Microbes and minerals from two ferruginous lakes on a spectrum of physical and chemical characteristics

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Our current work is exploring the microbial reactions and minerals forming and dissolving within two permanently stratified Midwestern lakes. The anoxic bottom waters of these lakes contain > 1000 μM Fe^{2+}, and hence are considered ferruginous. As such these lakes hold great promise for understanding the biogeochemistry of ferruginous Archean and Proterozoic oceans, overlain by oxygenated surface water. In particular, we are interested in what microbial reactions contribute to carbon and elemental cycling, and what mineral phases record the current geochemical conditions and microbial activity. These two lakes also represent endmembers in terms of anthropogenic disturbance: one is in a pristine wilderness, with natural factors contributing to its stratification; the second is urban and has become stratified as a result of physical, chemical and biological perturbations. The range of elements inventoried in the two lakes is therfore quite different, which provides an opportunity to see how such stratified aquatic systems responds in terms of the minerals produced, and the microbial activities supported. I will present data and interpretations from aqueous geochemistry and stable isotopes of the water column and sediments, culturing, incubations, and DNA-based approaches to assess microbial activity, calculations and modeling that inform the trends seen in the data, and a variety of microscopic, spectroscopic, and analytical tools to unravel how reactions in a ferruginous water column are reflected in the sedimentary record.