

Cadmium isotopes along the Line-P transect in the Northeast Subarctic Pacific

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Cadmium (Cd), a trace metal micronutrient for marine phytoplankton, has a dissolved oceanic distribution which shows a strong correlation with the macronutrient phosphate (PO_4^{3-}) [1]. Stable Cd isotopes exhibit significant oceanic variations that are controlled by the interaction of biological Cd utilization and physical ocean circulation [2, 3]. While Cd isotope data are available for the Atlantic Ocean (see compilation in [3]) and the Southern Ocean [2, 3], few data exist for the Pacific Ocean.

Here we present the first high-resolution depth ($n=25$) profile as well as the longitudinal Line-P transect for [Cd] and stable isotope fractionation in the North Pacific. Surface samples show heavy $\epsilon^{112/110}\text{Cd}$ values consistent with biological fractionation with a fractionation factor (α) of 1.00025 ± 2 , in agreement with that previously reported for the HNLC Southern Ocean [2, 3]. Below 150 m depth, $\epsilon^{112/110}\text{Cd}$ values show remarkably uniform behavior with an average of 1.11 ± 0.15 (2SD). Dissolved [Cd] is decoupled from PO_4^{3-} within the Northeast Pacific oxygen deficient zone. This decoupling is driven by a depletion of dissolved Cd beginning at a depth of approximately 300 m and a dissolved oxygen concentration of $50 \mu\text{mol kg}^{-1}$, while PO_4^{3-} continues to increase in a typical nutrient-type distribution [4]. Samples collected along the longitudinal transect from a coastal to an oceanic environment show [Cd] and $\epsilon^{112/110}\text{Cd}$ gradients along isopycnals, with both concentration and $\epsilon^{112/110}\text{Cd}$ elevated in coastal samples.

[1] Boyle *et al* (1976) *Nature* **263**, 42-44 [2] Abouchami *et al* (2014) *Geochim. Cosmochim. Acta*, **127**, 348-367 [3] Xue *et al* (2013) *Earth Planet. Sci. Lett.* **382**, 161-172 [4] Janssen and Cullen (2012) *AGU fall meeting abstr.* OS24E-08