

Isotopic Composition of Cadmium in the Equatorial Pacific Ocean

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Project Summary:

Cadmium concentrations in foraminifera and seawater have long been used as a paleoproxy for phosphate in the past ocean^{1,2} and cadmium isotope analyses in seawater are now the subject of growing interest due to observed fractionation in surface waters- from biological activity- and uniform composition in deep waters^{3,4,5,6}. The upcoming US GEOTRACES cruise holds great promise for cadmium isotope work, and the following fulfill three of the four principal scientific objectives for the Peru-Tahiti section.

Samples collected in Peru's upwelling zone are analogous to, and will complement, those being collected for our current study of cadmium isotopes in the California Current Upwelling Zone. These two regions of intense upwelling are of interest because they lead to high primary productivity which increases cadmium uptake, isotope fractionation, and particle scavenging. By comparing and contrasting these samples, we will greatly expand upon what is known of biologically influenced cadmium isotope fractionation.

Samples collected in the denitrified zone (i.e., nutrient limited waters) will allow us to observe how primary producers utilize cadmium under low trace metal concentrations. Marine phytoplankton preferentially incorporate lighter isotopes of cadmium⁴, but it has been hypothesized that biological isotopic fractionation ceases in extremely cadmium depleted waters- i.e., every cadmium atom encountered is utilized⁶. Evaluation of cadmium isotopes in seawater and particulates of this region will allow us to evaluate this hypothesis. Additionally, complimentary trace metal concentration analyses (Zn, Fe, Mn) will help us evaluate the in situ applicability of laboratory culture studies that have shown Cd is utilized more when Mn, Fe and Zn are depleted^{7,8}.

Samples collected in waters from the hydrothermal plumes of the East Pacific Rise will help us categorize how much cadmium is derived from hydrothermal activity. It is currently unknown how much seawater soluble cadmium originates from hydrothermal vent activity; comparing the isotopic composition of the hydrothermal plume waters to surrounding deep water will help us assess its contribution to the oceans.

References:

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