PIN HR-3071 - TIN BRONZE - LATE BRONZE AGE - SWITZERLAND

Artefact name	Pin HR-3071
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Url	/artefacts/1366/

The object

Fig 1: Pin with decorated head and round section,

Credit Laténium, C.Cevey.

Fig. 2: Green corrosion products (detail) around the head of the pin,

Credit HE-Arc CR, N.Gutknecht/L.Rémy

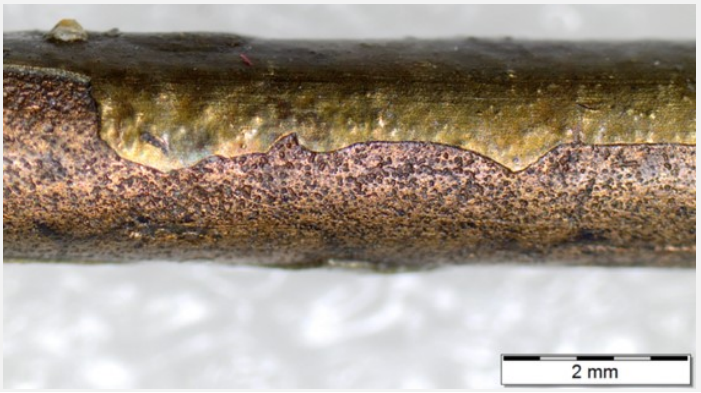


Fig. 3: Dense and smooth olive green corrosion products (detail) on the middle of the pin with lacunas showing the underlying metal,

Credit HE-Arc CR, N.Gutknecht/L.Rémy

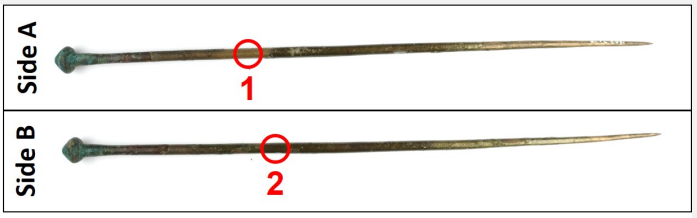
Description and visual observation

Description of the artefact	Pin with decorated head and round section. Locally a dense and smooth olive green stratum is preserved, while green corrosion products develop on the underlying metal (Figs. 1-3). Dimensions: L = 19.0cm; WT = 12.4g.
Type of artefact	Jewellery
Origin	Hauterive - Champréveyres, Neuchâtel, Neuchâtel, Switzerland
Recovering date	Excavation 1983-1985, object from layer 1
Chronology category	Late Bronze Age
chronology tpq	1050 B.C.
chronology taq	800 B.C.
Chronology comment	
Burial conditions / environment	Lake
Artefact location	Laténium, Neuchâtel, Neuchâtel
Owner	Laténium, Neuchâtel, Neuchâtel
Inv. number	HR-3071
Recorded conservation data	None.

Complementary information

The object was analyzed in 1987 by Schweizer. Documentation of the strata in binocular mode of the object was performed in 2022.

Study area(s)



Credit HE-Arc CR, N.Gutknecht/L.Rémy

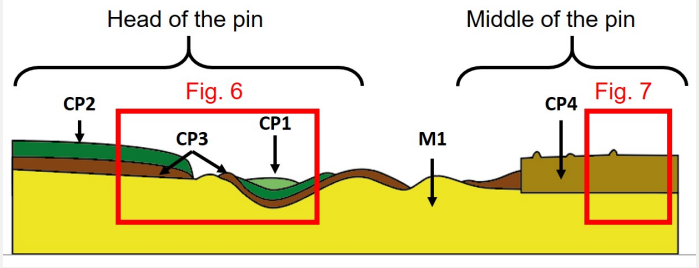
Fig. 4: Sides A and B (opposite sides) of the pin showing the XRF analysis areas (red circles),

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
CP1	Corrosion product	Light green, thin, scattered, non compact, very soft
CP2	Corrosion product	Dark green, thin, scattered, compact, very soft
CP3	Corrosion product	Dark brown, medium, discontinuous, compact, hard
CP4	Corrosion product	Olive green, medium, discontinuous, compact, hard
M1	Metal	Yellow, metallic, compact, 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. 5: Stratigraphic representation of the corrosion structure of the pin by macroscopic and binocular observation using the Micorr application with reference to Figs. 6 and 7,

MiCorr stratigraphy(ies) – Bi

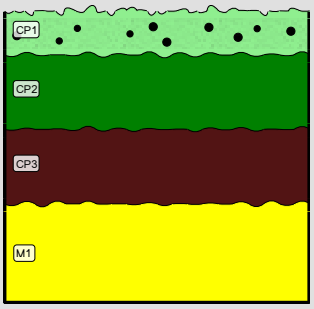


Fig. 6: Stratigraphic representation of the corrosion structure of the head of the pin (Fig. 2) observed macroscopically under binocular microscope using the MiCorr application with reference to Fig. 5. The characteristics of the strata, such as the discontinuity, are accessible by clicking on the drawing that redirects you to the search tool by stratigraphy representation, Credit HE-Arc CR, N.Gutknecht.

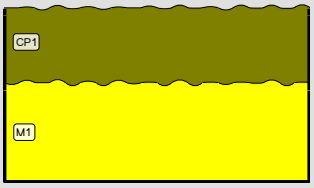


Fig. 7: Stratigraphic representation of the corrosion structure of the middle of the pin (Fig. 3) observed macroscopically under binocular microscope using the MiCorr application with reference to Fig. 5 where CP1 stands for CP4. The characteristics of the strata, such as the discontinuity, are accessible 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	85-194
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

XRF analysis was carried out on two representative areas of the surface (Fig. 4). Point 1 was performed on a lacuna of the olive green corrosion layer and point 2 on the olive green corrosion layer (CP4 of Fig. 5).

The metal is presumably a tin bronze alloy with proabably some Sb and As and traces of Pb and Ag. The other elements detected are: S, Fe, Si, Zn.

Results of point 2 are very different from those of point 1, they indicate the enrichment in Fe and in S and depletion in Cu.

Elements (mass %)	Cu		Sn		S		Fe		Sb		As		Pb		Ag		Si		Zn		Total
	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	
1	87.0	0.2	8.5	0.05	1.5	0.04	0.2	0.01	0.9	0.02	0.7	0.03	0.4	0.02	0.3	0.01	0.2	0.06	0.1	0.03	99.8
2	36.5	0.1	4.0	0.02	25.0	0.08	32.0	0.09	0.5	0.01	0.2	0.01	0.1	0.01	0.2	0.01	0.5	0.04	0.1	0.02	99.1

Table 2: Chemical composition of the surface of the pin at two 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

CP4 (dense, smooth olive green stratum) is enriched with Fe and S and depleted in Cu. It seems to correspond to chalcopyrite (CuFeS2).

Corrosion form Multiform

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 3071 (LAB MAH 85-194) were analysed with XRD. The results show that the pin contains sulfosalt (sinnerite Cu6As4S9) and copper carbonate (malachite Cu2(CO3)(OH)2) as well as copper iron sulfide (chalcopyrite CuFeS2). Sinnerite appears as dark cristals, malachite as green cristals and chalcopyrite as a brown smooth layer.

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. 6 & 7).

Conclusion

The pin is made from a tin bronze with possibly some Sb and As. It has been extensively documented by Schweizer to establish the lake and terrestrial patina typologies in his research paper from 1994. Chalcopyrite indicates a lake patina that was generated by the presence of sulfato-reducing bacteria

in the burial environment and copper carbonate refers to a terrestrial patina.

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-17773
6. MiCorr_PIN HR-18603
7. MiCorr_Pin HR-3389

References object

8. Rychner-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.