

The role of colloidal iron species in the marine environment

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Iron (Fe) is the fourth most abundant element in the earth's crust and composes roughly 5% of continental material by weight. In contrast, in the oceans Fe is not very soluble, and so dissolved Fe has very low concentrations. However, marine phytoplankton need Fe for photosynthesis and other cellular functions, which has led to the observation that in ocean regions far from Fe sources, phytoplankton growth can become limited by the flux of available Fe. This has a direct influence on the food web and also on global climate, since these plankton serve as a major vector of carbon transport from the surface ocean to long-term sequestration in the deep sea via the biological pump.

In this talk I will explore the influence of colloidal Fe on the fate of Fe in the marine environment. Colloids are group of compounds defined by their size: they are small enough to pass through the 0.2 μm filters that we use to define dissolved species; however, they act much more like particles because they are distinct from their surrounding solvent milieu and compose the very largest sized compounds in the dissolved phase. I will address the abundance and distribution of these colloidal Fe species in the global ocean, as well as the methods we use to monitor their presence. Then I will remark on the elusive chemical composition of marine colloidal Fe – organic or inorganic Fe compounds – and the effect that this might have on the bioavailability of colloidal Fe to marine phytoplankton. Finally, I will summarize some new analytical measurements of colloidal Fe in my lab including stable isotope measurements, synchrotron imaging, and the measurement of the colloidal Fe size distribution, and I will conclude with what these novel measurements may suggest about the role of colloids in marine Fe cycling.



Photo taken at the British Antarctic Survey Rothera Research Station on Adelaide Island, West Antarctic Peninsula