

Distributions of dissolved Rare Earth Elements in Jinhae Bay, Korea

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Rare earth elements (REEs) comprise 15 elements from the lanthanide series, with atomic numbers ranging from 57 to 71. In aquatic environments, REEs generally behave similarly due to their trivalent oxidation states, except for Ce (Ce⁴⁺) and Eu (Eu²⁺). Despite their chemical coherence, several processes cause fractionation because the ionic radii of REEs decrease with increasing atomic number. In particular, Light REEs (La to Nd) are preferentially scavenged onto particle surfaces, providing insights into scavenging conditions in seawater. As a result of these fractionations, REEs serve as effective tracers for biogeochemical processes in aquatic environments.

Jinhae Bay is a coastal region in South Korea characterized by low oxygen concentrations, with chronic hypoxic events occur annually in summer. These hypoxic conditions are primarily driven by anthropogenic inputs, including domestic, agricultural, and industrial effluents, which contribute to significant eutrophication and recurrent algal blooms. Additionally, the semi-enclosed embayment of Jinhae Bay limits water exchange, further exacerbating the hypoxic conditions in the bottom waters. Since Jinhae Bay serves as a spawning and nursery ground for various aquafarms, understanding biogeochemical processes might be important.

In this study, we investigated the distribution of dissolved REEs in Jinhae Bay and examined their biogeochemical cycling in this semi-enclosed bay, which is known for its hypoxic conditions.