

MEDIEVAL LEAD-TIN ALLOY OBJECTS FROM THE CITY OF LONDON

Justine Bayley

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Summary

A total of 42 medieval lead-tin alloy objects were analysed semi-quantitatively by X-ray fluorescence. The results show high tin alloys were used for vessels, slightly lower tin for lids, knobs and candlesticks, and a wide range of alloys for spoons.

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A total of 42 objects and fragments were analysed qualitatively by energy dispersive X-ray fluorescence (XRF). XRF is a surface technique so when, as here, it is applied to corroded or patinated surfaces it detects not only the elements in the bulk metal but any that have been deposited on the surface from the environment in which the object was buried. The relative amounts of elements present in the bulk of the metal may not be the same as at the surface as corrosion (patination) does not normally affect all elements equally.

It was assumed that the alloys used to make the objects were effectively binary ones of lead (Pb) and tin (Sn); the XRF peak heights for these two elements were recorded and appear in the Table. It was noted that high levels of iron and/or copper were detected on most objects but this was thought to be due to burial in anaerobic (waterlogged) conditions which had encouraged deposition from the ground water. They were thus ignored is assessing alloy composition though it is possible that the objects contained minor amounts of copper and/or iron in the bulk metal. No other elements were detected in significant quantities.

The ratio of lead to tin peak heights, labelled "Pb/Sn" in the Table, gives an approximate indication of composition. It is obvious that high numbers indicate relatively high concentrations of lead while low numbers indicate relatively low amounts of lead and corresponding high amounts of tin. Broadly similar ratio figures (which could be loosely defined as one figure not more than twice the other) indicate broadly similar compositions. Three lead-tin objects of known composition were analysed in the same way as the other objects to provide an approximate calibration of the results.

The values of the ratio have been plotted in the Figure as frequency histograms for the various types of objects analysed. It can be seen that most of the vessels and dishes are high tin alloys, though there are a few exceptions. From comparison with the 'calibration' it is likely that these high tin alloys contain over 80% tin, and some may be nearer 100%.

The lids and knobs, on average, contain a little less tin; the one with the highest ratio (lowest tin content) is probably well under 50% tin. Most of the candlesticks are of similar composition to the main group of lids and knobs, the exception is the small pricket candlestick which is pure lead.

The spoons present a quite different picture with a range of compositions from high tin alloys like the vessels down to around 50% tin; the small sample gives no indication of preferred compositions within this range.

The data obtained from a larger number of pilgrim badges and ampullae is also shown on the Figure for comparison. It can

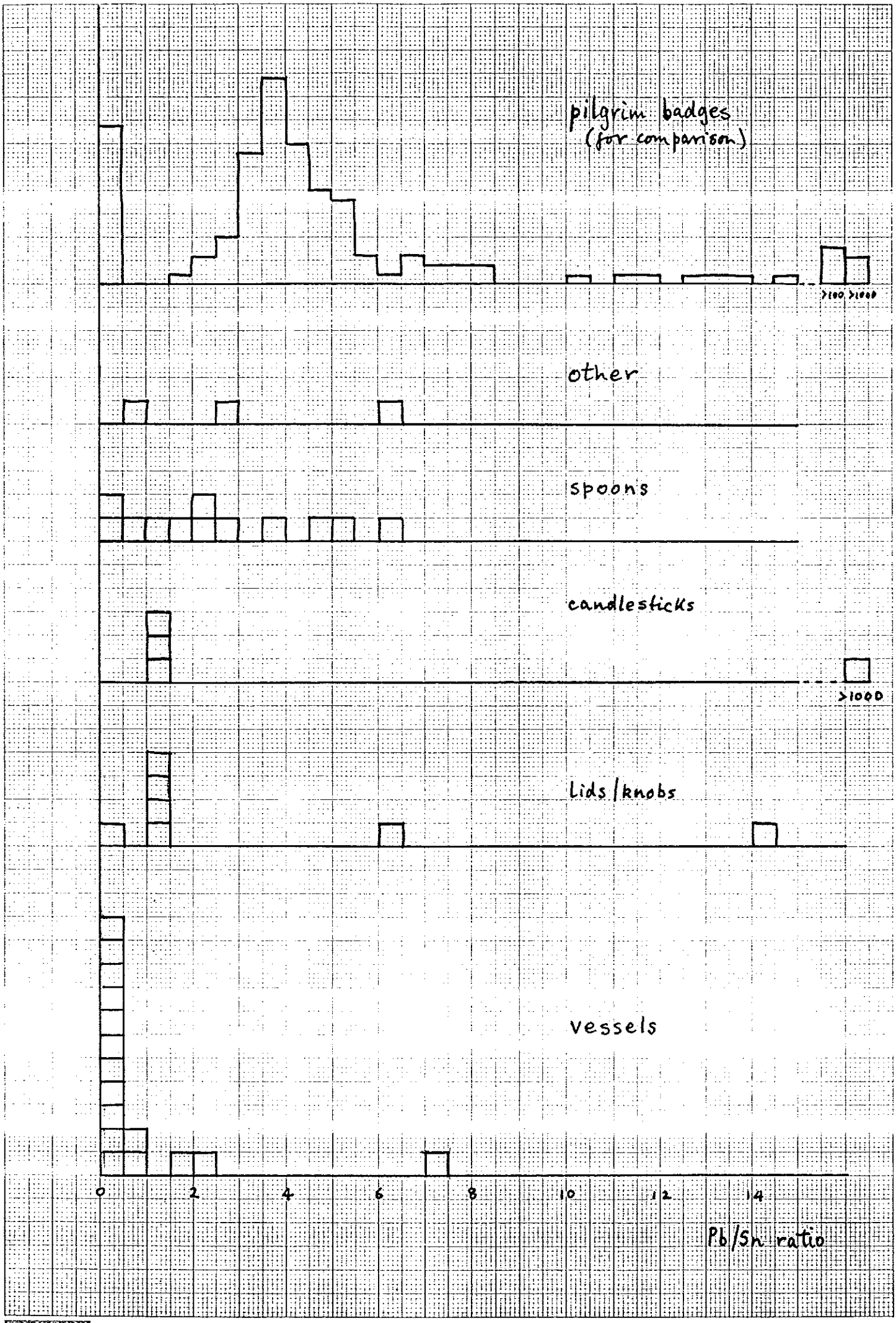
be seen that apart from the ampullae (which are unalloyed tin), the badges are generally made of lower tin alloys than the objects considered here and have a higher proportion of objects where lead is the major component of the alloy.

Acknowledgement:

I would like to thank Jon Webb for carrying out the analyses.

Table of analytical results

Site	Context	Accn	Pb	Sn	Pb/Sn	Object
BWB83	265	3251	4021	9160	0.44	acorn knobs (2 joined)
BWB83	117	4903	4137	2131	1.94	vessel rim
BWB83	131	2230	4008	4068	0.99	?handle fragment
BWB83	138	1251	4065	3319	1.22	half of hinged lid
BWB83	150	2392	223	1839	0.12	sheet fragment (engraved)
BWB83	157	1439	932	4060	0.23	vessel rim
BWB83	211	6014	1142	4100	0.28	vessel rim?
BWB83	291	5976	504	722	0.70	sheet offcut?
BWB83	300	3677	137	1775	0.08	vessel rim
BWB83	308	6062	1	427	0.00	?base
BWB83	359	5085	4133	580	7.13	base of dish
BWB83	389	5021	4039	1624	2.49	?vessel rim
BWB83	401	1902	4048	665	6.09	dog knob
SWA81	2082	3409	389	3996	0.10	vessel rim
SWA81	2103	2893	116	2126	0.05	vessel rim
TL74	414	745	58	868	0.07	shallow dish
BWB83	?900	1692	1027	770	1.33	candlestick
			536	700	0.77	ditto near rim
BWB83	359	4957	3972	280	14.19	hinged lid + knob
BWB83	307	1183	4110	2981	1.38	candlestick
BWB83	308	6064	829	689	1.20	vessel (candlestick)
BWB83	274	4561	2111	336	6.28	foliate moulding
BWB83	124	1286	2010	1496	1.34	acorn knob
BWB83	376	4978	2009	1466	1.37	acorn knob
BWB83	309	7023	43	598	0.07	vessel rim
BWB83	318	6005	844	3346	0.25	vessel rim
BWB83	401	603	2070	707	2.93	stand/base
BWB83	117	3241	287	342	0.84	vessel rim
SWA81	2081	2111	3973	2684	1.48	tankard lid
			4178	1982	2.11	ditto dark area
SWA81	2130	1121	4137	1	4137.00	pricket candlestick
SWA81	2109	2946	96	1646	0.06	vessel rim
			228	2783	0.08	ditto (second piece)
BWB83	108	1405	2077	412	5.04	spoon (?unfinished)
BWB83	219	4156	2049	979	2.09	spoon bowl
BWB83	274	4551	2000	332	6.02	spoon
BWB83	299	4635	2006	544	3.69	spoon handle
BWB83	314	5987	112	2050	0.05	spoon bowl
SWA81	+	863	193	2038	0.09	spoon
SWA81	2050	1976	2058	900	2.29	spoon
SWA81	2061	659	550	346	1.59	spoon handle
SWA81	2082	914	612	855	0.72	spoon bowl + handle
SWA81	2106	2048	752	693	1.09	spoon handle
SWA81	2109	1971	2052	799	2.57	spoon (complete)
SWA81	2130	1126	2064	426	4.85	sheet fragment


pilgrim badges
(for comparison)
>100 >1000
other
spoons
candlesticks
>1000
Lids/knobs
vessels
0
2
4
6
8
10
12
14
Pb/Sn ratio