

Ancient Monuments Laboratory  
Report 78/93

QUALITATIVE X-RAY FLUORESCENCE  
ANALYSIS OF TWENTY POST-MEDIEVAL  
COPPER-ALLOY OBJECTS FROM  
NONSUCH PALACE, CHEAM, SURREY

Catherine Mortimer BTech DPhil

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#### Summary

Twenty copper-alloy objects dating from the seventeenth century were shown to be mostly bronzes and brasses. Several objects were thought to be tinned.

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Qualitative X-ray fluorescence analysis of  
twenty post-medieval copper-alloy objects from  
Nonsuch Palace, Cheam, Surrey

Catherine Mortimer

Twenty copper-alloy objects were analysed qualitatively (*ie* on the surface, without surface preparation) to determine their alloy type. The X-ray tube in the LINK X-ray fluorescence analysis equipment was run at 35kV, 100mA, with a moderate sized incident beam area (c. 3mmx5mm was sampled). This allows analysis over a wide range of secondary X-ray energies. A higher current (200mA or 300mA) was selected when objects were so corroded or so thin that very low count rates were recorded at 100mA. The objects are all from contexts relating to the third quarter of the seventeenth century.

### Results

The detailed conclusions of the analysis are recorded in Appendix 1. The technique worked reasonably well for most of the objects. The exceptions are those which were coated with tin (in these cases, it was often difficult to tell whether the peak came entirely from the coating or if the object itself was tin-rich) and those with heavy corrosion (in these cases, the type of alloy may not be clear). Where visual evidence of tinning was present, this is noted.

The objects are made of various types of brasses and bronzes. These are 'normal' alloy types for the period; the database is too small to discern chronological differences in alloy use. Low levels of zinc may be due to de-zincification at the surface.

The cup (catalogue number 39) was shown to have nickel and antimony as significant traces (possibly more than 1% of each), which may be significant in the consideration of the object's origins; such high levels of such trace elements may be an indicator of German ore sources.

Appendix 1: Surface analysis by XRF; objects ordered by Phase and Catalogue number.

Phase 3: Construction, c. 1538

43, SF295: Thimble, **Cu Zn Fe**: Low-zinc brass [early 18th century, intrusive]

Phase 4: Occupation, 1538/46 - 1682/4, probably 1665-1682/4

1, SF322: Buckle, **Sn Cu Pb**: Tin or tinned copper-alloy object [probably 1670-1700]

4, SF371: Strap end, **Cu Sn Fe Zn Pb**: Bronze

25, SF38: Stud, **Cu Zn Fe**: Low-zinc brass

39, SF233: Cup, **Cu Pb Sn Fe Zn As Sb Ni (Ag)**: Leaded bronze, with traces of antimony, nickel and possibly silver.

40, SF113: Rim, **Cu Pb Zn Sn Fe**: Low-tin leaded bronze

Phase 5: Demolition, 1682-4

23, SF14: Strip, **Cu Zn Ni Pb Ag Fe**: Low-zinc brass, with significant nickel and silver traces. Silvered?

24, SF392: Loop-headed object, **Cu Zn Fe Sn (Pb)**: Brass

32, SF435: Door handle?, **Cu Zn Sn Pb Fe**: Ternary or tinned brass?

37, SF272: Hinged box, **Cu Zn Sn Fe Pb (Ag)**: Bronze or ternary alloy, ?silvered

41, SF262: Spoon bowl, **Cu Zn Sn Pb Fe**: Ternary or possibly tinned brass [?mid 17th century]. Appears not to be tinned.

Phase 6: Post-demolition activity, 1682/4-19th century

5, SF115: Clasp, **Cu Zn Pb Sn Fe**: Quaternary alloy, zinc-rich.

12, SF135: Button, **Cu Sn Zn Pb Fe**: Bronze, lightly-leaded.

Phase 7: Modern features, 1933-1959

2, SF108: Buckle, **Sn Cu (Zn) (Pb)**: Tin or tinned object [probably 1650-1700]. Appears to be tinned.

Phase 8: Modern topsoil, 20th century

29, SF455: Stud, **Cu Sn Zn Pb Fe**: Bronze

36, SF263: Powder flask, **Cu Zn Pb Fe**: Low-zinc brass [early 19th century]

95, SF354: Washer, **Cu Sn Fe Zn Pb**: Bronze

Phase uncertain, or dated by typology only

3, SF600: Buckle, **Cu Pb**: Bronze [late 16th-18th century]

42, SF434: Spoon handle, **Cu Zn Sn Pb Fe**: Probably tinned brass (white-metal colouration) [mid 17th century]

No catalogue number, SF 416: Oval object, **Cu Sn Zn Pb Fe**: Bronze

Codes:

Comments in square brackets are typological dates given by Alison Goodall.

Cu= copper, Zn= zinc, Sn= tin, Pb= lead, Fe= iron, Ag= silver, Sb= antimony, As = arsenic Ni= nickel. Bold elements are major components, those in brackets are at very low levels, otherwise relatively small amounts. Apart from this, the order of the elements is not significant.

Ternary alloys = copper-tin-zinc. Quaternary alloys = copper-tin-zinc-lead.