



Does $^{234}\text{Th}/^{238}\text{U}$ disequilibrium provide an accurate record of the export flux of particulate organic carbon from the upper ocean?

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ABSTRACT: The magnitude of the flux of biogenic particulate organic carbon (POC) exported from the surface waters of the world ocean and remineralized at depth is critical to constraining models of the global carbon cycle, yet remains controversial. The use of upper ocean sediment traps is still one of the primary tools for determining this export flux, although trap fluxes have been shown to vary significantly because of hydrodynamic and sample collection biases. Over the past decade, ^{234}Th increasingly has been used as a tracer to estimate POC export from the euphotic zone by multiplying the depth-integrated ^{234}Th flux by the POC/ ^{234}Th ratio of sinking particles. The accuracy of this technique is highly dependent on the natural variability in the POC/ ^{234}Th ratio and ^{234}Th flux, yet the significance of this variability to estimates of POC export remains uncertain. Based on an analysis of new ^{234}Th and POC data from the Labrador Sea and a review of 25 previous independent field studies, we report that POC export fluxes can vary 2-10 times or more solely because of variability in the POC/ ^{234}Th ratio and procedures used to estimate the ^{234}Th flux. Recommended improvements include studies of the biological, chemical, and physical mechanisms controlling ^{234}Th -organic matter interactions in seawater; detailed comparisons of POC/ ^{234}Th ratios in size-fractionated and sediment trap material; increased spatial and temporal sampling density of ^{234}Th ; and more standardized procedures to calculate the ^{234}Th export flux.

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