

INTEGRATED ANALYTICAL STUDY FOR THE EVALUATION OF CLEANING EFFECTIVENESS ON OLD WOOD ROMANIAN ICONS

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Abstract:

*This paper presents the evaluation of cleaning effectiveness on old wood Romanian Crucible. The old Orthodox Crucible is from a private collection, that has been cleaned long ago, and recently had a compatible cleaning, by using washing tests interventions in order to remove the dirt deposits. In the cleaning interventions there were used traditional mixture solvents and natural extracts from vegetables. For evaluating the cleaning process it was used the Colorimetric system CIE L*a*b*. Cleaning revealed extensive over painting that had not only dramatically changed the original appearance, but also the meaning and attribution of one of the Crucible.*

Key words: icons; cleaning effectiveness; washing test; organic solvent; natural extract; Colorimetry CIE L*a*b*.

INTRODUCTION

In current conservation practice, the original state of the work is very important with the object's integrity being respected and preserved as much as possible. Part of the evaluation of the effectiveness of cleaning is based on the need to establish the original chromatic equilibrium and to identify the original paint by distinguishing past interventions which distort the image, such as over paintings (Perusini 1990, Sandu 2009).

Difficulties arise when some layers have suffered irreversible physico-chemical alterations. Furthermore, the inconsistency of the previous cleaning gives a disequilibrium so in some areas that are fully cleaned with are much too different than others which remained as they were. The method and cleaning system of intervention must be chosen according to the chemical and physical nature of the materials to be removed and the sensitivity of the original materials (Brandi 1977, Brunetto 2000, Perusini 1990, Sandu 2010). The cleaning process has been debated intensely (Brandi 1949, Gombrich 1963, Philippot 1999, Rees-Jones 1962, Rhyne 2006, Ruhemann 1968) and continues to this day. One of the key issues has been the evaluation of "patina," a problematic concept regarding what is or is not original to the surface.

The cleaning of Icons means that the old and altered varnishes must be removed, but also past interventions such as over painting that have completely changed the meaning and attribution of these artworks.

In various technical treatises, the traditional recipe which is widely used is made by mixtures of organic solvents applied with swabs or brush. In many cases mechanical means, such as a scalpel, were also employed (Cremonesi 2000, Koklova 1996). Solvent mixtures in wide use have been based on ethyl and butyl alcohol, xylene, butyl acetate, acetone, and low aromatic hydrocarbons in various proportions. The solvent and/or solvent system is tested carefully before use, in microscopic areas primarily along the edges of the painting (Koklova 1996).

This study is about a cross from the 19th century, a Crucible with two painted faces, one with The Christ Baptism, and on the other with Jesus Christ crucified, from a private collection. Under the actual oily painting there is another tempera painting. The surface is blackened and with layers of dirt and clogged structures which raised big problems to the restoration team, being a difficult task of gradually bringing to light the original paint layers. While imaging techniques and cleaning tests had revealed the existence of a well preserved version, microscopy and chemical analyses were used in order to characterize most of the organic and inorganic materials.

EXPERIMENTAL PART

CONSERVATION STATE

For this study it was used a crucible from XIXth century, from a private collection, made by an anonymous painter on lime wood, with carved floral frames around the four arms. The preparative layer is made of animal glue and gypsum, and the polychromy is made of oil colors (**Fig. 1**). From the carving around the arms, there are some original rays in the middle, that are missing, and which were replaced with new ones recently carved by new wood. When the crucible arrived to the laboratory for investigation, preservation and restoration, from those middle rays, the crucible had just three. Also the top part of the carving on the right arm is missing as well, and there are new insertions of carvings on the other arms, left and top, which are roughly carved, probably by a local. The support of the cross used also at the carrying in the liturgical rituals is missing, existing only a fragment from the clamping head fixed in metallic nails (**Fig. 2**).

On the front of the crucible (**Fig. 2a**), in the inferior area where the support was, a bent nail can be observed, the top of the nail in form of a hobnail, and other new nails, thinner, used for fixing the support. On the reverse (**Fig. 2b**) it also can be observed the bent nail.

Both faces of the crucible have degradations and deteriorations of the wood panel, carving and polychromy (**Fig. 3**).

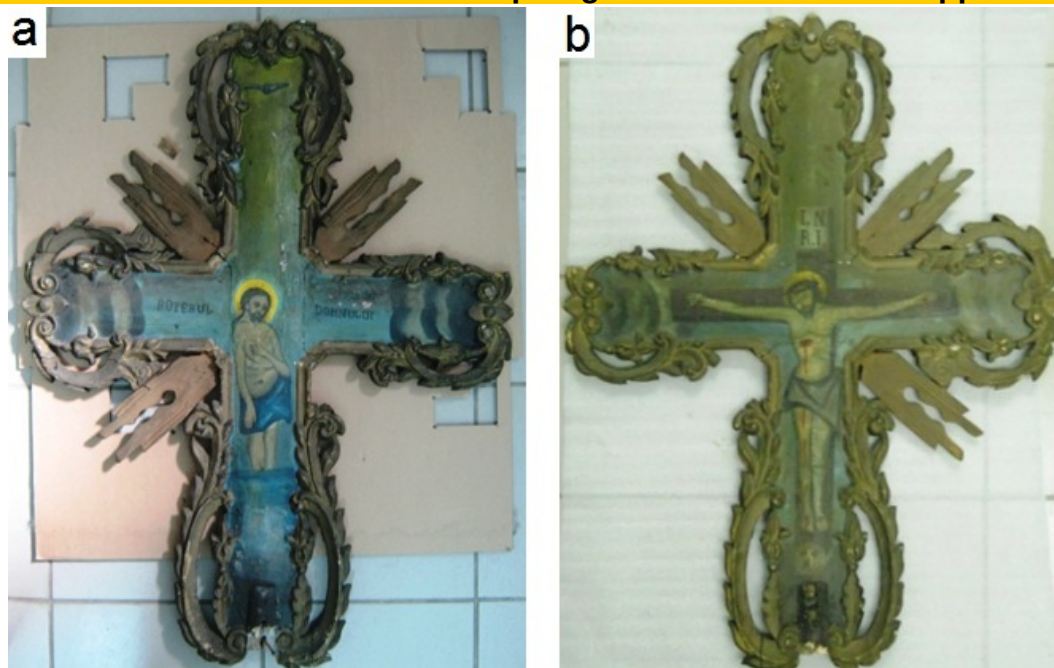


Fig. 1

Crucible from the XIXth century:

a – the front with Jesus Christ baptism; b – the reverse with Jesus Christ crucified.

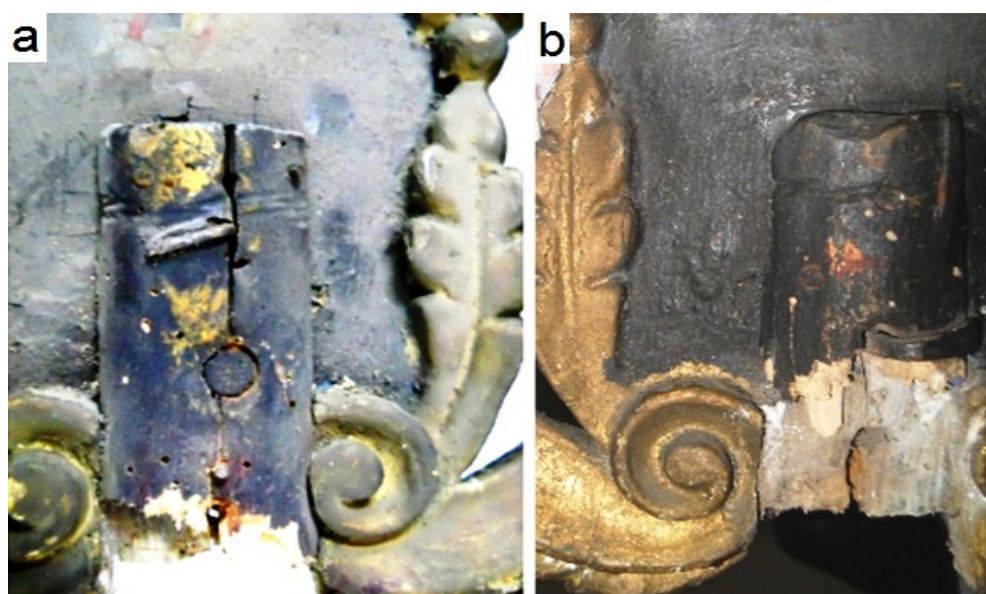


Fig. 2

Fragment from the crucible support:

a – front, b – reverse.

The ornaments were originally gilded with gold leaf and later they were painted with bronze (**Fig. 3**). After the analysis of the conservation state by hand lens in UV and IR light, different deteriorations and degradations were observed, resulted from faulty handling and storage in unsuitable conditions. Thus are distinguished deep fissures (**Fig. 3a**), evidence of erosion and separations in the painting layer (**Fig. 3b**), cracks in the joining of the arms and fouling patina (**Fig. 3c, d and e**), wood loss, repaints of the image and of the carvings (**Fig. 3f, g and h**) and gumming/oxidation of the varnish (**Fig. 3i and j**).

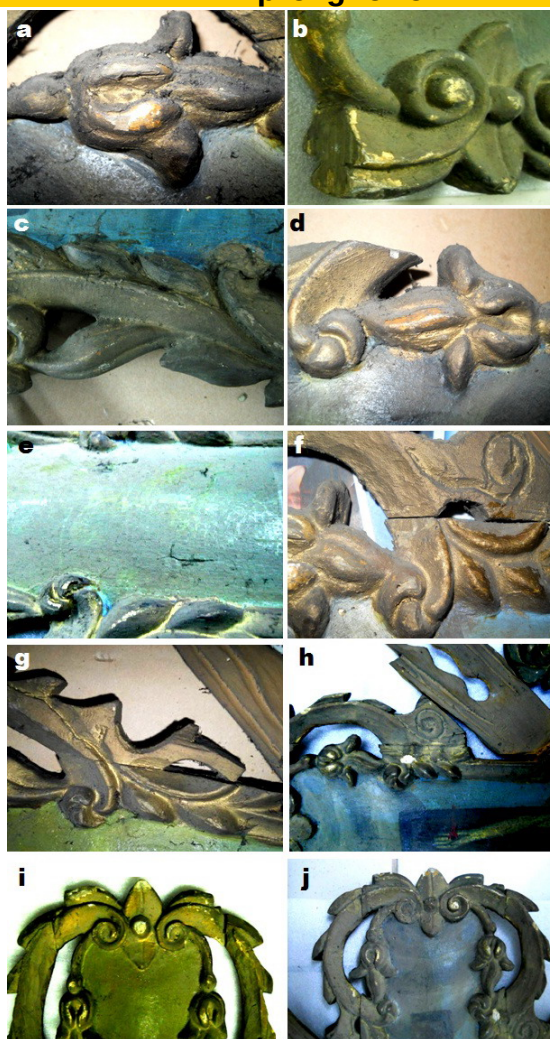


Fig. 3

Deterioration and degradations:

**a – crack with loss of painting layer; b – bronze loss by erosion
c - fouling bronze; d – preparation layer loss and bronze, e, i and j – fouling patina
f, g and h – new wood carving insertions, made by amateur sculptor.**

It is believed that the crucible was painted again in oil paints, at the begging of the XXth century (the proof would be by the oil paint leftovers from the ornaments), underneath is a tempera painting (**Fig. 4**), which was erased by rain during ritual processions.

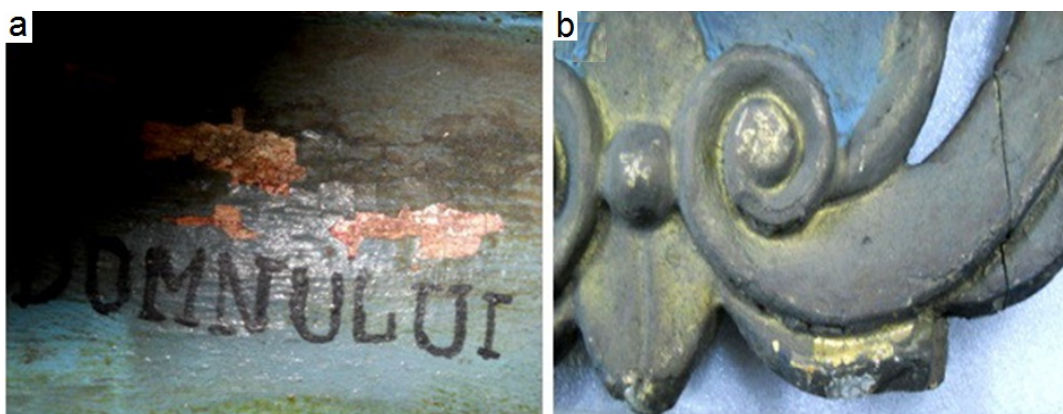


Fig. 4

The area in which the oil paint is missing,

*underneath it can be seen the original painting:
a – tempera color under the oil painting; b – the golden leaf under the bronze.*

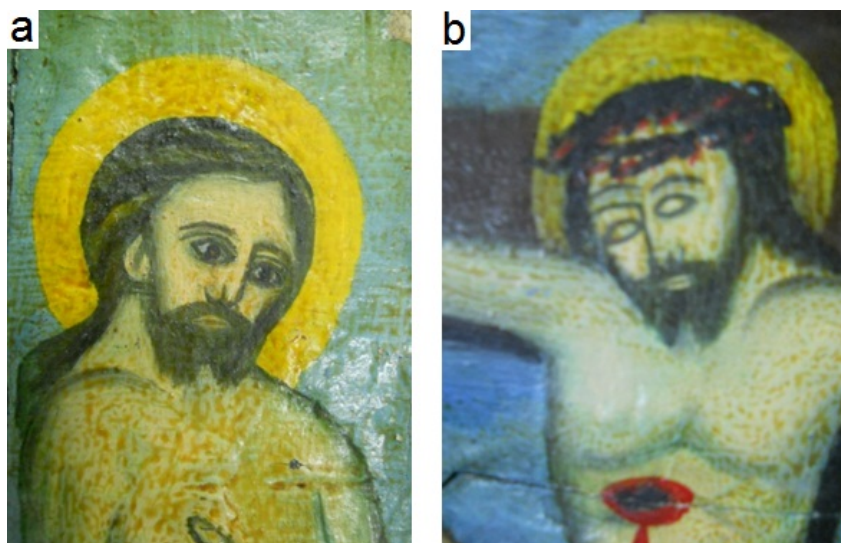


Fig. 5
Details of the two faces with superficial adherent structures:
a – Jesus Christ baptism; b – Jesus Christ crucifixion.

The crucible was covered in a thick layer of dust and adherent dirt (**Fig. 5**). Whereas the crucible came from the country where it was customary for the icons to be greased with oil to improve the appearance, later in time, together with the dust, ash etc., it interacted with the varnish and by oxidation it gained a shriveled appearance, dark colored, named adherent structures (**Fig. 5**). The repeated greasing of the painted surfaces led to a sticky surface, traces of leaking and yellowed and raised big problems to the cleaning process.

CLEANING PREOCESS, WASHING TESTS AND CLEANING ASSESSEMENT

After the analysis of the conservation state the crucible was cleaned, initially by brushing and vacuuming, and after words by washing, using different usual solvents and a series of natural juices and teas. For every cleaning process used, first of all the washing test was done on small surfaces with representative degradations of the painting (**Fig. 6**).



Fig. 6
Washing test on small surfaces.

The cleaning with solvents was done by two types of solutions: mixtures of organic solvents, usually used for cleaning the oil paintings, which were taken as reference and natural extracts of vegetables (cabbage, potato, radish, carrot, onion, celery, horseradish, parsley and garlic) and medicinal herbs decoctions (corn silk and basil). In the course of history for the cleaning of oil paintings there were used plant extracts so a systematic resumption was considered by using the most popular vegetables and medicinal herbs relying on some of their advantages (minimal aggressiveness, high synergy, low cost, no toxicity etc.).

The tests were made with cotton swabs 100% wrapped around wood sticks soaked in solutions or mixtures of different solvents (distilled water, absolute alcohol, acetone, butanol, xylene, butyl acetate). The next recipes were used: **S1** - ethylic alcohol 100%, **S2** - 90% ethylic alcohol and 10% distilled water, **S3** - 80% ethylic alcohol and 20% distilled water, **S4** - 70% ethylic alcohol and 30% distilled water, **S5** - 40% butyl acetate, 5% butanol, 35% toluene, 20% acetone.

In the same way the washing tests with natural extracts from vegetables and decocts were done, using the next recipes: **S6** - 10g cabbage juice, **S7** - 10g potato juice, **S8** - 10g radish juice, **S9** - 10g carrot juice, **S10** - 10g white onion juice, **S11** - 10g celery pulp dispersed in 10g distilled water, **S12** - 10g horseradish pulp dispersed in 10g distilled water, **S13** - 10g parsley pulp dispersed in 10g distilled water, **S14** - 10g garlic pulp dispersed in 10g distilled water, **S15** - 200ml decoct by 10g corn silk, **S16** - 200ml decoct by 10g basil, **S17** - 10ml corn silk decoct + 20g horseradish pulp, **S18** - 10ml corn silk decoct + 20g parsley pulp, **S19** - 10ml corn silk decoct + 20g celery pulp, **S20** - 10ml corn silk decoct + 20g garlic pulp.

The vegetables extracts (cabbage, potato, radish, carrot, onion and garlic) were obtained with a classical squeezing machine, implying there fine chopping and spinning. The more dense vegetables (horseradish, celery and parsley) were chopped, crushed and dispersed in distilled water in 1:1 ratio.

The corn silk and basil decoct was obtained by boiling 10g of dried herb in 200ml of distilled water for 5 minutes. It was used only the corn silk under the husk. The tests were made on very small surfaces, about 1cm², which were defined and marked with special pencils as waxcolors. First of all the single component systems were tested and then the mixtures. The cleaning efficiency was determined by comparison with hand lens and colorimetry CIE L*a*b*, using the LOVIBOND 300 Reflectance Tintometer colorimeter.

RESULTS AND DISCUSIONS

After the washing tests were made, the cleaning assesement was done with a hand lens by comparing the cleaned area with the adjacent test area. The findings will be presented next.

Initially the organic solvents systems were tested, the ones known in the scientific literature for the cleaning of oil paintings. As a starting point there were taken two aqueous systems of ethylic alcohol in various concentrations, gradually taken, and a mixture of organic solvents widely used.

In test **S1** with ethylic alcohol 100%, the varnish solubilized, the dirt was easily removed, the color was not affected and the cleaning period took about 2 minutes (**Fig. 7b**). The test **S2** with ethylic alcohol 90% in distilled water has removed the adherent dirt and partially the varnish, the cleaning period took about 3minutes (**Fig. 7d**). Test **S3** with 80% ethylic alcohol in distilled water enabled the removal of the superficial dirt, without penetrating deeper to the varnish, the cleaning period took about 4 minutes (**Fig. 7c**). Test **S4** with 70% ethylic alcohol in distilled water doesn't remove any kind of dirt even let to moisturize for 5 minutes (**Fig. 7c**). The **S5** test with 40% butyl acetate, 5% butanol, 35% toluene and 20% acetone, has removed the dirt very easily, the cleaning was better than the recipes based on aqueous solution of ethylic alcohol. (**Fig. 7 b, c and d**). The painting layer wasn't affected, because the substances are very toxic to the curator, the solution was used only as a reference since it is very efficient for cleaning the oil paintings. The solution gives the best cleaning, on the ornaments it removed the dirt completely but the bronze partially (**Fig. 7a**).

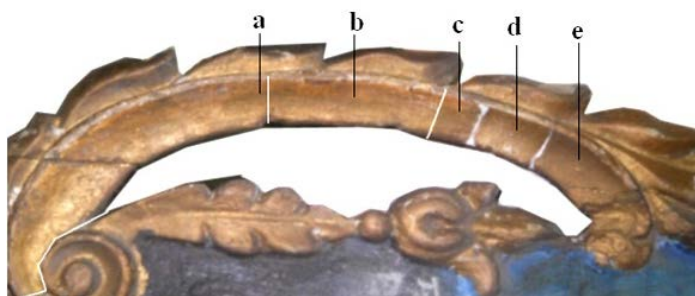


Fig. 7

Areas on the ornaments cleaned with organic standard solutions:

a – test S5; b – test S1; c – test S3; d – test S2; e – Test S4.

Of the 5 tests it can be observed that only S1 and S5 permit the use of references for the tests with natural extractive by vegetables and decocts of dried herbs (**Fig. 8**).



Fig. 8

Detail of the two areas cleaned with the most efficient organic solutions:
a - ethylic alcohol 100%; b - mixture of butyl acetate 40%;
5% butanol, 35% toluene and 20% acetone (S5).

The cleaning efficiency was measured by visual comparison by the areas cleaned with vegetables extractives like cabbage (Fig. 9i), potato (Fig. 9f and g), carrot (Fig. 9h), onion (Fig. 9b) and garlic (Fig. 9a), the other ones not so juicy like celery (Fig. 9j), corn silk decoct (Fig. 9e), with the areas cleaned with the reference solution (Test S5) presented in (Fig. 9c).

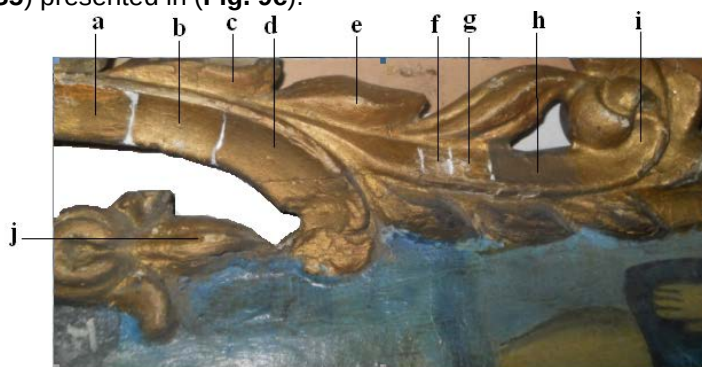


Fig. 9

Detail of the cleaned areas using vegetables extracts and corn silk decoct:
a - S14 (garlic); b - S10 (onion); c - S5 (mixtures of organic solvents); d - S8 (radish);
e - S15 (corn silk); f, g - S7 (potato); h - S9 (carrot); i - S6 (cabbage); j - S11 (celery).

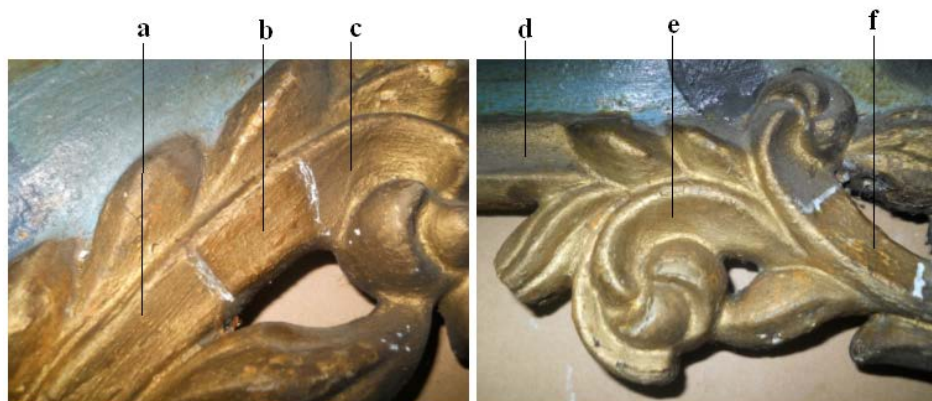


Fig. 10

Details of the cleaned areas using vegetables extracts and corn silk decoct:
a, e - areas cleaned with the reference solution S5; b - cleaned with S15;
c - cleaned with S13; d - cleaned with S17; f - cleaned with S16.

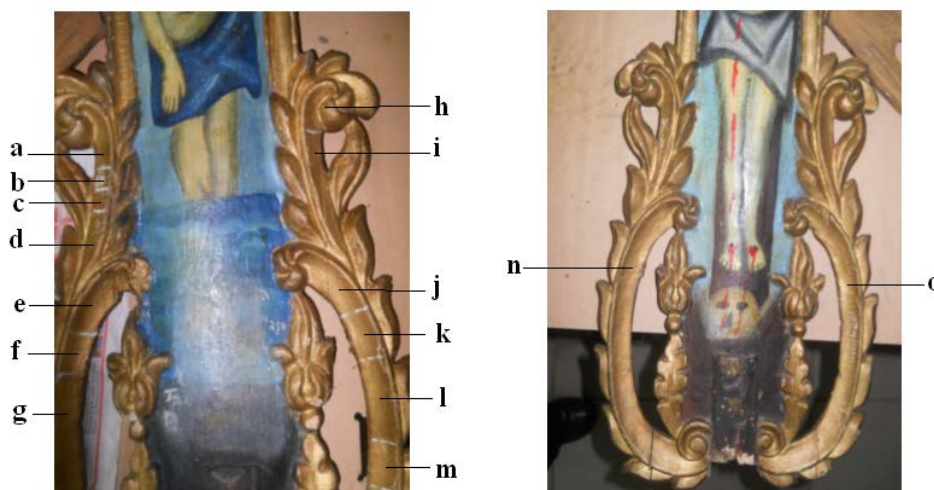


Fig. 11

Detail with the cleaned areas by vegetables extracts and corn silk:

a, h - reference areas washed with S5; b,c - washed S7; d - washed with S8; e - washed with S14; f - washed with S10; g - washed with S9; i - washed with S17; j - washed with S15; k - washed with S18; l - washed with S19; m - washed with S20; n - washed with S5; o - Washed with S20.

In Fig. 11 were considered the most effective cleaning solutions, that were used to clean bigger areas, so two pieces of ornament by the reverse of the crucible were cleaned with the solution S5 (Fig. 11n), mixture of solvents, and with the organic one S20 (Fig. 11o), the most effective plant solution, the corn silk decoct combined with garlic extract. The areas were compared using the CIE L*a*b technique.

When cleaning paintings by the fundamental principles of intervention (Brandi 1963, Baldini 1981) the operation must be done on different types of deposits and by their conservation state. From these considerations only over the golden leaves were made harsh cleaning interventions to remove all varnishes and bronze. for golden yellow was used the wavelength of 570 - 610nm. In (Fig. 12) it is presented the color before and after the cleaning with S5 and S20 systems. it can be observed that most of the dots read after the cleaning, were positioned almost linear in the dominant spectral domain. a better lining is in the case of the S5 cleaning area, which has a better cleaning efficiency, all the way to the first gilding. There were 15 readings done in the same area, before and after both cleanings.

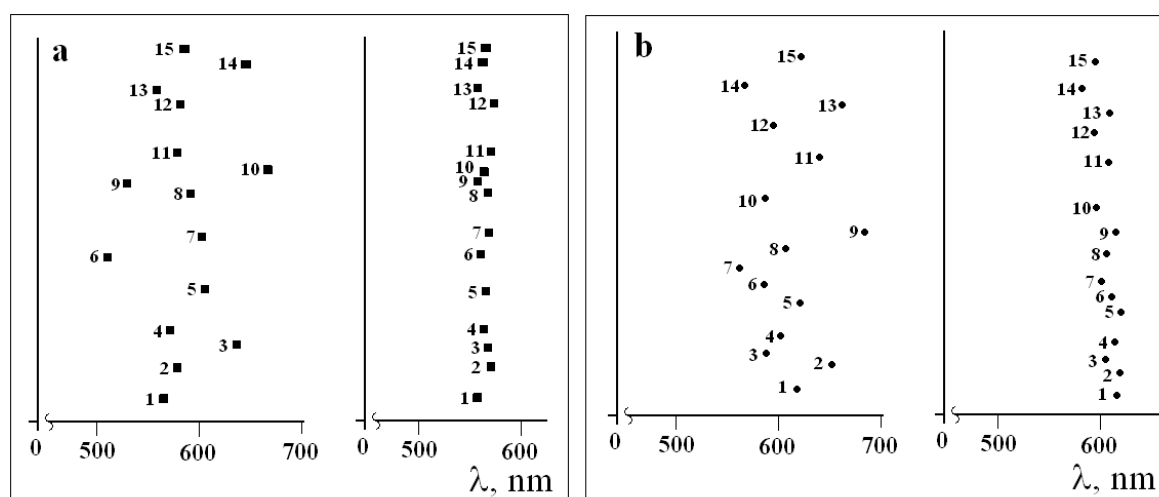


Fig. 12

Color grouping by wavelength:

a - after and before cleaning with S5 system; b - after and before cleaning with S20 system.

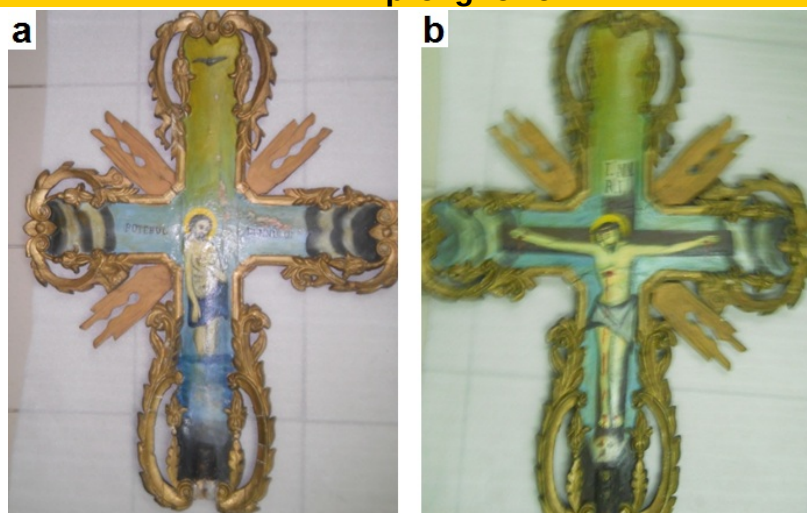


Fig. 13

The cleaned crucible:

a - Jesus Christ Baptism; b - Jesus Christ crucifixion.

CONCLUSIONS

For cleaning were used vegetables plant extracts and decoction of dried herbs and as reference: classic organic solutions based on alcohol and other organic solvents, which allow cleaning the oxidated and fouling deposits. Based on visual observation and colorimetric analysis the best results were for S20 system, made of 10ml corn silk decoct + 20g garlic pulp, followed by S5 system made of 40% butyl acetate, 5% butanol, 35% toluene, 20% acetone.

Cleaning revealed extensive over painting that had not only dramatically changed the original appearance, but also the meaning and attribution of one of the Crucible.

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