PIN HR-3389 – TIN BRONZE – LATE BRONZE AGE – SWITZERLAND

Artefact name Pin HR-3389

Authors Naima. Gutknecht (HE-Arc CR, Neuchâtel, Neuchâtel, Switzerland) & Rémy. Léopold (HE-Arc CR, Neuchâtel, Neuchâtel, Switzerland) & Domon Beuret. Emmanuelle (Laténium, Neuchâtel, Neuchâtel, Switzerland)

Url /artefacts/1367/

The object

Credit Laténium, C.Cevey.

Fig 1: Deformed pin with decorated head and round section,

Credit HE-Arc CR, L.Rémy.

Fig. 2: Dark brown corrosion products (detail) on the middle of the pin,

Credit HE-Arc CR, L.Rémy.

Fig. 3: Dense and smooth olive green corrosion products on the middle of the pin (detail). Discontinuity in the layer is showing the underlying corrosion structure,

Credit HE-Arc CR, L.Rémy.

Fig. 4: Dense and smooth olive green corrosion products on the middle of the pin (detail). A grain-like structure can be seen on the surface,

Description and visual observation

Description of the artefact	Pin with decorated head and round section. It has olive green and dark brown corrosion products (Figs. 1-4). Dimensions: L = 5.9cm; WT = 3.3g.
Type of artefact	Pin
Origin	Hauterive - Champréveyres, Neuchâtel, Neuchâtel, Switzerland
Recovering date	Excavation in 1983-1985, layer 3
Chronology category	Late Bronze Age
chronology tpq	1050 B.C.
chronology taq	800 B.C.
Chronology comment	Hallstatt A2/B
Burial conditions / environment	Lake
Artefact location	Laténium, Neuchâtel, Neuchâtel
Owner	Laténium, Neuchâtel, Neuchâtel
Inv. number	HR-3389
Recorded conservation data	The object was kept in wooden storage, No intervention documented.

Complementary information

No intervention documented, but a resineous material is present on the surface which indicate that a consolidation was made. Documentation of the strata in binocular mode of the object was performed in 2022.

Study area(s)

Credit HE-Arc CR, L.Rémy.

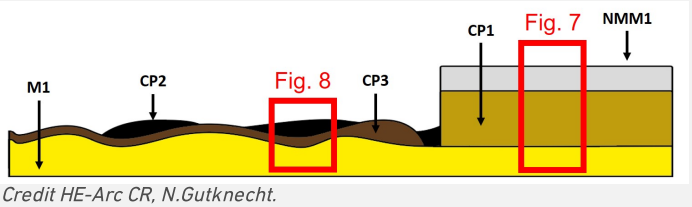
Fig. 5: Sides A and B (opposite sides) of the pin showing the XRF analysis areas (red circles),

Binocular observation and representation of the corrosion structure

The schematic representation below gives an overview of the corrosion structure encountered on the pin from a first visual macroscopic observation.

Strata	Type of stratum	Principal characteristics
NMM1	Non-metallic material	Transparent, thin, compact, only present in CP1
CP1	Corrosion product	Olive green, thick, discontinuous, compact, hard
CP2	Corrosion product	Black, veins shape, thin, discontinuous, compact, hard
CP3	Corrosion product	Dark brown, thin, continuous, compact, hard
M1	Metal	Dark yellow, thick, metallic, hard

Table 1: Description of the principal characteristics of the strata as observed under binocular and described according to Bertholon's method.



Credit HE-Arc CR, N.Gutknecht.

Fig. 6: Stratigraphic representation of the corrosion structure of the pin by macroscopic and binocular observation with reference to Figs. 7 and 8,

MiCorr stratigraphy(ies) – Bi

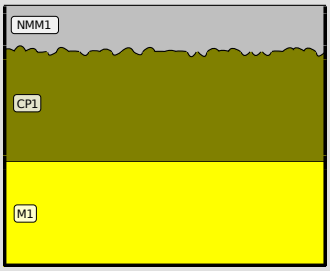


Fig. 7: Stratigraphic representation of the corrosion structure of the pin observed macroscopically under binocular microscope using the MiCorr application with reference to Fig. 6. The characteristics of the strata, such as the discontinuity, are accessible by clicking on the drawing that redirects you to the search tool by stratigraphy representation, Credit HE-Arc CR, N.Gutknecht.

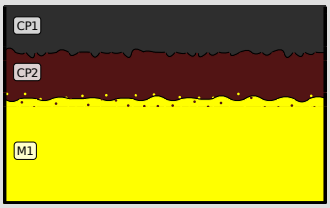


Fig. 8: Stratigraphic representation of the corrosion structure of the pin observed macroscopically under binocular microscope using the MiCorr application with reference to Fig. 6 where CP2 is CP1 and CP3 is CP2. The characteristics of the strata, such as the discontinuity, are accessible by clicking on the drawing that redirects you to the search tool by stratigraphy representation, Credit HE-Arc CR, N.Gutknecht.

Sample(s)

Description of sample	No sample has been taken. The observation and analysis were performed directly on the object.
Alloy	Tin Bronze
Technology	None
Lab number of sample	85-28
Sample location	None
Responsible institution	None
Date and aim of sampling	

Complementary information

None.

Analyses and results

Analyses performed:

Non-invasive approach

XRF with handheld portable X-ray fluorescence spectrometer (NITON XL5). General Metal mode, acquisition time 60s (filters: Li20/Lo20/M20).

Non invasive analysis

The XRF analysis of the pin was carried out on three representative areas of the surface (Fig. 5). Point 1 was performed on the residual metal, point 2 on the smooth and dense olive green stratum (CP1) and point 3 on the underlying black layer (CP2).

The metal is presumably a tin bronze alloy with possibly some As, Sb, Pb and Ni. The others elements detected are: S, Fe, Si, Al, Co, P, Ag.

Results of point 2 indicate the enrichment in Fe and in S and the depletion in Cu and in Sn typical of lake patina (chalcopyrite).

Results of point 3 indicate a slight enrichment in Sn and depletion in Cu.

Element (mass %)	Cu		Sn		S		Fe		As		Si		Ni		Sb		Pb		Al		Co	
	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+
1	85.0	0.1	6.5	0.04	2.0	0.03	0.1	0.01	1.5	0.03	1.0	0.06	1.0	0.02	0.8	0.02	0.4	0.02	0.3	0.1	0.3	

2	35.5	0.1	2.0	0.02	27.0	0.08	33.0	0.09	0.2	0.01	0.9	0.05	<LD	<LD	0.3	0.01	<0.1	0.01	0.4	0.1	<LD
3	75.0	0.1	7.5	0.04	8.0	0.06	0.7	0.02	2.0	0.04	1.5	0.07	1.5	0.03	0.8	0.02	1.0	0.02	0.3	0.1	0.3

Table 2: Chemical composition of the surface of the pin at three representative areas shown in Fig. 5, Method of analysis: XRF.

Metal

None.

Microstructure None

First metal element Cu

Other metal elements Sn

Complementary information

None.

Corrosion layers

Based on Schweizer analyses and results from table 2 CP1 of Fig. 6 should be chalcopyrite.

Corrosion form None

Corrosion type lake patina (Schweizer 1994)

Complementary information

In the article "Bronze objects from Lake sites: from patina to bibliography. In: Ancient and historic metals, conservation and scientific research" (Schweizer 1994), the corrosion products of the pin 3389 (LAB MAH 85-28) were studied through XRD. The results show that the pin contains copper iron sulfide (chalcopyrite).

MiCorr stratigraphy(ies) – CS

Synthesis of the binocular / cross-section examination of the corrosion structure

The corrosion structure has only been documented in binocular mode (Figs. 7 and 8).

Conclusion

This pin is made from a tin bronze with possibly some As, Sb, Pb and Ni. It has been extensively documented by Schweizer to establish the lake and terrestrial patina typologies (1994). One third of the surface is still covered with a stratum analysed as lake patina (chalcopyrite), generated by the presence of sulfate-reducing bacteria in the burial environment.

References

References on object and sample

Object files in MiCorr

1. MiCorr_Pin or needle fragment HR-3031
2. MiCorr_Tang fragment of a knife HR-6567
3. MiCorr_Tang fragment of a knife HR-6246
4. MiCorr_Pin HR-18152
5. MiCorr_Pin HR-3071
6. MiCorr_PIN HR-17773
7. MiCorr_Pin HR-18603

References object

8. RychRychner-Faraggi A-M. (1993) Hauterive – Champréveyres 9. Métal et parure au Bronze final. Archéologie neuchâteloise, 17 (Neuchâtel), pl. 61/65.
9. Hochuli, S. et al. (1988) SPM III Bronzezeit , Verlag Schweizerische Gesellschaft für Ur- und Frühgschichte Basel, 76-77, 379.

References sample

10. Empa Report 137 695/1991, P.O. Boll.
11. Rapport d'examen, Lab. Musées d'Art et d'Histoire, Geneva GE, 87-194 à 87-197.
12. Schweizer, F. (1994) Bronze objects from Lake sites: from patina to bibliography. In: Ancient and historic metals, conservation and scientific research (eds. Scott, D.A., Podany, J. and Considine B.B.), The Getty Conservation Institute, 33-50.

References on analytic methods and interpretation

13. Robbiola, L., Blengino, J-M., Fiaud, C. (1998) Morphology and mechanisms of formation of natural patinas on archaeological Cu-Sn alloys, Corrosion Science, 40, 12, 2083-2111.