PIN HR-18603 - TIN BRONZE - LATE BRONZE AGE - SWITZERLAND

Artefact name	Pin HR-18603
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Url	/artefacts/1091/

The object

Credit Laténium, C.Cevey.

Fig. 1: Pin with decorated head (ring) and round section,

Credit HE-Arc CR, L.Rémy.

Fig. 2: White corrosion products (detail) on the head of the pin,

Credit HE-Arc CR, L.Rémy.

Fig. 3: White and brown corrosion products (detail) on an area in the middle of the pin,

Fig. 4: White and brown corrosion products (detail) on an area in the middle of the pin,

Credit HE-Arc CR, L.Rémy.

Credit HE-Arc CR, L.Rémy.

Fig. 5: Brown and green corrosion products (detail) on an area in the middle of the pin,

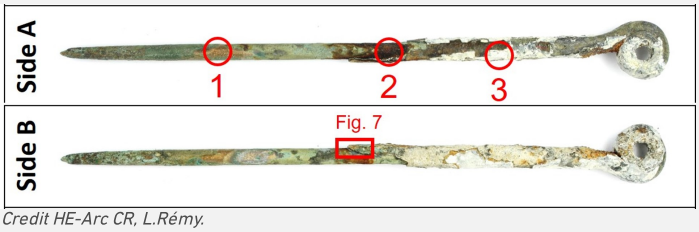
Description and visual observation

Description of the artefact	Pin with green-blue and brown shiny corrosion products (Figs. 1-5) and recently developed white corrosion products (see complementary information below). Dimensions: L = 10.5cm; WT = 6.6g.
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-18603
Recorded conservation data	The object has been kept in wooden storage, no intervention documented.

Complementary information

This object was documented in the article "Bronze objects from Lake sites: from patina to bibliography. In: Ancient and historic metals, conservation and scientific research p.41" (Schweizer 1994). The white corrosion layers were not present in this documentation and was noted in 2020. Documentation of the strata in binocular mode of the object was performed in 2022.

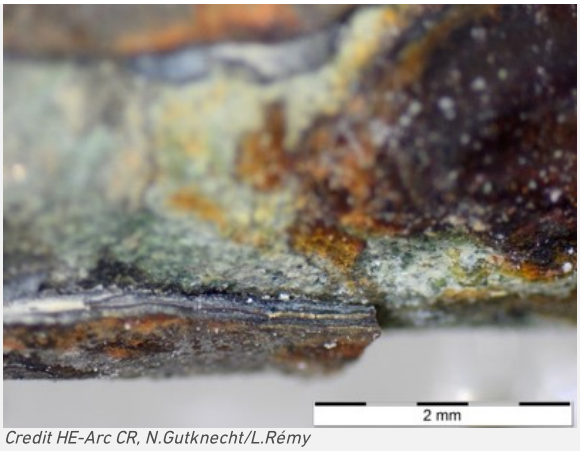
Study area(s)



Credit HE-Arc CR, L.Rémy.

Fig. 6: Sides A and B (opposite sides) of the pin showing the XRF analysis areas (red circles) and the location of Fig. 7 (red square),

Fig. 7: Detail of the pin with view of the layers used for the description of the corrosion structure in Fig. 8.



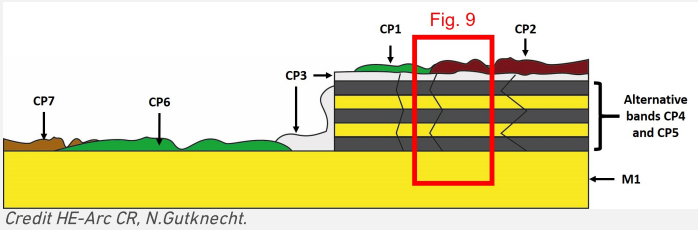
Credit HE-Arc CR, N.Gutknecht/L.Rémy

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	Dark green, thin, scattered, non compact, very soft
CP2	Corrosion product	Dark brown, thin, scattered, compact, hard
CP3	Corrosion product	Extra light grey, medium thickness, scattered, non compact, very soft
CP4	Corrosion product	Yellow, medium thickness, discontinuous, compact, hard
CP5	Corrosion product	Dark grey, medium thickness, discontinuous, non compact, very soft
CP6	Corrosion product	Dark green, thin, scattered, non compact, very soft
CP7	Corrosion product	Brown, thin, scattered, non compact, very soft
M1	Metal	Yellow, thick, metallic, soft

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. 8: Stratigraphic representation of the corrosion structure of the pin by macroscopic and binocular observation with reference to Fig. 9,

MiCorr stratigraphy(ies) – Bi

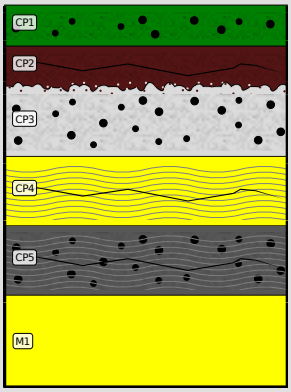


Fig. 9: Stratigraphic representation of the corrosion structure of the head of the pin observed macroscopically under binocular microscope using the MiCorr application with reference to Fig. 8. The characteristics of the strata, such as the discontinuity, are accessible by clicking on the drawing that redirects you to the search tool by stratigraphy representation, Credit HE-Arc CR, N.Gutknecht.

Sample(s)

Description of sample	A fragment (scale) of the white corrosion products close to the head of the pin was taken was sampled. It was turned to powder to be analysed by XRD
Alloy	Tin Bronze

Technology	None
Lab number of sample	86-77
Sample location	None
Responsible institution	None
Date and aim of sampling	April 2022

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).

XRD (to be completed).

Non invasive analysis

The XRF analysis of the pin was carried out on three representative areas of the surface (Fig. 6). Point 1 corresponds to the bright yellow surface and appears to be an area where the corrosion layers have dissociated to reveal the metal, point 2 corresponds to the dark brown surface (CP2), and point 3 to the white corrosion product (CP3).

The metal is presumably a tin bronze alloy with traces of As. The others elements detected are: S, Si, Fe, Zn, Al.

Results of point 2 indicate an enrichment in Fe and a depletion in Cu and in S in CP2.

Results of point 3 (CP3) are very different to those of points 1 and 2, they indicate the enrichment in Fe and in S and the depletion in Cu and in Sn.

Element (mass %)	Cu		Sn		S		Si		Fe		As		Zn		Al		
	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	%	+/- 2σ	Total
1	78.0	0.2	17.0	0.06	2.5	0.05	0.9	0.06	0.8	0.03	0.2	0.01	0.1	0.02	<LD	<LD	100.0
2	52.0	0.1	17.0	0.06	<LD	<LD	1.5	0.07	28.0	0.1	0.2	0.01	0.2	0.02	0.5	0.1	99.4
3	38.0	0.1	7.5	0.04	17.5	0.08	3.0	0.08	32.5	0.1	0.1	0.01	0.1	0.02	0.9	0.1	99.6

Table 2: Chemical composition of the surface of the pin at three representative areas shown in Fig. 8, Method of analysis: XRF.

Metal

None.

Microstructure	None
First metal element	Cu
Other metal elements	Sn

Complementary information

None.

Corrosion layers

None.

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 18603 (LAB MAH 86-77) are identified as copper iron sulfide (chalcopyrite) and as copper sulfate (antlerite). The first one is brown-yellow (probably CP2) and the other one is green (probably CP1).

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 (Fig. 9).

Conclusion

The pin is made from a tin bronze. The corrosion products of the pin 18603 (LAB MAH 86-77) originally formed were identified as copper iron sulfide (chalcopyrite) typical of lake patina and copper sulfate (antlerite).

The white corrosion (CP3) seems to have developed after excavation (to be completed).

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-3389

References object

8. Rychner-Faraggi A-M. (1993) Hauterive – Champréveyres 9. Métal et parure au Bronze final. Archéologie neuchâteloise, 17 (Neuchâtel), pl. 67/22.
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.