McMaster University

School of Geography & Earth Sciences
SEMINAR SERIES 2011-12

Insight on biogeochemical processes affecting geologic and environmental systems from high resolution redox geochemistry

Greg Druschel,
Associate Professor
Department of Earth Sciences
Indiana University- Purdue University Indianapolis (IUPUI)

Au-amalgam microelectrodes allow in situ, real time determination of a host of redox species, including a number of O, Fe, Mn, S, and As species that are critical energy sources for many microorganisms. The collection of this data also facilitates observations of speciation changes that are reshaping our picture of sulfur and iron speciation in many key environments. Current work at Yellowstone National Park, caves in central Italy, and microbial mats in BC, Guerrero Negro, and Milos (Greece) have provided fascinating evidence for the role of polysulfides and nanoparticulate elemental sulfur particles in sulfur cycling linked to microbial function. We can also delineate ecological niches associated with specific metabolic capabilities at micron scales in these environments and describe chemical changes in redox chemistry that tracks specifically with significant shifts in conditions and microbial mat populations.

Additionally we have used these tools to characterize changes in redox chemistry at and around the sediment-water interface in freshwater lakes and the control on nutrient fluxes between a water column and sediment reservoir this can exhibit. Seasonal, diel, and even shorter term, more chaotic events can play a significant role in the feedback between harmful algal blooms and the chemistry occurring over time in this critical sediment-water interface zone. We have been able to characterize the timing of redox fluctuations tied to nutrient changes and cyanobacterial ecology and neurotoxin production of primary concern with these harmful algal blooms, and quantify the intensity and direction of nutrient flux to/from the sediment as redox conditions change. We are also currently embarking on a new project with even higher resolution monitoring of the physical, chemical, and biological conditions of a model lake system to understand how changing physicochemical conditions can trigger, propogate, sustain, and terminate a bloom.

Tuesday February 28, 2012, 1:30 p.m.
General Science Building Room 330

School of Geography & Earth Sciences