Presence and regulation of alkaline phosphatase activity in eukaryotic phytoplankton from the coastal ocean: Implications for dissolved organic phosphorus remineralization

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ABSTRACT: The biologically important constituents of the dissolved organic phosphorus (DOP) pool, their bioavailability, and their cycling in coastal systems are still poorly understood. Here we use the enzyme alkaline phosphatase as a metric of DOP bioavailability and track the activity of this enzyme in a coastal system. We observed alkaline phosphatase activity (APA) in the >0.2-μm size fraction of all surface samples tested during an Oregon coast cruise in August 2001. Although there was not a significant trend between APA and phosphate concentration in the data set as a whole, chlorophyll *a*-normalized APA was elevated at the station with the lowest dissolved inorganic phosphate (DIP) concentration. Activity was also elevated in nutrient-addition experiments in which nitrate amendments were used to force community drawdown of DIP. These data are consistent with phosphate regulation of APA. A cell-specific APA assay revealed that the percentage of diatoms with APA mimicked the trend in the hydrolytic rate, but such a trend was not observed for the dinoflagellates. Further, the percentage of dinoflagellate cells with APA was routinely higher than the percentage of diatom cells with activity. In nutrientaddition experiments designed to evaluate the regulation of APA, diatom taxa expressed APA less frequently than dinoflagellates, but they displayed a tighter regulation of the activity by DIP than dinoflagellates. The variability observed in the presence and regulation of APA in these eukaryotic phytoplankton indicates that DOP bioavailability is a potential driver of phytoplankton nutrition and species composition in the coastal ocean.

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