Case study at National Museum of Banat
Maria Therezia Bastion

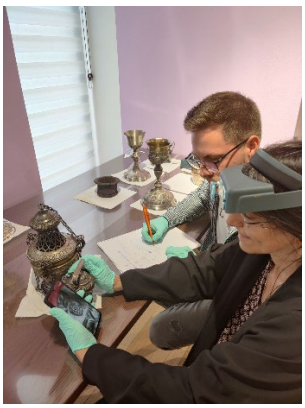
Timișoara, Romania
Str. Hector

September 19 - 21, 2023

The objective of this Case Study was to combine and apply all three ENDLESS Metal tools (MiCorr, Discovery Mat and Pleco) and the skills we acquired during the COST Innovators Grant (CIG) ENDLESS Metal to a real collection. The objects we investigated during this case study workshop are part of the Collection of the Museum of the Roman Catholic Diocese of Timisoara. They are religious objects, such as chalices, ciboria, patens, a monstrance, *naviculum*, a set comprising a teacup and saucer and metal bookbinding. The objects are mainly composed of silver or copper alloys and often silver-plated or gilded. They were selected by curator Dr. Claudiu-Sergiu Călin. Preliminary non-invasive XRF analysis was carried out by Prof. Petru Negrea, Polytechnic University of Timisoara and his assistant.

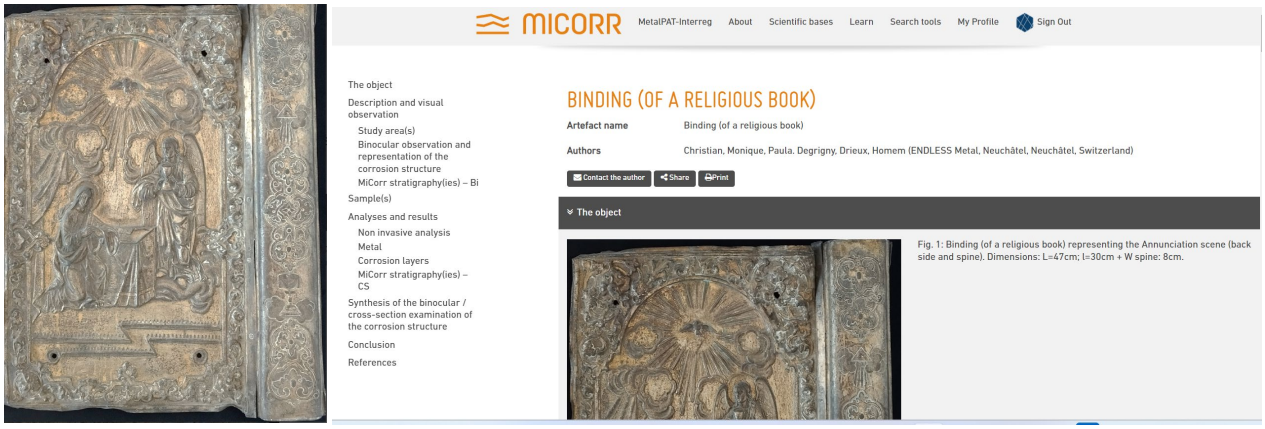
The objects were first investigated with MiCorr I to determine their general material composition. Besides validating the relevance of answers to our questioning on objects from a real collection, some interesting examples of corrosion features were also observed and added to the MiCorr database.

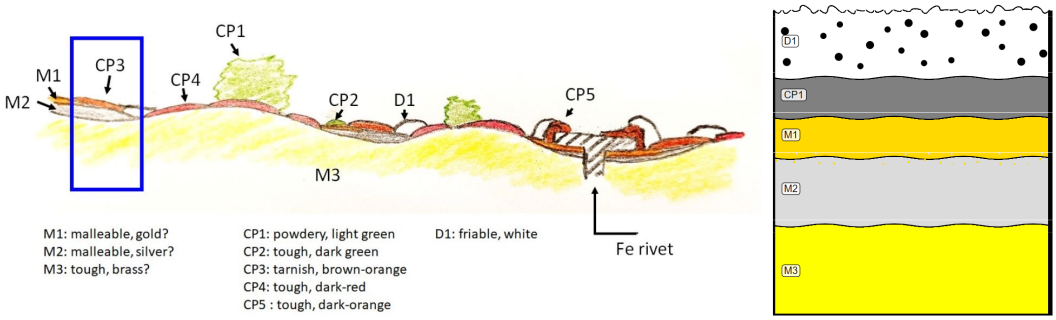
Local participants A. Horvath and A. Socaciu investigated the hallmarks found on many (silver alloy) objects, which also give valuable information on the object's composition.



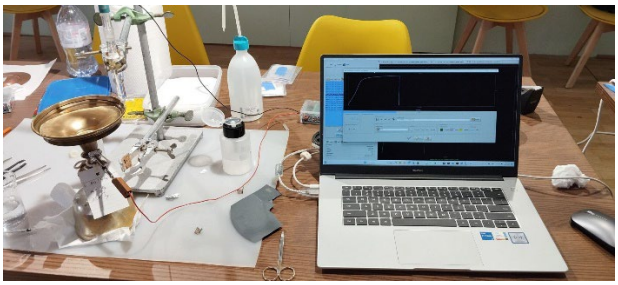
The CIG team then divided into groups to work further with specific tools on selected objects from the collection.

C. Degrigny, P. Menino Homem, M. Drieux and A. Socaciu worked with MiCorr, focusing particularly on creating stratigraphies in MiCorr II. They created an object file for the metal sheet book binding, which is made of gilded silver-plated brass.

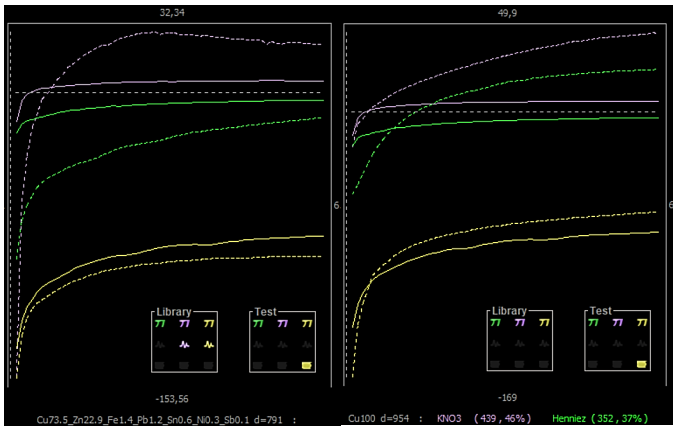




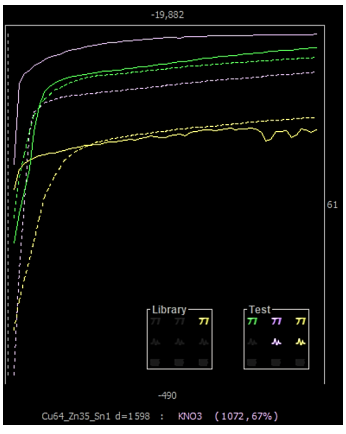
K. Schaefer-Rychel and R. Gavrila investigated two copper-based objects with Discovery Mat, a paten and a foot of a chalice.



As for the paten, the “proposals” results indicated that the metal is either pure Cu or an alloy (brass or bronze) with low concentrations of Zn and Sn. When looking at the graphs, it appeared that the plots in KNO_3 for brasses are very different which discards this option. When comparing results between Cu and bronzes, the Cu option seems to be more relevant, even if the plots do not match perfectly well, certainly because of an insufficient polishing of the metal surface.



Paten

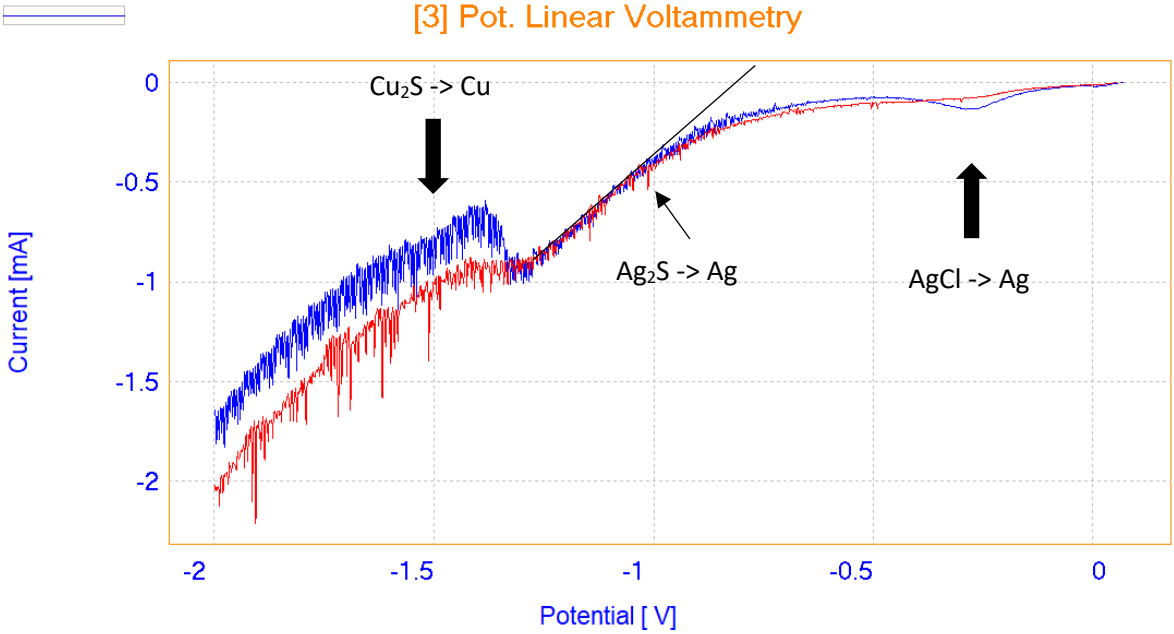


Chalice

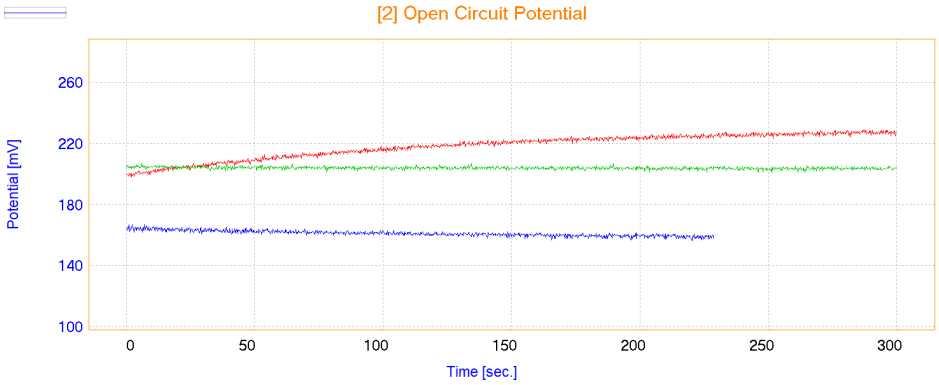
As for the foot of the chalice, the best match seems to be a ternary alloy CzZn35Sn1. The plots in sodium sesquicarbonate showed though fluctuations which might be due to the heterogeneity of the metal surface (microporosities) ?

R. Jeanneret and E. Menart worked on optimising corrosion layer analysis using the Pleco and potentiostat, focusing particularly on low-cost alternatives of some of the Pleco/system components. The diaphragm pumps were replaced by significantly cheaper peristaltic pumps (they cost an order of magnitude or two less), which provided a very satisfactory result.

Linear sweep voltammetry analysis of black spots on a silver saucer, obtained with both sets of pumps, are shown below (blue line: diaphragm pump, red line: peristaltic pump). The results are more or less the same. We distinguish though some additional reduction peaks for the blue pot due to silver chloride at low potential and copper sulphide with a max. at -1.5V/GC. The black spots seem to be due though to Ag_2S.



An alternative quasi-reference electrode was tested as well. The glassy carbon rod was replaced with a common graphite (pencil) lead, which is considerably cheaper. Although the OCP is a bit higher compared to glassy carbon and takes a few minutes longer to stabilise, it proved to be surprisingly stable over the course of the experiments. OCP measurements are shown below; glassy carbon in blue, graphite at the start of experiments in red and at the end of the day in green.



Throughout the workshop the team members worked together and combined the three tools to obtain the best results. In many cases only the combination of at least two of the tools provided the correct result on the object composition, proving the benefits of the 'toolkit' approach. The results of the investigation of hallmarks allowed the team to verify results obtained with the ENDLESS Metal tools, but also showed how important thorough visual investigation of an object really is. The workshop ended with a general discussion between the team members on the pros and cons of the tools.

As a conclusion, the three tools of the ENDLESS Metal toolkit fuffilled our expectations. Definitively they can be considered as portable. They are very easy to install (pack and depack) and can be used anywhere ; here for instance, in a room dedicated to meetings and not to "laboratories purposes". They are easy to use, can be combined and furthermore can be used safely.