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Non-Destructive Analysis of 14th–19th Century Papers

ABSTRACT

The William Barrow Laboratory's pioneering 1974 analysis of 1,470 historical papers from the 16th through 20th centuries demonstrated that early, well-preserved papers were made from pure cellulose (rags), were neutral or slightly alkaline in pH, and contained an alkaline reserve (likely calcium carbonate). Because the Barrow work was based on destructive tests, exceptionally stable 15th century papers were not included in the study due to their rarity and value.

With funding from the IMLS, the University of Iowa, and the Kress Foundation, and with support from a number of collaborating institutions, in the Fall of 2009 we completed a two-year study of 1,580 primarily European papers using non-destructive methods. Book, manuscript, and printmaking papers made between the 14th and the 19th centuries were tested using XRF and UV-Vis-NIR instrumentation. For each specimen, we gathered data on 15 chemical or physical variables as well as publication information (date, title, author, country, etc.). The data show that the 15th century papers tested were thicker and had higher gelatin and calcium concentrations compared with papers made in subsequent centuries. Preliminary results also indicate that lighter color was generally associated with higher levels of gelatin and calcium, and overall superior materials and workmanship. In two related experiments, we are investigating the ability of non-destructive XRF, UV-Vis-NIR, and ultrasonic methods to predict changes in the concentrations of Ca, Fe, alum, and strength in historical papers as a result of typical aqueous conservation treatments.

All research methods and results of the study will be published as an interactive website in 2010. Research results are expected to be of interest to conservators, paper historians, and those who manufacture modern archival papers. The data will also serve as a key reference for any future accelerated aging studies designed to investigate the causes of paper aging.

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