

Particulate organic carbon export flux in the Bay of Bengal and the Indian Ocean using ^{234}Th - ^{238}U and ^{210}Po - ^{210}Pb disequilibria

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The naturally occurring radionuclide tracers, ^{234}Th - ^{238}U and ^{210}Po - ^{210}Pb pairs, were measured in the Bay of Bengal and the Indian Ocean along a N - S transect from 20 °N to 25 °S during 2014 as a part of the Indian GEOTRACES program to evaluate export variability of organic carbon in the Euphotic zone. Seawater profiles for total (dissolved + particulate) activities of ^{234}Th and ^{210}Po - ^{210}Pb were measured at 13 and 7 stations, respectively. Particulate organic matter was collected at 200 m depth and measured for organic carbon and activity of ^{234}Th , ^{210}Po and ^{210}Pb .

Chlorophyll peaks were found between 50 - 100 m depth except at a station where MLD is deep (150 m). Its concentration varied between 0.5 - 3.9 mg m⁻³ at all stations and the peak value occurred at 20 °N in the Bay of Bengal. Oxygen profiles revealed that the water column was hypoxic to anoxic at depths where ^{234}Th was released. Excess of ^{234}Th immediately below the surface deficit are indicative of particle remineralization by heterotrophic bacteria and zooplankton. In general, ^{234}Th was released in the water column below the chlorophyll peak (150 m). In the Southern Bay of Bengal, in addition to microbial degradation of organic matter, ^{234}Th was also released from waters below 300 m (3.86 - 3.59 dpm L⁻¹), possibly due to episodic export events and/or intrusion of high saline seawater to the Bay of Bengal at 300 m depth, thus transporting POC from regions of high export. POC measured at 200 m depth ranged from 0.45 - 1.78 μM L⁻¹ and organic carbon export varied from ~0 to 9.4 mmol m⁻² d⁻¹; maximum POC and organic carbon export occurred at 2 °N. Though northern Bay of Bengal showed more POC (0.65 - 0.93 μM L⁻¹), most of the carbon was utilized at the sub-surface depths by microbes and no significant amount was exported to the bottom.

Profiles of ^{210}Po - ^{210}Pb measured concurrently at alternate stations showed high ^{210}Pb (19.82 dpm 100 kg⁻¹) in surface waters of northern Bay of Bengal (18 °N). ^{210}Po based organic carbon export varied from ~0 to 14.1 mmol m⁻² d⁻¹. High organic carbon export (14.1 mmol m⁻² d⁻¹) at 18 °N was not captured by ^{234}Th - ^{238}U disequilibrium technique due to high riverine sediment flux, whereas the high value of 6.3 mmol m⁻² d⁻¹ at 2 °N was in agreement. Considerably less POC export flux was found at other stations.