Accurate non-invasive analyses of pianitngs' primings – is it possible?

Mirosław Wachowiak

1) Departement of Conservation and Restoration of Modern Art, Fine Arts Faculty, Nicolaus Copernicus University, Center for Research and Conservation of Cultural Heritage, Torun, Poland

miroszwach@umk.pl

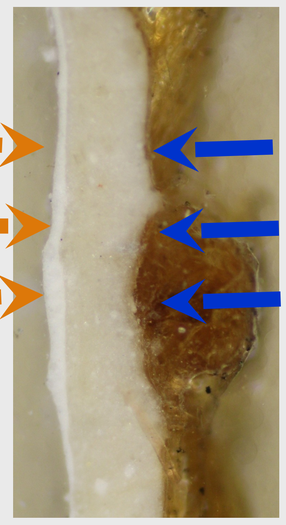
The composition and structure of primings especially in the case of commercially available, ready made primed supports after preliminary research proved to be an important tool broadening dating and authentication of the 19th century paintings. The materials differ in time as producers were exchanging or broadening the range of used fillers and admixtures, following availability of the sources and lowering prices of materials. The composition of grounds can be the characteristic indicator of time of execution and sometimes of attribution as are pigments. Yet the problem was the invasiveness of the analyses and necessity of the sampling.

Novel attitude toward the use of XRF and execution of FTIR equipped with movable light trasmiting arm ATR probe enables new non-ivasive approach of the primings research, broadenning its possiblities.

Non invasive examination of two layered grounds by XRF

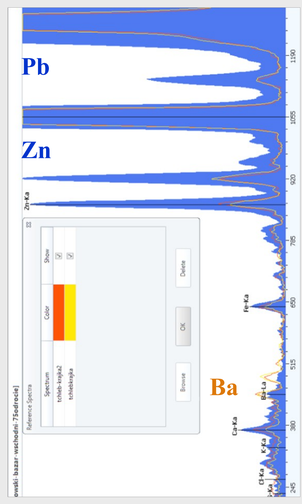
XRF measurement of primings on the top of the tacking margins

$2Pb\,CO_3 \times Pb(OH)_2$
$BaSO_4$



XRF measurement of primings from the backside trough the canvas

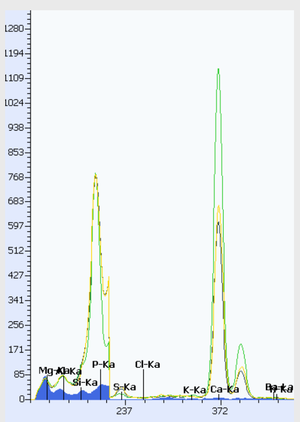
$2Pb\,CO_3 \times Pb(OH)_2$
ZnO
$CaCO_3$



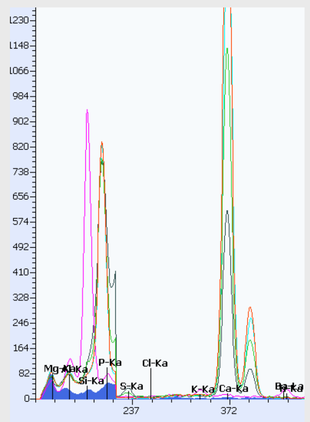
XRF measurements conducted from the backside of the painting and from top of the priming present on the tacking margins allowed recognition of structure and elemental composition of the two-layered grounds

Limits assesment measurements conducted on model samples

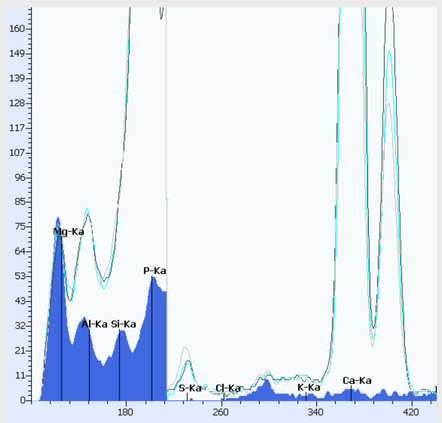
XRF



XRF spectra of two kinds of pure gypsum and one with **chalk admixture** (green line spectrum)



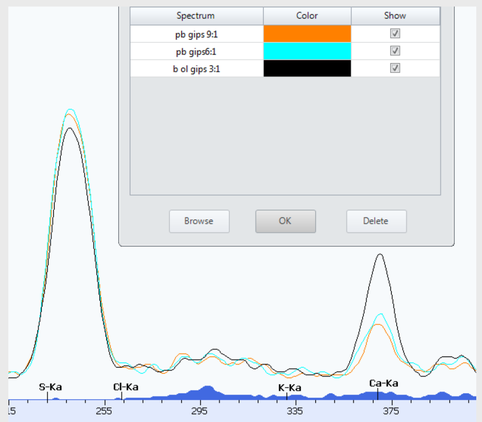
Comparison of gypsum (light and dark green line spectrum) and different kinds of chalk, which contain no sulfur



Raising amount of Ca and fall of S of mixtures of gypsum and chalk in ratios:

2:1

1:1

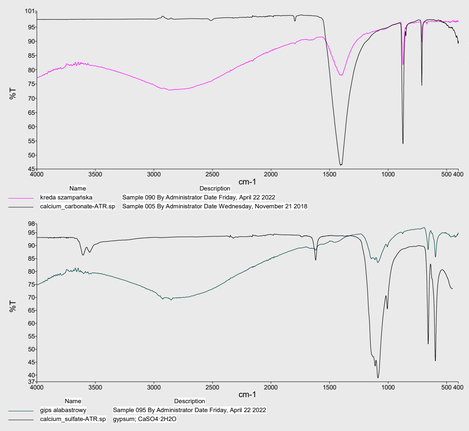


Comparison of mixtures of lead white and gypsum in ratios:

9:1 **6:1** **3:1**

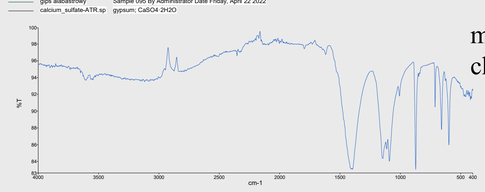
Ca peak gradually decreasing, S peak hidden by L-lines of Pb ions

FTIR –ATR spectra

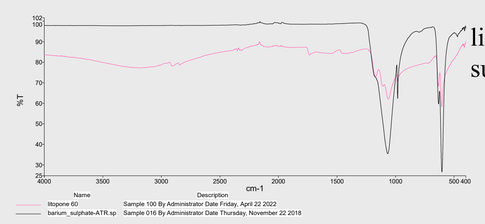


pure chalk

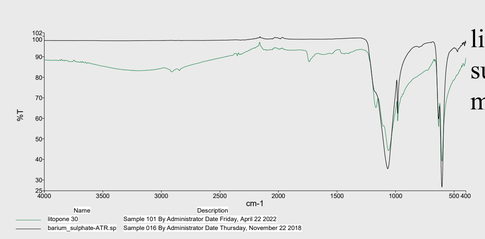
pure gypsum



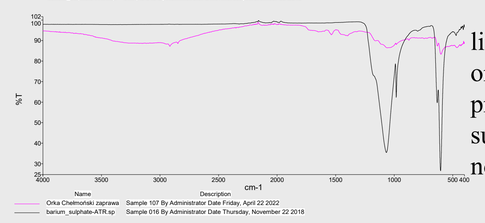
mixture of gypsum and chalk



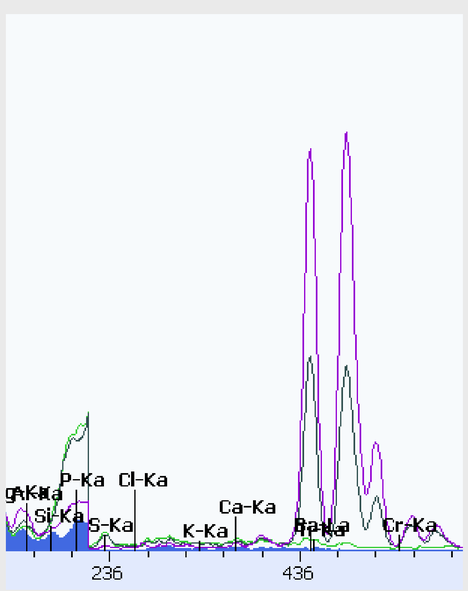
lithopone 60 – barium sulphate identified



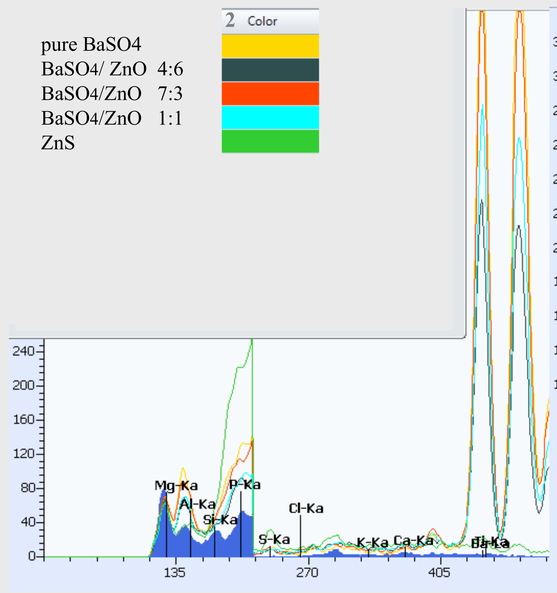
lithopone 30 – barium sulphate identified and more clearly visible



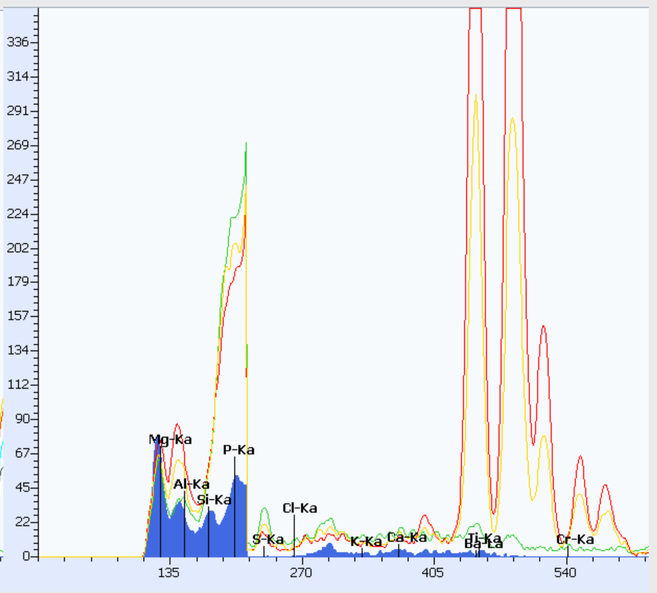
lithopone containting original historical priming – barium sulphate identified - no zinc sulifide visible



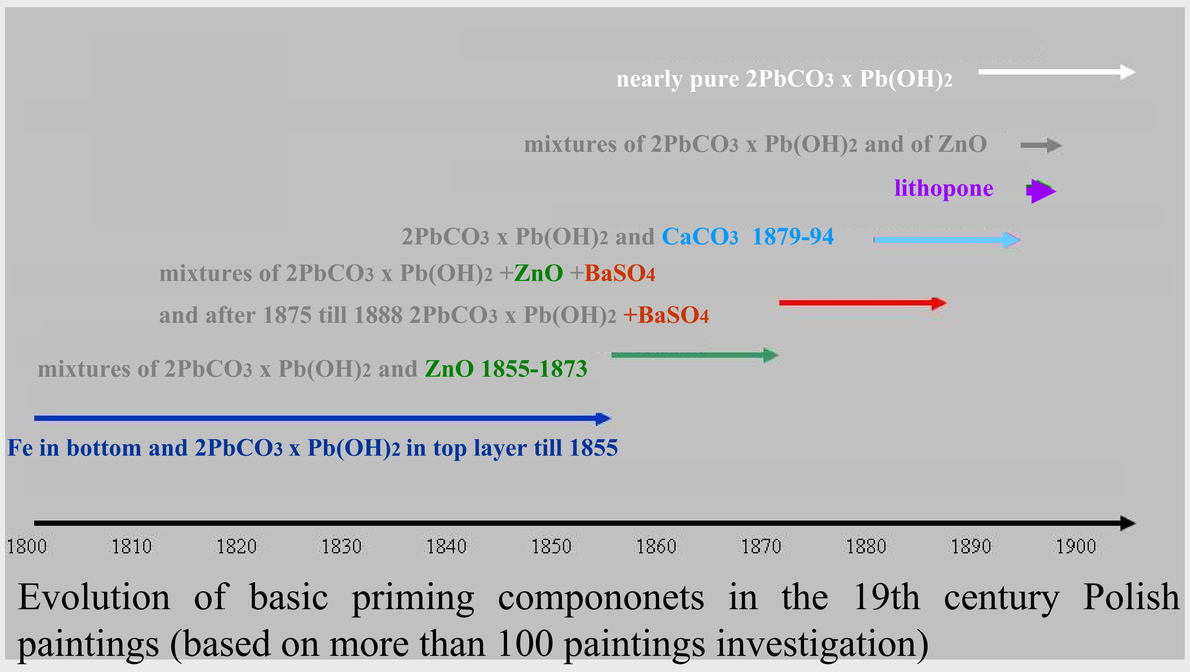
Zinc sulfide – no Ba containing high amount of S,
lithopone – Ba peak visible as is sulfur
barium sulfate – Ba high peak, S hardly visible



Mixture of zinc white with barium sulphate compared to zinc sulfide – in preceding mixture - S hardly visible



Zinc sulfide – highest amount of S,
lithopone 60 – signifcant amount of S little amounts of
lithopone 30 – higher Ba peak, S lower peak



Evolution of basic priming compononets in the 19th century Polish paintings (based on more than 100 paintings investigation)

Conducted research proved possibility of indicating changes of primings in the subsequent periods of the 19th. c. Non-invasive recognition of basic composition even of the two layers grounds was possible. Gypsum and chalk problematic to distinguish with XRF could be differentiated even when mixed together using FTIR-ATR. Lithopone is hardly to be indicated directly, yet as S in $BaSO_4$ is hardly visible in XRF, its presence suggests use of former one. Panorama of evolution of chemical composition of grounds in the researched period will support dating of the Polish 19th century paintings. Data gained with XRF portable spectrometry was complemented with SEM-EDX confirming accuracy of the XRF analyses.

Author would like to acknowledge National Centre of Science, Poland for funding project **2012/05/D/HS2/03385** entitled *New pigments of the 19th century*