Washing and Humidifying Iron Gall Ink on Paper: Effects on Iron Migration

ABSTRACT

Paper conservators generally hesitate to treat paper objects containing iron gall ink. Aqueous treatment of these objects can potentially result in changes in surface texture, color, or chromatic intensity of the ink. In addition there is a chance that an already brittle object will suffer further physical breakdown. Finally, water-soluble products might migrate from the ink into the surrounding paper, often resulting in a disfiguring halo formation around the applied ink. Not visible, but potentially very destructive, is the the migration of iron from the ink into the paper or even over the paper surface. Research conducted over the last five years has produced persuasive evidence that the excess portion of iron sulfate in iron gall ink is responsible for one of the degradation mechanisms. Fe(II) is capable of accelerating the oxydative breakdown of cellulose through the so-called "Fenton-reaction." Fe(II) is highly water-soluble and the fear for transporting iron and its destructive properties is legitimate.

In a joint research project the Museum Boijmans van Beuningen in Rotterdam and the Shell Research and Technology Centre in Amsterdam (SRTCA) have investigated the behavior of iron gall ink on paper both before and after aqueous treatment. Shell has cooperated with various institutions and generously sponsored research into iron gall ink on paper samples. The results were analyzed using a Fe(II) indicator test (developed by Han Neevel at the Mensch at SRTCA). Long-term effects were examined using two methods of accelerated aging (conducted at ICN and the Netherlands Organization for Applied Scientific Research, Delft (TNO).

A number of samples were washed in deionized water for thirty minutes. Using the newly developed non-bleeding iron test, excess iron [Fe(II)] from the iron gall ink was proven to dissolve into the washing solution. However, no increased deposits of iron were found in the areas outside of the ink line using SEM/EDX analysis. Although iron is proven to remain largely within the boundaries of the ink line during natural and accelerated aging, significant iron migration was found to occur during various types of humidification of the samples. For example, humidifying certain samples using Gore-Tex resulted in halo formation after accelerated aging. In other samples however, cold humidification resulted in significant migration of iron, clearly visible through SEM/EDX analysis after only two hours. These results clearly show that one type of aqueous treatment can have different effects on different types of iron gall ink.

Published reports on this research are forthcoming in the postprints of the conference "The Broad Spectrum: The Art and Science of Conserving Colored Media on Paper" (Art Institute of Chicago) in Chicago, October 5–9, 1999, and the postprints of the conference "Iron Gall Inks—Past, Present and Future" (University of Northumbria) in Newcastle, September 4–5, 2000.

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