SICKLE AUV-322 - LATE BRONZE AGE - SWITZERLAND

Artefact name Sickle AUV-322

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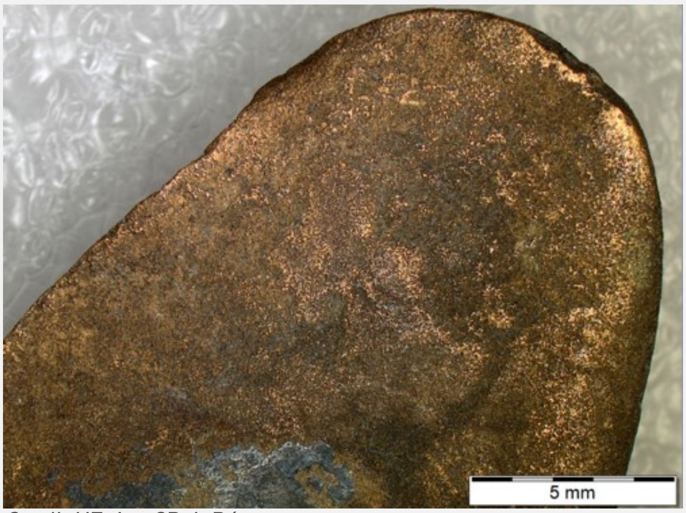
Url /artefacts/1274/

The object

Credit HE-Arc CR, L.Rémy.

Fig. 1: Sickle (side A) with a groove on the external front side,



Credit HE-Arc CR, L.Rémy.

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

Credit HE-Arc CR, L.Rémy.

Fig. 3: Brown-yellow and dark-grey corrosion products (detail) of an area close to the tip of the sickle,

Description and visual observation

Description of the artefact	Sickle with a groove on the external front side and brown-yellow/dark-grey corrosion products (Figs. 1-3). Dimensions: L = 12.0cm; Ømax. = 3.1cm; WT = 91.0g.
Type of artefact	Tool
Origin	Hauterive - Champréveyres, Neuchâtel, Neuchâtel, Switzerland
Recovering date	Excavation in 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 322
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)

Fig. 4: Both sides (opposed) of the sickle with location of XRF analysis areas (red circles) and location of Fig. 5 (blue square),

Credit HE-Arc CR, L.Rémy.

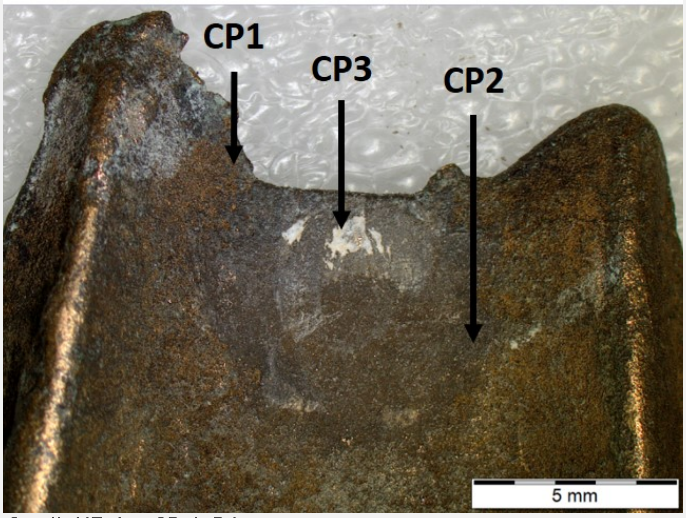


Fig. 5: Corrosion structure (detail) from Fig. 4 showing some of the documented strata in Fig. 6,

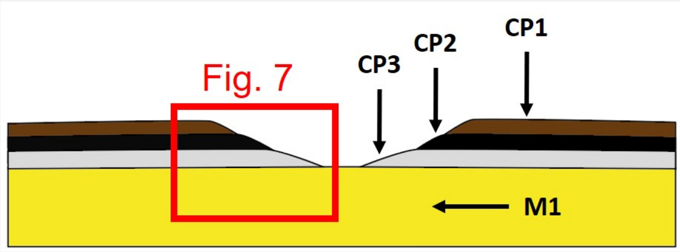
Credit HE-Arc CR, L.Rémy.

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.

Stratum	Type of stratum	Principal characteristics
CP1	Corrosion product	Brown, matte, thin, discontinuous, compact, powdery, very soft
CP2	Corrosion product	Black, matte, thin, discontinuous, compact, powdery, very soft
CP3	Corrosion product	Extra light grey, matte, thin, discontinuous, compact, powdery, hard
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. 6: 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. 7 (red square),

MiCorr stratigraphy(ies) – Bi

Fig. 7: Stratigraphic representation of the corrosion structure of the sickle observed macroscopically under binocular microscope using the MiCorr application with reference to Fig. 6. 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

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

XRF analyses of the sickle were carried out on five representative areas (Fig. 4). Points 1 and 2 were done in the brown corrosion layer of each side (CP1), points 3 and 4 on the black corrosion layer of each side (CP2), and point 5 in the extra light grey of side A (CP3). All strata (soil, corrosion products, and metal) are analyzed at the same time.

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

Results of points 1, 2 and 5 are very similar and give concentrations close to those of the remaining metal surface.

Results of points 3 and 4 are similar but different from those of points 1, 2 and 5: they indicate an enrichment in S and the depletion in Cu.

Elements (mass %)	Cu		Sn		S		As		Pb		Al		Sb		Si		Ni		Ag		Bi		P		Fe		
	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	%	+/-2σ	TOTAL
1	83.1	0.1	7.3	0.04	2.0	0.02	2.0	0.04	1.6	0.03	1.0	0.08	0.9	0.02	0.8	0.03	0.5	0.02	0.4	0.01	0.1	0.01	0.1	0.01	0.1	0.01	99.7
2	83.2	0.1	7.8	0.04	2.6	0.02	1.4	0.03	1.0	0.02	0.8	0.07	0.9	0.02	1.1	0.03	0.4	0.01	0.3	0.01	0.1	0.01	0.1	0.01	0.1	0.01	99.8
3	72.0	0.15	7.3	0.04	11.4	0.06	1.3	0.03	1.1	0.02	1.5	0.15	0.9	0.02	3.4	0.08	0.5	0.02	0.3	0.01	0.1	0.01	0.1	0.02	0.2	0.01	100.1
4	70.8	0.15	8.6	0.05	10.6	0.07	1.7	0.04	2.3	0.03	0.8	0.15	0.8	0.02	2.7	0.08	0.4	0.01	0.3	0.01	0.1	0.01	0.4	0.03	0.3	0.02	99.8
5	80.7	0.2	7.6	0.05	1.6	0.04	1.7	0.04	1.6	0.03	1.5	0.02	0.9	0.03	2.0	0.08	0.4	0.02	0.4	0.01	0.1	0.01	0.1	0.02	1.1	0.02	99.7

Table 2: Chemical composition of the surface of the pin at five representative points shown in Fig. 4, Method of analysis: XRF, UR-Arc CR.

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 CP2 and their composition (Cu, S) seem to indicate that they might be chalcocite or djurleite.

Corrosion form None

Corrosion type None

Complementary information

According to Rychner (1987), the dark corrosion layer (CP1) was previously analysed by XRD, it was identified as a mix of chalcocite (Cu_2S) and djurleite ($Cu_{1.93}S$).

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. 7).

Conclusion

The sickle is made from a tin bronze. The XRF analysis shows that the black corrosion layer CP2 has higher %S and lower %Cu, it would indicate the presence of black copper sulfide such as chalcocite (Cu_2S) and djurleite ($Cu_{1.93}S$), as described by Rychner (1987).

References

References on object and sample

Object files in MiCorr

1. MiCorr_Sickle Auv-310
2. MiCorr_Sickle Auv-313

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.