



# HERITAGE SCIENCE FOR CONSERVATION

## **ABSTRACT**

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## **TITLE:**

### **Paper degradation due to metal cation-catalyzed hydrolysis and oxidation in the library, museum, and archive**

Heritage Science for Conservation (HSC) is a part of the Department of Conservation & Preservation—the Sheridan Libraries, Johns Hopkins University. The research agenda of postdoctoral fellow John Baty, which commenced in summer 2009, is targeting the role of metal ions aluminum(III), copper(II), iron(II), and magnesium(II) in paper degradation in the library, museum, and archive. These ions were selected because of their possible role as catalysts for cellulose hydrolysis and oxidation, and because they are present in rosin-alum and gelatin sizing (aluminum), pigments and inks (copper and iron), and both aqueous and non-aqueous deacidification treatments (magnesium). Focusing on primary pathways of paper degradation, this research agenda is designed to (1) help conservators make better informed decisions on materials and techniques, (2) assist in the development of specifications for modern permanent and durable papers, and (3) assess the scope of accelerated aging procedures to predict the permanence of paper specimens containing these metal ions.

Completed phases of the research program have substantiated the overall thesis that papers containing aluminum salts such as papermakers' alum degrade primarily via a different chemical reaction than previously believed. Also substantiated is the thesis that deacidification should be an effective means of slowing this reaction. In present and future phases we are refining and broadening our sample

formulation to (1) better mimic the adsorbed water, (2) include more of the potential catalytic salts (sulfates, acetates), and (3) include more of the other compounds (hemicelluloses, lignin) present in paper in the library, museum, and archive.