SICKLE AUV-313 - LATE BRONZE AGE - SWITZERLAND

Artefact name Sickle AUV-313

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Url /artefacts/1059/

The object

Credit HE-Arc CR, L.Rémy.

Fig. 1: Sickle (side A) with a groove on the external front side and lacunas of the corrosion layers all over the surface,

Credit HE-Arc CR, L.Rémy.

Fig. 2: Brown-yellow and dark-grey corrosion products and lacunas of the corrosion layers (detail) of the haft of the sickle,

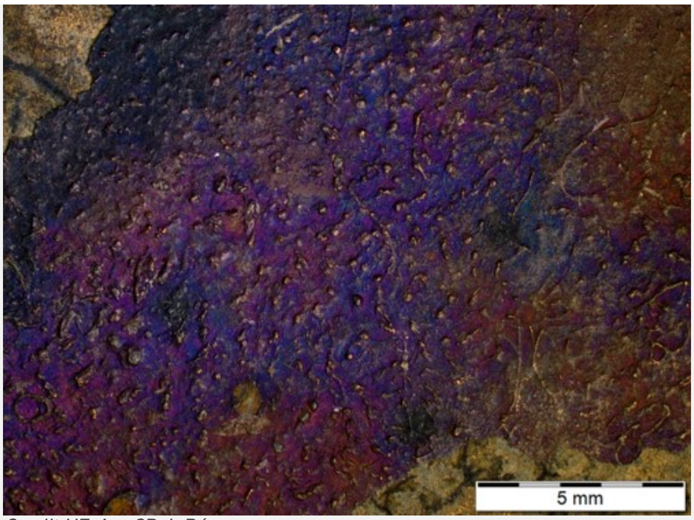


Fig. 3: Magenta-blue and brown-yellow corrosion products (detail) of the haft of the sickle,

Credit HE-Arc CR, L.Rémy.

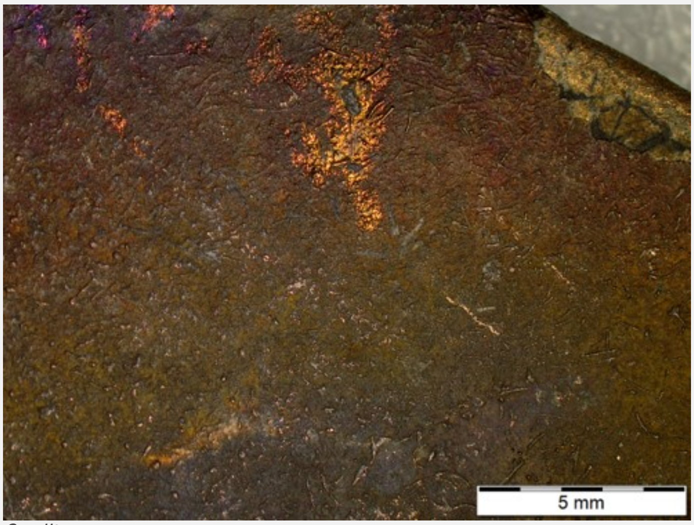


Fig. 4: Brown-yellow and dark-grey corrosion products (detail) of the middle of the sickle,

Credit

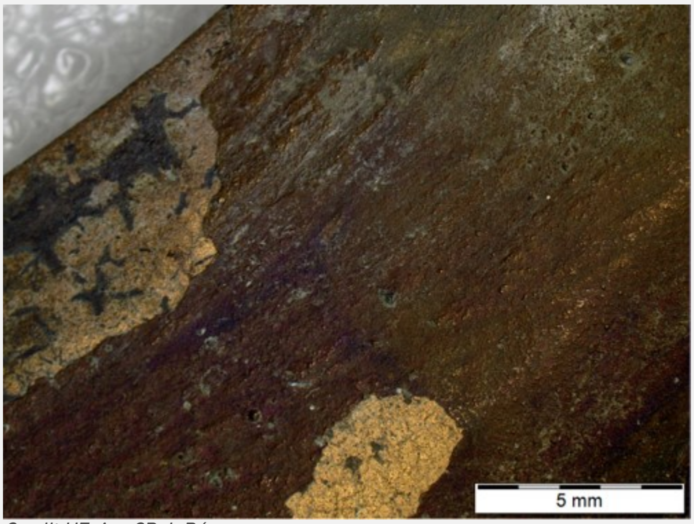


Fig. 5: Brown-yellow and dark-grey corrosion products as well as lacunas of the corrosion layers (detail) of the tip of the sickle,

Credit HE-Arc CR, L.Rémy.

Description and visual observation

Description of the artefact

Sickle with a groove on the external front side with brown-yellow/dark-grey corrosion products as well as lacunas of the corrosion layers (Figs. 1-5). Dimensions: L = 13.67cm; Ømax. = 3.0cm; WT = 89.38g.

Type of artefact

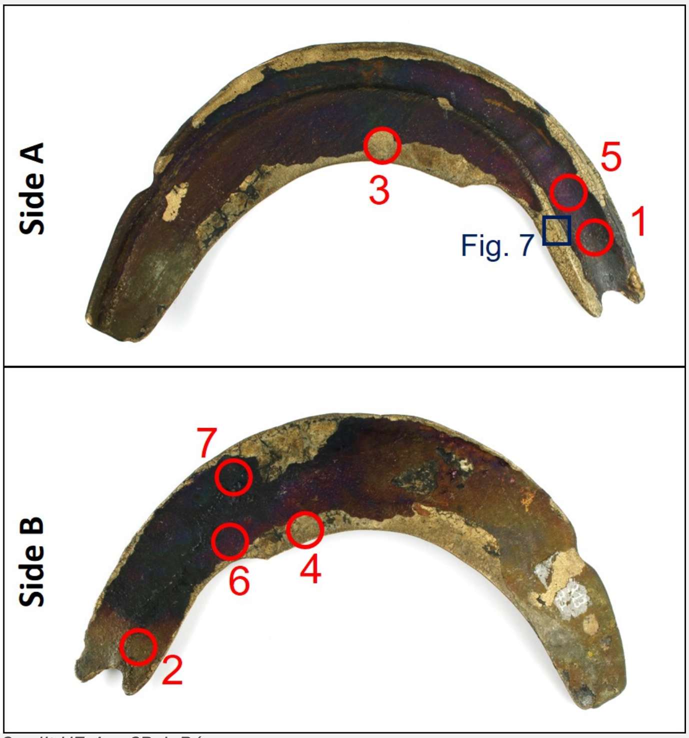
Tool

Origin	Hauterive - Champréveyres, Neuchâtel, Neuchâtel, Switzerland
Recovering date	Excavation 1971
Chronology category	Late Bronze Age
chronology tpq	900 B.C.
chronology taq	800 B.C.
Chronology comment	
Burial conditions / environment	Lake
Artefact location	Laténium, Neuchâtel, Neuchâtel
Owner	Laténium, Neuchâtel, Neuchâtel
Inv. number	Auv 313
Recorded conservation data	No conservation data available, but a coating and inventory number is visible on the surface.

Complementary information

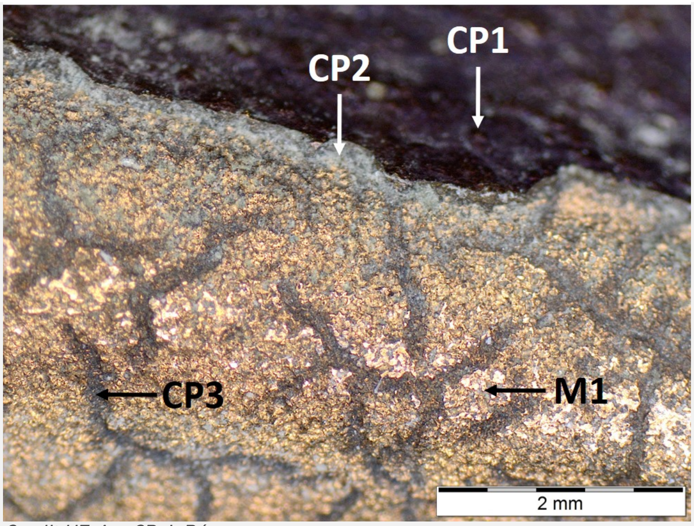
The object was documented in 1987 by Valentin Rychner. Documentation of the strata in binocular mode on the object was performed in 2022.

Study area(s)



Credit HE-Arc CR, L.Rémy.

Fig. 6: Sides A and B (opposite sides) with indication of XRF analyses (red circles) and location of Fig. 7 (blue square),



Credit HE-Arc CR, L.Rémy.

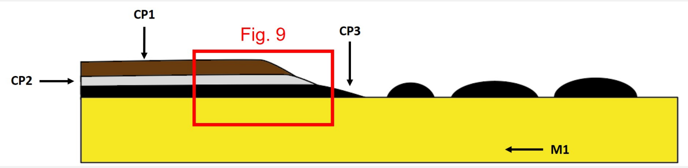
Fig. 7: Side view of a lacuna with the mention of the different strata,

Binocular observation and representation of the corrosion structure

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

Strata	Type of stratum	Principal characteristics
CP1	Corrosion product	Brown, pearly, thin, discontinuous, compact, brittle, very soft
CP2	Corrosion product	Extra light grey, matte, thin, discontinuous, compact, powdery, soft
CP3	Corrosion product	Black, matte, thin, discontinuous, compact, powdery, very soft
M1	Metal	Yellow, thick, metallic, continuous, compact, tough, very 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, L.Rémy.

Fig. 8: Stratigraphic representation of the corrosion structure of the sickle by macroscopic and binocular observation with indication of the corrosion structure used to build the MiCorr stratigraphy of Fig. 9 (red square),

MiCorr stratigraphy(ies) – Bi

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

Sample(s)

Description of sample	None.
Alloy	None

Technology None

Lab number of sample

Sample location None

Responsible institution None

Date and aim of sampling

Complementary information

None.

Analyses and results

Analyses performed:

Non-invasive approach

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

Non invasive analysis

The XRF analyses of the sickle were carried out on seven representative areas (Fig. 6). Points 1 and 2 were done in the brown corrosion layer of each side (CP1), points 3 and 4 on yellow areas covered with dark-grey corrosion layer (CP2 and CP3), points 5 and 6 on the magenta-blue corrosion layer (CP1), and point 7 on a black corrosion layer (CP1). All strata (soil, corrosion products, and metal) are analyzed at the same time.

The metal is presumably a tin bronze alloy with some As, Sb and Pb. The other elements detected are : Fe, S, Si, Al, Zn and Ag (points 3 and 4).

Results of points 1, 2, 5, 6 and 7 are different and indicate the depletion in Cu and Sn and the enrichment in Fe and S.

Elements (mass %)	Cu		Fe		S		Sn		Si		Al		Sb		Zn		Pb		
	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%
1	54.7	0.09	17.7	0.06	20.1	0.05	3.9	0.02	2.0	0.05	0.7	0.09	0.3	0.01	0.3	0.02	<LD	<LD	<L
2	51.4	0.07	17.2	0.05	26.6	0.05	3.6	0.02	0.4	0.02	0.3	0.07	0.3	0.01	0.1	0.01	<LD	<LD	<L
3	81.4	0.17	1.2	0.03	3.9	0.05	8.0	0.05	2.9	0.1	<LD	<LD	0.5	0.02	<LD	<LD	0.6	0.02	0.7
4	83.4	0.12	0.2	0.01	2.3	0.03	8.3	0.04	3.0	0.08	0.2	0.1	0.5	0.01	<LD	<LD	0.6	0.02	0.8
5	52.5	0.08	17.8	0.05	25.1	0.05	2.9	0.02	0.9	0.03	0.4	0.07	0.2	0.01	0.1	0.01	<LD	<LD	<L
6	52.4	0.08	17.4	0.06	24.5	0.05	4.3	0.02	0.5	0.02	0.3	0.07	0.3	0.01	0.1	0.01	<LD	<LD	<L
7	51.4	0.08	18.7	0.05	25.2	0.05	3.3	0.02	0.6	0.03	0.4	0.07	0.3	0.01	0.1	0.01	<LD	<LD	<L

Table 2: Chemical composition of the surface of the pin at seven representative points shown in Fig. 6, Method of analysis: XRF.

Metal

None.

Microstructure None

First metal element Cu

Other metal elements Sn

Complementary information

Rychner (1987) indicates that the metal of the object is bronze.

Corrosion layers

The appearance of CP1 and its composition (Cu, Fe, S) seem to indicate that it is either itaite or chalcopyrite.

Corrosion form	Uniform
Corrosion type	lake patina (Schweizer 1994)

Complementary information

According to Rychner (1987), the surface of the object is covered with itaite (Cu_5FeS_6).

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 sickle is made from a tin bronze. The XRF analysis show that the brown, purple and black corrosion layers (CP1) have higher %Fe and %S and lower % Cu and %Sn than the layer closer to the metal. It would indicate that CP1 is made of copper iron sulfide like itaite (Cu_5FeS_6) or chalcopyrite ($CuFeS_2$) as described by Rychner (1987). According to Schweizer's paper from 1994, it would mean that CP1 could be a lake patina which was generated on the metal by the presence of sulfate-reducing bacteria in the burial environment.

References

References on object and sample

Object files in MiCorr

1. MiCorr_Sickle Auv-310
2. MiCorr_Sickle Auv-322

References object

3. Rychner, V. (1987) Auvernier 1968-1975: le mobilier métallique du Bronze final Formes et techniques. In: Cahiers d´archéologie romande 37, Auvernier 6. 39-40.
4. Rapport d'examen, Lab. Musées d'Art et d'Histoire, Geneva GE, 87-194 à 87-197.
5. 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, 143-157.