

Chasing the Magic Binder: A multi-analytical characterization of binders used on hand-painted magic lantern glass slides

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Magic Lanterns Glass Slides

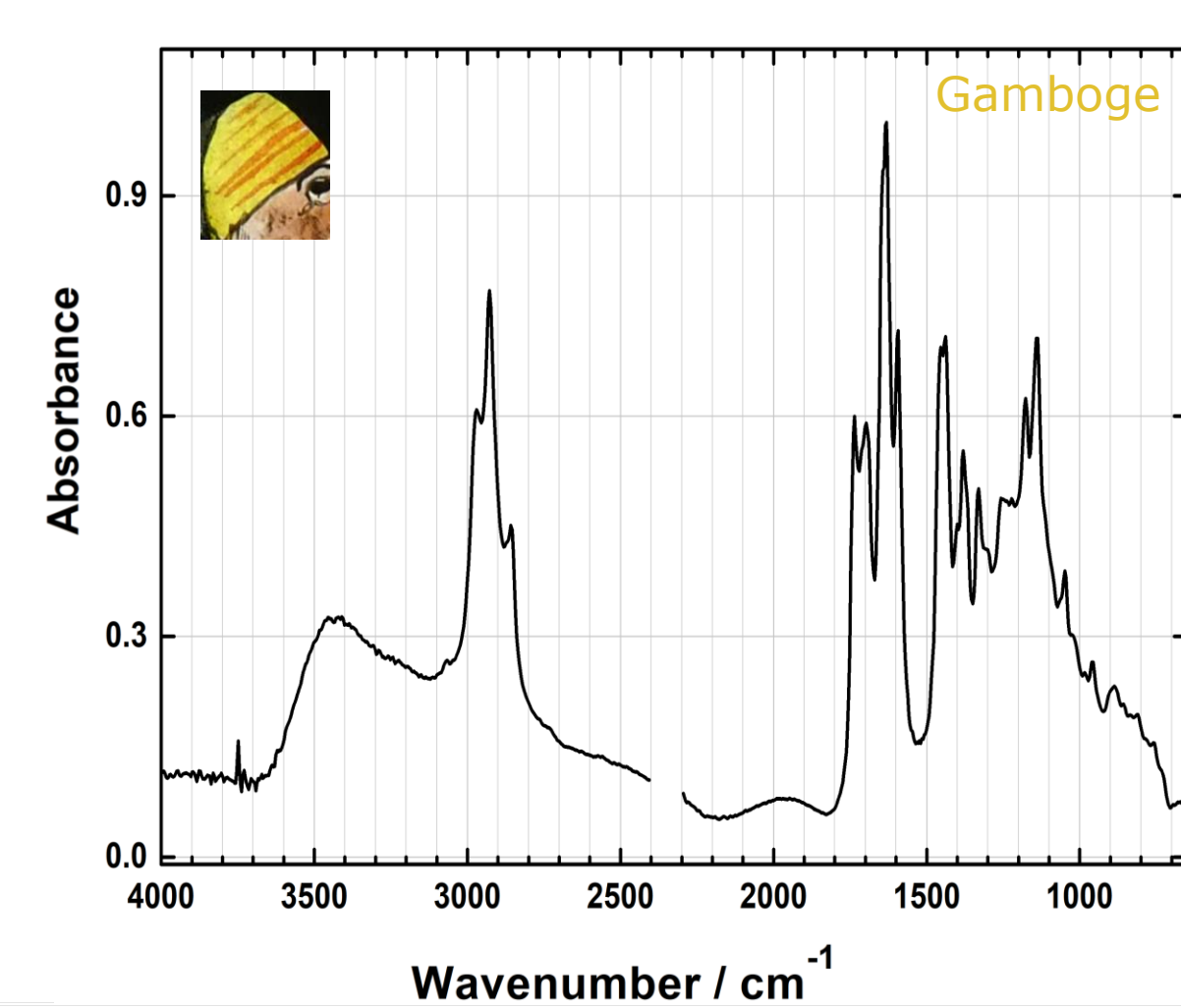
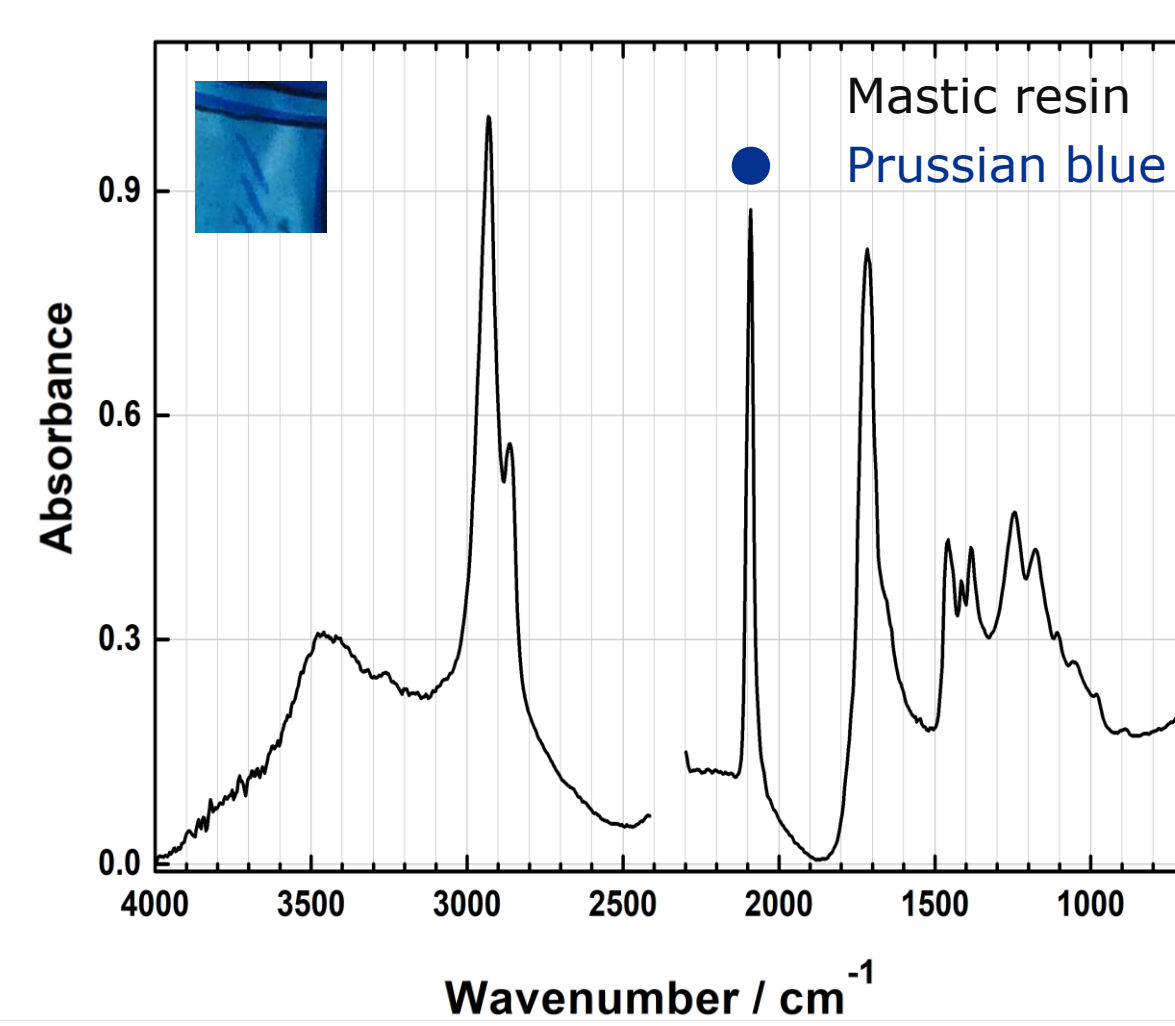
The Magic Lantern was a remarkable invention of the middle of the 17th century that allowed for the first time the projection of images for an audience. The combination of projection images and sounds made it extremely popular, during the 19th century, in all social media as form of entertainment and education [1].

The first images of magic lantern slides were hand-painted on glass supports, with watercolors, oil-based and varnishes colors. The creation of the most astonishing transparent vivid colors required brilliant skill and expertise, since any imperfection was clearly noticeable under magnification [2].

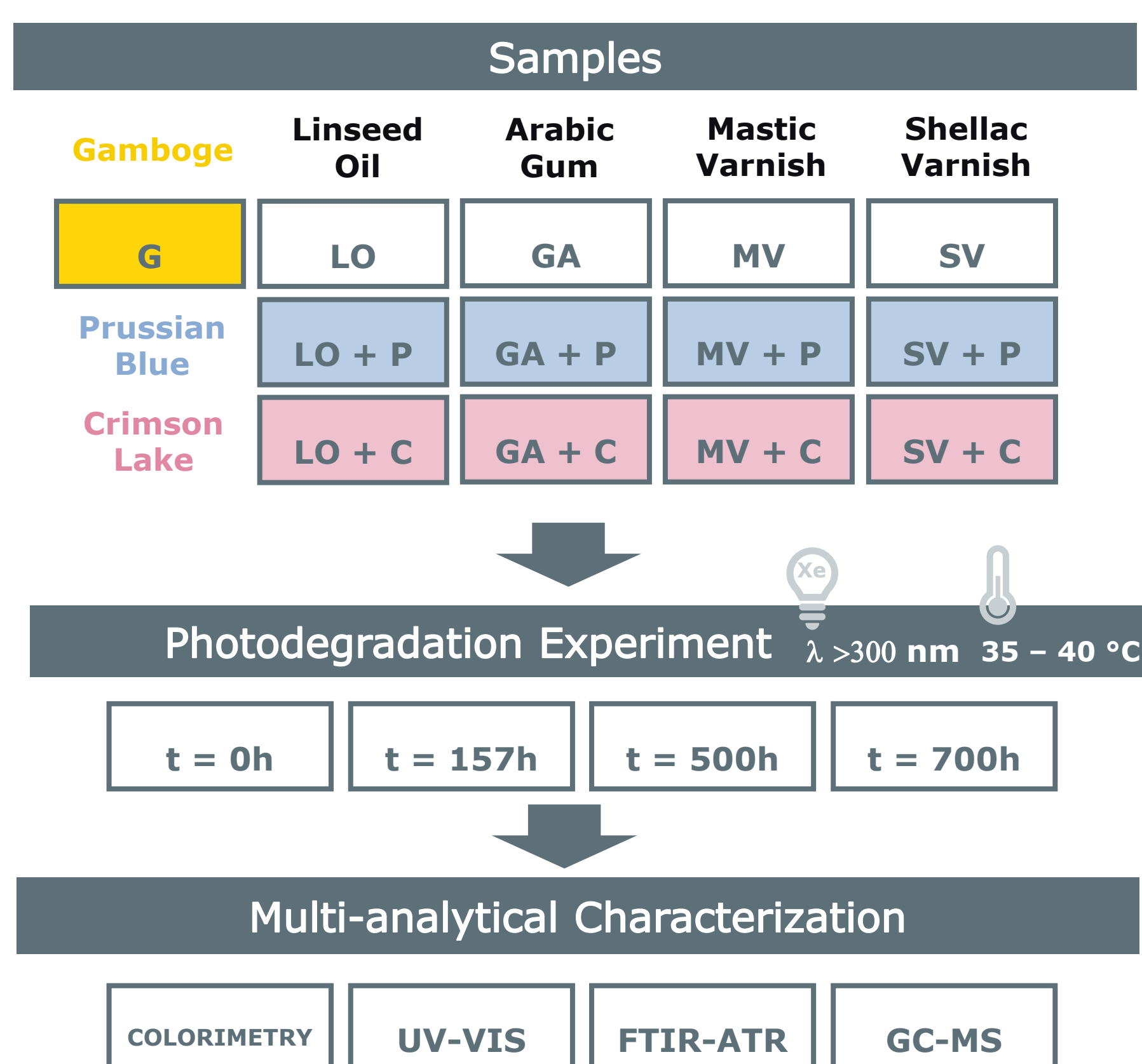


Characterization of Historical Glass Slides

The systematic characterization of these materials used on hand-painted magic lantern glass slides has been recently initiated by our group [3,4]. The characterization allowed the identification of colorants such as Prussian blue, red lake pigment and gamboge. Terpenoid resins such as mastic and shellac were also detected; however, this does not exclude the presence of other binders such as oils and gums.



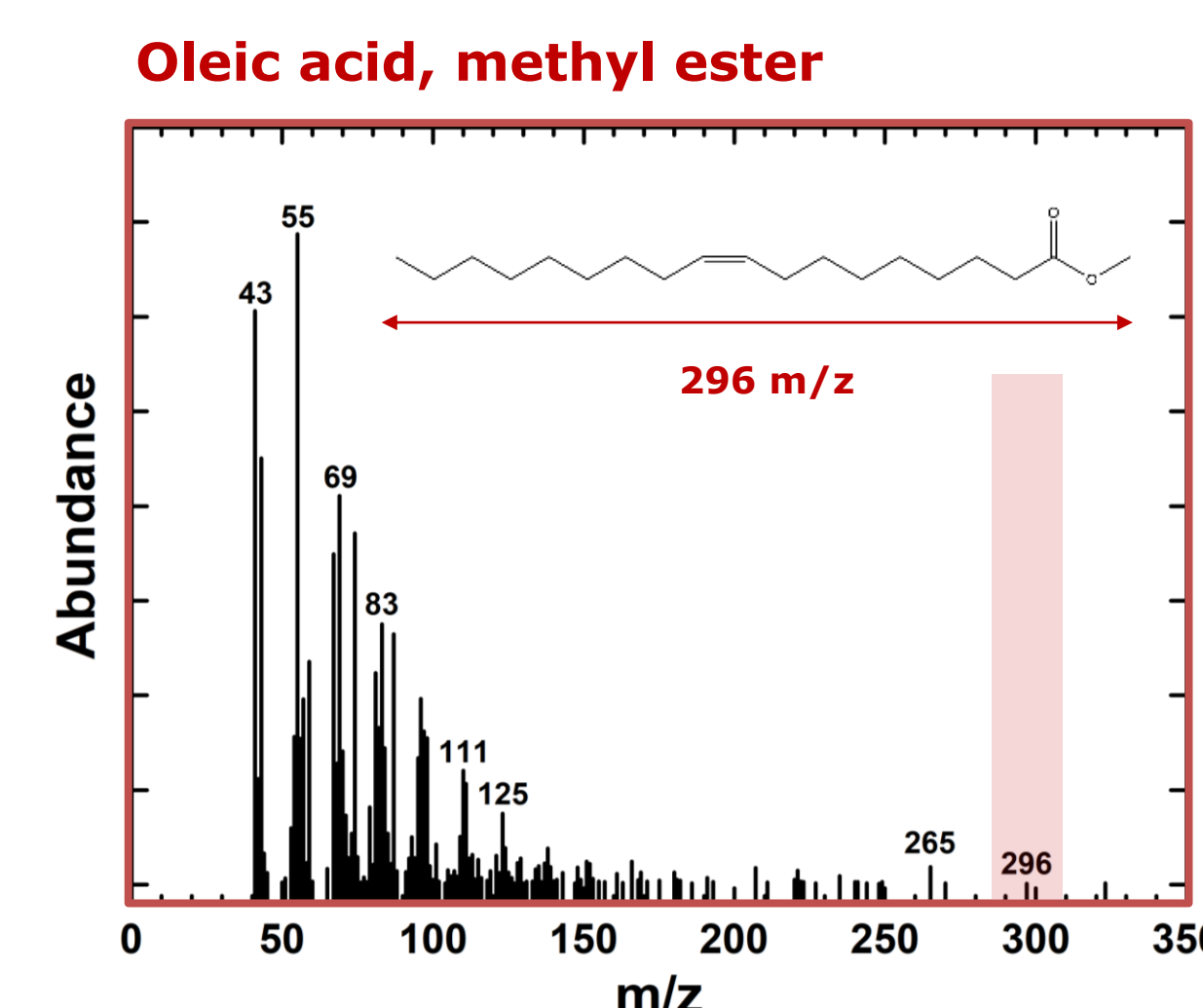
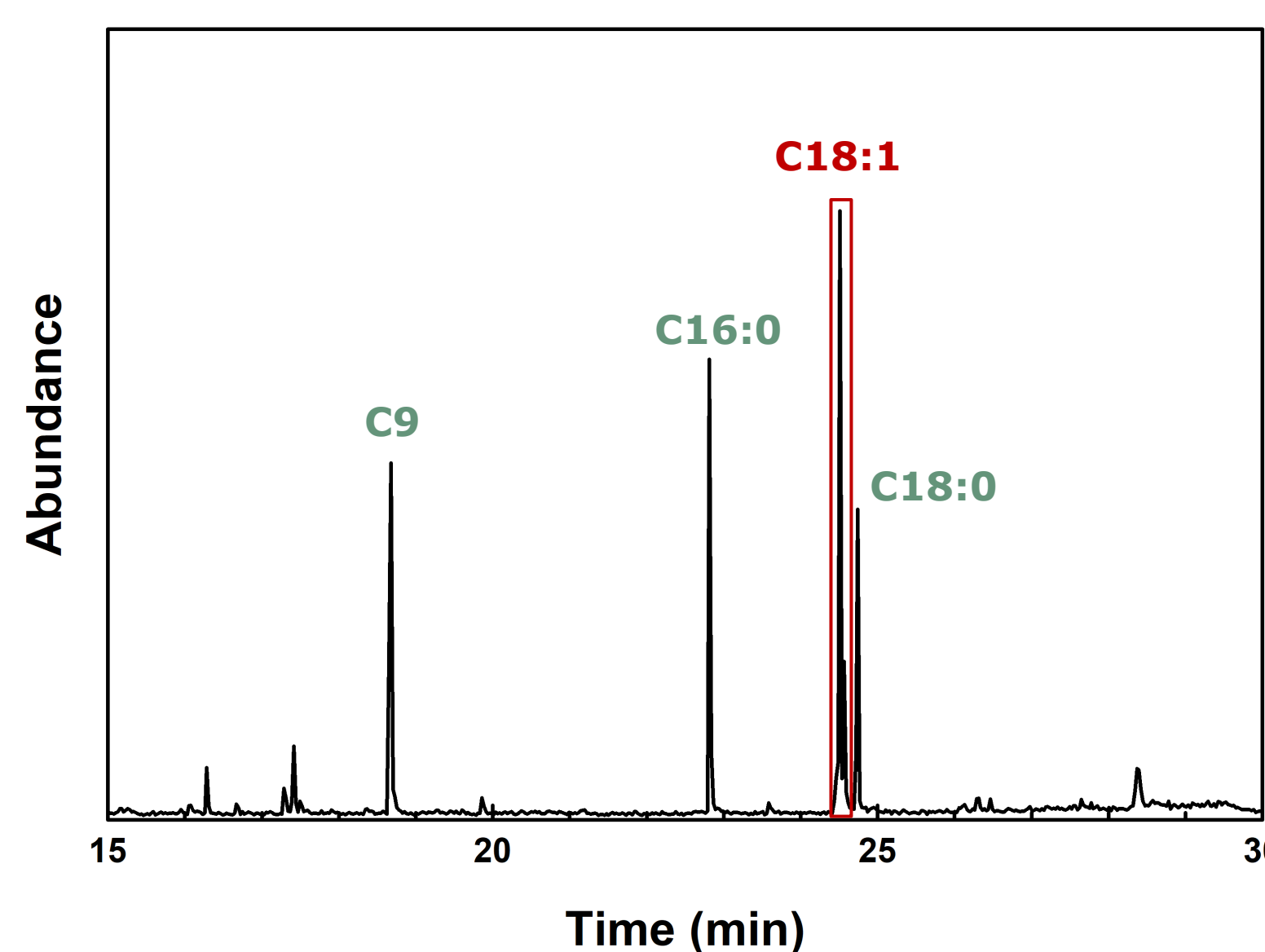
Methodological Approach



It was observed that under harsh conditions, the oil and resin-based paints used on glass slides suffer a significant loss of colour in a short period of time, that is translated by irreversible molecular changes. The gum arabic paints revealed to be more stable.

GC-MS Characterization

Gas Chromatography-Mass Spectrometry allowed the characterization of oil-based binders, through the identification of the marker compounds, particularly azelaic acid (C9), palmitic acid (C16:0), stearic acid (C18:0) and oleic acid (C18:1).

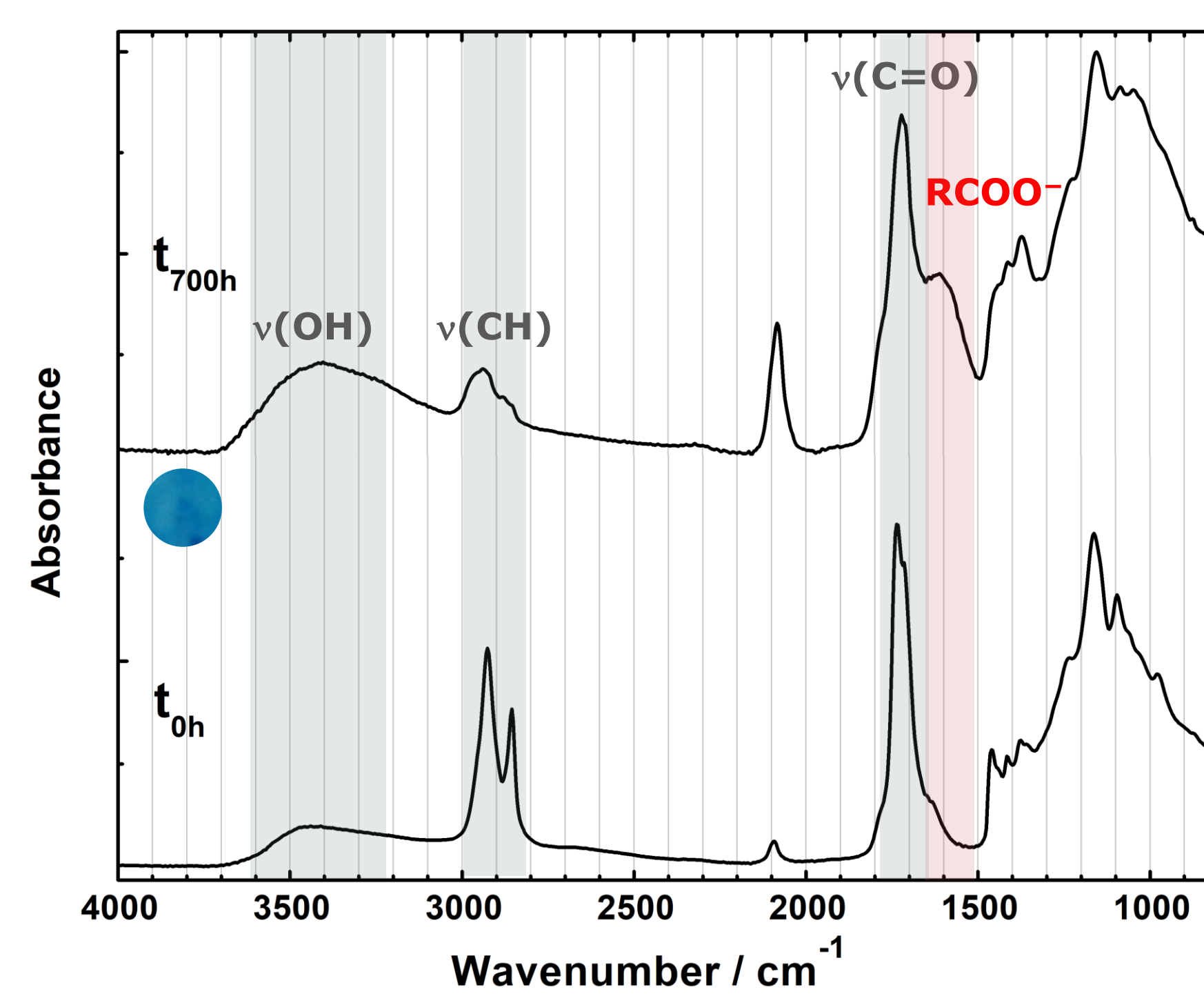
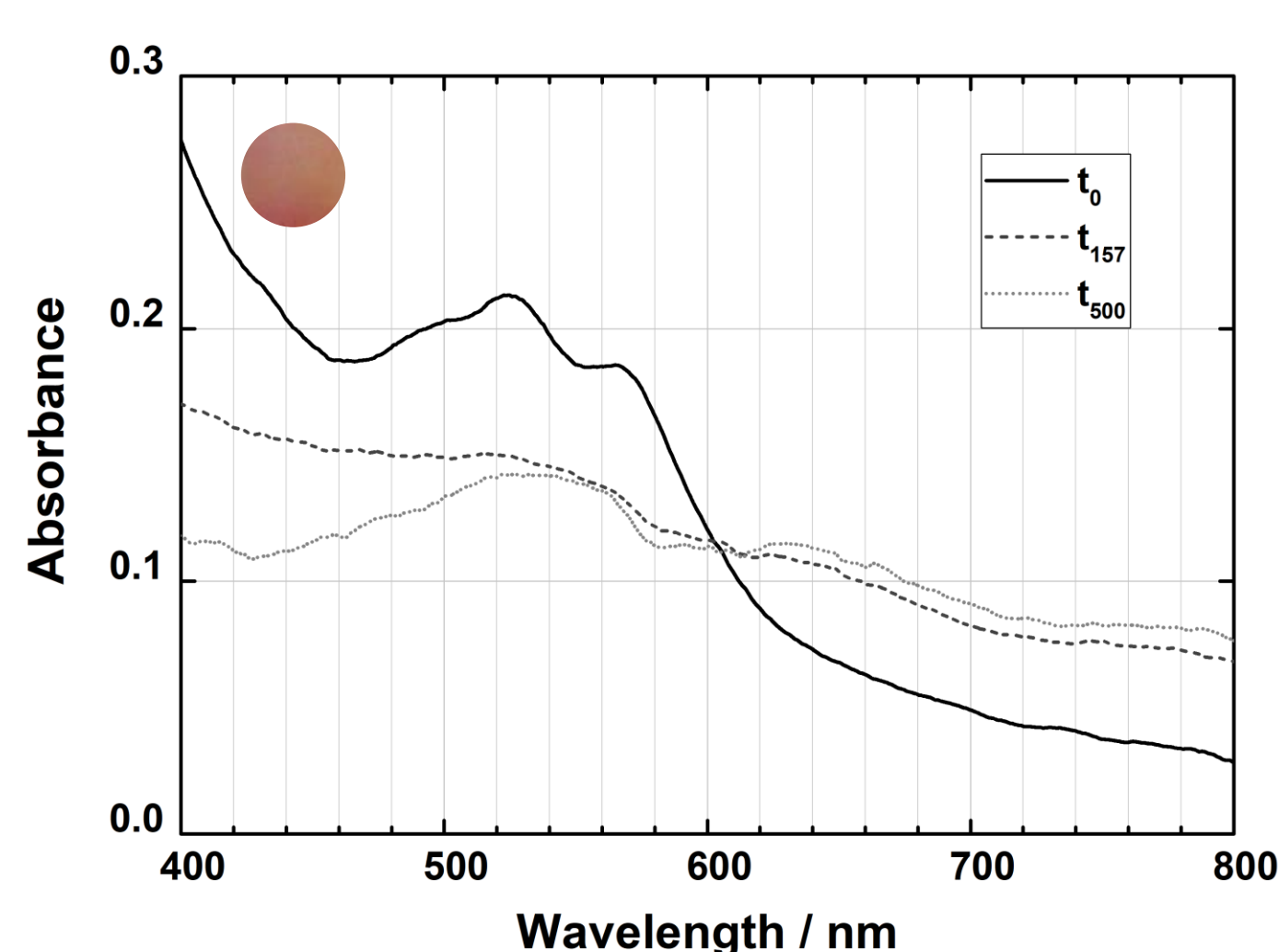
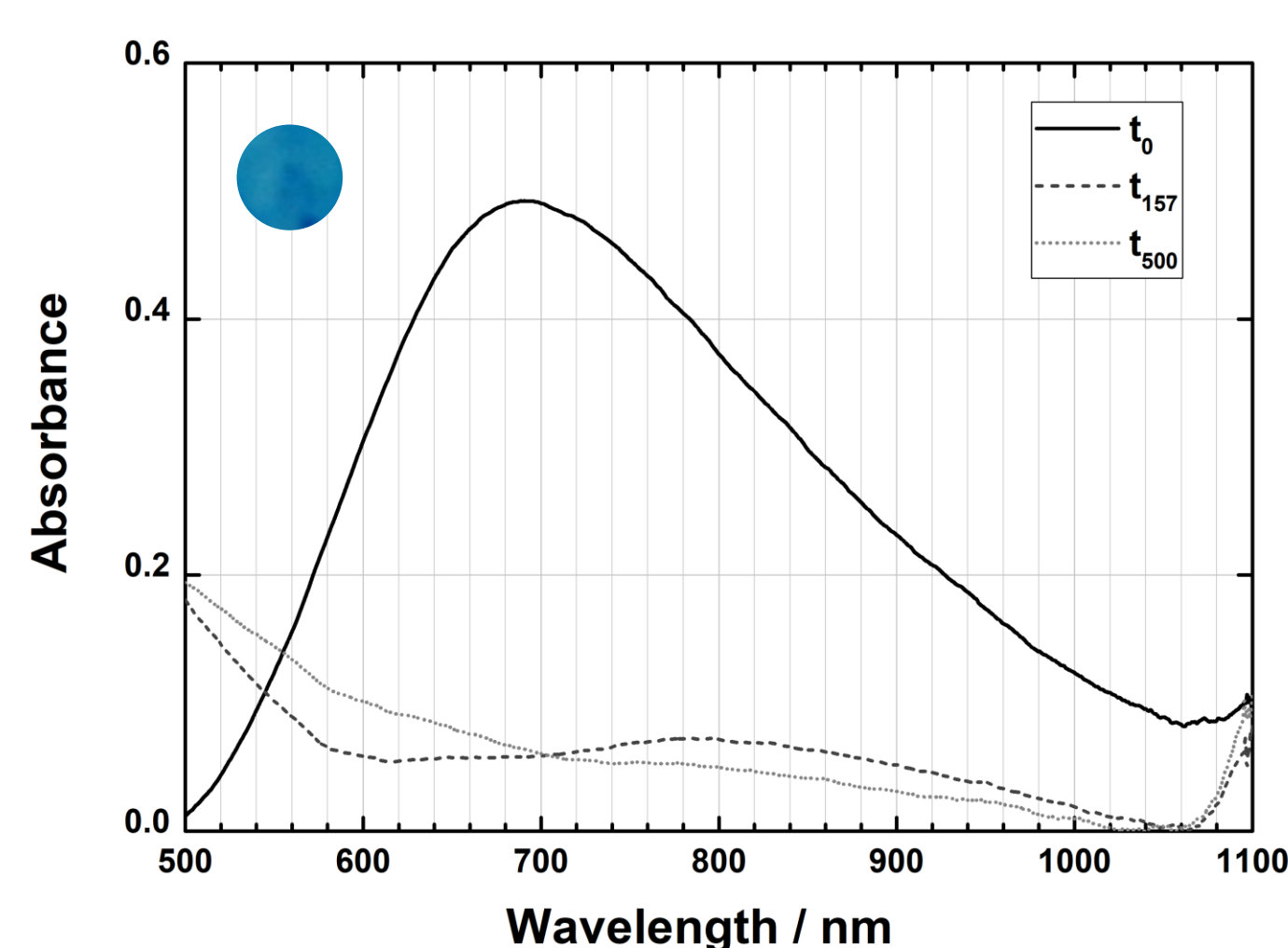


The identification of the marker compounds was based on the mass spectrum of the methyl esters formed by methylation with the derivatization reagent TMTFT*.

*m-(trifluoromethyl)phenyltrimethylammonium hydroxide

Photodegradation Study

	t _{irr} / h	L*	a*	b*	ΔE*	
Linseed oil with Prussian blue	0	42.51	-22.17	-32.48	-	
	157	59.51	-0.58	25.66	64.3	
	500	71.81	1.11	20.69	58.3	
Linseed oil with Crimson Lake	0	65.53	29.50	3.66	-	
	157	86.60	0.42	6.72	36.0	
	500	86.79	-0.37	5.14	38.3	



Overall, artificial aging resulted in an increase of the C=O/C-H absorption bands ratio. This increase of the carbonyl band is due to the formation of carboxylic acids through hydrolysis and/or oxidation reactions. Furthermore, the presence of metal ions from pigments can interact with the carboxylic acids to form carboxylates, known as metal soaps. Unfortunately, these common paint degradation products have been identified in historical magic lantern glass slides. [3]

This research will contribute to the identification of the binders used in hand-painted glass slides and add knowledge on the ageing behavior of these materials so that conservation guidelines can be established for historical glass slides

References

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