# Cadmium isotopic composition in the water column of the Northwestern Pacific Ocean

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We have determined dissolved Cd isotopic composition to investigate the biogeochemical and physical processes controlling Cd cycling in the two hydrographic related regions of the Northwestern Pacific Ocean (NWPO), including the Western Philippine Sea (WPS) and a meridional transect across the Kuroshio-Oyashio extension (160 degree E from 30 to 50 degree N). The hydrographic and biogeochemical parameters in the surface water and the thermocline vary drastically among the extension stations, with the parameters in the Kuroshio extension stations comparable to the WPS, providing an ideal platform to evaluate the relative importance of biogeochemical and physical processes on regulating Cd cycling in the water. We found that both Cd elemental and isotopic composition and hydrographic parameters in the water below 3000 m among all stations were constant. In the thermocline of the two most northern stations, where hydrographic parameters are vertically homogeneous, we found that Cd concentrations are extremely high, increasing from 1.0 to 1.1 nM in the zone from 1000 and 200 m but the isotopic composition are relatively comparable, ranging from +1 to +2 ε. The high Cd concentrations may be attributed to the decomposition of sinking particles. Relatively, the hydrographic parameters in the thermocline of the Kuroshio extension stations exhibit that the thermocline are composed of different water masses, where the Cd concentrations increase from 0.04 to 0.86 nM and the isotopic composition decrease from +8 to +3 ε with depths. The elemental and isotopic variations may be attributed the intrusion of the North Pacific Tropic Water and North Pacific Intermediate Water to the thermocline. The isotopic composition in the surface water elevates significantly for all of the stations, generally ranging from +3 to +10 ε. The variations may reflect the different effects of various processes among different stations, which can include biological uptake, sinking particle formation and/or aerosol inputs. Our results exhibit that physical mixing predominately control Cd cycling in the thermocline and deep water and biogeochemical processes may dominate the cycling in the surface water of the NWPO.