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METAL*Consn*-info

Metal working group

Bulletin of the Research On MEtal Conservation

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BROMEC 7

Editorial

You will find only a few number of abstracts in this Summer issue of our BROMEC bulletin but most of them have been sent by conservation students and recently graduated conservators who play an active role in developing new ideas in the field. If Summer is quiet, next Autumn will be more busy since two important conferences on Metal conservation have recently been advertised. The first one (**Metals: investigation and conservation**) is organised by the Asociación de Restauradores sin Fronteras and will take place in Brussels (Belgium) in October. The second one (**Metallic Alloys, Research and Conservation**) is organised by the Conservation and Restoration Laboratory of the Heritage Sciences and Techniques' Department of the University of Porto (Portugal) and will take place in November. I will attend both of them as the coordinator of our Working Group to give talks on our activities.

In this issue you will find too an abstract presenting the COST Action G8, a European programme networking art historians, archaeologists, conservators and natural scientists interested in *Non-Destructive analysis and testing of museum artefacts*. You have the possibility to benefit from this programme by registering to the **Special Interest Group** and applying to a **Short Term Scientific Mission**.

In the first 2003 newsletter of the Metal WG we announced that some members of the Metal WG volunteered to coordinate work on some research topics related to our four research themes. **Valentin Boissonnas** (v.boissonnas@heaa-ne.ch), Swiss correspondent for BROMEC and lecturer at the Haute Ecole d´Arts Appliqués, HEAA-CRAE, La Chaux-de-Fonds has proposed to coordinate activities on Preventive conservation of artefacts (archaeological) from site to storage (theme 1). **Dr Vasilike Argyropoulos** (Bessie@teiath.gr), Greek correspondent for BROMEC and assistant professor at TEI, Athens will coordinate activities on the conservation of ethnographic artefacts (theme 4). **Alice Boccia Paterakis** (alicepaterakis@yahoo.com), member of the ICOM-CC Directory Board and Head of conservation at Agora Excavation (Athens), will coordinate activities on the preventive conservation of artefacts in Museum collections (theme 1). I will myself coordinate activities on the use of electrolytic techniques in metal conservation (theme 3).

I invite you to contact the four of us if you want to participate to the activities of these research topics or just to be informed on them. It is planned that in the year coming these "leaders" will actively network members of the Metal WG especially interested in the 4 topics to prepare a roundtable during the next Interim meeting in Canberra. Other Metal WG members will be regularly informed about the activities of each research topic through BROMEC and the newsletters.

We advertised in BROMEC 6 the seminar organised last April by Johanna Theile, on the situation of metal conservation in Latin America (**1st Latino-American Congress on metal conservation** (7-11 April 2003, Museum of Contemporary Art, Santiago de Chile)). Johanna had compiled the abstracts in Spanish and was looking for some volunteers to translate them in English and French. Silvia Pain, conservator at the Service Archéologique Départemental des Yvelines, Versailles, France has kindly offered to translate the abstracts in French. I took care of the translation from French to English. All abstracts can now be found on the following website http://www.restauraciondemetales.cl/ (for English and French translations go to "noticias"). Furthermore you will find the last issue of BROMEC (6 & 7 there).

The Editor
Christian DEGRIGNY

Contents

Ongoing research projects

 Cost Action G8: Non-Destructive analysis and Testing of Museum Objects (***EC***)

COST (http://cost.cordis.lu/src/home.cfm) is an intergovernmental framework for European cooperation in the field of scientific and technical research, allowing the coordination on a European level of nationally funded research projects.

The main objective of the COST Action G8 is to achieve a better preservation and conservation of our cultural heritage by increasing the knowledge in museum objects through non-destructive analysis and testing and by improving the synergy between art historians, archaeologists, conservators and natural scientists. A 50:50% balance is aimed at between the activities of both groups, which should result in an improved interest to problems related to the study, preservation and conservation of valuable museum collections.

The expected benefits are twofold. First the capability of answering questions related to museum objects, which cannot be readily solved now, will be enhanced. This includes the exchange of knowledge of the available non-destructive techniques and the requirements to perform investigations on valuable or unique objects. In addition museums and similar institutes will get easy access to universities and research facilities that provide such techniques. Second the accumulation of data and knowledge for potential databases and means of comparison will be established. This information will be readily available via an Internet forum, which will allow a better and more efficient use for the preservation and conservation of art objects.

COST G8 covers the following scientific fields: Technology and authentication (WG1), Origin/provenance (including trade routes and supply zones) (WG2), Degradation processes, corrosion, weathering (WG3), Preservation and Conservation (WG4) and Development of analysis procedures (WG5). The various scientific fields are represented in the action by the corresponding working groups (WG1 to WG5).

The scientific activities of the COST G8 Action include organizing short-term scientific missions to train scientists of both groups in the others field as well as to transfer practical experience between the European countries. Furthermore regular meetings in the form of workshops are organized to exchange obtained knowledge in a broader group, to discuss new themes and to enhance the interest and give the possibility of new collaborations.

The COST Action G8 started on December 21, 2000 and has a duration of four years. Twenty countries are participating in the management committee. For more information on the scientific program, see http://srs.dl.ac.uk/arch/cost-g8/. Of special interest is the Special Interest Group (SIG) database.

Contacts: Annemie Adriaens (chairperson) & Christian Degrigny (coordinator of WG3)
Funding: COST - European Commission

Ongoing research projects

Mass treatment of archaeological iron artefacts using alkaline sulphite ***(TPM)***

The urban excavations in the Turku area in South-western Finland have produced large amounts of iron artefacts in recent years. These have been building up in temporary storage spaces waiting to be treated, because the stabilisation method used up to now, immersion in boiling water followed by wax impregnation, is too slow, labour demanding and possibly ineffective for large amounts of objects. Therefore a method for mass treatment was sought. Alkaline sulphite treatment proved to be suitable for our purposes.

After searching the literature and asking around, a set-up suitable for our needs and facilities was constructed. It consists of stainless steel treatment vats with air-tight lids for the alkaline sulphite solution, which are immersed in heated water baths to obtain the temperature needed (60-70^{o}C). Most of the literature suggests the solution to be agitated, but we decided not to do it. This is because we were told that the temperature alone would cause enough movement to mix the solution. We accepted this gladly, because any stirring devices would have been difficult to install in our containers. For the monitoring of desalination process, chloride ion concentrations of the treatment solutions are measured by potentiometric titration. Desalination is considered to be completed when the chloride level stays at around 20 ppm.

The first objects treated by this method are from the Rettiginrinne site, which was excavated in 2000-2001. The excavation produced several hundreds of small iron artefacts, ranging from ordinary nails and knives to buckles and other items. They were of mixed quality and their state of preservation varied quite a lot: some were wet and others dry, part of them had porous, powdery and thick corrosion layers but others were very hard and dense. Some mechanical cleaning was done before desalination, but in almost every case some corrosion layers remained at this point. The objects were then packed individually in perforated bags and a great number of them were placed in one vat. During the treatment, quite high concentrations of chlorides were detected, and it took several months and many baths to finish the desalination. After desalination more cleaning was conducted. In many cases the corrosion layers had softened in the alkaline baths. This made the cleaning easier, but very thorough cleaning was done only in very few most important cases – the primary objective of this procedure was to stabilise objects for storage, not to prepare them for display. Therefore the question about final sealant is troubling us at the moment. It is clear for the cleaned ones, they got a wax coating, but the ones retaining corrosion products need further thinking and observations about the post-treatment behaviour of objects. They will be stored in dry conditions, but whether the chloride extraction has been thorough enough for the stability to last without protecting sealant remains to be seen.

The case of Rettiginrinne has been the first experience of this treatment in Turku. The results are promising so far – a lot of chlorides could be extracted, the mat dark final appearance is acceptable and the method is quite practical. Still, the procedure will be optimised in the future to obtain more thorough stabilisation and to get things work more routinely. The first improvement will be to take all the objects wet and start the treatment immediately after the excavation. Secondly, the objects will be categorised in smaller groups of similar objects. In this first case it was not done. Therefore the objects in the baths were quite heterogeneous in their type and state of preservation. This probably means different chloride extraction rates, and might cause difficulties in determining the end point of the treatment. Another modification would probably be smaller number of artefacts per tank to make sure that stabilisation is achieved for all items.

Contacts: Eero Ehanti & Mats Sjöström (Turku Provincial Museum)
Funding: no external funding

New research project

Monitoring the corrosion on museum silver and silvered artefacts (*C2RMF*)

Since 1997 a Working Group (WG) has been set up within C2RMF to improve the conservation of silver artefacts in museum. This WG has developed a methodology to identify the nature and the causes of the corrosion of silver collections. This methodology is based on the characterization of corrosion products on metal artefacts as well as metal coupons and sensors exposed nearby to the museum atmosphere.

Indoor tarnishing of silver or silvered collections is a general corrosion process. The presence of electrolyte on the metal surface depends on the relative humidity (RH) of the air and the pollutants in the atmosphere (sulphur dioxide (SO_2), nitrogen oxides (NO_x), chlorinated compounds, and dust). This phenomena depends then on the local environment of the artefacts which is related to the nature of the exhibition materials (wood, textiles, glues), the quality of the air, the cleaning products used, etc…

Furthermore the chemical composition of the alloys, the manufacture and the surface of artefacts play a role in corrosion mechanisms. The different steps of the artefacts restoration have an influence too on their future conservation as confirmed by their study.

The Research Department within C2RMF is equipped with non-destructive analytical techniques used to characterise corrosion products without any sampling, among which techniques are the Rutherford backscattering spectrometry (RBS) in air that gives the amount of light elements (O, S, Cl) in the corroded layer, the grazing incidence X-ray diffraction (GI-XRD) that gives the crystallographic structure of silver corrosion products such as the Acanthite (Ag_2S) and the Chlorargyrite (AgCl) and the scanning electron microscope (SEM) used for topographic observation.

The Preventive Conservation Department within C2RMF studies the influence of different parameters such as the temperature, the RH, the nature and the amount of pollutants, the professional activity, the public, the lightening, the air filtration on silver sensors. The origin of the pollution and the corrosion rate can be determined through the analysis of these sensors. Thanks to these techniques it is possible to detect any change in the quality of the environment, to identify the emission sources of pollutants and to predict the alteration of collections by the estimation of the corrosion intensity in medium and long term.

- M. Dubus, M. Aucouturier, J-C. Dran, B. Moignard, L. Pichon, J. Salomon : Copper and silver corrosion monitoring in museums – a preliminary study, Exposure 2001, International Conference on Corrosion, Conservation in situ, on display and in storage, Hildesheim, Germany, 777-10th November 2001
- M. Dubus, M. Aucouturier, Atmospheric corrosion monitoring of silver in museums, Indoor Air Quality 5th International Conference, University of East Anglia, 28-29th April 2003, http://iaq.dk/iap.htm
- M. Dubus, A. Dion, B. Massiot, La conservation des œuvres en argent au musée du Louvre, Compte-rendu intermédiaire, C2RMF, 23 Juin 2003

Contact: Michel Dubus (C2RMF)
Funding: no external funding

New research project

 Corrosion Phenomena on a 17th century box of board games (***SABK***)

A box of board games dating from the 17th century was examined regarding techniques, damage and earlier restoration/conservation treatments for a diploma dissertation at the SABK. The box is made of a wooden body with decorative elements of gilded silver, enamel paintings, champleve enamel, jasper and wooden inlays.

The techniques are discussed in reference to historic data. The enamel paintings are very early examples of this technique. The damage observed on the champleve enamel shows a corrosion process that leads to massive enamel loss due to growing copper salts that press the enamel out of joint. The copper compound is identical to a corrosion product on Egyptian bronzes[1] similar to chalconatronite. Most likely, it is due to the action of sodium carbonate formed by enamel corrosion on the copper support. Three-dimensional silver sulphide growth on the silver elements is caused by a wax-like putty containing sulphur introduced during an earlier restoration.

A restoration protocol was developed and conservation treatments carried out to stop the progress of corrosion and to prepare the object for exhibition.

[1] D.A.Scott, Copper and Bronzes in Art: Corrosion, Colorant and Conservation, Conservation Resources International, LLC, 2002 p. 301, 446.

Contact: Elisabeth Hustedt-Martens (SABK)
Funding: No external funding

New research project

 Dissolution of iron corrosion layers by acid under cathodic protection (***ICN /RM***)

Mechanical and chemical techniques are commonly used to remove corrosion products on historical iron artefacts. If the corrosion products are located in a position which is difficult to reach these methods are not always feasible. The treatment of a large entrance iron gate of the Rijksmuseum (Amsterdam) was the occasion to study this conservation issue and to design an appropriate cleaning protocol.

In industrial processes acid baths are used to remove iron corrosion layers. Acids not only dissolve corrosion products but they cause too the electrochemical dissolution of iron. This dissolution is not a problem in industry but in conservation this attack is unacceptable due to the loss of the original surface. The idea rose to avoid the electrochemical dissolution of iron in acid through cathodic protection. This technique prevents metal corrosion in a humid environment by supplying electrons to the metal (reduction process).

During a five months research project performed as a final thesis of the Netherlands Institute for Cultural Heritage different experiments were conducted. We demonstrated that cathodic protection of iron in acid is possible practically. Corroded samples were successfully cleaned but it was found that the position of the anode has an important influence on the protection effect.

Further research is needed to safely carry out this treatment on real artefacts. The position of the anode has to be defined more properly. The addition of a corrosion inhibitor is another option. The ethical aspects of the treatment must be considered as well since the treatment leads to a complete removal of the corrosion layers which is not always desirable.

This treatment is promising in the case of engraved surfaces where corrosion trapped in deeper parts is difficult to remove mechanically but it should be avoided for composite artefacts where organic materials is associated to iron due to the low resistance of organic materials in acids.

Contact: Ilonne de Groot (ICN)
Funding : Rijksmuseum

Calls for collaboration

 Recent bibliography on conservation of aluminium alloys artefacts **(first reminder)**

Aluminium artefacts are typically found in ethnographic and industrial collections. Although there are many people working on them we do not find much publication on their conservation.

Some members from USA contacted me recently to have an up-dated bibliography on this topic. Although I worked in the field for some time, my subject was very limited since it concerned marine remains.

Any outcome from recent projects related to the examination, conservation or protection of these artefacts will be much appreciated.

Contact: Christian Degrigny

Calls for collaboration

 Conservation of aluminium alloys artefacts

The interest in conservation of historical or cultural aluminium alloys artefacts is a rather recent trend.

The development of usage of aluminium and aluminium alloys dates from the beginning of the twentieth century. Basically aluminium artefacts are found in industrial, ethnographic and military collections, from separate pieces of decorative incrustation to aircraft engines.

These artefacts are often composite metals containing both aluminium and copper or / and iron alloys, etc… Due to the difficulty to separate these materials, new conservation treatments have to be designed.

I have been working for some time on aluminium alloys and I would be willing to collaborate on research projects related to the cleaning of corrosion layers on aluminium alloys, the formation of an anticorrosive protective coating and the application of conservation strategies to ethnographic, industrial and military collections. In more details:

1. for cleaning of aluminium and aluminium alloys, industrial methods such as laser cleaning, ultrasonic cleaning could be used. To remove locally active corrosion, micro-technologies could be designed.
2. for protective coatings, we could test anticorrosive oxidizing, corrosion inhibitors in comparison to more traditional coatings - waxen and lacquer.
3. these approaches could be tested and optimised on ethnographic, industrial and military collections.

Contact: Andrey Chulin

General information

- Future seminars and conferences

  - **"Preservation of Heritage Artifacts" Conference** (14-17 September 2003, Ottawa, Canada). Organised by the National Association of Corrosion Engineers (NACE) Northern Area Eastern. Deadline for abstracts is March 1, 2003 and for completed papers is June 1, 2003. For more information contact Lyndsie Selwyn, CCI, Ottawa (lyndsie_selwyn@pch.gc.ca)
  - **Archaeometallurgy in Europe** (24-26 September 2003, Milan Italy). For more information consult http://www.aimnet.it/archaeo.htm
  - **Metals: investigation and conservation** (23-26 October 2003, Brussels, Belgium). Organised by the Asociación de Restauradores sin Fronteras. For more information contact C. Bermejo-Cejudo, IRPA, Brussels (jc.bermejo@restauradores-sinfronteras.org)
  - **Metallic Alloys, Research and Conservation** (13-14 November 2003, Porto, Portugal). Organised by the Conservation and Restoration Laboratory of the Heritage Sciences and Techniques' Department of the University of Porto. For more information contact Paula Menino Homem (pmeninoh@clix.pt)
  - **Benefits of Non-Destructive Analytical Techniques to the Knowledge of Museum Objects** (08-10 January 2004, Bighi, Kalkara, Malta). Seminar organised by COST Action G8, the Malta Centre for Restoration and the Institute of Masonry and Construction Research (University of Malta). For more information contact Christian Degrigny, DSL, MCR, Kalkara (cdegrigny@mcr.edu.mt).

- Abbreviations and acronyms

  COST: European Cooperation in the field of Scientific and Technical Research
  C2RMF: Centre de Recherche et de Restauration des Musées de France
  EC: European Commission
  ICN: Instituut Collectie Nederland
  MCR: Malta Centre for Restoration
  RBS: Rutherford backscattering Spectrometry
  SABK: SABK State Academy of Art and Design Stuttgart
  SEM: Scanning Electron Microscope
  TPM: Turku Provincial Museum
  XRD: X-ray diffraction

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