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Saito Lab Marine Bioinorganic Chemistry: Metalloenzymes in Oxygen Minimum Zones

Collaborators

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PROJECT SUMMARY

Metalloenzymes are often at the heart of biogeochemical cycles, catalyzing critical reactions that allow life to sustain itself on Earth. In the marine environment, microbial communities produce the metalloenzymes that influence carbon cycling (Fe, Mn, Cu, Zn, Co, Cd), nitrogen cycling (Fe, Cu, Ni, Mo), and organic matter degradation (Zn, Co, Ni) to name a few examples. Yet the oceans are extraordinarily depleted in many biologically important metals: Fe, Co, Ni, Cu, and Zn are found at nanomolar or lower concentrations in surface waters. Due to the analytical challenges associated with these low abundances, our understanding of how the scarcity of metals affects metalloenzyme biosynthesis and the corresponding biogeochemical cycles is in its infancy. Important questions have yet to be answered: what are the distributions of key metalloenzymes and their microbial hosts? How are metalloenzyme distributions governed by metal and oxygen distributions? How do those abundances affect biogeochemical processes such as primary production, denitrification, and carbon remineralization? How will climate change affect many biogeochemical processes catalyzed by metalloenzymes? In this study, we are applying new quantitative and discovery-based proteomic technologies to characterize the metalloenzymes found in the oxygen minimum zone of the South Pacific. A combination of culture studies and field analyses are being carried out to build a capability for the study of metalloenzymes in the oceans.

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Mail: Woods Hole Oceanographic Institution, 266 Woods Hole Road, Woods Hole, MA 02543, USA.
E-Contact: info@whoi.edu; press relations: media@whoi.edu, tel. (508) 457-2000
Problems or questions about the site, please contact webdev@whoi.edu