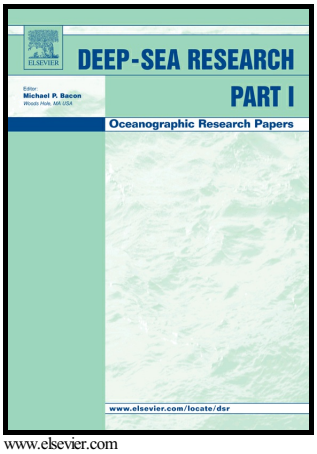

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Biogeochemical flux and phytoplankton succession: a year-long sediment trap record in the Australian sector of the Subantarctic Zone.

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Abstract

The Subantarctic Zone (SAZ) plays a crucial role in global carbon cycling as a significant sink for atmospheric CO_2. In the Australian sector, the SAZ exports large quantities of organic carbon from the surface ocean, despite lower algal biomass accumulation in surface waters than other Southern Ocean sectors. We present the first analysis of diatom and coccolithophore assemblages and seasonality, as well as the first annual quantification of bulk organic components of captured material at the base of the mixed layer (500 m depth) in the SAZ. Sediment traps were moored in the SAZ southwest of Tasmania as part of the long-term SAZ Project for one year (September 2003 to September 2004). Annual mass flux at 500 m and 2000 m was composed mainly of calcium carbonate, while biogenic silica made up on average <10% of material captured in the traps. Organic carbon flux was estimated at 1.1 g m^{-2} y^{-1} at 500 m, close to the estimated global mean carbon flux. Low diatom fluxes and high fluxes of coccoliths were consistent with low biogenic silica and high calcium carbonate fluxes, respectively. Diatoms and coccoliths were identified to species level. Diatom and coccolithophore sinking assemblages reflected some seasonal ecological succession. A theoretical scheme of diatom succession in live assemblages in compared to successional patterns presented in sediment traps. This study provides a unique, direct measurement of the biogeochemical fluxes and their main biological carbon vectors just below the winter mixed layer depth at which effective sequestration of carbon occurs. Comparison of these results with previous sediment trap deployments at the same site at deeper depths (i.e. 1000, 2000 and 3800 m) documents the changes particle fluxes experience in the lower "twilight zone" where biological processes and remineralisation of carbon reduce the efficiency of carbon sequestration.

Keywords

Diatoms; coccolithophores; sediment traps; Subantarctic Zone; mass flux; Southern Ocean

1. Introduction