

# SPECTROSCOPIC STUDY OF THREE PAIR OF PIGMENTS FROM THE FREScoes DATING FROM 17<sup>th</sup> AND 19<sup>th</sup> CENTURY IN SVETA BOGORODICA CHURCH – LESHOK, MACEDONIA

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## Introduction

In an attempt to introduce the use of spectroscopic and in the final approach, non-destructive techniques in dating and characterizing museum objects and artifacts, the study of pigments in fresco paintings is initiated. The pilot project is investigation of the pigments in the over layered fresco paintings in Sveta Bogorodica (Vergin Marry) Church in Leshok (North Western Macedonia). The church was built in 14<sup>th</sup> century, 1326 is the year mentioned by Stefan Decanski<sup>1</sup>. In the 17<sup>th</sup> century (1641), the major reconstruction of the church took place; the evidence for this was found on the inscriptions on one of the walls in the church. In the second reconstruction, in 19<sup>th</sup> century (1879) the western annex was added and the over painting of frescoes was painted by the zograph (fresco painter) named Mihail Gurcinov.

From the previous examination of the church, it was concluded that the 19<sup>th</sup> century layers of paints were placed directly on the previous, 17<sup>th</sup> century layer of paint, with (and in some cases without) the deposition of the ground layer. In the recent preliminary reconstruction-conservation measures, the historians of art concluded that the 17<sup>th</sup> century frescos were more valuable than 19<sup>th</sup> century and they suggested the removal of 19<sup>th</sup> century layer of paint in order to preserve the 17<sup>th</sup> century frescoes paintings. For this purpose, the samples of paints were taken from different parts of the wall paintings, both from 17<sup>th</sup> and 19<sup>th</sup> century.

The aim of this work is to detect the nature of the pigments taken from two different layers of paint (from 17<sup>th</sup> and from 19<sup>th</sup> century) by the use of IR and Raman spectroscopy. We report here our preliminary results on the origin of the three pair of pigments used in fresco paintings in this church: the red/brown, blue and ochre paint from the layers of paintings dating from 17<sup>th</sup> and 19<sup>th</sup> century. For the purpose of comparison, the corresponding spectra of the mortar, both from the 17<sup>th</sup> and 19<sup>th</sup> layers were also recorded.

## Experimental

The IR spectra were recorded on the FTIR Perkin-Elmer 2000 spectrometer with the technique of KBr pallets, in the spectral region 4000-400 cm<sup>-1</sup> and from 600-100 cm<sup>-1</sup> in Nujol oil between polyethylen plates. The Raman spectra were recorded on micro-Raman spectrometer FORAM-685-2 with He-Ne laser excitation and with the focal length x20 in the spectral region 2000-400 cm<sup>-1</sup>.

## Results

The details of the two layers of fresco paintings are shown on Fig.1 and corresponding Raman spectra of the two blue pigments are shown on Fig. 2.

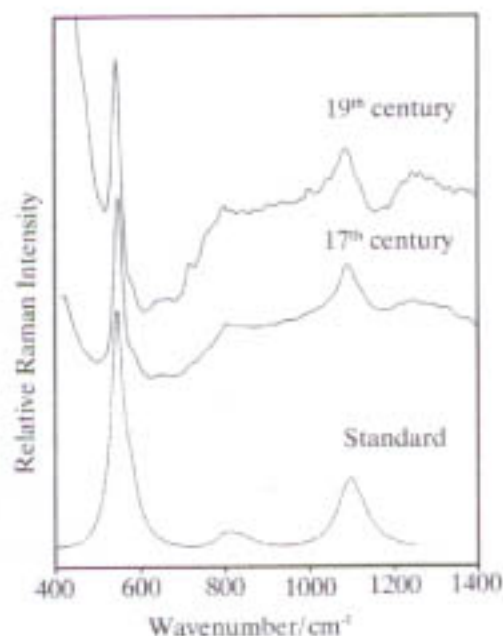


Fig.1 The details of the two layers of paint from 17<sup>th</sup> (middle) and lazurite (standard) pigment

Fig.2 Raman spectra of the blue paints; from 19<sup>th</sup> and 17<sup>th</sup> century and the 19<sup>th</sup> (upper and lower) century

The comparison of the Raman (and in some extent) the IR spectra revealed that the blue pigment used for the fresco paintings in 17<sup>th</sup> and 19<sup>th</sup> century was of the same nature: lazurite (lapis lazuli)<sup>2</sup>. The red/brown and ochre pigments could not be directly identified since the complex appearance of the IR spectra suggested a mixture of at least two pigments, while the Raman spectra were not completely conclusive. However, the Raman spectra indicated that the ochre paint used in 17<sup>th</sup> and 19<sup>th</sup> century frescoes are probably of the same origin, while the one used in the red/brown paint most probably belong to different pigments.

## References

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- [2] I. M. Bell, R. J. H. Clark and P. J Gibbs, *Raman Spectroscopic Library of Natural and Synthetic Pigments (pre- ~ 1850 AD)*, <http://www.chem.ucl.ac.uk>