

# Abstracts

**Eszter Tóth**

## **The conservation of a pair of inlaid iron phalerae from the Avarian Period**

Iron disks of this kind, called phalerae, are bridle ornaments of the late Avarian Period and, accordingly, they could be dated to the 8th century AD. Such inlaid iron disks have been reported from 17 sites in the Carpathian Basin, especially from its western part, but are unattested in sites outside of this area. The bigger disks, like the ones under discussion, were attached to the joint of the brow-band and the cheek piece of the bridle, while the smaller ones decorated the joint of the cheek piece and the noseband.

Inlay made of red copper was founded into the ground metal of the phalera made of wrought iron. The inlay was gilded, traces of which could be seen on top of the corrosion. Along the course of the conservation the gilding was revealed on almost the entire surface of the inlaid metal.

The disks were found on the outskirts of Sződliget in 2011, during the course of the excavation of a cemetery of the late Avarian Period. The phalerae from the grave of a warrior buried with his well-accounted horse were lying next to each other in an upside-down position under the skull of the animal.

Both of the disks were fragile and porous, the ground metal got delaminated and the composing materials, the iron and the copper alloy, turned into their corrosion products. Under the soil thick copper and iron corrosion products had been developed on the surface of the phalera, which entirely covered the inlaid pattern. The small traces of gilding on the face suggested that the gilding had been removed by the corrosion product of iron almost completely.

At first sight the inlay could not be seen on the disks. With X-ray imaging the pattern of the inlay became visible under the corroded surface, but it could be seen more clearly in CT images. They revealed that the design is composed of a net motif framed by a rope motif and divided by stylised foliage motifs into four sections. To determine the manufacturing method of the inlay the CT images taken of the net motif were compared with X-ray images of the same area coming from three other phalerae, and manufacturing simulations were also carried out. Despite these efforts, the original manufacturing technique – wire-inlay or inlay with melting – couldn't be determined surely.

By using energy dispersive X-ray microanalysis in a scanning electron microscope the gilding was analyzed, and it turned out to be made of remarkably pure gold. The significant amount of mercury found in the same sample served as evidence for fire-gilding.

After revealing the pattern, portable X-ray fluorescence spectrometry was applied to determine the material of the inlay, which is in fact copper. Since the inlay is entirely covered in gilding, the composition of the inlaid metal could be analyzed exclusively through the gold layer.

The conservation of inlaid artefacts is confined to mechanical cleaning because chemical or electrochemical methods can't be controlled properly, and they can be harmful for the inlay. Shot-blasting seemed to be a proper method for revealing the pattern. Several attempts were made on similarly corroded iron, but these served merely as guidance, because none of the trial pieces were inlaid, or gilded. To gather more experience about the method it was tested on a little piece of the more fragmentary disc as well. The shot blasting unfortunately damaged and destroyed the gilding that remained - contrary to our expectations – and still covered almost the entire surface of the inlaid metal.

With attention to securing the gilding, the pattern was revealed by use of a micro grinder and ultrasonic depurator. This process could be observed and controlled by microscope. Before removing the corrosion, consolidation was needed by using a more and more concentrated solution of Paraloid B72 in a 1:1 mixture of acetone-toluene. Tannin dissolved in ethanol was applied to passivate the corroded iron surfaces. Protection of the restored phalera is ensured by the coating of a thin solution of Paraloid B72 in a 1:1 mixture of acetone-toluene. The brightness of this protective layer could be softened with microcrystalline wax. After the conservation the fragments of the incomplete disk were planted into the hollows of a support in order to keep together the artefact in its entirety without the use of adhesives.

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**Mária-Márta Kovács**

## **The tin objects of the National History Museum of Transylvania**

The motivation of the present study was the exhibition *Tin Art in Transylvania. Use and iconography* organized by the National History Museum of Transylvania in the fall of 2014. During the exhibition an opportunity arose for an X-ray fluorescence spectroscopy study (XRF, using a portable Bruker S1 TITAN type device) of the very diverse kind of exhibited tin objects selected from the museum's collection.

Although compared to other museum collections in Transylvania, the tin collection of the National History Museum of Transylvania in Cluj with its 213 tin objects, is outstanding both in number and quality of the items, - excepting some early 16<sup>th</sup> century and the guild objects - most of them are unstudied and unpublished. The exhibition presented a selection of the very rich and diverse tin objects of the collection, consisting mainly of pots, plates and bowls produced in local tin manufacturing centers (Sibiu, Braşov, Sighişoara, Bistriţa, Cluj), enriched by embossed plates from Nürnberg or tin objects produced in Wien and Wrocław.

The objects submitted to XRF study were selected from the exhibited objects, based on different hypothesis. One of the questions of the study was targeting the manufacturer of the embossed plates, since most specialists addressing the issue consider that the high level, casted decoration known as Edelzinn technique was not used by the Transylvanian tin manufacturers and such items in Transylvanian collections originate from European trade. Analyses were performed on three items of the museums' collection, the 'Noah' and the 'Resurrection' plates which have got the Nürnberger trademark and the unmarked 'Memento mori' plate. Based on the alloy compositions found by the investigation it was obvious that the 'Memento mori' plate has a different origin compared to the two other plates and its composition is closer to the alloy of the Transylvanian tin objects produced in the 17-18<sup>th</sup> century.

The other presumption was concerning the pots made of different constituting elements. We assumed that the main part and the other elements of the pots might be produced in different workshops. At the same time, for a proper functionality and workability, the trunk and the other elements of the pot had a different alloy composition. Based on the four pots analyzed we could conclude that in each vessel the trunk was made of an alloy with higher tin content than the other elements of the pot. The use of different alloy compositions was not specific for a certain center or period, but seemed to be characteristic for every larger Transylvanian manufacture form the 16<sup>th</sup> to the 18<sup>th</sup> century.

The study of pewter objects from different periods enabled also a better dating of the items. The analysis of a pot produced in Cluj at the beginning of the 16<sup>th</sup> century revealed the fact that in the first part of the century, tin casters of Cluj, similar to those from Nürnberg, used the best quality pewter of the so called Prob Zinn, tin alloyed with lead. Further analyses revealed that alloys introduced in the last third of 16<sup>th</sup> century were used all over the 17<sup>th</sup> century, and, after the pewter objects became less popular, the quality further decreased from the 18<sup>th</sup> century onward.

In finding out if alloy composition can be connected to different Transylvanian workshops analyses gave us negative answer, since the Transylvanian manufacturers of a certain period had used the same alloy composition regardless to center or workshop.

The instrumental analyses revealed details that brought closer to specialists the technical knowledge on tin art, one of the most popular industrial branches of the 16-18<sup>th</sup> century.

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**Erika Tímea Nemes**

### **The painting technique of the mural paintings of the church of Bögöz**

The mural paintings made with fresco technique at the nave of the church of Bögöz are located in three horizontal registers under each other. Here as in many other churches in Szeklerland, the upper register of the northern wall is one of the main areas in the church; here the scenes of the legend of St. Ladislaus of Hungary can be seen. Under that the legend of St. Margaret of Antioch, and in the lowest register the scenes of the Last Judgement, St. Dorothy, veil of Veronica, St. Helena and St. Nicholas are depicted.

The heights of the two upper registers are different, the uppermost with the St. Ladislaus legend is 200 cm, and the one under it is 170 cm high. The vertical sections are not coincident, either. During the production the plaster had been smoothed in both cases, and then the borders of screens were marked with red. First the background was painted, that was followed with the representation of the architectural elements, and finally the figures were depicted. It is visible on the pictures of both legends that they were made by more than one artist. Although the figure of St. Ladislaus was painted with special attention, the representation of his face and his clothing is not uniform. The character of his face differs in each picture. In the scenes of the St. Margaret legend the faces differ very much from each other also. In the first picture a simple, light colour ground and dark contours were used, but going further to the end of the story the faces got more elaborated.

The plaster of the two upper registers has light colour, because of the big amount of lime and ground limestone. The strength of the plaster is given by the presence of the limestone pieces and the ground brick. The investigation of the pigments revealed that in the red area of the two upper registers red ochre, in the pink ones lime and red ochre, in the yellow ones ochre, in the grey ones carbon black of vegetal origin, and in the white ones lime was used. The figures are elongated, stylized with not appropriate ratio. Their faces are schematic, they don't show real emotions. The hands are simplified, the gestures are lifeless. The background of the scenes is composed from only a few elements, trees, castles, columns. The ground is marked with a simple wavy line or with a bordering strip. The strong contours were used primarily for accentuation. The colours aren't naturalistic. The composition of groups is integrative; the figures are represented behind each other.

The figures in the paintings of the lowest register are more emphatic and elaborated. Their faces are more expressive. The puckers of garments and the colours are rather realistic. The first signs of the intention to the naturalistic representation can be noticed here. The additive composition is characteristic in the scenes; the figures are depicted lined up next to each other. The attempt to illustrate the space is much more effective here than in the upper registers.

In the lower register too, the background was painted first, and then the figures. The figures were differentiated by their size and quality. Only a few colours were used, but with much more shades of colour and with more variety. The light-grey of the background was achieved with a mixture of carbon black of vegetal origin and lime. The background which seems to be dark blue was painted with carbon black. The yellowish brown colour was made with ochre and carbon, the red and orange of the garments was painted with mixture of ochre and red ochre. The high-lights were made with lime.

Compared the plaster of the upper register with the plaster used in the two lower registers, by stereo-microscopic examination it could be found that their colour and composition are completely different. The silt fraction of the upper one is almost white, while the lower one is quite dark, and contains iron. Probably the sand used for the plasters was taken from different areas.

With the help of microscopic examination it could be determined that the plaster of the two upper registers is completely identical with the plaster of the mural painting fragments found at the southern part of the tower, hidden behind a buttress. This demonstrates that the tower of the church had been there already when the paintings were made.

Based on the results of the research it seems that the pictures of the two upper registers in the church and the remnants under the buttress were painted at the end of the 14<sup>th</sup> century. The scene of the Last Judgement and the painting representing the Madonna enthroned above the portico could be made in the first third of the 15<sup>th</sup> century.

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**Éva Galambos – Zsuzsánna Váli – Ákos Török – Erika Nemes**

**Color alteration and investigation of the mural paintings at the church of Almakerék (Malmkrog)**

Based on the pigment investigations, the coloration of the wall paintings in the sanctuary of the church of Almakerék (Malmkrog) has been altered, and what we can see today of the medieval mural paintings differs substantially from the original appearance.

This alteration was primarily caused by the chemical effect of the water-soluble salts, which affected especially

the pigments containing lead and copper. The moisture and the water-soluble salts are at the root of the weakening and flaking of the plaster and painted layers as well.

The blue azurite has turned green on surfaces, where salts and pigments formed copper chloride. Where the surface was more affected by water leakage, the painted layers were washed off to the extent that only the under-painting or the plaster is left seen.

Similarly, some parts of the original spherulitic malachite pigment layers were transformed into copper chloride, but since this is also a green product, the chemical transformation did not cause a significant change in color.

It is easy to deduce the original coloring and iconography on surfaces, like the vault with the representation of the starry sky or the blue cloak of the Mother of Christ. But in the middle and lower zones of the vertical wall sections it was difficult to determine what used to be the original color of the robes of the Saints, and thus to identify them.

A similar problem of identification arises with the brownish-gray colors which can be seen on the vault. The original color in these cases can only be assessed by examination and analysis.

Characteristic of the upper zones of the wall paintings, the brownish-black layer containing copper oxide, originally was malachite green, which now appears in a variety of shades and tones: greyish, brownish, black, and sometimes white.

The color of the originally red lead on the frames of the scenes looks blackish, greyish, brownish, and sometimes even white and orange is generated by color change there.

There are many gradient color changing on the patterns as well. In the case of lead containing paint layers it is to be determined whether they were originally painted with red minium, or was there any lead yellow, lead white used as well, because the alteration products of any of these pigments are the same: lead oxide or lead chloride.

The changes are largely due to the chemical effect of salts migrating to the surface of the wall. The process can no longer be reversed; the restorer can either stop or slow down the decay process.

The mitigation of moisture supply is an important goal, but in certain pigments – eg. those ones containing lead – these changes almost always occur over time in an alkaline medium.

Material analysis and damage mapping documentation<sup>1</sup> was carried out, the building materials and moisture zones were determined, these were also important for planning the possible restoration interventions.

Where local conservation should be carried out, the presence of higher salt concentration and hygroscopic salts can obstruct the work processes and the delivery of treating agents into the porous system. Thus the local removal of salts may be necessary in these areas.

<sup>1</sup> Kiss Lóránd and coworkers

The complete desalination of the walls supporting the murals is not feasible, especially if some of the salts are contained by the building materials. The aim of the restoration interventions is to stabilize the existing condition, preventing the flaking of the paint and to reduce the moisture supply. Based on the results of the performed examinations, it is possible to make a digital color reconstruction, which can be of valued help in the research of the art history of the paintings and in determining the possible schools of authors of the paintings.

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**Ferenc Mihály**

**The conservation of the main altar of the Franciscan monastery church in Odorheiu Secuiesc**

The Franciscan church of Odorheiu Secuiesc and the adherent monastery were built in the 18<sup>th</sup> century and they are among the most significant monuments of the baroque architecture in Szeklerland. After the construction the church was nicely furnished, from which the main altar, the side altars, the pulpit, the priest's chair and some high quality doors have been preserved so far. In the central niche of the main altar built in honour of St. Peter and St. Paul the sculpture of the Holy Mary can be seen; on her two sides St. Peter and St. Paul apostles, and St. Stephan and St. Ladislaus the Hungarian holy kings are represented. On the pediment of the altar the sculpture composition of the Holy Trinity was placed surrounded by angels. The sculpture of the Holy Mary is one of the best artifacts of the wooden statuary of Transylvania; and – given its type – is unique in the Carpathian basin, with its pair in Dumbrăveni (*Erzsébetváros*, Romania). Mary is represented without the infant Jesus, with a lily as the symbol of purity in her right hand, and with a heretic under her legs who writes and tenaciously protects the false tenets. The gilding and painting of the altar was carried out in the years 1780 and 1781 by Mátyás Veres and his wife Krisztina Perger.

By the end of the 20<sup>th</sup> century the Franciscan Order got back its rightful ownership and could set to the reconstruction of the buildings which had been neglected for decades. After the architectural renovation of the church the research, the condition assessment, the planning of the

restoration could be carried out as well; and the conservation work could be started.

In the course of the conservation processes, methods and materials generally used and well known in the conservator profession were used. The several layers of overpainting were removed with heat gun and mechanically up to the varnish of the original painting. The lustred surfaces were revealed in more steps, going ahead from layer to layer, with various methods and materials. For the removing of the overpainting from the coloured lustre surfaces the concentrated (32%) ammonium-hydroxide proved to be the best. Moving slowly with the cleaning only small areas (half a cm<sup>2</sup>) were treated with the chemical, and after a short time it was wiped away completely from the surface. In this way the overpainting could be slowly wear down. The process of the removal of the overpainting from the marbled and lustred silver surfaces was efficient and very instructive.

At the end of the study the author draws attention to the importance of the patina-layer, to the preservation of some small areas where the original layers are kept and so they can be studied, and to the documentation of the completed areas with UV images as well.

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**Éva Mester**

**The chances for survival of the historical glass windows in Transylvania**

From the 15<sup>th</sup> century the window panes were made both from crown glass and from plate glass. The different sizes of crown glasses were made in mass – with various technologies and quality - in glassworks built in forests. From the plate glasses, which were made by blowing, it was difficult to make window panes because they were fragile and sometimes there was stress in them. At that time larger plates suitable for glazing windows without subdivision were not available yet. The larger pieces were cut to smaller, geometric elements, from which the windows were put together. Split window panes were used all over Europe. The basic forms were the rhomb, the honeycomb and the rectangle in the Carpathian basin as well. The window panes were built from elements bordered by straight lines. The pattern could be created from pieces with the same basic form or with the combination of different basic forms, hold together with rigid metal comes which had high tin content. The crown glass elements were kept together by flexible lead comes, which were suitable for building windows also with the combination of arched (round) and angular shaped pieces.

This simple technology could be practised also in the countryside; so the travelling glassmakers could repair the broken windows from time to time. The glass was not

made by themselves, it was bought by them. All the glassworks produced glasses with different properties. The quality of the glass was determined by the composition of raw materials used for the melting. Sand was the most important component, and its contaminants modified the properties of the glass greatly. The place of origin of the sand and the characteristics of the other components can be identified by nanotechnological analysis, and from the findings of comparative investigation the date of manufacture can be concluded. The metal comes were made by the glassworkers, so the composition of the lead, tin and the solders are individual, it is suitable for the identification of the workshop.

In the second half of the 19<sup>th</sup> century around the central area of the Carpathian basin, the windows with simple geometric subdivision were replaced with stained glass windows in the catholic churches, according to the current European public taste. This process happened in Transylvania and in the Partium as well. In the churches of reform religions the attitude was different. In that unsophisticated buildings with Romanesque foundation and walling, the windows with geometric subdivision made from unstained glass, metal canes and wooden frame served as protection against cold and rain for centuries, and bore precious information about the technical solutions of previous era. They survived the World Wars and the hard decades of the Soviet occupation.

The regime change and the joining the European Union accelerated the changes. Unfortunately, there was a need for the reconstruction of the historical buildings, before the education of the experts could happen. Although the painted, wooden coffered ceilings, the pulpits, the stallums and the mural paintings of the buildings are treated today considering the international standards, only a few people paid attention to the importance of the preservation of the distorted, sometimes incomplete and weak glass windows. That lead to the situation that due to the renovations only a small part of that kind of windows can be found for now, although they were preserved until 1990 in almost all the towns and villages. Today they can be found only where the reconstruction of the buildings hasn't happened yet.

Whether after some years will be any church, building where the old, subdivided windows will be preserved together with their original glass panes and metal comes? What kind of regulation could save these windows for the posterity, if to be included on the World Heritage List is not enough to draw the attention to them?

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## Brigitta Mária Kürtösi

### Investigation and conservation of mosaics from the Votive Church of Szeged; research on their characteristics and damages

The Votive Church of Szeged was built after the 1879 flood of the Tisza River, to commemorate the survival of the city. The only Hungarian cathedral built in the 20<sup>th</sup> century is richly decorated with mosaics designed by Ferenc Márton from Transylvania, and Károly Szörényi-Reischl. The mosaicist was Imre Zsellér. The works began in 1913, but during the World War I the construction could not continue; thus the mosaics were finished to the consecration in 1930. The architectural design of the building was made by Frigyes Schulek and Ernő Foerk.

The introduction of mosaic art in Hungary associated with the name of Miksa Róth. Imre Zsellér is seen primarily as glass painter, but he has a significant oeuvre in mosaics too. After his studies and practice in the Róth-workshop, he started to work independently from 1903. He could understand the essence of the different kinds of artworks/plans and he could perfectly choose the best fitting phraseology in the performance of the mosaic.

The material of these mosaics is glass paste coloured with different metal oxides. *Smalti* and *piastra* are the two types according to their shapes and manufacturing. The cut pieces can be differentiated by their visible surface. The larger surface of the *smalti* is the thickness of the molded and than cooled glass paste. *Piastra* is useful to cut *tesserae* with various dimension, because the used side is the top surface of the molded paste.

The degradation of the gold *tesserae* is highly visible not only in the raster of the outdoor, but in the case of the indoor mosaics too. The gold-leaf *tesserae* have a special sandwich-structure made of a glass support, a metal leaf and a thin glass layer on the top, the so called *cartellina*. The main conservation problem is usually the detachment of the *cartellina*, which cannot protect the very thin gold leaf anymore.

The Trinity mosaic (85 m<sup>2</sup>) decorates the vault of the apse. The degradation processes of the 85 years old mural were observable only from the scaffoldings because of their special nature. It was only a one-month-long period to investigate the phenomena, and no way to the long-term comparison of the changes.

Dry cleaning, sampling and documentation of the mosaic were performed. It was important to carry out the processes gently, because one type of the components became fractured and lamellated in the past.

It is not clear yet, what is the cause of the devitrification process of the white *smalti*, in which high lead content was found with XRD measurements, by István Sajó. The phenomenon affects the ~1/6 part of the whole mosaic surface. Several steps of the moisture measurements are not representative enough because of the short time available. At least annual monitoring cycle would be needed to diagnose the real salt movement.

The Trinity mosaic was made in atelier; the boundaries of sections can keep track. The bedding mortar is a lime-sand mixture. Where the larger coloured sections of the composition demanded, pigmented joint mortars were used.

The gold background of the ornamental mosaic decoration in the main entrance of the church is a very good example of the pictorial effect often used. Five types of gold were applied here. In the lower sections lacks, efflorescences, and separated parts could be found. It was visible, that the degradation level was slowly moving upward. Following the movement of the building blocks the opened gaps gave way to the rain, and the cyclical frost damage left its mark as well. The constant moisture activates the water-soluble salts of certain building materials; the cyclic salt movement continuously exerts a destructive influence. It was necessary to remove certain parts of the mosaic, where the *tesserae* could not bind sufficiently to the damaged, full salted bedding mortar layer. The reconstructed details were made from Venetian glass *tesserae* in the atelier of the author. The work was performed by indirect technique.

Mounting of the reconstructed mosaic details was performed at the end of November 2015. The forced finishing of the work was not justified professionally following the explored and documented knowledge of the real conditions of the supporting structure. The possibility of premature deterioration of the surface is not excluded.

The author thanks for the cooperation of the following colleagues: Miklós Ernő Balázs, István Bóna, István Sajó, András Seres.

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**Zita Sor**

### **Digital prints in collections**

The technology of digital printing has developed at a rapid pace over the last 25 years, and today an ever increasing number of graphic documents are being generated digitally, including fine art prints, books, office documents, and product packaging. The lines between imaging media and document media are disappearing. An enormous volume of digital output media is now entering institutional collections. Digital printing is especially popular in the realm of photography. As these contemporary materials constitute a major part of our current and future social and cultural heritage, it will be important in the long term to gain an understanding of their structure, materials and stability, as well as devise strategies for dealing with them properly in archives and museums.

There is variety of digital printing technologies as well as mixed traditional and digital systems. The sensitivity of digitally printed photographs is highly variable.

The goal for cultural institutions is to prevent the materials in their collections from deterioration.

Digitally printed materials have similar deterioration effects as traditional analogue prints have. Types of deteriorations can be: fading, yellowing, gloss change, abrasion, scratches, cracking, bleeding and delamination.

These types of deterioration are dependent upon the printing technology and the materials were used to create the final print. That's why it is important to know which technology was used to create the artwork.

To be able to identify the different types of prints and printing technologies is essential. But of course, the environmental conditions which surround the digital print also play a critical role. Control of temperature, humidity and air quality can extend the usable lives of these materials.

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