

Micro-chemical and Spectroscopic Study of Component Materials in 18th and 19th Century Old Printed Holy Books

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The Cyrillic books *Menology for May* (1705), *The Bible* (1822) and *Mirror* (1816) were appointed to preservation in the Laboratory for Conservation and Restoration at the National Library in Skopje in order to stop and remove the physical, chemical and biological deteriorations. The first two books represent the Russian printing traditions, while the third book was printed in Vienna thus representing the West European printing traditions, although it originates from the territory of the former Ottoman Empire (present-day Republic of Macedonia).

In the present study the emphasis is on characterization of *paper*, original and restoration, and *inks* used in the text and ornamentation by the application of micro-chemical tests and sophisticated instrumental spectroscopy techniques. Optical microscopy was used to examine the type of fibres forming the paper support while micro-chemical analyses were performed to identify the materials added to the paper support such as starch, alum, rosin and gelatine (or animal glue). Fourier Transform Infrared Spectroscopy (FTIR) was applied to confirm the findings for the sizing and fillers found in the paper support. Mineral and inorganic pigments were revealed by micro-Raman spectroscopy.

The study showed that the original paper in Russian books was made of rags with lignin fibres present in less than 5% (Fig.1), whereas the paper in *Mirror* was found to be made of raw and unbleached hardwood. Distinct types of sizing have been identified to form the paper material. Thus, gelatine/alum type of sizing was present in *Menology for May* and *Mirror*, while gelatine/rosin type was identified in *The Bible*. Starch was detected as an additive to the binding agents in restoration paper of *Menology for May*. The pigments identified are lamp black (Fig. 2), vermilion, Prussian blue and chalk.

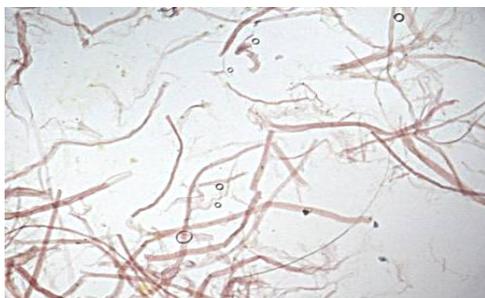


Fig.1 Photomicrograph (x200) of rag fibers treated with Graff 'C' stain found in original paper of old printed books *Menology for May* and *The Bible*

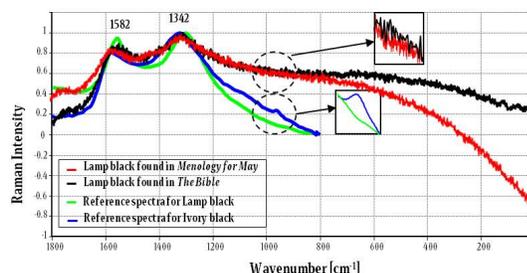


Fig.2 Raman spectra of lamp black found in black ink of old printed books *Menology for May* and *The Bible*