Identification of Painting Materials From the Main Church of Polovragi Monastery

C. Măruțoiu[1], M. Tecla[2], O.F. Măruţoiu[1], I. Bratu[3], V.C. Măruțoiu[1], L. Jäntschi[4]

[1]"Babeş-Bolyai" University, 18 Avram Iancu sq., 400117 Cluj-Napoca, Romania; [2] Monastery of Polovragi, Gorj, Romania; [3] INCDTIM, 65-103 Donath st., 400293 Cluj-Napoca, Romania; [4] USAMV, 3-5 Calea Manastur st., 400372, Cluj-Napoca, Romania.

Abstract

The Polovragi Monastery Church is a historical monument from the Gorj County, Romania, where the interior painting was finalized in the year 1712. The employed painting materials were identified through the Fourier Transform Infrared Spectroscopy (FTIR spectroscopy) and through atomic absorption.

Introduction

Polovragi Monastery is situated in a picturesque landscape, at the entrance to the Oltet Gorge, in the north of Oltenia. The current monastery church was rebuilt on the old foundation dating from 1647. The painting of the main church was finished in 1712, being executed by the first apprentices who graduated the Brancoveanu School from Hurezi [1].
The aim of the paper is to provide a recipe for the restoration technicians which use similar materials to restore old pictures.

Materials& Methods

The metal identification has been made using a atomic absorption spectrophotometer, Varian Tehnoton model. FTIR spectra were obtained with a JASCO 6100 FTIR spectrometer using KBr pellet technique in the 4000 to 350 cm^{-1} spectral range with a resolution of 2 cm^{-1} [2]. The classification of the wavenumbers of light absorbed from the investigated painting were investigated using hierarchical clustering techniques (between wavenumbers linkage as clusterization method, squared Euclidian distance as metric), SPSS 18.0 software. Moreover, the wavenumbers of absorbed radiation from the investigated painting were compared with online library of known compounds in order to identify the composition.

Results

After the analyses have been carried out, the materials used in creating the painting have been identified: calcium carbonate ($CaCO_3$) (Fig. 1), iron ochre ($Fe_2O_3.H_2O$) in a mixture with ultramarine in order to obtain the green colour (Fig. 2) and natural red iron. Nitrate has also been identified, which comes from the guano deposit in the church attic.

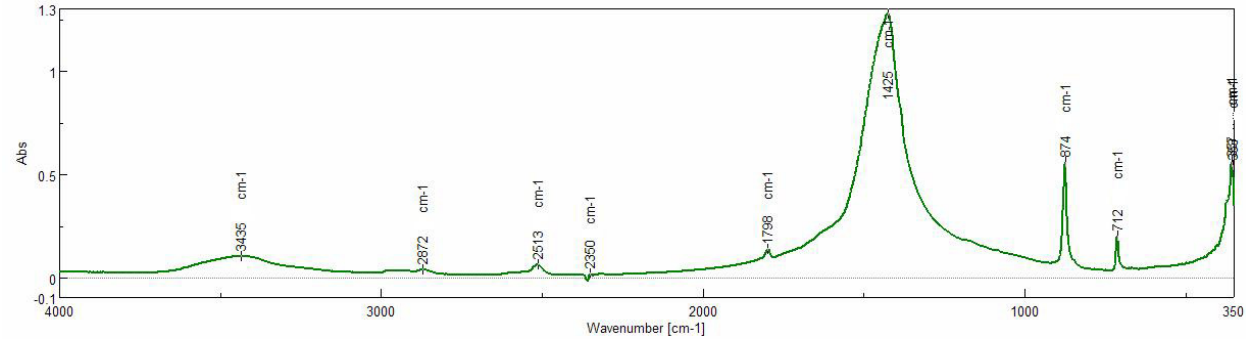

Fig.1; FTIR spectra for white sample.

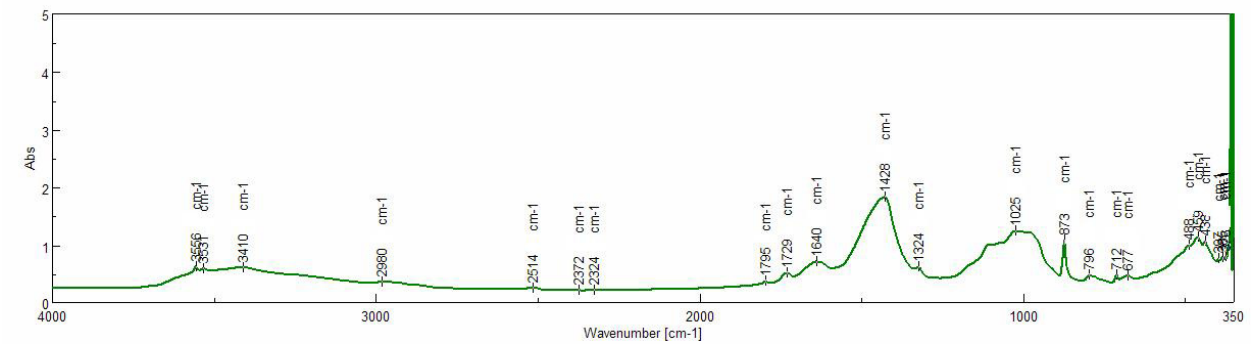

Fig.2; FTIR spectra for green sample

A multivariate analysis can be conducted in order to reveal the influences of different restoring materials to the colour and intensity providing the suitable combination of the restoring materials. The classification of wavenumbers in red and blue extracted from the investigated painting is graphically presented in Fig. 3. With two exceptions, represented by wavenumbers of 2872 and 3435, pairs of wavenumbers on white linked together in the first step of analysis. The first two pairs linked together in the second step when the 2872 also linked to two similar wavenumbers at level of 2000. The classification of wavenumbers is done in five steps for both white and green. The similarities of wavenumbers identified in green create the groups for the following ranges: ≤ 1025; [1025; 1795], [1795; 2514]; [3410; 3556]. The linkage was furthermore similar for red and blue samples, another two steps being necessary till the linkage of all wavelengths (Fig. 3).

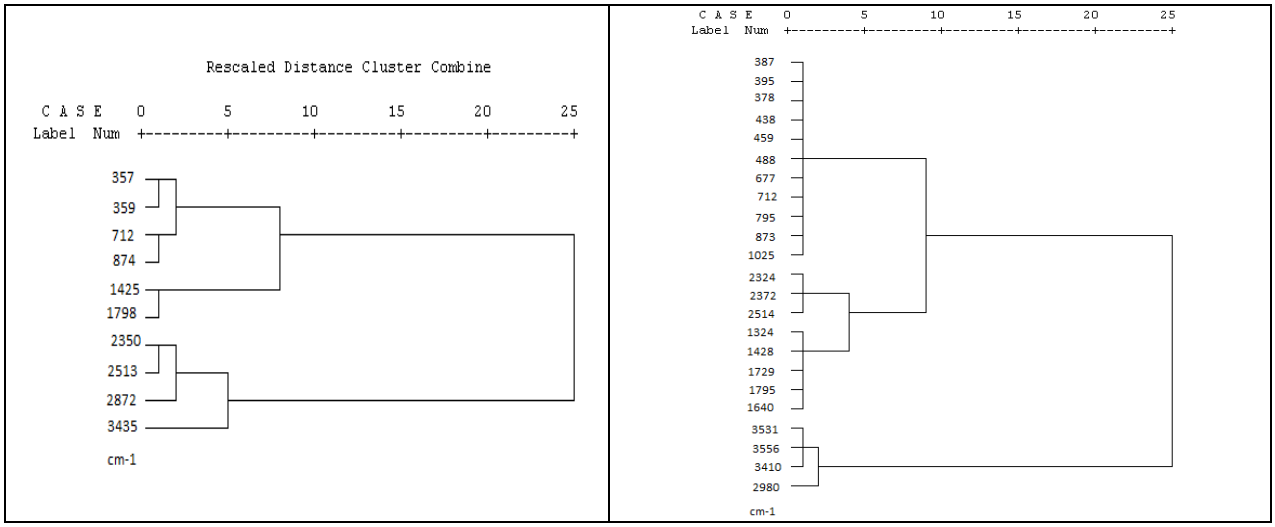

Fig. 3; Average linkage: Dendrogram on white (left) and green (right)

Conclusion

The informations obtained from the analysis show that the painters trained at the Horezu school used materials specific for the beginning of the XVIIIth century. This information can be used in the later interventions for preservation and restoration.

Reference

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2) C. Măruțoiu, I. Bratu, A. Trifa, M. Botiș, V.C. Măruțoiu, FTIR Analysis of painting materials from the church Saint Paraschiva of Poienile Izei, Maramureș, Romania, *Int. J. Conserv. Sci.*, 2(1), (2011) 29-35