The FABRIC of Rome's Heavy Bronze

an interim report

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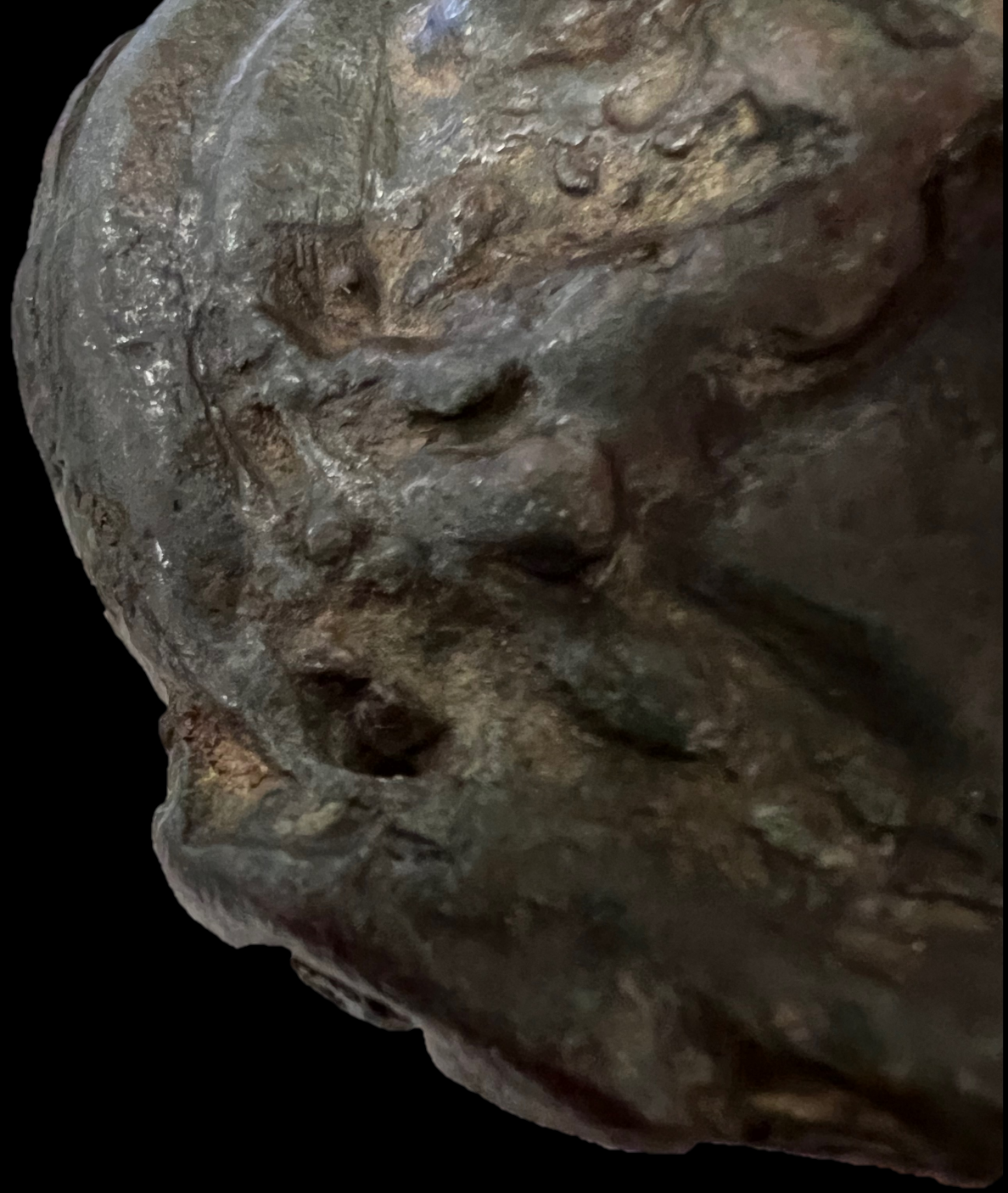


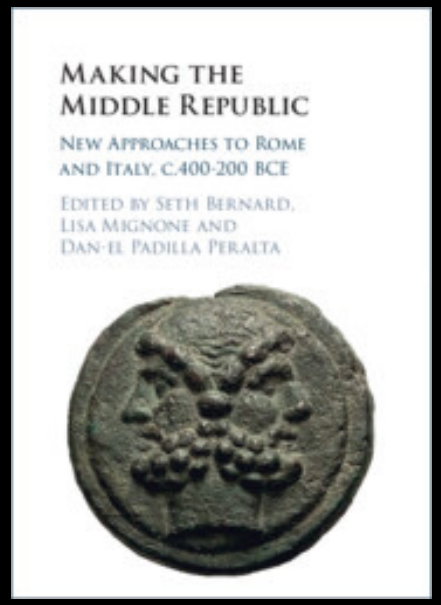
The Burnett Hypothesis

6 The Strangeness of Rome's Early Heavy Bronze Coinage

LIV M. YARROW

6.1 The Money Problem

Roman coinage is one of the most important and certainly most tangible 'firsts' of the Middle Republican period. This chapter suggests we have not yet looked as hard as we should at the historical implications of cast coinage, as opposed to the relatively well studied (if controversial) early struck coinages.[1] Yet even as these early cast bronzes are some of Rome's earliest 'coins' in a formal sense, in many ways they are quite alien in both form and function to any modern sense of that word.



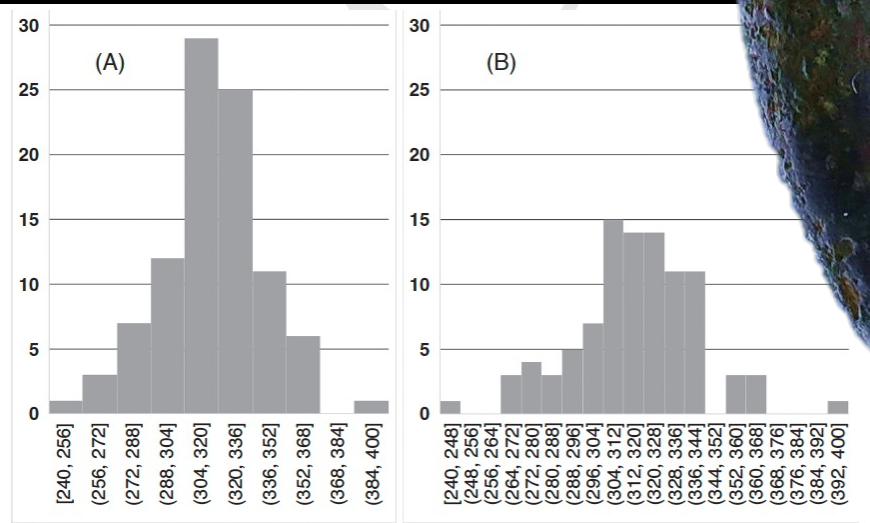
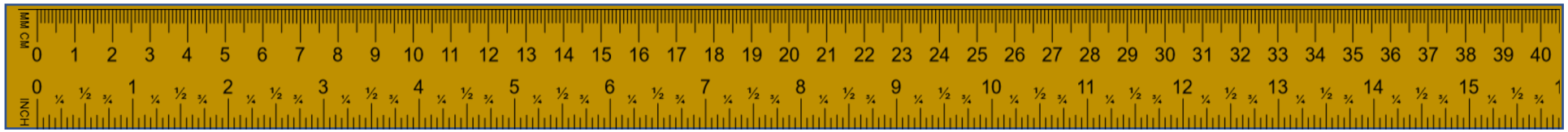


Chart 6.3 Ten-bin (A) and twenty-bin (B) histograms of the *RRC* 14 as based on Haeberlin
Prepared by the author.

A **Base-12** Denomination System

As = 1 (*libra?*)	Semis = 1/2	Triens = 1/3	Quadrans = 1/4	Sextans = 1/6	Uncia = 1/12	Semuncia = 1/24
	6 uncia	*4 uncia*	*3 uncia*	*2 uncia*		*½ uncia*



ANS specimens of RRC 14, to scale

Questions

Provisional Answers

Is there a consistent bronze ‘recipe’ (*i.e.* ratio of main elements) across issues and/or within issues? **Yes**

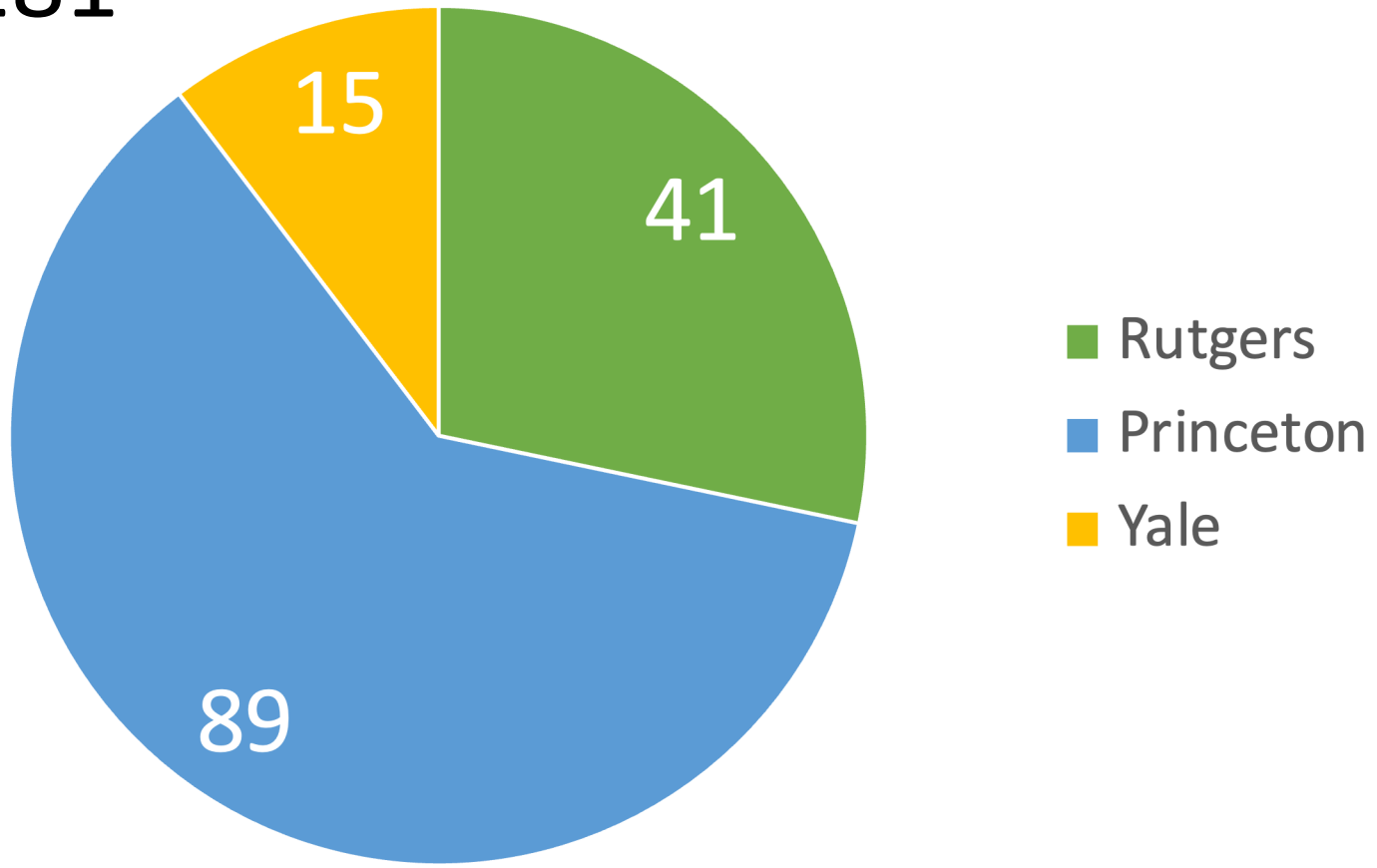
Is it similar to other known monetary objects (esp. *aes rude* or Roman currency bars)? **No**

Did Roman *aes grave* have *meaningful* intrinsic value? **No?!**

Work Thus Far

Based on **146** out of 281 *pXRF* readings from three collections

from 75 specimens



Current Testing Protocols

- Minimum two readings for each specimen
- Initial readings taken at center of large flat sides
- If reading suggests chemical change, additional elements, or modern fabrication take further readings on available surface noting location in relation to the design or other features (as surface area allows)
- If highest point or most obvious wear point does not correspond with centers of each side, retest at those points as well
- **Prioritize analysis on areas that are free of visually evident patina or incrustation**

Reasons for Exclusion

Zinc (any more than trace presence suggests modern manufacture in this period)

Barium (suggestive of artificial modern patina over potentially ancient specimen)

Light Elements indicating oxidative alteration, esp. copper loss and tin oxide accumulation

Incrustation (elements reflecting conditions of deposition: Silicon, Calcium, Sulfur, Chloride, etc.)

Suspected Human Error

Significant Data Outlier (when multiple lines of evidence suggest modern imitation likely)

Next steps.

- Test **Nemi specimens** on deposit at Nottingham (UK) this May
- Identify ideal specimens for internal sampling (**drilling**) to contextualize surface readings and conduct SEM and isotope analyses
- **Experimental archaeology**: replicate metal using hypothetical recipe and investigate metal structure using SEM, study color spectrum of recipe variations, test casting properties using a variety of mold materials and and channel structure: *can we explain the multiple voids observed?*
- Analyze quantitive **spue data** for patterns
- Determine if enough **Italian aes grave** data has been collected for meaningful comparison

Even drilling will give mixed results!

> *Indeed, because lead has* ***substantially no solid solubility in copper*** *and copper-based alloys, if the percentage of lead in bronze is higher than a few percent (pct),* ***lead occurs as a dispersion of fine particles throughout the bronze*** *[7–9].*

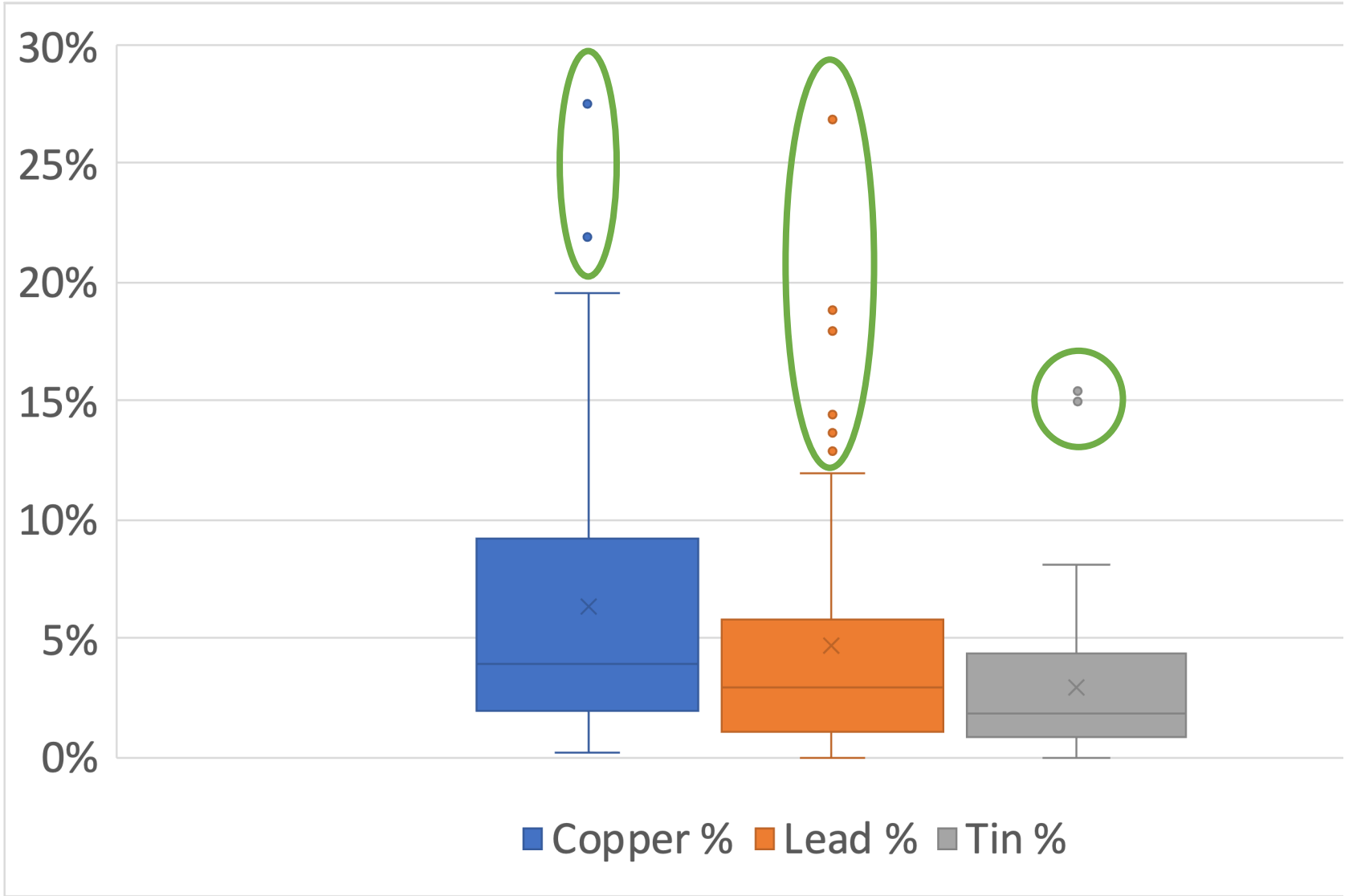
Ingo et al. 2006: 516

Difference between multiple readings of the same specimens

Standard Deviations (Relative)

Copper	6% (94)
Lead	5% (111)
Tin	3% (103)

66 specimens with two or more presumed valid readings

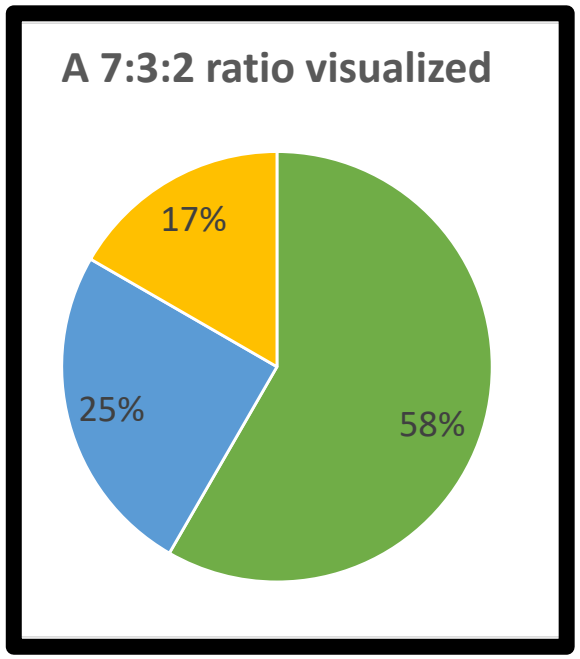


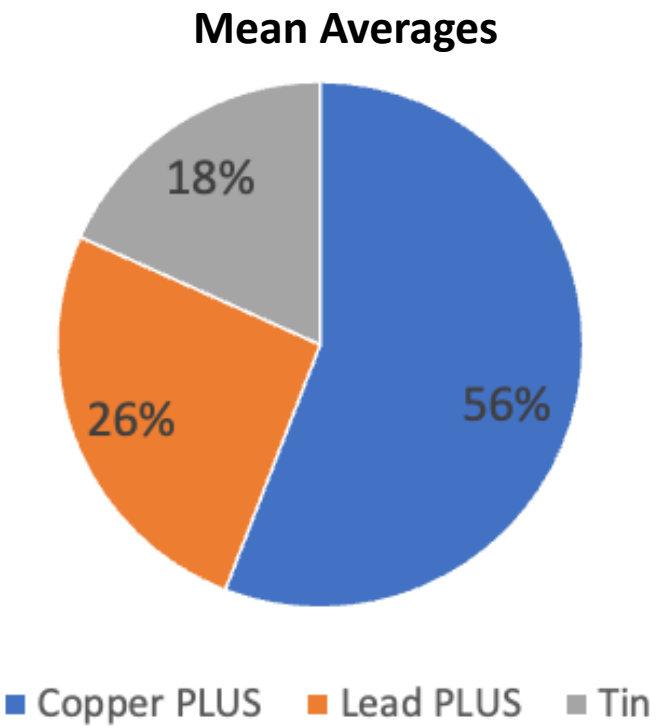
Questions

Is there a consistent bronze ‘recipe’ (*i.e.* ratio of main elements) across issues and/or within issues?

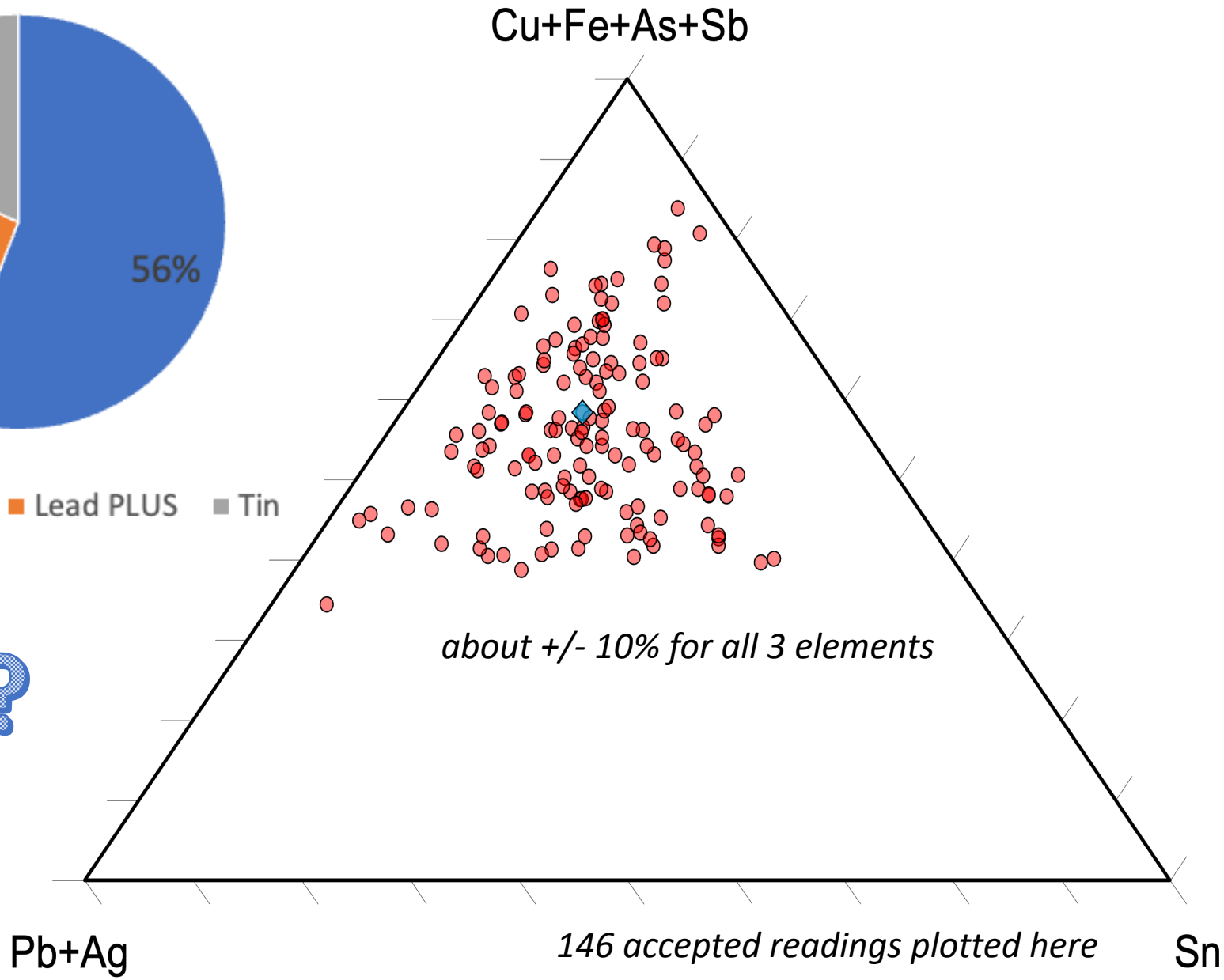
Is it similar to other known monetary objects (esp. *aes rude* or Roman currency bars)?

Did Roman *aes grave* have *meaningful* intrinsic value?





Base-12 recipe?



Explaining Data Variation

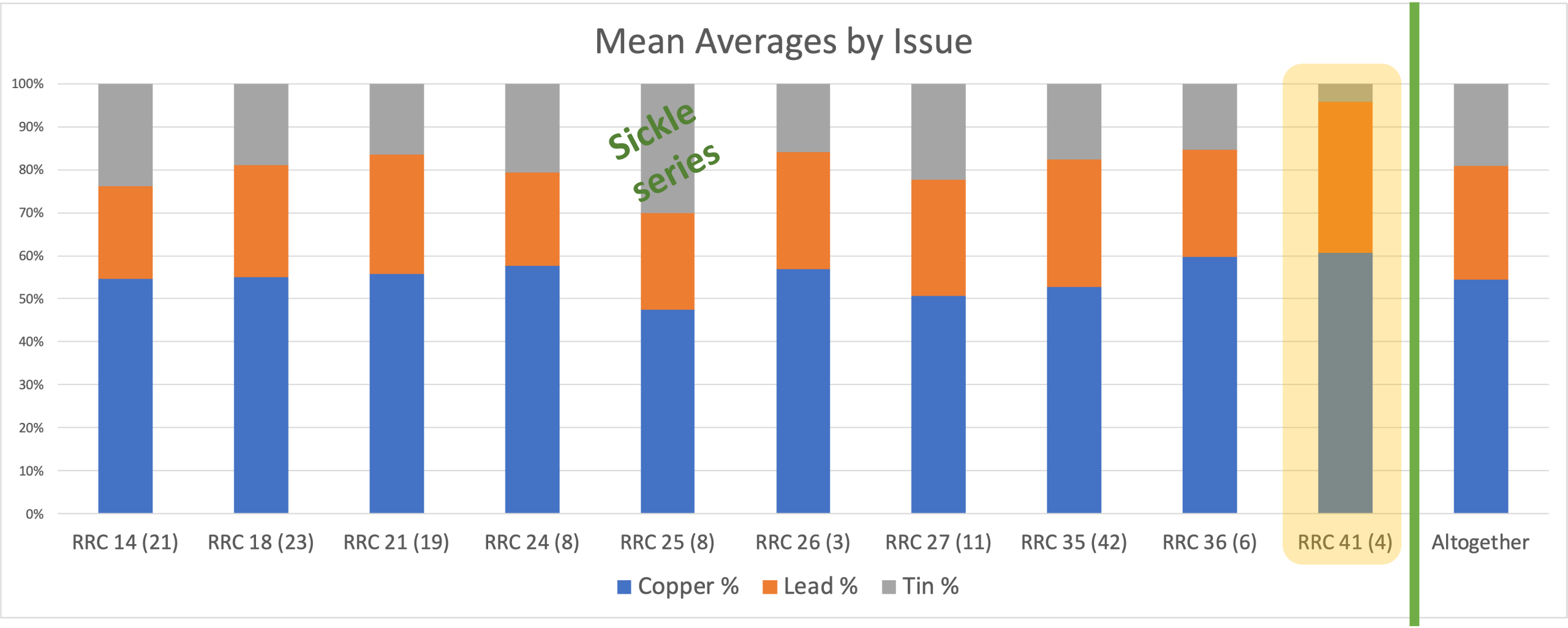
Readings from the same specimen

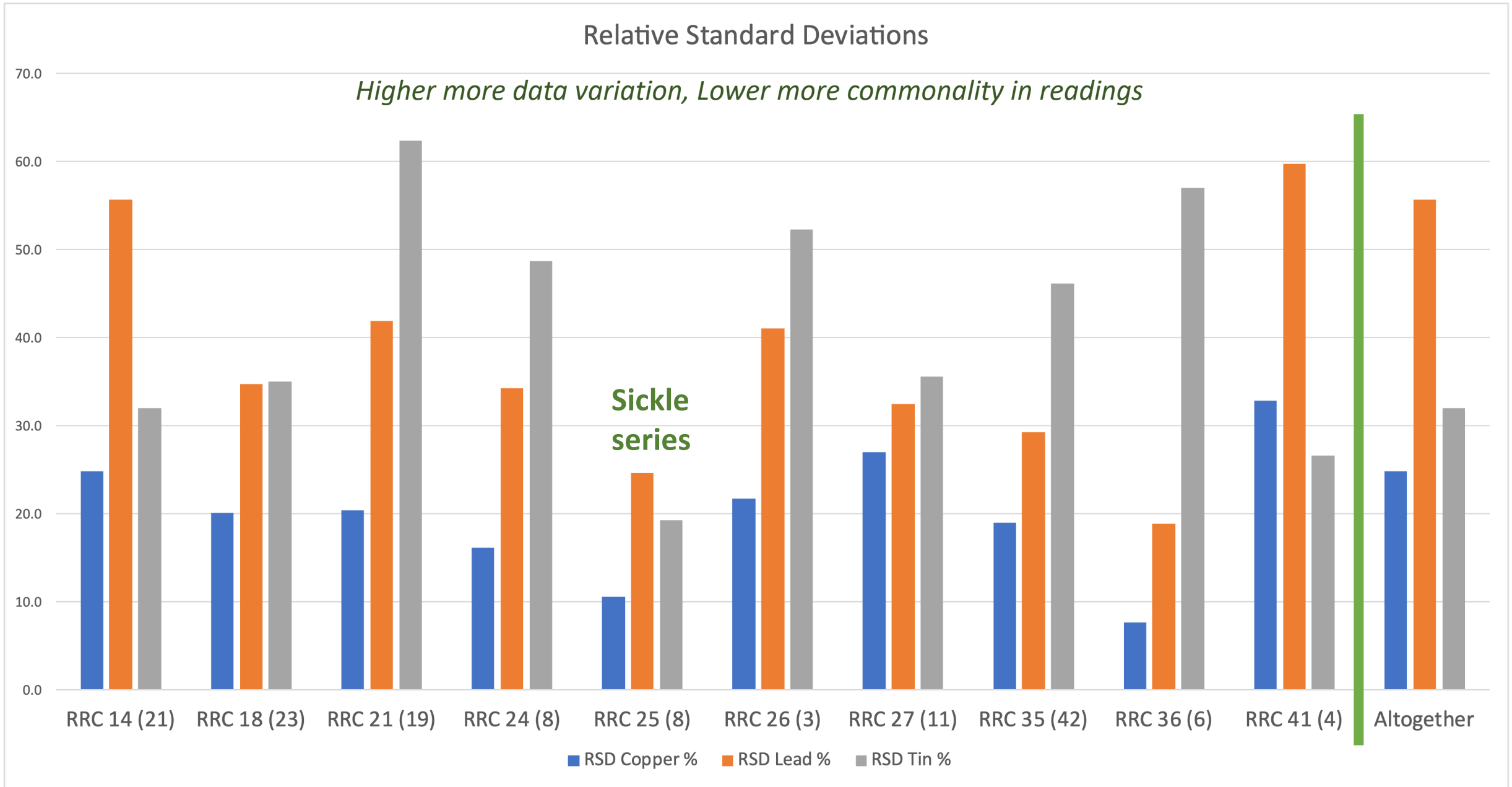
> *Indeed, because lead has* ***substantially no solid solubility in copper*** *and copper-based alloys, if the percentage of lead in bronze is higher than a few percent (pct),* ***lead occurs as a dispersion of fine particles throughout the bronze*** *[7–9].*
>
> Ingo et al. 2006: 516

Readings from different specimens

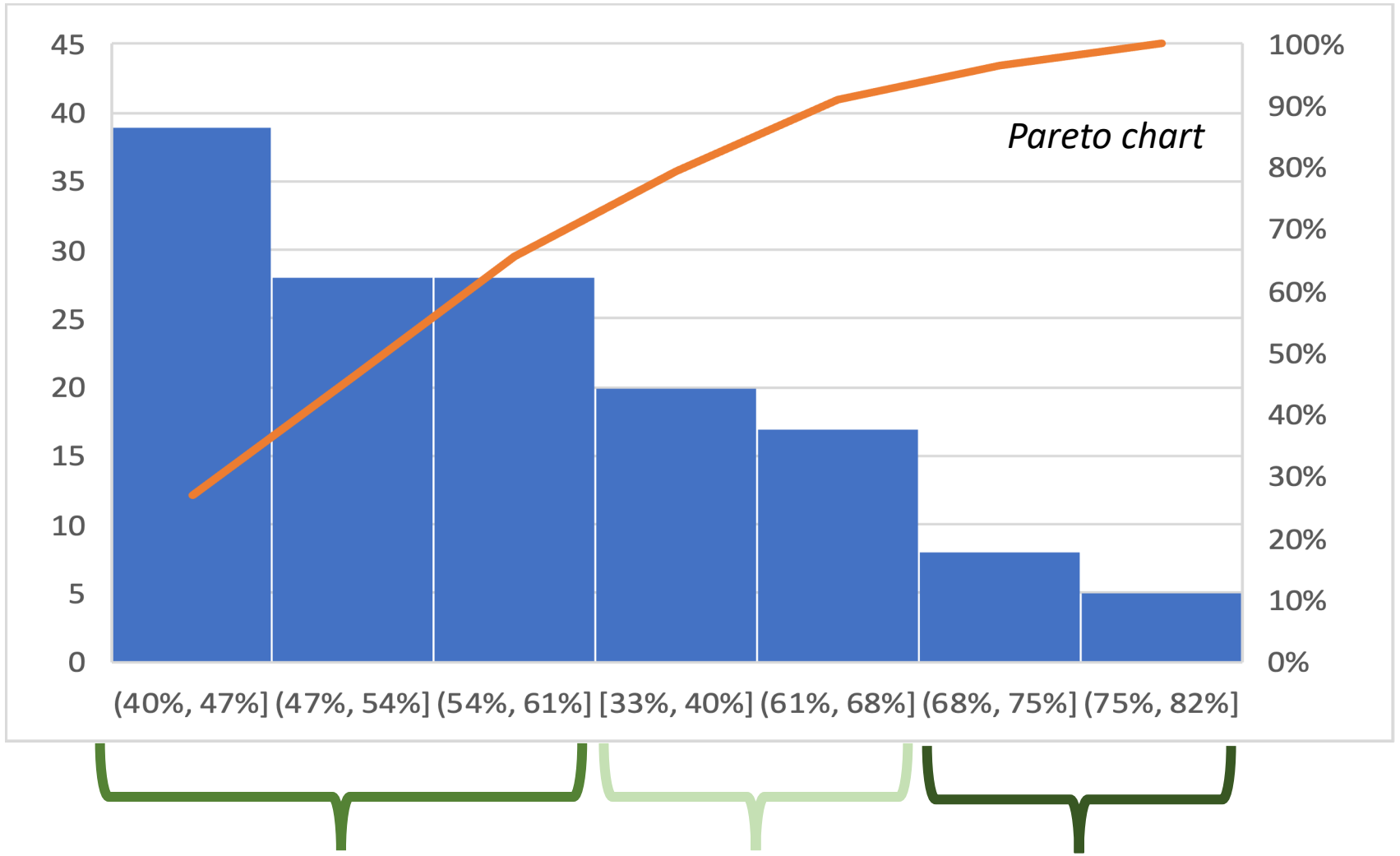
> *…the data seems to conform remarkably well to one of the* ***phase boundaries in the Cu-Pb-Sn system*** *with the majority of artifacts fitting into a field* ***where the molten metal will separate into two separate liquids, one Cu-rich and one very Pb-rich.*** *Was this intentional? …*
>
> Wayne Powell, private correspondence

Ratio relatively stable issue to issue…




Relative Standard Deviations
Higher more data variation, Lower more commonality in readings
Sickle series
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
RRC 14 (21)
RRC 18 (23)
RRC 21 (19)
RRC 24 (8)
RRC 25 (8)
RRC 26 (3)
RRC 27 (11)
RRC 35 (42)
RRC 36 (6)
RRC 41 (4)
Altogether
RSD Copper %
RSD Lead %
RSD Tin %

Copper by far the least variable component



<u>Relative</u> Standard Deviations

Copper	21
Lead	38
Tin	47

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Ghiaccioforte Aes Rude Finds

Pre 280 BCE

1:2, Cu:Pb

1:1, Cu:Pb

~100% Cu

1:4 Sn:Cu+Pb

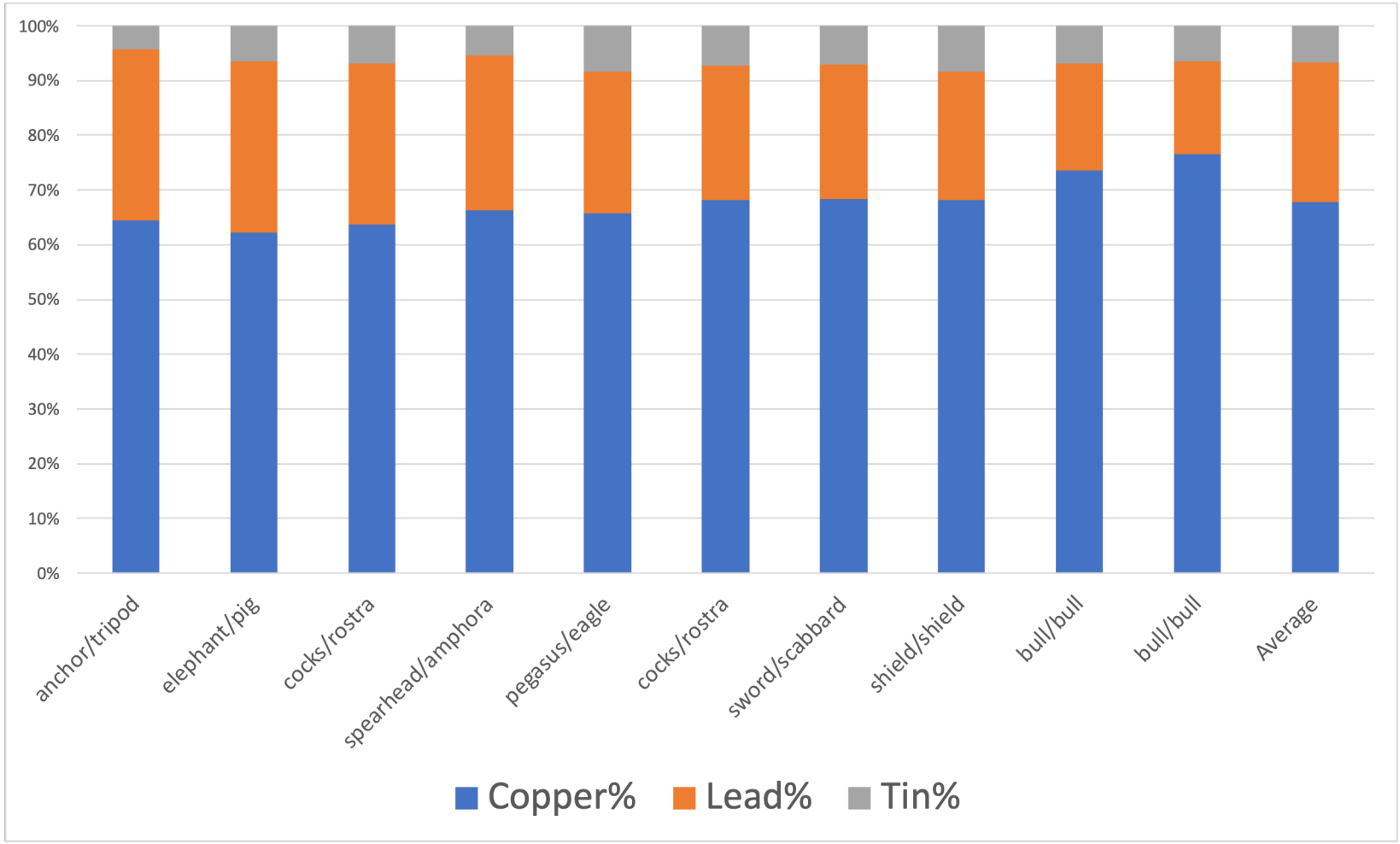
9:1 Fe:var.

Other combinations

Baldassarri et al. 2007, Baldassari 2015; *cf*. de Caro et al. 2005 on testing of Sardinian material

BM Currency Bars

tested drilled samples (Burnett, Craddock, Meeks 1986)



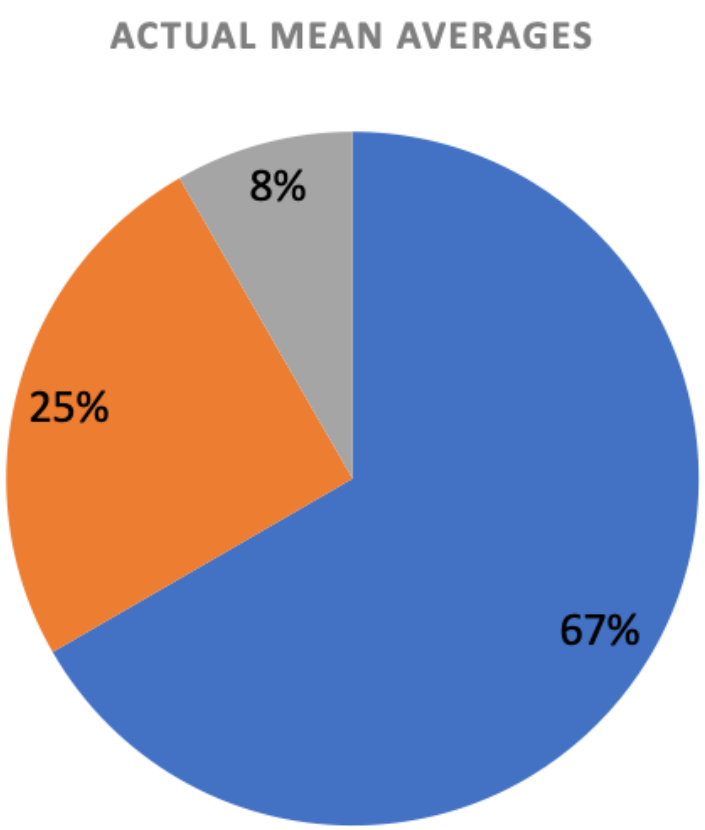
Relative Standard Deviations BARS

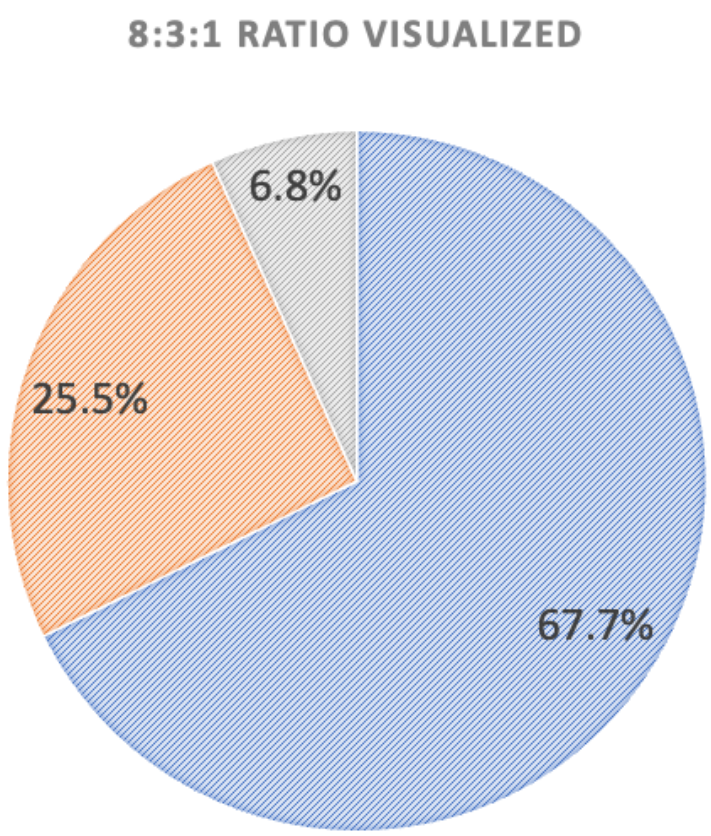
Copper	6.5
Lead	18.7
Tin	18.3

Relative Standard Deviations AES GRAVE

Copper	21.1
Lead	38.3
Tin	47.2

A different (richer) ratio?





The "Blitz" Bar

"compositional values of ca. 76-80% copper, 8% tin, 11-15% lead"

- BM unpublished scientific report, shared with kind permission of Frederik Rademakers and Richard Abdy

FIG. 25. A specimen (or possibly an electrotype) of RRC 12/1 observed and photographed in the British Museum, but not in the major catalogues. Based on comparison with drawings by Franciszek Smuglewicz and etched by Charles Norton as they appear in BYRES 1842, part 5 pl. 5, I believe this may be the same bar as that owned by James Byres, or a reproduction of that bar (cf. FIG. 1); further investigation is necessary. Not to scale. Photograph by Andrew McCabe.

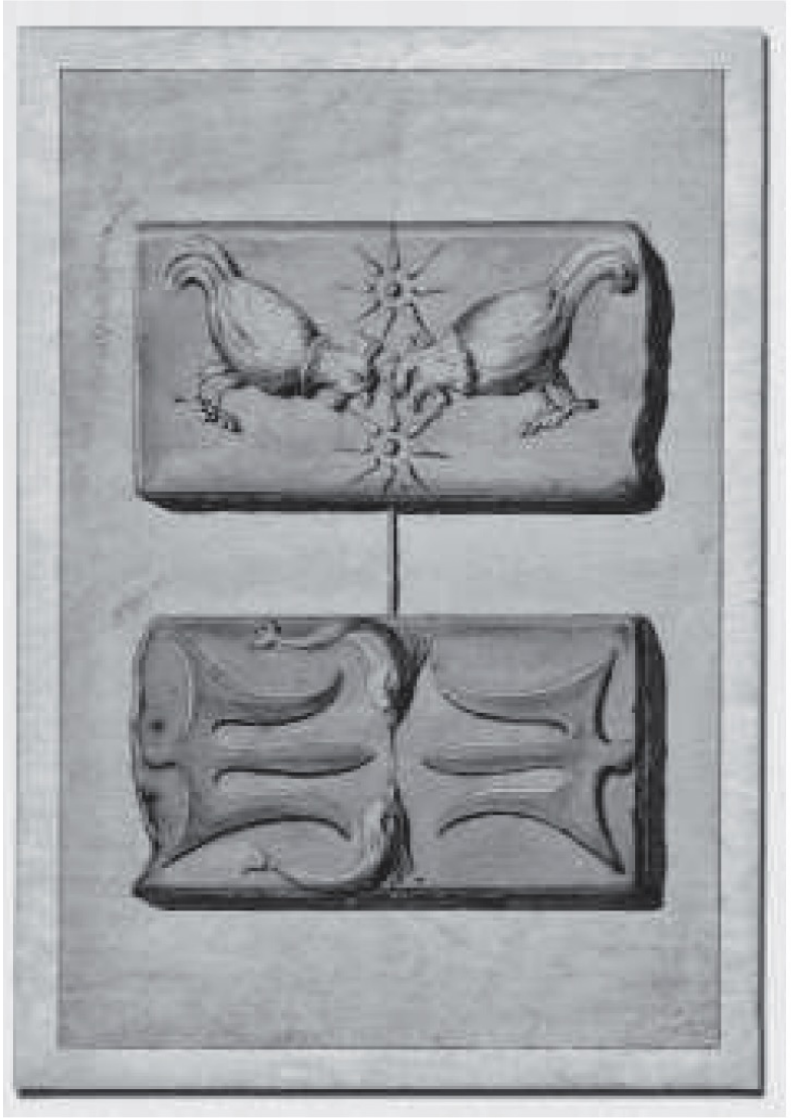
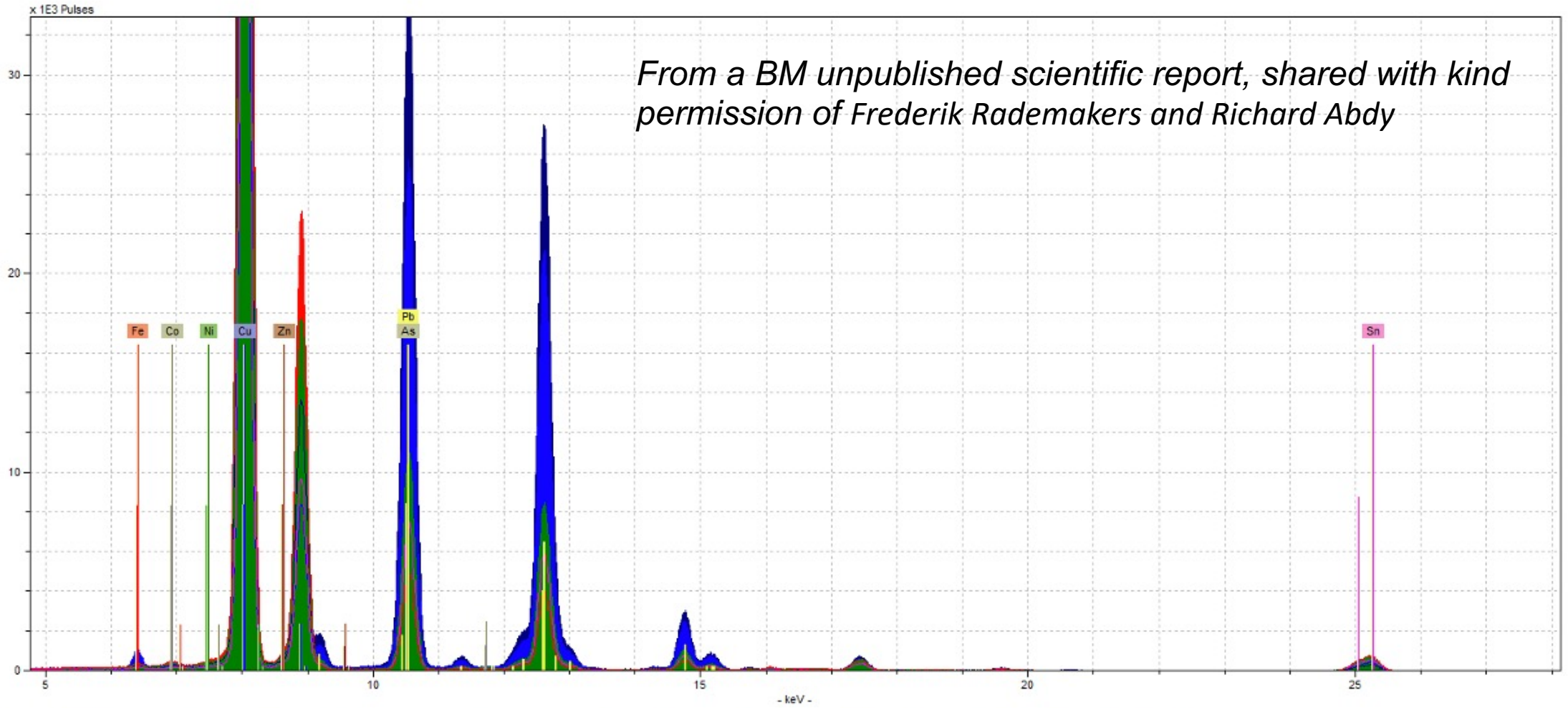


FIG. 1. BM 2010,5006.525, graphite and watercolor likely by James Byres, 1778. Depicts a bronze currency bar of the RRC 12/1 type recovered as part of a hoard in Tuscany in autumn 1778. Not to Scale. Public Domain.

corrosion/patination shows higher Pb/Sn, lower Cu



From a BM unpublished scientific report, shared with kind permission of Frederik Rademakers and Richard Abdy

Figure 2: XRF spectra of patinated/corroded areas compared to one exposed metal area, revealing lower Cu, Sn and As and higher Pb peaks (Blitz bar).

XRF spectra of RRC 14/6 compared to Blitz Bar

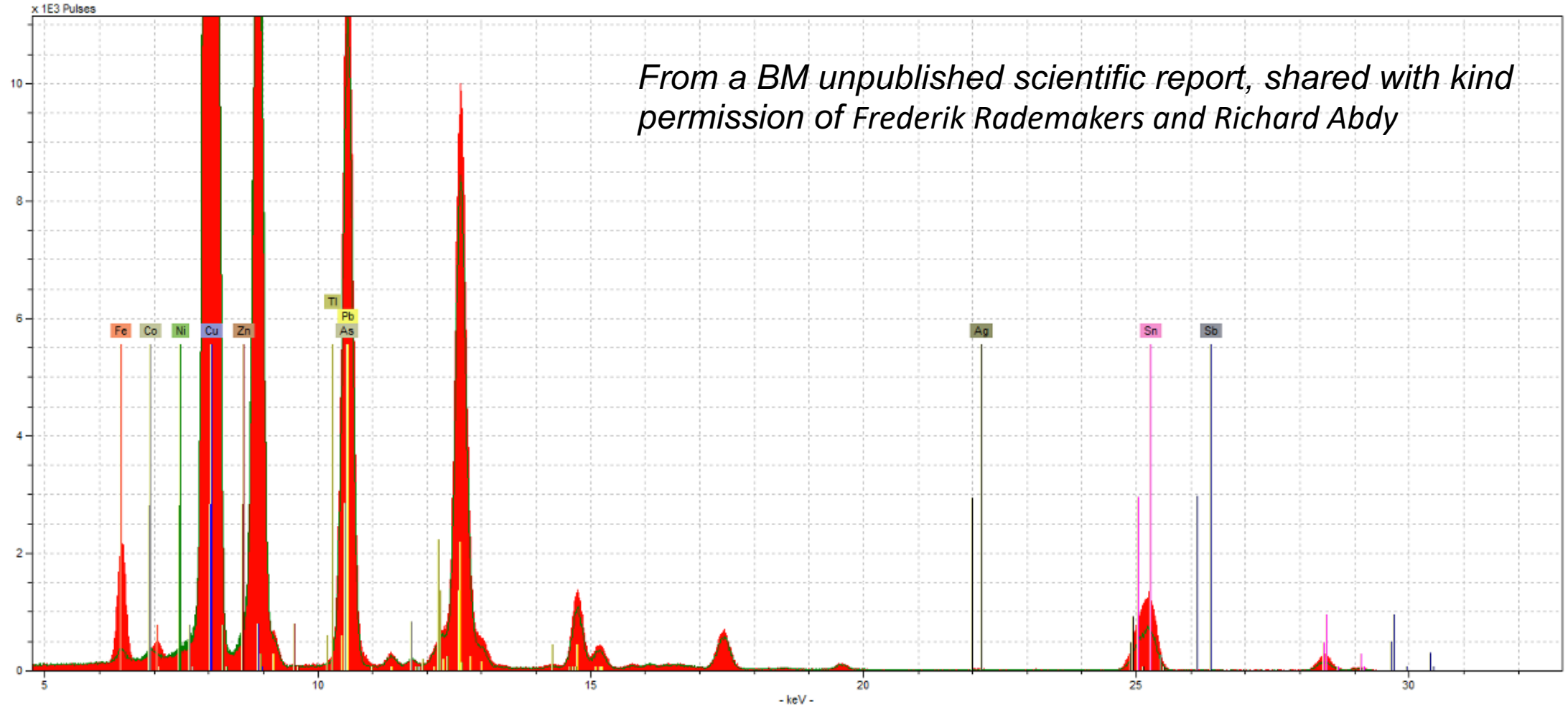


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Figure 6: XRF spectra for patinated/corroded area of R.12175 – RRC 14/6 (red) compared to patinated/corroded area of Blitz bar (green). Leaded tin bronze with traces of iron, nickel, arsenic, silver and antimony.

Authenticated and re-accessioned into the BM Collection

coin

1935,0401.16884 | Ruler: Christoph Franz von Hutten | 1724-1729 | Minted in: Würzburg

drawing

2010,5006.525 | 1778 - 1805

currency-bar

R.16884 | Issuer: Anonymous | Roman Republican | 280BC-250BC | Minted in: Rome (city) | Excavated/Findspot: Tuscany

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