2018 Geodynamics Seminar

NanoSIMS and Stable Isotope Probing for Quantitative Microbial Biogeochemistry

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Tuesday, February 6, 2018
1:30 – 2:30pm
Clark Lab 507, Quissett Campus, WHOI

Abstract

Microbial cells (both autotrophic and heterotrophic) produce, metabolize, and alter organic material in aquatic ecosystems. The individual activities of these single cells are ultimately responsible for the biogeochemical cycling of major elements on earth. In order to gain a mechanistic and quantitative understanding of such microbial activities, our group uses the strategy of adding stable isotope labeled substances to track their incorporation into cellular biomass. We use several approaches for this, most of them taking advantage of the NanoSIMS instrument, an imaging secondary ion mass spectrometer that allows quantification of isotopes with nanoscale spatial resolution. I will discuss a few examples of this approach where we have examined bacterial niche partitioning for organic matter incorporation, transfer of C and N between autotrophic and heterotrophic microbial cells, and degradation of particulate organic matter. I will conclude with some possible ideas about how such isotope incorporation data can be integrated with other microbial measurements (bulk processes, high-throughput ‘omics data, etc) to better understand and ultimately predict microbial responses to a changing environment.