The impact of environmental factors upon panel paintings

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PhD Thesis Abstract

The PhD Thesis entitled "*The impact of environmental factors upon panel paintings*" was elaborated using experimental data and studies regarding the deterioration and degradation of the materials used for the creation of old panel paintings, under the influence of environmental factors (temperature, humidity, UV light and pollutants). These experiments were based on the practical observations made in the conservation-restoration activity and on the study of the specific literature channeled on the following directions:

- Artistic techniques used for the creation of the panel paintings and materials used for this purpose;
- Deterioration and degradation of the old panel paintings' materials under the influence of microclimatic factors (humidity, temperature, light, and pollutants) and biotic factors (fungi, xylophagous insects, rodents, and humans)
- Methods and techniques used in the analysis of the old panel paintings.

The purpose of these researches is to evaluate the influence of the different microclimatic factors on old panel paintings, especially the ones from the ecclesial environment, where the artifacts are exposed to a microclimate with variable parameters, depending on the season or on the liturgical or cultural activities that take place there, when the icons are in contact with the anthropic factor (kissing, touching, friction, splashing, manipulation and incorrect display) or with different pollutants (dust, incense smoke).

The chosen theme is justified by the existence of numerous old icons painted on panels that pertain to the cultural heritage, which are in a precarious state of conservation that does not allow their display and use in liturgical activities. Also, the icons assembled in the iconostasis or the mobile ones (feast icons that are changed depending on the religious celebrations) during their display and use, come in direct contact with people, suffering in time evolutional processes of destruction and alteration. Many of these icons, with artistic or historical value, already present different types of deteriorations and degradations, most frequently encountered being: adherent dirt, which change the aspect and makes the image hardly legible; panel warping; detachments, cracks, fractures and lost parts of the panel; cracks, cupping, unseen detachments, detachments and lacunae of the painting layer; darkening of the varnish, discolourations of the pigments; flaking of the painting layer; powdery ground layer which leads to painting layer loss..

The increased number of the deterioration and degradation cases determined the completion of a PhD thesis which will bring new information about the interaction of the environmental factors with the materials that were used in the making of the old panel paintings by different artistic techniques. For this purpose, the following objectives were taken into account:

- *The study and bibliographic synthesis* of the present stage of knowledge regarding the materials used in the making of the panel paintings (chemical nature, preparation and

artistic techniques) and their behavior in time under the influence of temperature, light, humidity, pollutants and biotic factors;

- The elaboration of a *protocol* for the *selection* of old icons with rizas, which presented deteriorations and degradations induced by the criptoclimate;
- The elaboration of a *protocol* for the *selection* of icons from state or private collections which presented specific cases of deterioration and degradation under the influence of environmental factors, corroborated in some cases with the wrong technique or the inadequate preservation- restoration interventions;
- The elaboration of *experimental protocols* regarding the sampling and processing of materials from panel paintings, and also the creation of samples similar to the panel paintings, using different recipes for ground or varnish preparation, exposing them to artificial ageing under the influence of UV light, temperature or hygroscopic humidity
- The establishment of complementarity relations (corroboration and co-assistance) between different types of interdisciplinary analysis techniques in order to realize an analytic protocol, the obtained data having multiple uses: authentication, determination of the state of conservation, or their implication in compatibility studies for panel painting creation or preservation - restoration studies.
- The interpretation of the analysis results and the corresponding correlation between artistic technique, the materials used in creating the panel painting and the changes occurred under the influence of the environmental factors (inherent vices and exogenous factors).
- The dissemination of the obtained results in national and international conferences, and articles published in ISI and BDI publications.

The implementation of the objectives brought original elements like:

- Study of the influence of criptoclimate, created by rizas, on the old icons painting layer;
- The evaluation of the influence of pollutants specific to churches (incense and myrrh smoke, candles and charcoal smoke) on the varnish and wooden support;
- The study of the behavior of some new structural elements (ground layer, varnish, gilding materials) specific to panel paintings, by artificial ageing at high temperature, UV light or humidity, for their compatibility;
- The evaluation of the artificial ageing effects by correlation of the artistic technique with the deterioration and degradation of the simulated samples;
- The study of the influence of the human skin surface lipids on the panel paintings, varnished or not;
- The obtained results were published in 20 scientific papers, of which 9 were published in ISI journals (6 national and 3 international), 10 in SCOPUS/BDI journals and1 in volumes of international symposiums. Also, 8 papers were presented as oral presentation or posters at international or national conferences. It is noteworthy that some of the published papers were quoted 14 times in ISI journals (7), and SCOPUS/BDI (7), together with 4 self citations in ISI journals.

The PhD thesis theme represents an important chapter of the environmental science and engineering, referring to the exploitation of cultural heritage goods, involving knowledge from different fields, like: chemistry, physics, biology, materials science and technology, art history and theory, the science of artifacts conservation, with its subdomains, scientific investigation

(expertise for the authentication and determination of the state of conservation), compatibility studies of the preservation-restoration interventions, monitoring the behavior of the interventions on a certain period of time and monitoring the state of conservation while the painting is displayed/deposited, preventive preservation or climate maintenance, active preservation, restoration, followed by museum capitalization (display).

The thesis has 11 chapters, structured in two parts.

A. The theoretic part (*critical review and bibliographic synthesis* of the present state of research) is presented in two chapters:

- **Chapter I –** presents the materials that are used in the making of a panel painting and their chemical nature, starting with the macroscopic and microscopic structure of the wooden support, followed by its chemical composition, ground layer, mediums and pigments composition, ending with the chemical nature and composition of the protection films (varnishes).
- **Chapter II –** focuses on the environmental factors (humidity, temperature, light, and pollutants), biotic and anthropic factors and their effects on the panel paintings.

B. The original part which contains contributions regarding different protocols and the experimental research is extended on nine chapters, presented bellow:

- **Chapter III –** presents specific cases of deterioration and degradation of panel icons under the influence of environmental factors, starting with the ones that affect the support and ending with the ones that affect the painting layer.
- **Chapter IV –** presents the analysis methods and techniques used in the sample research, samples taken from the lacunae's margins of the original paintings or newly created, imitating the panel paintings structure, and artificially aged.
- **Chapter V –** is focused on the study of the influence of criptoclimate with high humidity induced by rizas on the painting layer of icons pertaining to the cultural heritage; the rizas favour the deposit of cleaning products used for the rizas' and painting cleaning, and the accumulation of dust, plant remains, pieces of paper which lead to the degradation of the painting layer.
- **Chapter VI –** analyzes the effects of the applied canvas on the wood movements determined by the high humidity; for the experiments were used pieces of linen and cotton cloth, applied on fir wood samples, cut in radial and tangential plan.
- **Chapter VII –** discusses the effects of humidity and temperature on the schlagmetal (gold imitation made of Cu and Zn) applied on different types of mixtion.
- **Chapter VIII –** presents a complex experiment regarding the chromatic variations of some ground layers with different admixtures (dammar varnish, linseed oil, egg yolk, honey) exposed to artificial ageing at high temperature.
- **Chapter IX –** focuses on the effects of artificial ageing at high temperature and UV-A light on varnishes prepared after different recipes: simple dammar varnish made of resin dissolved in turpentine, an oil varnish made of hot linseed oil with dammar resin and hot turpentine, and an oil varnish made of cold linseed oil mixed with dammar resin dissolved in turpentine.
- **Chapter X –** presents the effects of the smoke of natural incense, myrrh and artificial incense (obtained from a mixture of rosin, perfume and magnesium

oxide) on the lime tree and fir tree wood samples, and also, on the dammar varnishes made of dammar resin dissolved in turpentine, or melted and mixed with linseed oil, hot or cold.

- **Chapter XI –** analyzes the effects of the human skin surface lipids that create a film on the painting layer, as a result of touching during liturgical services, on materials used in panel paintings: ground layer,linseed oil mixed with ochre pigment, egg yolk emulsion and dammar varnish.

The thesis ends with a chapter of general conclusions, followed by bibliography made of 169 titles.

123 figures were used for this thesis, figures that presented the macro and microscopic structure of the materials used in the making of the panel paintings, study cases of deterioration and degradation, changes in the aspect and structure of the materials artificially aged, highlighted by spectra and graphics. Also, the experimental data obtained after the analysis were presented in 16 tables. The figures and the tables show the activity performed for the study of the environmental effects on different components of the panel paintings.