

Hypoxia driven changes in phosphorus cycling in water and sediment columns in the Chesapeake Bay

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Proliferation of hypoxia due to enhanced anthropogenic nutrient loading is quite common in many coastal environments. Hypoxia exerts an influence on the stability of minerals and organic debris, direction of nutrient flux at the sediment-water interface, and the extent of benthic-pelagic coupling. We analyzed paired water and sediment column samples from the Chesapeake Bay for chemistry, Fe and P speciation by using ³¹P NMR, Mössbauer spectroscopy, and stable isotope methods. Our results show that the significant fraction of settling organic P compounds is mineralized both in water and sediment columns. Authigenic phosphate isotope data suggest that the regeneration of inorganic P in the sediment from organic matter degradation (remineralization) is the predominant, if not sole, pathway for authigenic P precipitation in the sediments. Interestingly, small-particle poorly crystalline iron oxide with P and/or organic matter coatings was found to be relatively recalcitrant against reductive dissolution. This is also consistent with EXAFS results which show relatively high stability of Fe(III) minerals in anoxic sediment column. These results collectively support the predominance of coupled C–P pathway of P cycling, rather than Fe–P coupling, in hypoxic environment in the Chesapeake Bay.