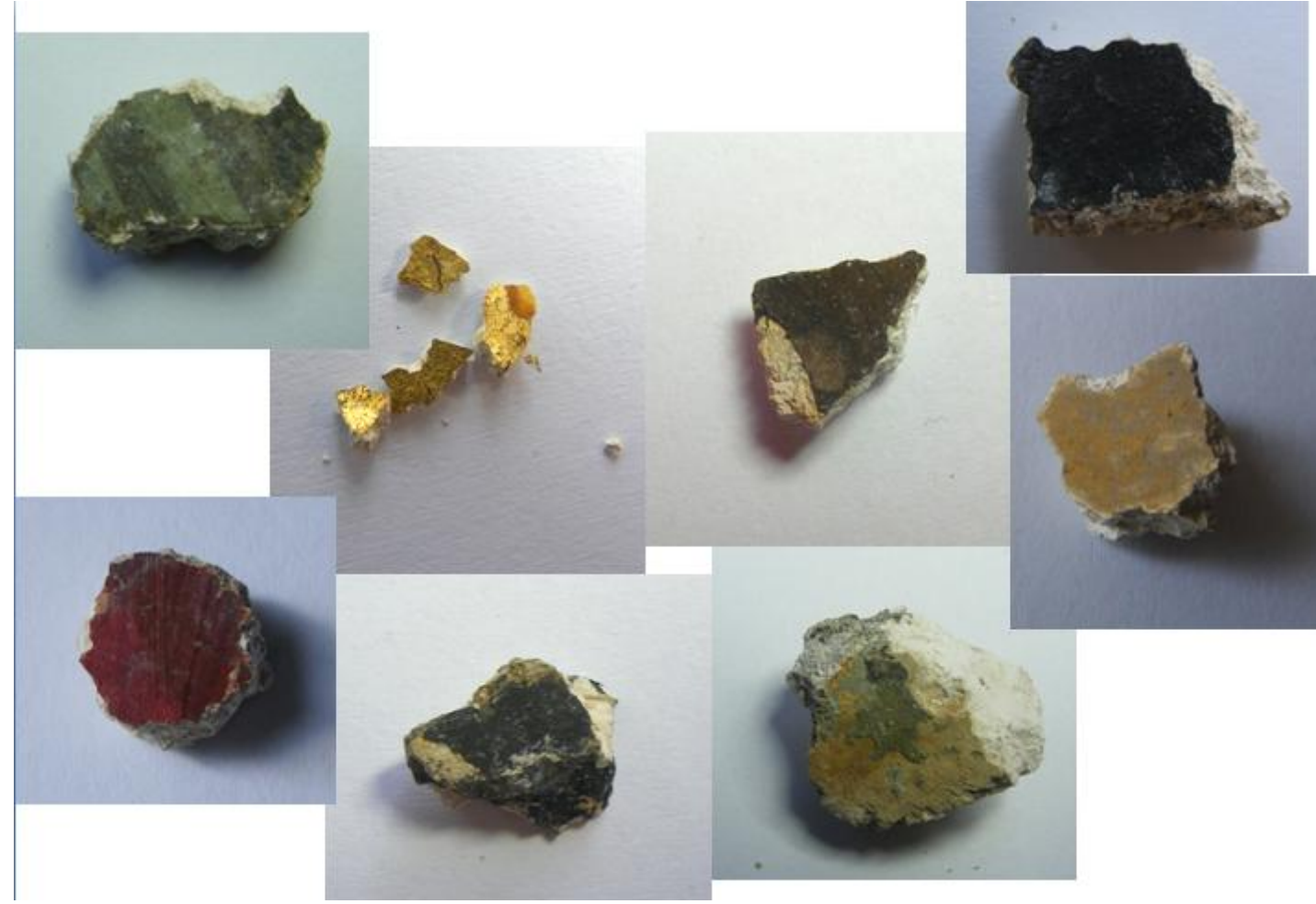


# STUDIES ON PIGMENTS OF RELIGIOUS MURAL PAINTINGS USING A PORTABLE X-RAY FLUORESCENCE SPECTROMETER – THE CASES OF CICANESTI-ARGES AND ICOANEI-BUCURESTI CHURCHES

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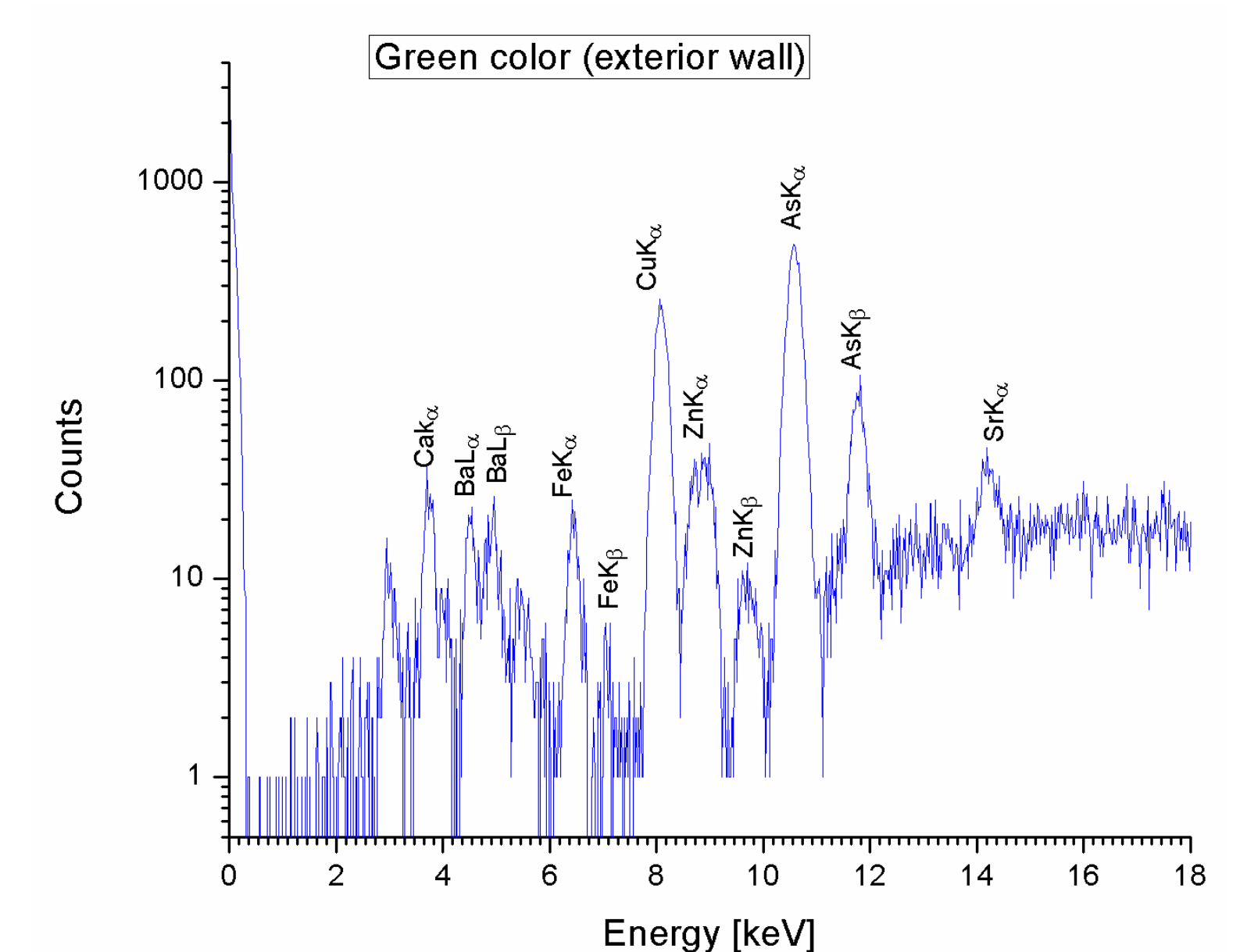
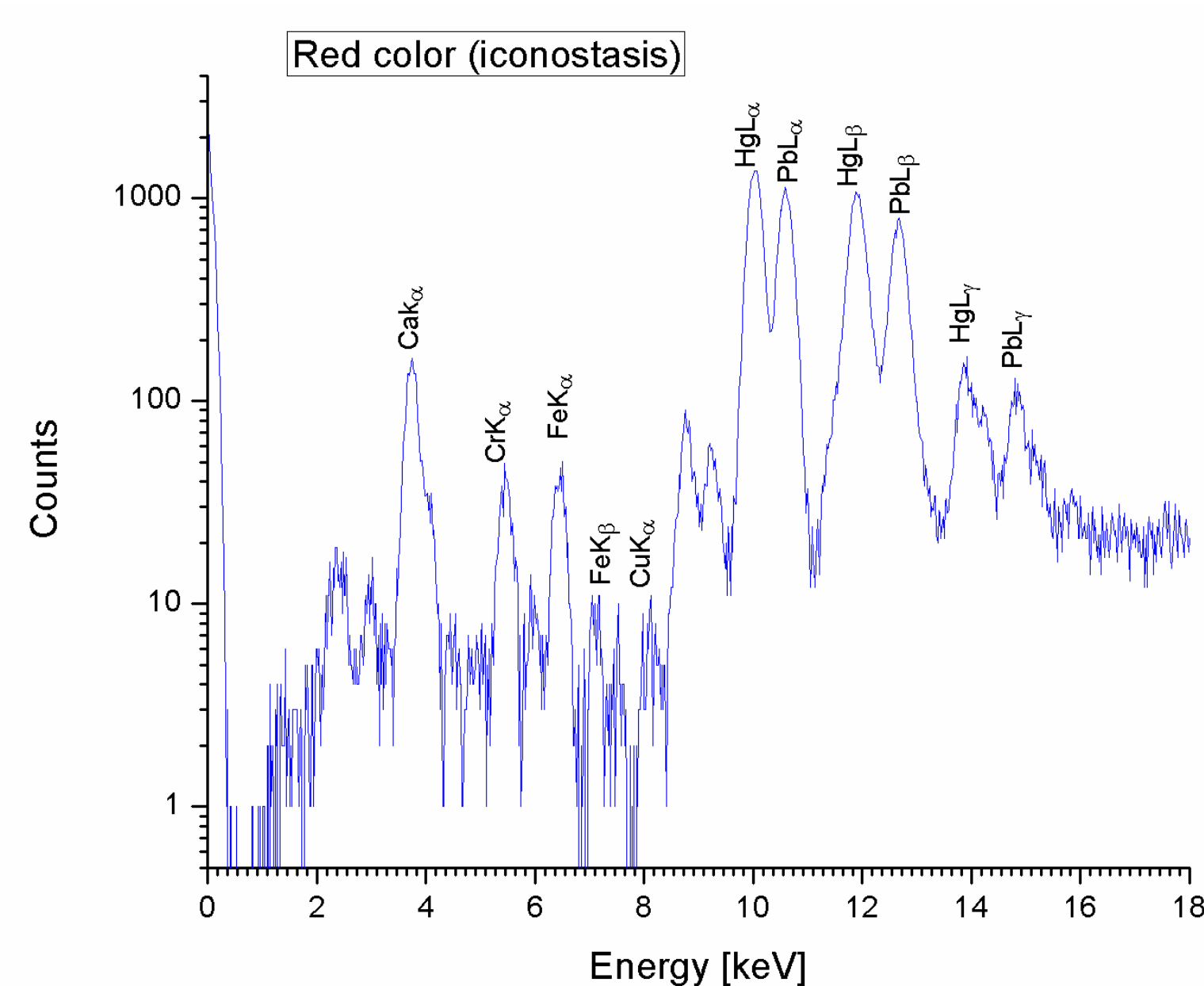
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Small samples from the mural paintings (internal and external) of Holy Trinity Church in Urechești village - Cicanesti, Argeș County (XIX<sup>th</sup> Century) and of Icoanei Church, Bucharest, painted by Grigore Zugravul (1784 - 1786) in “a fresco” technique, but repainted in XIX<sup>th</sup> Century in oil technique were analyzed in our Institute's laboratory of archaeometry using X-MET 3000TX+ portable X-ray fluorescence (XRF) spectrometer to determine the elemental composition of the pigments from original and restoration (re)-paintings.



X-MET 3000 TXR+ portable XRF spectrometer: 40 kV tube Rh-anode; PIN Si diode detector, Peltier cooling; 270 eV resolution for  $K_{\alpha}$  line of Mn (5.89 keV); measurement spot size about 30 mm<sup>2</sup>; Hewlett-Packard (HP) iPAQ personal data assistant (PDA) for software management and data storage.

For the Church of the Holy Trinity from Urechești-Cicanesti, Arges County, the original painting is from 1832, but major restorations, including repainting, were made in 1871, and after 1950. For a correct restoration is necessary to identify the pigments used by the old masters and from the later re-paintings.

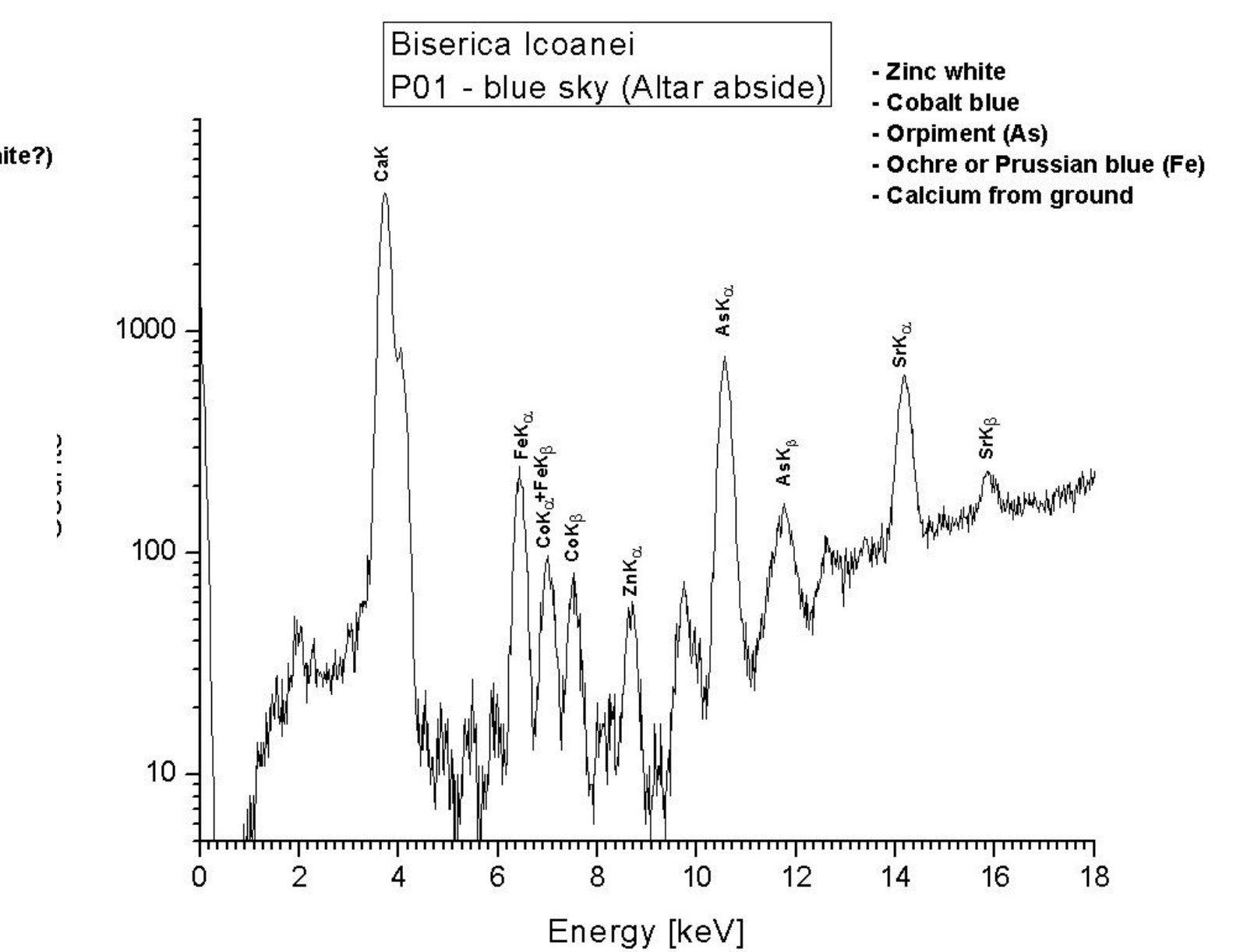
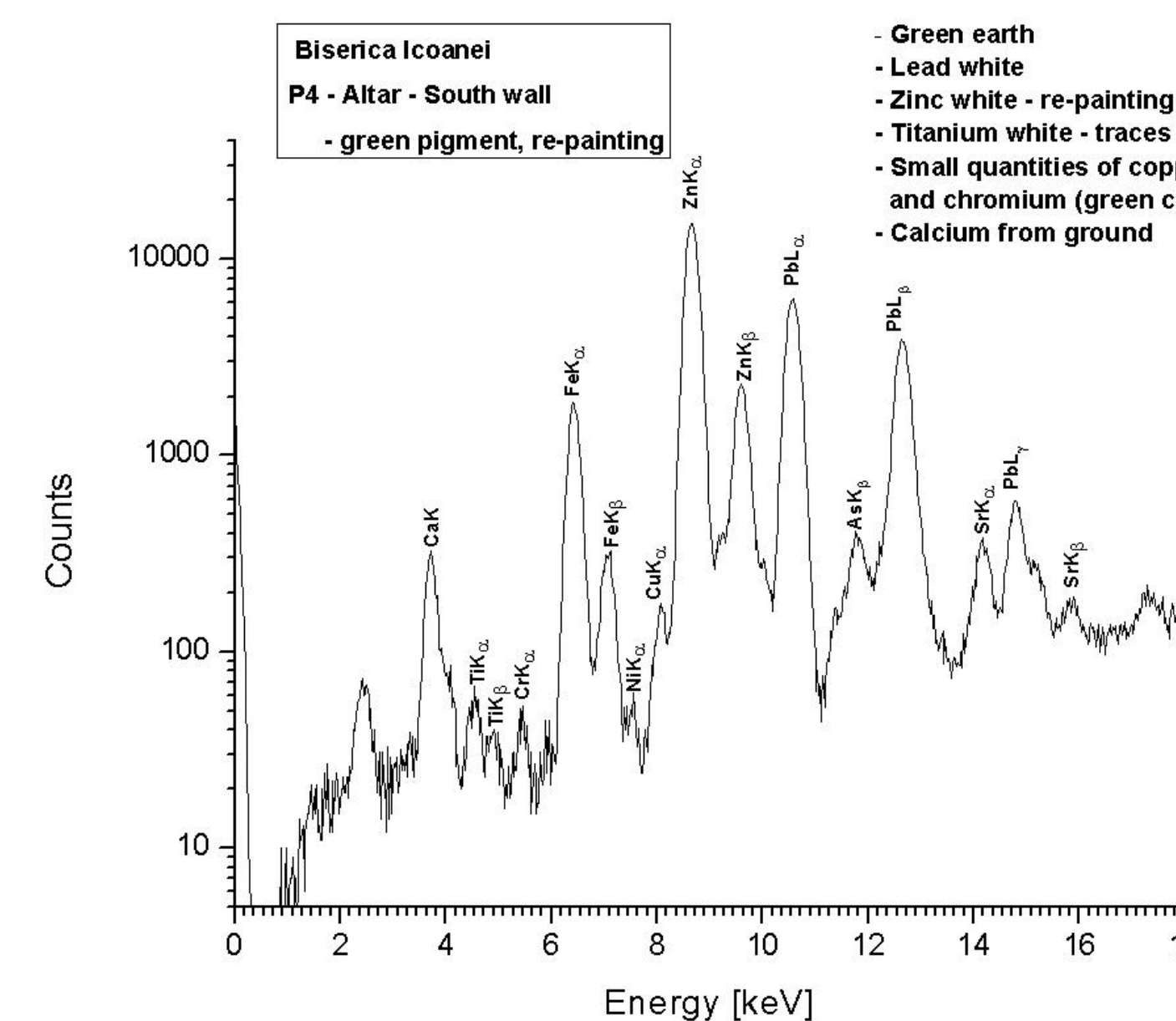
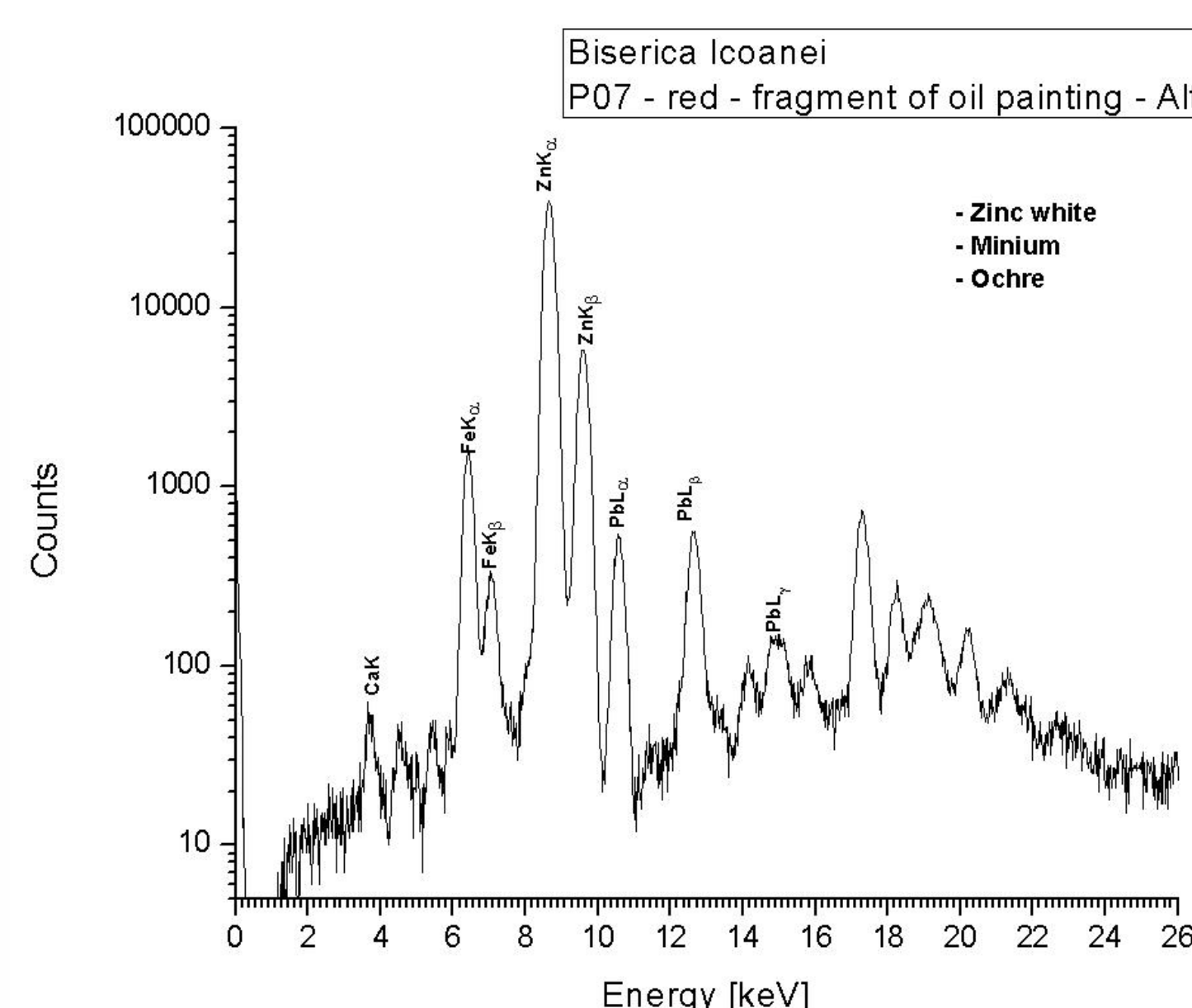
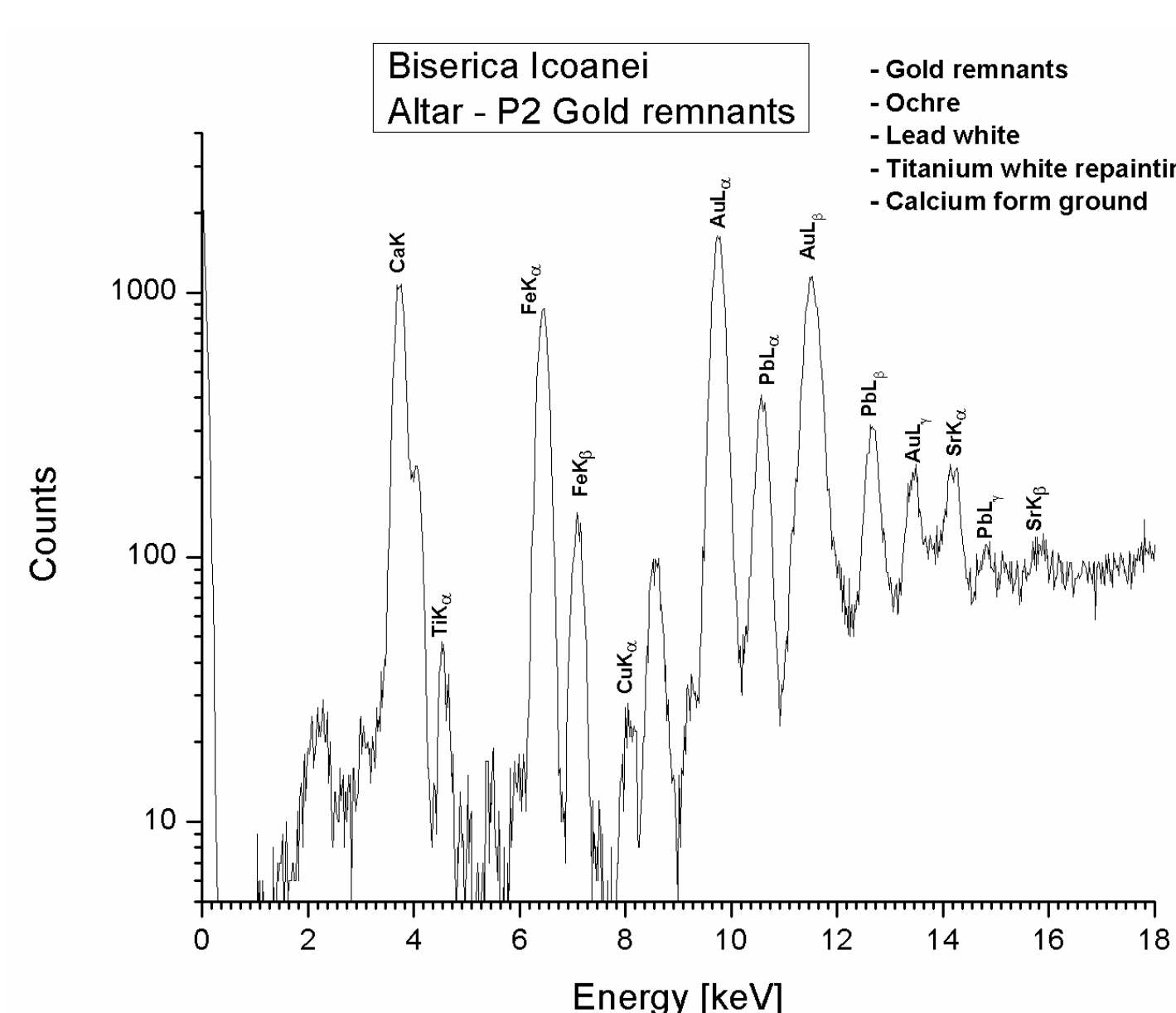


Relevant for the **red color** in Iconostasis is the original cinnabar (mercury compound) overlaid with lead minium, probably from the restoration of 1871. Traces from the original painting of 1832 are also found in the painting of the founders, where red is also given by cinnabar mixed with lead minium. The **green color** was originally an artificial copper pigment, superposed in XX<sup>th</sup> Century with Paris green (arsenic-copper combination) for repainting (probably after 1950). The white color was originally from lime white. Repainting (1871 or even later) was done with zinc white, and after 1950 with titanium white.



In the case of Icoanei Church, the original “a fresco” painting was covered in all compartments with a new oil painting decoration successively in 1838, 1873 and 1889 (see “Note privind reconstituirea unor etape de refacere a picturii Bisericii Icoanei din Bucuresti” - by Gabriela Stefanita, in Caietele restaurarii 2017, ed. ACS).

Our most spectacular results are the identification of **gold (remnants of foils?)** in the gold haloes, and of four white pigments: lead white, zinc white (probably from the 1873 or 1889 oil re-painting), smaller quantities of Litopon (BaSO<sub>4</sub> +ZnS), but also titanium white, probably used for retouching after 1930. The **red pigment** is lead minium. The **green pigment** is green-earth, a copper-based pigment (copper malachite? - copper acetate?) mixed with chrome green. For **blue color** was used blue-cobalt, probably the original pigment of the fresco, but also some Prussian blue during restorations. Ochre is present almost everywhere, as well as calcium from the primer.



Our results are usefully for the restorers to re-paint with original or very similar pigments, trying to preserve the initial characteristics of painting.

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