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Distribution and behaviors of dissolved trace elements in the northwestern Pacific marginal seas

XIAOYU CHEN[1], INTAE KIM[2] AND HYERYEONG JEONG[3]

[1]Korea Institute of Ocean Science and Technology (KIOST)
[2]Korea Institute of Ocean Science & Technology
[3]Ifremer, CCEM-Unité Contamination Chimique des Ecosystèmes Marins (CCEM)

Trace element behaviors in ocean waters are crucial in regulating phytoplankton growth, influencing oceanic primary production [1]. This study investigates the biogeochemical cycling of trace elements in the marginal seas of the northwestern Pacific, East/Japan Sea (EJS) and Yellow Sea (YS), with different environmental settings. The distribution patterns of trace elements in the EJS were categorized into three groups. Mn, Fe, and Co showed a considerable influence from atmospheric input in the surface layer and significant benthic input in the bottom water. However, Ni and Cu were removed from the surface water and had a limited influence from the benthic input. The distributions of Zn and Cd were more strongly regulated by biological activity. On top of that, we discovered an unusual decoupling between the concentrations of Zn and SiO_4^{2-}, with a negative relation between these two components being observed in the deeper layers (> 500 m) of the EJS. This decoupling could largely be attributed to the intensive regeneration processes or additional shelf input. In the shallow waters of the YS, all trace elements exhibited a vertically conserved distribution owing to rapid water mixing. In this study, the fractionations of rare earth elements ($(Nd/Er)_{PAAS}$ and Ce/Ce* ratios) were also used to trace the scavenging processes and the input of water mass. Moreover, the benthic flux of Mn was found to be considerably higher than the atmospheric deposition flux previously reported near the study area in EJS [2]. The cycling of trace elements in the marginal seas around Korea has been rarely reported; thus, our data could have a critical impact on elucidating the marine biogeochemical cycling in the North Pacific.

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