

Short-lived Thorium isotopes as tracers of TEI Export and Remineralization

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We plan to submit a proposal to participate in the GP17, US GEOTRACES legs from Tahiti-Chile-Antarctica. We will focus on the shorter-lived thorium isotopes, Thorium-234 ($t_{1/2} = 24.1$ d) and Thorium-228 ($t_{1/2} = 1.8$ y). ^{234}Th is an ideal tracer of water column particle export and remineralization on biologically driven timescales. We have demonstrated that we can reduce the volume sampled for total ^{234}Th to 2 L with high precision and accuracy by bringing onboard our lab van outfitted with a large number of beta counters (six, 5 sample beta counters) for longer and multiple ^{234}Th counts while still at sea. This allows us to process even more sample depths to obtain the highest spatial resolution possible for quantifying particle associated export of TEIs and their remineralization in the upper several hundred meters. Measurements of ^{228}Th will be in the second GEOTRACES leg along the Chilean and Antarctic margins, where the ^{228}Ra source of ^{228}Th from the margin is larger and particle removal processes are greater. Dissolved ^{228}Th concentrations would be collected using Mn-impregnated cartridges in collaboration with Charette and Moore. As shown in prior studies, both Th isotopes are empirically linked to the fluxes of C, N and the TEI's by their ratio on particles, collected here via large volume *in-situ* pumps. Thus, we also propose to use *in-situ* pumps to sample particulate ^{234}Th (small and large particles) and dissolved (on Mn cartridges) and particulate ^{228}Th at selected sites. While our focus will be on quantifying export and remineralization, the dissolved and particulate Th data is also useful when coupled with longer lived Th isotopes, measured by other PIs, to model particle cycling. For ^{234}Th , sampling and onboard measurements require one berth. Depending upon the number of pump and cartridge samples collected for ^{234}Th and ^{228}Th and potential collaborations, a second berth may be needed.