

# **Preservation protocols for oxygen-sensitive minerals within laminated aquatic sediments for spectroscopic and other geochemical analyses**

ELIZABETH SWANNER<sup>1</sup>, RAISA ISLAM<sup>1</sup> AND  
GABRIELLE LEDESMA<sup>2</sup>

<sup>1</sup>Iowa State University

<sup>2</sup>Memorial University of Newfoundland

Presenting Author: [swanner@colorado.edu](mailto:swanner@colorado.edu)

Laminated lacustrine sediments have been used as archives of paleoclimate proxies for decades, while their utility for paleoredox proxy calibration is becoming increasingly valuable to geochemists. The seasonal changes in sedimentation of material from anoxic lake waters, includes minerals of the redox-active elements Fe, Mn, and S whose formation and burial can signify varying redox and mineral saturation conditions. The redox-driven scavenging of metals can be preserved in their abundance, distribution, speciation, and isotopic fractionation in sediments. However, preserving both the oxygen-sensitive minerals is challenging when preservation of the spatial arrangement of seasonal laminae is also desired. This study compared methods for embedding sedimentary materials from anoxic waters and sediments from Brownie Lake, Minnesota, USA for analysis of the redox speciation for Fe, Mn, and S using synchrotron-based X-ray absorption near edge spectroscopy (XANES). Acetone dehydration and resin replacement in a 100% nitrogen glovebox successfully preserved the speciation of Fe and Mn minerals within laminated sediments. However, acetone removed organic sulfur species from sediments, and epoxies contained elemental sulfur that interfered with sulfur speciation. Embedding sediments in a two-component epoxy as grain mounts was more promising for mitigating these problems with sulfur, but the spatial structure of sediments was disturbed. Results from this study will aid researchers who are interested in spatial analysis, elemental mapping, mineral identification, or isotopic measurements of oxygen sensitive sediments, soils, or microbial mats in choosing a preservation method.