

Oceanography Seminar

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“Is a cobalt a limiting nutrient in the oceans?
A macro view of an overlooked
micronutrient.”

Phytoplankton growth in the ocean depends on an adequate supply of over a dozen elements to sunlit waters. Of these elements, the metal cobalt is found at the lowest concentrations in seawater and several nutrient amendment experiments have suggested a role for cobalt in regulating phytoplankton production. However, it has been difficult to extrapolate from these incubations because measurements of cobalt in seawater are sparse and the amount of cobalt needed by important phytoplankton groups is unknown.

I will present results from over 1000 measurements of dissolved cobalt from two full-depth transects in the Pacific Ocean, which show a cobalt cycle that is strongly influenced by dissolved oxygen. Low oxygen conditions appear to enhance coastal Co sources and inhibit Co removal by scavenging, leading to predictions that the ocean's cobalt inventory may vary synchronously with the size of oxygen minimum zones. Globally, the lowest cobalt concentrations are found in the surface waters of the South Pacific gyre, an environment inhabited by the cyanobacterium *Prochlorococcus*. Culture experiments, theoretical calculations, and quantitative proteomic measurements indicate that this organism can survive with less than 100 cobalt atoms per cell. This extraordinarily small requirement ensures that other nutrients, notably iron, will be exhausted before cobalt can be fully depleted, helping to explain the persistence of cobalt-dependent metabolism despite its scarcity in the modern ocean.

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*The speaker is a candidate for a faculty position in the Department of Oceanography.