Analysis of Ancient Paper Structure in Transmitted Light by Application of Different Microscopic Techniques. Examples From Collection of The Kórnik Library of the Polish Academy of Science

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In general hand made or machine made paper is a product which shows a certain transparency. However, some kinds of paper found in museum, library and archive collections may reveal a more noticeable transparency (tracing papers, waxed paper negatives etc.). The degree of transparency of paper products depends on their thickness, technology production, pulp composition, additional substances applied and other agents. In this field stereoscopic microscopes with additional equipment offer many possibilities in non-invasive investigations of paper surface structure, as well as its look-through by scientists and conservators. Additional helpful tools are equipment for polarization (polarizer, analyzer) and the dark field condenser easily mounted in stereoscopic microscopes. They are very useful tools for obtaining much more information on antique paper structure without sampling in comparision with the results obtained by normal light applications. Beside fibers it is possible to determine the presence of additional inorganic and organic matters in paper structure.

In polarized light the presence of fillers can be detected and it is also possible to analyze their distribution within the paper, crack lines of overlayers, writing or painting inks distribution (or other media) on paper surfaces, as well as distribution of substances applied by conservators (cellulose derivatives, powdered erasers used for cleaning etc.). Moreover, in some cases it is possible to identify the types of fiber by analysing their morphological features and colours appearing during polarization. Application of polarized transmitted light allows the study of many paper features or degradation changes which can be emphasized much more in this configuration of lighting. Additionally, pictures of better quality can also be taken by applying another technique, reflected polarized light, during investigation of paper surfaces.

By using the dark field condenser it is possible to observe light paper structure (from white to greys) on a dark background. The image is reversed (like a negative) in comparison with an image obtained in normal transmitted light, where the dark outlines of fibers are visible in light field. The stronger contrast is also characteristic for the dark field technique.

An elaborated technique of simultaneous use of the black field technique and reflected light (low angle of reflection: ca. 10-20^{o}) serves to provide an additional interesting effect of a mixed image where the paper is observed in dark field but at the same time the structure of the surface is also visible.

Possibilities for analysing tracing papers, foxing stains, albumen, gelatin and salt paper prints are presented in the poster. The examples present mainly come from the photographic collection of The Kórnik Library of the Polish Academy of Science.

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