

Saito Lab Marine Bioinorganic Chemistry: Welcome to the Saito Lab - Marine Bioinorganic Chemistry

Marine microbes exert an enormous influence on the cycling of chemical elements in the marine environment. These elements include the relatively abundant carbon, nitrogen, and phosphorus, as well as rarer trace elements such as iron, cobalt and zinc that are essential micronutrients. It is the biogeochemical cycling of these elements that creates that foundation on which life subsists. These biogeochemical cycles must have co-evolved with life throughout the history of the Earth, and they are fundamental to our understanding of key environmental problems such as climate change and pollution control. In recent decades it has become evident that metals have an important role in influencing marine biogeochemical cycles, with ~30% of the ocean phytoplankton productivity and as much as 70% of nitrogen fixation being limited by the micronutrient iron. Other metals and metal-containing molecules such as the cobalt containing vitamin B₁₂ appear to be also influencing the species composition or are colimiting productivity.

The unique chemistry of seawater creates a selection pressure for novel use of metals in the oceans that is understudied and largely unknown.

In the Saito laboratory, we study the interactions between metals and microbial life using a combination of cutting-edge analytical chemistry and proteomic technologies. We also conduct metal physiological studies with cultures of marine microbes that we and others have isolated from marine environments from the Costa Rica Dome to the Ross Sea of Antarctica. The scientific questions we study relate to understanding the geographical distributions, chemical transformations, and ecological and biochemical importance of bioactive metals and micronutrients, such as iron, cobalt, zinc, cadmium, nickel, manganese, and vitamin B₁₂, in the modern ocean. In addition, we study how the metal requirements in life might have coevolved with biogeochemical cycles throughout Earth history. With human economies now large enough to impinge upon many biogeochemical cycles, obtaining an understanding of the mechanisms that create and maintain these cycles is important component of achieving sustainable economies. Our laboratory focuses on adapting and developing complex analytical chemistry and biomedical [proteomic techniques](#) for use on natural samples and physiological culture experiments in order to gain insights into these areas of study.

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The sea-ice edge in McMurdo Sound, the Ross Sea of Antarctica, where we conducted field research on sea-ice algae genomics and proteomics, and iron geochemistry in January and November of 2009. (Mak Saito)



[Enlarge Image](#)

Mak Saito water column sampling on the sea-ice over the McMurdo Sound and the Ross Sea in November 2009. During this expedition we traversed and camped on the sea-ice with a mobile trace metal laboratory.



[Enlarge Image](#)

An iceberg observed in the Ross Sea.

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