

The spectroscopic analysis of constituent materials of the Romanian icon "The Entry of the Lord into Jerusalem" by Grigore Ranite

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1. General presentation of Icons

What is the icon?

Put simply an "icon" means a devotional painting of a holy image, normally made on wood. Yet the rendering of this image is a complex process. Making this image is called "writing" and not painting. Also, the image of the icon is formed in prayer. The progress in this "writing" from darker to lighter colours follows the passage from darkness to light.

The spirituality of the icon transposes the believer beyond his image. Once finished, he places it in front of the archetype, that is, in front of the Divine.

Principal materials of icons and their symbolic meanings

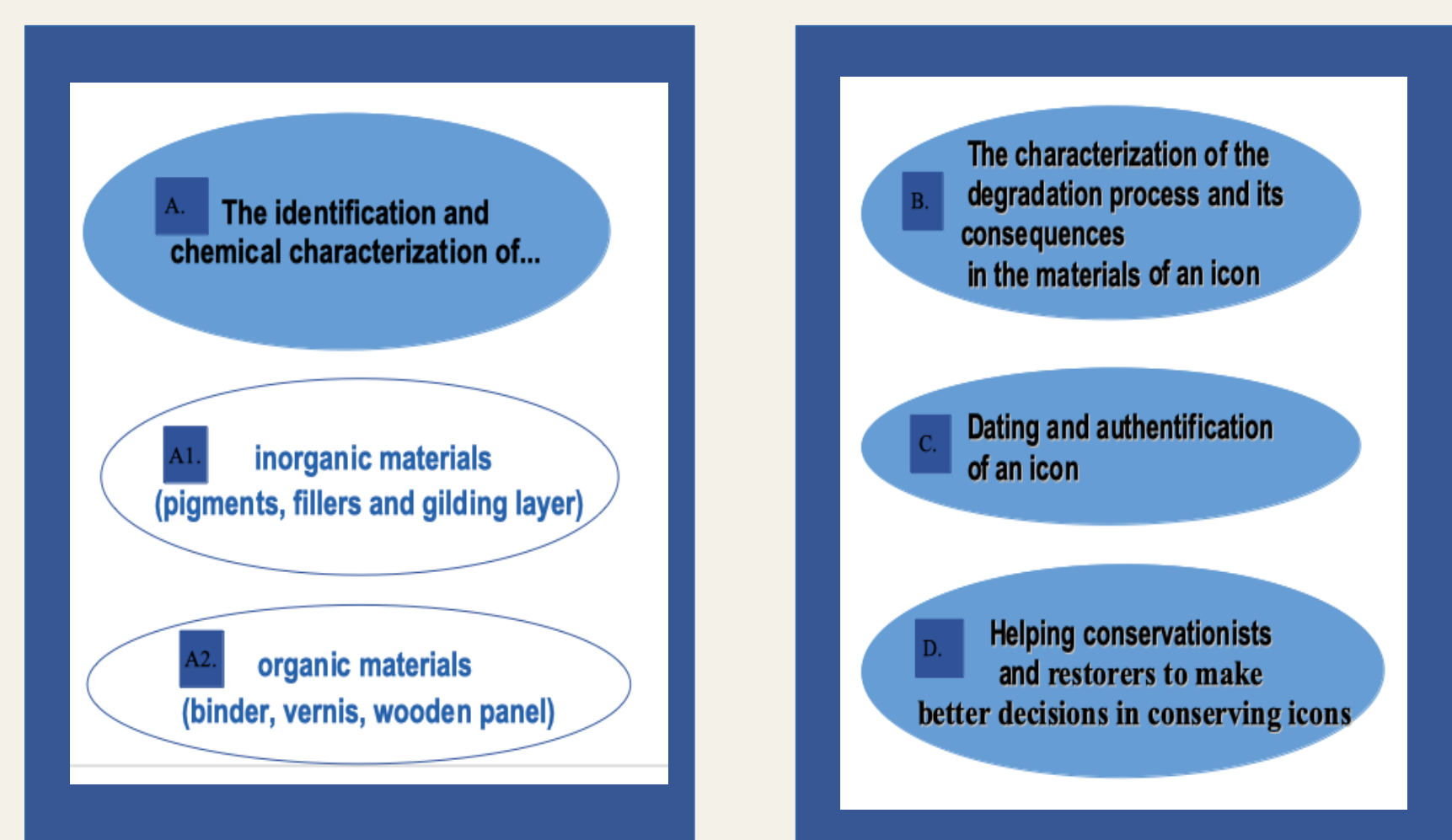
- The gold represents the "light of the world" (John 9,5).
- The wooden support of the icon alludes to Christ on the wooden cross.
- The canvas stretched out on the table brings us back to the image "not made by human hands", the Mandylinion.
- The ground - made with stone powder and animal glue, symbolises Christ's reference to himself as "the cornerstone" (Psalm 118, 22-23; Matthew 21.42).
- The egg used to write the image in the tempera represents the Resurrection

The icon "The Entry of the Lord into Jerusalem"



The "writer" of an icon: Grigore Ranite (18th-century)
Artistic style: post-Byzantine
Size: 48,5 x 31,5 x 3,2 cm
Original location: Galda de Sus church (city Alba)
Collection: The Ethnographic Museum of Transylvania

Objectives of scientific investigation



Analytical methods and conditions

Non-destructive methods of investigation

Energy-dispersive X-ray Fluorescence (EDXRF)

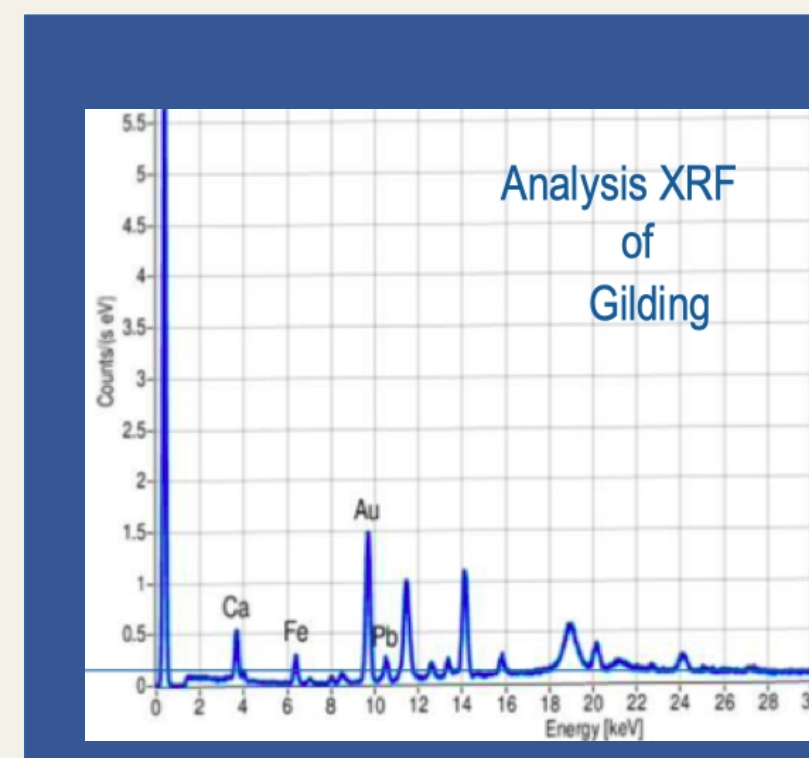
- Handheld Bruker spectrometer S1 TITAN series
- Silicon diode PIN, detector (SIPIN), Rh target X-ray
- 50kV, 9µA. Live Time: 47s.
- Softs: Bruker Instrument Tools and Artax by the method of Bayesian spectral deconvolution

Destructive methods of investigation

Fourier Transform Infrared Spectroscopy (FTIR) in absorption

- Jasco FTIR spectrometer; Spectral domain 4000 - 354 cm⁻¹
- Resolution of 4 cm⁻¹; 256 scans; KBr pellet technique;
- Soft pentru interpretarea datelor: OMNIC 5.1 de la Nicolet Instrument Corp (1992-1999)

Results and discussions



'And God said:
'Let there be light.'
(Genesis 1:3)

The gilding is the first layer of colour that the "writer" makes in the creation of the icon.

- The results XRF for gilding layer suggest the using of materials: Gold (Au), gypsum (CaSO₄ x 2H₂O), iron bolus (Fe₂O₃).
- The Pb can derivate from white lead (2PbCO₃ x Pb(OH)₂ or essicant of the varnish (olifa).

Assegnations	Absorption frequencies of Gypsum (cm-1) CaSO ₄ x 2H ₂ O	Absorption frequencies of Bassanite (cm-1) 2CaSO ₄ x H ₂ O	Absorption frequencies of Anhydrite (cm ⁻¹) CaSO ₄
ν_{OH} O-H;	3489 (m)	3605	-
ν_{OH} O-H	3404 (s)	3553	-
δ_{OH} O-H	1620 (vs)	1617	-
ν_{S-O} S=O	1114 (s)	1007 (m)	1015 (m)
δ_{S-O} S-O	667 (s)	661 (w)	672 (s)
	595 (s)	594 (s)	614 (ms)
			591 (s)
ν_{S-O} S-O	1004 (m)	1115 (w)	1095 (m)

Table 1. The main infrared absorption bands characteristic of Ca-sulfates, adapted after [5]

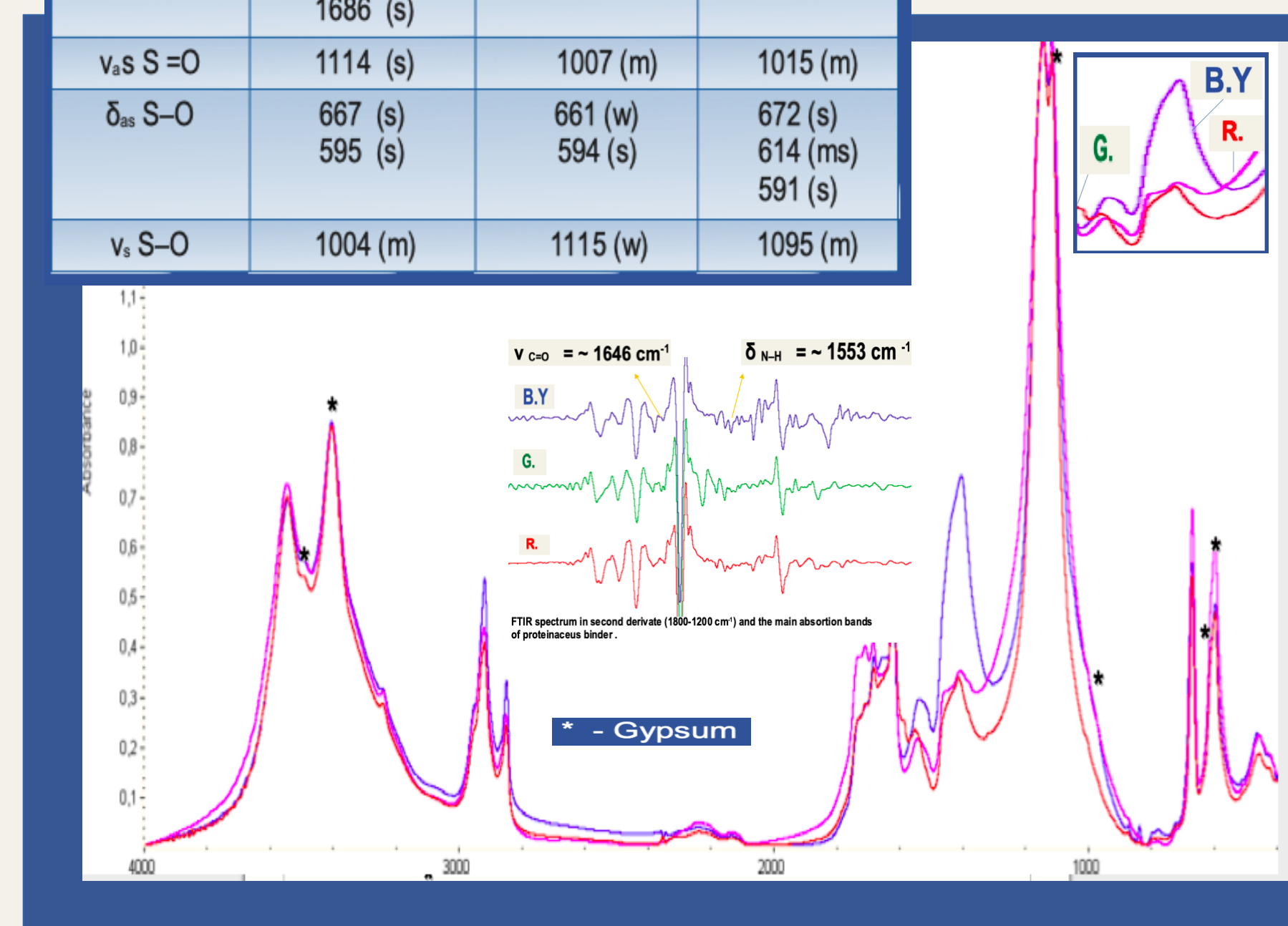


Figure: Infrared spectra of samples analysed various chromatic zones: blue-yellow paint sample B.Y.; green paint sample G.; red paint sample R.

The different degrees of hydration of gypsum suggests the use of "gesso grosso" and "gesso sottile". These, together with animal glue, were common materials used in the ground layer of ancient icons from Eastern Europe [1, 15].

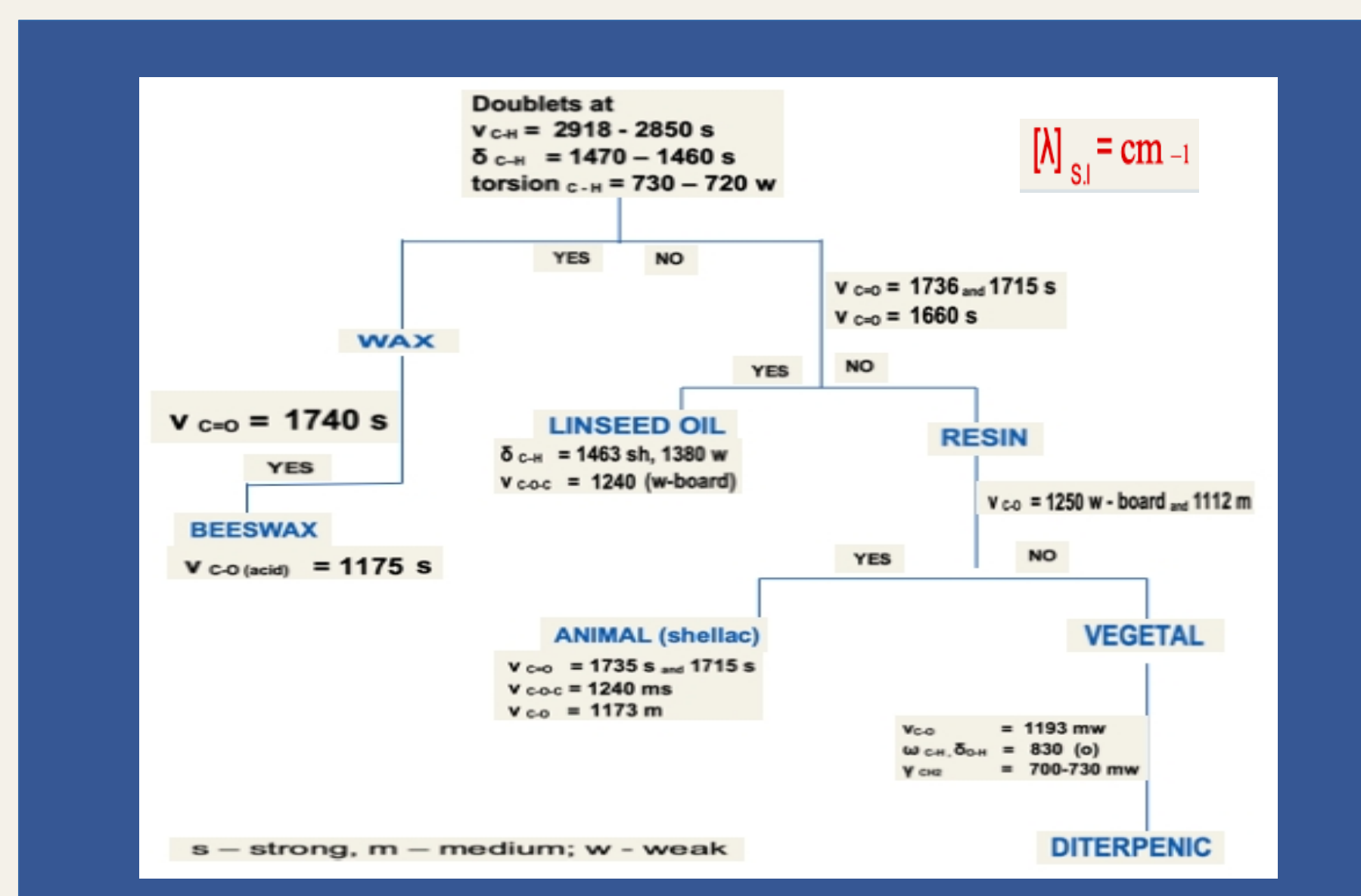
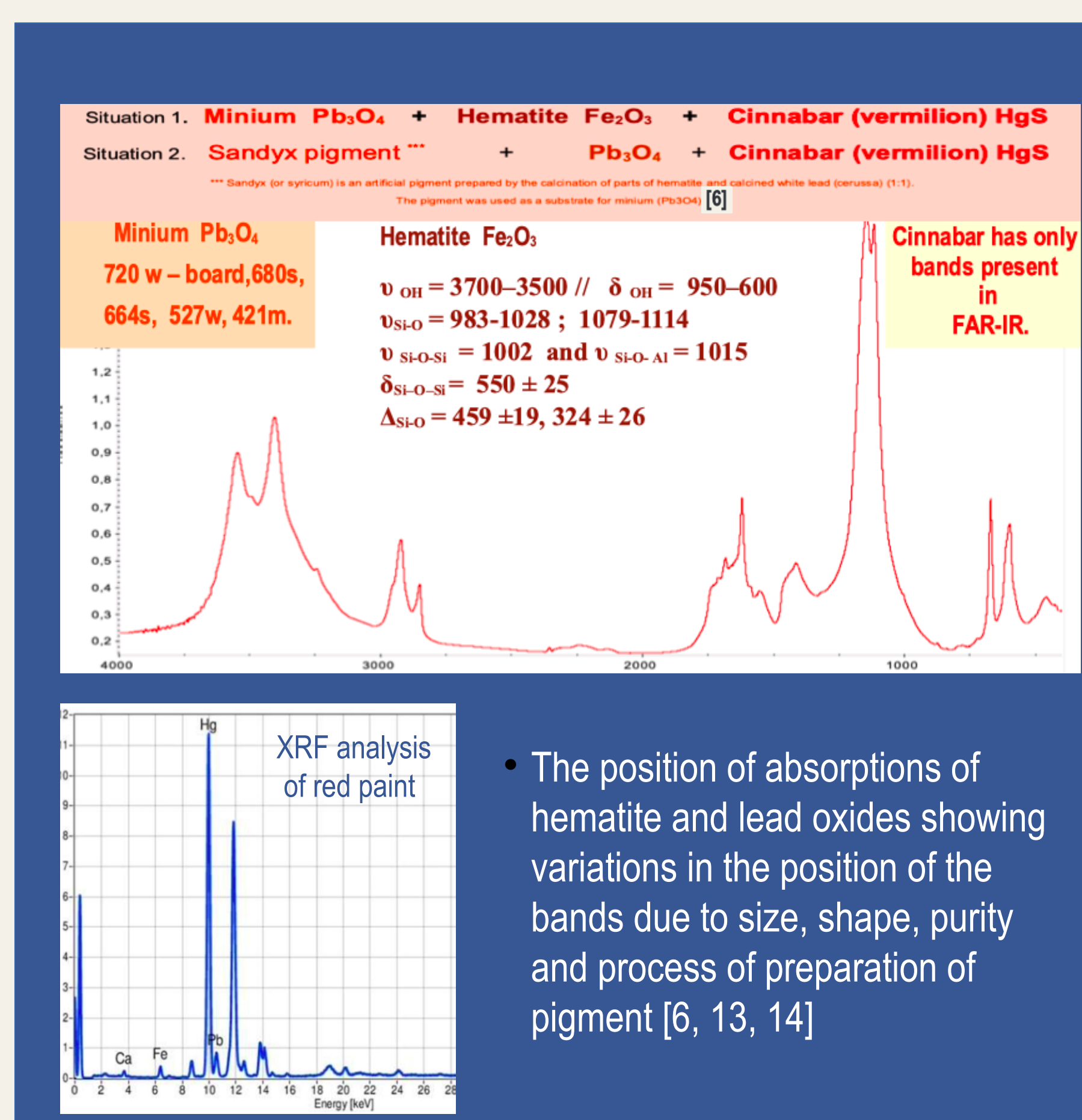
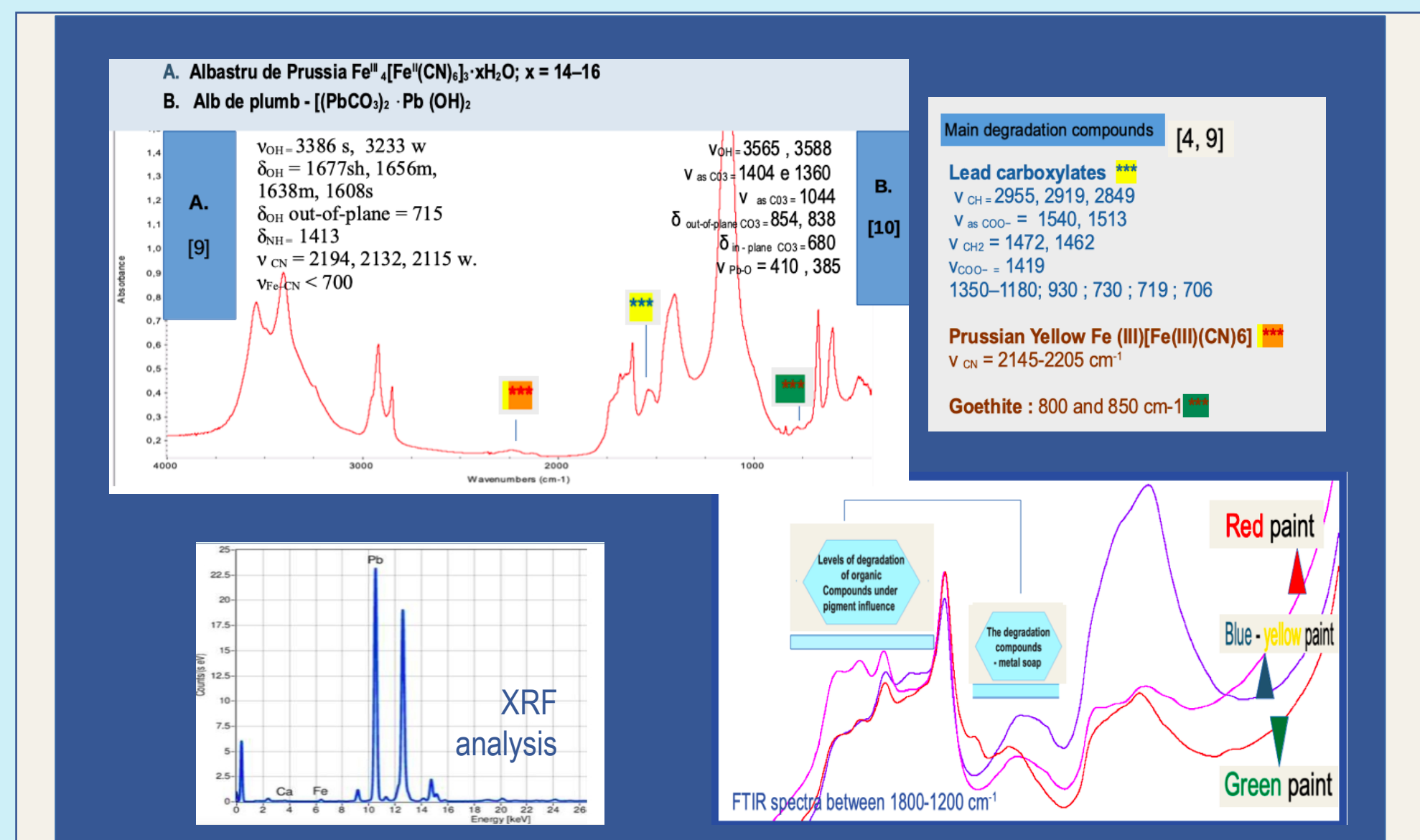


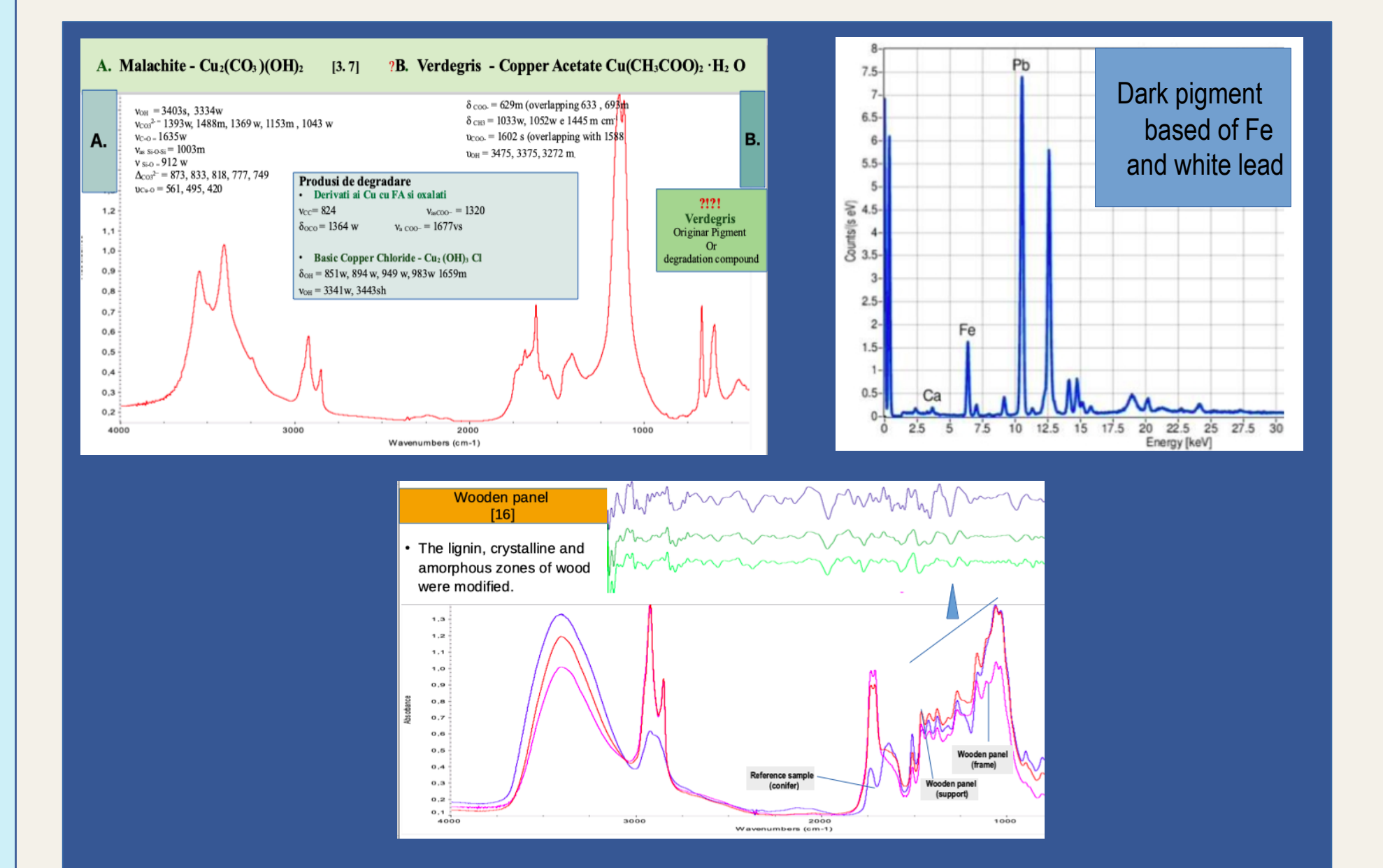
Figure . Flowchart showing the identification of organic compounds present in binders and varnish [11, 12]



- The position of absorptions of hematite and lead oxides showing variations in the position of the bands due to size, shape, purity and process of preparation of pigment [6, 13, 14]



- The presence of small bands of (PO₄)³⁻ suggest the possibility of a mixture of bone black pigment with Prussian Blue and white lead [3].
- The pigment Prussian Blue was very difficult to be identified [8, 9].
- The presence of allumina and ferrhydrite suggest the ancient preparation of the Prussian Blue pigment.
- Prussian Blue is a very delicate pigment (light, basic solution, anoxia, t°C, U.R%).
- Lead white is a classic pigment for post-Byzantine icon painting.



CONCLUSIONS

- The chromatic palette is limited to a few pigments, such as: white lead, Prussian Blue, hematite, red lead, possibly *candyx*, cinnabar, Cu-based pigment, and brown earth.
- The materials of ground layers, white lead, early version of Prussian blue and varnish are all adherents to the ancient creation of icons.
- The principal degradation process is the apparition of metal soaps, oxalate and the fading of Prussian Blue.

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