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Phosphorus cycling in the Sargasso Sea: Investigation using the oxygen isotopic composition of phosphate, enzyme labeled fluorescence, and turnover times

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ABSTRACT

Dissolved inorganic phosphorus (DIP) concentrations in surface water of vast areas of the ocean are extremely low (<10 nM) and phosphorus (P) availability could limit primary productivity in these regions. We utilized multiple techniques to investigate biogeochemical cycling of P in the Sargasso Sea, Atlantic Ocean. We found that dissolved organic phosphorus (DOP) is extensively utilized by phytoplankton and bacteria to supplement cellular requirements. Remineralization of the DOP pool was most extensive above the thermocline as indicated by expression of alkaline phosphatase, rapid P turnover (4 - 8 hours), and large $\delta^{18}\text{O}_p$ deviations from equilibrium. These data suggest that DOP remineralization by extracellular enzymes in the euphotic zone can account on average for 35% (range 10 - 50%) of P utilized. Below the thermocline, alkaline phosphatase expression is reduced, turnover times increase, and $\delta^{18}\text{O}_p$ values approach isotopic equilibrium. In the surface waters of the Sargasso Sea, C-fixation supported by regenerated DOP utilization may account for 4×10^9 mol C year⁻¹.

Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2011AnnualReport/ar11_323_334.pdf