

# XRF analyses of Roman and Dacian bronze artifacts from Romanian museums

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# Bronze Imperial Statues

## 9 | The Bronze Statue of Trebonianus Gallus in the Metropolitan Museum of Art Restoration, Technique, and Interpretation

*Seán Hemingway, Sarah McGregor, and Dylan Smith*

FIGURES 9.1A–C. Trebonianus Gallus, A.D. 251–253.  
Bronze, H. 241.3 cm (95 in.). New York, Metropolitan  
Museum of Art, Rogers Fund, 1905 (inv. 05.30). Three  
views of the statue in its present state.

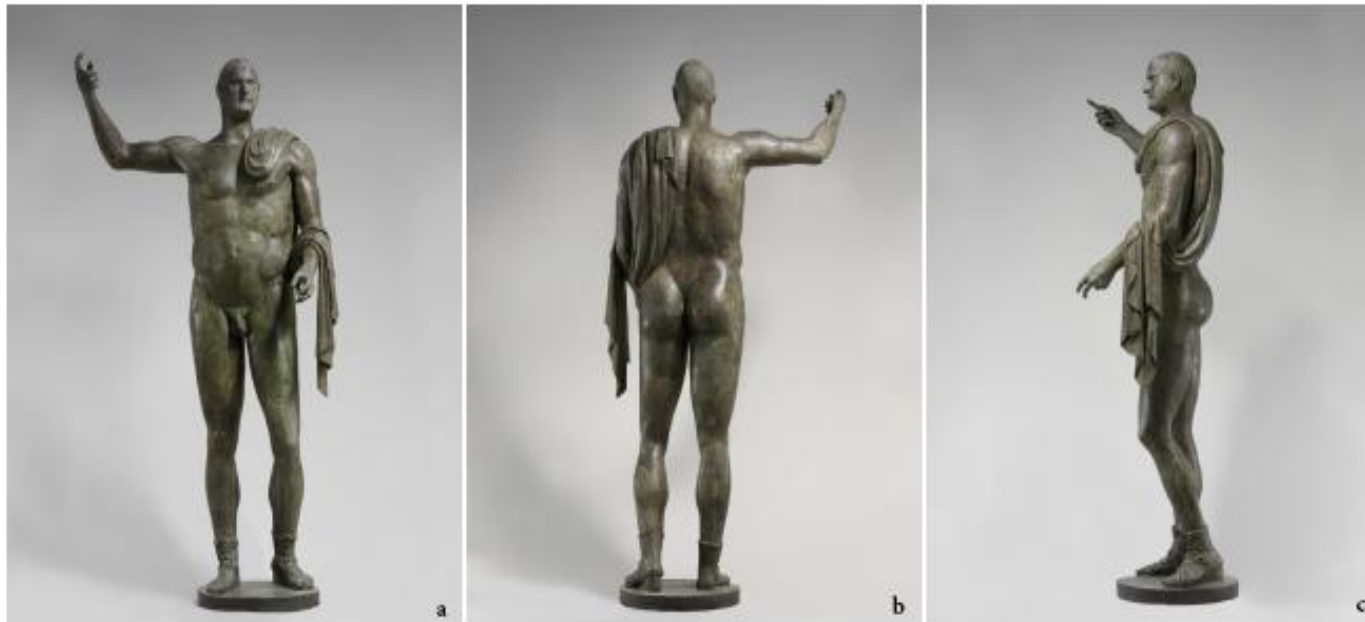


TABLE 9.1. Elemental Analysis of the Trebonianus Gallus (weight %)

No.	SEM-EDS sample site	Cu	Sn	Pb	Zn	As	Ag	Sb	Fe	Probable date
1	Left hand	76.5	8.2	15.1	bdl	bdl	bdl	bdl	0.1	ancient
2	Right hand	74.1	11.7	13.8	bdl	bdl	bdl	bdl	0.3	ancient
3	Left ear	69.5	7.3	23.0	bdl	bdl	bdl	bdl	0.1	ancient
4	Left buttock	68.5	6.5	24.8	bdl	bdl	bdl	bdl	0.2	ancient
5	Right calf (2)	80.7	7.6	10.7	0.5	bdl	bdl	bdl	0.6	ancient
6	Top of neck opening	78.8	2.3	17.0	1.1	bdl	0.4	bdl	0.3	ancient
7	Front of neck opening	80.0	0.9	18.2	0.4	bdl	0.3	bdl	0.1	ancient
8	Upper back (1)	85.2	9.5	4.8	bdl	bdl	bdl	bdl	0.4	?
9	Cape	77.3	8.3	14.2	bdl	bdl	bdl	bdl	0.1	modern
10	Left foot	80.2	5.4	12.0	1.2	0.3	bdl	0.6	0.2	ancient
11	Right foot	90.8	5.3	3.2	0.3	bdl	bdl	bdl	0.3	restored
12	Right calf (1)	63.7	18.0	17.3	0.4	bdl	bdl	bdl	0.5	w/solder?
13	Upper back (2)	89.0	7.2	3.1	0.3	bdl	bdl	bdl	0.4	?
	XRF surface site									
14	Restoration plate, back	94.5	1.6	3.4	bdl	bdl	bdl	bdl	bdl	restored
15	Restoration plate, neck	95.9	1.9	1.9	bdl	bdl	bdl	bdl	bdl	restored
16	Interior of left arm	57.2	6.2	35.7	bdl	bdl	bdl	bdl	bdl	ancient?
17	Solder, neck plate	3.4	22.8	71.9	1.7	bdl	bdl	bdl	bdl	restored



**4-5 mm “plate thickness”; Horse: 15 pieces; Emperor: 17 pieces;  
Solder: based on lead**

TABLE 2. Alloys described by Pliny (1961).

Alloy	aes	*a.c.	**p.a.	***p.n.	plumbum
1. <i>Campana</i> , bronze alloy for vases and utensils	90.9		9.1		
2. Alloy similar to the previous one	92.6				7.4
3. Alloy for statues and bronze plaques	68.6	22.8	8.6		
4. <i>Tenerrima</i> , alloy for casting statues in molds	87.0		4.3	8.7	
5. <i>Ollaria</i> , alloy for vases	96.2-97.1		2.9-3.8		

\*a.c. = *aes collectaneum*

\*\*p.a. = *plumbum argentarium*

\*\*\*p.n. = *plumbum nigrum*

TABLE 3. Pliny's alloys according to Caley (1970).

Alloy	Copper	Tin	Lead
1	90.9	4.5	4.5
2	92.6	7.4	
3	86.8	6.6	6.6
	81.2-81.3	8.7-9.7	9.1-10.0
4	81.4	6.8	11.8
	72.7	7.8	19.5
5	96.2-97.1	1.4-1.9	1.4-1.9

TABLE 4. Pliny's alloys according to Picon et al. (1967).

Alloy	Copper	Tin	Lead
1	90.9	9.1	
2	92.6	7.4	
3	87.0-89.0	11.0-13.0	
4	86.9	4.4	8.7
5	96.2-97.1	2.9-3.8	

# Large Roman Bronze statues from the UNESCO World Heritage Limes

## Summary

Fragmented bronze sculpture is an important category of finds from the provinces in the north of the Alps at the frontier of the Roman Empire. Portraits and statues of the emperors and their families were raised in a great number in the military camps and civil settlements along the Limes. Numerous fragments of these statues are still preserved, but they have never been systematically registered. The paper introduces the project and the first results. Three different techniques of gilding have been revealed: besides leaf and fire-gilding, the unusual technique of diffusion gilding has been observed. Also various repair techniques, different to those already documented for Mediterranean statues have been exposed.

## Introduction

One of the important categories of finds from the Roman border provinces between the north of the Alps and the North Sea are large roman bronze sculptures. Portraits and statues of the emperors and their families were raised in a great number in the military camps and civil settlements along the Limes in Germania inferior, in Germania superior and in Raetia. Though also in ritual contexts, there must have been bronze statues in considerable numbers. Many of these statues are likely destroyed by invading German troops in the middle of the 3<sup>rd</sup> century AD when the Limes was abandoned or in case of *Damnatio memoriae* when the emperor fell out of favor. (Fig. 1).



Fig. 1: Fragments of bronze statues from Aalen. Archäologisches Landesmuseum Baden-Württemberg. Scale 33 x 353 cm

(EDX).

Apart from the categorization of the bronze fragments themselves, the reconstructions of the original statues, their locations and functions as well as aspects of production techniques will become more interpretable. The results are documented and recorded in an internet database, which is available to all participants during the whole project and which will also be available for everybody at the end of the project.

In addition to the research on bronze fragments, the compilation and analysis of all known statue bases with inscriptions is in progress. They are, as far as they are no bases for stone statues, directly and functionally associated with the bronze statues. They can provide important information on the source for the assembly and disassembly, and they are essential for the historical context.

## Alloy compositions, surface decorations, experiments and exceptional casting techniques

According to a recipe given by Pliny, it is thought, that a third part of the bronze used for statues was scrap (Caley 1970; Gazda & Hanfmann 1970). Bearing in mind,

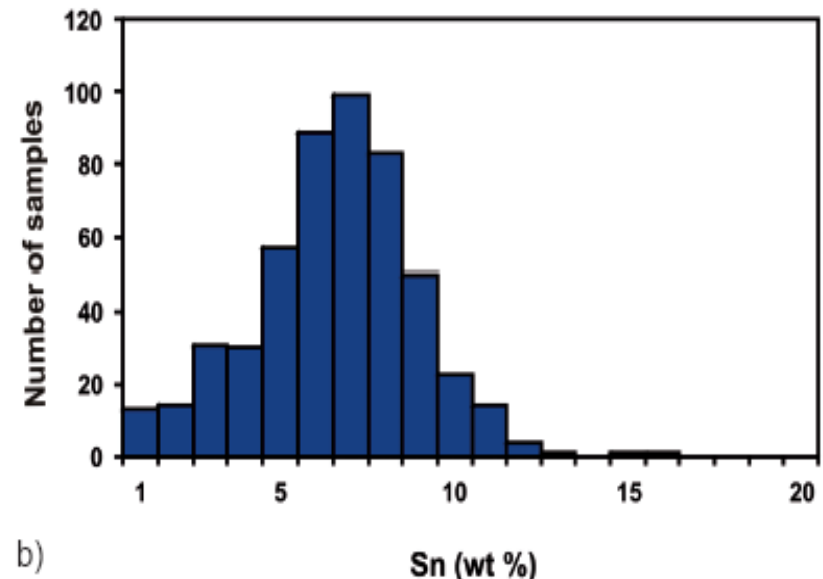
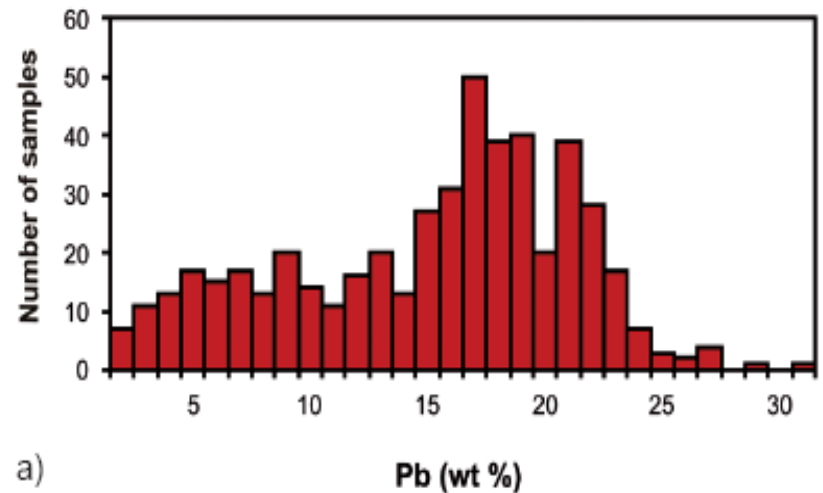


Fig. 4: Histograms showing the lead (a) and tin concentrations (b) of statues analyzed so far. Landschaftsverband Rheinland-LandesMuseum Bonn and Curt-Engelhorn-Zentrum Archäometrie, Mannheim



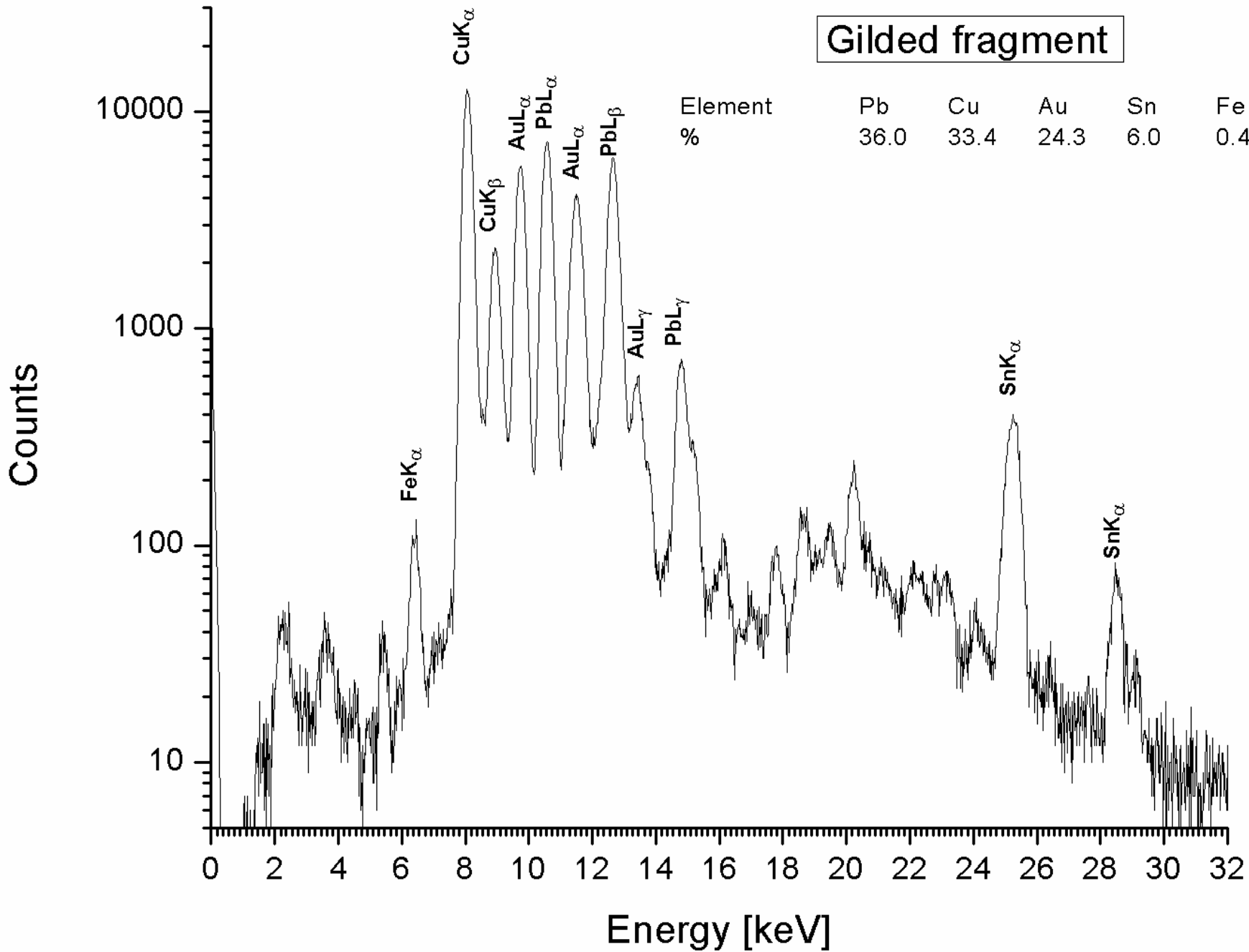
**Fragments of (gilded) bronze Imperial Statues found in Racari Roman Castrum, Oltenia, closed to Danube, opposed to Moesia Superior, 3-4 Centuries AD**





**Repair not gilded (left): Cu 59.6%; Pb 32.8%; Sn 7.2%**

# Gilded fragment



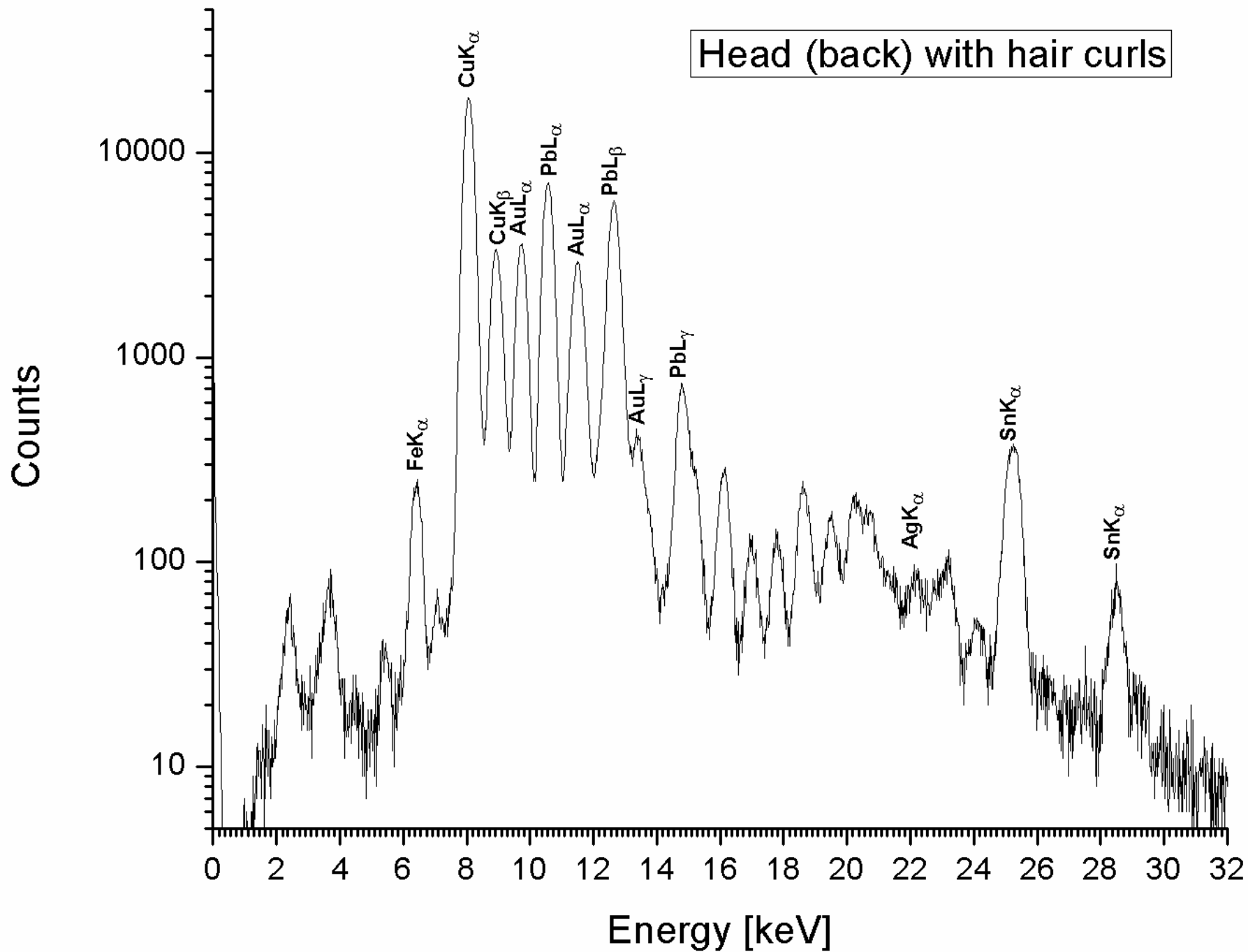


**Cu 63.1%; Pb 34.4%; Sn 1%      (Commodus lips?)**



**Head (back) with hair curls**

**Cu 45.6%; Pb 32.8%; Au 15.7%; Sn 4.7%**





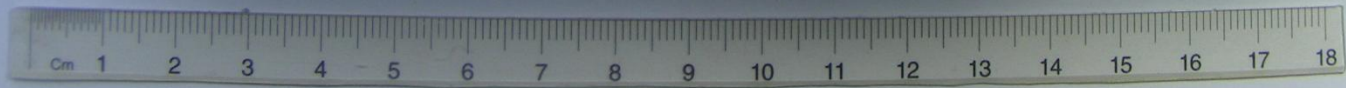
**Belt fragment**

**Pb 83.5%; Cu 13.4%; Sn 0.7%**

# Epomida



III + OK 1a

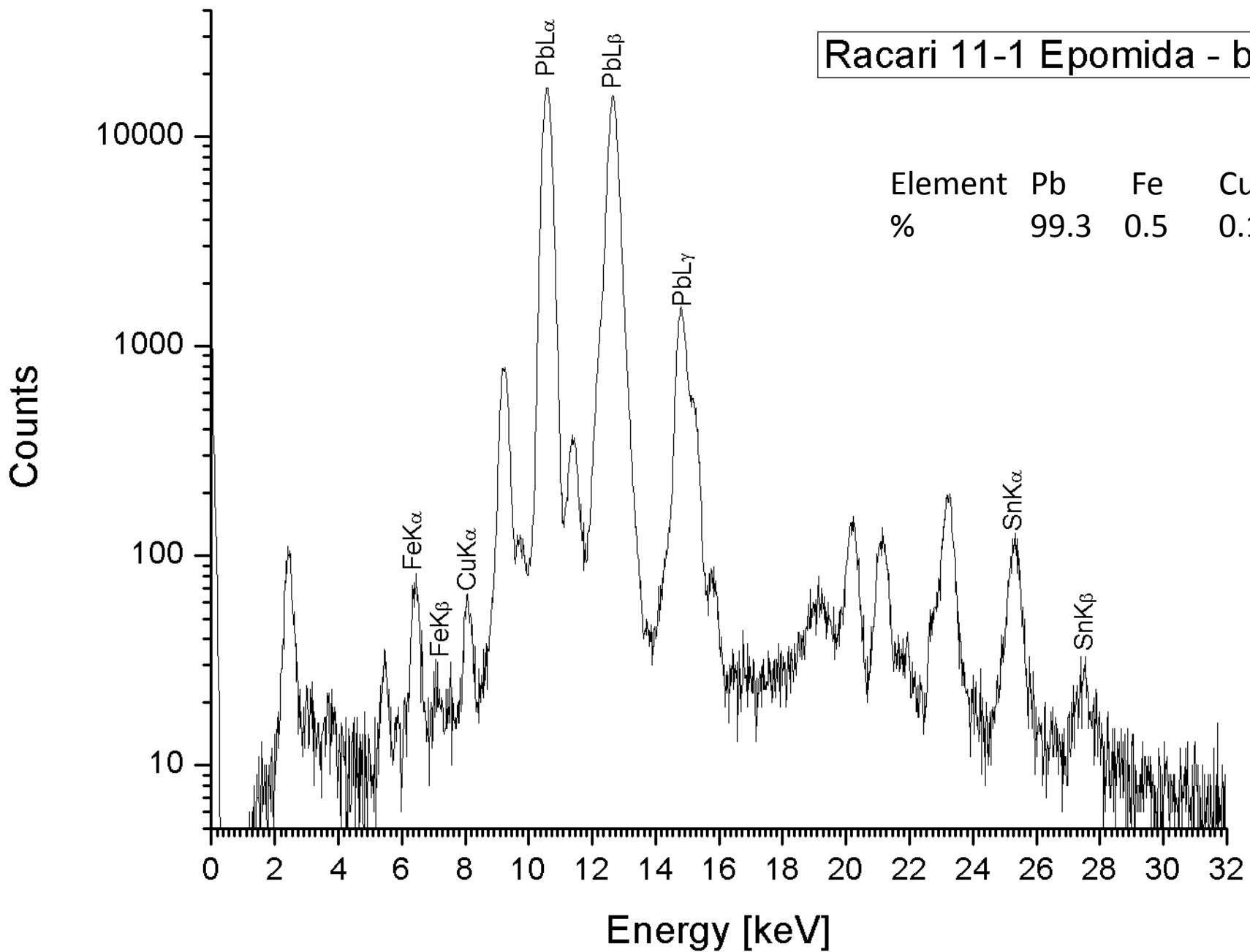




**Epomida - detail**



Racari 11-1 Epomida - back





**Lorica fragment**  
**Cu 80.5%; Sn 14.7%; Pb 4.5%**

**Lead solder**  
**Inside the statue**  
**Too much solder used**

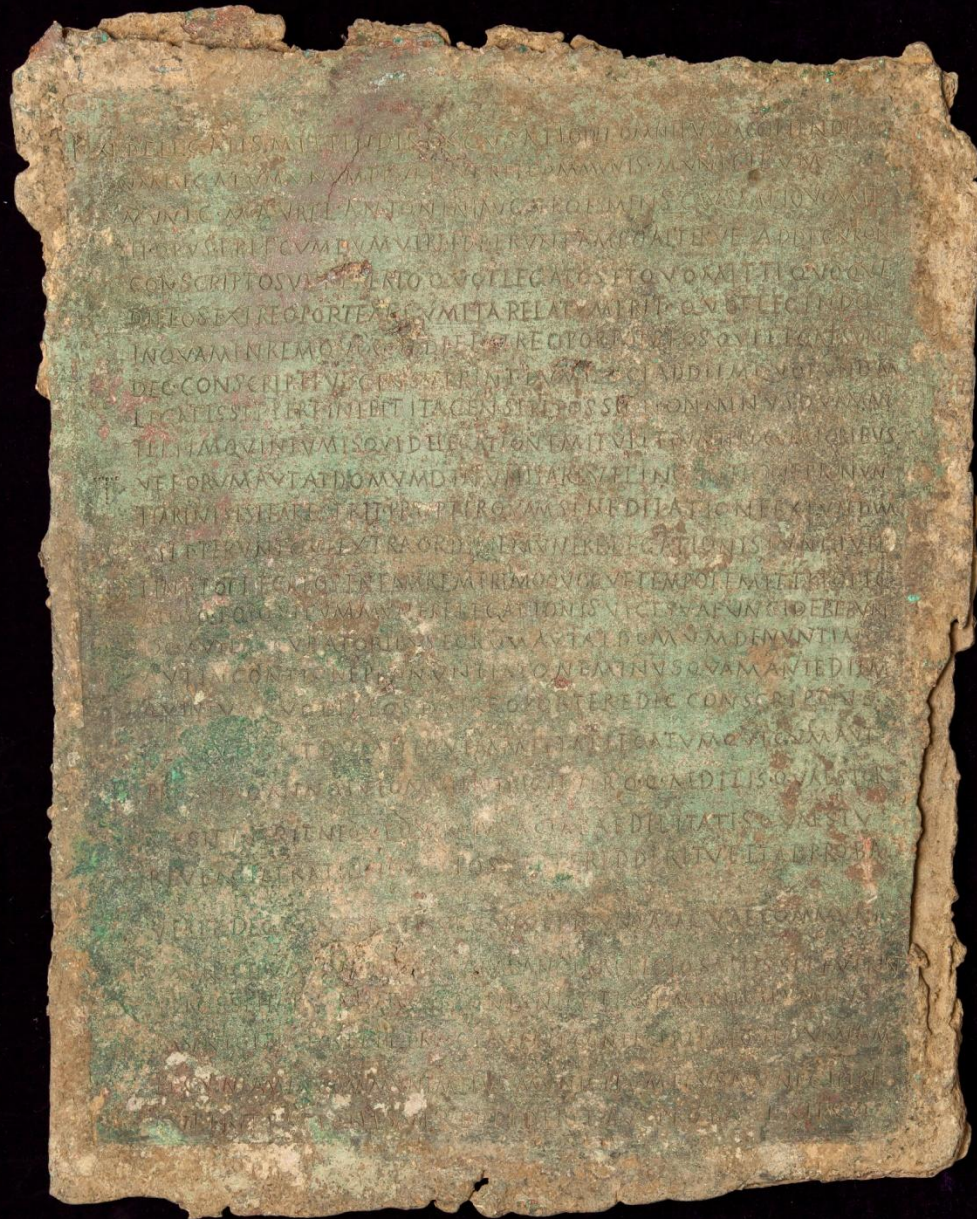


**Local workshop or import from Moesia Superior?**

**Remnants of lead solder and the big (6-7 mm) thickness of bronze plate suggest a local not-experienced workshop.**

# Troesmis 1

**Two tabulae  
Municipal laws  
Troesmis  
Danube border with  
Dobroudja  
Moesia Inferior  
3-4 Centuries AD**



# Troesmis 2

Fragment of a papyrus scroll with ancient Greek text, likely a legal or administrative document. The text is arranged in approximately 25 lines, though many characters are illegible due to damage and fading. The fragment is irregularly shaped with frayed edges and shows signs of significant wear and tear, including discoloration and missing sections of the surface.



IM CAESAR DIVINERVALENTINIANVS  
 AVG SVS GERMANICVS PONTIFEX MAXIMVS  
 TRIPLEX C. DCLESTAE C. S. P. P.  
 Q. M. I. S. S. E. T. T. I. E. N. S. O. V. E. N. T. I. A. N. G. I. N. A. L. I. S.  
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 T. E. M. P. L. V. M. D. E. V. I. A. V. G. A. D. M. I. N. E. R. V. A. M.

**Military diploma**  
**Oltina Castrum**  
**South-West Romania**



IMD CAESAR DIVI NERVAE NERVA TRAIANA  
AVGVSTVS GERMANICVS  
PONTIFEX MAXIMVS TRIBVNVS POTESTATIS  
XIII KAL APR VI COS V P P  
DITTOVAE ET OVITIBVS OVI MLLIANE  
INDE PARS TETRITONVM MELLARIA  
VALLIS TORONATA DECIVM ROMANA  
QVAE EST INDACIA SUB D  
TERENTIOSCAVRIANO QVORVM ANNO  
MINASVB SCRIPTASVNTIIPETIPELLI  
TER EXPEDITIONE DACICA FVNCTIS  
MELIACI TETRITONVM MELLARIA  
TEM ROMANAM DEDIT  
A D III IDVS AVC  
DARNITHITHI  
L MINICIO NATAE COS  
Q SILVANO GRANIANO  
PEDITI  
MULTO AD COBROVATI FNOVANTICORATI  
DESCRIPVT METRECOGNITVM EXT  
BYLAENEAOVAE FIXA ESTRO  
MAEINMYROPOST TEM  
DIVI AVCA D MINERVA

**Military diploma  
Porolissum Municipium  
Transylvania**

### **Tabula Troesmis 1**

Cu 22.5 – 50%; Pb 45.2 – 69.6%; Sn 2.2- 6.7%

### **Tabula Troesmis 2**

Cu 18.5 – 51.8%; Pb 32.9 – 70.9%; Sn 3 – 12.7%;  
traces Sb

Local workshop not  
experienced;  
different  
metallurgical  
charges

### **Military diploma Oltina**

Cu 50.2 - 51%; Pb 34.7 - 36.5%; Sn 10.4 – 11.3%

### **Military diploma Porolissum**

Cu 63.4 – 64.4%; Pb 25.9 – 26.5%; Sn 7.8 – 7.9%

Well experienced workshops  
– Roma?



**Tabula Claudiana: 1.93m x 1.39m; 222.5 kg; Lyon-Lugdunum  
Inscription by casting**

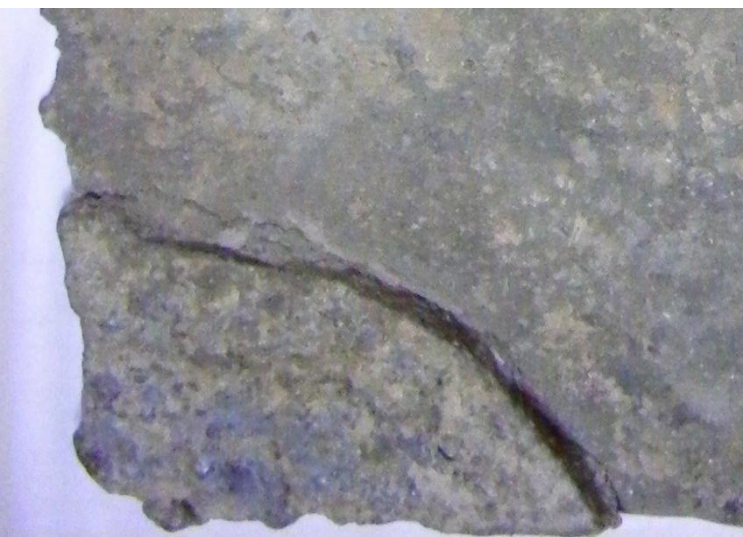


## Tabula Clesiana

49.9cm x 37.8cm x 0.61cm

7.14 kg

**Remnant of a frame?**



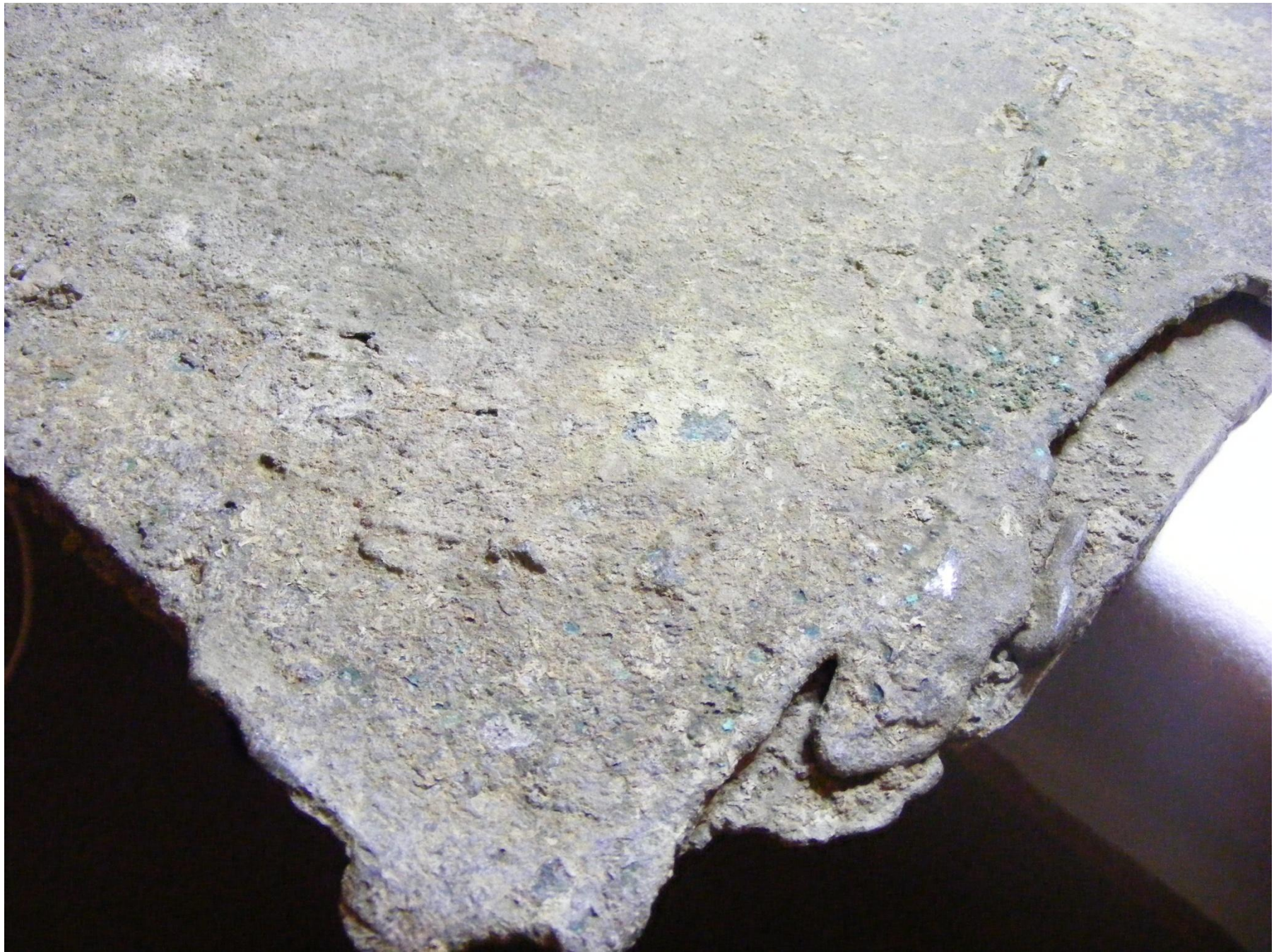






**Copper rivet**







Chisel cutting



Remnants of copper corrosion: coins?

...CIBVS AD SVFFRA  
...ONENDIS ADSINGVLA  
...NTITE VSIQVISIN  
...FRAGINTVLERIT  
...RESVETASSELLASIN  
...ERIT







**Sarmizegetusa Regia - The Sacred Zone**

**Bronze findings in this area**



**Dyes - positive ? – Roman Denarii**





**Cu 61%; Sn 35.6%; Fe 1.3%; Pb 1.2%; Zn 0.2%**





**Bendis Goddess? Head: Cu 81 %; Sn 14.2%; Pb 3.7%; Zn 0.4%, Sb 0.2%  
Arm: Cu 62.2%; Sn 29.5%; Pb 5.9%, Zn 1%; Sb 0.2%**