

**FORUM FOR CONSERVATORS-RESTORERS 2014****ABSTRACTS****The investigation and conservation of the St. Wenceslaus mail armor****Dušan Perlík, Alena Havlínová, Milena Bravermanová, Petr Ledvina**

From 2009, investigation of the condition of St. Wenceslas unique mail armor was carried out resulting in its conservation and new adjustments in 2012. Part of the investigation was a detailed documentation of the state of the mail armor. The corrosion damage of its iron rings was examined and radiography examination of the complete armor was conducted. The nondestructive determination of elemental composition of the materials used was carried out by the X-ray fluorescence analysis. We also discussed the advantages and limitations of the supporting mesh on which the mail was settled. Used polyamide is not entirely suitable material. The conservation consisted of gentle cleaning of the armor and subsequent treatment of the surface by microcrystalline wax. During conservation the showcase was redesigned in which the mail armor is presented in the long-term to fulfill better the rigorous climatic conditions for its exhibition.

**Investigation and restoration of a bronze ring from the Iron Age using advanced 3D technologies****Jiří Kmošek, Šárka Msallamová**

This paper addresses the investigation and restoration of an archaeological object – a bronze ring, using modern 3D technologies for the reconstruction interventions. The object was found as part of the burial grave equipment from the Iron Age site at Červený Hrádek in western Bohemia. The combination of mechanical stress and corrosion damage (bronze disease) led to the disintegration of the object to a number of fragments. The object investigation was aimed at determining the corrosion damage, chemical and phase composition of the metallic material, technological aspects of the production technology and identification of previous conservation interventions on the object. Modern 3D technologies were used in the shape reconstruction of the bronze ring fragments. Individual fragments were scanned through optical 3D scanning technology with high resolution into digital form and virtually reconstructed to its original shape. The obtained 3D model served as the basis for the creation of supporting construction through 3D printing technology to semi-transparent polymer material. Individual fragments of the ring were reconstructed on a printed template. This work describes available 3D technologies that are commonly used in foreign institutions for the purpose of professional documentation, presentation and restoration of various historical monuments.

## **The effect of temperature and 1,2,3-benzotriazole on the diffusion removal of chlorides from corrosion products of copper alloys**

**Šárka Msallamová, Petra Korandová**

The presence of chlorides in the corrosion products in objects from copper and copper alloys is one of the causes of their corrosive damage. The goal of this work is to assess the effect temperature on the rate of diffusion of chlorides in water. This work also assesses the possibility of using the 1,2,3-benzotriazole (BTA) adsorption inhibitor in desalination bath. Samples of copper and brass sheets and other brass grave goods were used in the experiment. The corrosion rate of copper sheets was determined using the method of mass defect. The concentration of chlorides in water extracts was determined with the FIA LAB 2000 spectrophotometer. The corrosion products colour change in the samples was evaluated by the Datacolor TM colorimeter. The inhibitory effect of the 1,2,3- benzotriazole (BTA) in the desalination bath is apparent from the measured values of the corrosion rate. At the desalination bath increased temperature also increased the rate of diffusion of chlorides into a solution. The presence of an inhibitor in the desalination bath significantly reduced the diffusion of chlorides into a solution and led to a very strong change in the colour of the original patina.

## **Microemulsions for cleaning – options for its composition and properties**

**Petr Kotlík**

The paper provides basic information about the microemulsion systems suitable for the removal of organic compounds from the surface of historical objects materials. The most important criteria for the selection of individual components (mainly surfactant and organic solvents) are summarized and the overview of the published composition of some microemulsion systems used in the cleaning of monuments is given.

## **Effect of relative humidity on the cracking of gels of modified silicic acid ester consolidants**

**Barbora Benetková, Monika Slavíková, Adéla Peterová, Petr Kotlík**

Silicic acid esters (classed among alcoxysilanes) are the most frequently used consolidants applied to building materials in historical buildings. If exposed to water, SiO<sub>2</sub> gel is formed which strengthens the material under treatment. Although this gel consolidates a deteriorated monument, it cracks over the time, which reduces its strengthening capacity. In our previous works the effect of addition of SiO<sub>2</sub> nanoparticles in the silicic acid ester consolidant was studied to see whether the cracking of the gel could be suppressed by this approach. Modified consolidants were prepared, that, under laboratory conditions, occurred to

crack less than the unmodified consolidant. To find out if these modified consolidants can be used for exteriors we had some samples of both the modified and unmodified consolidants exposed to different levels of relative humidity at 20 °C for 11 weeks. After this time, the samples of consolidant gels were compared and the effect of different relative humidity on the degree of cracking was discussed.

### **Effect of the oxygen content and the relative humidity on the pyrite and marcasite**

**Michal Novák, Petr Kotlík**

Pyrite and marcasite decay is one of the most serious problems when taking care of mineralogical and paleontological collections. It is generally acknowledged that the rate of decay is influenced by many factors, such as relative humidity, bacterial activity, presence of oxygen and other chemical substances etc. To prevent the decay, it is important to identify the relevance of each of these factors and to determine the most detrimental ones and – hopefully – the most easily controllable in the long term. This work examines the influence of oxygen content and of relative humidity on pyrite decay. It was found that the influence of increased oxygen content on the rate of pyrite decay is significantly higher than that of increased relative humidity.

### **New possibilities for historic plaster consolidation**

**Renate Tišlová, Luboš Machačko**

The basic issue associated with the restoration of historic plasters is the selection of appropriate consolidant which would have a sufficient strengthening effect and would meet the general criteria for compatibility at the same time. This consolidation of historic and highly deteriorated lime plasters was widely studied in the interior of the Litice Castle, Czech Republic. Heavily weathered plasters represent a model example of the damage that requires specific solutions relating to the selection of suitable consolidant and its application technology. To address the issues related to the consolidation of these plasters areas of very poor lime plaster were prepared in the laboratory, which should simulate the in-situ condition of plasters. The surface in these areas was adjusted to look like the original places with a rough finish. Two types of consolidants have been used for the plaster consolidation - both comply with the material compatibility; lime nanosuspensions and esters of silica acid. The assessment objective was to set appropriate conditions for their application, to define the best concentration, to compare the effect of those two consolidants, and to discuss the potential of lime nano-suspensions for the reinforcement of heavily degraded historical plasters and compare it with the effect of silicic acid esters. The comparison was based on the assessment of the application and the depth of penetration. The mechanical properties before and after consolidation were measured; the degree of strengthening was defined by measuring the material cohesion and its capillarity. The visual evaluation of the surface colour changes and microscopic assessment of the consolidants behaviour in the tested materials were also part of the procedure.

**Investigation and analysis of Baroque ceramic sculpture sketches****Alexandra Kloužková, Radka Šefců, Tomáš Trojek, Ivana Turková**

The creation of a sculptural work as such is preceded by several stages, one of them being a sculptural sketch known as bozzetto. Masters of sculpture workshops in the Baroque period, such as Giovanni Guiliiani, Georg Raphael Donner, Matthias Rauchmiller, Matthias Bernhard Braun, Ignaz Franz and Ignaz Michael Platzers created many first-quality models that had become valued artefacts themselves. In 2013 a research was carried out into ceramic sculptural models in the collections of the National Gallery in Prague. The aim of the investigation was the characterization of the employed ceramic materials, determination of the firing temperatures and analysis of the surface polychrome. To study the chemical and mineralogical composition, non-invasive techniques were used, but also, techniques applied to micro-samples, particularly optical microscopy, X-ray fluorescence and diffraction analysis, and elemental SEM/EDS analysis. The results obtained from the application of complementary analytical techniques allowed qualitative evaluation of the applied ceramic materials and significantly broadened the knowledge of production processes, of the history and specific methods used in the Baroque sculptural workshops.

**Silvered glass from the Museum of Bohemian Forest in Sušice – history and technology of production, decorative techniques and conservation****Eva Rydlová**

An effort to replace the hazardous process of making tin-amalgam mirrors with another technology resulted in the invention of chemical silvering. In this process silver is reduced by aldehydes from a solution prepared with silver nitrate. In the mid-nineteenth century chemical silvering was widely used for double-walled glass. By the late nineteenth century the production of fine luxury silvered pieces was replaced by inexpensive glassware made for the provincial market. Among the 75 objects chosen for conservation, this more common type of glass prevailed. The objects were dirty, with missing plugs and damaged silver layers. The cold paintings frequently used to decorate such cheap silvered glass were often partly damaged or almost entirely lost. Some pieces were broken with complex losses to the glass. The surfaces of all the objects were cleaned and the paintings were stabilized. The losses were filled with painted thin-walled epoxy fillings using embedded Japanese paper and textile mesh. Finally the hollows were sealed in a dry environment using both the original and the new plugs made of sheet lead, zinc and glass.

**Application of dust particles on model samples of paper and testing of the mechanical cleaning efficiency****Marie Benešová**

Dust particles sticking to the surface of paper are highly hygroscopic, which is a possible cause of activation of microbiological attack. They consist of salts, soot, grease from imperfectly burnt hydrocarbon fuel, and other substances present at emissions. Pollen spores, and other biological matters, are other integral components. Salts

of acids cause acidic hydrolysis of cellulose, and transient metals have catalytic effect on all degradation processes. Effective removal of dust particles is, therefore, an integral part of restorer's procedure. Various techniques were examined of application of dust particles on a paper, so that they mostly corresponded to real samples. Subsequently, various materials used for mechanical cleaning in conservation practice were tested: air flow, vacuuming, and mechanical cleaning using a brush. Measurement of color changes in the CIELab system was used for evaluation of mechanical cleaning efficiency. For comparison of extent of paper surface damages, the samples were observed under microscope, and by the help of confocal microscope, 3D scans of surfaces were evaluated. Real dust obtained by mechanical cleaning of books in the NL depositories using a vacuum cleaner was used for application. Two methods were selected for application of dust; application by fractioning, and application by a roller. As a paper pad, Whatman No. 1 chromatographic paper was used.

#### **Identification of inorganic substances in damaged roof trusses of the Malostranska mostecka tower** **Václava Antušková, Irena Kučerová**

Wood degradation is usually due to biological attack. However wood deterioration could also be caused by the presence of inorganic compounds, resulting in defibration of wood surface. Single wood fibers are fragile and easily broken. This type of deterioration was observed on the roof structure of the Malostranska mostecka věž tower in Prague. Samples taken from the roof structure were observed using light and electron microscopy. Their infrared spectra were collected and pH values of water extracts were measured. Inorganic compounds in wood samples were identified using atomic absorption spectroscopy (AAS) and X-ray diffraction (XRD). Results suggest that roof structure of Malostranska mostecka věž was treated with inorganic fire retardants containing ammonium and with preservatives containing sodium chloride, copper and zinc. Presence of this inorganic compounds caused delamination of wood surface.

#### **Copy of a Slovakian ninera as a museum object** **Anna Danihelová, Dominik Spišiak**

This work describes a museum exhibit called "ninera" in Slovakian located in the Podtatranske muzeum museum in Poprad. The aim of the work described in this paper was to document the knowledge and to create drawings for making a copy of the ninera. One of the interesting elements of the instrument and the specific design solution that makes the ninera exceptional is the use of infinite bow and thus making a continuous tone and harmony. For this purpose, a terminology of the different parts of the instrument was proposed, which is now gradually introduced into practice when individual parts of the instrument are produced. The work also describes the history of the instrument, its historical development and its practical use.

### **Modular method of painting´s cleaning in practice**

**Igor Fogaš, Kateřina Svobodová**

Restoring of Joža Uprka´s art piece „Jizda kralů“ - one of the most famous Joža Uprka´s art piece belongs to the collection of Moravian Gallery in Brno for more than one century. Complicated history of the piece affected it´s condition, there were a lot of defects in the painting, surface was very dirty and except that, the piece has been repaired several times with a problematic result. After the presentation made on the recent Uprka´s retrospective in The National Gallery in Prague, the more detailed research of painting´s condition and subsequently restoring work could finally begin. The research of canvas support [Turkova 2011] and material research by method of non-invasive and invasive measuring ran through to identificate pigments and binding agent [Hradilova - Hradil 2013]. Use of modular method of painting´s cleaning, which contributes to minimize risks of damaging original [Fogaš - Zmydlena - Kůra 2013]. The part of intervention was even restoring of original fancy frame with a special construction and a piece´s comeback to the condition known by its contemporaries [Kluka 2013].

### **Cleaning of silver Great Moravian jewelry by potentiostatic reduction**

**Estelle Ottenwelter**

Potentiostatic reduction was used to clean Great Moravian jewelry from Lumbe´s garden cemetery, Prague Castle. These artefacts were covered by a thin tarnish layer. Polarization plots, recorded directly on selected objects, and SEM/EDX analysis helped to identify corrosion products present in the tarnish layer and to set adequate parameters for treatment. Objects were successfully cleaned by electrolytic reduction at a constant potential in a sodium nitrate solution.

### **Today´s standards for microclimates in museums**

**Alena Selucká, Petr Jakubec**

Recommendations concerning microclimate parameters for the storage of museum objects have been recently revised and reassessed. One of the new standards is the European standard EN 15757 that brings a new perspective on the implementation of the internal environment control based on a concept called “historical climate”. This paper summarizes the practical experience with the application of this standard in a microclimate analysis of a particular museum depository in the Technical Museum in Brno, Czech Republic, including other assessed areas. The paper provides options for the evaluation of seasonal cycles and short-term relative humidity and temperature fluctuations in relation to the risk of damage to museum collections.

## **Preventive conservation – requirements, standards, and possibilities in 2014**

**Ivana Kopecká**

On the basis of special literature and conferences held in recent years on preventive conservation the paper briefly introduces the history of standards for indoor environment parameters for long-term preservation of cultural heritage and introduces the trends and results of recent research in this field (low energy depositories, flicker fusion light, "microfading" test).

## **Polish conservators-restorers in Zhovkva Castle, Ukraine**

**Sylwia Pawełkowicz, Petr Svora, Pavla Bauerová, Michał Witkowski**

Zhovkva Castle (Western Ukraine) together with the city of Zhovka was founded in 1597 by Stanislaw Zolkiewski. At the end of the 17th century, his great-grandson Jan Sobieski, the future king of Poland, made the Zhovkva Castle his official residence. In 2011, Polish conservators restorers discovered wall paintings that presumably are contemporary to Zolkiewski. Accompanied by thorough material studies (OM, petrographic study, SEM/EDS/WDS, FTIR,  $\mu$ -XRD, nano-LC-ESI-Q-TOF), a detailed digital documentation, including the orthophotographs, and some emergency conservation works have been performed. The painter's palette consisted of calcite, white lead, massicot, red lead, vermilion, malachite and an expensive smalt with high concentration of cobalt. In blue areas, casein binder was identified, while in the red ones – egg and animal glue. To date the wall-paintings, a 14C method was applied and a stylistic analysis has been performed. Art historical and archival studies helped to interpret properly the results of instrumental analysis.

## **Gemstones in restoration**

**Radek Hanuš, Zdeněk Srb**

The aim of this contribution is to point out the original work applicable in common production and particularly restoration practice of jewelry and other items containing gemstones. Jewelers often solve the relatively difficult problems whether it is safe to put particular jewel containing gemstone into the "fire" (i.e. whether soldering is possible in close proximity of the gemstone). Similar question is about the use of ultrasound sonication for cleaning the jewel or application of various acids, hydroxides and other chemicals. In the experimental part, samples were prepared from gemstones commonly utilized in jewelry. Tested gemstones were in the form of plates about 1.5 mm thick and the material was chosen to contain typical inclusions with typical abundance and distribution to simulate a real stone as much as possible. The samples for testing in particular chemicals, ultrasound sonication or "fire" were then cut off the plates.

## **Restoration of garden decorative pottery owned by Albrecht von Wallenstein**

**Ljuba Svobodová**

The paper presents the basic methodology of restoring the garden pottery from 17th century, probably owned by Albrecht Wallenstein, including the removal of the surface pollution, searching and completing the fragments and filling the gaps. Different methods of gap filling are described as well as their coloring. Attention is paid to the fact that restorer is obliged to use only those technologies and materials, which according to the current knowledge will not harm the vessel integrity and which are as much as possible easily and totally removable with the minimized risk for the vessel.

## **Reverse painting on glass - new experience and findings**

**Dana Modráčková**

This paper summarizes the typical and less typical examples of damage to reverse paintings on glass. It explains the glass corrosion process, damage to the painted surfaces and the wooden frames used to adjust the painted sheets of glass. The practical case studies demonstrate various options for conservation and restoration of reverse paintings on glass. The paper summarizes the experience and knowledge of conservation of folk-art reverse paintings on glass in the Czech Republic. It is based mainly on the knowledge and experience of the author who has been restoring paintings on glass for 27 years. During that time she has repaired more than 350 pieces of paintings on glass. This article is the third in the sequence of papers addressing this issue.

## **„What to do with it?“ Conservation of oriental silk screen from Veltrusy Chateau, Czech Republic**

**David Frank, Jarmila Franková, Hana Tefal Juránková, Václav Vondráček, Jakub Vondráček**

The article describes conservation-restoration treatment of screen painted and embroidered on silk fitted in decorative frame. The screen from Veltrusy, originally established as Chinese is a part of permanent exhibition in the Chateau. The poor physical state of the object posed a question "what to do with it". The question addressed not only the problems with its conservation but also its subsequent presentation in the castle interior. The conservation treatment involved collaboration of conservators of paintings, paper, textile and wood in order to find a convenient treatment of destroyed material. It was obvious at the initial discussions that the traditional method of sewing the silk fabric on auxiliary fabric cannot be an option in all the silk pieces. Following an agreement with the contracting entity and on the basis of tests, local repair of damaged places by contact bonding onto the adjusted protective mesh was carried out. The slip sheets, although they were considerably degraded, were re-used for their historical value. Therefore, the whole surface had to be bonded using Japanese paper. The original function of the

slip sheets to protect the silk parts from rupture or puncture was therefore enhanced by inserting lightweight plates from archival corrugated cardboard into the frame.

### **The microbial contamination of textile cultural heritage objects**

**Hana Polášková, Markéta Hrubanová, Petr Nasadil, Zdenka Kuželová, Richard Ševčík**

Natural textile fibers represent an ideal breeding ground for various microorganisms (bacteria, yeasts and fungi). If a microorganism is in convenient conditions for its survival and breeding, this can result in a significant damage of textiles. The aim of this study, which has been implemented within the project NAKI DF11P01OVV017 „Traditional folk dress in Moravia: identification, analysis, context, conservation and sustainable condition of materials collected between 1850 and 1950”, is to describe methods suitable for an examination of microbial contamination not only for textiles, but also for the environment where the textile exhibits are stored. Monitoring of a microbial contamination of the environment, determination of the number of dust particles which can carry microorganisms and also assessment of the effect of active air-conditioning on occurrence of bacteria and microscopic fungi in workrooms, laboratories, depository and exhibition spaces (including open-air museums) in several institutions were carried out. Final results obtained from several inspections, prevention and suitable precautions for successful exhibits storing are discussed in the conclusion. Also the consequent necessity of periodic inspections of the environment is mentioned.

### **Study of the causes and mechanisms of printing ink degradation on paper base**

**Hana Holická, Tomáš Halenkovič, Ondrej Panák**

This paper deals with restoration procedures, concretely deacidification and disinfection applied to paper covered by black printing ink. Two types of papers covered by two types of black printing inks were used. Printed samples were exposed to several methods of accelerated ageing with following procedures of deacidification and disinfection. Neutralization was carried out by applying water solution of calcium hydrogen carbonate and magnesium hydrogen carbonate, methoxy magnesium methyl carbonate (MMMC) and Bookkeeper process. Disinfection was carried out in vapors of butanol and the mixture of ethylene oxide and CO<sub>2</sub>. To analyze the influence of accelerated ageing, neutralization and disinfection scanning electron microscopy with energy dispersive X-ray Spectroscopy, UV-VIS and FTIR spectroscopy were used.

## **Aging of the colour photograph in the day light (Effect of the cardinal I directions on the amount of light In buildings)**

**Katarína Kianicová, Vladimír Bukovský, Ivana Koláriková**

The aim of the article is to follow the rate of degradation of dyes in color photos under the effect of daylight illuminating the photograph from various cardinal points. Also, we monitored how the colour changes of the degradation products are manifested in the exposed photograph. We examined colour which are resulting from subtractive mixing color (CMY), white-black scale and the pad. Colour photos were exposed under the influence of solar energy in the interior of the building (for glass used in building) where the incident energy is reflected in building glass, which allows to determine how much energy is enough to degrade colour photos at different times. This can help in regulating the amount of light as a precaution against damage of colour photographs by this phenomenon.

## **Rescue of a coffin lid from the St. Thomas Church crypt and a coffin from the crypt of St Peter and Paul at Petrov , Brno, Czech Republic**

**Vlado Rusnák**

Coffins of monks with paintings of Christ on the lids were discovered during the rescue archaeological research in the crypt of the St. Thomas church in Brno. The surviving pieces of planks were conserved with Paraloid B 72 and microcrystalline Ostraplax L wax. By applying these substances sufficient strength for the future careful handling and storage in proper depository was achieved. The coffin with the secondarily stored remains of Ladislav Popel of Lobkovicz, who died in the first quarter of the 17th century, was discovered during whole-surface uncovering of the floor in the St. Peter and Paul Cathedral in Brno. Its good condition after the conservation allowed it being used in the same way as it was originally. After its reinforcement and application of protective coatings the coffin was deposited in the northeast corner of the newly renovated Romanesque-Gothic crypt under the presbytery of the existing building. The jacket and original coat of arms are missing in the initial equipment of the coffin as the latter was replaced by a replica. The original coat of arms is stored in the museum.