Variations in marine microbial phosphorus uptake rates and cellular allocation strategies

KIMBERLY J. POPENDORF*[1], SOLANGE DUHAMEL[2], SARAH RANEY[3], ANA GONZALEZ[4]

[1]University of Miami Rosentiel School of Marine and Atmsopheric Science, Miami, FL USA 33149 (*correspondence: kpopendorf@rsmas.miami.edu)
[2]Columbia University Lamont-Doherty Earth Observatory, Palisades, NY USA 10964 (sduhamel@ldeo.columbia.edu)
[3]Eckerd College, St. Petersburg, FL USA 33711 (seraney@eckerd.edu)
4Harvard University, Cambridge, MA USA 02138 (gonzalezvaldes@g.harvard.edu)

Microbial uptake of dissolved phosphorus is an important lever in controlling both microbial production rates and the fate and cycling of marine phosphorus (P). Different microbial groups have been shown to have variable P uptake rates, as well as different preferences for dissolved inorganic versus organic phosphorus. These patterns of P uptake rates may be a function of the different intracellular P allocations strategies employed by individual microbial groups, which are linked to different cellular stoichiometries, cellular P quotas, and potentially different cellular P turnover rates. We investigated the variation in microbial P uptake rates and cellular allocation strategies of individual microbial groups (heterotrophic bacteria and the phytoplankton groups *Synechococcus*, *Prochlorococcus*, and picoeukaryotic phytoplankton) in the phosphorus-depleted Sargasso Sea. By coupling radioisotope tracing of phosphate and adenosine triphosphate (ATP) with cell sorting flow cytometry and subsequent biochemical extractions, we measured P uptake rates and P allocation to DNA, lipids, and polyphosphate in individual microbial groups from environmental populations. Additionally these results were compared to P allocation into RNA, DNA, lipids, and polyphosphate in representative microbial cultures. We found different allocation strategies in heterotrophic bacteria compared to phytoplankton as well as different P uptake rates, highlighting the distinct role of these microbial groups in marine P cycling.