EGU2020-2812, updated on 18 May 2022
https://doi.org/10.5194/egusphere-egu2020-2812
EGU General Assembly 2020

Phosphorus dynamics associated with partitioning of organic carbon oxidation pathways in the surface sediments of the deep Ulleung Basin, East Sea

Jin-Sook Mok, Bomina Kim, Hyeyoun Cho, Sung-Uk An, Hyun-Ji Lee, and Jung-Ho Hyun
Hanyang University, Ansan, Korea (hyunjh@hanyang.ac.kr)

As sediments play an important role as either a sink or a source of phosphorus (P) for water column, it is important to elucidate the major P fractions and behaviors (i.e., mobilization and immobilization) in the sediments to better understand P cycles in local and global scale. We investigated major P speciation associated with the partitioning of organic carbon (C_{org}) oxidation in the sediments to elucidate the P dynamics at two contrasting sediments in the continental shelf (EB1) and rise (EC1) in the Ulleung Basin (UB), East Sea. Sulfate reduction (SR) pre-dominated C_{org} oxidation at shelf site (EB 1), comprising % of C_{org} oxidation, whereas Mn- and Fe-reduction combined accounted for >80% of C_{org} oxidation in Mn-oxide and Fe-oxide-rich basin site (EC 1). Under SR-dominated condition (EB 1), H_2S oxidation coupled to reductive dissolution of FeOOH to form precipitation of FeS induced the accumulation of dissolved iron and phosphate in the pore water. On the other hand, phosphate in the Mn- and Fe-oxide-rich basin sediments (EC 1) was depleted because the P released through organic matter decomposition or reductive dissolution of Fe oxide/Mn oxide was effectively adsorbed to the metal-oxides in the surface sediments. Sequential extraction of P phases revealed that Fe bound P (52-65% of total P) was the major phase in the surface sediments of both sites. Interestingly, the organic P (P_{org}) fraction was 2.4-times higher at the basin site (12 μmol g^{-1}) than at the shelf site (5 μmol g^{-1}). C_{org} : P_{org} ratios presented as redox proxies in sediments were 644 and 191 for EB1 and EC1, respectively,. The results indicate that P_{org} has an effective preservation relative to C_{org} under sub-oxic conditions (EC1), whereas P_{org} was preferentially regenerated under anoxic conditions (EB1). Overall, the dynamics of P in the UB sediments were largely regulated by the partitioning of C_{org} oxidation pathways (i.e., sulfate reduction vs. metal reduction) and resultant interaction between Fe/Mn-S-P.