The Seasonal Distribution and Controls of Bioactive Trace Elements Cadmium and Cobalt in the Southern Ocean, Atlantic Sector.

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This study reports on the meridional and seasonal variation of trace metals in the Southern Ocean where a high-nutrient low-chlorophyll (HNLC) paradox subsists. The seawater collection method – an adaptation of the GEOTRACES method – facilitated the collection of uncontaminated seawater samples during the austral summer and winter (2015). A *SeaFAST ™* system coupled with ICP-MS, allowed the accurate and precise quantification of up to 10 trace elements (Al, Zn, Cu, Fe, Mn, V, Cd, Co, Pb and Ni) simultaneously. Here we report on the distribution and controls of Co and Cd in different water masses in the Atlantic Sector of the Southern Ocean – located proximal to the SAF (46°S), the AAZ (54°S) and south-eastern Weddell Gyre (65°S). The depletion of dissolved Co (DCo) and Cd (DCd) in the sub-surface euphotic layer can be attributed to biological uptake by marine phytoplankton. DCd exhibits a typical nutrient-like profile, with biological uptake in the sub-surface and conservative behaviour thereafter. The concentrations ranged from 125 ± 3.8 pmol/kg to 836 ± 6.1 pmol/kg. The Cd/P surface correlation (R^2 = 0.94) in the Weddell Gyre exemplified that biological utilization was proportional to phosphate. Conversely DCo demonstrated a typical hybrid-type vertical distribution – nutrient uptake and remineralization in the sub-surface succeeded by scavenging due to an affinity for organic complexation. The concentrations ranged from 9.46 ± 0.12 pmol/kg to 38.4 ± 1.4 pmol/kg. High surface DCo concentrations and a poor but significant DCo/salinity correlation ($R^2 \leq 0.301$) suggest atmospheric input as a source for DCo. Further, an inter-calibration station was performed at 54°S. The locale at 46, 50 and 54°S will form the centre of a seasonal comparative effort aimed at establishing the role of marine phytoplankton on trace metal cycling and vice versa. Ultimately the study will report the interpreted data from 10 stations in the Southern Ocean, Atlantic Sector. The elucidation of these interactions will advance the understanding of trace metal cycling and source regions in the Southern Ocean.