

Non invasive XRF examination of paintings' primings from the years 1838-1938 – novel tool supporting dating and authentication of modern paintings

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Till this moment the main dating and attribution tool for the 19th c. and 1st half of the 20th paintings was the identification of pigments.

Most of the 19th and 20th century paintings were executed on the readily primed market available canvases. The chemical composition of such commercial primings was quite stable for certain periods for the exact producer. Supports were made in manner of readily stretched paintings or pieces of primed supports bought in bigger formats and then cut and stretched by artist him-self. In both cases tacking margins covered with ground layer enable non-invasive examination of elemental composition by means of portable XRF and as a result reliable recognition of the extenders used. Additionally XRF measurements from the backside of the canvas through the fabric were implemented and their accuracy assessed, using SEM-EDX on taken samples in order to cross-check the data gained with the XRF technique and confirm the stratigraphy.

Research proved that XRF identification was accurate and consistent with the SEM-EDX examination. Moreover when there was an access to tacking margins and measurements were executed both – from the top of the priming and then from the backside of the canvas –, the stratigraphy of two-layered grounds was recognized totally non-invasively using XRF, as complementary SEM-EDX comparisons confirmed.

More than 100 paintings were researched. Basing on measurements panorama of evolution of chemical composition of grounds was drawn and moments of introduction of additions of zinc white, barites, lithopone to the lead white based grounds. Moreover for some painters some characteristic compositions of stable ratio of extenders to each other in complex mixtures used in exact periods of their artistic activity were recognized as being distinguishable.

Non invasive novel method of non invasive-examination of the primings from the backside of the painting through its canvas, proved to be powerful tool significantly supporting dating and attribution of 19th and first half of the 20th century paintings in non-invasive way, enabling in situ applications in museums, at the auction market and in other institutions.

Till half of the century most popular were the two layer primings with the lead white on top and earth based pigments' mixtures in bottom layers. Since 1855 composition of zinc white added to the main ingredient lead white t are to be detected. In the period 1874-1888 barium sulphate and lead white mixture appear and parallel more complex mixtures of zinc, lead and barium white appear in 1870ies. Since about 1895-7 lithopone had been used. Since 1880-ies there appear mixture of lead white and chalk priming and pure lead white priming return in 1890-ies. There were only three cases of pure zinc white primings in the 19th century – the self-applied grounds of Władysław Podkowiński.

In the twentieth century more significant addition of zinc white was observed. Since about 1910 there appear zinc white dominated grounds with addition of lead white and in 1930-ies pure zinc white based commercial priming become popular. There were few cases of mixtures of zinc white and chalk as well as chalk, lead white and zinc white. Significant group of paintings comprised of pure chalk were self prepared primings. Pure lead white primings were still in use as well.

The research proved possibility of supporting dating of the modern paintings in non-invasive way basing on identification of composition of grounds. More over significant shifts in time in application of zinc whit and barium sulphate were observed as barium sulphate is detected since 1874 in more significant amounts and pure zinc white only exceptionally as late as last decade of the 20th century. Pure zinc white commercial primings become popular in Poland as late 1930ies of the 20th century. The result assured that basing only on literature to suggest dates implementation of implementation of whites to the grounds can be misleading. The research will be continued and broadened.

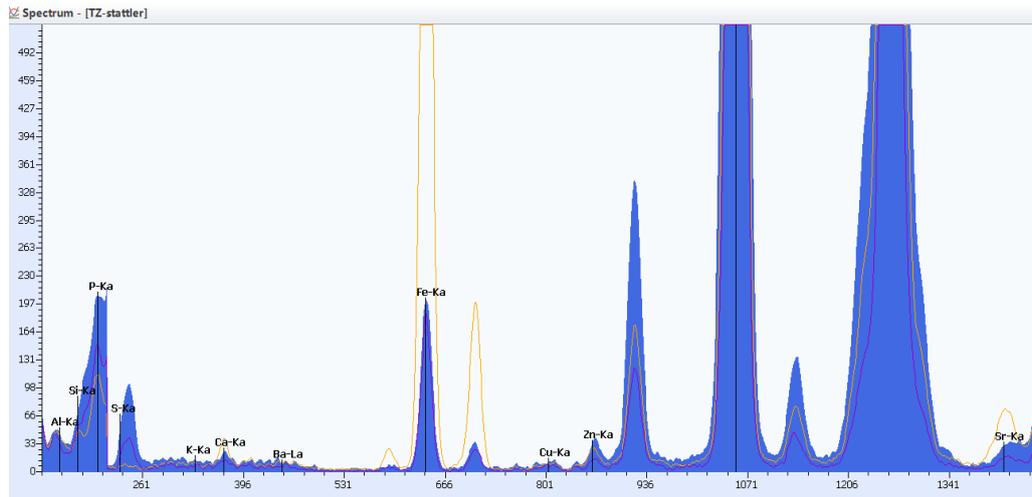


Fig. 1. Two layers grounds, earth pigments (**Fe**, red line) in the bottom, lead white (**Pb**, blue colour spectrum) in the upper one – measurements conducted from backside and from the ton of primings respectively

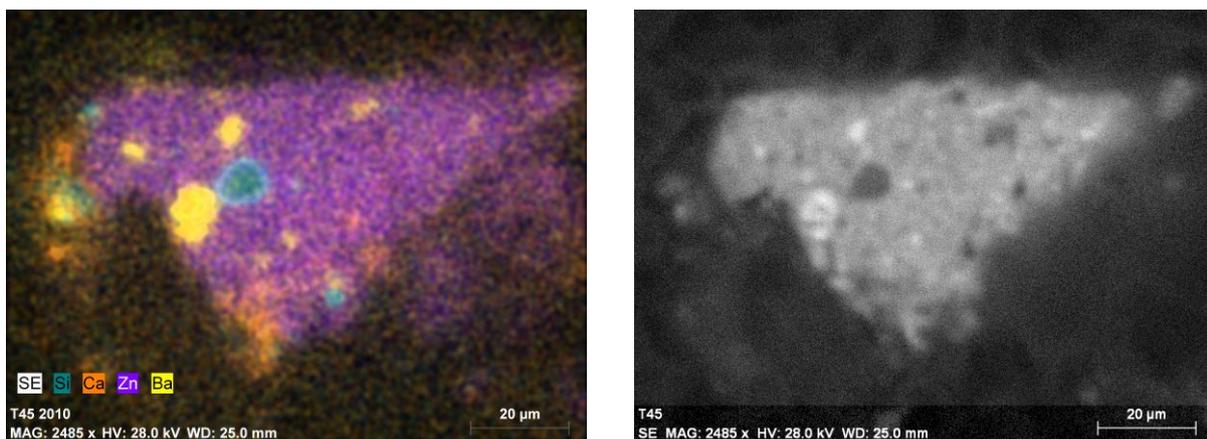


Fig. 2 BSE image and EDX based elemental distribution, sample T45, L. de Laveaux, *Portrait of Katkiewiczowa*, 1889, District Museum Torun, zinc white barium sulphate chalk and silica grains detected.

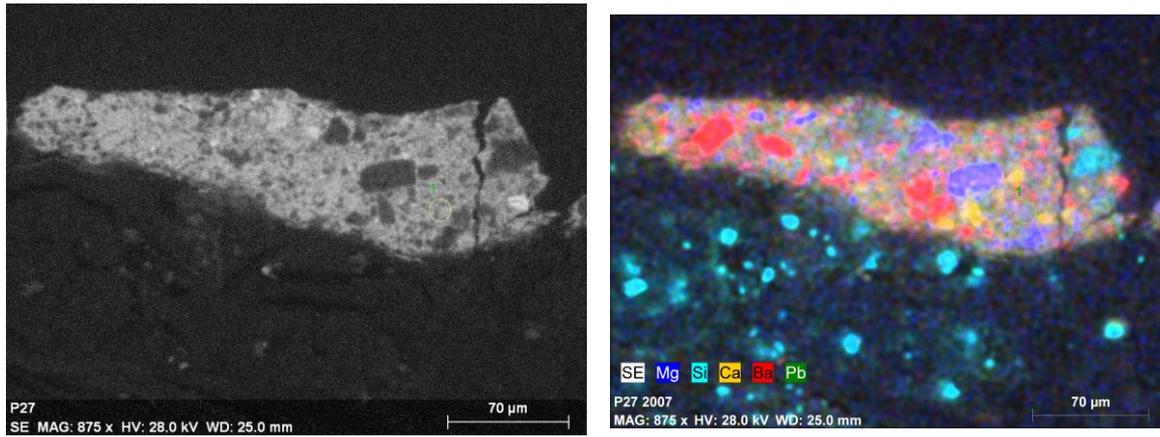


Fig. 3. BSE image and EDX elemental distribution, sample P 27 from J. Chelmonski, *Zjazd*, 1874, MNP , lead white, barium sulphate and chalk visible, moreover some grains of silica sand and magnesium crystallites (originating from dolomite?) are added