Distribution and chemical speciation of phosphorus in surface sediments of the central Pacific Ocean

JIANYU NI[12], LAODONG GUO*[1], PENG LIN[1], YANG ZHEN[2] AND XUYING YAO[2]

[1]School of Freshwater Sciences, University of Wisconsin-Milwaukee, Milwaukee, WI 53204, USA (*correspondence: guol@uwm.edu)

[2]Key Laboratory of Submarine Geosciences, Second Institute of Oceanography, State Oceanic Administration, Hangzhou 310012, China

Phosphorus (P) is an essential element and is thought to control marine productivity over both geological and shorter time scales. Although the sediment is the major sink of allothogenic and authigenic P in the open ocean, the sequestered P in the sediments could be released into the overlying water column. Therefore, knowledge of abundance and phase/chemical speciation of P in open ocean sediments and its potential to be returned to water column is important to better understanding of biogeochemical cycling of P in the ocean.

Surface sediment samples were collected from the central Pacific Ocean (4.5-15°N, 154-143°W) by box-corer during Dy29 cruise of R/V HAIYANGLIUHAO in 2013. In addition to total P (TP), five sedimentary P species operationally defined by sequential extraction techniques (SEDEX) were quantified to examine the partitioning of P among different P phases. TP concentrations ranged from 13.2 to 119 μmol-P/g. Total inorganic P (TIP) concentrations varied from 11.1 to 121 μmol-P/g, while TOP concentrations changed from undeteable to 4.8 μmol-P/g. Overall, inorganic P was generally the predominant form in the surface sediments, comprising on average up to 93% of the sedimentary P in the study area. Within the sedimentary P pool, the authigenic or CaCO3 bound P and detrital P were the two predominant P species (43.4% and 45.7% of TP, respectively), followed by the refractory organic P, representing about 6.7% of TP. Fe-bound P accounted for about 3.3% of TP, and the readily exchangeable adsorbed P was only 0.9% of TP. These results suggest that most of the labile P had been regenerated or remineralized into the water column during its setting from surface to the seafloor. The high proportion of authigenic P in the deep-sea sediments suggests that open ocean could be an important sink for reactive P in the ocean.