Cultural Heritage Metals

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ANCIENT & HISTORIC METALS

• PAST
  - characterisation of constituent materials (microstructure/composition)
  - understanding historic materials and technologies ➔ valorization of Cultural Heritage

• PRESENT
  - assessment of the state of conservation

• FUTURE
  - understanding degradation mechanisms
  - conservation strategies ➔ safeguarding Cultural Heritage
### Alma HeritageScience

**Integrated Research Team**

Dept. SMETEC (METALS SCIENCE, ELECTROCHEMISTRY AND CHEMICAL TECHNIQUES)

- Optical Microscopy
- SEM + EDS/Raman microprobe*
- X-Ray fluorescence*
- X-Ray diffractometry
- Wet chemical analysis
- Stylus profilometry/ Scanning Probe Microscopy (SPM)

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<th>Non-Destructive/micro-destructive/destructive</th>
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<td><strong>Morphology</strong></td>
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<td><strong>Composition</strong> (structural/elemental)</td>
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- Thermal analysis (DSC/DTA/TGA)
- Hardness/impact/tensile testing
- Corrosion testing

* Available through the Service Center of the Faculty of Industrial Chemistry
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<td><strong>Organ pipes: damage mechanisms/conservation</strong></td>
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| • **COLLAPSE EU-Project** ([http://goart.gu.se/collapse/](http://goart.gu.se/collapse/))  
  → Field studies on corroded pipes → corrosion factors  
  → Lab studies: evaluation of protective efficacy |
| • **Traeri 1673 Project** (Fondazione del Monte + Acc. Filarmonica, BO; Organbuilder M.Fratti, MO) |
| **Archæological metals** (Dept. Engineering, UniFe – Dept. Historical Sciences of the  
  Ancient World, UniPi – Museums and Restoration Labs) |
| → understanding historic metals and technologies  
  → identification of fakes and forgeries |
| **Corrosion of outdoor monuments** (Université de Toulouse, CNRS, UMR 5608 TRACES (F);  
  Dept. Industrial Chemistry & Materials, Dept. Physical & Inorganic Chemistry, UniBO) |
| → Lab studies: accelerated ageing  
  → Field studies: outdoor statues (real cases) |
• COLLAPSE (Corrosion of Lead and Lead-Tin Alloys of Organ Pipes in Europe)
Archaeological metals: inscribed bronze vessels from Sumhuram (Southern Oman)

Photo by IMTO (University of Pisa)

Archaeological metals: fakes?
• Outdoor monuments → Lab studies

Accelerated ageing
Sheltered areas: Wet&Dry Test

Unsheltered areas: Dropping Test

Corroded surfaces

Comparison with real samples

Ageing solutions


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