

Geochemistry of trace elements at the seawater/ferromanganese oxide interface

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Chemical reaction on the surface of ferromanganese oxides, which are widely present in a variety of forms such as crusts, nodules, and precipitate particles, strongly affects geochemical behaviors of trace elements in the marine environment. Accumulation of some valuable metals into ferromanganese oxides is closely related with the formation of mineral deposits including Co-rich crust, Mn nodules, and REY-rich mud, whereas scavenging of trace elements from seawater sometimes controls their concentrations and isotopic compositions in seawater. Molecular structures revealed by synchrotron X-ray analysis can explain the mechanisms of incorporation and isotopic fractionation of trace elements at the seawater/ferromanganese oxide interface. For example, the extreme enrichment of Te among oxyanions can be explained by structural substitution into Fe (oxyhydr)oxides via coprecipitation reaction because its molecular geometry is similar to Fe octahedron, in contrast to other oxyanions incorporated via adsorption reaction. In the adsorption reaction, on the other hand, the mode of attachment (inner- or outer-sphere) is an important factor, where the formation of inner-sphere complex causes the larger adsorption than outer-sphere complex, as observed in the case of Mo, W, As, Sb, and Se. We found the correlation between these molecular structures at the seawater/ferromanganese oxide interface and chemical properties of elements including pKa, and pKOH, which can lead to the systematic understanding of variable behaviors of elements. In this presentation, I will talk about the chemistry of trace elements at the seawater/ferromanganese oxide interface and its significance in the study of marine environment and submarine resources.

Reference

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