Geophysical Research Abstracts, Vol. 7, 10581, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10581

Role of hydrostatic pressure on surface marine prokaryotes responsible for biogenic silica dissolution during a simulated diatom sinking experiment

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Most of the organic material produced in the euphotic zone (photosynthetic production) is respired in the upper layer of the ocean. However, part of this production is exported deeper. During its transit towards the seafloor, the largest pool of particulate organic carbon (POC) is remineralized into inorganic forms and only a small fraction of the organic matter leaving the euphotic zone reaches the bottom floor. Currently, models of POC mineralization assume that a constant fraction of the organic carbon exported from the euphotic zone is remineralized at a given depth (Martin et al., 1987). Recently, Armstrong et al. (2001) argued that fluxes of ballast minerals (biogenic silica or diatom opal, carbonate biominerals, and dust) are determinant for the deep-water POC fluxes, so that a mechanism-based model of POC export must simultaneously model both POC and ballast minerals fluxes. Diatoms tend to dominate phytoplankton communities in many oceanic systems, contributing significantly to total primary production as well as to downward fluxes of biogenic silica and organic matter towards the seafloor (Honjo et al., 1995; Tréguer et al., 1995; Smith et al., 1996). Even though regeneration is now known to play a major role in the oceanic silicon (Si) cycling, the mechanisms that regulate this process are not well understood in particular in mesopelagic and bathypelagic realms. Current biogeochemical models are based on the assumption that biogenic silica dissolution is controlled by temperature, zooplankton grazing and diatom aggregation rate (Tréguer et al., 1989; Nelson et al., 1995; Dugdale & Wilkerson, 1998). However, nothing is known the (biotic and abiotic) effect of the hydrostatic pressure on silicic acid regeneration during particles fall. This talk will focus on the roles of the prokaryotic community in the mineralization of organic matter throughout the meso- and bathypelagic zones. In order to obtain significant measurement of degradation rates of particulate material during its descent through the water column we developed an special device, called PArticles Sinking Simulator (PASS), to simulate particle sinking down to 4000 m deep. This equipment will allow sampling of aliquots without decompression of the main culture, nor of the aliquot fraction, so measurements of microbial activities will be processed without decompression at any stage of the experiment. The uniqueness of our equipment allow laboratory simulations of hydrostatic pressure increase experienced by bacteria attached to particles during their sinking throughout the water column. We demonstrated that increase in hydrostatic pressure conditions alters bacterial mineralization rates and slows down the regeneration of silicic acid during their fall throughout the water column. We also follow the effect of hydrostatic pressure on the structure of the attached to particles prokaryotic community sinking through the water column.

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