Fate of particulate phosphorus in river estuaries in the Chesapeake Bay

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The Chesapeake Bay and its watershed suffer from varying degrees of water quality issues fuelled by both point and non–point nutrient sources. Here we paired phosphate oxygen isotope technique with a suite of mineralogical (XRD), microscopic (SEM and TEM), and spectroscopic (^{1}H and ^{31}P NMR) methods to identify sources, compositions, and preferential degradation of particulate phosphorus in the water column. Our results show that NaOH extractable P in the particulate matter is the most dominant yet recalcitrant P pool in creek waters and carry its source signature. Remineralization efficiency of particulate P in the Bay water column is significant (8-56%) suggesting P derived from remineralization of particulate P could be an underestimated source of P for biological demand. Furthermore, decrease in diester-to-monoester (D/M) ratios with water column depth indicates preferential degradation of diesters in the settling particulate matter. Sequential extraction of P pools in particulate matter indicates potential precipitation of Ca- phosphate mineral in the water column. These findings provide new scientific insights that could help improve water quality in the Chesapeake Bay and its watershed.