Isotopic Analysis of Purple Sulfur Bacteria and the Environmental Conditions of Lakes in Indiana and the Pacific Northwest: Water Column Characterizations for Use in Developing a Water Column Profiling Device

Daniel L. Orazi, Brock Mehringer, Shan Khan
Department of Earth Sciences, School of Science, IUPUI

A better understanding of purple sulfur bacterial geochemical signatures within natural anoxic lakes will provide essential information for the fabrication of a device to isolate and sample the biomass. Purple sulfur bacteria are sulfide (H_2S) oxidizing phototropic organisms. They utilize the process of anoxygenic photosynthesis, the reaction of a reducing agent other than water (H_2O) and light energy, to produce chemical energy. Dissolved oxygen inhibits the anaerobic respiration of the bacteria causing blooms, or clusters of cellular mass, to form in very restricted conditions. Sulfide is produced by another class of microorganisms called sulfate reducing bacteria. Purple sulfur bacteria must form near the transitional layer between aerobic and anaerobic water (known as the chemocline); at a depth light can reach (photic zone); and in the presence of reduced sulfur. Environments conducive to the development of purple sulfur bacteria can be further understood by isotopic analysis. Samples of lake water from various depths were taken and filtered to isolate the bacteria, and preserve the dissolved sulfate and sulfide. Sulfate was precipitated as $BaSO_4$, and sulfide was extracted using acid volatile extraction (AVS) to trap Ag_2S for analysis using mass spectrometry. Sulfur and oxygen isotopes in the samples allow for a comparison between Northern Indiana and Pacific Northwest lakes. Research is ongoing, but the lakes in Indiana have higher lower concentrations of sulfate (~10mM) compared to the Pacific Northwestern lakes (20 to 100mM). Sulfide concentrations are extremely high in the Pacific Northwest lakes (up to 30 mM), possibly reflecting high rates of sulfate reduction and high concentrations of sulfate. Combined, this research will give insight on the nature of anoxic bacterial systems and how they change sulfur isotope composition. The research also provides the opportunity to understand the sedimentary record of the geologic past.

Mentors: William P. Gilhooly III, Department of Earth Sciences, Purdue School of Science, IUPUI; James H. Harris IV, Department of Earth Sciences, Purdue School of Science, IUPUI; Horia Petrache, Department of Physics, Purdue School of Science, IUPUI; Merrell Johnson, Department of Physics, Purdue School of Science, IUPUI