

Composition of dissolved organic phosphorus produced by marine phytoplankton

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Marine dissolved organic matter (DOM) is a key source of the nutrient phosphorus to microbial life in the oceans. DOM from diverse ocean regions and depths contains surprisingly consistent proportions of three P compound classes, P esters, ~83%; polyphosphates, ~10%; and phosphonates, ~7%. This uniform dissolved organic phosphorus (DOP) composition is distinct from the P-ester dominated composition of particulates derived from marine organisms. The unusual composition of ambient marine DOP has been attributed to selective microbial utilization during decomposition and/or production of specific P compound classes in response to changing nutrient availability. A major unknown in marine systems is the composition of DOP initially produced by microorganisms. Complexities associated with DOM isolation from seawater have hampered its compositional characterization. Electrodialysis (ED) and PPL extraction resin based techniques have vastly improved DOM recoveries, producing representative bulk DOM samples. ED techniques were used to extract DOM produced under nutrient replete, N stressed, and P stressed conditions in triplicate, axenic cultures of the diatom, *T. pseudonana*, in order to provide insights into the composition of freshly produced marine DOM. Under nutrient replete, N stressed, and P stressed conditions, DOM C:P ratios were 130, 81, and 2446, respectively. NMR spectroscopy identified P esters as the dominant P species in DOM produced under nutrient replete and N stressed conditions, with small contributions from phosphonates, and polyphosphates. However, based on fluorometric analysis, DOP from P stressed cultures was enriched 8 fold in polyphosphate compared to DOP from replete and N stressed cultures. Preferential utilization of N and P relative to C and amino acids and P esters relative to other C and P containing compounds during decomposition likely leads to observed ambient ocean DOM composition. Increases in the ratio of dissolved polyphosphate to DOP observed in P stressed cultures are consistent with polyphosphate enrichments in marine particulates and increased polyphosphate gene abundance observed in P stressed ocean regions.