

# GEOC: Division of Geochemistry

## 190 - Scaling up molecular reactions to ecosystem processes: Organic matter degradation controlled phosphorus cycling in the Chesapeake Bay

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**Abstract:** Phosphorus (P) contamination in the Chesapeake Bay has long been a major water-quality problem because its restoration is complicated by the multitude of P sources, their temporally and spatially variable inputs, and complex interacting factors affecting their occurrence, fate, and transport. These complexities not only restrict formulation of effective restoration plans but also open up debates on accountability issues with nutrient loading. To develop a detailed understanding of P dynamics in the sediment, we used phosphate oxygen isotope ratios ( $\delta^{18}\text{O}_p$ ) of sediment P pools along with sediment chemistry and Mössbauer spectroscopy to identify the sources and pathways of sedimentary P cycling and to infer potential feedback effect on the bottom water hypoxia and surface water eutrophication. Based on the knowledge of isotope effect of organic P degradation and the  $\delta^{18}\text{O}_p$  values of authigenic phosphate in the sediment, we conclude that the regeneration of inorganic P from organic matter degradation (remineralization) should be the predominant pathway for authigenic P precipitation in the mid-bay sediments. Predominance of remineralization pathway against remobilization (coupled Fe-P cycling) classically assumed in the Chesapeake Bay and many other comparable ecosystems around the world has significant implication for the current understanding of P cycling and benthic-pelagic coupling in the bay, particularly on the sources that feeds hypoxia and potentially supports phytoplankton growth in the surface water.