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The Enigma of Organic Phosphorus Preserved in Marine Sediments

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The origin of the organic phosphorus (P_{org}) found in marine sediments includes the suite of biochemicals that are synthesized by living organisms. We think of these as inherently labile compounds, and as such, the fact that P_{org} is preserved, even in very ancient sediments, remains an enigma. Most methods for quantifying the bulk P_{org} reservoir in marine sediments use a fairly aggressive acid extraction to solubilize inorganic P in order to directly quantify P_{org} (e.g., as in the SEDEX method of Ruttenberg (1992, 2009)) or to quantify P_{org} by difference (e.g., Aspila et al. (1976)). Application of such methods to freshly deposited organic matter may result in loss of the labile fraction of particulate P_{org}, and possibly its incorrect attribution to inorganic-P reservoirs. This labile P_{org}-loss effect will likely be amplified for water column particulate matter, which may be dominated by living organisms (e.g., plankton).

To address the potential problem of incomplete recovery of P_{org} from marine sediments due to under-recovery of labile P_{org}, we have explored addition of a pre-extraction step to the SEDEX method designed to separately quantify labile P_{org}prior to subjecting sediments to the more aggressive subsequent SEDEX extraction steps. After discussing results of standardization experiments conducted to evaluate the efficacy and specificity of labile P_{org} pre-extraction from sediments, we will present some unanticipated results that raise intriguing questions about the nature of the P_{org} pool that is preserved in marine sediments.

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