Biogeochemical cycling of ultra-trace levels of cadmium in the Southwest Pacific Ocean

C.H. STIRLING[1,*], E. GEORGE[1], M. GAULT-RINGOLD[2]

[1] Dept. Chemistry, Univ. Otago, Dunedin, New Zealand *cstirling@chemistry.otago.ac.nz
[2] IMAS, Univ. Tasmania, Hobart, Australia

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 utilisation in the oceans. However, the processes controlling the distribution and uptake of Cd remain poorly understood, especially in oceanic areas where the supply of Cd and other trace metal micro-nutrients, such as Fe and Zn, is extremely limited.

As a diagnostic tracer, stable isotopes of Cd have the potential to offer additional insight into the biogeochemical cycling of Cd in the oceans. 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 paired measurements of Cd isotopic composition and concentration for water column samples collected from a comprehensive suite of 8 depth profiles along 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, an understudied region of the world's oceans, where Cd concentrations in the upper water column are at ultra-trace levels, and some of the lowest detected globally. There is also 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. This comprehensive dataset provides important constraints on the systematics of the oceanic Cd isotope system when Cd concentrations are at sub-picomolar levels, and reveal an unexpected cyclicity in the character of Cd isotope fractionation from west to east across this zonal section that is not detected from measurements of Cd concentration alone.