The relationships of dissolved Cadmium with major nutrient Phosphate along the Ocean Conveyor of the West Atlantic Ocean

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The metal Cadmium (Cd) has been known since the 1970s to correlate with major nutrient phosphate (PO_4). This metal-nutrient relationship exhibits a so-called kink - a change in the steepness of the slope - at a PO_4 concentration of ~1.3 μmol kg^{-1}. The origin of this kink has been the subject of much debate. Usually data to the left of the kink is from the surface ocean and data to the right is from the deep ocean, but this division is not valid for all ocean regions. We use data from the GEOTRACES–NL section along the entire West-Atlantic Ocean (track length: 17500 km) to shed new light on the Cd distribution in general, the Cd-PO_4 relationship, and its kink. This large data set encompasses >1400 samples in major water masses of Antarctic and Nordic origin. We employ extended optimum multiparameter analysis to distinguish the presence of the different water masses. It becomes evident that straightforward mixing of different endmembers with varying Cd-PO_4 compositions fully explains the basin-scale observations, including the much discussed kink. Remineralisation of biogenic particles in combination with water mass mixing explains the remaining, finer scale details. More research is needed to determine if the relative depletion of Cd in the Atlantic Oxygen Minimum Zone is the result of scavenging, or alternatively, the result of the Cd/P ratio of the exported particles from the productive surface ocean. A combination of both processes is not unlikely. More research is also needed to unravel the origin of the different Cd/PO_4 uptake ratios and the resulting remineralisation ratios in different ocean regions, but it could be the mere availability of Cd that plays a dominant role. Even though the actual cause for the varying Cd/P ratios remains to be conclusively determined, it is apparent that there is variation and the use of a constant, Redfield-like Cd-PO_4 ratio is unwarranted. This in turn affects the use of Cd/Ca in foraminifera as a paleotracer to infer past nutrient concentrations.