DISSOLUTION OF BIOGENIC SILICA IN ADRIATIC WATER MASSES

P. Del Negro [1]*, A. Bergamasco [2], M. Celussi [1], C. Comici [1], E. Crevatin [1], C. Falconi [1] and M. Giani [1]
[1] Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS BIO - pdelnegro@ogs.trieste.it
[2] CNR ISMAR

Abstract

Dissolution of diatom biogenic silica (BSiO2) and its control by prokaryotic activity were investigated in different Adriatic water masses.

Keywords: Adriatic Sea, Biokinetics

In the Adriatic sea, diatoms are the most important primary producers and represent the basis of pelagic and benthic coastal food chains. Orto-silicic acid [Si(OH)4] is an essential requirement in the formation of diatom frustules and its availability depends on both external inputs and internal recycling. Although the recycling of biogenic silica (BSiO2) at the sediment-water interface has already been quantified in different environments (1), very little is known about the processes of the silica cycle that occur along the water column, particularly below the euphotic zone. The silica cycle in Adriatic coastal ecosystem is now receiving much attention, because the increased P limitation conditions is changing the chemical composition of coastal waters. This may favour drastic modifications to phytoplankton community structure. Current biogeochemical models assume biogenic silica dissolution to be controlled by temperature, zooplankton grazing and diatom aggregation (2) but the role of prokaryotes has not been well established. Prokaryotes utilize the organic matter derived from primary production by varied strategies, including attack on dead and living diatoms by using hydrolytic enzyme, and could hasten silica dissolution by degrading the organic matrix which protects diatom frustule from dissolution. Here we report the results of experiments carried out on three Adriatic waters in which we measured BSiO2 dissolution kinetics and prokaryotic enzymatic hydrolysis. During an oceanographic cruise carried out during December 2007 on bord on Dallaporta CNR vessel, we sampled three different waters (surface - SW, Adriatic Deep Waters - AdDW, Modified Levantine Intermediate Waters - MLIW) in the southern Adriatic basin. 50 L microcosms were incubated under controlled temperature and BSiO2, POC, Si(OH)4 concentrations were analysed at different time intervals. Additionally, the diatom and prokaryotic abundances were detected. Since of the organic matrix is a key biochemical mechanism regulating diatom-silica recycling, we measured protease activity and calculated the enzyme kinetics in order to verify if different environmental conditions induce a variation in the conformation and thus in the efficiency of the enzymes produced. The results showed a fast increase in Si(OH)4 inside the deep and surface waters associated to an increase in enzymatic activity. Prokaryotes mediate potentially rapid but highly variable silicon regeneration rates enhancing the role of microbial loop on diatoms production and their biogeochemical fate in the Adriatic ecosystem.

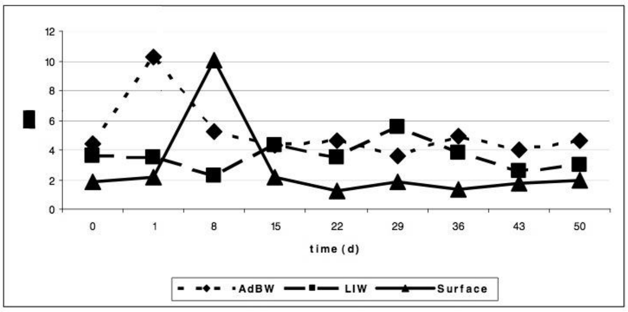

Fig. 1. Time evolution of dissolved silica(µM)

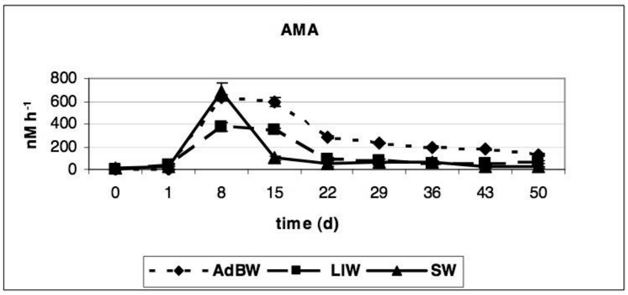

Fig. 2. Time evolution of aminopeptidase activity (AMA) (nM h^{-1})

References

1 - Chauvaud L., Jean F., Ragueneau O. and Thouzean G., 2000. Long term variation of the Bay of Brest ecosystem : benthic-pelagic coupling revisited. *Mar. Ecol. Prog. Ser*., 200: 35- 48.

2 - Bidle K.D. and Azam F., 1999. Accelerated dissolution of diatom silica by marine bacterial assemblages. *Nature*, 397: 508-512.