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Biogeochemical cycling and multilayer production in the Black Sea

A. Yilmaz, Y. Coban-Yildiz, S.Tugrul

Middle East Technical University, Institute of Marine Sciences, P.O. Box 28, 33731, Erdemli, Mersin, Turkey

ayilmaz@metu.edu.tr / Fax: +90 312-2101239

The Black Sea is a unique marine environment representing the largest land-locked/semi-enclosed and deep anoxic basin in the world. The coastal waters of the Black Sea are principally fed by the river input and by the lateral/ vertical nutrient transport mechanisms. In the open ecosystem, which is dominated by the cyclonic eddies, primary production is mainly sustained by the influx of nutrients from the oxic/suboxic lower layers mainly by vertical mixing processes. However, the input from the anoxic layer is limited due to the presence of a permanent pycnocline in the Black Sea which coincides with the oxic-anoxic transition zone. Intense denitrification and redox-dependent processes within this zone also limit nitrogen and phosphorus input to the productive layer.

Planktonic nitrogen productivity and relative importance of NO_3, NO_2 and NH_4 on productivity in the Black Sea were estimated using ^{15}N isotopic technique. Though the main nitrogen source utilised by phytoplankton was NH_4, annual 'f-ratio' was high, which could not be compensated by the estimated budget of new nitrogen input. Available estimations on new nitrogen input to the euphotic zone of the Black Sea corresponded to less than 20 % of annual N-production rate estimated and the direct measurements revaled an f-ratio of 0.3-0.5.

Multilayer systems having anoxia support multiple layers of biological production. In addition to photosynthetic production at the surface layer, microbial communities at the oxic-anoxic interface live on the residual chemical energy originate from anoxic waters. Photosynthetic and chemosynthetic production rates have been measured using ^{14}C isotopic technique in the Black Sea. Present data showed that, chemo-

autotrophic production at O_2-H_2S interface is relatively high in the Black Sea and it is potential mid-water source of sedimentary biogenic particles for the basin related to the microbial activities and red-ox processes which are persistent features in the Black Sea ecosystem.

Carbon and nitrogen natural isotopic ratios (δ^{15}N and δ^{13}C) of suspended particulate organic matter (SPOM) produced in the water column of the Black Sea were also determined in the Black Sea. The results revealed important vertical and regional variations in terms of isotopic composition while the seasonality was less remarkable. SPOM of each layer possessed distinct isotopic composition associated with microbial decomposition and formation of organic matter. Isotopic signature of planktonic productivity in the euphotic zone, bacterial decomposition in the oxycline, chemo-auto- and –heterotrophic activities in the suboxic and anoxic layers were traced.