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X-RAY RADIOGRAPHIC STUDY OF SOME PANEL PAINTING ICONS FROM THE BEGINNING OF THE XXTH CENTURY

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Abstract

Nondestructive investigation methods with penetrating radiations, such as digital radiography and computed tomography proved to be very useful not only in assessing the cultural heritage, but also but also in any restoration and conservation activity by supplying a multitude of micro-structural details regarding a great diversity of works of art. Consequently, present paper presents two case studies regarding the use of digital radiography in investigating panel icons from the Popa Tatu Church, Bucharest. In both cases it was possible to evidence not only the actual state of conservation of wooden panels but also fragments of the oil picture, allowing a better planning of the future conservation work.

Keywords: *Digital radiography; Panel paintings; Panel icons.*

Introduction

Discovery of X rays by Wilhelm Rontgen in 1895 opened a new way to investigate the internal structure of objects [1]. Among a great diversity of techniques available today to investigate material structure of artifacts, non-destructive methods such Computed Axial Tomography (CAT) and Digital Radiography (DR) are amongst the preferred ones due to their ability to portray the inner structure of various artifacts, with beneficent effects for any restoration-conservation process [2-4]. Moreover, any Computer Tomograph (CT) using a fan-beam geometry could generate, due to a reduced scattered radiation, high quality and parallax free digital radiographies, making them very suitable to investigate a large category of objects, including various type of work of art such as paintings, sculptures, building materials, etc. [5-7]. In order to preserve the art objects, art conservators must constantly seek the condition of objects, and, where required by state breakdown, to use techniques and materials compatible to restore it in good condition without affecting its integrity, especially in the case of friable

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materials such as wood [8]. For above stated reason, DR [9] was used to investigate and to assess the actual state of conservation of two oil painted wood icons, property of the Popa Tatu Church in Bucharest [10,11].

St. Nicholas Church in Bucharest

The first church of wood, which no longer exists today, was built in 1682, by Mihai Cantacuzino Banul, on the place of the actual one.. In 1810, the church was named Popa Tatu after a priest who restored the church after the 1802 earthquake and built a bathroom and a home hosting for the poor people. Again the 1838 earthquakes damaged the narthex so that between 1870 and 1879 the church was rebuilt with donations from Madona Dudu Church guardianship of Craiova and other benefactors following Al. Tergevale architect. G. Ioanid restored the painting between 1877 and 1879 while the temple and pulpit were carved by Mihai Babic [9]. The present church was rebuilt after the 1940 earthquake of 1940, while the painter Emil Ivanescu partially repainted the church in 1943 and G. Bobuleanu restores eight paintings of the nave west wall. The last restoration was performed in 1969 at the initiative and expenses of Col. Ioan Negoescu Bârlad [10].

The interior painting of Popa Tatu Church encompasses, in terms of artistic styles, different techniques of painting, as a result of earlier interventions. The present-day oil painting of nave altar shows the influence of neoclassical Tatarescu master, in which the characters portrayed are surrounded by large panels of marble imitation, in the narthex the holy personages are painted in a close to Byzantine style manner, with stylized character surrounded by a starry sky.

Materials and methods

Icons

Iconostasis consists of a beams and tables wooden structure with applied carved ornaments while icons are made of pine wood panels joined without respect of traditional wood manufacturing technologies such as double dovetail. The painting of each icon, painted on wooden countertop, consists of three successive layers: a coat of primer as a support, the painting layer itself and a layer of protective oil mints. Painting is of Western influence regarding both image and technique used. The coating varnish aged and it is covered with powder and tar from the burning candles. Numerous inadequate interventions have damaged painting.

For this study, we have considered two wooden icons, representing Evangelist Matthew and Evangelist John painted in oil on pine panels reinforced by two transverse beams and temporally removed from iconostasis in view of a future restoration.

Digital radiographic equipment

All digital radiographs were performed by using a homemade dual-energy CT provided with a tungsten anode X-ray tube (Uanod =150 kV, Ianod = 3 mA) and a two sets of 240 solid state in-line detectors (maximum width of 0,4 mm), separated by a 1 mm Cu shield, such that each set of detectors to be impressed by X-rays having different energy spectra. To reduce the

influence of scattered radiation, X-ray beam was collimated in “fan beam” geometry by a pair of optically aligned lead collimators, disposed on both sides of the sample. In this configuration, the X ray beam has a thickness of maximum 1 mm. More details concerning the CT can be found in Ref. [7].

Although primarily designed to be used as CT, the same instrument provide digital radiographs, free of parallax, with a spatial resolution better than 1mm. After acquisition, digital images were processed by using ImageJ [12] as well as Corel Photo Paint 12® software.

Results and Discussions

To illustrate the performance of DR in investigating chosen objects, in Figure 1 we have reproduced the optical images of icons (both painted obverse and reverse) as well as corresponding digital radiographs.

Fig. 1. Photos of the Icons (obverse and reverse) and digital radiography:
a - Evangelist Matthew and b - Evangelist John.

Although the wooden panel has a thickness of more then 10 mm while the painting itself was less then 0.5 mm thick, the presence of mineral pigments was enough to assure a minimum of radiological contrast so that on both DR could be observed fragments of painting. Other details such double dove tail reinforcing joint of wooden panels can be remarked too on radiographic image.

A summary visual inspection evidenced, in the case of Evangelist Matthew, a severely damaged wooden panel, but a relatively less damaged painting. Judging on the reverse photograph, the panel consisted of two pieces, joint together and reinforced by two horizontal wooden beams (Fig. 1, upper row). The corresponding digital radiography illustrate with clarity not only damaged wooden panels but also the median joint between them, a number of galleries proving an insect attack, and, at the same time, almost clear fragments of image of painting. The right hand, head, mantle, a fragment of book could be well distinguished.

Similar observations could be made regarding the second icon representing Evangelist John. In this case, the wooden panels were less damage, but presented also the same traces of insect attack. The corresponding digital radiography evidenced the same wooden support consisting of two jointed wooden panels reinforced by transverse beans. As in previous case, on radiography it could be observed parts of painting, especially the head, right hand and fragments of mantle (Fig. 1).

The fact that a painting whose thickness is less than 1 mm including varnish as well as the primer applied on the surface of a wooden panel more than 10 times thicker, could be evidenced on both DR suggests the use of mineral pigments, rich in heavy metals. By taking into account that probably both icons are more than one century old, we can suppose the use of historical pigments such as ochre and Prussian blue (rich in iron), cobalt blue (rich in cobalt), vermillion (mercury sulfide), lead white (lead carbonate), chrome yellow (lead chromate), etc. In view of this, a further noninvasive scanning performed by means of X-ray fluorescence could be very useful in determining the composition of utilized pigments and dyes.

Conclusions

Digital radiography was used to investigate two wooden icons, property of the Popa Tatu Church, in Bucharest. Both icons, dated from the beginnings of XX^{th} century, were in a relatively poor state of conservation. Digital radiographs obtained by using a home made computer tomograph able to generate also radiographic images depicted not only details of wooden panel onto painting was applied, but also fragments of painting itself, despite the contrast between picture thickness estimated at less than 1 mm and wooden boards whose thickness was well greater than 10 mm.

This fact suggests the use of historical mineral pigments containing diverse salts of heavy metals, enough to assure the radiological contrast necessary to evidence the painting.

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