

PAJA JOVANOVIĆ A PAINTER FROM SERBIA: A DATA BASE OF PIGMENTS

M. Stojanovic², S. Ridolfi¹, P. Petrovic²

¹Ars Mensurae, Rome, Italy, Email: stefano@arsmensurae.it

²National Museum Belgrade, Belgrade Serbia, Email: m.stojanovic@narodnimuzej.org.yu

ABSTRACT

This paper presents the results obtained by non-destructive XRF analyses conducted on six paintings fulfilled to obtain the data base for the pigments used by one of the best known Serbian artists. Paja Jovanovic (1859-1957), is one of the most significant representatives of the Academic Realism in Serbian art at the end of XIX and the beginning of XX century. His work can be found in many European museums.

Paja Jovanović finished the Academy of Fine Arts in 1877 in Vienna. In response to growing interest of Europe for the Balkans, Jovanović painted mostly scenes from the life of the Albanians, Montenegrins, Herzegovinians, which won him a lasting reputation (The Wounded Montenegrin, Fencing, Decorating of the Bride, Cockfighting, Migration of Serbs etc). After 1905, he devoted himself exclusively to painting the portraits in the style of Academic Realism, for the wealthy clientele, and he became very famous thanks to his portraiture. He also made the iconostasis in the Dolovo and Saborna churches in Novi Sad. With the aim of studying the variation in his colour palette as he matured as a painter, and for the purpose of verifying the authenticity of many of the paintings that are claimed to be his, under the Technical project of IAEA we have performed the examination of the Paja Jovanović paintings from the National museum Belgrade using the non destructive technique provided by the transportable EDXRF system. As an aim of the XRF analysis non destructive imaging analyses (X rays, Infrared Reflectography and UV Fluorescence) were also fulfilled. The work in progress results show that Paja Jovanovic had a very rich and multiform palette both in the colours used for painting and in the ground layers. In this work we are going to present the diversity of ground layers from 27 paintings and pigments from one of his paintings named "The First Ball".

INTRODUCTION

In order to identify the pigments we have examined six painting by Paja Jovanović from the National Museum Belgrade for which we are certain that they are painted by this artist. First we conducted IR and UV (take away radiography) examinations in order to identify if there are some retouches on these painting. After consultation with restorers we have decided what are the best points on the paintings to be examined with EDXRF. We also did the EDXRF measurements on the back side of the paintings to better identify the ground layers. Here it will be presented the result for painting named "The First Ball" as one example of pigments that Paja Jovanović used. To analyze the pigments a EDXRF portable system was used working with an X Ray tube tension of 35 kV and a tube current of 0.2 mA; the detector is a SDD (Silicon Drift Detector) with a resolution of 150 eV at 6.4 keV. The analyzed areas have a diameter of 2 mm. In Figure 1 you can see the moment of the EDXRF data collection.

Ground Layers (Priming Coats)

It is vary often the case that painters used to buy the material for their paintings from the same supplier or made the ground layers by themselves in the identical manner for some period. In order to see if this is the case for Paja Jovanović it was examined the ground layers from 27 paintings. For these paintings it is obvious that the canvas was prepared industrially because there is a ground layer all over the canvas, even where there is no painting. The ground layer would be only on the painted surface if painter had applied the ground layer by himself.

The samples were taken from the canvases and immersed in epoxy resin. In order to have the cross sections we grinded the samples mechanically with grinding paper of 500, 800, 1000. These samples were examined with SEM EDXRF.

ANALYTICAL RESULTS

All the points that have been investigated are presented in Figure no.4 on the photograph of the painting and the same numbers are given to the spectra. Summary of the obtained results are given in Table no.1.

The characteristic of all spectra done on the painting "The First Ball" is that there is a pick of titanium zinc. This are also two major signals that can be seen on spectra made on the back side of the painting (Figure no.1).

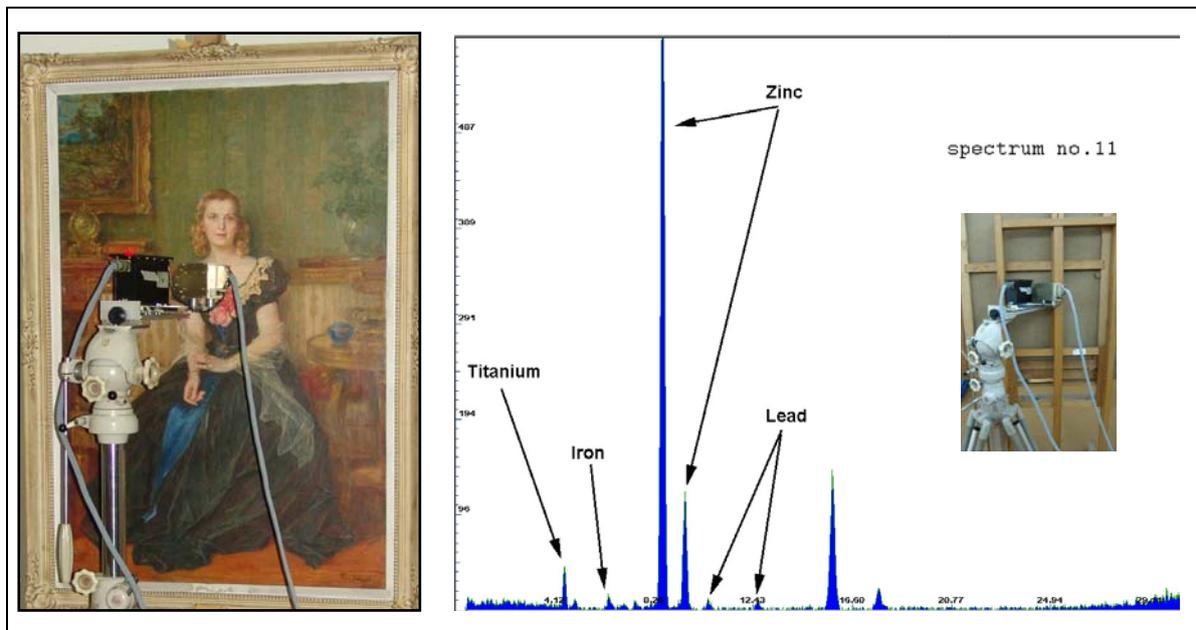


Figure no.1. EDFRF Data collection and spectrum no. 11 of the back side of the painting

On the spectra of pigments where the white colour is used for incarnate (Figure no. 2) the peak of zinc is of the larger intensity. This indicates the use of zinc white ZnO as a white pigment.

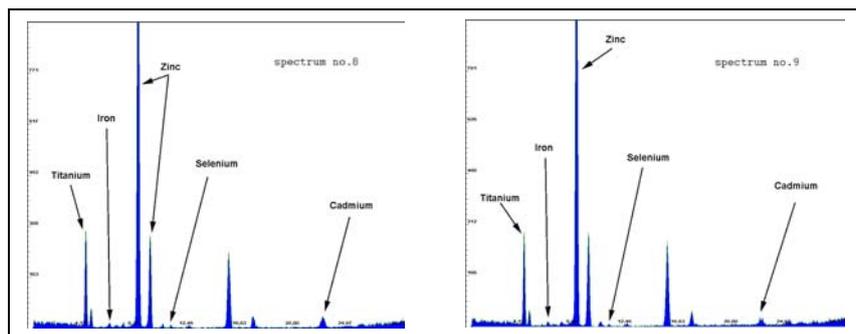


Figure no. 2. Spectrums of incarnate, spectrum no.8 and no.9

Other than zinc, in some places there is evidence of lead white, spectrum no.6, 5 and 2. (Figure no.3). Since lead is visible only on the parts where there is white colour or in mixture with pigments witch are not expected to have lead we can say that this is white lead or $2PbCO_3Pb(OH)_2$

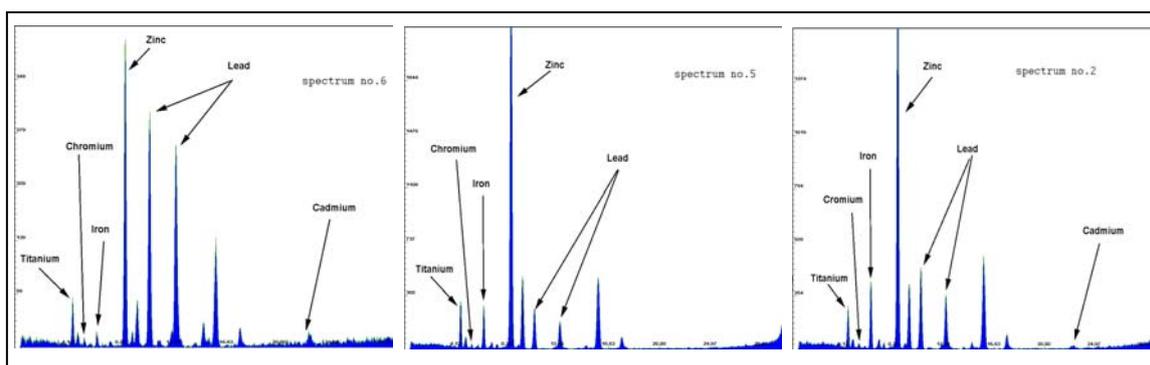


Figure 3 Spectrum no 6 of the yellow of the metal bowl, spectrum no 5. of the green on the back and spectrum no. 2 of the lite velow on the chair

As the blue pigment on all the spectra there is the peak of iron spectrum no.7 (Figure no.4). This is the sign of the Prussian blue pigment $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$. For the green colour in points 4 and 5 and 10 there is the pick of iron also. This is an indication of the earth pigments (Figure no. 3 and 4). Green earth pigments are recognised by the peak of iron, with chromium as a trace element. For the red pigment (Figure no.4) on roses (spectrum no.1) there is the pick for cadmium, cadmium red $\text{CdS}(\text{Se})$ and the pick of mercury, cinnabar HgS . The red colour on the books (spectrum 3) in the back shows also red cadmium and the peak of iron (hematite or red ochre also the earth pigment). Cadmium red is pigment that was commercially in use from year 1910 and is always found in some correlation with selenium as the trace element. For the yellow colour on the chair (spectrum no.2) and on the bowl on the table (spectrum 6) there is the peak of iron in combination with chromium which can be assigned to yellow ochre also earth pigments. Summary of the results is given in Table no.1

Colour	Element	Line	Energy (keV)	Can be found in spectrum no.
White Zinc	Zn	K_{α} ; K_{β}	8.63; 9.57	all
White Lead	Pb	L_{α} ; L_{β}	10.54; 12.61	2,3,4,5,6,7,10 and retro
White titanium	Ti	K_{α} ; K_{β}	4.51; 4.93	all
Blue Prussian	Fe	K_{α} ; K_{β}	6,40;7,05	7
Green Earth	Fe	K_{α} ; K_{β}	6.40; 7.05	4,5
	Cr	K_{α} ; K_{β}	5.41; 5.94	
Red Cadmium	Cd	$K_{\alpha 2}$; $K_{\alpha 1}$	22.98, 23.17	3,8,9,10
	Se	$K_{\alpha 2}$; $K_{\alpha 1}$	11.18, 11.22	
Red vermilion	Hg	$L_{\alpha 1}$	9.98	1
Red ochre	Fe	K_{α} ; K_{β}	6,40; 7,05	3,8,9,10
Yellow ochre	Fe	K_{α} ; K_{β}	6.40; 7.05	2,6
	Cr	K_{α} ; K_{β}	5.41; 5.94	

Table no.1. Summary of the results obtained by EDXRF

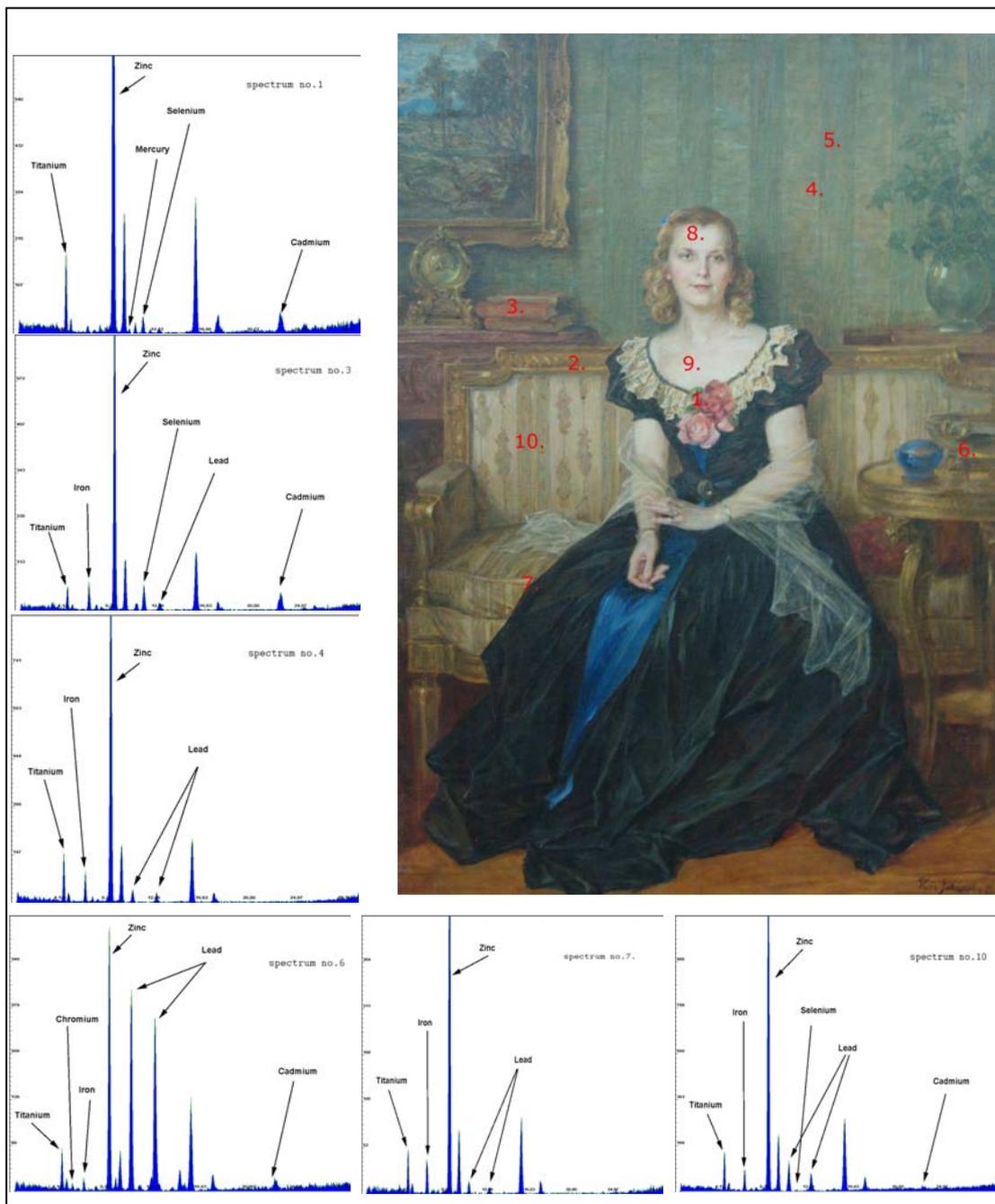


Figure 4. Points on the painting show the areas where the EDXRF spectra are collected and spectra of red, blue, green, yellow pigments

All of these results are in accordance with results obtained for other paintings of Paja Jovanović that have been investigated in the same manner.

Analytical results for the ground layers are given in Figure no. 5. Ground layers are usually made of calcium carbonate, lead white, zinc white, barium sulphate or their mixture. Titanium white is the white colour that was introduced in painting techniques at the beginning of the XX century. It has been observed that on three paintings there are different kinds of double layers which are combinations of zinc, calcium and lead. There is just one painting with a ground layer made of a mixture of zinc white and barium sulphate known as lithopone and just one painting with a combination of zinc white and titanium oxide as the ground layer. The

former is the case with the painting "The First Ball". There are eight paintings with lead white as the ground layers and the remaining paintings mostly have mixtures of calcium with other white pigments (lead, zinc, lead and zinc together) in 12 cases, and with pure calcium in 5 cases.

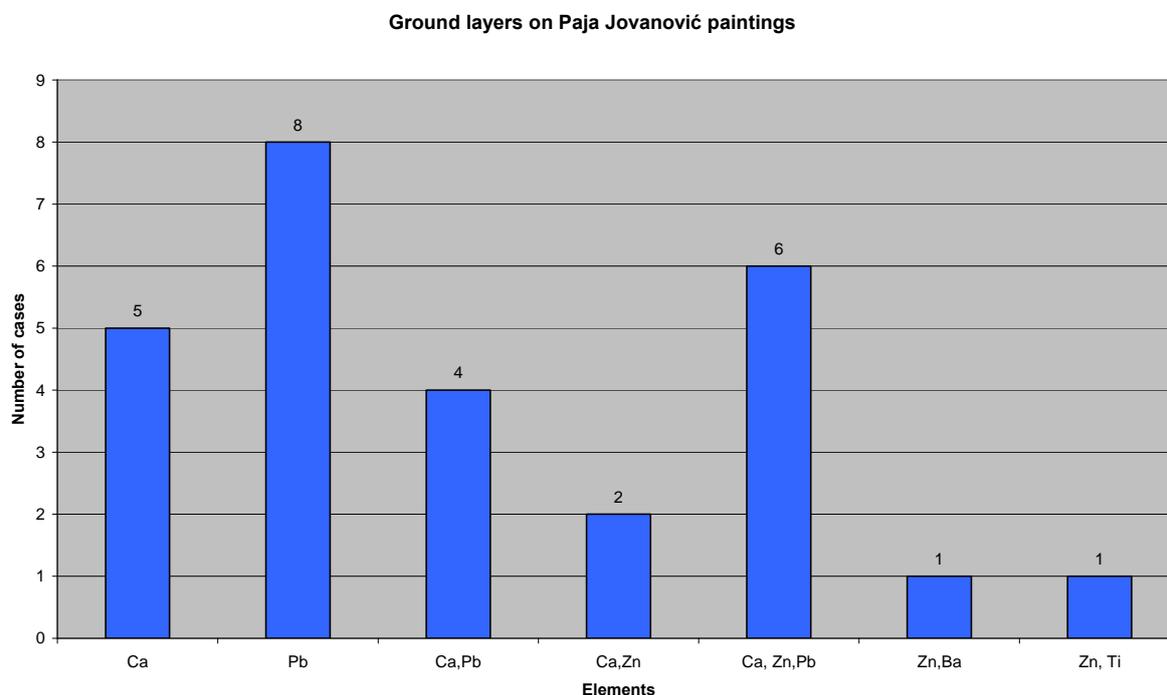


Figure 5. Data of ground layers of 27 paintings of Paja Jovanovic made by SEM EDXRF, showing just one with ZnO/TiO₂ combination and one with litopone ZnO/BaSO₄

CONCLUSIONS

Paja Jovanović is the painter with very good knowledge of painting techniques. His paintings are for almost one hundred years still stable and unchanged. His pallet mostly consists of pigments that are already in wide use at the end of XIX and the beginning of XX centuries. These are cadmium red, red ochre, vermilion for the red colour, Prussian blue for the blue colour, earth green and yellow pigments and different types of white colours as zinc white and lead white.

Since Paja Jovanović used to travel a lot and change the place of living it seems that he did not have the same supplier for the canvases and probably this is the reason for great diversity of the ground layers found on his paintings. In the painting the "The First Ball" the ground layer is rather unusual and consists of zinc white and titanium white.

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