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SPECTROSCOPIC INVESTIGATION OF MILO MILUNOVIĆ'S CANVAS PAINTING "THE INSPIRATION OF THE POET"

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Abstract

A canvas painting by Milo Milunović "The Inspiration of the poet" was investigated in this work by multianalitical approach in order to identify pigments used by the artist as well as his painting technique. Results obtained by optical microscopy, fluorescence photography under UV light, energy dispersive X-Ray fluorescence (EDXRF) and FTIR Spectroscopy revealed following pigments on the painting: lead white, zinc white, cobalt blue, red pigment vermilion, green pigment viridian, as well as several earth colours. Optical micrographs show regions with no separation between layers, indicating that these areas were painted wet paint over wet paint.

Introduction

Milo Milunović, distinguished painter and professor at the Faculty of Fine Arts in Belgrade, during his stay in Paris made a copy of the Nicolas Poussin's painting "The inspiration of the poet". Milunović was a great admirer of Poussin's work and by copying the great artist Milunović wanted to show that he also has mastered the art of painting. Milunović made his painting in Louvre in 1926/27. "The Inspiration of the poet" painted by Milunović is 2.18 x 1.80 cm large and it has been permanently exhibited in the hall of the Faculty of Fine Arts in Belgrade since 1990. This painting will undergo restoration at the Faculty of Applied Arts in Belgrade, which provided a unique opportunity for physico-chemical investigation of the painting.

Traditionally, characterization of art-works has mainly been carried out by art-historians and restores by naked eye and by microscopic analysis. Information obtained by these methods, combined with consistent evidence of the art materials obtained by physico-chemical methods can help conservators and restores to decide upon the most appropriate procedures to be followed for the purposes of restoration. The scientists always have to balance the possible risks of damage against the profits that are obtained from the investigation of the artefact. Hence, the risk-of-damage/information ratio should be considered and optimized carefully for each investigation [1,2].

In this work home-made portable energy dispersive X-Ray fluorescence (EDXRF) spectrometer was used for investigation of well preserved regions of the painting, while paint chips obtained from the edges of the damaged regions were investigated by optical microscopy and FTIR spectroscopy. The aim of this study is to obtain information about pigments, binders and ground layer in investigated painting and to identify if any over-paintings have been made by the artist.

Methodology

For the nondestructive and nonsampling analysis of the painting portable home-made EDXRF spectrometer was used which consists of a Oxford X ray tube (Rh anode, max voltage 50 kV, max current 1 mA) and complete X-ray spectrometer (X123, Amptek Inc.) equipped with Si-PIN detector (6 mm^2/500 μm, Be window 0,5 mil/12,5 μm thickness and 1,5 inch detector extension). Measuring head was mounted on the housing which enables moving along all three axes allowing analysis of large scale paintings like the one analyzed in this work. Experimental setup for all measurements was the same: distance between sample and X-ray tube was 16 mm, distance between sample and detector was 21 mm and angle between detector and X-ray tube was 45˚. The X-ray tube voltage was altered to give two excitation working modes 22 keV and 40keV which enable detection of all elements heavier then Si. For all measurements current setup was 300 μA and 40s acquisition time in order to avoid any damage of the painting by intensive X-rays. Total of 45 points were analyzed on this painting including several points for a particular colour and few sample points on the backside of the painting for the characterization of preparation layer. The FTIR spectra of 10 samples of paint flakes taken from the edges of preexcisting damaged regions of the painting were recorded on a FTIR Nicolet 6700 spectrometer using KBr pellets technique, in the wave number range from 4000 cm^{-1} to 400 cm^{-1}. Cross sections of these 10 samples were recorded by optical Olympus BX51M microscope equipped with UV lamp Olympus U-RFL-T and U-MWUS3 and U-MWBS3 filters.

Results and discussion

An optical image of the cross section of sample taken from the blue region of the sky on the Milo Milunović's "The Inspiration of the poet" painting is shown in Fig.1. Thin layer of red colour is clearly visible indicating that thicker layer of blue pigment was painted over red one.

In order to obtain information about ground layer, five EDXRF spectra of the painting's backside were recorded. Obtained spectra were identical, which leads to the conclusion that the ground layer was homogeneously applied on the canvas. Ground layer consists mainly of Pb with traces of Ca. In addition, EDXRF spectra of the unused canvas from the front side, which was folded under the frame, have also shown presence of only Pb with traces of Ca. From these results it can be concluded that lead white and calcium carbonate were used for ground layer. Optical micrographs of all investigated cross sections show compact, white monolayer bellow pigment layers (see Fig.1.). Based on the homogeneity of ground

layer and the fact that it spreads on the entire canvas it can be assumed that canvas was bought with already prepared ground layer.

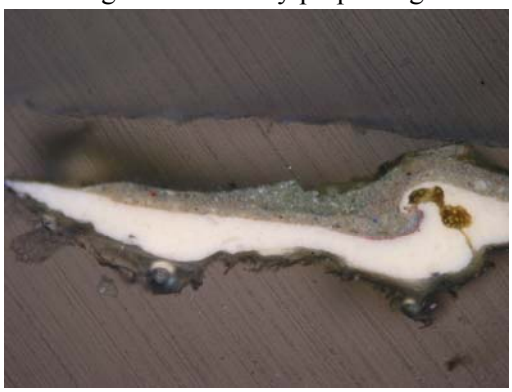

Fig. 1. The cross section from the blue region (sky)

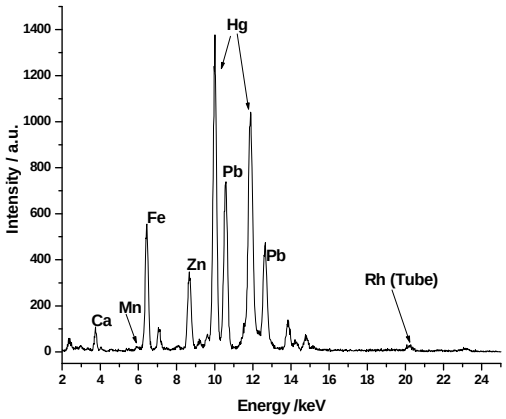

Fig. 2. EDXRF spectrum of the red region on the front side of the painting

The following pigments were identified: lead white [$2PbCO_2 \cdot Pb(OH)_2$], zinc white [ZnO], cobalt blue [$CoO \cdot Al_2O_3$], red pigment vermilion [HgS], two different green pigments, one with Cr – viridian [$Cr_2O_3 \cdot 2H_2O$] and one without Cr – most probably green earth, as well as several other earth colours which were mixed with other used pigments, since amount of Fe differs on most of the investigated points, even within the same colour. Representative EDXRF spectrum of red colour from the front of the painting is shown in Fig. 2. Signals originating from Hg dominate the spectrum indicating use of HgS as red pigment. Signals originating from Pb and Ca are from the ground layer, while intensive signals of Fe and Zn indicate that red ochre and zinc white were used for hues in this particular region of the painting. In majority of EDXRF spectra Cr was detected in very small amounts. This result gives insight into painting technique of the artist - most probably Cr was present due to the mixing of earth colours with other pigments for achieving specific shades.

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