

## **The utility of oxygen isotope disequilibrium in understanding microbial P cycling**

ALBERT S. COLMAN<sup>1</sup>

<sup>1</sup>Dept. of the Geophysical Sciences, University of Chicago,  
Chicago, IL 60637, USA; asc25@uchicago.edu

The molecular scale mechanisms by which phosphorus is taken up by and released from microbial cells are critically important to the efficiency of P cycling in aquatic ecosystems. Each of these processes leaves an imprint on the oxygen isotope composition of dissolved orthophosphate ( $\delta^{18}\text{Op}$ ) in aquatic ecosystems. Conventional interpretations hold that phosphate ( $\text{P}_i$ ) turnover by microbial ecosystems tends to isotopically equilibrate  $\text{P}_i$  oxygen with water oxygen in a temperature dependent manner. However, experimental data coupled with the present modeling study suggest that trends in  $\delta^{18}\text{Op}$  are quite dependent on the particulars of the microbial ecosystem and the pathways by which phosphate enters cells and is remineralized. At present, the isotope effects attendant to phosphonate hydrolysis and release of  $\text{P}_i$  from polyphosphate are poorly constrained and are potentially quite important. Nevertheless, isotopic disequilibrium may prove valuable for diagnosing the dominant biochemical and cellular processes impacting P availability in marine ecosystems, sediment porewaters, and soils.