

SICKLE AUV-313 - LATE BRONZE AGE - SWITZERLAND

Artifact name Sickle AUV-313

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Url [/artefacts/1059/](#)

▼ The object



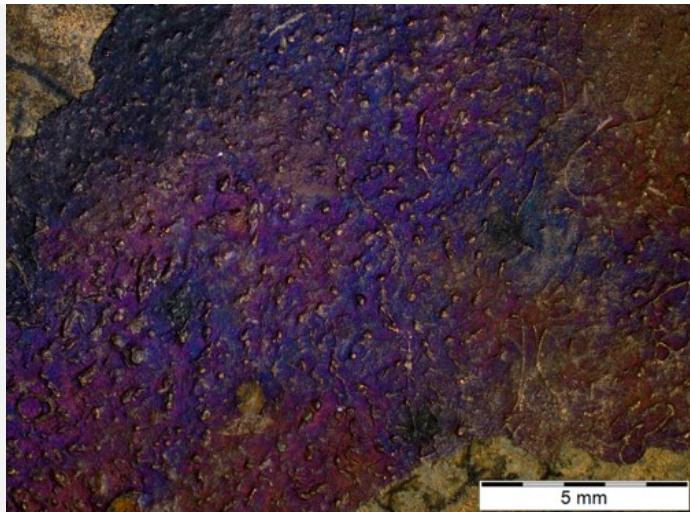
Credit HE-Arc CR, L.Rémy.

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,



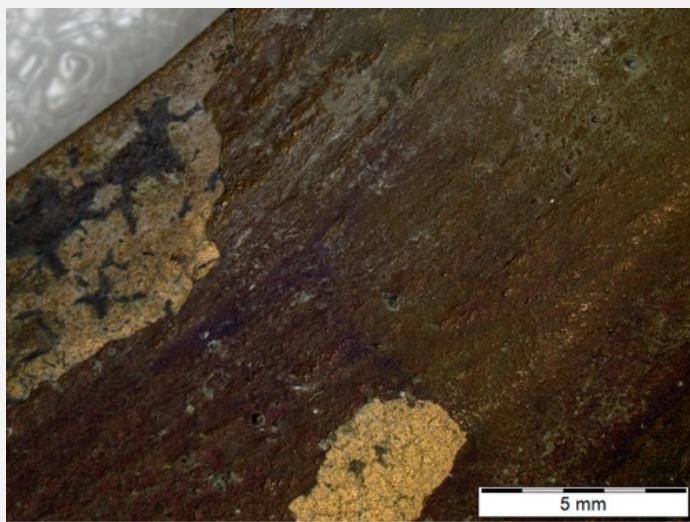
Credit HE-Arc CR, L.Rémy.

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



Credit

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



Credit HE-Arc CR, L.Rémy.

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

▼ 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. <input type="button" value="▼"/> |
| chronology taq | 800 | B.C. <input type="button" value="▼"/> |
| 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)

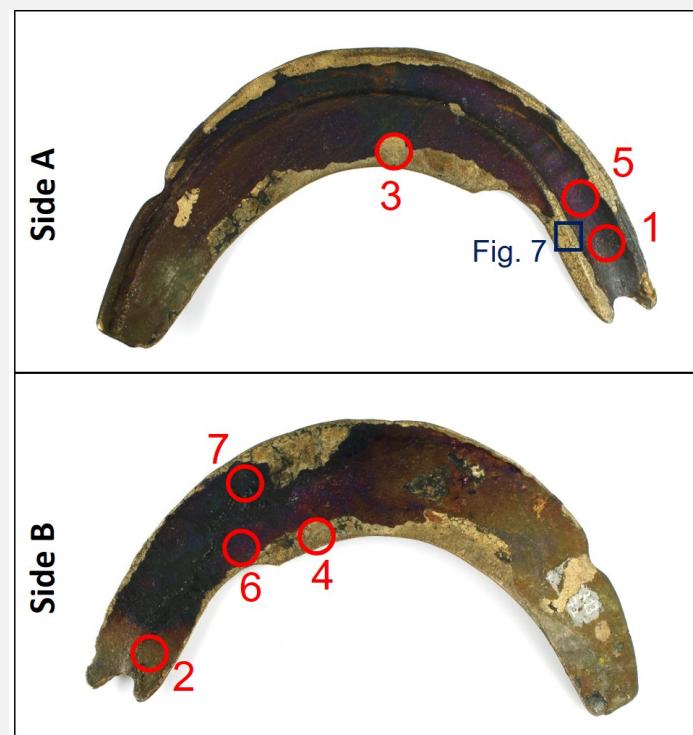


Fig. 6: Sides A and B (opposite sides) with indication of XRF analyses (red circles) and location of Fig. 7 (blue square),

Credit HE-Arc CR, L.Rémy.

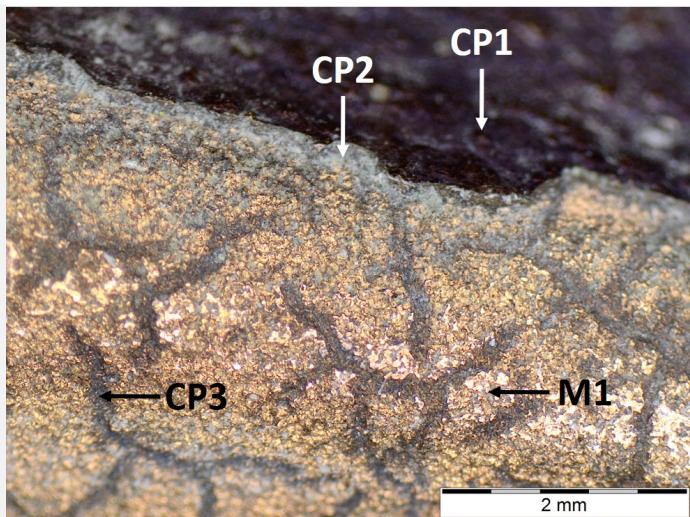


Fig. 7: Side view of a lacuna with the mention of the different strata,

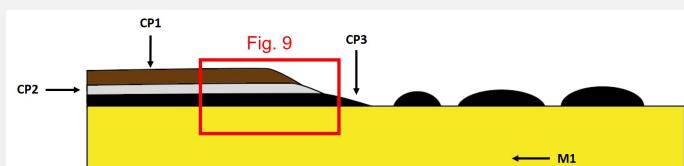
Credit HE-Arc CR, L.Rémy.

▼ 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.

| 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. |

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| ▼ Analyses and results |
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|---|
| <i>Analyses performed:</i> 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 | % | +/-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 | <LD | <LD |
| 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 | <LD | <LD |
| 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 | 0.1 | 0.01 |
| 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 | 0.01 |
| 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 | <LD | <LD |
| 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 | <LD | <LD |
| 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 | <LD | <LD |

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

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|---------|
| ▼ Metal |
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|-------|
| None. |
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|----------------------|------|
| Microstructure | None |
| First metal element | Cu |
| Other metal elements | Sn |

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|--|
| 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 (Cu₅FeS₆).

▼ 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 (Cu₅FeS₆) or chalcopyrite (CuFeS₂) 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.