

# TOWEL BAR – AL ALLOY – MODERN TIMES – FRANCE

<b>Artefact name</b>	Towel bar
<b>Authors</b>	Christian. Degriigny (HE-Arc CR, Neuchâtel, Neuchâtel, Switzerland)
<b>Url</b>	/artefacts/712/

## ∨ The object

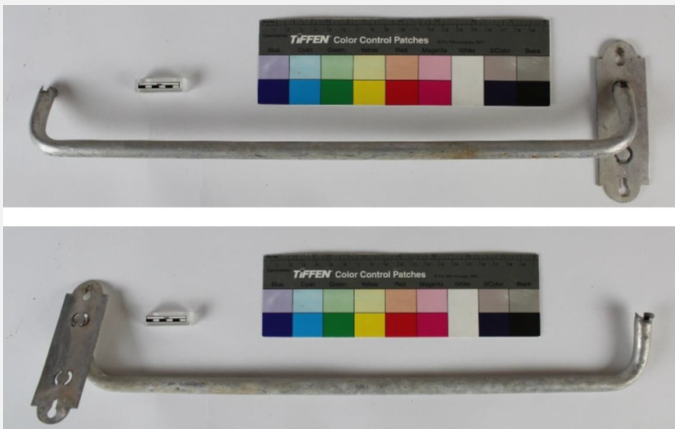


Fig. 1: Front and back sides of a towel bar,

*Credit HE-Arc CR, J.Schröter.*

## ∨ Description and visual observation

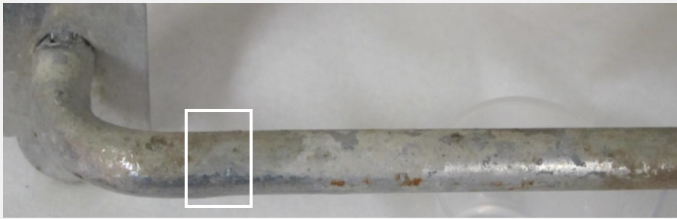
<b>Description of the artefact</b>	Towel bar with traces of use and a broken section (Fig. 1). White deposits have developed on the metal surface. Dimensions: L = 45cm.
<b>Type of artefact</b>	Household implement
<b>Origin</b>	Château de Germolles, Mellecey, Bourgogne, France
<b>Recovering date</b>	Unknown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

<b>Artefact location</b>	Château de Germolles, Mellecey, Bourgogne
<b>Owner</b>	Château de Germolles, Mellecey, Bourgogne
<b>Inv. number</b>	None
<b>Recorded conservation data</b>	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)

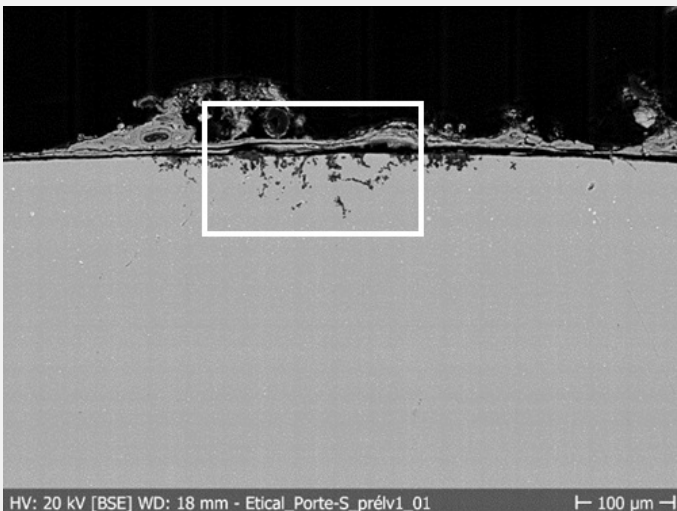


Fig. 3: SEM image of the cross-section of the fragment sampled from the towel bar showing the location of Fig. 5,

HV: 20 kV [BSE] WD: 18 mm - Etical\_Porte-S\_prélev1\_01 100 µm

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

#### Complementary information

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Nothing to report.

#### ∨ Analyses and results

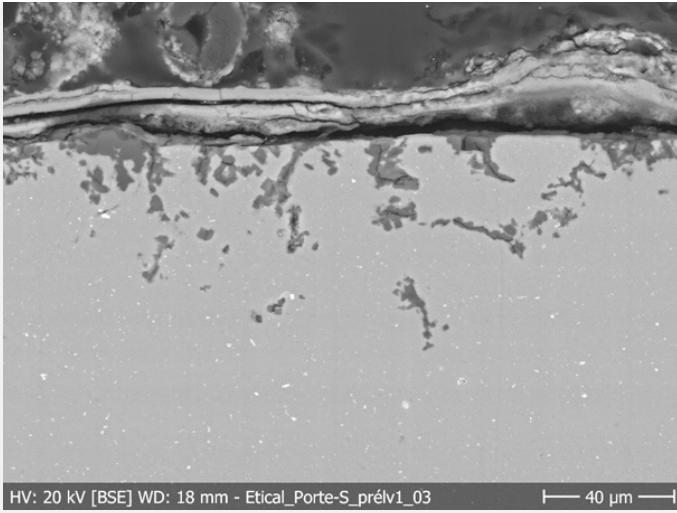
*Analyses performed:*  
Metallography, SEM/EDS.

#### ∨ Non invasive analysis

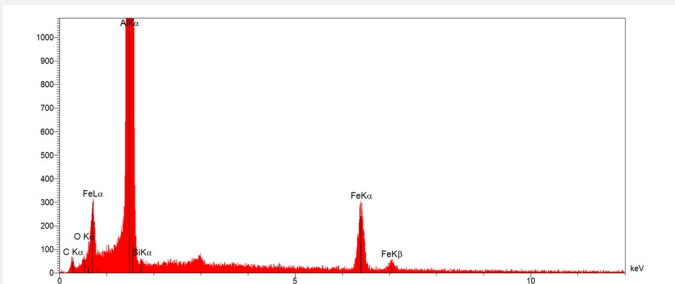
#### ∨ Metal

The metal is a relatively pure aluminium alloy with numerous inclusions (Fig. 5). From their chemical composition they can be interpreted as Al<sub>3</sub>Fe 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).

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.



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

<b>Microstructure</b>	Recrystallized grain structure
<b>First metal element</b>	Al
<b>Other metal elements</b>	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 CaCO<sub>3</sub> and SiO<sub>2</sub>, 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,

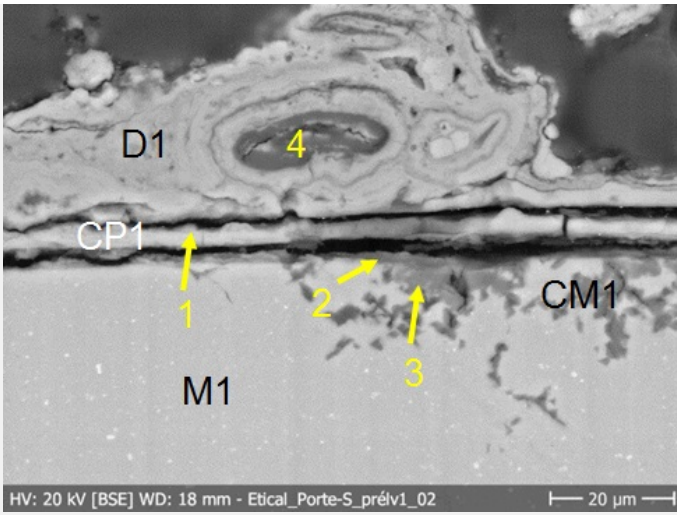


Fig. 8: EDS spectrum of area 1 of Fig. 7,

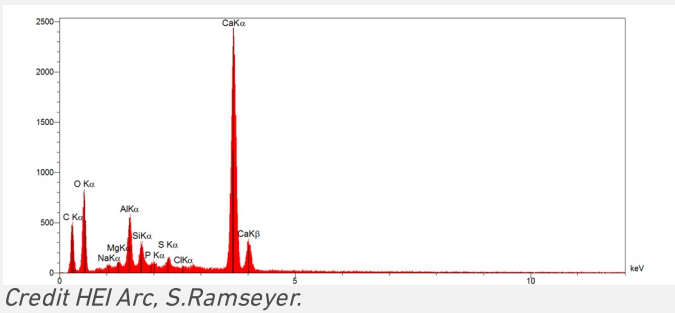


Fig. 9: EDS spectrum of area 2 of Fig. 7,

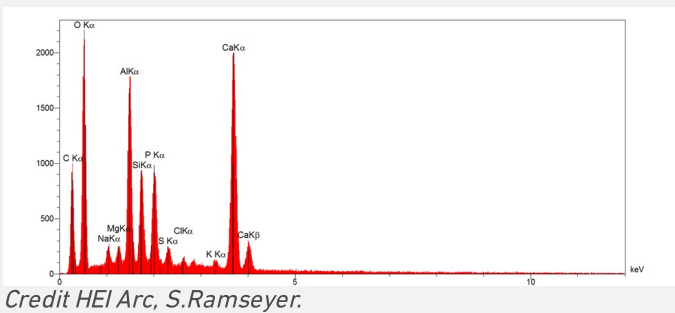


Fig. 10: EDS spectrum of area 3 of Fig. 7,

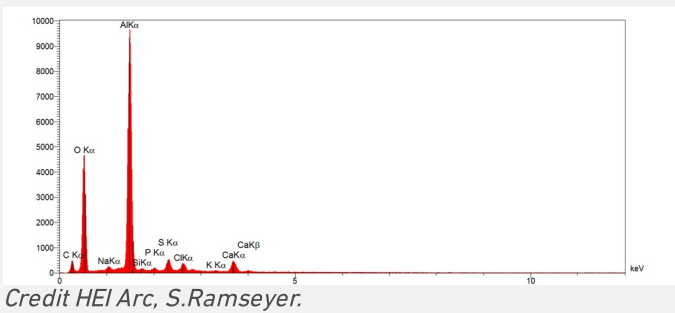
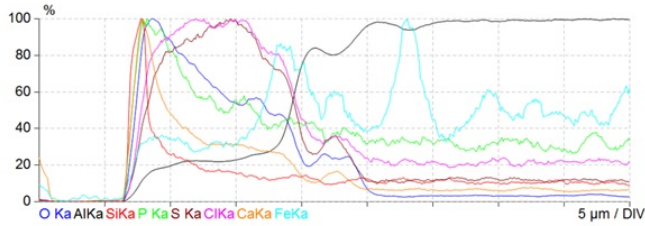
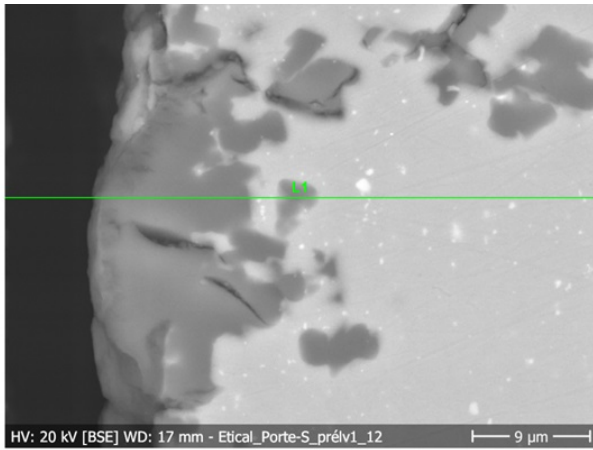
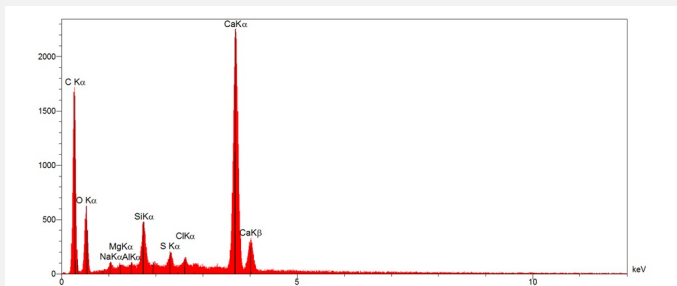


Fig. 11: EDS Linescan from CM1 to M1,



Credit HEI Arc, S.Ramseyer



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

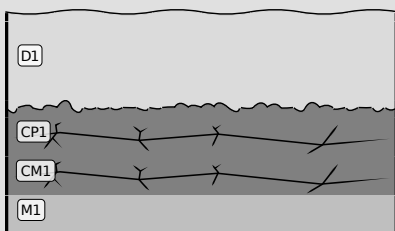


Fig. 4: Stratigraphic representation of the fragment sampled from the towel bar in cross-section (SEM-BSE) using the MiCorr application. The characteristics of the strata are only accessible by clicking on the drawing that redirects you to the search tool by stratigraphy representation. This representation 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 (Al<sub>3</sub>Fe) 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. Degriigny, C. (2018) Etude, identification des objets en aluminium patrimoniaux et classification de leurs formes de corrosion - projet EtICAL, rapport interne HE-Arc CR.
2. Degriigny, 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. Degriigny, 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*