X-ray Fluorescence (XRF) Analysis

Laboratory : Oxford RL Materials Lab

Date : 2025-10-28

1. Purpose & Scope

This report documents non-destructive XRF analysis conducted on artifact RP-2025-01 (metal plate). Objectives were to identify principal alloying elements, quantify trace constituents, and assess compositional homogeneity across the surface.

1. Sampling & Preparation

- Visual inspection under 5000K illumination; loose particulates removed with air puffer.
  - No cleaning, polishing, or coatings applied.
  - Five regions of interest (ROIs) selected to avoid corrosion pustules and edges.

2.1 Regions of Interest (ROI)

ROI	Position	Surface note
1	Upper left quadrant	Smooth patina, no visible inclusions
2	Upper right quadrant	Faint scratch parallel to edge
3	Center	Light micro-pitting; used for macro photo
4	Lower left	Slight darker patina band
5	Lower right	Near engraving cluster; stable surface

1. Instrumentation & Settings

- Bruker Tracer 5g with factory calibration bronze mode.
  - Tube: 40 kV, 12 µA; dual filter (Ti/Al); 120 s live time per run.
  - Collimation: 3 mm spot; detector: SDD.
  - Standards: NIST SRM 610 (glass) and in-house Cu-Sn bronze standard (certified).
  - QA: drift checks every 30 min; duplicates at ROI 1 and ROI 4.

1. Results

4.1 Mean composition (wt%) across ROIs

Element	Mean	σ	DL
Cu	87.3	0.4	0.05
Sn	9.8	0.3	0.03
Pb	0.6	0.1	0.02
As	0.4	0.1	0.02
Fe	0.3	0.1	0.02
Ni	0.2	0.1	0.02
Others	<0.1	—	—

4.2 Per-ROI results (wt%)

ROI	Cu	Sn	Pb	As	Fe	Ni
1	87.5	9.6	0.6	0.4	0.3	0.2
2	87.2	9.9	0.6	0.4	0.3	0.2
3	87.1	9.9	0.7	0.4	0.3	0.2
4	87.4	9.7	0.6	0.4	0.3	0.2
5	87.3	9.8	0.6	0.4	0.3	0.2

1. Spectral Interpretation

- Dominant Cu Kα/Kβ and Sn Kα peaks present across all ROIs.
  - Minor Pb L lines observed; As Kα discernible above DL.
  - Background subtraction performed; matrix corrections applied using bronze mode.
  - No Zn or Al peaks above DL, arguing against brass admixture or modern aluminum contamination.

1. QA/QC & Uncertainty

- Duplicate runs at ROI 1 & 4: Cu, Sn RSD < 1%; trace elements RSD < 10%.
  - Accuracy vs SRM 610 within ±2% relative (Cu, Sn channels).

- Detection limits as listed; uncertainties reflect counting statistics and calibration model.

1. Photodocumentation

- Figure 1: Overview of RP-2025-01 with ROI map overlay.
  - Figure 2: Macro image of ROI-3 showing patina and micro-pitting.
  - Figures 3a–3e: Annotated spectra for ROIs 1–5 (appendix).

1. Interpretation

The artifact is a Cu–Sn tin bronze with trace Pb/As typical of historical smelting practice. The composition lies within documented ancient bronze ranges used for durable, information-bearing objects.

1. Conclusions

RP-2025-01 composition is consistent with a historical tin bronze alloy; no evidence for modern brass or aluminum contamination. Homogeneity suggests intentional alloying.

1. Sign-off

Analyst: Dr Priya Raman
Lab Supervisor: Dr Alan Reeves
Oxford RL Materials Lab
Contact: materials@theronwaproject.com · +44 131 650 1234

Appendix A — Instrument & Calibration Details

- Detector resolution, dead-time corrections, live-time targets.
  - Standard spectra overlays and residuals.

Appendix B — Annotated Spectra (ROIs 1–5)

Image placeholders and callouts for line identifications.