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## Bulletin of the Research On METal Conservation



Metals Working Group

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# BROMECC28

### Editorial

BROMECC 28 marks the initiation of a series of developments aimed at increasing dissemination of BROMECC and the ICOM-CC Metals Working Group's (WG) research activities.

This issue sees the first time BROMECC is published in both French and Spanish versions. And for this we welcome BROMECC's Francophone and Hispanophone Coeditors and Translators. So, acknowledgements and thanks to Michel Bouchard, Nathalie Richard and Emilio Cano for committing their time to increase BROMECC's international and multilingual circulation. At this early stage, interest from all contributing abstract authors, in this expanded multilingual approach, has been demonstrated by their submission of abstracts in French or Spanish, not English. These abstracts have subsequently been translated by the new editorial team for simultaneous publishing in mirror issues of BROMECC 28. We wait to see if, in turn, a broader readership finds this development of interest and use. We encourage feedback from the authors & readership to help evaluate the value of this initiative.

The method of BROMECC publication notification is set to change from this issue onwards. Most recently, the publication notification of BROMECC issues has been forwarded by email via the Working Group's National Contact persons. A review of this system has concluded that, for now, a direct email notification will be of greater efficiency. This is especially relevant for Working Group countries (50%) that do not have National Contact persons to perform this vital task for WG members. The BROMECC publication notification email will be sent by the WG Co-ordinator, David Hallam, and include hyperlinks for downloading BROMECC from a series of websites (notably [www.icom-cc.org](http://www.icom-cc.org), [www.metalsconservationinfomation.wetpaint.com](http://www.metalsconservationinfomation.wetpaint.com) & <http://tech.groups.yahoo.com/group/Metals-WG-ICOM-CC/>).

Research abstract contributions in this issue include a conclusion to Monnier's PhD thesis that used historic wrought iron in France to assist modelling long term atmospheric corrosion of mild steel. Meanwhile, a new project has been launched in Belgium that aims to facilitate the accessibility of well informed and practiced electrolytic conservation techniques. Lastly, in Spain, focus on discriminating between original manufactured surfaces and corrosion induced alterations of Pre-Roman iron artefacts of the Iberian Peninsula has been drawn with a call for project collaboration and also with an announcement for a meeting on the subject. Another conference announcement made in this issue is for the 3rd Latin American Metal Conservation Congress, Mexico. A reminder for abstract submissions is also noted for ICOM-CC's Metal 2010: Triennial Metals Conservation Conference, United States of America.

### Editor

James CRAWFORD

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## Call for collaboration



### Ferric surfaces of Pre-Roman weapons of the Iberian Peninsula: characterization, deterioration and treatment. (DFA-AFA)<sup>1</sup>

While paleometallurgical studies concerning surface finishing of copper based alloys have earned great attention in the last years – highlighting many ancient objects covered by different techniques, such as tinning, gilding and artificial patination – this has not been the case for iron based objects. Indeed, the vulnerability of iron to long term corrosion and the easy destruction of its surface finishing might explain our scarce knowledge of the colouring, patination or darkening treatments that probably covered many iron artefacts; as they did on copper or silver based ones. In this scenario, the recognition of artificial patinas or magnetite coverings on protohistoric iron weapons from the Iberian Peninsula is, so far, an exceptional fact in the assortment of surface treatments of ancient metallurgical works.

Our investigations in this area are based on studies carried out during conservation treatments on a range of weapons from the Iberian Peninsula's protohistory. Nevertheless, the first identification of compact magnetite coverings was reported in a work by Coghlan<sup>2</sup> who presented the analysis of a falcata and a dagger stored in the Ashmolean Museum of Oxford. From our work, we have recognized artificial patinas on several techno-typological variants developed on the Iberian Peninsula in the centuries preceding Roman rule, showing up what seems to be a usual treatment of ferric surfaces. Additionally, we have identified a second variant of covering, so far identified only in one of the metallurgical groups, consisting of two enveloping layers of bronze and magnetite.

The existence of these coverings raises some important questions about the technology and conservation that should be addressed. The problem of their identification, conservation and restoration requires an interdisciplinary effort to adapt and improve an appropriate methodology for analysis and intervention. Unquestionably, many of these surface treatments have been unnoticed in studies about weapons from the Iberian Peninsula, and in many cases are irretrievably lost given the vulnerability of the surface to corrosion after excavation and to the unsuitability of some treatments applied. These coverings allow a new look into the study of paleocorrosion on archaeological iron, the problem of the localization and identification of the original surface or the recognition of natural versus anthropogenic magnetite.

With the aim of reviewing the state of the question and promoting an appropriate and coordinated methodological development to tackle its study, an interdisciplinary meeting will be held in Vitoria-Gasteiz (Spain), 23 May 2009 (see General information, Future seminars and conferences, p. 6).

**Contact:** Jesús Alonso López (DFA-AFA) ([omdartegi@orange.es](mailto:omdartegi@orange.es))

**Funding:** No external funding

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<sup>1</sup> Translated into English by E. Cano, B. Rosales & J. Crawford. Original language version submitted by author in Spanish; refer to BROMECS 28 Spanish version.

<sup>2</sup> COGHLAN, H.N. (1956-57), Etruscan and Spanish swords of Iron, *Sibirium* 3. pp. 167-171

## New research project



Development of electrolytic treatment protocols to guide conservator-restorers' choices.  
(AHA-KASK)<sup>3</sup>

The metal restoration/conservation department of the University College of Conservation and Restoration of Antwerp has set up a research project on the electrolytic techniques used for treatment of corroded metal. The main purpose of this project is to make these technologies actual and accessible, and therefore more widely used by conservators and no longer confined to a few specialized laboratories.

There are already many treated objects with electrolytic techniques, which led to important publications on this subject. From these experiences, the most favourable procedures will be selected; together with unwanted effects and problems which often occur.

The cleaning treatments, locally or by total immersion, of silver, gilt silver and silvered copper alloys will mainly be considered. Local treatments should benefit composite objects such as metal wires in textiles or very sensitive objects such as daguerreotypes.

This work began in January 2009 and will continue until December 2010. The results are planned to be published in different conservation journals and will be part of a workshop intended for professional metal conservators.

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**Funding:** Artesis Hogeschool Antwerpen, Koninklijke Academie voor Schone Kunsten

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<sup>3</sup> Translated into English by N. Richard, M. Bouchard & J. Crawford. Original language version submitted by authors in French; refer to BROMECE 28 French version.

## Finalised research project

 Indoor atmospheric corrosion of historical ferrous alloys. System characterization, mechanisms and modelling discussion. (ICMPE LPS)<sup>4</sup>

Understanding mechanisms of long term indoor atmospheric corrosion of ferrous alloys is relevant to several fields. The large-scale use of iron in medieval architecture poses, in particular, the question about the long term evolution of this material under these conditions. Meanwhile, the storage period during the management of the nuclear waste produces the need for modelling the behaviour of mild steels (the material under consideration for nuclear waste over-containers) over several hundred years. A common approach was developed for these two problems and was applied to the metal reinforcement chains of the cathedral of Amiens (15<sup>th</sup> century). Long term indoor atmospheric corrosion is controlled by a humidification-drying cycle, during which the oxidized layer plays a role.

The first methodology consisted of finely characterizing the corrosion system, using complementary techniques, from the macroscopic to the nanometric scale. Emphasis was particularly made on micro-focused techniques of structural analysis ( $\mu$ -Raman,  $\mu$ -XRD and  $\mu$ -XAS), which make it possible to determine the nature of the phases present, their localization and their proportions. From the surrounding environment the corrosion system comprised the layer of corrosion products and the metal substrate. The corrosion product layers consisted of a nanocrystallized matrix of goethite containing small quantities of lepidocrocite and akaganéite; these two phases being mainly located in the external layer. Moreover, light marbling was observed within the matrix. Sometimes composed of maghemite, this marbling was mainly made up of ferrihydrite/feroxyhite and might have been connected, or not, with the metal substrate. The second methodology involved specific experiments designed to test certain hypotheses about mechanisms related to the humidification-drying cycle. In this way, the oxygen reduction sites were localized in an unsaturated medium and several cases were evidenced as a function of the morphology of the corrosion product layer. Additionally, experiments in an electrochemical cell coupled with structural analysis techniques allowed *in situ* monitoring of the reduction of reference models. This coupling demonstrated the influence of reduction and the medium's pH on the nature of the phases formed.

Overall, these results proposed a series of mechanisms for long term indoor atmospheric corrosion of iron that involved the morphology of corrosion product layers and properties of the involved phases. These various hypotheses were integrated into a proposal for a diagnosis method on the stability of old ferrous systems, while they also made it possible to discuss the existing models of atmospheric corrosion.

Research related to this abstract was first presented, in part, in BROME C 20: "Characterisation of corrosion layers formed during long-term exposure to atmospheric corrosion: application to the study of the reinforcing chain at Amiens cathedral" and also subsequently at Metal '07: "The long term indoor atmospheric corrosion of iron: rust layer characterisation". The above abstract finalises this PhD thesis of the University Paris Est that is available, in French, online (<http://tel.archives-ouvertes.fr/tel-00369510/fr/>).

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**Funding :** CNRS & CEA

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<sup>4</sup> Translated into English by J. Crawford, N. Richard & M. Bouchard. Original language version submitted by author in French; refer to BROME C 28 French version.

## Abbreviations and acronyms

**AHA-KASK:** Artesis Hogeschool Antwerpen, Koninklijke Academie voor Schone Kunsten

**CEA:** Commissariat à l'Énergie Atomique

**CNRS:** Centre National de la Recherche Scientifique

**DFA-AFA:** Diputación Foral de Alava-Arabako Foru Aldundia

**ICMPE:** Institut de Chimie et des Matériaux Paris-Est

**LPS:** Laboratoire Pierre Süe

**Raman:** Raman spectroscopy

**XAS:** X-ray absorption spectroscopy

**XRD:** X-ray diffractometry

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## **General information**

### Future seminars and conferences

**New**

**Ferric surfaces in protohistoric weapons of the Iberian Peninsula: characterization, deterioration and treatment. State of the question and methodological proposals** (23 May, 2009, Restoration Service of the Diputación Foral de Alava-Arabako Foru Aldundia, Vitoria-Gasteiz, Spain). An interdisciplinary meeting aimed at professionals working in the study and treatment of ancient weapons, including specialists in historic and archaeological analysis, materials analysis and conservation and restoration. Contact person: Paloma López Sebastián ([plopezsebastian@alava.net](mailto:plopezsebastian@alava.net)). For more information: <http://armasmagnetita.wordpress.com>

**New**

**Incredible Industry: Preserving the Evidence of Industrial Society** (24-27 May, 2009, National Museum of Denmark, Copenhagen). The Nordic Association of Conservators (NKF) Electronic registration <http://kongres09.nkf-dk.dk>.

- **Archaeological Iron Conservation Colloquium** (24-26 June, 2010, Stuttgart, Germany). Held at the State Academy of Art and Design Stuttgart, in collaboration with AIAE "Archaeological Iron After Excavation", sub-WG of ICOM-CC Metals. For more information please contact Gerhard Eggert ([gerhard.eggert@abk-stuttgart.de](mailto:gerhard.eggert@abk-stuttgart.de)).

**New**

**3rd Latin American Metal Conservation Congress** (1-4 September, 2009, National School of Conservation, Restoration & Museography – INAH "Manuel del Castillo Negrete", Mexico City, Mexico). Deadlines: Abstract submission – 17 April, Paper acceptance notification – 29 May & Paper submission – 17 July. Congress Organization: Pilar Tapia, Jannen Contreras, Johanna Maria Theile. More information: [clrmetales3@gmail.com](mailto:clrmetales3@gmail.com).

- **ENAMEL 2010** 3<sup>rd</sup> Experts meeting on Enamel on Metals Conservation (8-9 October, 2010, Frick Collection, New York, United States of America). Organised by ENAMEL, sub-WG of the WGs "Metals" and "Glass & Ceramics". For more information see <http://www.icom-cc.org/52/event/?id=68>.

- **Metal 2010: Triennial Metals Conservation Conference** (11-15 October, 2010, Charleston, South Carolina, United States of America). Metals Working Group of ICOM Committee for Conservation. Extended abstract (400-600 words) electronic submission deadline: 1 June 2009 ([ICOMCC.Metal2010@gmail.com](mailto:ICOMCC.Metal2010@gmail.com)). Publication timeline: <http://www.timetoast.com/timelines/4880> Further information: <http://www.icom-cc.org/51/news/?id=22>.

#### Websites

- **ANDRA**: Agence Nationale pour la Gestion des Déchets RadioActifs. The following documents can be ordered for free from this website: *Analogues archéologiques et corrosion* (French) and *Prediction of Long Term Corrosion Behaviour in Nuclear Waste Systems* (English) ([http://www.andra.fr/interne.php3?publi=publication&id\\_rubrique=82&p=produit&id=5](http://www.andra.fr/interne.php3?publi=publication&id_rubrique=82&p=produit&id=5)).

- **ARTECH network**: Network facilitating the access of conservation professionals to different investigation techniques for Cultural Heritage artefacts (<http://www.eu-artech.org/>).

- **BigStuff 2004**: Care of Large Technology Objects (<http://www.awm.gov.au/events/conference/bigstuff/index.asp>).

- **CAMEO**: 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://cameo.mfa.org/>).

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

- **Cost Action G8: Non-destructive analysis and testing of museum objects**: Abstracts and booklets from previous workshops can be downloaded as well as announcements of past activities (Short Term Scientific Missions deadlines, training schools...) (<http://srs.dl.ac.uk/arch/cost-g8/>).

- **Cost Action D42: ENVIART**: Chemical Interactions between Cultural Artefacts and Indoor Environment. Register (free) to access all information (<http://www.echn.net/enviart/>).

- **e-Preservation Science**: Online publication of papers in conservation science (<http://www.morana-rtd.com/e-preservation-science/>).

- **European Cultural Heritage Network**: European network of professionals interested in the conservation of Cultural Heritage (<http://www.echn.net/>).

- **ICOMAM**: International Committee of Museums and Collections of Arms and Military History: (<http://www.klm-mra.be/icomam/>).

- **ICOM-CC Metals Working Group**: (<http://www.icom-cc.org/31/working-groups/metals/>). This site is for all official ICOM-CC Metals WG activities, forums, news, file downloads and information. The co-ordinator can email members from this site once members have registered on-line as a member of the Metals WG. Public access to this site is limited.

- **Industrial artifacts review:** Industrial design and the role of art and photography in promoting cultural heritage (<http://industrialartifactsreview.com/>).
- **Infrared and Raman for cultural heritage:** (<http://www.irug.org/default.asp>).
- **Laboratoire Pierre Sue:** LPS PhD thesis related to the alteration of archaeological artefacts can be downloaded in French. Follow the link to “Archéomatériaux et prévision de l’altération” (<http://www-drecam.cea.fr/lps/>).
- **LabS-TECH network:** (<http://www.chm.unipg.it/chimgen/LabS-TECH.html>).
- **METALCons-info:** Metals Conservation Information (<http://metalsconservationinfomation.wetpaint.com/>) is where the old METALCons-info site is being moved and redeveloped. This is a wiki based site, which means it can be grown by contributions from “writers” - i.e. you. Its power depends on how willing you are to use it. Each week it sends a summary of activity to members – so sign up! It is currently publicly visible, but this may change with any unwanted activity.
- **M2ADL:** Microchemistry and Microscopy Art Diagnostic Laboratory ([http://www.tecore.unibo.it/html/Lab\\_Microscopia/M2ADL/](http://www.tecore.unibo.it/html/Lab_Microscopia/M2ADL/)).
- **New York Conservation Foundation:** (<http://www.nycf.org/>).
- **PROMET:** A 3.5 year European 6th Framework funded project (21 partners from 11 countries around the Mediterranean basin) that developed conservation strategies for outstanding metals collections throughout the Mediterranean (<http://www.promet.org.gr>).
- **Restauración Metal Sur America:** (<http://www.restauraciondemetales.cl/>).
- **TEL:** PhDs on line (<http://tel.ccsd.cnrs.fr/>).
- **Yahoo Groups Metals Conservation:** (<http://tech.groups.yahoo.com/group/Metals-WG-ICOM-CC/>). A discussion group for all who are interested in Metals Conservation. Join in and make this a Metals Cons-Dist List.

#### National Contacts for the ICOM-CC Metals Working Group

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