CHEMICAL CHARACTERIZATION AND MICROBIAL SOURCES OF PHOSPHONATES IN THE OCEAN

MARIANNE ACKER[1,2], SHANE HOGLE[3], PAUL BERUBE[3], SALLIE CHISHOLM[3] AND DANIEL REPETA[2]

[1]MIT/WHOI Joint Program, ackerm@mit.edu
[2]Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, MA, USA, drepeta@whoi.edu
[3] Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Cambridge, MA, USA, shogle@mit.edu, pmberube@mit.edu and chisholm@mit.edu

Phosphonates, organic compounds with a C-P bond instead of the more classic C-O-P bond, constitute 20 to 25% of high molecular weight dissolved organic phosphorus in seawater (HMWDOP). Recently, the degradation of phosphonates in HMWDOP by heterotrophic bacteria has been recognized as a source of methane and other trace gases in the ocean, thereby providing an explanation for the "marine methane paradox", i.e. the production of methane in fully oxic waters. However, the sources and cycling of phosphonates in the ocean remain poorly understood. We screened cultured strains of *Prochlorococcus*, the most abundant photosynthetic microorganism in the ocean, for known phosphonate biosynthetic genes. We then used ^{31}P nuclear magnetic resonance and mass spectrometry to confirm that *Prochlorococcus* SB, a cultured strain, with a phosphonate biosynthetic gene cluster, produces phosphonates in culture. We also examined 676 genomes from *Prochlorococcus* and uncovered the potential for phosphonate production within diverse *Prochlorococcus* clades. We are currently combining incubation experiments, chemical analyses to identify the phosphonates produced, and community/single cell genome sequencing to reveal new marine phosphonate sources. This will help us to better understand the marine phosphorous cycle.