

Editor:
Christian Degrigny
cdegrigny@mcr.edu.mt

Assistant editor:
James Crawford
jamesbcrawford76@yahoo.com.au

METAL *Consn*-info



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BROME C11

Editorial

As with BROME C 10 the number of abstracts in this new issue is rather low. This is no reflection on the Metal Working Group's activity since we are all focussed on contributing to the proceedings of our forthcoming Metal WG interim meeting in Canberra.

This meeting will be the occasion to listen to talks that refer to some of the abstracts which were presented in previous BROME C issues. In this instance, BROME C has particularly played its role by informing you in advance of research projects that are currently in progress and outcomes that will be published in the Metal 2004 proceedings.

For this issue, Malta is again in focus, as is shown in the abstract presenting the "Ecorr-Droplet" monitoring technique as a possible spot test for metal artefacts. Other abstracts refer to an outstanding composite triptych currently under investigation and treatment in Lisbon, a EUREKA project which aim is to produce bronze alloys with better corrosion resistance for outdoor monuments and a dissertation work from a conservation student on the conservation of firearms.

Lastly, we look forward to meeting as many of you as possible at the 2004 Metal WG interim meeting in Canberra, Australia (4-8 October 2004). Please note that the reduced rate "Early Registrations" are available for last payment received by 31 August.

<http://rsc.anu.edu.au/~hallam/Registration%20form.html>

Hoping you will find this new issue as useful and as interesting as ever.

Editor

Christian DEGRIGNY

Assistant editor

James CRAWFORD

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Ongoing research projects



The Nativity Triptych - an interdisciplinary project (IPCR)

The triptych of the Nativity from the collegiate church of "*Nossa Senhora da Oliveira*" belongs to the "*Alberto Sampaio*" Museum in Guimarães. In 2002, the study and conservation treatment of this object were undertaken at the Instituto Português de Conservação e Restauro (IPCR) as part of a series of multidisciplinary research projects on major works of art of our cultural heritage.

The triptych is a reference work of Portuguese goldsmithing art, from the late 14th century, early 15th c. Besides the great exceptionality of the construction and decoration techniques and its dimensions (1330x1735x105mm), it has raised, along the years, many questions related to its historical significance.

The triptych is made of silver, gilded silver, enamelled silver and polychrome silver pieces and sculptures and is mounted on a wooden structure. Dismantling of the triptych was absolutely necessary because of the instability of the wooden structure, which had become very fragile due to insect attack. It no longer performed its function as a support for the silver pieces. All the elements were carefully removed and the whole triptych was taken to pieces, which enabled the study of its construction and the identification of old repairs and restorations.

Characterisation of the alloys was made by X-ray Fluorescence (XRF) and Inductively Coupled Plasma-Mass Spectroscopy (ICP -MS). Pigments from paint layers were identified by XRF and the binding media by Fourier-transformed Infra-Red spectroscopy (FT-IR).

Dismantling of the triptych gave access to the polychrome pieces of the decorated architectural elements, to the reverse of the sculpted elements, various positioning marks, decoration experiments and artist symbols which were unexpected.

A thorough conservation treatment was performed too. It consisted mainly of the removal of corrosion products, dirt and old residual cleaning products. A major problem was the cleaning of the polychromy that can be found on the sculptures and the glass-windows of the architectural ornamentation and which composition is similar to that of old restorations.

The project was an excellent opportunity to answer many art historical and technological questions, to treat an emblematic European medieval work of art and also propose appropriate preventive conservation measures for its future exhibition in the museum.

Contacts: Belmira Maduro and Isabel Tissot (IPCR)

Funding: European Commission

Ongoing research projects



Artistic bronzes: selection of alloys, protective evaluation using conventional and advanced techniques (TecMinho)

The European EUREKA Project E!140 *EUROCARE – Artistic bronzes: selection of alloys, protective evaluation using conventional and advanced techniques*, is being developed by several partners from industry and universities. The project is coordinated by the industry partner, Fonderia Artistica Ventury Arte, from Italy. The other partners of the project are the following: Svuom Praha A. S. (Czech Republic), Mountanuniv. Leoben/Ins. F. Allgemeine und Analytische Chemie (Austria), TecMinho – Associação Universidade Empresa para o Desenvolvimento (Portugal), Cariátides – Produção de Projectos e Eventos Culturais Lda. (Portugal), Tu-Wien/Atomisntitut der Oesterreischen Universitaeten (Austria).

The aim of the project is the development, evaluation of properties and validation of new bronze alloys to be used in the production of replicas and modern sculptures. The results will be the final selection of new materials with improved aesthetic features and greater resistance according to different environmental parameters. The project allows the development of new materials and at the same time provides solutions for the safeguarding of cultural heritage.

TecMinho is a project partner involved in the study of corrosion behaviour of developed alloys by exposure of bronze specimens and small statues in Portuguese sites of specific climates: urban, industrial and marine. The samples' atmospheric exposure is done in accordance with the standard ISO 8565 (Metals and alloys – atmospheric corrosion testing – general requirements for field tests). Two sites were selected with the following characteristics: one is urban with low pollution levels and the other is in an urban/marine place with high industrial pollution levels. TecMinho is also performing the chemical and microstructural characterizations of the alloys used in ancient Portuguese sculptures.

The project started in October 2001 and ends in October 2004.

Contact: Fernando António Portela de Sousa Castro (TecMinho)

Funding: EUREKA funds. European Commission

New research projects

◆ The “E_{corr}-Droplet” monitoring technique: a possible spot test for metal artefacts? (MCR)

The structure of archaeological and historic metal artefacts is known to be quite heterogeneous. Analysing the metal from its surface is a difficult task due either to the presence of different phases or the enrichment of some elements with time, particularly in the case of archaeological artefacts buried in corrosive environments. Spot tests might be performed locally and reveal the presence of one or more elements, but is the amount obtained representative of the composition of the metal core? The presence of large amounts of tin in an archaeological bronze alloy covered with a regular patina is typical, but this concentration does not reflect the real composition of the core material. Furthermore, spot tests are often sensitive to several interfering elements and the chemicals used (acids, chelating agents) for the tests are aggressive towards the compound tested.

For these reasons, metal conservators use a more empirical approach to determine the nature of artefacts. This one is based on their experience of metal artefacts, their date and provenance, the nature and colour of corrosion products and the appearance of the original surface (when it can be found).

Our objective within this project is to study the possibilities of the “E_{corr}-droplet” monitoring technique as a spot test, where E_{corr} stands for corrosion potential. The idea is to locally measure the corrosion potential taken from a metal artefact when a droplet of solution (chosen to be non aggressive towards the material) is deposited on its surface and to monitor it with time. Clean and pure metal (Ag, Cu, Fe, Pb, Sn, Zn, Al) coupons are first considered. Pourbaix diagrams (diagrams E-pH for pure elements) are used to determine the appropriate solution in order to prevent any corrosion (immunity or passivation areas). Once the droplet is applied on the metal coupons, the local potential measured versus a reference electrode is recorded with a voltmeter. The COM terminal of the voltmeter is connected to the reference electrode and the V terminal to the metal coupon. The reading is possible only when the tip of the reference electrode is put in contact with the droplet of solution.

To date tests have been performed with deionised water. These tests gave interesting results that were compared to the plots obtained when the coupons are totally immersed in a large volume of solution. Most of the curves obtained are very different, therefore revealing the important influence of the ratio M/V (Metal surface / Volume of solution) on the behaviour of the metal. The reproducibility of the results obtained was also tested and it seems that the “E_{corr}-droplet” monitoring technique is able to give trends that reflect the composition of the metal.

The second step was the optimisation of the technique. Clean surfaces are rarely found on archaeological and historic artefacts. Obviously only a small area of the metal can be tested. The solution used should therefore have low wetting properties. Furthermore, the solution should remain neutral towards corrosion products in case it comes in contact with them.

The third step is currently being performed. We are studying the influence of alloying elements on the plots E_{corr} vs. time. Several copper based materials of different composition (analysed with SEM/EDS) have been considered. The final step will be the application of the approach to real copper based artefacts of unknown compositions.

The “ E_{corr} -droplet” monitoring technique appears as a simple spot test for metal artefacts that can be considered as non-invasive or in some cases non-destructive. The results obtained show that this technique gives trends and not exact compositions. To get more precise information further experiments are needed and more materials with known compositions have to be tested. An atlas of electrochemical behaviour of different metals in different solutions could therefore be obtained and completed each time a new material is studied.

The “ E_{corr} -droplet” monitoring technique is a tool that conservators can easily use when the considered artefact has an exposed metal area. Since most archaeological and historic artefacts are covered with corrosion layers that often cannot be cleaned the electrochemical behaviour of corrosion layers will have to also be studied.

Contact: Christian Degriigny and Claire Galea (DSL - MCR)

Funding: no external funding

New research project



Problems in the conservation of firearms (SABK)

This project for a diploma thesis at the State Academy of Art and Design discusses elements of the construction of (hand) firearms, their historic military care, the history of their conservation, and their restoration. Typical damage is often inherent in the construction itself as a result of the inflexible way of assembling the iron barrel with the wooden stock. Due to the hygroscopicity and acidity of the wood, metal parts of the weapon can be affected.

Damage is also caused externally by inappropriate climatic conditions or earlier treatments. Considering the combination of iron, wood and copper alloys, a summary of common methods for preserving firearms is given. Traditional treatments have to be reflected in light of modern conservation ethics. The suitability of commercial products of unknown composition in use in conservation is tested by experiments carried out on test samples. Often, these products have been found to be harmful, e.g. producing green copper carboxylates.

Publications on the conservation of firearms are scarce. In particular, the treatment of decorative iron objects in combination with wood and other materials needs further research.

Contact: Ursula Sattler (SABK)

Funding: no external funds

General information

Websites

- **Cost Action G8: Non destructive analysis and testing of museum objects.**
<http://srs.dl.ac.uk/arch/cost-g8>. Abstracts and booklets from previous workshops can be downloaded.

- **Cost Action G7: Artwork conservation by laser**
<http://alpha1.infim.ro/cost>

- **Working Group Metals ICOM Committee for Conservation**
<http://icom-cc.icom.museum/WG/Metals/>

- **CAMEO**: website containing chemical, physical, visual, and analytical information on over 10,000 historic and contemporary materials used in the conservation, preservation, and production of artistic, architectural, and archaeological materials
http://www.mfa.org/_cameo/frontend/

- **IR and Raman for cultural heritage**
<http://www.irug.org/default.asp>

- **LabS-TECH network**
<http://www.chm.unipg.it/chimgen/LabS-TECH.html>

- **ARTECH network**
http://server.icvbc.cnr.it/progetti_futuri/progetto_artech.htm

Future seminars and conference

- **Workshop on "Heritage Conservation/Corrosion of Archaeological Objects"** (14 September 2004, Nice, France) within the EUROCORR 2004 congress (12-16 September 2004). Organised by Philippe Dillmann (dillmann@noos.fr), CEA & Gérard Béranger, UTC. Papers presented at this workshop will be published in the Proceedings of EUROCORR 2004 (CD-ROM).

- **Workshop "Bigstuff: Care of large technology object"** (29 September – 1 October 2004, Canberra, Australia), organised by the Australian War Memorial. Contact person Alison Wain (alison.wain@awm.gov.au)

- **Metal 2004, Interim meeting of the ICOM-CC Metal Working Group** (04-08 October 2004, Canberra, Australia). The meeting will take place at the National Museum of Australia. For more information consult <http://rsc.anu.edu.au/~hallam/metals2004.html>

- **Elaborer une méthodologie de réflexion et d'appréhension de l'objet métallique avant toute intervention de conservation-restauration** (26 novembre 2004, Paris, France) conference organised by the French section of the ICOM-CC Metal WG. Deadline to submit an abstract: 10 October 2004. Contact persons Marie-Anne Loeper-Attia (philattia@wanadoo.fr) and Annick Texier (annick.texier@culture.gouv.fr)

- **Material Issues in Art and Archaeology VII** (29 November – 03 December 2004, Hynes Convention Centre and Sheraton Boston Hotel, Boston MA), organised by the Materials Research Society. For more information consult www.mrs.org/meetings/fall2004/

- **Conservation and Management of Outdoor Bronze Monuments** (2-4 December 2004, Genoa, Italy). Organised by ISMAR, ICR, SPSADL, SRBACL and CG. For more information contact Paola Letardi (paola.letardi@ismar.cnr.it) or visit the following website: <http://www.bmc2004.org>
- **2nd Congress Latinoamerican on metal conservation** (25-28 July 2005, Rio de Janeiro, Brazil), organised by the Museum of Astronomy and Sciences (MAST) and the Latinoamerican Group of Metal Conservation (GLRM). For more information contact Marcus Granato (marcus@mast.br) or Johanna M. Theile (jtheile@abello.dic.uchile.cl)

Abbreviations and acronyms

DEM-LM-UM: Departamento de Engenharia Mecânica- Laboratório de Metalurgia- Universidade do Minho
DSL: Diagnostic Science Laboratories
EDS: Energy Dispersive Spectroscopy
FTIR: Fourier Transformed Infrared
ICP-MS : Inductively Coupled Plasma – Mass Spectroscopy
IPCR : Instituto Português de Conservação e Restauro
MCR: Malta Centre for Restoration
SABKS: Staatliche Akademie der Bildenden Künste Stuttgart
SEM: Scanning Electron Microscope
XRF: X-ray Fluorescence

Contacts

Christian Degrigny / MCR (cdegrigny@mcr.edu.mt)
Belmira Maduro / IPCR (belmiramadura@hotmail.com)
Fernando António Portela de Sousa Castro / DEM-LM-UM (fcastro@dem.uminho.pt)
Ursula Sattler / SABKS (ursulasattler@gmx.de)
Isabel Tissot / IPCR (isabeltissot@hotmail.com)

National correspondents

Argentina: Blanca Rosales, Buenos Aires (brosales@sion.com) & Miguel Crespo, Buenos Aires (cloclo@infovia.com.ar)
Australia: David Hallam, Canberra (d.hallam@nma.gov.au)
Belgium: Patrick Storme, Antwerp (patrick.storme@skynet.be) & Gilberte Dewanckel, Brussels (gilberte.dewanckel@kikirpa.be)
Brazil: Luiz Roberto Martins de Miranda, Rio de Janeiro (miranda@metalmat.ufrj.br)
Bulgaria: Petia Penkova, Sofia (petiapenkova@yahoo.com)
Chile: Johanna Theile, Santiago de Chile (jtheile@abello.dic.uchile.cl)
Czech Republic: Alena Silhova, Prague (silhova@arup.cas.cz)
Denmark: Karen Stemmann Petersen, Copenhagen (karen.stemmann.petersen@natmus.dk)
France: Jean-Bernard Memet, Nantes (arcantique.recherche@wanadoo.fr) & Régis Bertholon, Paris (bertholon7@aol.com)
Germany: Gerhard Eggert, Stuttgart (gerhard.eggert@abk-stuttgart.de)
Greece: Vasilike Argyropoulos, Athens (Bessie@teiath.gr)
Italy: Paola Letardi, Genova (paola.letardi@ismar.cnr.it)
The Netherlands: Bart Ankersmit, Amsterdam (bart.ankersmit@icn.nl)

Norway: Birgit Wilster-Hansen, Oslo (b.w.hansen@ukm.uio.no)
Portugal: Isabel Tissot, Lisbon (isabeltissot@hotmail.com)
Romania: Dorin Barbu, Sibiu (dorin.barbu@brukenthalmuseum.ro)
Russian Federation: Andrey Chulin, St Petersburg (andrey_chulin@yahoo.com)
South Africa: Jaco Boshoff, Cape Town, (jboshoff@iziko.org.za)
Spain: Emilio Cano, Madrid (ecano@cenim.csic.es)
Sweden: Helena Strandberg, Göteborg (helena.s@hem.utfors.se)
Switzerland: Valentin Boissonnas, La Chaux-de-Fonds (v.boissonnas@heaa-ne.ch)
United Kingdom: David Thickett, London (david.Thickett@english-heritage.org.uk)
USA: Paul Mardikian, Charleston (mardikian@hunley.org)
