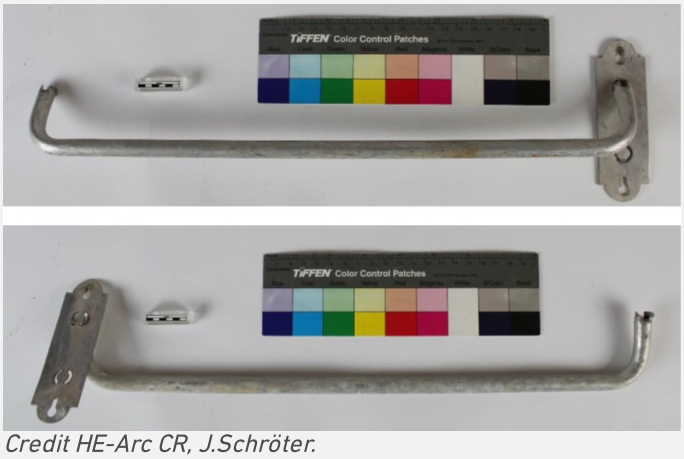
TOWEL BAR - AL ALLOY - MODERN TIMES - FRANCE

Artefact name	Towel bar
Authors	Christian. Degrigny (HE-Arc CR, Neuchâtel, Neuchâtel, Switzerland)
Url	/artefacts/521/

The object



Credit HE-Arc CR, J.Schröter.

Fig. 1: Front and back sides of a towel bar,

Description and visual observation

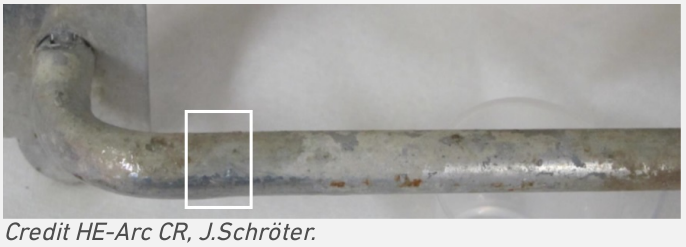
Description of the artefact	Towel bar with traces of use and a broken section (Fig. 1). White deposits have developed on the metal surface. Dimensions: L = 45cm.
Type of artefact	Household implement
Origin	Château de Germolles, Mellecey, Bourgogne, France
Recovering date	Unknown
Chronology category	Modern Times
chronology tpq	1960 A.D.
chronology taq	2000 A.D.
Chronology comment	20th century

Burial conditions / environment	Indoor atmosphere
Artefact location	Château de Germolles, Mellecey, Bourgogne
Owner	Château de Germolles, Mellecey, Bourgogne
Inv. number	None
Recorded conservation data	Not conserved

Complementary information

Nothing to report.

Study area(s)



Credit HE-Arc CR, J.Schröter.

Fig. 2: Detail of the back side of the towel bar showing the location of the sampling area,

Binocular observation and representation of the corrosion structure

Stratigraphic representation: none.

MiCorr stratigraphy(ies) – Bi

Sample(s)

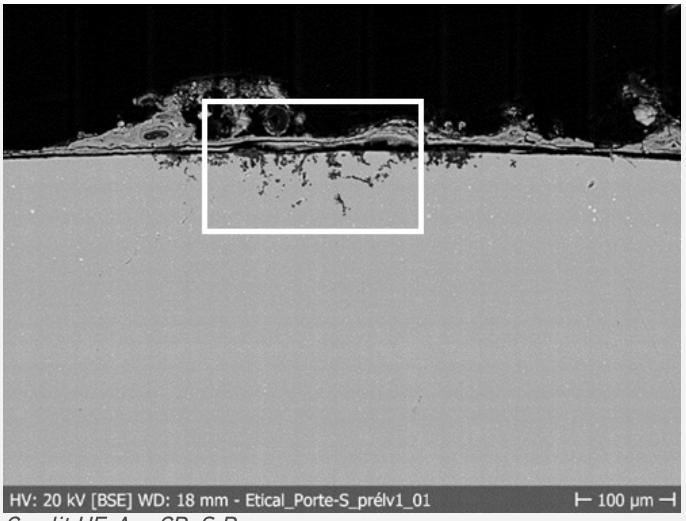


Fig. 3: SEM image of the cross-section of the fragment sampled from the towel bar showing the location of Fig. 5,

Credit HE-Arc CR, S.Ramseyer.

Description of sample	Sample cut from the back side of the towel bar (Fig. 2).
Alloy	Al Alloy
Technology	None
Lab number of sample	None
Sample location	HE-Arc CR, Neuchâtel, Neuchâtel
Responsible institution	HE-Arc CR, Neuchâtel, Neuchâtel
Date and aim of sampling	2017, EtICAL project (Study of corrosion forms of aluminium alloys from Swiss public collections)

Complementary information

Nothing to report.

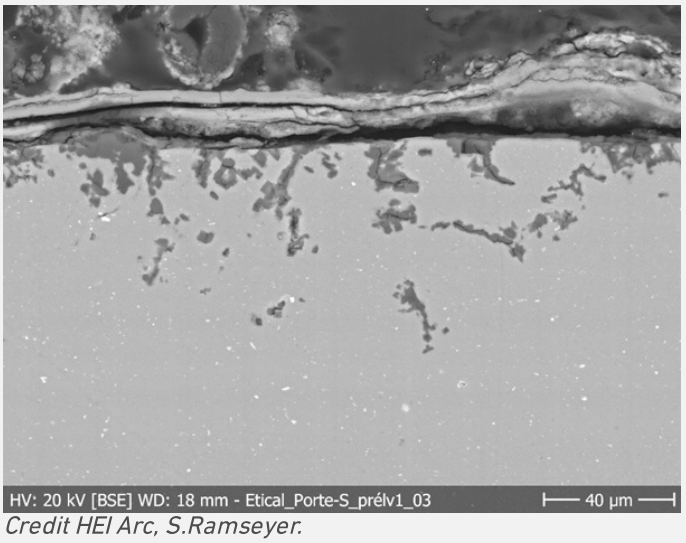
Analyses and results

Analyses performed:
Metallography, SEM/EDS.

Non invasive analysis

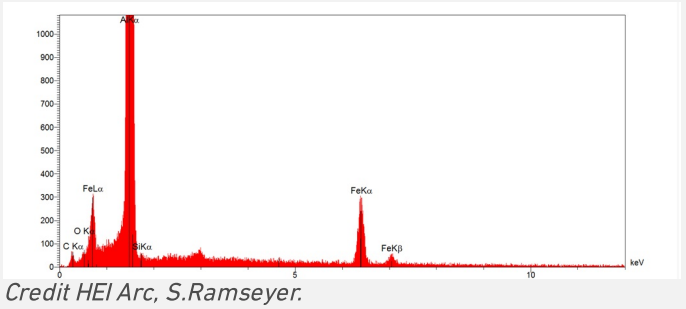
Metal

The metal is a relatively pure aluminium alloy with numerous inclusions (Fig. 5). From their chemical composition they can be interpreted as Al3Fe intermetallic compounds (Fig. 6). Pitting corrosion as well as a start of intergranular corrosion developing locally under the deposits, outlining some of the grains (Fig. 5).



Credit HEI Arc, S.Ramseyer.

Fig. 5: SEM image of the metal sample from Fig. 3 (detail), BSE-mode. We observe the presence of numerous inclusions,



Credit HEI Arc, S.Ramseyer.

Fig. 6: EDS spectrum of the inclusions of Fig. 5,

Microstructure	Recrystallized grain structure
First metal element	Al
Other metal elements	Fe

Complementary information

Nothing to report.

Corrosion layers

A very thin and loose oxide film has formed on the metal surface (CP1) and is locally covered by white deposits (D1). Intergranular corrosion has developed under the deposits (Fig. 7). EDS-SEM analysis indicates that the oxide layer rich in Al and O is contaminated with P and Si (area 1 on Fig. 7 and Fig. 8). These elements are even more present at the interface between CM1 and CP1 with Cl and S (area 2 on Fig. 7 and Fig. 9). The concentration of P and Si decreases in CM1 (area 3 on Fig. 7 and Fig. 10) while the concentration of S and Cl increases (Fig. 11). The deposit is mainly constituted of Ca, O, C and Si (probably CaCO3 and SiO2, area 4 on Fig. 7 and Fig. 12).

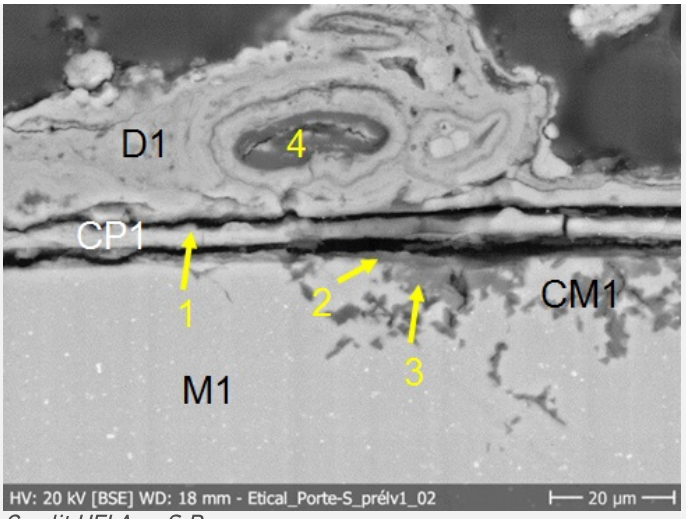


Fig. 7: SEM picture with location of EDS analyses of areas 1 to 4), BSE-mode. From bottom to top: the metal (M1) in light grey, the corroded metal (CM1), CP1 and D1,

Credit HEI Arc, S.Ramseyer.

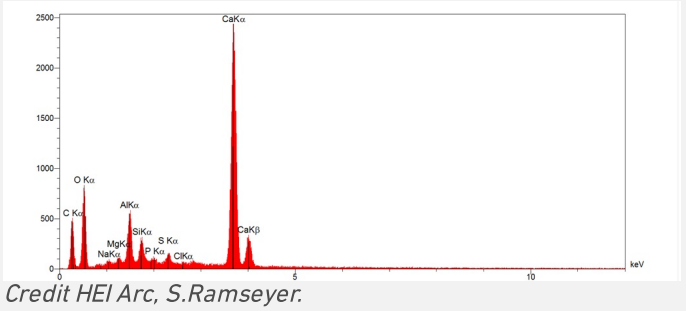


Fig. 8: EDS spectrum of area 1 of Fig. 7,

Credit HEI Arc, S.Ramseyer.

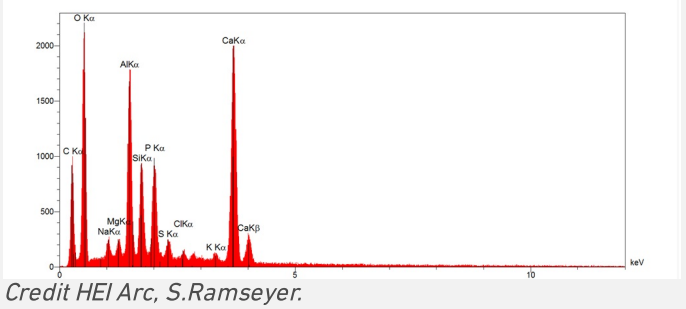


Fig. 9: EDS spectrum of area 2 of Fig. 7,

Credit HEI Arc, S.Ramseyer.

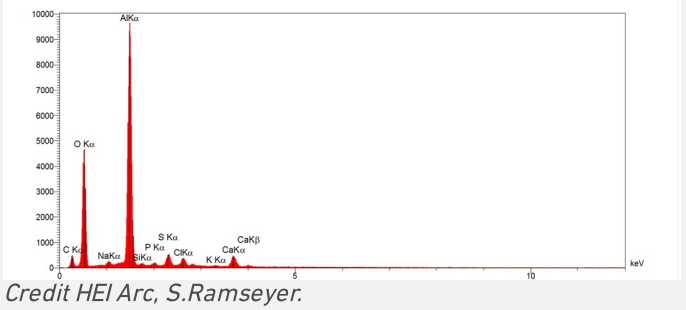
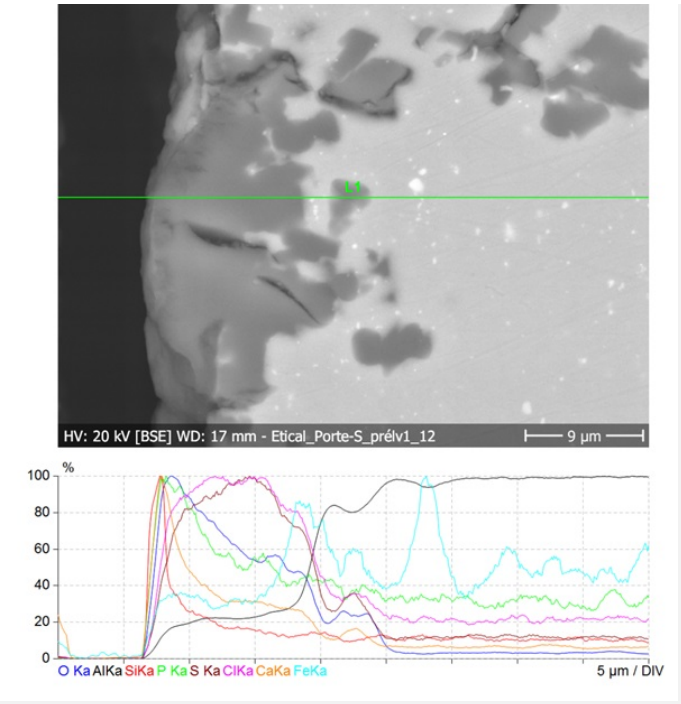


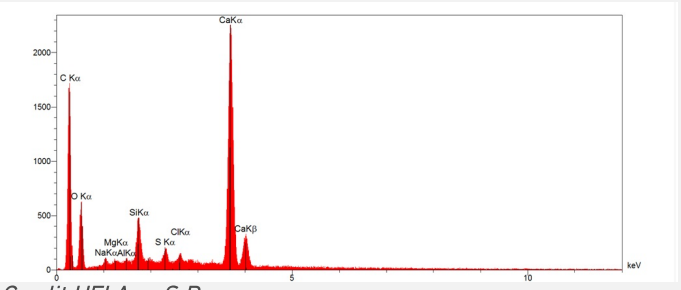
Fig. 10: EDS spectrum of area 3 of Fig. 7,

Credit HEI Arc, S.Ramseyer.



Credit HEI Arc, S.Ramseyer

Fig. 11: EDS Linescan from CM1 to M1,



Credit HEI Arc, S.Ramseyer.

Fig. 12: EDS spectrum of area 4 of Fig. 7,

Corrosion form	Multiform - intergranular
Corrosion type	None

Complementary information

Nothing to report.

MiCorr stratigraphy(ies) – CS

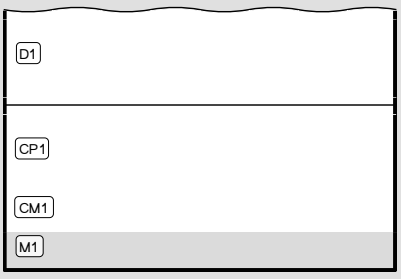


Fig. 4: Stratigraphic representation of the fragment sampled from the towel bar in cross-section using the MiCorr application. The characteristics of the strata are only accessible by clicking on the drawing that redirects you to the search tool by stratigraphy representation. This representation can be compared to Fig. 7, Credit HE-Arc CR, C.Degrigny.

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

Corrected stratigraphic representation: none.

Conclusion

This aluminium alloy has a composition similar to a primary aluminium with an Al content between 99 and 99.8 mass%. The main impurity is Fe forming intermetallic (Al3Fe) inclusions. It is covered by a thin oxide layer (probably aluminium oxide). Pitting corrosion has formed under calcareous white deposits. It seems to develop as intergranular corrosion.

References

References on object and sample

References object

1. Degrigny, C. (2018) Etude, identification des objets en aluminium patrimoniaux et classification de leurs formes de corrosion - projet EtICAL, rapport interne HE-Arc CR.
2. Degrigny, C. and Schröter, J. (2019) Aluminium alloys in Swiss public collections: identification and development of diagnostic tools to assess their condition, in Metal 2019, proceedings of the ICOM-CC Metal WG interim meeting, eds. C. Chemello, L. Brambilla, E. Joseph, Neuchâtel (Switzerland), 408-415.

References sample

3. Degrigny, C. (2018) Etude, identification des objets en aluminium patrimoniaux et classification de leurs formes de corrosion - projet EtICAL, rapport interne HE-Arc CR.

References on analytic methods and interpretation