# WP21
# Corrosion of historical and archaeological artefacts

Business meeting

Chair Delphine Neff, CEA, France
Vice-chair David Watkinson, Cardiff University, UK
Secretary Sabrina Grassini, Politecnico Torino, Italy

# History of WP21

- Founded in 2008 by Philippe Dillmann (CNRS) in Nice
  - Special issue in CEST in 2008
- Joint session with atmospheric corrosion in 2009
  - Corrosion of historical statues and monuments

Since 2013

Chair: Delphine Neff
Research scientist at CEA (France)

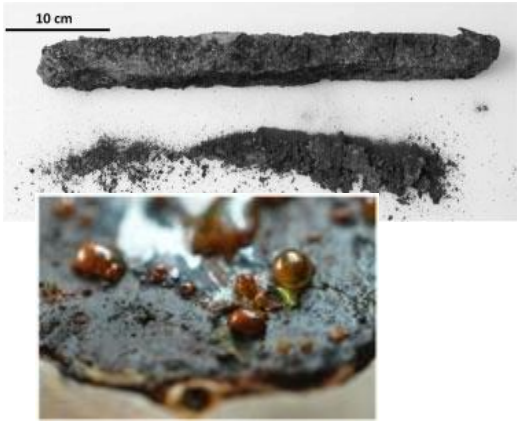
Vice-chair: David Watkinson
Conservation scientist at Cardiff University (UK)

Secretary: Sabrina Grassini
Full professor of Applied Physical Chemistry
at Politecnico di Torino (Italy)

# Concerns: protection of cultural heritage

- UNESCO convention of the 16th November 1972
  - Museum objects
  - Statuary and transport
  - Reinforced buildings

Brunel's ss Great Britain launched 1843 Bristol UK




Roman ingot, 1st century, NIMBE/LAPA ©

Lions Gate, Louvre, Paris, 19th c.
NIMBE/LAPA©

Amiens' cathedral, 15ème siècle, NIMBE/LAPA ©

ONERA wind tunnel, 1930 and 1950, NIMBE/LAPA ©

# Goals

**To control the corrosion of cultural heritage metals**

- A wide range of metals and alloys in differing contexts
  - Fe, Cu, Pb, Al, Zn, Ag, etc
  - Archaeological to present day
  - Composite objects
    - Coatings
    - Glass
    - Plastic
    - Textiles


**Bone handle on medieval knife (Cardiff University)**

Figures 1, 2. A restored Douglas SBD-3 Dauntless which crashed into Lake Michigan during carrier qualification training in October, 1943. Photographs by P. Fix.

**Metal 2010 conference proceedings, ICOM-CC**

# Scientific and technical

**Understanding long term corrosion mechanisms**

- Historic and artistic metals
  - Material-environment interaction
- Archaeological metals
  - Post-excavation corrosion phenomenon
  - Physico-chemical transformation during treatment
  - Interaction between organic compounds, metal and corrosion layers


Medieval door latch post-excavation corrosion (Cardiff University)

# Treatment design and evaluation

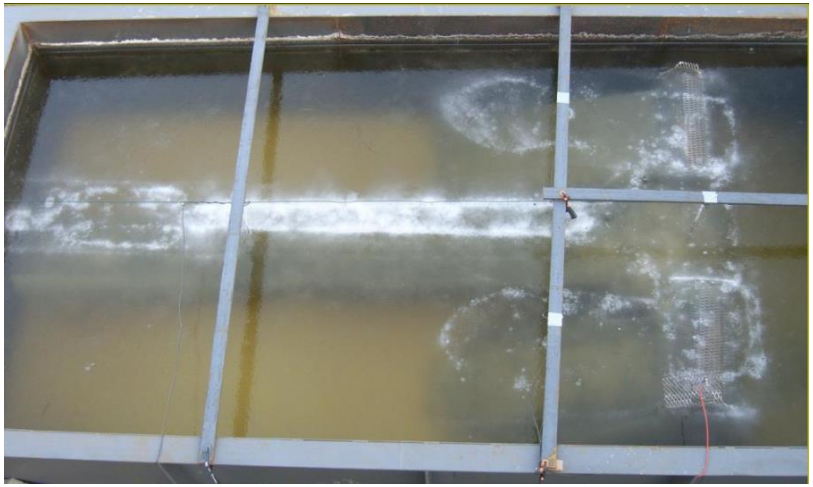
- **Cleaning**
  - Chemical (EDTA, phosphoric acid)
  - Mechanical

Figure 8. A pigeon camera before treatment

Figure 9. A pigeon camera after treatment

**Metal 2010 conference proceedings, ICOM-CC**

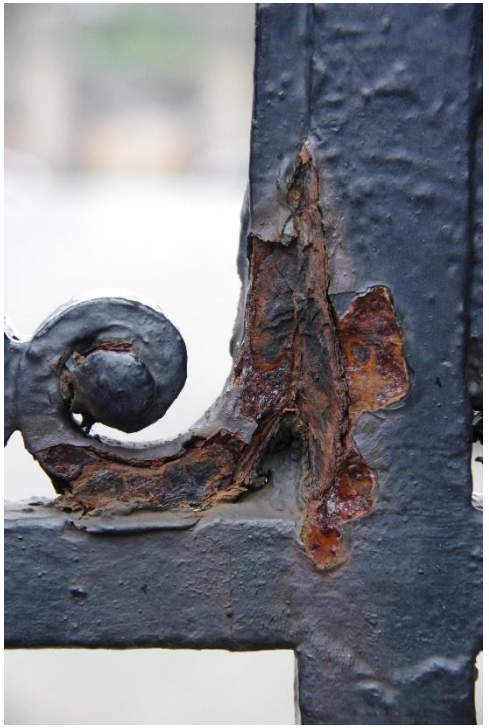
- **Stabilisation**
  - Removal of chlorides



**Anchor in polarized alkaline bath, A-Corros©**

# Protection design and evaluation

- **Coatings**
  - Currently used: microcristalline wax, BTA, Polyacrylic resin
  - Innovative: ecocompatible, bioorigin…
- **Criteria**
  - No change of the aspect of the object
  - Removable/reversible
  - Non toxicity for restorers and conservators (green chemisty)
  - Resistance to long time alteration (eg RH, UV)

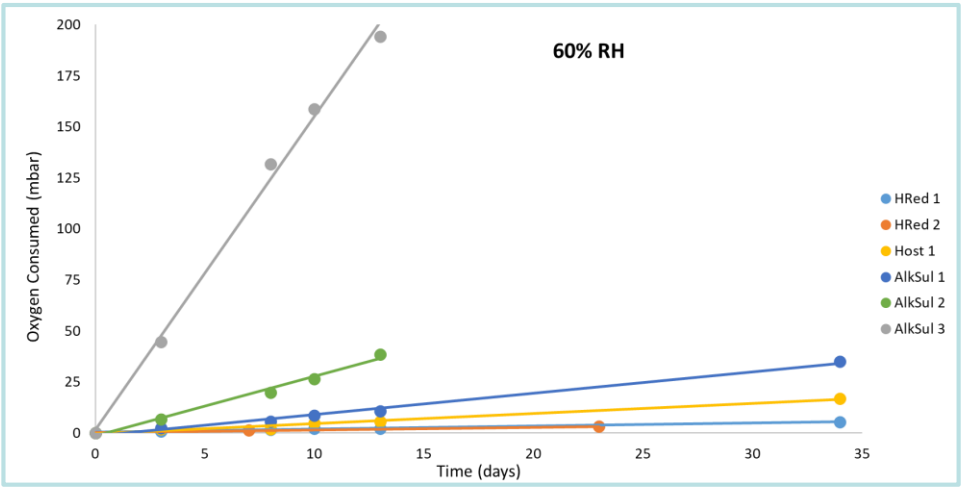


Historic coating - Holyrood Palace Edinburgh

# Sensors and diagnostics

- Non-invasive techniques
  - In-situ monitoring of  corrosion
  - Assessment of conservation methods
- Sensors
  - Temperature and humidity monitoring

Electrochemical measurements on bronze artefacts - POLITO©




Post-treatment stability of iron objects treated by differing desalination methods measured by measuring oxygen consumption at 60% RH (Watkinson et al Metal 2016)

Temperature and RH sensor- POLITO©

# WP21

- Reinforce connections between conservation practitioners, conservation scientists and corrosion scientists
  - Connections with ICOM-CC:
    - International Council of Museum – Committe for Conservation
      - triennal meeting of the ICOM-CC Metals Working Group in 2025, Cardiff, UK
  - Collaboration on national / European projects
    - JPI- **Joint Heritage European Programme**
    - **H2020** special call for cultural heritage
    - Marie Skłodowska-Curie Actions for cultural heritage

# Members: interdisciplinary

- Approximately 70 members from 19 countries
  - Average of 12 oral Eurocorr presentations annually
    - Partly one day registration

- Conservation field: restorers, curators and conservators
- Physico-chemistry: academic and private companies
- Sensors and instrumentation: academic and private companies

# Publications

- EFC Green books 2007 (48) and 2013 (65)
- Special issue 2016 in Materials and Corrosion