Biogeochemical cycling of cadmium in the South West Pacific Ocean

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The biogeochemical cycling of cadmium (Cd) is likely to be an important component of the ocean's biological pump and thereby global climate. Moreover, the nutrient-like distribution of Cd and its linear relationship with phosphate makes Cd a useful proxy of past nutrient utilization in the oceans. However, the processes controlling the distribution and uptake of Cd remain poorly understood.

As a diagnostic tracer, stable isotopes of Cd have the potential to offer more insight about the biogeochemical cycling of Cd in the oceans. Additionally, Cd stable isotopes may in itself act as a potential proxy for the past and present nutrient utilisation. The limited data acquired so far shows considerable variability in the Cd isotopic composition between different regions, suggesting the influence of different processes including biological uptake, particle scavenging, atmospheric input and the mixing of different water masses. Further studies are therefore required to understand more about the marine cycling of Cd.

The simultaneous collection of Cd isotopes using Multiple Collector Inductively Coupled Plasma Mass Spectrometry (MC-ICPMS) with double spiking protocols has increased the ability to measure Cd isotopic fractionation with uncertainties at the 0.01% level. Using these methods, we present measurements of Cd isotopic composition and concentration for water samples collected from a comprehensive suite of depth profiles during the GEOTRACES GP13 zonal section. This cruise transect extends for 5,500 km from offshore Australia to the remote interior of the subtropical Pacific Ocean. There is a strong longitudinal gradient, with respect to the supply of trace metal-bearing dust and phytoplankton biomass, along this transect, allowing the biogeochemical cycling of Cd, in relation to other micro- and macro-nutrients, to be systematically investigated across a gradation of changing oceanographic settings.