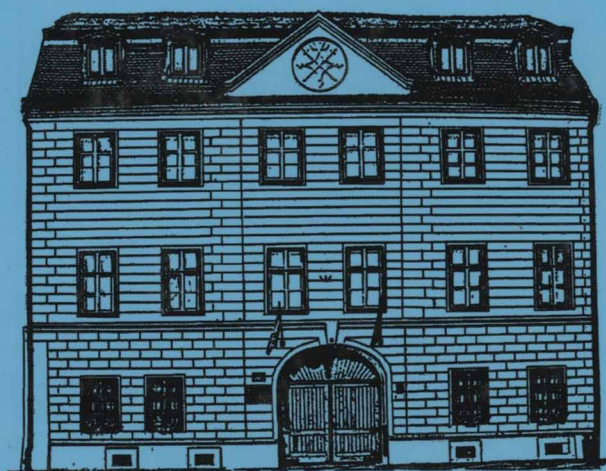


BRVKENTHAL  
ACTA MVSEI  
VIII. 4



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# **BRVKENTHAL. ACTA MVSEI**

## **VIII. 4**



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**MUZEUL NAȚIONAL BRUKENTHAL**

**BRVKENTHAL**  
**ACTA MVSEI**

**VIII. 4**

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## SEVERAL ISSUES REGARDING THE CONSERVATION AND RESTORATION OF A GROUP COMPRISED FROM ARCHAEOLOGICAL LEATHER OBJECTS FOUND IN THE BRUKENTHAL NATIONAL MUSEUM COLLECTION

Ruxandra-Ioana STROIA\*

**Abstract:** *The object of this presentation is the manner in which the activities of research, restoration and preservation of a leather footwear lot, consisting of 12 pieces, boots and shoes, which belong to the end of the eighteenth century - beginning of the nineteenth century. The objects were found by archaeologists of the Brukenthal National Museum following the restoration works carried out in the basement of the Roman Catholic Church in Grand Square and in a niche of the medieval asylum hospital building attic, Sibiu.*

**Keywords:** *archaeological leather, restoration and conservation operations*

**Abstract:** *Obiectul prezentării îl constituie modul în care se desfășoară activitatea de cercetare, restaurare și conservare a unui lot de încălțăminte din piele, format din 12 piese, cizme și pantofi, aparținând sfârșitului de secol XVIII - începutului de secol XIX. Obiectele au fost găsite de arheologi ai Muzeului Național Brukenthal în urma unor lucrări de restaurare desfășurate în subsolul clădirii Bisericii Romano-Catolice din Piața Mare și într-o fîridă din podul corpului de clădire al Azilului de Bătrâni – Spitalul Medieval Sibiu.*

**Cuvinte-cheie:** *piele arheologică, încălțăminte din piele, operații de restaurare și conservare*

### I. History

Leather archaeological objects presented in this paper entered Leather Restoration Laboratory in 2009 to be preserved and restored. These objects composed mainly from footwear components were originated from two different sites, namely:

1. The Roman Catholic Church basement in the Large Square of Sibiu, where during the development and modernization of a multicultural area, were discovered by the Brukenthal National Museum archaeological team, led by Mircea Lazar, in seventy-two niches the skeletons of some personalities off Sibiu, their family members and religious figures of eighteenth and nineteenth centuries. On this occasion, were recovered valuable objects, which consisted of elitist elements, coats of arms, copper ornaments, religious items specific to the Catholic religion, rosaries, scattered pieces of clothing and shoes and many fragments of this kind items. Among these the ten leather footwear studied, were included.
2. The attic of the Sibiu old Asylum hospital building the wing from Tower Street, where

together with other objects, a complete child's shoe without missing parts and another footwear fragments were found. The objects remained by chance in a niche and later were covered with plaster. In one of the books found together with the other items mentioned above, the year 1761 was printed, which could, within large limits of time, date the period of the objects manufacture. The information about the objects brought in the Leather Restoration Laboratory was provided by Peter Beșliu PhD., researcher at the History Museum Sibiu (Stroia 2010, 855).

All objects fell in the same dating period, the 18th century and the beginning of the 19th century. Each one needs its own reconstruction and analysis of the relationship between the different composite materials approach. According to this were they fell in one of the following categories:

1. Complete items but stiff and deformed (Fig.1,8,10,15,17)
2. Items found in piles of leather fragments that allow the reconstruction because they kept their original shape (Fig.2,11)

---

\* Muzeul Național Brukenthal

3. Items from which only small fragments remained so in this conservation state to establish the objects shape was impossible (Fig.3-7)

We consider that the correct identification of outer, inner and intermediate pieces fragments from the footwear component, especially where there are areas with material loss, is the most important step to determine the object integrity.

It is known that footwear just like clothes provides information about the people's lives who wear them. Footwear is representative for the culture and the history of a society, reflects the economic position, the wearer's social level or may indicate a profession, an evolution of forms and patterns after the fashion of the time.

By simple definition, the footwear is an object which role is to protect the feet. Depending on the utilitarian purpose or merely by fashion their shape can vary to infinity

Commonly, the raw material used is leather, alone or in combination with textiles, metals, wood, etc.

The ornaments can be made multiple simple techniques or a combination of them: blanking process with different punches, embossing, embroidery, leather applications, beads, fur, feathers, thin strips of leather braids, laces, buckles.

## II. The work procedure

In order to receive the best restoration and preservation procedures for each item, it was applied a standard working method, used in all major conservation and restoration leather laboratories and then it became special. This involves the following steps:

1. File an identity data sheets that record:
  - general identification data: date, weight: g; dimensions: L-l-h mm, colour.
  - composite materials - e.g. wood heels, nails, metal buckles...
  - fragments drawings made by copying their forms, patterns and templates execution (Fig.9,16)

Detailing the components involves the identification marks that make up the upper parts: (vamp, instep, tongue, cap toe, eyelet, counter, in seaming) and the sole of the footwear (heel, insole, shank, outsole, and welt), also the constructions of the patterns for each element (Fig.12, 13, 14)

- identifying the manufacturing steps; the structural and decorative elements such as the stitching types, the seam, the ornaments types, the nails, the knots, the bindings etc.)

2. Determining the degradation type, namely:

- physical and mechanical degradation: functional wear, dust deposits, dirt and fat substances, leather loss, folds and deformation
- physical-chemical: leather aging with elasticity and hygroscopicity loss, leather acidification, oxidation and hydrolysis of collagen, iron corrosion products deposits on leather, colour transformation
- biological and microbiological: active bacterial attack, mould and fungi, damage caused by rodents
- inadequate interventions: e.g. Replacing the material loss near the tip of the sole with leather and other small repair

3. Evaluation and analysis report preparation: visual observations and measurements, microscopic analysis combined with photomicrography and comparisons with leather sample book for animal breed identification, the tanning determination through specific analysis, pH measurement, tests to determine the content of moisture and fat in the leather, the presence of fatty material deposited on the leather surface, oils, fats, waxes, etc..

4. The execution of photographs before, during and after restoration

5. Establishing the restoration treatments in compliance with the minimal intervention principle, all materials used in restoration work are pH\_neutral and reversible.

- disinfection and disinsection, cleaning tests
- dry and wet cleaning (brushing, vacuuming, different erasers types, chemical sponges, etc).
- humidification
- bonding, refitting, stitching, punctual consolidation, doubling the fragile areas
- restoration of the tri-dimensional original form,
- realization of the display support concept

The newest publication (ex. ISIS 2009, 77; Mould 2003) shows that the conservation treatments on leather objects should be minimal; the general trend is to take preventive conservation actions and the way the leather objects are stored. It aims to minimize the application of emollients, lubricants and cleaning agents because of long-term negative effects on the leather.

Each piece will be stored in the dark at the Altemberger History Museum storage. The storage case is made of neutral materials in accordance with

conservation standards, the objects and fragments dimension.(CCI Notes, 1992, 8/1-4)

The health status of the fragments will be check every 3 months.

The objects will be preserved in a sealed case, in dark storage, in stable microclimate, protected from dust (Moldoveanu 2003).

T = 16-18 ° C

Ur = 45-55%

I= 50 lucsi

UV< 75 microwatt

### **III. Special mentions:**

- Objects and fragments will be handled only by specialists, who will wear cotton gloves
- In exhibition, the leather objects will be displayed in the enclosed window cases made with chemically neutral materials, in resting position, without internal tensions and in controlled environment.

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1. Child sock shoes - M2



2. Fragments of leather - boot - FM3



3. Fragments of leather, shoe - FM 5



4. Leather fragments archaeological - M8



5. Leather fragments archaeological - M5



6. Archaeological leather fragments - E M 12

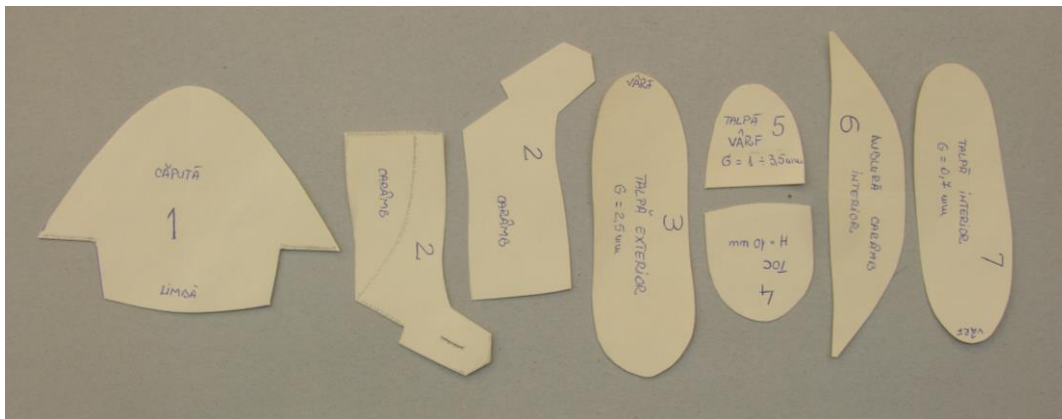


7. Archaeological leather fragments -B2





8. Child shoe, no. inv M9186/B1 - before restoration



9. Child shoe, no. inv M9186/B1 - pattern



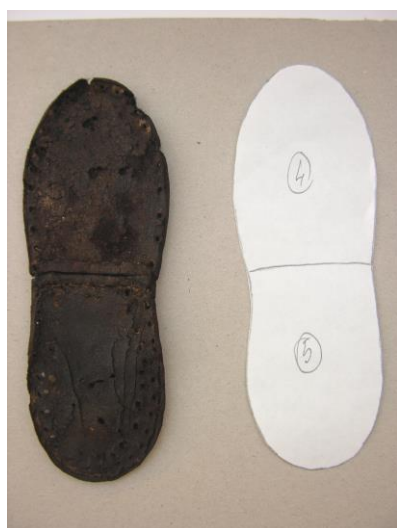
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11. Fragments of archaeological leather – shoes - before restoration



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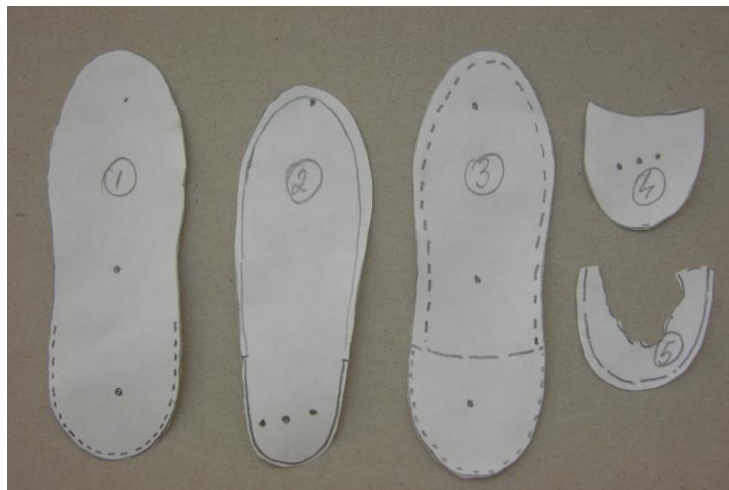
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## TOWARDS A RISK-BASED APPROACH TO PREVENTIVE CONSERVATION AT THE ASTRA NATIONAL MUSEUM COMPLEX

Andrea Gabriela Bernath\*

**Abstract:** *This year, the Open Air Museum from Dumbrava Sibului is celebrating 50 years since the establishment of the Museum of Folk Technology (ASTRA Catalogue-guide 1995, 17). Since 1963 the museum has been developing in many different ways. During this half century, the ethnographic institution, nowadays entitled ASTRA Museum of Traditional Folk Civilization, has managed to expand its collections and to improve its conservation possibilities. One of the most recent and significant achievements of the museum has been the building of a new and modern conservation facility - the ASTRA Centre for Heritage. Building this centre was necessary in order to change the inadequate preservation conditions from the past and to provide the proper means for the care of the heritage values of the Open Air Museum<sup>1</sup>. Although our aim was to show that at present the collections are being well protected from potential irreversible degradation, the utility considerations regarding the use on this purpose of the risk assessment model, which was developed and used in the framework of the ICCROM programme on Reducing Risks to Cultural Heritage<sup>2</sup>, has determined us to present this method as a reliable example of application.*

**Key words:** *preventive conservation, risk assessment, ASTRA Centre for Heritage, collections, storages, agents of deterioration, specific risks, risk analysis, incorrect RH, magnitude of risk.*

**Rezumat:** *Anul acesta Muzeul în aer liber din Dumbrava Sibului sărbătorește 50 de ani de la înființarea Muzeului Tehnicii Populare. Din 1963, muzeul s-a dezvoltat în diverse moduri. Instituția etnografică, în prezent denumită Muzeul Civilizației Populare Tradiționale ASTRA, a reușit pe parcursul acestei jumătăți de secol să-și îmbogățească colecțiile și să-și îmbunătățească condițiile de conservare. Una dintre cele mai recente și mai semnificative realizări ale muzeului a fost construirea unei noi și moderne clădiri destinate conservării bunurilor culturale - Centrul ASTRA pentru Patrimoniu. Construirea acestui centru a fost necesară pentru a schimba condițiile inadecvate de prezervare din trecut și asigurarea mijloacelor optime pentru păstrarea valorilor de patrimoniu ale Muzeului în aer liber. Cu toate că scopul acestei lucrări este acela de a arăta că în prezent colecțiile sunt protejate corespunzător de potențialele degradări ireversibile, considerațiile practice cu privire la utilizarea în acest scop a modelului de evaluare a riscului, care a fost elaborat și folosit în cadrul programului ICCROM, Reducerea riscurilor pentru patrimoniul cultural, ne-a determinat să prezentăm această metodă ca un exemplu de aplicație demnă de încredere*

**Cuvinte-cheie:** *conservare preventivă, evaluare a riscului, Centrul ASTRA pentru Patrimoniu, colecții, depozite, agenți de degradare, riscuri specifice, analiză a riscului, UR incorectă, magnitudinea riscului*

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<sup>1</sup> *Conservation and restoration of the ethnographic heritage in ASTRA Open Air Museum from Dumbrava Sibului*, [http://conservareapatrimoniului.ro/centru\\_pentru\\_patrimoniu\\_en.php](http://conservareapatrimoniului.ro/centru_pentru_patrimoniu_en.php) accessed on 22 April 2013

<sup>2</sup> All intellectual property rights relating to the information of the ICCROM course programme and teaching materials that this paper is referring to are vested in ICCROM, the Canadian Conservation Institute and the Cultural Heritage Agency of the Netherlands, however this work is a derivative creation subjected to the author's adaptation.



## Background of learning about a risk-based approach

Risk is the chance of something usually negative to happen, causing an undesired impact on various objectives. Hence the need to mitigate or avoid risks arises. In an inherent way, risk is to be found in any activity we undertake and, consciously or not, all of us have to deal with it all the time. Even if we foresee it, the question is still here about when it will take place or what unwanted impact it will have on things (Ashley-Smith 1999, 16), because, by definition, risk depends on probability and severity (Waller 2003, 48). Risk management, a logical and systematic process, is about identifying harmful potential variation and being prepared to avoid or minimize possible loss in the future (AS/NZS 4360:2004, 7). As international directions have been attesting it lately, in preventive conservation, where reducing unnecessary deterioration to cultural heritage is the main goal, a *risk-based decision-making* approach or risk management for cultural property plays a key role (Waller 2003, iii). In this respect, during the last two decades, several models have been elaborated and I am just mentioning a few of them. These are the ones I have used (for their guidelines) for a better understanding of the risk-based approach: the *Cultural Property Risk Analysis Model*, developed and applied by R. Waller (2003) to preventive conservation at the Canadian Museum of Nature, the Australian/New Zealand Standard, *Risk Management* (2004) and the ICCROM method, *Reducing Risks to Cultural Heritage* (adjusted between 2005-2012).

I for one have begun to become acquainted with a risk assessment proceeding starting since 2007, when I was involved in the local organisation of the ICCROM international course on Preventive Conservation: *Reducing Risk to Collections* (Guttmann et al. 2008, 124-130) as a course assistant. At that time, the case studies that the participants had to work on were related to the ethnographic collections of the host institute, the ASTRA Museum. For this purpose, I had to prepare the documentation for the case studies, which allowed me to understand the main steps in following the method of risk analysis. Although in the meantime I have had other connections to risk approaches, my major gain has been the knowledge I acquired in taking part in the *Reducing Risks to Cultural Heritage* online ICCROM course. The time span of the course (May 2011 - February 2012), as well as the fact that each participant assessed risks for his/her

collections were the greatest advantages of this edition of the programme. The International Workshop on *Cultural Property Risk Analysis* (Lisbon, 2011), directed by Robert Waller, a pioneer in the use of risk assessment for collection management, provided me with another perspective in this field.

Altogether, generally speaking, the various tools framed for a comprehensive risk assessment and risk management deal with a more or less similar approach which include slightly different ways of identifying and thoroughly understanding risks and planning a systematically risk mitigation strategy. In all cases, the ultimate goal of risk management is the efficiency of performance, which becomes reachable by way of a system of priorities.

In the following pages I am going to describe in which way I have applied the ICCROM method of risk assessment within the collections of the ASTRA Museum. I will also try to provide explicative support for this attempt, according to the hesitations that I have myself experienced during the learning process.

## Reasons for undertaking this risk assessment

The ASTRA Museum of Traditional Folk Civilization is an ethnographic open air museum of national importance and it forms part of the ASTRA National Museum Complex. Its major role in both national and international level is bringing out the significance of the most representative Romanian specificities, emphasizing identity and features which make the Romanian people different from others and answering the question *who are we?* In April 2011, the externally funded project *Conservation and Restoration of Ethnographic Heritage in ASTRA Open Air Museum* was carried through, with the most significant outcome being a new building which includes restoration laboratories and storage spaces designated for the museum collections. In this context, four storages of the Open Air Museum which had been located before in different places have been merged, under the same preservation conditions. More than always, the essential condition for the new storage facility was providing optimum answers for the conservation requirements for the objects.

In this regard, we have deemed it right that a comprehensive understanding of all hazards which at some point could bring about risks harmful to the cultural property was appropriate so as to properly prevent needless damages and losses.

When the opportunity to undertake a risk assessment arose for me, by way of applying the ICCROM method - a facilitating tool in five steps, which includes the establishment of the context, the identification of the risks, their analysis, evaluation and, finally, the treatment of the risks - I had already taken into account the benefits that would arise and I have thus seized the opportunity.

As a newly commissioned building, many aspects were unknown or in an estimative state. By comparing the designed features to the real ones, by analysing the conservation conditions provided through this achievement, we would have become aware of the actual degree of reliability of this facility. On the other hand, in the course of this process relevant information was supposed to be obtained, which could have helped in reviewing the emergency preparedness plan or would have led to drawing up recommendations for the improvement of the internal procedures.

Although after identifying the various kinds of risks, the assessment has been carried out only for three of them, as these risks have been considered the most relevant for the category they belonged to (rare, frequent, cumulative)., This paper illustrates, however, the risk assessment method only by presenting the process for one of the risks. I emphasize the fact that the numbers used for calculations are subject to personal estimates and assignments and that they have to be regarded only as examples.

Since there was a consensus on the division between the analytical phase, which includes the identifying and analysing of risk and the selection of the priority steps in dealing with the identified risks, a separate undertaking of the assessment can be carried out by a technical specialist for the first part and a senior decision maker for the second part. This independence has sometimes been seen as beneficial (AS/NZS 4360:2004, viii). Although in our case the assessment had been carried out more on the analytical process, the reason was rather a consequence of the outcome, which has validated the project investment. This has meant that the magnitude of the risk was low enough so as not to consider treatment options as an important concern. Thereby justifying the funding, the ultimate reason of undertaking the risk assessment has been achieved.

### Establishing the context

Establishing the context integrates different external and internal considerations within which risks must be analysed and treated. These aspects

relate to environmental parameters, configuration and structure of the institute, define the goals and scopes (which we have somehow included in the motivation above) and many others (AS/NZS 4360:2004, 27-29). Two important points regard the assigning of the time horizon and building the value pie within which the evaluation is carried out<sup>3</sup>.

The entire ensemble of the ASTRA Traditional Folk Civilization Museum lies in the Dumbrava Forest of Sibiu, in central Romania, a country with a climate which ranges from temperate to continental (Figure 1.). The environment extent of 96 ha (237 acres), including a lake of 6 ha (15 acres) in the centre of the site (Figure 2.), holds the largest open-air museum in Romania, which cares for a valuable cultural heritage asset and which enjoys an original thematic concept, enabling the museum to grow into one of the most representative institutions of this type in South-Eastern Europe.

### The storages of the ASTRA Centre for Heritage

The risk assessment (this case study) refers to the collections stored within the ASTRA Centre for Heritage. This is a two storied building. On the first floor there can be found the restoration studios and laboratories, whereas on the ground floor the storages and auxiliary rooms are endowed for the treating and preserving of the cultural property of the ASTRA Open Air Museum (OAM).

The architectural plans of the ground floor include two large storages of 340sqm each and their mezzanine of 260sqm. They make up together a total storing space of 1200sqm (Figure 3.). One of them was designed for permanent storing, and the other one, for temporary seasonal storing (situated towards the exhibition of the OAM for an easier access). Objects which in summertime are displayed in the ethnographic units are brought inside during the winter; this is what we have called *temporary storage*. Each of these two storage spaces has been eventually provided with one outer door and ten windows on the northwest side, for fire emergency purposes according to national standards.

The cultural goods herein stored have got various material supports, so that the collections consist in textiles, ceramics, small wooden objects or pieces

<sup>3</sup> Based on original teaching material created for the course *Reducing Risks to Cultural Heritage* presented by ICCROM (2011-2012)



of furniture, with or without painting layers, and large wooden elements belonging to traditional folk mechanisms and architectural structures.

The shelving system has got a basic metal framework providing the possibility of placing heavier objects, rolled up textiles and protecting fragile, sensitive objects inside cases.

A separate room was planned for storing the metal objects. In this room, a moving shelving system was designed. The quarantine zone, mostly used for the surveying and treatment of wooden objects, according to the everyday basic procedure, was placed between the metal and the temporary storages (Figure 3.). These two smaller rooms have got no windows at all, while access to the spaces is possible through internal corridors.

The mechanical system (HVAC - heating, ventilation and air conditioning) was designed to work by making use of four devices, as marked on the figure below (Figure 4.). At the beginning, especially for the winter period, the set-points that the climate control system had been programmed to reach were 18°C for the temperature (T) and 55% for relative humidity (RH). Adjustments were in the meantime thought necessary and dehumidifying was considered prior to heating. Except for the metal storage, where mechanical device is inside, the other three were insulated in small separate technical rooms with access from outside the building. Independent devices of distinct capacities control the temporary storage and the quarantine, sharing the same technical room.

#### A brief description of the heritage asset

The Open Air Museum is the largest and the most significant museum in the entire complex. The heritage cared for within this ensemble includes more than 330 household units and installations and its inventory numbers over 21,000 movable goods having got various material supports. A fraction of the artefacts are kept inside the ethnographic monuments of the open air exhibition all the yearlong, whereas a number of roughly 15,500 objects find themselves in storage for winter time or in permanent storage. In summertime, textiles and icons are removed from the storages and exhibited in the houses for the reconstitution of the traditional way of life.

This risk assessment refers to the collections which are preserved in the storages of the ASTRA Centre for Heritage. The 15,500 objects are housed in three separate areas – the permanent storage, the

temporary storage, and the metal storage -, with a quarantine zone between them. The care and management of the collections relate to the classification of objects according to properties, provenience, but systematic storage mostly depends on the various groups of materials, as shown in Table 1.

#### Building the value pies

As concerns the values, it was stated in several codes of ethics for conservators<sup>4</sup> that *all objects have equal values*<sup>5</sup>, which in the development of conservation profession has meant a moment of blocking. Jonathan Ashley-Smith, head of conservation at V&A and author of a monograph on risk assessment for object conservation, made the observation that *rejecting the notion of relative values does not allow prioritization and it inhibits analysis of decisions*, stating that recent development had been achieved by *directing differing amounts of effort and expenditure to classes of objects with different values, national relevance and importance* (Ashley-Smith 1999, 83).

In clearly analysing a risk, it is essential to understand the cause and the effect which is brought about within the process. When we talk about effects, we are referring to the damage that an object undergoes, otherwise the loss in value, loss in usefulness, loss in the stream of benefits. That is why we need to consider values. Robert Waller said that *objects do not have value as an inherent property* (Waller 2003, 32), instead their valuation is conditioned by a *social construction* (Avrami et al. 2000, 6). The range and diversity of values which are associated with objects and collections allow a great subdividing of kinds of values under categorisation such as economical, informational, cultural, emotional, and others.

One important simplifying rule that is applicable for this method is that no absolute valuation is required. Instead one can use ratios of values, as it has been done here by using common sense

<sup>4</sup> AIC Code of Ethics and Standards of Practice, 1979, Chapter. II. Obligations to Historic and Artistic Works, pt. C. Single Standard: *regardless of* [the conservator's] *opinion of* [the historic or artistic work's] *value or quality*

<sup>5</sup> Based on original teaching material created by Veerle Meul, *Why do we care? Value assessments in heritage conservation and management* for the course *Reducing Risks to Cultural Heritage*, presented by ICCROM (2011-2012)

judgments for the reason of demonstrating how value influences the result of risk evaluation. In conformity with the Romanian law, the tangible national cultural heritage, according to its importance, falls into two classification categories: *treasury* and *background*<sup>6</sup>. Although the ASTRA Complex owns some cultural goods classified as treasury and others as background, objective impediments have been encountered when considering their rate for calculations. Furthermore, due to the continuous acquisition, currently the amount of the assets might also have changed since the evaluation has been carried out. So please look at the numbers chiefly as demonstrative examples (Table 2. and Figure 5.).

In Table 3. we present the six categories that the assessment included as a case study. The number of objects and the associated percentages, calculated proportionally to the entire amount of items considered, is different from what the ratio of value of each category results in unison with the overall value of the case study asset (Figure 6. and 7.). As for instance, each item from the category of furniture, which has been considered the most valuable one, is tantamount to five metal objects. Purposeful equivalences have been obtained as a result of informal documentation, including casual dialogue with the museum staff. Valuation in this explicit sense has, however, never been systematically carried out and so these ratios have been arbitrary assigned for undertaking this application (showing how outcome changes according to values).

The time horizon of 30 years on which we have focused – a selection intended for the prioritization of risks –, has got the perspective of a common career time span in such a way that a young staff currently involved in the care for the museum collections could easily relate to this assessment. The utility of the time horizon for the present paper is, however, not really relevant, as long as a single risk has been evaluated.

### Risks identification

Using a systematic and well-structured approach, especially for a comprehensive process, is crucial for this step, which aims at identifying the risks. Even if the assessment is limited to certain risks, or a single one, just like in our case, it is important to be aware of other specific risks. Processes in this

regard make use of tools and techniques that include checklists, judgments based on experience and records from past events, flow charts, brainstorming, systems, scenario analysis, and so on (AS/NZS 4360:2004, 37). Stefan Michalski, a distinguished researcher in environmental issues for museums, has developed a wall chart which includes a matrix showing the agents of deterioration. For each of them there are five stages of control: avoid, detect, block, respond, and recover (Michalski 1990, 589-591; Michalski 1994, 8-11) (Figure 8.). The Canadian Conservation Institute developed *Framework for the Preservation of Heritage Collections*, conceived on the ten agents of deterioration (Physical Forces, Thieves and Vandals, Dissociation, Fire, Water, Pests, Pollutants, Light, Incorrect Temperature, and Incorrect Relative Humidity<sup>7</sup>) has recently led to developments in risk assessment<sup>8</sup>. Both Robert Waller's method and the ICCROM approach are making use of chart combinations based on this, demonstrating successful results (Waller 2011, p. 8).

Many studies of Robert Waller focus on the *three types* of risk occurrence (Waller 1994, 12-16; Waller 1995, 21-28; Waller 2003, 51) varying according to their frequency and impact intensity from rare and catastrophic to gradual processes. The ICCROM method makes use of rare events (occur less often than approximately once every 100 years), common events (occur many times per century), and cumulative processes (they occur continuously or intermittently)<sup>9</sup>.

A combination between Michalski's *stages of control* and Waller's *levels for control*<sup>10</sup> grows into a *risk mitigation strategy*. This framework, providing in theory numerous means of control, is extremely useful for finding options at the treating risk stage.

As we have not carried out, however, the treatment phase of a thorough assessment, but taking into

<sup>6</sup> The Law 182 of 25 October 2000 on the protection of mobile national cultural heritage, Ch. I, Article 4, a) and b)

<sup>7</sup> *Ten Agents of Deterioration*, CCI, <http://www.cci-icc.gc.ca/caringfor-prendresoindes/articles/10agents/index-eng.aspx> accessed on 30 April 2013

<sup>8</sup> *Caring For: Collections*, CCI, <http://www.cci-icc.gc.ca/caringfor-prendresoindes/collections-eng.aspx> accessed on 30 April 2013

<sup>9</sup> Based on original teaching material created for the course *Reducing Risks to Cultural Heritage* presented by ICCROM (2011-2012)

<sup>10</sup> Location, site, building, room, cabinet, specimen, policy and procedure in Robert Waller, *Risk...*, 1995, p. 25

account that each layer of enclosure *can be the source of hazards as well*<sup>11</sup>, we believe that mentioning them (Figure 8.) could provide readers a clue about its efficiency in identifying risks.

Table 4. introduces the mixed *generic* and *specific* potential risks that we have identified according to course instructions. We tried to determine for almost each of the ten agents of deterioration, the *three types* of risks with a possible impact (their magnitudes have not been evaluated yet) on the collections conserved and preserved at the new ASTRA Centre for Heritage.

### Analysing the risk

This step is about thoroughly understanding the risk, its sources, likelihood, consequences, and the existing levels of control. The process is a combination between qualitative and quantitative analysis as shown below. The three questions needing an answer for this purpose are the following: How often will the event occur?; What fraction of the value will be lost in each affected item?; How many items will be affected?

This analysis refers to a sporadic (*common* or *frequent*) event, expected several times over the next 100 years, regarding in terms of deterioration the incorrect RH agent (*generic risk*). The situation assumes a failure of the mechanical (HVAC) system leading to high RH excursion, by which increased amount of moisture in organic objects and on the surface of metal objects results in the deterioration of the objects, caused by mould and corrosion.

### General aspects

The scenario considers summertime mechanical failure, when computer simulations of the designed climate have revealed the fact that *the relative humidity may reach a level too high from a conservation point of view, but can then be lowered by the use of mechanical dehumidification*<sup>12</sup>. The summer peak of relative

humidity at an air exchange rate of 0.05 room volume per hour has been calculated at 71%RH. The airtightness level of the storages, however, considered for the simulation, might be different as compared to the real one, if we just take into account that ten extra windows and one outer door have been added in the meantime for each of the two main storages. Even if another simulation has showed that to an air exchange rate of 0.1 room volume per hour the maximum relative humidity reaches 82%RH, the air exchange of the storage rooms has never been controlled by tracer gas tests, although the building had been already erected for two years now. For the other seasons, as no mechanical climate control is purposely needed the HVAC system, failure could not represent a risk in the sense of this analysis.

A different aspect regards the time span needed for fixing the failure. The climate control system, an installation over average complexity, requires the intervention of professional technicians, a fact that could lead to at least a couple of weeks for solving the problem.

#### A. Frequency (How often will the event occur?)

It is important mentioning that the HVAC system has recently been commissioned and quality criteria had been demanded for its purchase. Being the first system of this kind that the museum was experiencing for the care of collections, data about past malfunctions or failure incidents were not available. That is why we considered the taking into account of the life expectancy of HVAC equipment.

*Life expectancy is one of those things that will vary widely from location to location based on usage, installation procedures, and type of system for example. Air source heat pumps can be expected to achieve 12-18 years while A/C units may last 15-20 years. Ground source heat pumps should achieve an 18-25 year life. Gas and oil furnaces will likely have life expectancies of 15-25 years. Boilers may range from 15 years to well over 30 plus years (...). The most important aspect to "long life" is the quality of the initial installation of the equipment*<sup>13</sup>.

<sup>11</sup> Based on original teaching material created for the course *Reducing Risks to Cultural Heritage* presented by ICCROM (2011-2012)

<sup>12</sup> Morten Ryhl-Svendsen, Lars Aasbjerg Jensen, Poul Klenz Larsen, *Simulation of the designed climate in Center for the Conservation, Restoration and Improvement of the Cultural Heritage at the Open Air Museum – Dumbrava Sibiului (ASTRA National Museum Complex)*, National Museum of Denmark,

Department of Conservation Research, Analysis and Consulting

<sup>13</sup> *What is the average life expectancy of HVAC equipment?*

According to various technical data, the estimation of the risk frequency for this analysis has been assumed at an average occurrence of 25 years. This is the mean time between events (MTBE) when a mechanical system failure taking place in one of the 4 devices installed at ASTRA Centre for Heritage causes high RH issues for the collections. As the uncertainty of the likelihood still remains an open argument, for a high frequency we have estimated 15 years and for a low one - 30 years between events. These have led us to the calculations below:

1 out of 4 in 30 years =  $1/4 \times 30 = 7.5$  years

1 out of 4 in 25 years =  $1/4 \times 25 = 6.25$  years

1 out of 4 in 15 years =  $1/4 \times 15 = 3.7$  years

Low	Probable	High
4	4	4 <sup>1/2</sup>

A ranking scale has been developed and offered through the ICCROM courses as a tool (Figure 9.) meant to help scoring the three levels of the risk analysis, so that the assessment would be carried out as well on a quantitative level.

#### B. Loss to each item

According to the scenario, during a period of two weeks in the summertime, as no climate control is available, relative humidity inside one of the storages reaches 82%RH or even more, exceeding the practical boundary for damp which is to be found at 75%RH<sup>14</sup>. Damp causes among other types of deterioration, mould and rapid corrosion, however visible effects require certain time spans.

Stefan Michalski's studies show that in 10 days at/over 80%RH mould gets visible on organic materials - leather, textiles, basketry, and even wood -, causing disintegration or discolouring of materials. In between 75%RH - 100%RH corrosion of metal also becomes visible in 10 days - iron, copper alloys, mixed metals as, tools, implements, kept bright and clean, but without coatings<sup>15</sup> (Michalski 2000, 8).

Although deterioration rates all climb rapidly with increased RH, the reduction of it to the safe zone within the couple of weeks that we assumed necessary for HVAC to get repaired will *reset the mould growth clock back to zero*. Also as a *respond to risk* control method, mobile dehumidifiers can be introduced to act on lowering humidity, but still ventilation deficit would permit the formation of high RH spots.

Table 5. is based on the museum staff's experience and opinions regarding the loss to each item and the damages caused by high RH on the different material categories for which the risk had been assessed. Generally, the average estimation has ranged from minuscule to tiny.

It is important to say that this part of the analysis has caused the most confusion and hesitation, especially because assigning percentages or numbers to various losses either of material nature, or value representation was a complicated and unfamiliar process. Even though no **right** or **best** number has been required, as Robert Waller used to say when asking for the **good** useful number (Waller 2011, 25), the word guideline (created for the ICCROM courses) has turned out to be the best for this step.

Low	Probable	High
1/2	1	1 <sup>1/2</sup>

As a consequence, we decided that the most likely was a minuscule loss of each item, while due to uncertainties, for the low and high probabilities we have scored with half points less and more (Figure 10.).

#### C Items affected (How many items will be affected?)

We have determined four different situations, according to the storages that benefit of the HVAC facility in ASTRA Centre for Heritage. On the other hand, according to museum staff's experience, for the biological activity, one major risk, incorrect temperature, is a bias factor, together with dust, organic remains, and other protein sensitive deposits, as well as superficial residues of various restoration treatments.

<http://www.boyersheatingandair.com/faq.htm> accessed on 2 Mai 2013

<sup>14</sup> Stefan Michalski, *Deterioration by Incorrect Relative Humidity, and the Collections Most Vulnerable*, <http://www.cci-icc.gc.ca/caringfor-prendresoindes/articles/10agents/chap10-eng.aspx> accessed on 2 Mai 2013

<sup>15</sup> Stefan Michalski, Table 1. *A summary of all forms of deterioration due to incorrect RH, and the sensitivity of*

*various collections to each one*, <http://www.cci-icc.gc.ca/caringfor-prendresoindes/articles/10agents/chap10-eng.aspx> accessed on 2 Mai 2013



Objects from the permanent storage should be less affected in case of a climate mechanical control failure. Instead, the collections from the temporary storage are much more exposed to risk, considering the seasonal transference of objects from the open air exhibition to the storage. Although, at their return, the items in storage are carefully cleaned and surveyed in a transit zone, situations of undetected pest (mould, insects) presence might arise. From the point of view of conservation procedures, spring and autumn are the busiest periods at the ASTRA Centre for Heritage, for that when objects are brought in from the ethnographic units, these ones happen to be kept over a few weeks in the quarantine, making possible, if high RH, the development of biological activity.

Iron-made objects were usually cleaned and coated. Some of the new acquisitions, however, might be still untreated and mostly these would be at risk of corrosion if a mechanical failure occurs.

Table 6. contains the estimated numbers of items affected, showing, according to valuations presented in the stage of context establishment, how the value of each category has got an influence on final scores. At the moment of the analysis, the distribution of objects in storages was following provisory solutions, some of which are now being different.

These calculations have demonstrated that the most value-affected was expected if a HVAC system failure occurred in the temporary storage and the less in the permanent and metal storages, whereas the expected loss for the quarantine area was between of these. For the majority of close likelihood we have thereby assigned the same for low and probable estimations, as for the high probability we considered the results for the temporary storage (Figure 11.).

Low	Probable	High
1 <sup>1/2</sup>	1 <sup>1/2</sup>	2

### Evaluating the risk

Although the purpose of risk evaluation is to make decisions, based on the outcomes of the risk analysis and to appoint on these which are the priorities for treatments, being a single risk assessment we are pleased to make a few remarks on the magnitude of risk. First we should mention that the magnitude of risk is given by the sum of the three components of the risk scale ( $MR = A + B + C$ ). In our case, adding our probable scorings took us on the ABC scale at the value of **6<sup>1/2</sup> magnitude of risk**.

The ICCROM method uses a ranking scale of five levels, which covers risks of catastrophic priority (15 – 13<sup>1/2</sup>), extreme priority (13 – 11<sup>1/2</sup>), high priority (11 – 9<sup>1/2</sup>), medium priority (9 – 7<sup>1/2</sup>), and below. The number obtained by this analysis places our risk in a non-priority zone (Figure 12.). This means that a minuscule damage was expected to occur in a tiny fraction of the collection value, although the frequency relates to, probably, a few events in a century.

An interesting aspect of the assessment regards the uncertainty when trying to predict the future. For this particular reason, as it can be noticed above, besides the most likely estimate, a high and a low estimate of each component were also assigned, so that the span between the last two represents our uncertainty.

CCI Heritage Risk Management Database, an extremely useful tool, was provided to participants within the ICCROM Course. The utility of it results not only in introducing precisely the data of the assessments, but also in the fact that, for instance, uncertainty is handled mathematically, and an average or expected value is computed (Figure 12.). Being realistic about that is accepting that on average basis, risk was close to the medium priority level<sup>16</sup>, while for high estimations the score crossed its lower boundary.

### Conclusions

I believe that the outcome expected and confirmed has been proved and the actual circumstances will provide much better conditions for the preservation of ASTRA Museum of Traditional Folk Civilization collections. The newly built ASTRA Centre for Heritage stands for a major improvement of storage conditions. For the museum collections, the highest priority risk which they dealt with was the situation that took place in the past.

According to the utility of the risk-based approach, I believe that disseminating the knowledge and information about the ICCROM method for reducing risk to cultural heritage is an opportunity

<sup>16</sup> Medium priority. *Moderate damage or likelihood of loss over many decades or significant loss over most of the collection that is expected to take many millennia. These scores apply to the ongoing improvements even conscientious organizations must make after addressing all of the higher risks.* Based on original teaching material created for the course *Reducing Risks to Cultural Heritage* presented by ICCROM (2011-2012)

for professionals to acknowledge the benefits of risk management.

From the inside of a conservation department - the Training Centre for Conservators and Restorers -, the carrying out of this assessment has made me understand many particular and theoretical aspects, as well as professional practical issues concerning the care of collections. It has also given me an overview comprehension of the recently constructed conservation facility and its endowments. Furthermore, having the chance of attending an ICCROM course has offered me the unexpected opportunity of meeting and interacting with a whole world, unified far and wide by the same cultural interests.

From this out, a comprehensive risk assessment would be the ultimate challenge to be accomplished for a complete evaluation, prioritization, and exploration of the options for risk treatment.

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Figure 1.



Figure 2.

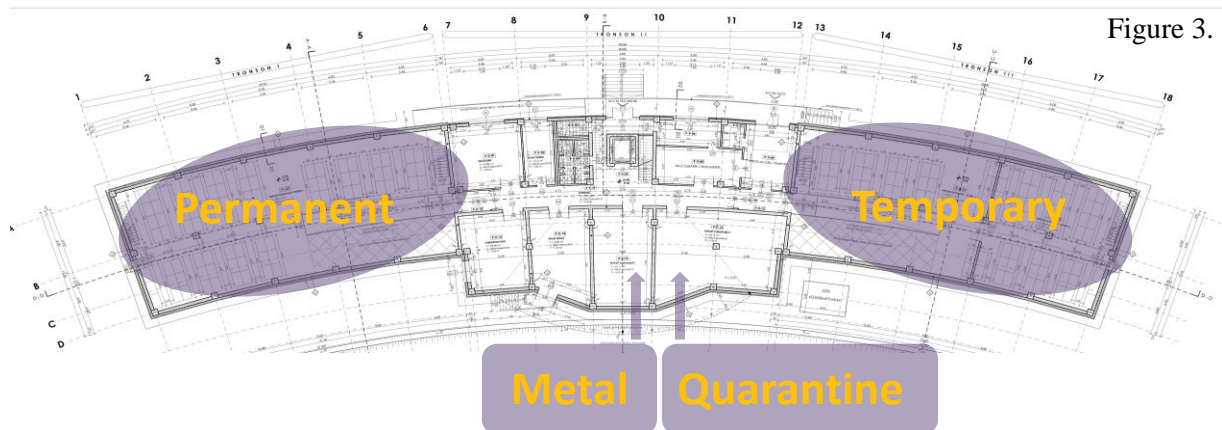


Figure 3.

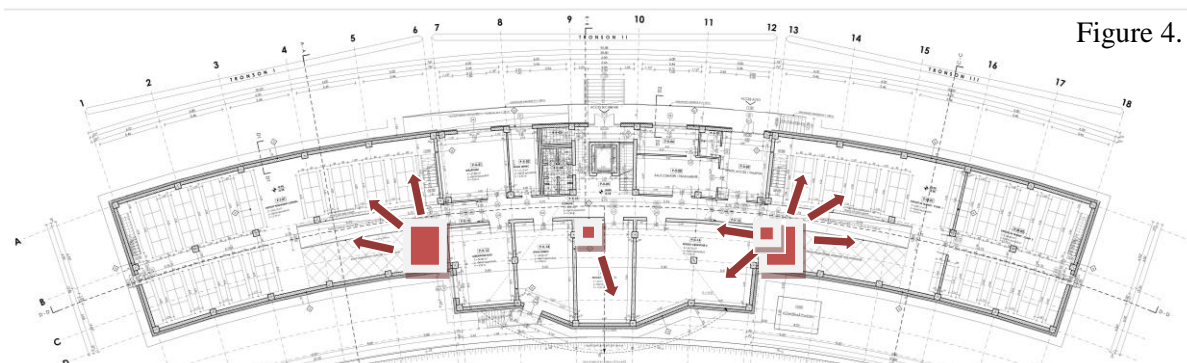


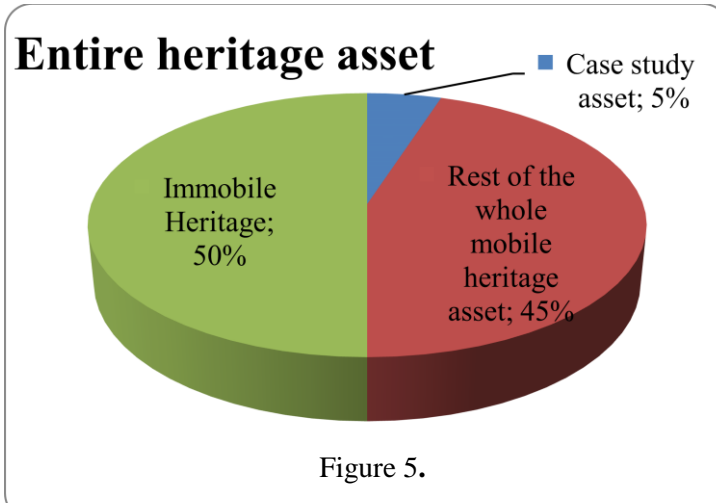
Figure 4.

Collections of objects	Groups of materials
Collection of the Open Air Museum (OAM)	Furniture/ Painted Furniture
Collection of Craiova	Metal
Collections of Orlat	Textile (includes leather apparel)
- Landlers Collection	Wood
- Rangers School ( <i>Școala Grănicerească</i> )	Ceramics
	Icons

Table 1.

Value category	Brief explanation of the importance in relation to the entire heritage asset	%contribution to the overall value of the entire heritage asset	
Case study asset	21,722 ethnographic objects represent the mobile collection of ASTRA Museum of Traditional Folk Civilization, one of the four ASTRA Museums. The importance of the collections is relevant in the context of presenting the traditions of the Romanian people and their regional specificities according to the mission of the Open Air Museum. 6,238 objects of them are not in storage and we will not refer to them. These were added to the rest of the mobile heritage.	15.484 objects	5%
The whole mobile heritage asset (except case study asset)	ASTRA National Museum Complex is an ethnographic complex, of four important museums, which gathers an overall of 166.689 cultural mobile goods with regional, national and even international ethnographic significance. This assessment regards a fraction out of the entire asset as shown in Figure 5.	151.205 objects	45%
Immobile Heritage	Ethnographic monuments - household units and installations, representative for all the country has a national and international significance due to their uniqueness in Romania. Together with the mobile collections represent the whole cultural property cared for by the ASTRA National Museum Complex.	330 constructions	50%
Overall value of the entire heritage asset of ASTRA			100%

Table 2.



Categories in the case study	Quantities and corresponding % of items considered for the assessment		Brief explanation of the significance of the items from each category	Ratios and % correspondent in regard to the overall value of the case study asset	
<b>Furniture</b>	5000	32%	The furniture/ painted furniture are important for their intrinsic and aesthetic values, but these also include an important ethnographic significance related to the conditions of life and social affiliations of the original owners.	1:5	53,48%
<b>Metal</b>	2455	15,86%	The value of metal ethnographic objects relates to the skilful methods of manufacturing and the ingenious traditional and preindustrial utilities in the Romanian traditional households.	1:1	5,25%
<b>Textile</b>	3327	21,49%	Textile significance results out of their traditional manufacturing techniques, the uses of natural colours, the utility of the items and decorative value within house interiors as well as the traditional folk fashion representation and the social statute association.	1:3	21,35%
<b>Wood</b>	2000	12,92%	The value of wooden made ethnographic objects relates to the skilfulness and the manufacturing methods as well as their ingenious traditional and preindustrial utilities in the Romanian households.	1:3	12,84%
<b>Ceramic</b>	2500	16,15%	Significance of ceramics results out of their traditional manufacturing techniques and the applications of decorative colours and enamels as well as their utility and ornamental meaning in the house interiors.	1:1	5,35%

<b>Icons</b>	202	1,30%	Icons have major aesthetic and traditional folk technique value, but they are also important for their ritual significance.	1:4	1,73%
<b>TOTAL</b>	<b>15.484</b>	100%	<b>Overall value of case study asset</b>		<b>100%</b>

Table 3.

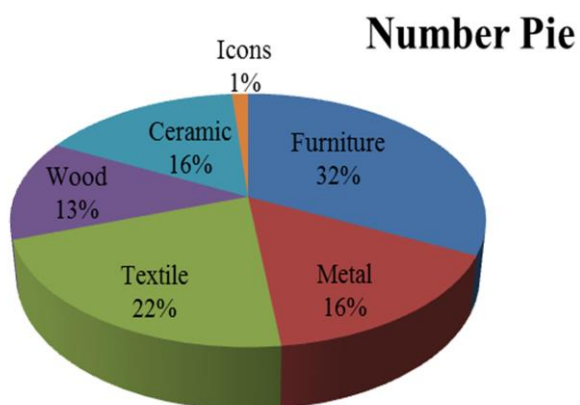


Figure 6.

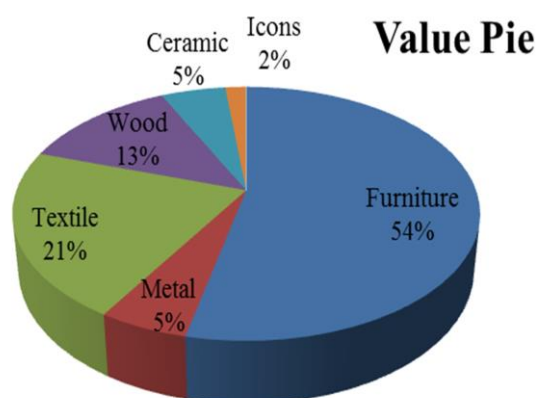
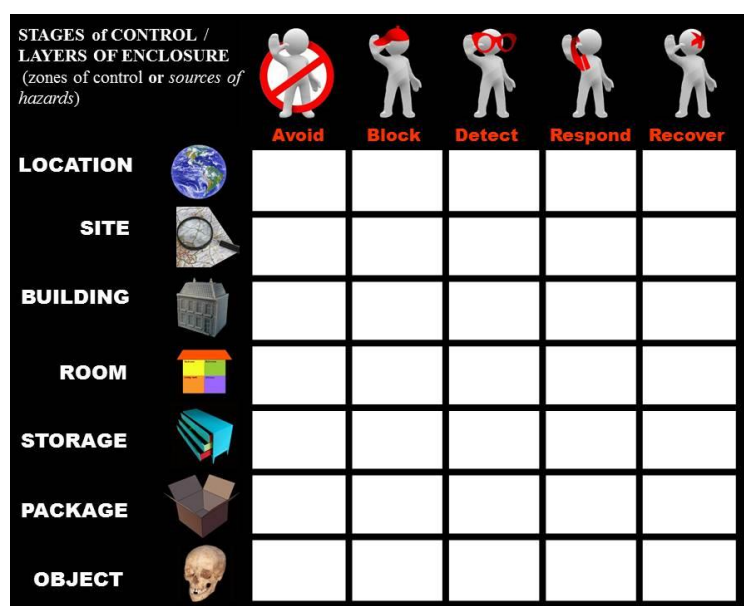


Figure 7.

Figure 8. Based on original teaching material created for the course *Reducing Risks to Cultural Heritage* presented by ICCROM.

Types of risk / Agents of deterioration	Rare events (less than 1 event per ~100 years)	Sporadic events (more than 1 event per ~100 years or at least one per year)	Cumulative processes (includes small events that occur many times per year)
Physical forces	Vibration induced by earthquake causes falling	Poor handling at transportation causes tears	Squeezing objects in overcrowded storages



	and breaking of ceramics.	on textiles and scratches on wooden objects.	causes distortion (deformation) of objects.
Criminals	Unauthorized persons accessing storage steal objects causing total loss of objects.	Unintentional displacing of objects results in temporary loss of objects.	
Fire	Fire ignited in storage because of faulty electrical system causes soiling and fumigation of collections.	Fire ignited by prohibited smoking spreads in one room fumigating a few objects.	
Water	Rain water inundates storages at ground floor because of external inefficient drainage swelling and distorting wood structured objects.	Water from accidental pipes breakage causes migration of natural colours in textiles and deformation of objects.	Water resulted from condensation falls from the ceiling on the objects causing stain marks on textile and corrosion on the surface of metal objects.
Pests		Undetected pests enter in storage from nearby rich vegetation habitat causing stains and partial losses of objects.	Insects enter in storages with objects treated incompletely against pests causing loss from objects by consuming parts of them.
Pollutants/ Contaminants	Pesticides transferred by contact from early treated objects causes modification of scientific investigation resulting in loss of informational value	Dust produced after recent drying of building materials leads to superficial abrasion on objects.	Cleaning materials applied excessively causes surface damages to objects.
Light and UV		UV from lighting during working hours in the storage area causes yellowing of textiles.	Daylight entering by the windows of the storages causes fading of painted furniture and coloured textiles.
Incorrect T	Seasonal high temperatures (together with high RH) activate mould growth in the collection causing stains on organic objects. Fluctuating temperature at the transfer of objects from households to storage causes physical damage by material fatigue.		High temperature set for RH control accelerates chemical reactions causing progressive disintegration of objects.
Incorrect RH	High RH due to HVAC system failure leads to the rising of moisture in/ on objects which causes deterioration by mould/ corrosion. High RH in deficient ventilated spots causes local mould growth which disintegrates or stains (discolours) textiles, leather and wooden objects.		Fluctuating RH due to differences in expansion of layered objects causes tensions and detachment of painting layers.
Dissociation		Loss of documentation of a household mobile goods assembly results in loss of ethnographic value.	Fading of painted inventory numbers makes impossible the identification of objects leading to their loss of

		value.
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Table 4. based on original teaching material created for the course *Reducing Risks to Cultural Heritage* presented by ICCROM (2011-2012).

<b>5</b>	<b>~1</b>	<b>year</b>	<b>1 – 2 years</b>
<b>4½</b>	<b>~3</b>	<b>years</b>	<b>2 – 6 years</b>
<b>4</b>	<b>~10</b>	<b>years</b>	<b>6 – 20 years</b>
<b>3½</b>	<b>~30</b>	<b>years</b>	<b>20 – 60 years</b>
<b>3</b>	<b>~100</b>	<b>years</b>	<b>60 – 200 years</b>
<b>2½</b>	<b>~300</b>	<b>years</b>	<b>200 – 600 years</b>
<b>2</b>	<b>~1 000</b>	<b>years</b>	<b>600 – 2000 years</b>
<b>1½</b>	<b>~3 000</b>	<b>years</b>	<b>2 000 – 6 000 years</b>
<b>1</b>	<b>~10 000</b>	<b>years</b>	<b>6 000 – 20 000 years</b>
<b>½</b>	<b>~30 000</b>	<b>years</b>	<b>20 000 – 60 000 years</b>

Figure 9. Extracted from original teaching material created for the course *Reducing Risks to Cultural Heritage* presented by ICCROM.

Category	Degradations caused by high RH	Loss
Furniture (painted furniture)	Mould growth causing superficial weakening of the materials, stains, covering painted surface. Loss from aesthetic value. Bias wood borers activity (if present in any latent life stage) which can result in galleries and holes in the wood. Loss from object. Micro-fissures in the varnish and paint layers due to high RH can generate a mat aspect. Loss from aesthetic value. Loss from traditional technique value.	Minuscule
Textile (also leather items)	Mould growth causes alterations - fibres get brittle, while coloured stains modify aesthetic aspect. Loss from material integrity. Bias moth and insect activity (if undetected moth eggs are present) causing holes in textiles. Loss from aesthetic value and consuming material of the object.	Tiny
Wood	Mould growth causes the weakening of the materials, stains. Bias wood borers activity which leads to galleries and holes in the wood. Loss from object.	Minuscule
Ceramic	Low sensitivity	0%
Metal	Alloys and iron based objects, with no coatings, corrode. Loss of material integrity and aesthetic value.	Tiny
Icons (wood panels)	Mould growth causes the weakening of the materials, stains, cover painted surface, (especially if organic residues, deposits, fingerprints are present), resulting in loss of aesthetic value. Bias wood borers activity resulting in galleries and holes in the wood. Loss from object. Micro-fissures in the varnish and paint layers due to high RH can generate a mat aspect. Loss from aesthetic value. Loss from traditional technique value.	Minuscule

Table 5.



<b>5</b>	Total or almost total loss of value in each affected item
<b>4½</b>	
<b>4</b>	Large loss of value in each affected item
<b>3½</b>	
<b>3</b>	Small loss of value to each affected item
<b>2½</b>	
<b>2</b>	Tiny loss of value to each affected item
<b>1½</b>	
<b>1</b>	Miniscule loss of value to each affected item
<b>½</b>	

Figure 10. Extracted from original teaching material created for the course *Reducing Risks to Cultural Heritage* presented by ICCROM.

Storages	Distribution of categories in each storage	Nr and % of objects in each storage	%Value of the entire category asset and % value of each item from its category	Nr. of items affected	%Value of items affected	Total %value of items affected
Permanent Storage	Furniture	<b>4980</b> -99,6%	53,48% / 0,0106%	<b>2</b>	0,021%	0,046%
	Wood	<b>300</b> -15%	12,84% / 0,0064%	<b>4</b>	0,025%	
Temporary Storage	Wood	<b>1600</b> -80%	12,84% / 0,0064%	<b>6</b>	0,038%	0,119%
	Icons	<b>202</b> -100%	1,73% / 0,0085%	<b>2</b>	0,017%	
	Textiles	<b>3327</b> -100%	21,35% / 0,0064%	<b>10</b>	0,064%	
Metal storage	Ceramics	<b>625</b> -25%	5,35% / 0,0021%	-	-	0,042%
	Metal	<b>2455</b> -100%	5,25% / 0,0021%	<b>20</b>	0,042%	
	Ceramics	<b>1875</b> -75%	5,35% / 0,0021%	-	-	
Quarantine	Wood	<b>100</b> -5%	12,84% / 0,0064%	<b>8</b>	0,051%	0,093%
	Furniture	<b>20</b> -0,4%	53,48% / 0,0106%	<b>4</b>	0,042%	

Table 6.

<b>5</b>	<b>~100%</b>	<b>100% – 60%</b>
<b>4½</b>	<b>~30%</b>	<b>60% – 20%</b>
<b>4</b>	<b>~10%</b>	<b>20% – 6%</b>
<b>3½</b>	<b>~3%</b>	<b>6% – 2%</b>
<b>3</b>	<b>~1%</b>	<b>2% – 0.6%</b>
<b>2½</b>	<b>~0.3%</b>	<b>0.6% – 0.2%</b>
<b>2</b>	<b>~0.1%</b>	<b>0.2% – 0.06%</b>
<b>1½</b>	<b>~0.03%</b>	<b>0.06% – 0.02%</b>
<b>1</b>	<b>~0.01%</b>	<b>0.02% – 0.006%</b>
<b>½</b>	<b>~0.003%</b>	<b>0.006% – 0.002%</b>

Figure 11. Extracted from original teaching material created for the course *Reducing Risks to Cultural Heritage* presented by ICCROM

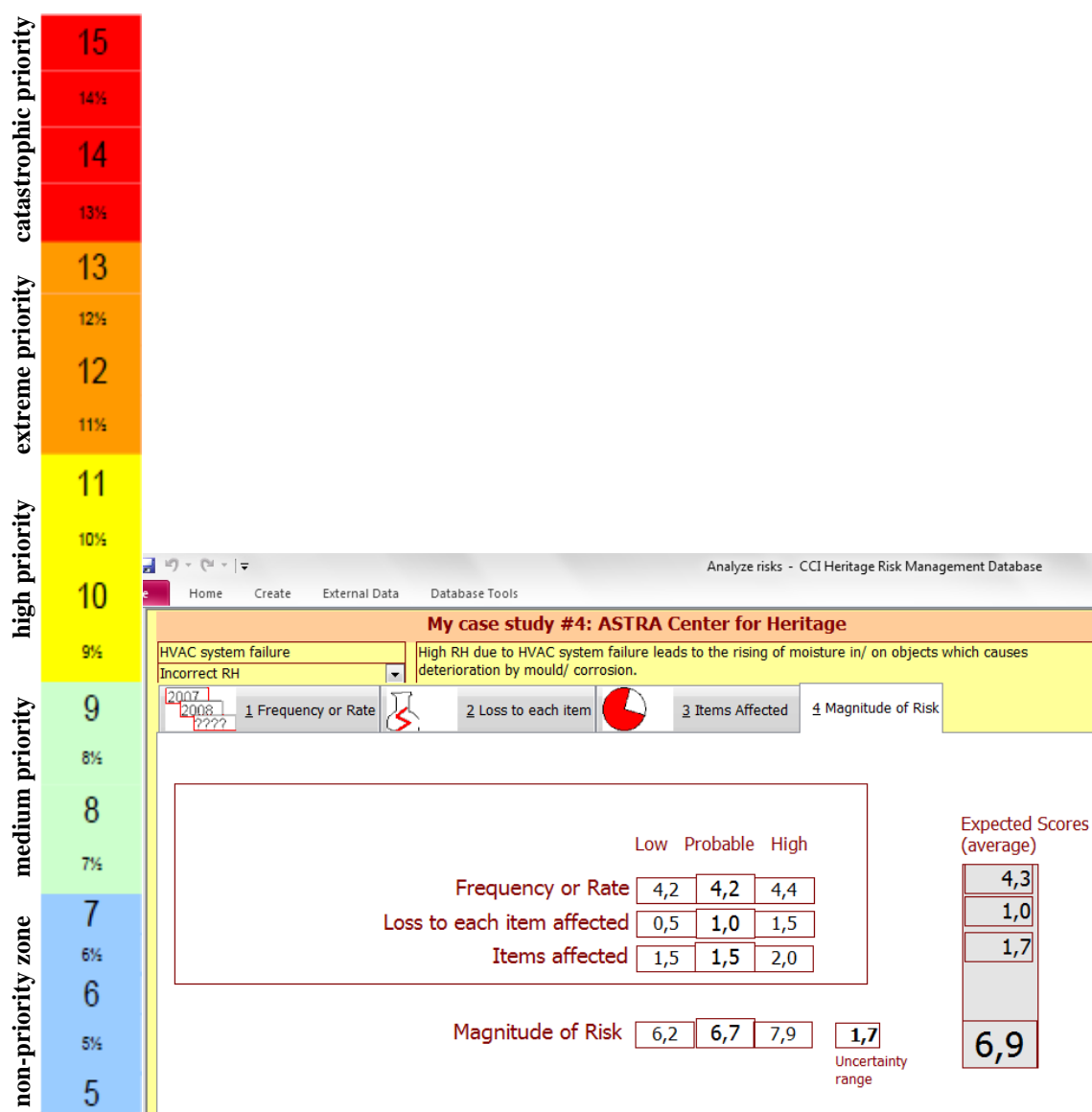


Figure 12.



## FIREARMS RESTORATION AND PRESERVATION

Dorin BARBUE, PhD\*

**Abstract:** *This paper describes the different methods of restoring firearms components used in Brukenthal National Museum laboratory and guidance for their exhibition and storage*

**Keywords:** *fire arms, restoration, exhibition, storage*

**Abstract:** *În acest articol sunt descrise metode diferite de restaurare a componentelor armelor de foc, folosite în laboratorul Muzeului Național Brukenthal, precum și indicații de expunere și depozitare a acestora.*

**Cuvinte-cheie:** *arme de foc, restaurare, expunere, depozitare*

The previous preservation of weaponry and of combat equipment was done partially by the combatants, under the supervision of the master gunsmith (Abrudan, Sontag 1974-1975, 121-140). But the gunsmith was compelled as it was stated in the duty regulations, drafted in 1557 by the town magistrate (A.S. Sibiu, documents and fly-sheets collection, level U, V, nr 1689 of 1557) "twice a year to clean and lubricate the double arquebuses and the small ones, the hand barrels and the iron lances, to stir the gunpowder within the barrels, to move the cannon barrels within the crates,..., to put some planks under the muzzle to prevent rust". There surely must have been early pursuits to preserve and "repair" firearms, there are many guidelines in books that deal with our topic, but the best advice that was given by J. Heymann (Heymann 1998, 379) is: "when you're in possession of a firearm it is better to give it to a restorer rather than ruin it yourself".

Because of the mechanical complexity of these pieces as well as the diversity of in-built materials (metal inserted wood, nacre, bone, horn, casted or molded steel with precious metals or gold plated, brass, silver etc) to treat each component accordingly cannot be done but after a general

dismantlement. Such a dismantlement encountered often hurdles due to the corroded jammed components. Therefore, the restorer could fully analyze the "health" of the respective firearm, recording besides the condition of the outside components also new elements, only inward visible.

### Firearms preservation and restoration procedures

Before any restoration procedure, certain physical and chemical investigations are mandatory; corrosion products, metallographic samples, scans, biological investigations are analyzed (type of wood, bone, nacre), as well as a photographic documentation before and after the restoration is drafted. Depending of the outcome of these investigations, after the manufacturing technique has been studied and the preservation state of the object has been assessed, the restorer similar to a physician drafts a diagnosis of the object involved.

According to the type and intensity of corrosion, different restoration techniques are applied by withholding the principles of restoration: minimal intervention, the usage of compatible and reversible materials, safeguarding of all components, the completion of the object only

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when over 50% is available etc.

Partial or total dismantling (barrel and mechanism) is recommended not only for cleansing of components (which is mandatory) but also brings with itself new information about the type of mechanism, inner marks, etc. Jammed screws are unlocked by using Breakfree, a product that dissolves iron corrosion products.

### **The barrel and iron components without springs**

- a. If the corrosive attack isn't that strong, a mechanical cleansing is desirable, using appropriate tools like: glass fiber brush, bamboo sticks, iron wool, the glass beads microsandblaster, abrasive pastes (Dibon, Autosol, Blaupol), fine abrasive paper dipped in weapon oil, then a degreasing follows using organic solvents (acetone, carbon tetrachloride) and a lubrication with silicone oil.
- b. If the corrosive attack is strong, depending on its intensity a chemical cleansing by immersion is used in one of the following solutions:

1. Phosphoric acid 10%, thiourea 1% as a corrosion inhibitor (Stambolov 1985), 1% stripping auxiliary, 8% N-butyl alcohol, up to 100% distilled water; repeated baths of distilled water until neutralization is achieved, passivation by phosphate conversion coating in phosphoric acid without inhibitor (3 min. immersion, then 10 min. for drying after which the surplus is removed.
2. Complexon III 10%, ph=5,5; repeated washings with distilled water, phosphate conversion coating in phosphoric acid 20%, then a fine protection layer of Paraloid B72,5% is applied.
3. Na citrate 10% (Heinrich 1994); repeated washings with distilled water, phosphate conversion coating in phosphoric acid 20%, then a fine protection layer of Paraloid B72,5% is applied.

The inside of the gun barrel: mechanical cleansing with spiral brushes, lubrication with Balistol, wiping with cotton applied on a rod. If this doesn't suffice then a degreasing with carbon tetrachloride will be used, followed by a treatment with Fertan

and after 24 hours a fine protection layer of Paraloid B72,5% is applied.

### **The springs**

All springs are mechanically cleansed in order to avoid the hardening loss that usually occurs after a chemical treatment; after that a degreasing with organic solvents follows, then a lubrication with silicone oil

### **The brass and silver fittings**

- a. If the corrosion products are inactive or if the fittings cannot be dismantled: degreasing with organic solvents; local cleansing with Sidol, Duraglit (White 1995, 4), polish pastes or Metarex (a special wadding imbued in a cleansing solution; antioxidant protection a special cloth for polishing and the protection of silver.
- b. if the fittings show signs of an active attack with corrosion products such as chlorides and copper carbonates:
  1. Degreasing with organic solvents; chemical cleansing in formic acid 10% (Hucke, Bleck 1981); washing in distilled water; polishing with polish paste (Blaupol, Autosol, Dibon, etc); it is not recommended to varnish the fittings
  2. degreasing; chemical cleansing in Complexon III 10%, ph=10 with a buffer solution (77 g of pure ammonium acetate dissolved in 200ml of water. We prepare separately 350ml NH<sub>3</sub> 25%. We pour the 350ml solution over the ammonium acetate after that we complete it with distilled water up until 1000ml; lavation in distilled water, polishing with a polish paste.

### **The wood**

First of all it should be known exactly what wood essence we possess and how it has been treated (up until the 18-th century it was polished with flaxseed oil, beeswax).

- a. If we don't have a Xylophage attack and the wood has tar residues: stripping with an universal cleaning agent (Vernistac), the completion of the wood if necessary with wood of the same essence, on the fiber,

glueing with bone glue, grouting with wooden putty, finishing, chromatic integration with stains, polishing with wax or flaxseed oil, if appropriate.

- b. If we have a Xylophage attack (usually weapons before 18-th century): injection of Per-Xil 10 in all holes, wood strengthening by impregnation with Paraloid B72 12% in toluene both injection as well as brushing, stripping, coarse grouting with Sinto Legno (Pergan GmbH, Bocholt, Germany), and the fine grouting with Modostuc (Plasveroi International, Vellezzo, Italy) at the wood color, finishing of grouting with fine sandpaper, chromatic integration with stain and polishing with flaxseed oil or wax.

### Ornaments, missing components

1. The wooden, bone, nacre, iron, brass, silver, etc components will be completed (only if less than 50% of the original is missing) or a replica of the same material is made of the same essence as the original only if there are similarities (Barbu 2003)
2. The screws with a worn-out thread: a new part of the screw is made with the help of a lathe; this is welded on the original screw, the worn-out part is kept for subsequent metallographic analysis. Where they are missing, parts are to be made in full on lathe, maintaining the original thread pitch

Of course these procedures cannot be always applied because each weapon has its peculiarities.

### Weapon exposure and storage

Essential for ensuring a proper conservation of museum objects is to ensure a constant climate whose parameters must comply with the permissible values without sudden fluctuations, both in exhibitions and storages. Main microclimatic factors that affect the condition of the objects are: the relative humidity, the temperature, the light and the pollutants.

A. Relative Humidity shows the degree of air saturation with water vapors, it is expressed by the ratio between the amount of water vapors contained in a certain space at a specific moment in time and the maximum amount of water vapors

that the same air volume could contain at the same temperature. The relative humidity varies inversely with temperature: if the temperature rises, the relative humidity decreases and vice versa, if the temperature drops, the relative humidity rises. All firearms have 2 major components: one is inorganic: the barrel, the mechanism, the fittings and one organic component: the butt and the groove, the ornaments made of: bone, horn, nacre, coral.

For the metallic components, a relatively low humidity is recommended, between 0-30%, for the organic components: wood 55-65%, bone between 45-65% (Lang, 1990, p 26) at a temperature of 10-20<sup>0</sup>, but in our case as we have a mixture of these conditions an optimum range of humidity results, between 55-60% at a temperature of 14-18<sup>0</sup>, ideal case would be a relative humidity of 58% at a temperature of 16<sup>0</sup> (Moldoveanu 1999, 91).

- High values of relative humidity accelerate the chemical and photochemical processes that modify the woods color
  - accelerate some processes of autooxidation
  - intensify the metal corrosion
  - cause the migration in time of absorbed salts to the surface (in case of wood, bone)
  - favor the biological decay determining the occurrence of fungi
  - soften the natural adhesives used.
- Low values of relative humidity lead to dehydration of organic materials and decrease their mechanical resistance
  - cracks, cuts and pronounced distortions that cause loss of substance and modify the shape of the object.

Much more serious is when the relative humidity fluctuation of more than 40% (Michalski 1994, 6).

In order to maintain an optimal relative humidity the following methods are used:

- Common devices for air-conditioning
- compensation of moisture deficit (forced, controlled evaporation)
- the use of hygroscopic buffer substances (in closed showcases silica gel is used, 20 kg/m<sup>3</sup>).

B. temperature reflects the energy level of a material. As a degradation factor of cultural objects, temperature acts in 3 specific directions:

- a. Participates in the construction of relative humidity values
- b. Modifies objects through dilatations-contractions
- c. Promotes numerous chemical processes as source of activation energy

A rise of temperature entails by itself physical effects (increases interatomic and intermolecular distances, size changes and changes some physical properties as well), chemical (increases the rate of chemical processes through thermal activation) and biological (emergence and development of biological pests).

Effective measures against damages caused by temperature:

- tightly closed rooms
- Their thermal insulation
- Correlation of temperature with relative humidity
- Screening of incandescent light sources

C. The light is one of the most important environmental factors involved in the processes of degradation of cultural goods. Its contribution to the degradation processes: it provides the activation energy of numerous processes and chemical reactions, called in this case photochemical processes. Light sources used in museums: natural light, fluorescent and incandescent light; they emit a different amount of infrared and ultraviolet radiations. Because of this, the exposure of objects to daylight (the most harmful) must be avoided. The artificial light sources that will be used must be chosen with great care.

- a. in order to eliminate UV rays, different filters are used (Mourey 1997, 118):
  - Powder filters: they are chemical products (benzophenone, benzotriazole), that once incorporated in a support material allow only to the visible light to pass, blocking UV rays.
  - sheet or film shaped filters (methyl polymethacrylates)

- b. In order to eliminate infrared rays - as was the case for UV, there are protective films that reflect a great amount of the IR, leaving only the visible spectrum rays to pass.
- c. Protection against lights of the visible spectrum. The allowed brightness for these objects is between 50-100 luxes.

So one should try to shield the light sources and in addition to the restrictions regarding the amount of light, one has to take into account that the light sources should be located outside the showcases.

D. Pollutants. Some gases are harmful to metal objects therefore we can protect these objects placing them into enclosed spaces (exhibitions, warehouses) where there are air-conditioning devices equipped with carbon active filters.

Within an exhibition, the objects can be displayed in special, tightly closed showcases or on glass protected panels; for a warehouse, special racks or metal cabinets are used. It is preferable for the weapon springs to be in a relaxed position so that they not lose of their strength (Hartink 2002, 40). In all cases where we have wood, certain problems could emerge because the wood has components that emit small amounts of harmful gas (hydrogen sulphide, organic acids). In a study undertaken at the British Museum on most of the wood essences, the lowest attack was caused by the Honduras Acaju wood and among synthetic materials, methacrylates and polystyrene (Strolow 1981, 39). This selection isn't always possible, therefore the shelves inside warehouses are protected with inert materials and inside the showcases silica gel is placed; in addition to the fact that it lowers the relative humidity it also absorbs most of the organic vapors and thus slows down to a stop all forms of corrosion. Also, in tightly closed showcases several different inhibitors can be introduced as vapors. The ideal preservation technique for enclosed spaces where objects are stored would be a slight Nitrogen overpressure in these spaces (Mourey, quoted works, 115). We must not forget the handling, transport, firefighting, safety and security rules according to the law as well as the microclimatic factors monitoring devices

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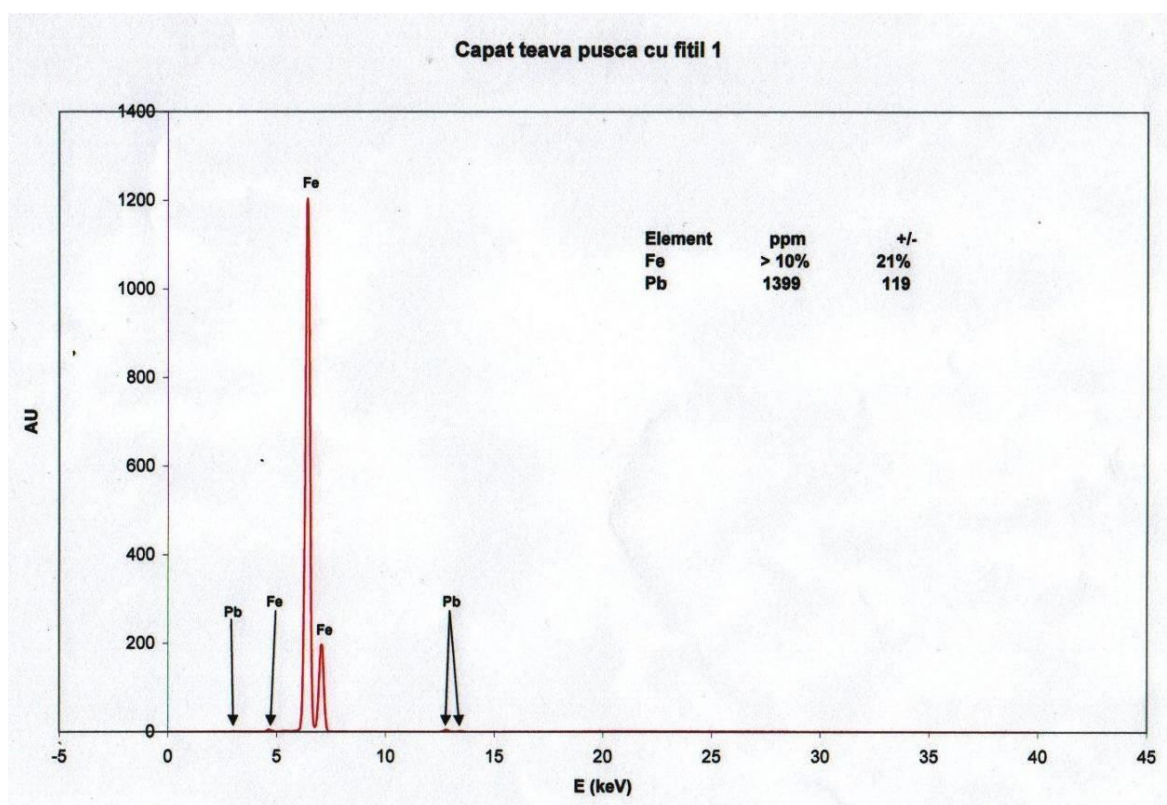


### **LIST OF ILLUSTRATION**

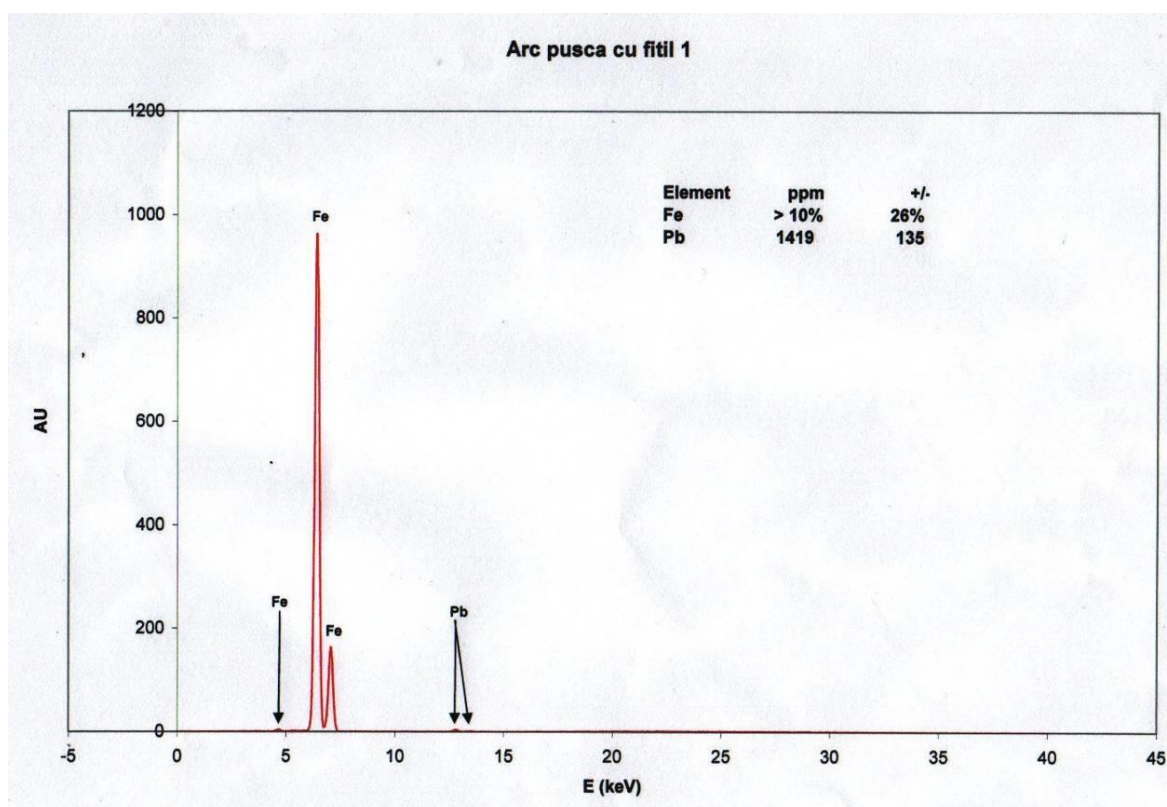
1. Analysis result of a sample from within the muzzle of a rifle with fuse, using X-ray fluorescence, analysis carried out at the INCCR Bucharest
2. Analysis result of a sample from within the spring of a rifle with fuse, using X-ray fluorescence, analysis carried out at the INCCR Bucharest
3. Rifle with fuse before restoration
4. Rifle with fuse before restoration
5. Rifle with fuse after restoration
6. Pistol before restoration
7. Pistol after restoration
8. Pistol before restoration
9. Pistol after restoration
10. Pistol before restoration
11. Pistol after restoration
12. Pistol before restoration
13. Pistol after restoration
14. Rifle before restoration
15. Rifle after restoration
16. Rifle before restoration
17. Rifle after restoration
18. Crate for transportation of firearms

### **LISTA ILUSTRAȚIILOR**

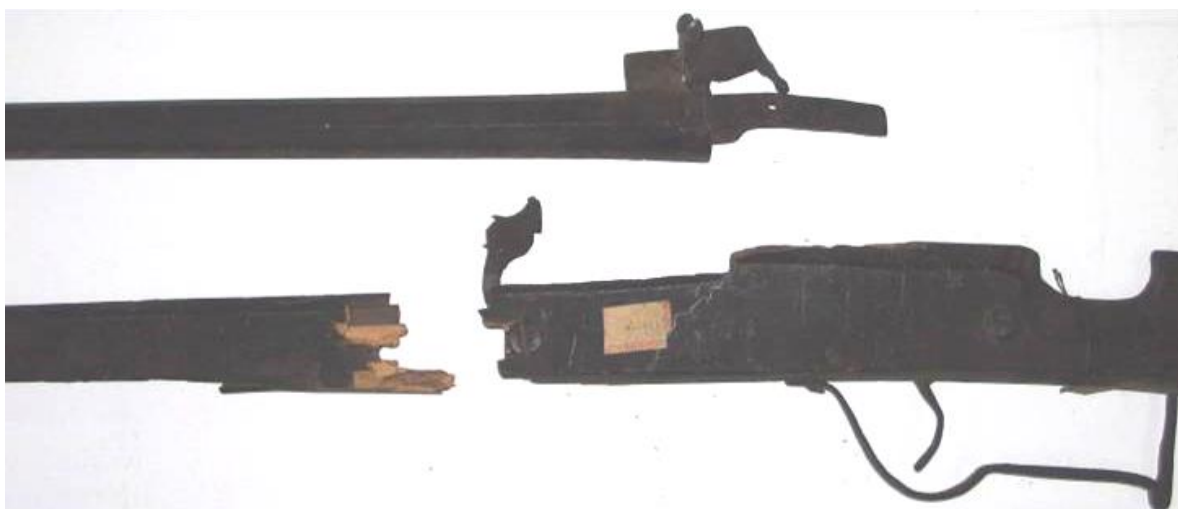
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2. Rezultatul analizei probei din arcul unei puști cu fitil prinfluorescență de raze X realizată la INCCR București
3. Pușcă cu fitil înainte de restaurare
4. Pușcă cu fitil înainte de restaurare
5. Pușcă cu fitil după restaurare
6. Pistol înainte de restaurare
7. Pistol după restaurare
8. Pistol înainte de restaurare
9. Pistol după restaurare
10. Pistol înainte de restaurare
11. Pistol după restaurare
12. Pistol înainte de restaurare
13. Pistol după restaurare
14. Pușcă înainte de restaurare
15. Pușcă după restaurare
16. Pușcă înainte de restaurare
17. Pușcă după restaurare
18. Ladă pentru transportul armelor de foc



1. Analysis result of a sample from within the muzzle of a rifle with fuse, using X-ray fluorescence, analysis carried out at the INCCR Bucharest



2. Analysis result of a sample from within the spring of a rifle with fuse, using X-ray fluorescence, analysis carried out at the INCCR Bucharest



3. Rifle with fuse before restoration



4. Rifle with fuse before restoration



5. Rifle with fuse after restoration



6. Pistol before restoration



7. Pistol after restoration



8. Pistol before restoration



9. Pistol after restoration





10. Pistol before restoration



11. Pistol after restoration



12. Pistol before restoration



13. Pistol after restoration



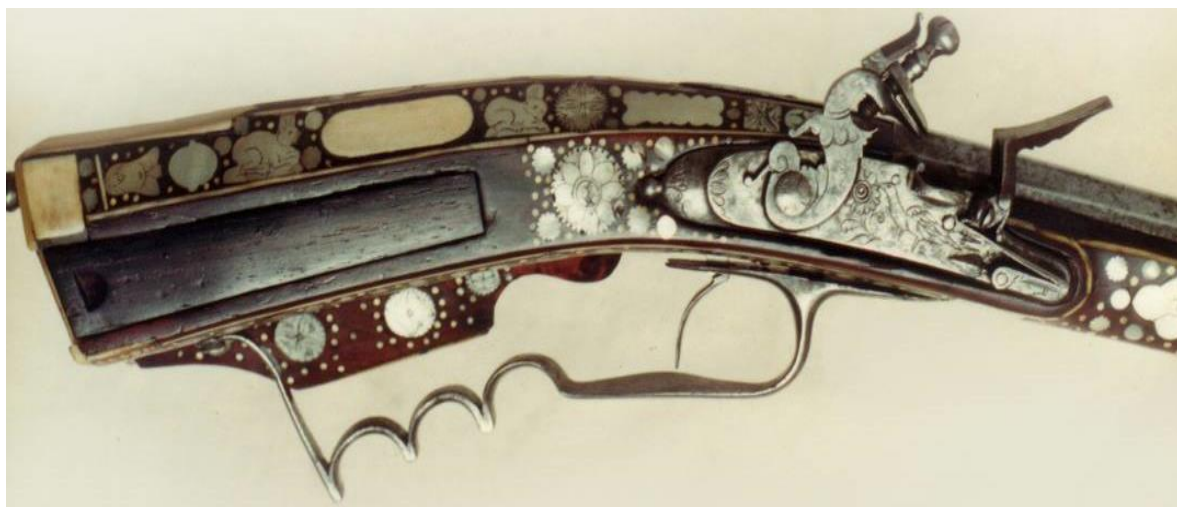
14. Rifle before restoration



15. Rifle after restoration



16. Rifle before restoration



17. Rifle after restoration



18. Crate for transportation of firearms



## TESTING OF SUBSTANCES AND MATERIALS USED IN RESTORATION – AN IMPORTANT CONDITION TO PREVENT SUBSEQUENT DEGRADATIONS

SIMONA-MARIA CURSARU-HERLEA\*

**Abstract:** *The article presents a study made on three ceramic pots that belong to the late Roman period and that were discovered in Capidava, being kept in the warehouse of this archeological site. In this study we started from one of the principles of restoration, which was formulated as follows: “The use of materials, substances, etc. that have been experimented, tested in controlled conditions, rigorous enough to be conclusive in determining incompatibilities and side effects”. Therefore, choosing these pots, with similar sizes, was due to the fact that we want to use for each piece, materials and substances for restoration as different as possible, preliminary tested certainly, so as to see with time which pot behaves best in the conditions, not very favorable, of microclimate, that the warehouse of the Capidava archeological site offers, which is in fact, as we have on another occasion said, the former community center of the village. We find this test essential in order to further select the materials and substances for restoration, proper to the conditions in the warehouse of Capidava (that do not change with time), thus being able to protect the objects from subsequent degradations.*

**Keywords:** *Romania, Dobrogea, Capidava, pottery, conservation, restoration*

**Abstract:** *Articolul prezintă un studiu realizat pe trei vase ceramice ce aparțin perioadei romane târzii și care au fost descoperite la Capidava, fiind păstrate în depozitul acestui șantier arheologic. În realizarea acestui studiu am plecat de la unul dintre principiile restaurării care a fost formulat în felul următor: „Utilizarea unor materiale, substanțe etc. care au fost experimentate, testate în condiții controlate, suficient de riguroase pentru a fi concludente în determinarea incompatibilităților și efectelor secundare”. Prin urmare, alegerea acestor vase, cu dimensiuni asemănătoare, s-a datorat faptului că dorim să folosim pentru fiecare piesă, materiale și substanțe pentru restaurare cât se poate de diferite, bineînțeles testate preliminar, pentru a putea urmări în timp care dintre acestea se comportă cel mai bine în condițiile, nu foarte favorabile de microclimat, pe care le oferă depozitul șantierului arheologic Capidava, care este de fapt, așa cum am mai spus și cu altă ocazie, fostul cămin cultural al satului. Această testare ni se pare esențială în vederea selectării ulterioare a materialelor și substanțelor pentru restaurare adecvate condițiilor din depozitul de la Capidava (care să nu sufere modificări în timp) putând astfel să protejăm obiectele împotriva degradărilor ulterioare.*

**Cuvinte-cheie:** *România, Dobrogea, Capidava, ceramică, conservare, restaurare.*

Starting from one of the principles of restoration, which was formulated as follows: “The use of materials, substances, etc. that have been experimented, tested in controlled conditions, rigorous enough to be conclusive in determining incompatibilities and side effects”<sup>1</sup> we decided to make a study on three ceramic pots discovered in

Capidava and kept in the warehouse of this archeological site. As we mentioned on another occasion (Cursaru-Herlea, 2011, 646), in this warehouse there is no microclimatic stability and particularly because of this reason the restored pottery can be affected with time.

We chose three pots with similar sizes that belong to the late Roman period: **a pot without handle** (CAP. 2009, I, J 56); **a bowl**<sup>2</sup> (CAP. 1990, III, V

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<sup>1</sup> Decision no. 1546 of December 18, 2003 on the approval of conservation and restoration norms of classified mobile cultural goods, art. 32

<sup>2</sup> This type of pot is named bowl in the bibliography of specialty, see Opris 2003, p. 125, 137, cup-glass, see Covacef 1999, p. 166, small cooker pot without handles, see Radulescu 1975, p. 338



76, inv. no. 2692; and a **cup** (CAP. 1994, III, 1)<sup>3</sup>. We chose these pots because we want to use, for each of them, materials and substances for restoration as different as possible, preliminary tested certainly, so as to see with time which pot behaves best in the conditions, not very favorable, of microclimate, that the warehouse of the Capidava archeological site offers, which is in fact, the former community center of the village. We find this test essential in order to further select the materials and substances for restoration, proper to the conditions in the warehouse of Capidava (that do not change with time), thus being able to protect the objects against subsequent degradations.

As known, the conservation and restoration of an object has certain phases and steps. At first, after we photographed the fragments/pots (Fig. 1, 2, 3), we evaluated the degree of fragility and the conservation condition of the pot. The macroscopic exam only permitted the research of the surface. In order to evaluate the degree of degradation of the objects, determine the composition of the material and state what substances and materials had been used in the previous restoration attempts, find out the type of deposits on the walls of the pots and establish how much the physical and mechanical properties had been affected, we asked for the intervention of the laboratory for physical-chemical investigations, which issued the analysis reports for each piece<sup>4</sup>.

As a result of these exams and tests, we drew the following conclusions concerning their conservation condition:

- all pots suffered attempts of previous restoration made on the archeological site, by unauthorized persons and in inadequate conditions, which led to the improper bonding of the fragments. This bonding was made with polyvinyl acetate in the case of the pot without handle and the cup, and with polyisoprene adhesive (Prenadez type) in the case of the bowl. We do not insist in this study on these inadequate interventions made on the

archeological site, as we have previously approached this subject (Cursaru-Herlea 2009, 261; Cursaru-Herlea 2012, 716), but we however state that in what these pieces are concerned, these interventions caused supplementary degradations such as separations of ceramic materials on the edges of the fragments;

- the three pots present moderate adherent and adherent dirt (clay and stains of adhesive);
- the bowl presents rust deposits;
- the pot without handle and the bowl present adherent and moderate adherent deposits of calcium carbonate ( $\text{CaCO}_3$ );
- there are fragments missing from all three pots, but in different proportions: about 10% of the pot, about 15% of the bowl and about 20% of the cup.

After we have observed all of these problems (put the diagnosis), we made the restoration suggestions and, as we first said, we suggested for each piece restoration techniques, materials and substances as different as possible, taking into account of certainly, the respect of the fundamental principles of restoration. Thus, after we received the approval of the restoration commission, we passed on to the practical restoration which included several operations that we briefly present as follows:

1. First of all, we acted to remove adherent and moderate adherent dirt (clay, stains of adhesive) by immersing pots and fragments in an aqueous solution of nonionic detergent and by mechanically cleaning them with soft brushes. As a result, the fragments bonded with polyvinyl acetate (the pot – 50 fragments and the cup – 13 fragments) were removed, and with a scalpel and tweezers the softened adhesive was removed from the edges of the fragments. The fragments were rinsed by immersion in three successive baths of distilled water. According to the Analysis Report no. 362/12 the adhesive used for the inadequate bonding of the bowl is Prenadez, adhesive which doesn't soften in water. Thus, after taking the pot from the last rinsing bath, it was left on filter paper for about 5 minutes to dry a little, then compresses with toluene were applied ( $\text{C}_6\text{H}_5\text{-CH}_3$ ) both on the joints of the fragments and on their surface to remove the stains of adhesive. We chose to apply compresses on the pot still wet in order to prevent the toluene from getting in the ceramic mass. After about 30 minutes, the adhesive softened and we were able to

<sup>3</sup> The pots were restored under my direct supervision by Speriatu Vicentiu Stefan, graduate student of the Faculty of Social Sciences, Conservation and Restoration specialization (LBU Sibiu), as practical part of his diploma paper.

<sup>4</sup> The analysis reports no. 367/12 for pot without handle (CAP. 2009, I, J 56), no. 362/12 for bowl (CAP. 1990, III, V 76, inv. no. 2692), no. 363/12 for cup (CAP. 1994, III, 1) were issued by the laboratory of physical-chemical investigations of the ASTRA National Museum Complex Sibiu and made by the expert in chemical investigations, Dana Lazureanu.

separate the fragments (19 fragments). We mechanically removed the softened adhesive from the surface and the edges of the fragments, with the scalpel and some tweezers. We removed the toluene from the surface and the edges of the fragments by wiping them with ethyl alcohol (the toluene being insoluble in water). At the end of this operation we considered necessary a neutralization operation, thus preparing the fragments for the removal of the calcium carbonate ( $\text{CaCO}_3$ ) deposits. The neutralization was made by repeatedly immersing the fragments in baths with distilled water. We made 4 neutralization baths of 30 minutes each, thus obtaining total neutralization checked with the Ph indicator paper.

2. Two fragments from the bowl had rust deposits, which were removed by applying compresses with Complexon III, which is a disodium salt of the ethylenediaminetetraacetic acid and has both an acidic and an alkaline component. The solution for compresses was prepared from the crystalline salt of Complexon III (3.27%) in distilled water (or 32.7 gr. in one liter of distilled water). We applied three series of 30 minute compresses, then, in order to facilitate the removal of the rust deposits we used a brush with soft bristles under running water, thus removing the rust deposits. After this operation, the two fragments were neutralized in 4 successive baths of distilled water until total neutralization, checked with the pH indicator paper.
3. The calcium carbonate ( $\text{CaCO}_3$ ) deposits from two of the pots (pot and bowl) were removed by chemical baths. The chemist recommendation was weak acids. We chose acetic acid ( $\text{CH}_3\text{-COOH}$ ) and citric acid ( $\text{HOOC-CH}_2\text{-C(OH)(COOH)-CH}_2\text{-COOH}$ ) because they are not toxic and can be relatively easily neutralized. The concentration used was 20% for both acids. The tests showed that in the case of the bowl, where the  $\text{CaCO}_3$  deposit was thinner and moderately adherent, the citric acid proved efficient, but the adherent deposits of  $\text{CaCO}_3$  from the fragments' surface of the pot were removed only with acetic acid. Thus, the  $\text{CaCO}_3$  deposits were removed after baths with proper acids (in concentration of 20%). The final neutralization was made by repeatedly

immersing the fragments in baths with distilled water. We made 5-6 neutralization baths of 30 minutes each, thus obtaining total neutralization checked with the Ph indicator paper. The fragments taken out of the last neutralization bath were put on filter paper and left to dry at ambient temperature (Fig. 4, 5, 6).

4. In order to facilitate the assembly of the fragments, we first identified them and established the order in which they were to be bonded by numbering them. We used polyvinyl acetate type BISON D to bond the fragments belonging to the pot without handle, butyral polyvinyl dissolved in acetone (20 gr. polyvinyl powder dissolved in 100 ml. acetone) for the fragments belonging to the bowl and butyral polyvinyl dissolved in ethyl acetate (20 gr. of polyvinyl powder dissolved in 100 ml. ethyl acetate) for the fragments belonging to the cup. All adhesives respect the principle of compatibility and reversibility, it is important to notice how they behave with time in the microclimatic conditions from the archeological site of Capidava. The assembly was made step by step, at the sand crate in equilibrium position, starting from the base of the pots to the mouth (Fig. 7).
5. In order to diversify the working technique, for impression we used three types of impressions: elastic impressions of dental wax for the cup, semi-elastic impressions of modeling plasticine for the pot and very elastic impressions of high viscosity condensation silicone called Stomaflex (solid), which offers a very accurate impression for the bowl. We took the impressions from the witness parts of the pots, from the exterior in the case of the bowl and the pot, to cast then the plaster from the inside, interior finishing being allowed as the aperture of the pots' mouth is large enough and the incised decoration of the pots is accurately imprinted. In the case of the cup, we took the impression from the inside, to cast then the plaster from the exterior of the pot. We chose this option because the mouth of the pot is quite tight, the finishing of the parts missing from the outside is easier, plus the pot has no decorative elements.
6. The completion of the missing parts was made with dental plaster, which is a white, fine powder, without impurities, with a superior

mechanical resistance. To complete the missing parts of the pots, in Romanian laboratories plaster (natural hydrated calcium sulfate) is currently used.

7. After we completed the missing fragments (after the plaster hardened a little), we took the impressions from the pot and roughed the additions with the scalpel. We made this operation with different grit sandpaper (Fig. 8) in order to facilitate the final finishing of the additions. In the case of the pot, whose impression was made with modeling plasticine, we had to degrease the imprinted zones with a fabric tampon (cotton) soaked in ethyl alcohol ( $C_2H_5-OH$ ) with a concentration of 90%.
8. For the chromatic integration we used three different techniques. We made the chromatic integration of the pot without handle in the plaster mass with natural color pigments. The tests showed that the mixture containing 100 ml. water, 8.5 g. ocher, 6 g. sienna and 100 g. plaster is the best. For the bowl, we made the chromatic integration using water colors (Tempera) applied by brushing on the surface of the plaster additions. In the case of the cup, we made the chromatic integration by using mixtures of natural pigments (sienna, ocher) dissolved in water and applied by brushing in three successive layers, on the whole surface of the plaster additions.
9. For the protection of the additions and the color layer we chose a film-forming material that is Paraloid B72 (which is a copolymer of ethyl methacrylate and methyl acrylate used in restoration for more than 50 years). Paraloid B72 is in the form of transparent, colorless, hard granules and is highly soluble in aromatic hydrocarbons, ketons, esters, and are limited soluble in alcohols. It is applied in solution, and we chose for the three pieces different solvents: butyl acetate ( $CH_3COOC_4H_9$ ) for the pot, ethyl acetate ( $CH_3COOC_2H_5$ ) for the bowl and methyl acetate ( $CH_3COOCH_3$ ) for the cup. In all three cases, the concentration of Paraloid B72 was low, of 1%, not to polish the additions, as we dealt with unglazed pots. The Paraloid B72 solution was applied by brushing (with a soft bristle brush) in two successive layers on the inside and outside surface of the additions. This film-forming material respect the principle of reversibility, being easily

removed (only when necessary) with the solvent used to prepare the Paraloid solution.

10. Final photography after the restoration operations. We photographed the pieces along the technological flux of the restoration process, captured details of each operation and after each operation, making a very ample photo documentation. After we applied the Paraloid B72 solution we made the final photography of the restored pieces, then we measured them, obtaining the following data: pot without handle: height: 17,1 cm; maximum diameter: 14,4 cm; mouth diameter: 11,2 cm; base diameter: 9,3 cm; bowl : height: 10,9 cm, maximum diameter: 12,1 cm, mouth diameter: 9,6 cm, base diameter: 4,9 cm; cup: height: 10 cm, maximum diameter: 11,4 cm, mouth diameter: 8,8 cm, base diameter: 4,9 cm ( Fig 9, 10, 11).
11. The realization of protective packages needed for the transportation of the pieces from the laboratory of ceramic restoration of the ASTRA National Museum Complex Sibiu, where their restoration took place, to the deposit of the Capidava archeological site (Constanta district). For the manufacturing of the packages, we took into consideration that the materials that come into contact with the pieces must not stain, be abrasive or acid or emanate harmful chemical products. Likewise, we wanted the packages/boxes to have the following qualities: mechanical resistance, lightproof, waterproof, tight closure, protection against shocks and vibrations, protection for the pieces in conditions of sudden changes of microclimate (thermal isolation). Thus, the packages needed for the transportation were made of wood, we made three boxes padded as follows: the box for the pot without handle padded with EPS (expand polystyrene) – thermal isolator, covered with netex (Fig 12); the box for the bowl was padded with thick sheets of polyethylene foam (Fig. 13), and the box for the cup was padded with EPS covered with thin sheets of polyethylene foam (Fig 14)<sup>5</sup>. The use of the white polyethylene foam

<sup>5</sup> The packaging was made, under my guidance, by the students from the Conservation and Restoration specialization ("Lucian Blaga" University of Sibiu): Tiurean Haralambie, Avram Ana-Maria, Paun Florin, during practical classes of Conservation of Cultural Goods.

proved easy, soft, good thermal, chemical and mechanical isolator, chemically inert, waterproof and protective against vibrations. The boxes were made waterproof by applying several layers of varnish or linseed oil (box for the bowl). We closed the boxes using wood-screws. Nails are never to be used for closing the boxes, as they accidentally can pierce the objects. Likewise, nailing or removing nails can degrade pieces. On the boxes, we drew the international marks showing fragility of the content, position in which they have to be transported and protection against humidity. We applied on each box a label containing all the data of the pieces from the inside (photo of the piece, name, inventory number, owner, restorer, no. of restoration sheet, laboratory where restoration took place). This label is protected by a pocket of transparent plastic material applied on the box.

The pots were put in the boxes in an equilibrium position, facing mouth up. For better stability and thermal isolation, before putting the pieces in boxes, we packed (wrapped) the pots using different materials: the pot was wrapped in netex and then in wadding; the bowl was wrapped in filter paper and then put in an air bubble polyethylene bag; the cup was wrapped in Japanese paper and then in a sheet of polyethylene foam. To fill empty

spaces in the boxes, we used polystyrene chips.

As mentioned on another occasion (Cursaru-Herlea, 2011, 649), because of not very favorable microclimate conditions in the Capidava warehouse, the restored pots will remain in the boxes in which they were transported, thus the temperature and humidity variations will not be sudden for the objects put in the well-padded boxes.

The restored pots will be tracked for several years, annually registering their condition and the changes that appear. It will be carefully noticed: resistance to aging of the adhesives and the Paraloid; color changes of the pottery and the chromatically integrated additions; if microbiological attacks are present; if there are exfoliations of the Paraloid layer; if there are separations of the additions; condition of the packages. Therefore, true conclusions can be drawn only after several years, being helpful in choosing, for the restoration of the pottery from Capidava, those materials and substances that best behave in the microclimatic conditions in the warehouse of this site. The presentation of the restoration technological flux of the three pots allows knowledge of different working techniques as well as of usage, dosage and application of some reversible and compatible substances and materials.

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1. Pot without handle (CAP. 2009, I, J 56). Fragments before restoration



2. Bowl (CAP. 1990, III, V 76, inv. no. 2692). Pot before restoration



3. Cup (CAP. 1994, III, 1). Pot before restoration





4. Pot without handle (CAP. 2009, I, J 56)  
Fragments after neutralization and drying



5. Bowl (CAP. 1990, III, V 76, inv. no. 2692)  
Fragments after neutralization and drying



6. Cup (CAP. 1994, III, 1)  
Fragments after rinsing and drying



7. Pots after assembling the fragments



8. Pots after addition of the missing fragments and finishing



9. Pot without handle (CAP. 2009, I, J 56)  
Photo after restoration



10. Bowl (CAP. 1990, III, V 76, inv. no. 2692).  
Photo after restoration



11. Cup (CAP. 1994, III, 1)  
Photo after restoration



12. Package pot without handle (CAP. 2009, I, □ J 56)



13. Package bowl (CAP. 1990, III, □ V 76, nr. inv. 2692)



14. Package cup (CAP. 1994, III, □ 1)





## PORTRAIT OF A GENTLEMAN OVERPAINTING: THE USE TO CREATE HISTORICAL ART FAKES

Teodor GALON\*

**Abstract:** *Throughout history, art fakes have been made whenever creative works were considered valuable for a collection. Historical faking is a form of fraud, and is therefore as blameworthy as any other fraud which involves the production and sale of misrepresented goods. As the demand for old Flemish paintings increased in the 19<sup>th</sup> century, the number of historical art fakes augmented. In reference to this perspective, the present article seeks to illustrate a particular case of historical fake, viz. a presumed 17<sup>th</sup> century Flemish portrait, which in fact was a 19<sup>th</sup> century (second half), academic oil painting.*

**Keywords:** *fake art, historical fakes, oil paintings, restoration, overpainting.*

**Abstract:** *De-a lungul istoriei, s-au realizat falsuri de artă, ori de câte ori lucrări aparte au fost considerate valoroase de colecționari. Falsul istoric este o formă de fraudă, prin urmare este condamnat ca oricare alt tip de fraudă ce implică producția și vânzarea de bunuri disimulate. Întrucât cererea pentru vechi picturi flamande a crescut în secolul XIX, numărul de falsuri istorice a sporit; făcând referire la aceste aspecte, prezentul articol caută să ilustreze un caz particular de fals istoric, respectiv un presupus portret flamand de secol XVII, care era în fapt o pictură academistă din a doua jumătate a secolului XIX.*

**Cuvinte-cheie:** *falsul în artă, falsul istoric, pictură în ulei, restaurare, suprapictare.*

A painting usually is brought for restoration because it is discolored, damaged or structurally unstable. Sometimes, though, a painting needs restoration because it has been poorly restored. In the latter case, one problem that is frequently encountered is the overpainting. One of the final stages of the restoration treatment, after an artwork has been structurally stabilized and cleaned, is retouching. According to Althöfer, a standard retouching is dependent on several factors: the affected part of the painting, the artwork's importance, its format, the way it is hung and the way it is lit. (Althöfer, 1974). For this procedure, the restorer uses pigments suspended in a binder to integrate damaged areas into the rest of the painting. Retouching is always restricted to the parameters of the damage and describes painting "with-in" areas of paint loss. Conversely, overpainting describes painting "over" the entire area of damage, including covering some of the original paint applied by the artist. For example, if a less than competent restorer was unable to hide a small area of damage in the background and decided to repaint the entire area, he would be covering a large portion of the original painting. This approach would diminish the paint-

ing's quality and appearance and, consequently, compromise its value. In addition to covering the original image, overpainting also may serve as deceiving inexperienced customers. In past centuries, paintings were often overpainted under the guise of being retouched (Brandi, 1950). Style, of course, is of the greatest importance. A forger of painting needs to have an adequate grasp of period brush techniques, produce a typical subject matter for a specified target artist. Most forgeries tend to be pastiche works: paintings or drawings which bring together miscellaneous elements from authentic paintings in a way that will allow them to fit comfortably into an accepted body of work. However, it is almost impossible for a modern painter to think himself completely back into the representational conventions of a previous epoch (Dutton, 1998).

Sometimes a visual or ultraviolet examination will reveal that a picture has been overpainted. It also may be necessary to make chemical tests to determine whether an area of restoration has been overdone.

The case study privately owned oil painting origi-

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nates from Köln and the depicted subject is the portrait of a man. Apparently, the gentleman's 17<sup>th</sup> century garments and the opposing hairdo appearance, suggested an anachronism. This led to further investigation by use of ultraviolet (UV) light. The various classes of coatings could reveal different color fluorescence. Depending on the age of the coatings, their thickness or number of layers, the underlying paint film and older retouches could be highly detectable through the fluorescing varnish (Webber, 2009).

The conservation status of the painting was bad. The work had been stored in an attic, in poor conservation conditions, inadequate humidity and temperature, wrapped in a linen sheet. The initial visual analysis revealed that the work was previously restored and resized. It's original shape and stretcher were octagonal, but later, canvas corners were added in order to fit it on a rectangular stretcher. Also the painting was punctured by a sharp object from the verso, which generated considerable loss of original material. UV fluorescence analysis indicated retouched surfaces on the family crest and the collar's two elements of embroidery. These elements, together with the coarse execution and thick impasto, raised questions about their originality. Also, the highly viscous coat of varnish was intended to render the work a false patina.

Considering the fragility of the damaged areas, the picture layer was firstly secured by a facing of Japan paper. The next step was removing the canvas from the rectangular stretcher. The added canvas corners were anchored by a weak glutoline glue, therefore their detachment was easily done by moist compresses, followed by scraping away the residues. A new octagonal stretcher with rounded back edges was executed in order to back up the original shape of the canvas. The reverse was cleaned by scalpel and vacuumed. The edges of the canvas were then flattened by applying moistened filter paper, and leveled off by marble tiles. The

tear was then glued and further reinforced by thread bridges. The canvas was then stretched onto the new stretcher and the facing removed by moistened cotton swabs. The colophony based varnish was removed together with the overpaintings – the added tassel collar and coat of arms. These two additions were easy to remove because they consisted of an egg tempera mixture. The filling used was a six percent concentration fish glue and chalk putty. The structuring finish was done by using a moistened cork, after which an initial tempera based retouching was performed. The intermediary varnish was preceded by the final retouching, done in varnish colors. The final coat of dammar varnish was applied by paint brush.

The removal of both varnish and overpaintings revealed the true nature of the portrait: a 19<sup>th</sup> century portrait concealed in 16<sup>th</sup> century clothes. The recently retrieved sartorial elements – the elaborate bow tie, together with the upturned collar and coat lapels – were once deliberately covered with a poorly executed 17<sup>th</sup> century style tassel collar, thus simulating an older, more valuable work. This had probably been done somewhere towards the end of the 19<sup>th</sup> century. The overpainting technique also suggested the intention of art faking: by using egg tempera, one can very closely emulate both the coloration and the characteristic structures of an old paint layer (Knut, 1999), adding further confusion to its true origin.

The laws of supply and demand dictate that there will be no end to the growing commercial value for a limited number of great works of art; and as long as those who deal in the commercial aspects of art – galleries, art dealers, auction houses and the media – are involved as the arbiters of criteria in judging art, market prices will continue to rise and art forgery will proliferate (Dolice, 2001).

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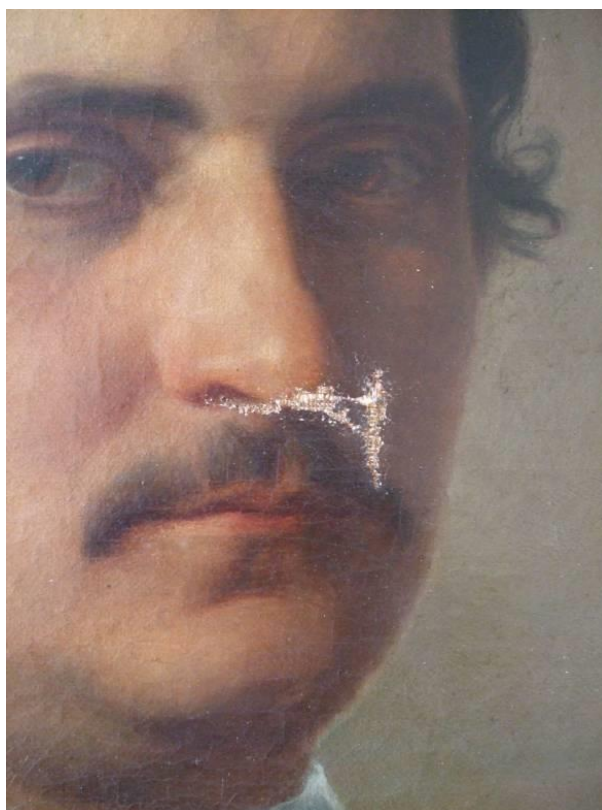
2. General view – before restoration - verso



3. Detail. One of the added canvas corners



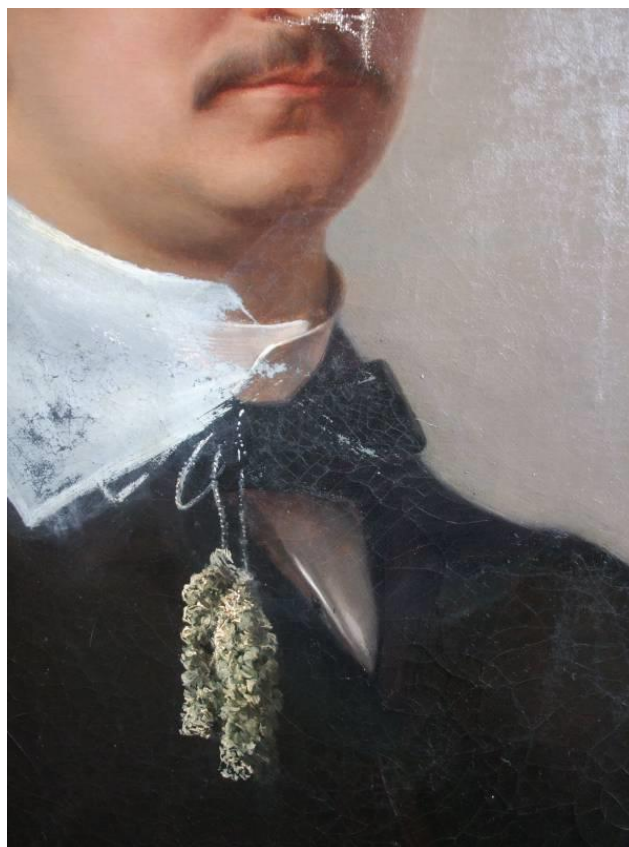
4. Detail. One of the added canvas corners



5. The canvas puncture



6. Detail – removing the overpaint



7. Detail – removing the overpaint



8. General view – after restoration – recto



9. General view – before restoration - verso





10. Overlapped view – the overpaintings

## THE WET CLEANING OF A PRAYING CARPET "OF TRANSYLVANIA" FROM THE SECOND HALF OF THE 17<sup>TH</sup> CENTURY

Simona STĂNCULESCU, Carmen SOTELECAN, Camelia DORDEA\*

**Abstract:** *The present article presents an experiment within the workshop "A New Method of Cleaning Old Carpets" that took place at the Zonal Laboratory of Restoration and Preservation of the Brukenthal National Museum in collaboration with two German specialists in the preservation of the carpets.*

**Keywords:** *carpet, preservation, wet cleaning, wool*

**Abstract:** *Articolul următor prezintă un experiment din cadrul workshopului intitulat "O nouă metodă de curățire a covoarelor vechi", desfășurat în cadrul LZRC al Muzeului Național Brukenthal în colaborare cu doi specialiști germani în domeniul conservării covoarelor.*

**Cuvinte-cheie:** *covor, conservare, curățire umedă, lână.*

The storage of textiles of the Brukenthal National Museum is the place where to be found the best preserved collection of carpets in Transylvania which numbers round 50 carpets of different types.

At the beginning of 2012 took place in the Laboratory of the Brukenthal National Museum a change of experience regarding the wet cleaning of Oriental old carpets together with two specialists from Germany, Eva and Peter Hoffmeister. Mr. Hoffmeister being a keen collector of carpets, who together with his daughter, restorer specialized in restoring old carpets, deals with the preservation of these carpets.

The object of this present work is from the category of the so called praying carpets "of Transylvania" with two columns, handmade in loom and in the Ghiordes knot technique, the density of the knots being of approximately 1600 knots/cm<sup>2</sup>. For sewing there were used two types of wool: inferior and intermediary one. From the compositional point of view this type of carpets stands out by the elegance and sumptuousness of the drawing, which central portal, often associated with "the heaven gates", gives it a sacral aura. The piece also stands out by a different winding edging (Ionescu 2007). The mihrab is red with two columns in rhombic row, which prop up on geometric supports that renders the perspective. The superior corners of the central field presents on a white background floral and vegetal typical decorations. The edging on yellow background is decorated with big floral ro-

settes (red and white) united through a continuous creeping stalk. The central frame, identical with the edging one is decorated on red background with small floral rosettes in yellow and light blue, linked through a winding creeping stalk (Kertesz Badrus 1978).

Regarding the preservation of the carpet, it presents an advanced stage of degradation being doubled entirely with the sack cloth, which exerted many tensions upon the fibers of warp and filling, tensions caused by the way of catching this. In the central part, in the frame part and in right edging the carpet presents lacking zones and in the right upper corner is missing. These degradations were caused, most probably, by the attacks of rodents. The beauty of colors kept during the time are shadowed by a deposition of black color on the entire surface extremely visible and which raised questions regarding the origin and the way of deposition, it being the only carpet in the collection presenting such a way of degradation (Fig. 1,2).

The steps of the cleaning process were as follows:

1. Preparing the carpet for the wet cleaning:
  - a thorough dusting with a hand vacuum cleaner with lint on the upside and back of the carpet
  - provisional consolidation by doubling with lint of lacking zones, overcasting the edges in the degraded zones of the festoon, the fringes doubled with lint and fixed in point

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of Byzantium embroidery (Fig. 3,4).

2. The wet cleaning:

- Laying the carpet in the washing basin made from wooden frame covered with white polyethylene sheet (Fig. 5)
- Immersion of the carpet in the first bath with washing detergent brought by the German specialists.
- The washing was done by the help of a role that was made on purpose for removing the dirty particles (Fig. 6).
- After the second bath with detergent solution the object was left to rest.
- Then followed repeated rinsing with jet of running water; the rinsing was done with the help of the role on the back of the carpet (Fig. 7).
- The last bath was done with distilled water.
- Trickling by rolling the carpet with the upper side inside on wooden inclined prop

- Controlled drying on a plane surface and removing the excess water with filter paper (Fig. 8).

- Selective pressings with marble plates (Fig 9).

The theme of the workshop was “A New Method of Wet Cleaning of Old Carpets”; the novelty of the methods was the use of a chemical detergent used by the German part at cleaning old carpets. The detergent is a product done especially not a product on the market, being tested for many years with good results. The role used for removing the dust particles is a creation of Mr. Hoffmeister, which as a result of the experience gathered regarding the wet cleaning of the carpets reached to the conclusion that pressing with the role the dirt is removed without affecting the textile fiber.

The restoring was done during 2012, the carpet being comprised in the thematic plan of The Carpet Exhibition which takes place in Gdansk in 2013. (Fig. 10)



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2. Ensemble verso before restoration.
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6. Aspect during wet cleaning.
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9. Selective pressing.
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6. Aspect din timpul curățirii umede
7. Clătirea
8. Uscare controlată pe suprafață plană
9. Presare selectivă
10. Ansamblu după restaurare



1 Ensemble before restoration.





2 Ensemble verso before restoration.



3. Detail of the consolidation for the wet cleaning.



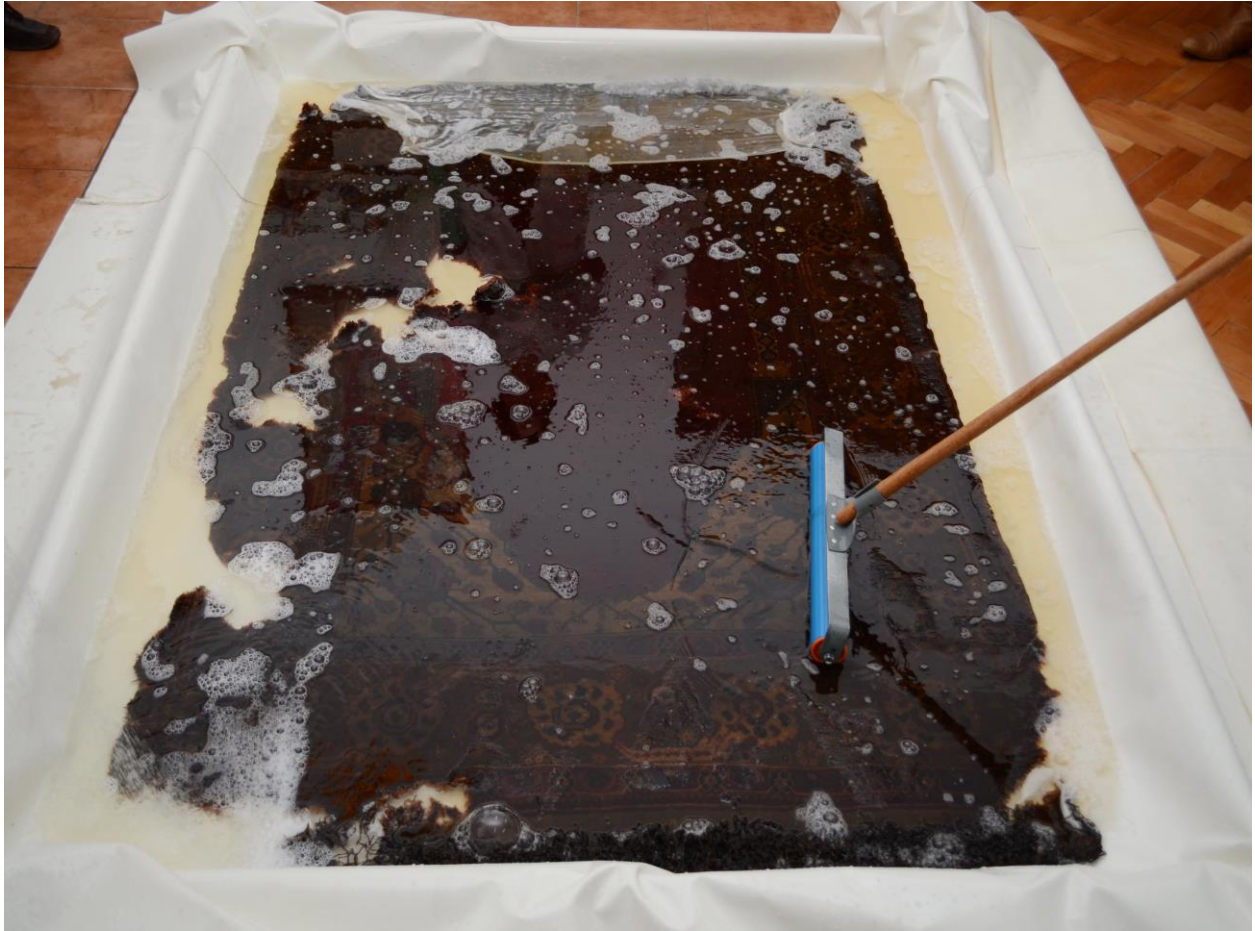


4. Detail of the consolidation for the wet cleaning.



5 Wet cleaning preparation.





6 Aspect during wet cleaning.





7 Rinsing



8. Controlled drying on a flat surface.



9. Selective pressing.





10. Ensemble after restoration.





## LANDSCAPE IN BALCHIK

Ioan MUNTEAN\*

**Abstract:** *Balchik Landscape painted by Ion Theodorescu Sion, completed in 1927 was surprisingly painted on both side of the canvas. The presence of numerous paint layer flaking and stratigraphic cleavages determined the conservation treatments. During the development of work methodology, a system that allows the painting to be seen on both sides it was also designed. The artwork was anchored on tensions screws stretcher that was transformed into a frame, on the other side a golden frame with passe-partout was mounted.*

**Keywords:** *Sion, Balchik, restoration, painting on the front and the back.*

**Abstract:** *Lucrarea Peisaj la Balcic, operă a maestrului Ion Theodorescu Sion, realizată în anul 1927, a fost pictată pe ambele fețe. Lucrarea prezenta numeroase lacune și clivaje stratigrafice, fapt ce a determinat intervenții de restaurare. Cu ocazia acestor operațiuni de restaurare am propus și realizat un sistem care permite vizualizarea lucrării pe ambele fețe. Pânza a fost ancorată pe un șasiu mobil, prevăzut cu șuruburi pentru tensionare, acest șasiu a fost transformat în ramă iar pe versoul lui a fost aplicată o ramă aurie cu paspartu.*

**Cuvinte-cheie:** *Sion, Balcic, restaurare, pictură pe față și verso.*

The Balchik Landscape comes into Painting Restoration Laboratory of the Brukenthal National Museum in 26 November 2009, after its conservation state had been analysed. The painting was previously present in the exhibition space of the Romanian Art Gallery and was part of Brukenthal National Museum bearing the inventory number 2834.

The conservation status of the work was inappropriate, a series of degradations were present. First, it was important to mention the fact that the painting was executed on both sides of the canvas. Initially after the canvas was prepared, the artist painted a landscape (face I) then perhaps dissatisfied with the result, removed the canvas from the stretcher, turned it over, applied a second ground layer on it and re-painted the same landscape (face II). In the end he signed and dated 1927. Note that the execution time between these two landscapes was up to a few days. As soon as the first landscape was removed from the stretcher, the colour was still wet, the edges of the wood stretcher were printed in this colour layer and traces of paint were present also on the stretcher. It was to be appreciated the fact that the second painting was executed just after the canvas was

prepared with a second coat of ground.

Some of the degradations presented at the time of entry into the restoration laboratory were caused by the fact that the canvas was painted on both sides. Due to this fact the canvas became fragile and lost its flexibility. Because of inadequate manipulation the painting was damaged and its planarity had suffered. In addition, the signature face, the ground did not have a good concentration of glue in its composition and cleavages were present in this layer. The painting was varnished only on the front side; the first painted face was not protected by the layer of varnish, which allowed the dust and dirt to adhere and to settle directly on the colour layer.

The painting had a complex stratigraphy, because it was executed on both sides.

The colour was applied impasto using a brush, with physical mixtures between different colour tones. Many areas, especially the one with the hill in the background had hachured lines, made with nervous gestures, with changes of colour tone and direction of the hachures. The verve and the dynamism of these surfaces allow us to see the fight carried out by the painter in order to obtain the final result which was accepted with a

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signature.

From compositional point of view the two images were identical, Theodorescu-Sion did not wanted to alter in any way the composition but what different was the chromatography and the harmony between colours. If the first had more vivid tones with stronger contrast; the second a lower contrast was used, the landscape was flooded by the bright light specifies to the Silver Coast, as this Dobruja area have been named. The painter's words which were spoken at a Conference in 1931 best described this atmosphere *Balcicul e cel mai puțin colorat, griu de cenușă și cenușiu de alb cretos peste tot. Pretutindenii volume confuze, planuri tremurătoare, șterse ...* " (Sion 1931, 2). About the artwork of Ms Iulia Mesea PhD written in Romanian Art Gallery Guide "the Dobrujan artworks are characterized by the contrast and monumentality, through the refinement with which the artist converts the picturesque in pure pictoriality. *Balchik Landscape* falls between these coordinates: solid, a balanced compositional construction, the major importance of drawing through contours highlighted by energetic and clear delineation of the volumes, but also through the elegance use of light which allows a refine colour modulation. Although an aerial viewpoint is used, the high horizon brings closer the motifs to the viewer. Registers are rapidly succeeded, are driven by short diagonals of the roofs toward the horizon, where the landscape stops looking forward. The mosque (tr. Cami) tower has an important role in composition, centring and highlighting it, at the same time" (Mesea 2010, 117).

The meeting between the painter and the Silver Coast landscape took place according to Mrs Daniel Păuleanu PhD when "between the 501.127 participants in 1913 war campaign the soldier Iosif Iser and officer Ion Theodorescu-Sion were also included and they discovered Dobruja and loved it with passion" (Păuleanu 2012, 12). Mrs Daniel Păuleanu PhD also wrote that the painter Ion Theodorescu-Sion "was enlist as officer for the military campaign in 1913 and understood on this occasion the originality and timeliness – in painting, drawing and speech theory – of this Mediterranean and equally primitive space, of this static world, dusty and bright, which can lure and urge towards solid construction of scenographic aspects towards chromatic reveries of a moment but also by repeating views of the place, with exotic an mandatory props "(Păuleanu 2012, 25-29).

Returning to the present subject, it was discussed within the Commission for restoration about designing a system through which the both painted surface could be seen. Primarily was proposed and realized the protection of the stratigraphical cleavages by facing; then canvas was removed from the stretcher; at the end reattachment and securing of the layers was realized (with signature). This operation was carried out successfully by using Rabbit-skin glue in 8% concentrations and applied on the perimeter of cleavage by using a brush. After that, the implementation of the alternative press in warm-cold followed. On the edges of the stretcher presented traces of two rows of nails holes, old ones from the first anchor of the canvas. In addition as mentioned above on the edges of the stretcher were imprinted small traces of colour from the painting on the front, these were adherent to the wood slat and were not glued on canvas.

To be able to reattach and secure the layers of this complex stratigraphy, an IR lamp was used in order to heat up and thus decrease the rigidity of the two layers of oil. Cold pressing was carried out on a soft "bed", made of, non-woven material, covered with Melinex® Polyester films and on top a Melinex® Polyester film and sands bags were used to press on. In this way the impasto layers of the landscape were not flattened.

To anchor and to tension correctly the canvas on the new stretcher, peripherally were applied some strips of canvas. It was opted the use of a canvas with the same texture as the original. The adhesive used for this operation was thermoplastic glue, Beva 371 (mixture of microcrystalline wax and synthetic resin).

The stretcher had a tensioning screw system, covered now by string form decorative ornaments. It was stained and lacquered, so was transformed into a frame for the face I. It must be mentioned that stretcher fitted tensioned with keys would have covered, in part, the corners of the painting. On the back of this stretcher the frame and passe-partout was put on the side II.

The painting was cleaned on both sides, after the cleaning tests it was opted for the use of ammonia solution 0.5% then a mixture of white-spirit and acetone for the side two.

For filling the flaking area on the side II, a filling putty made of rabbit skin glue and calcium carbonate applied in successive layers and imitated the original colour layer relief was used, continuing the brush stroke of the artist.

A first retouching was made with watercolours, and then was followed by general varnishing with dammar varnish. Then a second retouching was made in varnish colours (Maineri Restauro).

Finally, the anchoring system of the artwork on the wall was realized and a recommendation for

exposure in the Art Gallery was made. In this regard it was suggested to cut a window through the plasterboard wall and to fix the painting inside it. This would allow watching both sides of the artwork and would give a unique touch for the public who threshold the gallery.

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Sion 1931      Ion Theodorescu-Sion, *Câteva considerațiuni artistice despre Balcic*, Crainicul, I, nr.4, Balcic, 12.04.1931

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2. Balchik, Landscape, back or side I prior to restoration.
3. Cleaning Tests
4. Filling
5. Side I after restoration
6. Side II after restoration
7. The stratigraphy of painting layers
8. The painting in the Romanian Art Gallery

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1. Peisaj la Balcic, fața 2 înainte de restaurare
2. Peisaj la Balcic, verso sau fața 1 înainte de restaurare.
3. Teste de curățare
4. Operațiunea de chituire cu redarea reliefului stratului de culoare
5. Fața 1 după restaurare
6. Fața 2 după restaurare
7. Desen cu secțiune în stratigrafia lucrării
8. Propunere mod de expunere în Galeria de Artă Românească



1. Balchik, Landscape side II before restoration



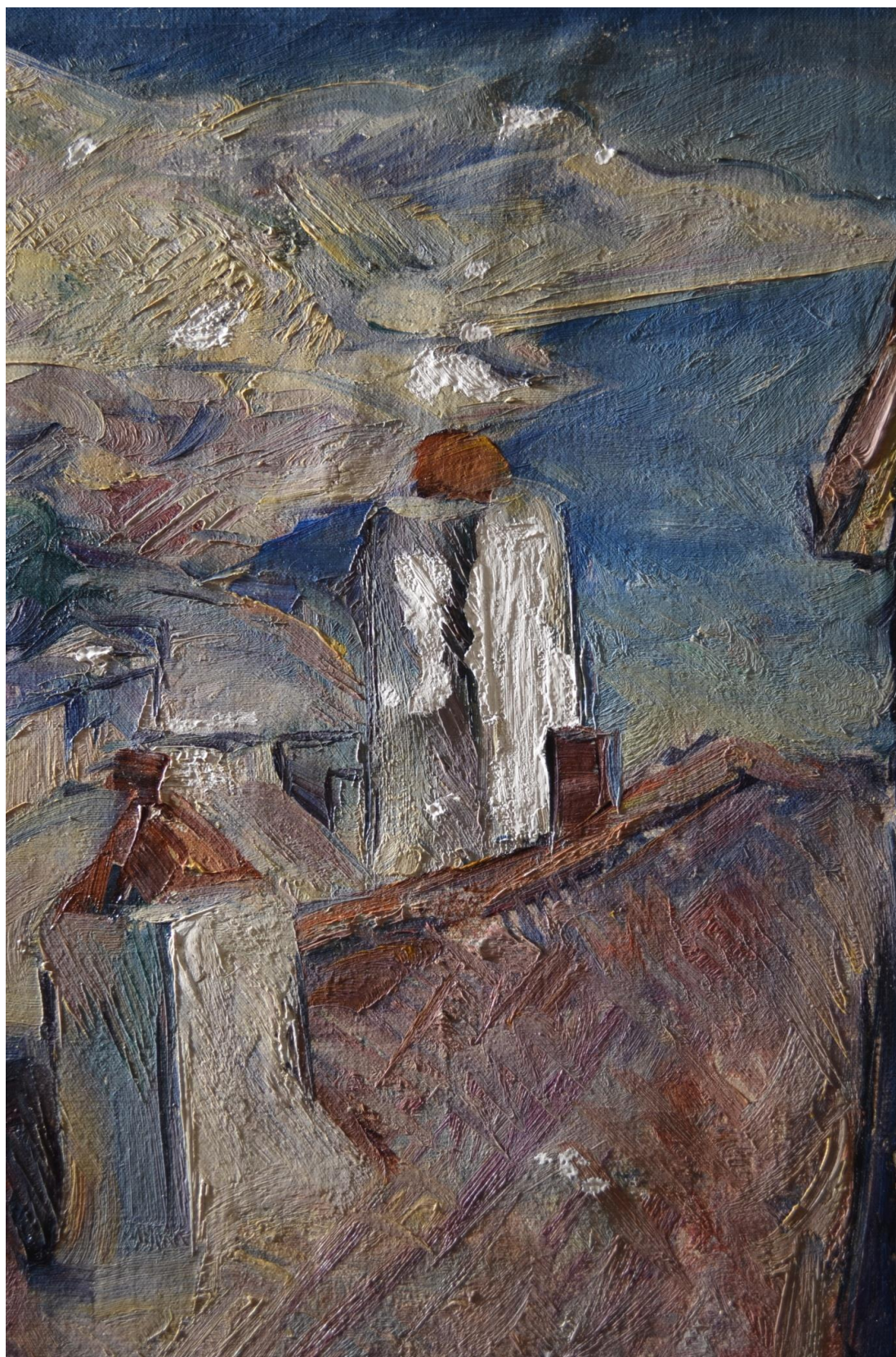
2. Balchik, Landscape, back or side I prior to restoration.





### 3. Cleaning Tests





4. Filling



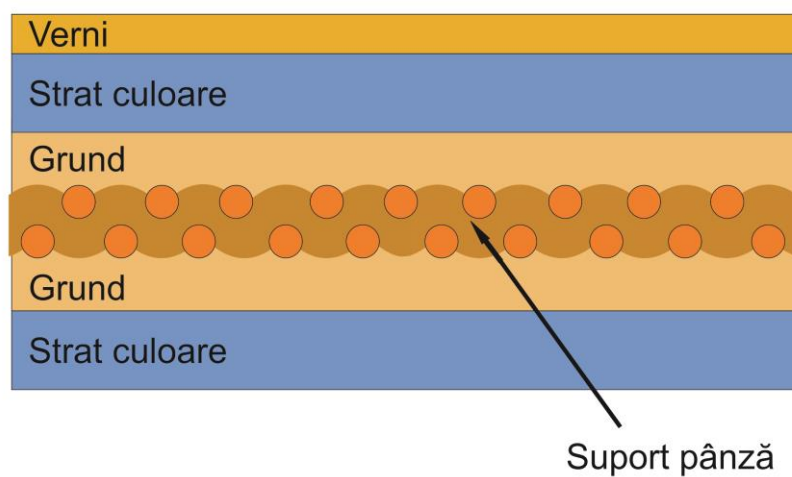


5. Side I after restoration



6. Side II after restoration

## Secțiune în stratigrafia lucrării



7. The stratigraphy of painting layers



8. The painting in the Romanian Art Gallery



## THE RESTORATION OF THE ICON WITH THE THEME DEISIS, FROM THE “SUB PIATRĂ” MONASTERY, ALBA COUNTY

Cristina Daniela SCĂRLĂTESCU\*

Olimpia COMAN SIPEANU, PhD\*\*

**Abstract:** *The restoration of the icon with the theme “Deisis” implied reaching a visual equilibrium between the original painted layers and the ones subsequently applied, during a later intervention. Therefore, the beautiful decorative elements were kept, alongside the initial painting, so that the icon can be able to convey the visible characteristics of the ages it has crossed.*

**Keywords:** *icons, restoration, repainting, traditional techniques*

**Abstract** *Restaurarea icoanei cu tema „Deisis” a presupus atingerea unui echilibru vizual între straturile picturale originale și cele aplicate ulterior, printr-o intervenție de epocă. Prin urmare frumoasele elemente decorative au fost păstrate, alături de pictura inițială, astfel încât icoana poate transmite caracteristicile vizibile ale epocilor pe care le-a traversat.*

**Cuvinte-cheie:** *icoane, restaurare, repictare, tehnici tradiționale*

The oldest icons represent portraits painted on wood with watercolours, or with colours diluted in wax. Their origins are considered to be the Egyptian funeral portraits from the Hellenic and roman epochs, that used to be disposed on the sarcophagi of the mummies. The portraits, most of them discovered at Antinoe or Akhim, have a very pronounced individual character (Brehier, 1994, p. 212).

As much as these the old Christian icons were portraits of martyrs, represented in the way that they looked like before the rack. Later on, they became pictorial creations, unceasing to be taken by worshippers as authentic portraits, wakening feelings of reverence.

After the victory of the orthodoxy (14<sup>th</sup>-15<sup>th</sup> century A.D.), a development of the fabrication occurred due to the cult of the icons, which passed to the fore in the religious practices. The production of iconostasis proves the place the icons had during the ceremonies. The cult of the icons was a part and parcel of the Orthodox Church dogma and the byzantine missionaries introduced it in all of the countries they converted to Christianity, in Bulgaria, Serbia, the Romanian Countries and Russia. Because they were easy to carry, they were then taken to Italy and the entire West, where they had a

big influence on the development of art and iconography (Brehier, 1994, p. 217).

Deisis, or the mediation, is a scene from the Judgement Day. Christ is represented on the throne, situated between the Virgin Mary and Joan the Baptist, who pray, mediate for humanity. In iconography there is a representation of the Little Deisis and the Large Deisis. In the Little Deisis, just the Virgin Mary and Joan the Baptist appear near Christ. In the Large Deisis, the 12 apostles and the two archangels are represented.

This scene fills the centre of the apostle frieze, but it can be encountered in the narthex too, on the right wall. Also, it is present in the exterior painting, in the Judgement Day representation, on the walls of the churches in northern Moldavia.

As far as the icon Deisis, from the Pious Paraschiva church, is concerned, it is known that its existence was referred to in an annotation on one of the pages of the Cazania of Varlaam, in a place of worship in 1723. Its restoration and study were performed as a bachelor's degree final work, for the Restoration and Conservation Department of the Lucian Blaga University in Sibiu, under the coordination of Dr. Olimpia Coman Sipeanu, expert restorer.

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Presumably burned down by Bucow, if the popular information is correct, the monastic location, elevated initially in the beginning of the 18<sup>th</sup> century, was then rebuilt in 1767. From the old monastery precious icons are still kept in the new built monastery, and amongst them, this icon, with the theme Deisis, stands out, with its “ornamented stucco halo and background, in a clean Brancoveanu spirit” (Cristache, Panait, 1987, p. 83). The backgrounds on the wooden panels of the Brâncoveanu period are ornamented with brocade patterns engraved in the gesso (Dancu, 1966, p. 64). The valuable heritage of the old monastery is kept today in the wooden Pious Paraschiva Church (Porumb, 1998, p. 392).

In the restored icon, the Saviour is presented with dark long hair falling on his shoulders in tress, with a short beard, and with big peaceful and gentle eyes. Christ looks upon us with serenity. This image is the prototype of the ones in apses and the roman mosaics (Arhim. Boghiu, 2001 p.59). The face is round, mobile, serene (Fig. 1).

The Saviour appears in ancient vestments. The tunic is the coat underneath, with large sleeves, in warm colours (Monahia Iuliania, 2001, p.130). In this case, the initial colour was a darker red, and the one applied subsequently is a warmer one; the red tunic symbolises the Hebrew thoughtfulness, “the blood”, equivalent of life (Sendler, 2005, p. 165). The narrow stripe woven on the sleeve, called “klav” is yellow, decorated with a geometrical black and green contoured pattern. The klav is the symbol of the Saviour, and also the attribute of prophets and apostles sent by God (Sendler, 2005, p. 167).

The mantle, a piece of cloth, usually worn over the tunic, is blue. Its colour is always cold, from bright blue to bright or dark green.

The letters that signify the names are painted on the vestments in white colour. Thus, on the cloth of Jesus, above the book, can be seen the inscription IC.XC..

The Virgin Mary is represented in the left side vested in red. Saint Joan the Baptist, on the right side of the icon, is dressed in a brighter red vestment. Both the virgin and Saint Joan have their hands pointed at Christ, but they are covered with the vestments as a sign of humility. The figures are inclined towards the Saviour, conducting the watchers attention on the centre of the image.

The background of the icon is decorated with clouded motifs. These geometrical models, specific for the Brâncoveanu style, are repeated, ennobling

with their rhythm the entire bright surface, covered in gold leaf.

The icon is surrounded by a frame, consisting of a rather narrow plane surface, on the exterior, followed by a twilled rope chiselled model, on the interior, frequently encountered in the decoration of Brâncoveanu style painted panels. This, also, has the role of conducting the attention of the watcher toward the centre of the image. The motif is also encountered on the icons painted on glass.

The drawing is clouded, outlining the shapes. The “etching” of the drawing was usually executed especially in the areas that were to be painted with dark colours, covering the lines entirely, and it was performed with a hilted pin (Monahia Iuliania, 2001, p. 85).

As a subsequent intervention, the repainting of the image can be mentioned. This intervention can be distinguished from the original because of the colour and, also, the type of execution. On the red surface of the vestment of Christ, a decorative floral motif can be observed. The original cope that can be seen in the areas the repainted layer is deteriorated, is simpler, following the tradition of byzantine painting. The original painted layers could also be seen on the vestments of Saint Joan and the Virgin Mary, underneath the ones applied later, locally, even over the gold leaf.

The repainting of the carnation can easily be distinguished from the original one, especially in the nose, eyes and eyebrows areas, on the face of Christ. Another detail that comes into notice is the existence of two pairs of ears, because the ones applied later can be distinguished by the intensity and the consistency of the colours, and the original ones only keep the first layer of colour.

As the chemical tests, performed by Dr. Livia Bucşa, expert biologist, show, the panel the icon was painted on was made of fir wood (*Abies alba*). The support was executed from two unequal plates, affixed with wooden nails, a method used in Europe from the 14<sup>th</sup> -15<sup>th</sup> century A.D. They were cut in a tangential manner.

The entire panel was processed with the saw, and brought to a uniform shape, most probably with the poleaxe and the hand plane. The surface of the panel had a coarse semblance.

In the inferior side of the thinner plate the panel is made of, there is a linden (*Tilia cordata*) additional piece, with the fibre disposed perpendicular to the rest of the wooden panel. It was pinned to the sup-

port with a metallic nail, and it has formed an integral part of it since the panel has been processed.

The wooden nodes in the structure of the panel, that were able to reach the gesso, have been replaced with wooden bungs in order to avoid tensioning the support or the painted layers.

After the radiographic examination, effected at the “Luther” Pediatrics Hospital, in Sibiu, the fact that the two plates that composed the wooden panel were affixed with three wooden bungs, could be observed. The low density of the wooden material was the cause for a weak radiographic signal, but this aspect could also be due to the multiple painted layers on the surface of the panel (Fig. 3).

Around the support, as the radiographic examination also revealed, the frame was three cm. thick, and it was processed differently. The fibre of the wood was impossible to see because of the pigments in the painted layers that had a stronger radiographic signal.

The panel was stabilized with two traverses embedded in splayed grooves that start from the same side and cross the entire surface of the wooden support.

On the sides of the icon, traces of wooden nails, which were a part of the anchorage system on the iconostasis, were visible.

On the back of the icon, a thin white preparation layer was visible, which might have had a protective or even aesthetic role.

According to the results of the chemical tests, effected by chemist Martha Guttmann, the preparation layer, or the gesso, was made with gypsum, a white powder produced through the grinding the natural gypsum at temperatures over 150°C.

The glue, used in order to give the gesso elasticity, was an animal origin one, based on collagen, the main protean component of tissues (Istudor, 2011, p. 208). In certain areas, the detachments or the wear of the painted layers allowed us to see the gesso, or even the wooden panel. Deterioration of the gesso, and even its absences were visible on the surface of the twilled rope model that framed the icon, especially in the corners. On the entire surface of the panel, flight orifices could be observed, remaining from a former attack of the xylophages insects *Anobium punctatum*.

The gold leaf in the chiselled rope model area, that surrounds the icon, that apparently had an inferior quality than the one used for the background, presented traces of deterioration almost on the entire surface.

As far as the painted layers are concerned, the identified pigments were lead white, lead red, a natura synthetic pigment obtained by heating whitewash at 480°C (Istudor, 2011, p. 145), iron based brown and red ocre earth, with different hydration points, ultramarine blue, carbon black.

On the faces of the Virgin and Saint Joans, the colour had lead white, used for painting since the oldest times, in its compenence, that produces quite a resistant layer (Istudor, 2011, p.130). This fact was determined both by the chemical tests and by the X-ray analysis, which showed a powerful radiographic signal in the carnation area. The lead white was also present in the composition of the blue colour on the mantle of Christ.

The leaf, used for the frame and the background of the icon, was made from gold, which, according to the ancient techniques, was applied with the help of special adhesives, an obtained by hammering coins. Then, the gold leaf was set over a layer of red bolus, an iron based clay (Istudor, 2011, p. 163).

In the moment the icon arrived in the restoration laboratory, the varnish layer, applied for the protection of the paint layers, was in a relatively good state. In the left side of the icon wax deposits, with the aspect of trickles, could be seen. The ageing of the varnish generated a buffy semblance that determined the difficulty of “reading” the image.

In other areas, like the mantle of Christ, the book and also, the vestment of Saint Joan, varnish congestions could be seen (Fig. 4). It appeared that it had been applied in successive, quite thick, layers.

In this case, there were two layers of varnish, the first one, applied over the initial (original) painting, and other, the final varnish, applied over the entire surface, after the repainting. Both the first and the second layer were natural resin based, soluble in a solvent that, after drying, formed a protective film (Istudor, 2011, p. 221).

As a first step in the restoration, a dedusting with soft brushes was performed, followed by the removal of the wax deposits with the help of solvents and scalpels.

The prophylactic conservation was achieved by locally applying Japanese veil with skin glue in low concentrations. After all the investigations were performed, the general prophylactic consolidation was executed, consisting in the application of Japanese veil, with glue, on the entire painted surface.

The structural consolidation of the support was realized by impregnating Paraloid B72 dissolved in Toluene and diluted in Xylene, in 6% - 10% concentrations in order to reestablish the mechanical resistance. Paraloid B72 is a methyl-acrylate copolymer (Leahu, 2006, p. 91), characterized by a good chemical stability, Toluene, Xylene, Acetone etc. soluble (Fig. 5).

In the areas where wooden nails have been applied in order to supplement the adhesive joint, twines of tinder were used to improve the completions resistance and adhesive qualities (Fig. 6).

In the marginal areas, the joint of the wooden bungs was executed with hot Covidez, a mixture that contains 60% paraffin, 30% esterified resin and 10% EVA thermoplastic copolymer (ethilen-vinyl acetate) with a high flow parameter when melted at 75 - 80°C. For a higher stickiness, in the corners, a mixture of Covidez and sawdust was used, in order to also facilitate the execution of the chromatic reintegration on the painted surface. The wooden completions were levelled with a mixture of Covidez coloured with brown pigments in the outside areas.

Heating the wooden support in order to liquefy the Covidez a I.R. light lamp and a hot air blower were used.

For the consolidation of the painted surfaces an ironing was performed, with an electric spatula at 70-90°C, alternated with the application of cold presses having the role to ensure a thermal stabilization of the heated area (Fig. 8).

The removal of the Japanese veil and the glue, used for its application, after the consolidation of the painting layers, was executed with cotton wool immersed in hot water.

The completion of the areas where lacunae were present was effected with a putty based on rabbit glue, obtained by boiling the rabbit cartilages, in a 6% concentration mixed with mountain chalk. This operation was followed by polishing the putty with low druse abrasive paper.

As far as the cleaning process is concerned, for the removal of deposits on Christ's mantle, Saint

Joan's vestment and the Virgins, a mixture of egg-yolk emulsion with a 1:3 concentration, and five drops of ammonia was used. For the softening of the varnish congestions, a 50:50 mixture of ethylene acetate and dimethylformamide was used. In the book area, and, also, on the tunic of Jesus and on the frame the proportions of the mixture were 75:25 alternated with 50:50, based on the kind of deposit.

The equalization and the thinning of the varnish, especially on the gold leaf gilded surfaces, were effected, also, with a mixture of ethylene acetate and dimethylformamide 50:50. The purpose of this operation was to cover the areas with varnish usage on the vestments of the Virgin Mary, St. Joan and Jesus, with original, dissolved, varnish (Fig. 9).

The chromatic reintegration was performed in the pointillage manner, with watercolours, in the putted areas, and with restoration varnish colours in the areas with Covidez completions (Fig. 10).

The dammar varnish, made from a natural resin, excreted by a species of the *Dipterocarpus* genus, that creates a soft, colourless, resistant to light film, and turpentine, an oleoresin excreted by some species of *Pinus* (*Pinus silvestri*, *Pinus maritime*) (Istodor, 2011, p.p. 231, 234), was applied in successive layers (Fig. 11).

The restoration of the icon with the theme "Deisis" implied a series of interventions meant to re-establish both an aesthetic and a conservation state equilibrium.

After all the investigations precursory to the restoration, the conclusion was that the original painting was partially lost, and this was one of the reasons the repainting was performed at some point. Therefore keeping the beautiful decorative elements, that cover the vestment of the Saviour, and also the painting applied over the faces, was chosen. These elements are a part of the history of the work of art and, also, they put forward the aesthetic characteristics of the ages the icon has crossed.

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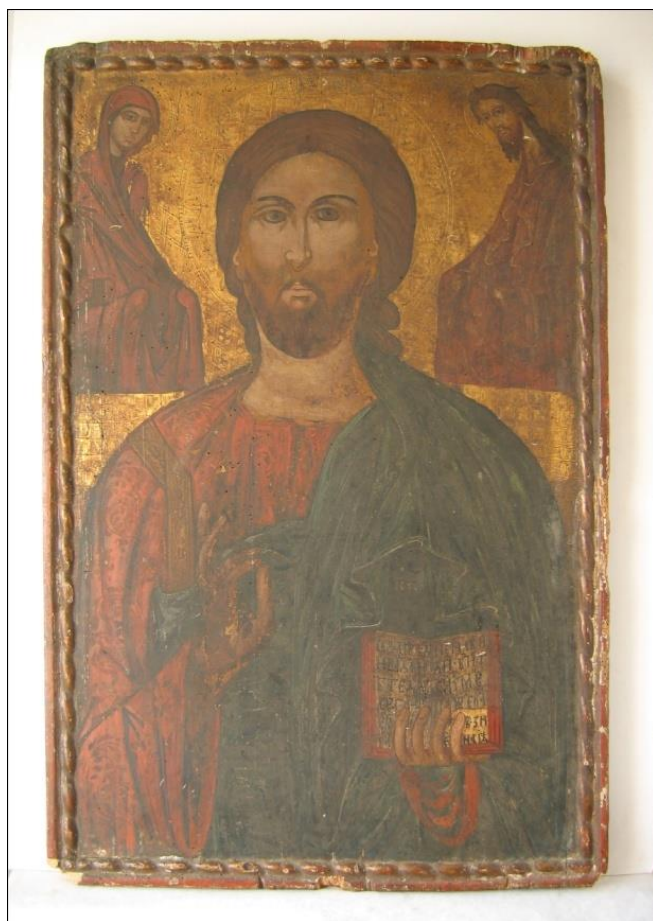
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8. Consolidation of the painted layers
9. Cleaning
10. Chromatic integration; detail
11. After restoration

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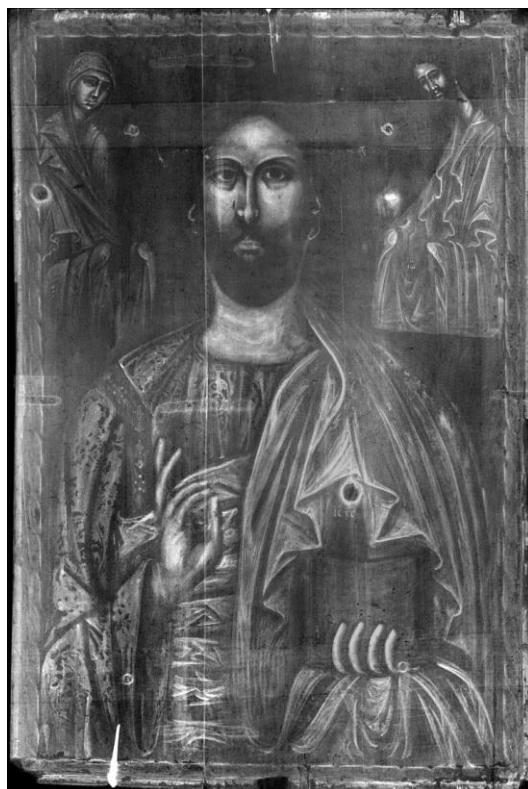
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1. Before restoration

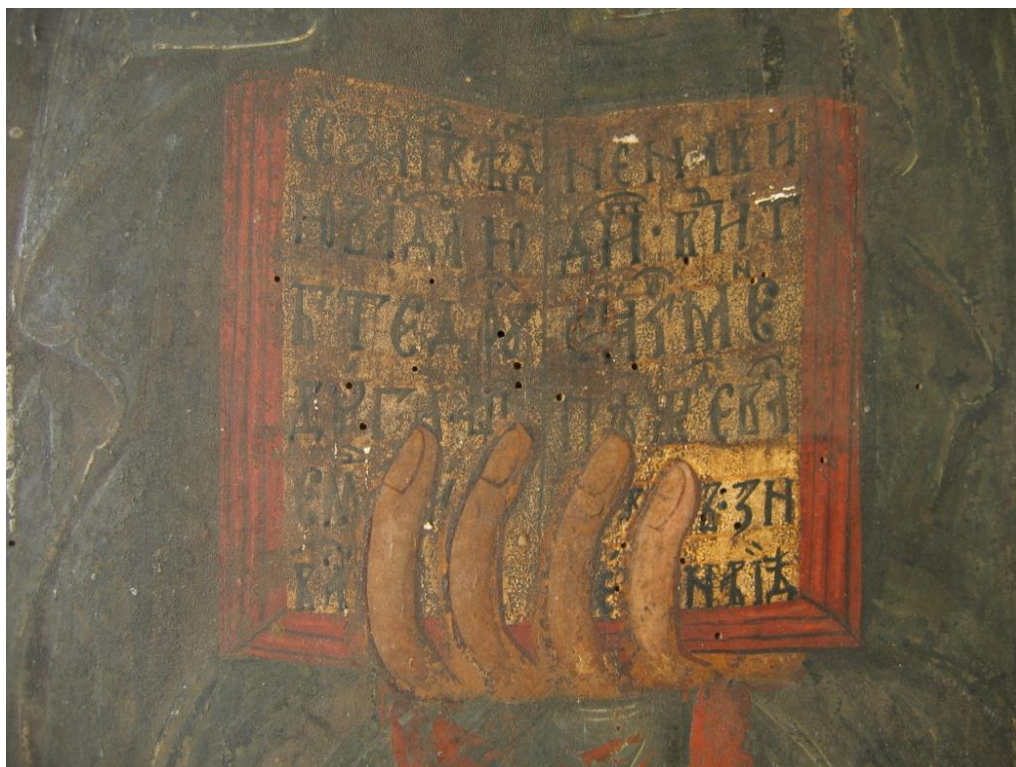


2. Repainting; detail



3. X-ray; detail





4. Varnish degradation; detail



5. Structural consolidation; detail





6. Mechanic consolidation; detail



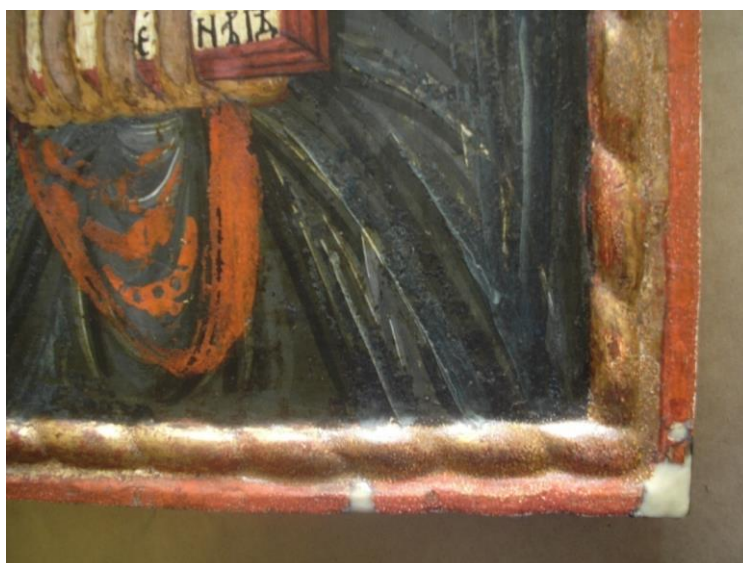
7.Completion; detail



8. Consolidation of the painted layers



9 Cleaning



10 Chromatic integration; detail





11 After restoration

## SPECIFIC RESTORATION PROBLEMS OF GILDED FRAMES FROM THE COLLECTIONS OF THE BRUKENTHAL NATIONAL MUSEUM

Constantin SCĂRLĂTESCU\*, Cristina Daniela SCĂRLĂTESCU\*\*

**Abstract:** *The specific restoration problems of the frames with relief elements, that surround graphic drawings, paintings or mirrors, are related to the complexity of the elements they are composed of and the type of degradation they are exposed to. Therefore, the interventions on this kind of artworks aim to re-establish the balance between the various materials utilized for their execution and/or during repeated conservation/restoration interventions. Also, their aesthetic and functional role must be rendered and maintained.*

**Keywords:** *frame, stucco, sculpture, restoration*

**Abstract:** *Problemele specifice de restaurare a ramelor cu elemente în relief, ce încadrează lucrări de grafică, pictură sau oglinzi, sunt legate de complexitatea elementelor din care acestea se compun și de tipurile de degradări la care sunt expuse. Astfel, intervențiile asupra acestui tip de piese au rolul de a restabili un echilibru între diversele materiale utilizate pentru executarea lor și/sau în timpul intervențiilor repetate de conservare/restaurare. De asemenea, trebuie redat și menținut rolul estetic și funcțional pe care acestea îl dețin.*

**Cuvinte-cheie:** *ramă, stuc, sculptură, restaurare*

The frames evolved from borders which appeared 3-4,000 years ago on tomb paintings, and later on mosaics, narrative scenes and decorative panels. Although framing borders in ancient art were used to divide scenes and ornamentation by ancient Egyptian and Greek artists in pottery and wall paintings, the first carved wooden frames as we know them today appeared on small panel paintings in twelfth and thirteenth century Europe ([en.wikipedia.org/wiki/Picture\\_frame](http://en.wikipedia.org/wiki/Picture_frame)). These early „framed” panel paintings were made from one piece. The area to be painted was carved out, leaving a raised framing border around the outside edge. The whole piece was then covered with gesso and painted.

Early Christian art adapted these to the carved endings of book covers and diptychs, and finally of altarpieces. By this time, the function of the frame had changed, not merely a decorative boundary, it protected and emphasized works they held, and might even have a strongly symbolic aspect (Mitchell, 1, 2).

When it was realized this method of producing a frame and the image within in one slab of wood was too costly, „a more efficient” method was eventually developed, which used carved wooden strips, and, later, modelled stucco elements.

In the collections of the Brukenthal National Museum, numerous frames, decorated with chiselled wood models, or modelled stucco (it. *stucco*) elements, that surround painting and graphic art works, and also mirrors, can be found.

For the chiselled traceries, usually, the linden wood (*Tilia cordata*) was used, which permitted, due to its structure, the execution of fine details. In these cases, one can speak of the specific gilded wooden elements technique. It implies the application of successive layers of gesso (preparation) on the surface of the wood, usually composed of glue and chalk dust, which were then smoothed. As a precursor to the application of the golden leaf layer, bolus was used, an iron based clay (Istudor, 2011, 163).

As far as the type of the wood, used for the

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wooden structure of the frames decorated with stucco elements, is concerned, various species of softwood or oak (*Quercus robur*) can be mentioned.

For the realisation of the stucco, several types of backing materials, mixtures of marble dust and gypsum, a sedimentary rock disseminated in nature in the form of compact or fibrous masses, white or coloured, due to the iron oxide, have been used, through the ages, especially for works situated indoors (Istudor, 2011, 184). Also, marble dust, chalk dust and old extinguished lime, obtained after the thermal dissolution of calcium carbonate contained by several kinds of rocks (Istudor, 2011, 178), were used.

Several glues and gelatines, based on collagen, the main protein contained by the skin, bones and tendons of mammals (Masschelein-Kleiner, 1992, 75), were used as binding media, to obtain the stucco.

Frequently, several mineral toners, which, in contradistinction to pigments, are soluble in the dispersion medium, and have a specific chemical structure (Istudor, 2011, 167) were included in the composition of the stucco. Also, in order to increase the mechanical durability, different types of canvas, vegetal or animal fibres, have been used.

Above the stucco, after drying and finishing process, a layer of bolus was applied, followed by the application of the gold leaf.

The specific degradations of this type of frames are due to the decay of the component materials, the environment the objects were placed in and/or to the human factor. These can occur both on the wooden frame but, also, on the decorative stucco elements level.

Therefore, at the wooden structures level, tensioning traceable to structural modifications, cleavages, clefts, detachments or lacunae and deteriorations of the material, due to xylophages insects attacks, take place. These processes occur also in the cases of carved wood decorative elements.

Also, the interventions, executed in time, subsequent to the realisation of the object, such as additional metallic elements, on the corners level, nails, the inappropriate replacements of the hanging systems, can generate tensions on the wooden support level. On account of these, both wood and stucco material losses can occur.

As far as the stucco, relief, elements are concerned; the most frequent types of degradations are lacunae, due to the deterioration of the materials used for their execution. The cause is, most of the times, the loss of the cohesive qualities of the adhesives used both for the realisation of the stucco paste and for its application on the wooden support (Fig. 1). Also, another cause is the fragility of the material after drying, which leads to its vulnerability in the case of possible accidents (Fig. 2).

The frames in the Museum's collections suffered various conservation/restoration interventions along time. Some of these interventions implied the use of unsuitable materials, which lead to additional damage.

Among these, the improper completions of lacunae with various mixtures of gypsum and/or chalk and concentrated glues solutions, which generated tensions on the original stucco elements level, can be mentioned and the result was the local detachment. Also, in some cases, chromatic retouching with various types of gold pigments based paints were applied, which, in time, suffered oxidation processes, deteriorating the aspect of the objects.

Another type of degradation is the wearing out of the gold leaf and the protective layers applied on the relief elements, that can be traceable to several improper preventive conservation interventions, respectively dustings/mechanical cleaning operations.

The restoration of these kinds of frames implies using similar or compatible techniques and materials to the original ones. Therefore, a first step encompasses the rehabilitation of the structural and mechanical resistance of the wooden segments that hold the stucco decoration. The aim of this operation is to ensure the durability of the frame in order for it to continue having the role of sustaining the artwork. Wherever necessary, disinfection treatments are executed, followed by structural consolidations executed with Paraloid B72. As far as the mechanical consolidation is concerned, it implies the re-gluing of the joints (Fig. 3) and, also, the completion of the losses of wooden material, where it is necessary.

In the case of the decorative motifs, the restoration interventions imply, as a first step, the prophylactic consolidation of the original elements presenting a high fragility degree. The following step is the application of a layer of Japanese veil with 6% concentrated glue. The consolidation and the

reapplication of the brittle stucco elements on the support can be executed with hot presses followed by cold ones, and this operation is similar to the one used in the restoration of painted wood artworks. Also, the reapplication of the detached fragments is executed by gluing and trampling them with the help of hand presses (Fig. 4).

The removal of the inadequate completions can be executed mechanically, with the help of the laboratory instruments, (scalpels, and small chisels), then the cleaning process of the areas covered with improper chromatic retouching can be performed. This operation, also similar to the cleaning process of painted wooden panels, implies the use of several mixtures of solvents.

The next operation, in the case of stucco elements, is the replication of the elements in order to complete the missing parts. During this operation, a print is executed, usually from silicone rubber, with an insulator, that prevents it from adhering to the surface to be copied, that does not require a prior preparation. The resulted copies have a very good quality (Fig. 5, 6, 7).

The completions are then processed and finished in order to fit the lacunae, and their application is also realised with glue, according to the original execution technique.

In the cases of frames with chiselled wooden elements, the completions of the missing parts are executed with similar wood, that is then covered with layers of gesso and bolus, finished with abrasive paper and a chromatic retouching is performed (Fig. 8).

The chromatic retouching is executed with water based colours, which can easily be removed during a subsequent intervention. For the protection of the gold leaf, a natural, amorphous structured resin, soluble in organic solvents, which form colloidal solutions, with good adhesive and protective properties, varnish is applied.

The frames, decorated with sculpted wood or modelled stucco elements, rise restoration problems specific to the painted wood artworks, given that they are complex structures, composed of diverse materials which require several types of interventions. Therefore, the study of the materials is an important stage of the restoration process.

The frames form an integral part of the assembly with the works they surround, and their significance is as big as the artworks itself, thus their restoration is has the same importance.

The techniques the integrity of the object can be re-established through comprise of information about the type and the processing techniques of wood, the materials utilized, through the ages, for this kind of artworks and the interactions that take place between them. Therefore, the most common restoration problems are connected with re-establishing the balance between the elements that compose these structures.

Most of the times, the degradations of the frames are different from the artworks they surround, therefore needing more complex and longer treatments, due to the role they have, aside from the aesthetic one, to protect the artworks.



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3. Structural and mechanical consolidation; detail
4. Mechanical consolidation of detached fragments; detail
5. Execution of the silicone print; detail
6. The missing stucco elements completion process; details
7. The missing stucco elements completion process; details
8. The missing wooden elements completion process; details

### LISTA ILUSTRAȚIILOR

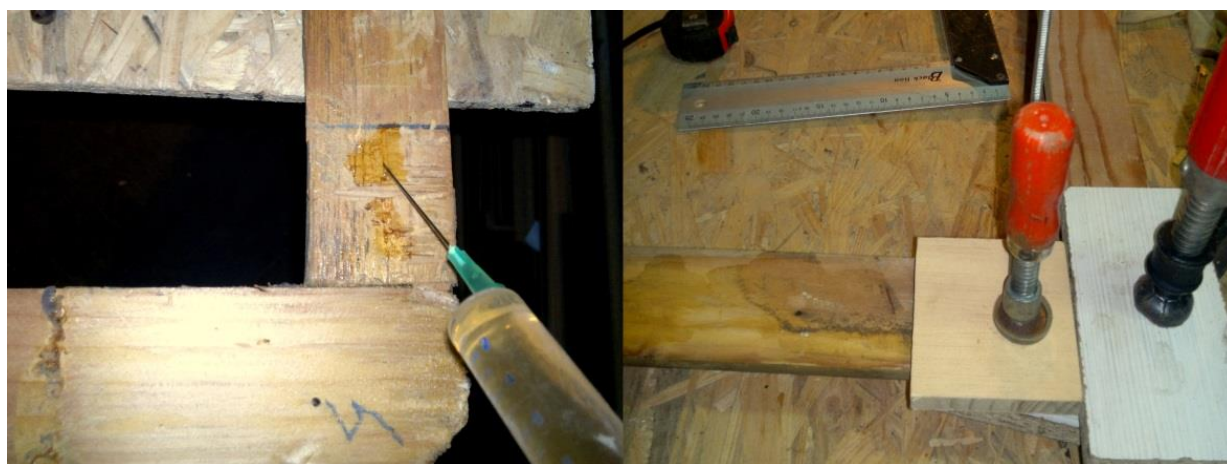
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7. Procesul de completare lipsurilor de stuc; detalii
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1. Fragment detachments; detail

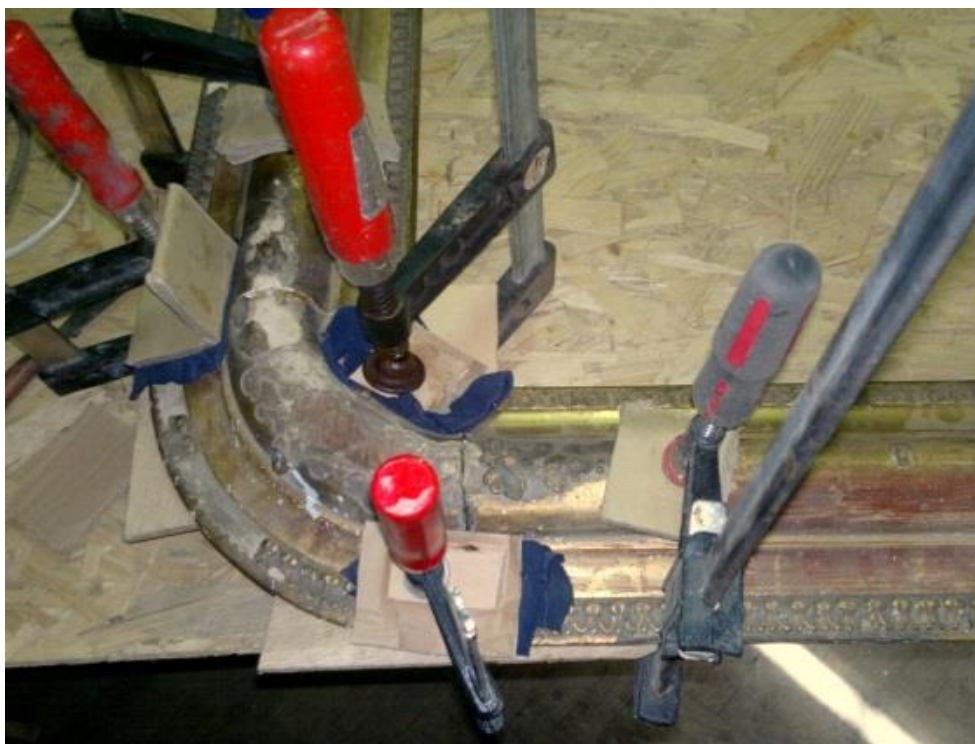


2. Missing stucco fragment; detail



3. Structural and mechanical consolidation; detail





4. Mechanical consolidation of detached fragments; detail



5. Execution of the silicone print; detail



6. The missing stucco elements completion process; details



7. The missing stucco elements completion process; details



8. The missing wooden elements completion process; details





**RADIOLOGICAL ANALYSIS AND RESTORATION INTERVENTIONS  
FOR WOODEN ICON "MADONNA WITH CHILD" FROM THE COLLECTION  
OF THE PRAHOVA COUNTY HISTORY AND ARCHEOLOGY MUSEUM**

**Mirel BUCUR, Drd. \***

**Abstract:** This paper presents the interventions made to restore this icon held by The Prahova County Museum of History and Archaeology. It places particular emphasis on the digital radiological analysis as a method of modern non-destructive investigation. After the restoration, the play was recovered by the holder, being exhibited in the permanent exhibition at the Museum of Religious Art in Vălenii de Munte, museum founded in 1923 by Nicolae Iorga.

**Keywords:** icon on wood panel, digital radiography, non-destructive analysis, restoration, color integration

**Abstract:** Lucrarea prezintă intervențiile executate pentru restaurarea acestei icoane deținute de Muzeul Județean de Istorie și Arheologie Prahova. Se pune un accent special pe analiza radiologică digitală ca alternativă de investigare modernă și non-distructivă. După resturare, piesa a fost valorificată de deținător, fiind etalată în cadrul expoziției permanente de la Muzeul de Artă Religioasă din Valenii de Munte, muzeu înființat de Nicolae Iorga în anul 1923.

**Cuvintele-cheie:** icoană pe panou din lemn, radiografie digitală, analiza non-distructivă, restaurare, consolidare, integrare cromatică

### **Preliminary**

The icon that is the subject of this case study is part of the collection of The Prahova County Museum of History and Archaeology and is called "Madonna with Child" in institution records appearing in the inventory record number 64-349 (Fig. 1-2). It is an image which is in the tradition of the representations made in Walachia, where the eighteenth century "we are witnessing a gradual shift mountaineers painters painting from an art yet balanced, for an increase in the baroque spirit, the exaggeration of ornament and use gold and effeminacy forms" (Efremov, 2002, p.69). The icon is not dated, but we believe that the fall in the latter part of the eighteenth century and the first half of the next. Icon is relatively few data on the record sheet and the labels are noted to be from the church of Filipeștii de Pădure. The

similarity between the present and the royal icon, icon of the Virgin Mary on the Throne of the iconostasis of the church is significant and if we can't say with certainty that belongs to Pârvu Mutu is the least talented hand of one of his disciples, who had worked with him to fresco the iconostasis of the Filipeștii de Pădure, their names are inscribed on the wall of anaphora, with Slavonic letters: Pârvu, Marin, Andrew, Stan, Neagoe and Nicolai.

Icon is made on a base of good quality linden wood without knots, size 428 x 588 mm and a thickness of 32 mm. The panel no curvature and is reinforced with two sleepers association with beveled edges. Although initially icon was mounted in a frame at present, the edges are free pictorial field, higher than the painting surface and slightly curved upwards, meaning that priming and framing icon was executed in

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a single technological phase (Fig. 3).

### Analysis

In order to understand the constituent materials and the conservation status of the play, basic steps in determining appropriate treatment, we conducted a series of investigations such as: visual investigation and grazing of natural light through the magnifying glass and microscope, it photomicrographs were made with portable digital microscope, biological investigations, chemical investigation and digital radiography.

Digital radiological image data obtained and combined micro-chemical tests revealed the presence of pigments such as lead white, red cinnabar, red lead, gold leaf.

### Digital radiography

Between the act of restoration prior investigations we used a modern method digital radiography and non-destructive. Of course, over time, these explorations have become a relatively common practice and appreciated for the information they reveal. Since 1977, there is a volume conducted by Arturo Gilardoni and his team, in which the theoretical basis of the method and a series of concrete cases, devices dedicated investigation of heritage objects and working methodology based on the material you investigated (Gilardoni *et al.* 1977). Our method is, in fact, the adjustment of modern version of the digital type to investigate the human body, the investigation of the icons on the panel and glass. The case is part of a set of inquiries, we make currently at the stage of establishment of the conservation status and the constituent materials of the artifacts to be restored. As mentioned in other articles, under collaboration agreements with Sibiu Pediatric Hospital, and in this case we used SWISSRAY DDR Multisystem, year of manufacture 2000, average power (150 kV, 400 mA), with a maximum resolution of 5 megapixel camera, equipped with operating system SwissVision (Bucur, Sofariu 2008, p.60; Bucur, 2009, p 253-254)

Given the size of the whole area icon radiography was performed by two exposures, the two images obtained are further processed to

obtain the overall picture (Fig. 4). We refer to the x-ray image that wood fiber is not highlighted, so the structure is uniform, corresponding to lime. We refer also to be highlighted fissures, small cracks and losses recorded in the x-ray image wood in shades of dark gray, almost black. The traces of biological attack are also highlighted in the same dark tones into many small areas with relatively circular aspect. It clearly distinguish four areas bright, oblong, oriented along the fiber, which correspond to areas of mass defects primer coated panel over overlapping layers of painting.

Tonal range from white to black is complex highlighting information about the nature of the pigments used. Thus, we consider that the face and hands contain lead white characters because of their radiographic signal light, open. Since the signals and gives Virgin Mary garment radiographic quite bright, suppose that contain red lead.

Gaps paint layers are visible in the radiograph as irregular areas with dark grays signal range. Grays intensity scale is different depending on depth worst losses with a dark signal. In these cases, the electromagnetic radiation passing through fewer layers has a lower attenuation and the resulting dark tones.

### Conservation status

A powerful attack boring insects produced a weakening support in areas causing loss of the wood corners (Fig. 9). In the analysis 39/2008 issued by Dr. Livia Bucșa stating that the attack was caused by *Anobium punctatum* and woods used in making panel and sleepers is lime - *Tilia sp.* Paint layers the aging cracks, separation and depth gaps and different areas, especially in the central and bottom of icon. Also in the bottom, it may refer to a severe wear of the color layer. Large extent, this was due to excessive humidity that has undergone panel, halos of moisture is visible on the back. We can see the degradation caused by the proximity of a flame (candle, lamp) is visible in the lower combustion. Decisive role in the emergence of gaps in the middle played the high temperature. Varnish old is yellow and brown. Surface dirt, sticky and clogged is pre-

sent over the entire surface, making it difficult to read clearly composition.

### Previous interventions.

No previous restoration interventions highlighted but have to mention subsequent interventions. Two labels application, one on the front, on the painted surface (Fig. 5) and the other on the back. Another intervention is trying cosmetic coarse red painted panel marginal areas, wood is apparently due to the loss frame rods. In some areas, the painting went and painted surface.

### Restoration

Removing the front label was achieved by hot water compresses, excess adhesive was removed mechanically scalpel (Fig. 6-7). Similar was removed and the label on the verso. Strengthen the painting layers were done in several stages. First, the fish brushing with hot glue (3% aqueous solution), Japanese paper was applied to the entire painted surface. Because we observed strong glue absorbing, I brushed the entire surface again with isinglass 3%. After 24 hours I applied a new layer of hot glue (4% aqueous solution) all by brush, after which a period of about 2 hours, I applied hot press with spatula electronic press alternated with cold pressing.

Structural support was reinforced with Paraloid B72 solubilized in ethyl acetate (10% concentration) into the flight, fine sawdust to stabilize the flight holes and play support, largely mechanical strength loss. Subsequently, each hole of one of the painted surface was blocked by the layer of paint with a mixture of sawdust and glue fish, most of the time in two or three steps (Fig. 10). Finally, run a grouting with a mixture of chalk mountain and warm isinglass (concentration 8%).

For mechanical strengthening in the lower bracket, where a crack is visible fairly large and several small cracks was made of wood of the same essence a flyer and a wand. This rod has rounded ends to prevent creating new tensions in the table panel, which usually produce new tension cracks. The table panel on the bottom edge and back into the crack were

practiced suitable places for the two elements made. Their fitting was done with fish glue (15%) by maintaining pressure for 24 hours (Fig.11-12). Excess timber was removed with a chisel edge to the panel. Small differences were clogged with fine sawdust mixture of isinglass. Gaps in the paint layers were grouted with chalk mixture already mentioned mountain and isinglass. Grouted areas were finished with cork and egg yolk emulsion (Fig.13).

Cleaning the painting layer was performed according to the tests with ammonia water, artificial saliva, mixture of alcohol, water, ammonia, purified turpentine oil. Verso icon was cleaned with ammonia water, keeping a small witness. The intervention provides a good surface insulation, reducing much "wood game" and subsequent dimensional changes under the influence of environmental factors. Grouting small losses of wood in the corner was made with a mixture of coarse sawdust and Covidez RLP, in a first phase with fine sawdust into the surface and finally the addition of pigment. The edges have applied a stain aqueous solution.

Chromatic integration was performed with water colors - watercolor - the pointillist technique. Final varnish optical part and the protection is solubilized in a mixture of dammar of turpentine (concentration 8% to not have a high gloss) applied by brush.

### Recommendations and conclusions

Because the support exerts a capital influence in preservation paint layer, it should be protected primarily by thermal variations and relative humidity. Very hygroscopic, rapidly absorbs and wood moisture, to achieve a balance with the environment. The relative humidity should hold it's far as possible between 50 and 65% without exceeding the upper limit. Moreover, the law stipulates that the parameters should be fit for different microclimate of movable cultural media. Recommendations are almost universal and most all states have legislation and concerns to publicize and enforce such rules that ensure preservation of heritage, the principle of medicine says it is much easier to predict than cure.

Temperature is closely related to relative humidity. An optimum temperature is situated between 18-20° C. The maximum illumination must be between 150 and 180 lx.

Precarious conservation status determined keeping track in the warehouse, but after restoration piece was recovered by the holder, being exhibited in the permanent exhibition at the Museum of Religious Art in Vălenii de

Munte, museum founded in 1923 by Nicolae Iorga. If at first we saw an image composition distinguishing them hard enough, with the support weakened, we reached the end, the results almost miraculous that an object to have healed, with enhanced support that could be attached in an exhibition, and especially, we came to rediscover a hidden images or layers of dirt and old varnish.

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### LIST OF ILLUSTRATION

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2. Assembly back before restoration
3. Detail before restoration. Painting field surfaces slightly curved upwards
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7. Detaliu. Resturi ale etichetei aderente la suprafață
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1. Assembly face before restoration



2. Assembly back before restoration



3. Detail before restoration. Painting field surfaces slightly curved upwards





4. Digital radiographic images



5. Detail before restoration. Label attached to the painted surface



6. Detail. Applying a warm compress



7. Detail. Remnants the label adhered to the surface





8. Detail. Consolidation of the paint layers



9. Gaps in the paint layers to the support of wood Observe the flight holes



10. Grouting holes flying with fine sawdust and glue mixture.





11. Mounting a flyer.



12 Embedding wand on the icon



13. Detail after grouting



14. 15. Detailed during cleaning



16. Loss of timber



17. Corner area completion





18. Detail while integrating chromatic



19. Detail after chromatic integration





20. Whole face after restoration



# MUZEUL BRUKENTHAL

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