An oxygen-driven Cobalt cycle in the tropical Pacific Ocean

Cobalt is the least abundant inorganic nutrient in the ocean, but whether it is a limiting nutrient remains an open question. While some bottle incubations have suggested enhanced cyanobacterial growth in response to exogenous cobalt additions, scaling these observations to the global ocean demands a more thorough description of the marine cobalt cycle. I will present dissolved cobalt concentrations in over 1000 samples collected onboard two cruises in the Equatorial and South Pacific Ocean, including the 2013 U.S. Geotraces expedition. Together, these measurements indicate a strong association between elevated dissolved cobalt and the upper oxygen minimum zone along the eastern margin, matching similar observations in the North and South Atlantic. This plume appears to be maintained by three processes: 1) a cobalt supply from organic matter remineralization, 2) low-oxygen inhibition of manganese oxidation, which scavenges dissolved cobalt from the water column, 3) an amplified sedimentary source from oxygen-depleted coastlines. Upwelling along the Peru margin delivers dissolved cobalt to the euphotic zone, and biological uptake and export return cobalt to depth in concert with phosphate. Because all of these processes are tied to the strength and extent of the oxygen minimum zone, oceanic cobalt inventories are likely dynamic on the span of decades and may affect phytoplankton nutrition on such timescales.