SWORD GRIP NG-1980-27-H-693 - LEADED BRASS - 18TH CENTURY - UNITED KINGDOM

Artefact name Sword grip NG-1980-27-H-693

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Url /artefacts/1644/

The object

Credit Rijksmuseum Amsterdam, A.Hammond.

Fig. 1: Overview image of sword grip from the Hollandia shipwreck,

Description and visual observation

Description of the artefact	This object is a sword grip, a composite object made from a wooden core with embedded leaded brass wire recovered from Hollandia, a Dutch East India Company ship. The wire is loose in some areas, and deeply embedded in others, with some periodic breakage throughout the piece. Some wire is twisted, and some is flattened. The wire presents locally black spots, brown fuzzies.
Type of artefact	Sword
Origin	Hollandia, Isles of Scilly, England, United Kingdom
Recovering date	Excavated between 1971 and 1980
Chronology category	18th Century
chronology tpq	

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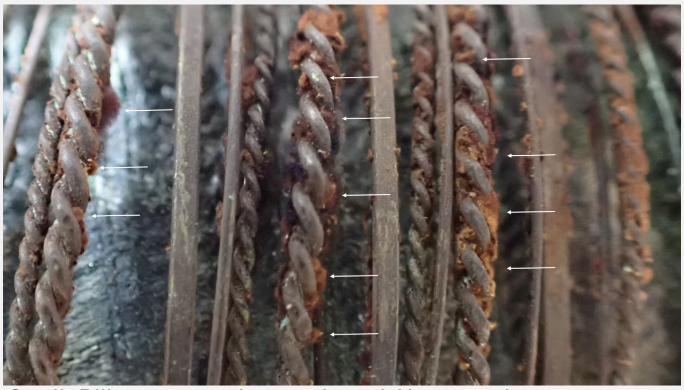
chronology taq	1742 A.D.
Chronology comment	Dutch golden age
Burial conditions / environment	Maritime
Artefact location	Rijksmuseum, Amsterdam, North Holland
Owner	Rijksmuseum, Amsterdam, North Holland
Inv. number	NG-1980-27-H-693
Recorded conservation data	Likely treated in 1980 with BTA, and potentially treated in England prior, treatment unknown (Hammond and Davidowitz 2025 [1], 2025[2]).

Complementary information

The Rijksmuseum in Amsterdam contains thousands of finds from nine different Dutch East India Company (Vereenigde Oostindische Compagnie) shipwrecks, many originating from the Hollandia, wrecked off the Isles of Scilly in the United Kingdom in 1743 (Gawronski 1998 [3]). The wreck was located in 1971 and excavated between then and the early 1980s (Gawronski 1998[3]). There are 1477 cupreous objects in the Rijksmuseum's Hollandia collection, in varying states of corrosion.

This object was analyzed as a componant of the VITAl Cu project, a study that was initiated to help develop a conservation strategy for objects from Hollandia, which were moved to a new storage facility in 2020, CollectieCentrum Nederland, with improved climate conditions. Accurately monitoring the stability of the collection required an understanding of how active the corrosion processes are. The collection also shows clear signs of having undergone treatment (efflorescence, stripped surfaces, coatings) but has since become dissociated from much of its conservation documentation.

Study area(s)



Credit Rijksmuseum Amsterdam, A.Hammond.

Fig. 2: Macro image of small brown fuzzies, some of which are indicated by arrows,

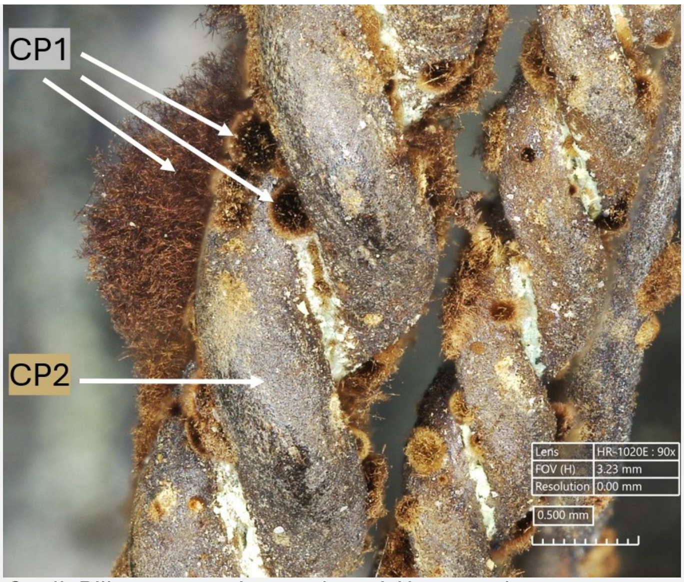


Fig. 3: Hirox image of black spots, brown fuzzies,

Credit Rijksmuseum Amsterdam, A.Hammond.

Binocular observation and representation of the corrosion structure

The schematic representation below gives an overview of the corrosion structure(s) encountered on the sword grip from a first visual macroscopic observation.

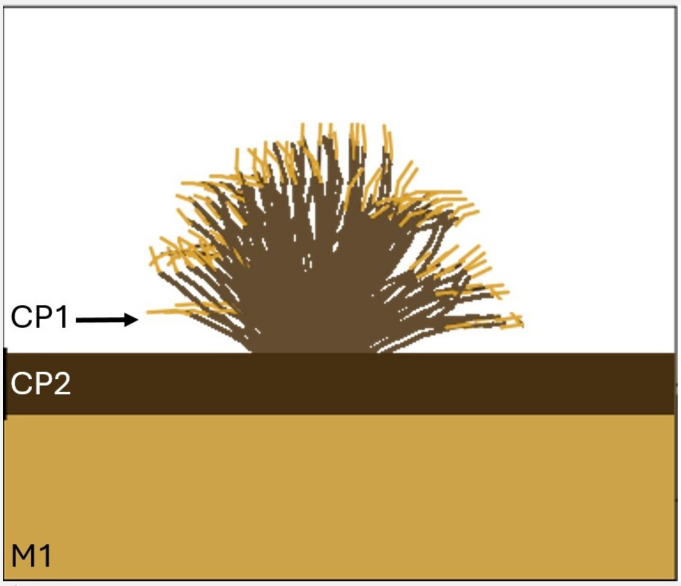


Fig. 4: Stratigraphic representation of brown fuzzies on copper-based wire by macroscopic and binocular observation,

Credit Rijksmuseum Amsterdam, A.Hammond.

MiCorr stratigraphy(ies) – Bi

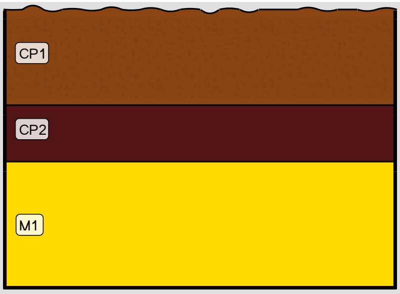
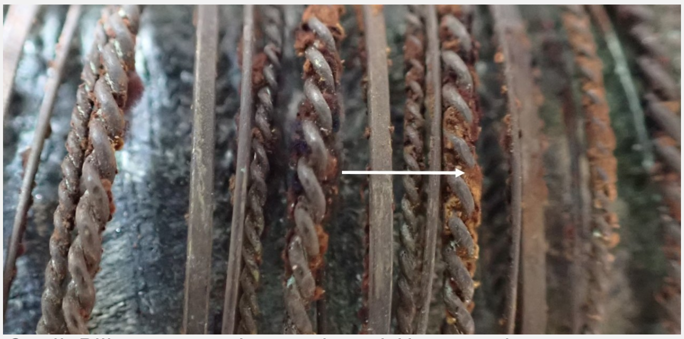


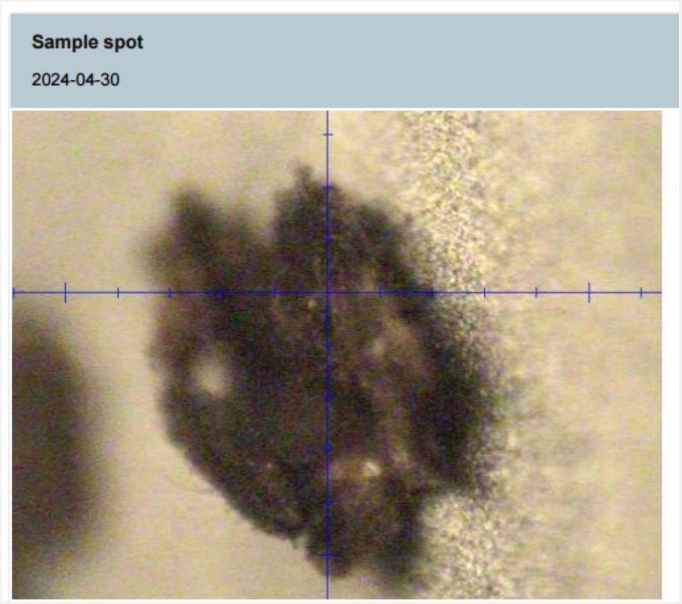
Fig. 5: Stratigraphic representation of the corrosion structure of brown fuzzies observed macroscopically under binocular microscope using the MiCorr application. The characteristics of the strata are only accessible by clicking on the drawing that redirects you to the search tool by stratigraphy representation. This representation can be compared to the stratigraphy in Fig. 4, credit Rijksmuseum Amsterdam, A.Hammond.

Sample(s)



Credit Rijksmuseum Amsterdam, A.Hammond.

Fig. 6: Spot corrosion (brown fuzzies) was sampled from for SEM-EDX analysis,



Credit Rijksmuseum Amsterdam, Rijksdienst voor het Cultureel Erfgoed, L.Megens.

Fig. 7: Corrosion sampled for XRD analysis,

Description of sample	Sample of figs. 6 and 7 was collected from the surface of one of the twisted wires, in an area of thick corrosion, using a sterile scalpel blade. It was scraped from the surface of the object directly into a diveted slide, and was covered with a flat slide while being transported for X-ray diffraction.
Alloy	Leaded Brass
Technology	Cast and rolled
Lab number of sample	2024-04-30 (XRD)

Sample location	Rijksmuseum, Amsterdam, North Holland
Responsible institution	Rijksdienst voor het Cultureel Erfgoed, Amsterdam, North Holland
Date and aim of sampling	Corrosion sampled in 2021 in order to identify corrosion product

Complementary information

None.

Analyses and results

Analyses performed:

Non-invasive approaches

- Digital microscopy: Corrosion was analyzed using a Hirox digital microscope Model HRX-01.

- X-ray fluorescence: The corroded surface was analyzed through the use of an Olympus Delta X Professional X-ray fluorescence (XRF) spectrometer. Data was calibrated using CHARMed by PyMca, and was recorded by Ari Pappot (Rijksmuseum).

- SEM-EDX: The analysis was carried out without sampling. The analysis utilized a JEOL JSM-IT700HR scanning electron microscopy in combination with electron dispersive X-ray spectroscopy (SEM-EDX). This analysis was performed by Ineke Joosten (Rijksdienst voor het Cultureel Erfgoed).

Invasive approach

- X-ray Diffraction was carried out using a Bruker D8 Discover with a 2D VÅNTEC-500 detector with GADDS X-ray diffractometer (XRD). This analysis was performed by Luc Megens ((Rijksdienst voor het Cultureel Erfgoed).

Non invasive analysis

The metal seems to be a leaded brass containing a small percentage of antimony (Sn and Ag). It is difficult at that stage to determine whether Fe is an additional element or just external pollution (Table 1).

Element	Cu	Zn	Pb	Ag	SnK	Fe
Concentration (%)	70.0	23.0	3.6	0.1	<.1	3.0

Table 1. X-ray fluorescence results.

EDX analysis is provided below in the corrosion layers section.

Metal

X-ray fluorescence analysis indicated that the wire is a leaded brass, though this measurement was made on a corroded surface which may not be indicative of the composition of the alloy itself.

Microstructure	None

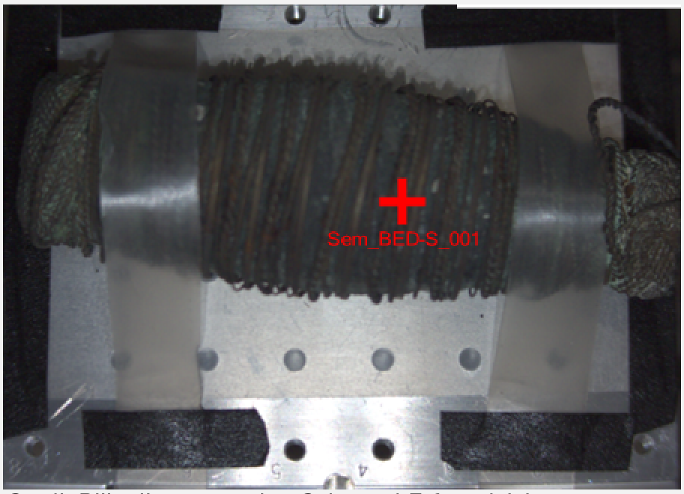
First metal element	Cu
Other metal elements	Zn, Pb

Complementary information

None.

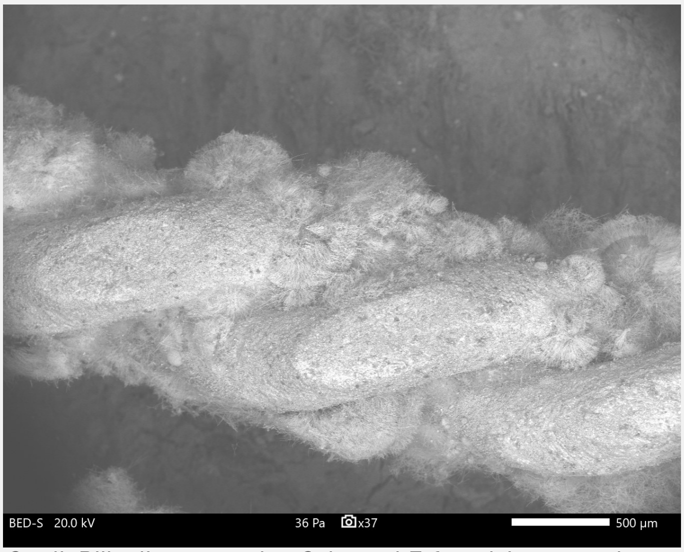
Corrosion layers

SEM-EDX observation and analysis of the brown fuzzies (Figs. 7 to 9) indicated major peaks of copper and sulfur with lower peaks of oxygen and carbon. XRD diffractograms of brown fuzzies (Fig. 7) matched with copper iron sulfide Bornite, iron oxide Hematite and copper sulfides Covellite CuS and Haycockite $CuFe_5S_8$, the latter might be the most probable due to the absence of iron in EDX analysis (Fig. 10).



Credit Rijksdienst voor het Cultureel Erfgoed, I.Joosten.

Fig. 7: Image indicating spot analyzed in SEM-EDX analysis,



Credit Rijksdienst voor het Cultureel Erfgoed. Image and analysis by Ineke Joosten.

Fig. 8: SEM image of copper sulfide structure,

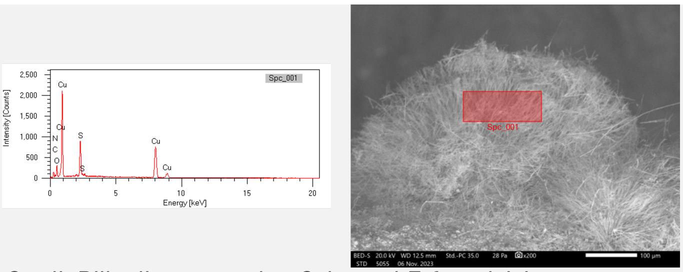


Fig. 9: SEM image of brown fuzzies and corresponding EDX readout,

Credit Rijksdienst voor het Cultureel Erfgoed, I.Joosten.

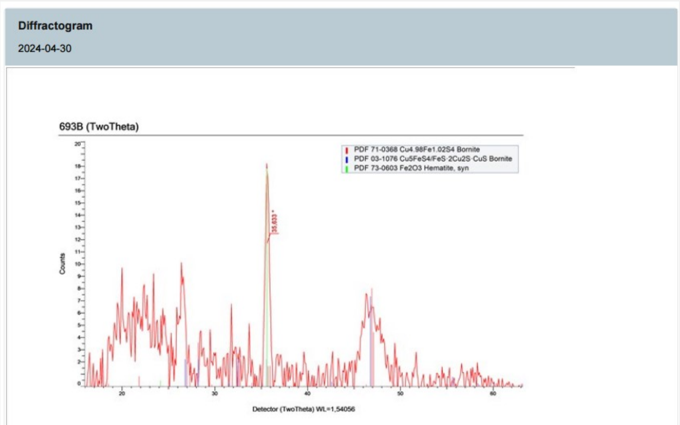


Fig.10: XRD diffractogram of the brown fuzzies,

Credit Rijksdienst voor het Cultureel Erfgoed, L.Megens.

Corrosion form	Bushes, branches, or cauliflours
Corrosion type	Copper sulfide corrosion

Complementary information

None.

MiCorr stratigraphy(ies) – CS

Synthesis of the binocular / cross-section examination of the corrosion structure

None.

Conclusion

This object is afflicted by corrosion known by a few names such as black spots, brown fuzzies, and copper (iron) sulfides, this process is known to cause pitting in copper alloys (Eggert 2023[4]). First published on in 1977 by Brinch-Masden, this process has been studied since, and has been described both as "high in sulphur and unpleasant to look at" and as an “enemy of copper” causing pitting corrosion on metallic substrates (Eggert 2023[4]).

References

References on objects and samples:

1. Hammond A. and Davidowitz T. (2003) Keeping an eye on copper alloys: The VITAL Cu diagnostic protocol for identifying corrosion on cupreous shipwreck finds. ***ISCUA '23 Conservation: Proceedings for the International Symposium of Conservation for Underwater Archaeology***, Formentera, Spain, Spanish Ministry of Culture, pp. 113-130.
2. Hammond A., Davidowitz T. and Joosten I. (2025) Understanding corrosion through visual examination: VITAL Cu in practice, ***Metal 2025***, proceedings of the ICOM-CC Metal WG Interim Meeting, Cardiff, Wales, Cardiff Studies in Archaeology and Conservation, pp. 368-374.
3. Gawronski J. (1998) Hollandia, in J. Delgado (ed.), ***Encyclopedia of underwater and maritime archaeology***, New Haven, Connecticut, Yale University Press, pp. 196-197, 329.
4. Eggert G. (2023). Copper and bronze in art and the Search for rare corrosion products, ***Heritage, vol.*** 6, no. 2, pp. 1768–1784.

Suggested reading:

5. MacLeod I.D. (1991) Identification of corrosion products on non-ferrous metal artifacts recovered from shipwrecks, ***Studies in Conservation***, vol. 36, no. 4, pp. 222–234.
6. Weichert M., Eggert G., Jones A.M. and Ankersmit H.A. (2004) Trees, bunches, cauliflowers–A closer look at sulphurous corrosion on copper alloys and minerals ('Black Spots'), ***Metal 2004***, proceeings of the ICOM-CC Metal WG Interim meeting, Canberra, Australia, National Museum of Australia, Canberra, pp. 149–159.