PRODUCTION OF P(+3) COMPOUNDS IN NORTH ATLANTIC SURFACE WATERS

BENJAMIN A. S. VAN MOOY AND ALINA M. EBLING[123]

[1]Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, MA; bvanmooy@whoi.edu.

[2] Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, MA; aebling@whoi.edu.

Phosphorus is an essential element for marine plankton, and has been a focus of chemical oceanography for nearly a century. For most of this time, phosphorus was thought to occur only in the +5 oxidation state, in compounds such as phosphate. However, 19 years ago, Ingall and colleagues discovered phosphonates in the ocean, and since then numerous lines of geochemical and genomic information have emerged to show that phosphorus in the +3 oxidation state, particularly dissolved phosphonate compounds, may play a very important role within upper ocean plankton communities. This is particularly true in oligotrophic gyres where growth by plankton can be limited by the scarcity of phosphate. Yet phosphorus redox cycling rates are almost completely unknown throughout the ocean, as are the fundamental geochemical controls on these rates.

We used a simple method based on ^{33}P-tracing, incubations, and ion-exchange chromatography to measure phosphorus redox rates on a transect from the coastal waters of New England to the oligotrophic Sargasso Sea, which spanned two orders of magnitude in surface phosphate concentrations. We attempted to resolve rates of both phosphate reduction and the synthesis of low molecular weight phosphonates. We also determined phosphite uptake and oxidation rates. Our results showed that the relative importance of phosphorus redox cycling across our transect varied considerably, although at this stage of our project it is unclear whether phosphorus scarcity is a primary control. The motivation for surface water plankton to engage in phosphorus redox cycling remains unknown.