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The Dissolution State of Heavy Metal in Seawater

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Summary

The elucidation of the dissolution state of metal ion has been very important problem, however, the concentrations of the metal ions are too low to detect the dissolution state in solution *as they were*. Recent research reveals that the complicated species of the metal ions exist in seawater as the dissolution state. This study deals with the speciation of metals, especially, aluminum speciation in solution. Aluminum species have been detected by ^{27}Al-NMR and their species in the solution have been surveyed. However, the concentration of aluminum needed for ^{27}Al-NMR is so high that the aluminum species in environmental solutions, such as seawater and river water, could not be detected. Therefore, for the detection of aluminum species, electrospray mass spectrometry (ESI-MS) was used as the method with high sensitivity. In some concentration of aluminumchloride ($AlCl_3$) solution, the aluminum species observed by ESI-MS were in good agreement with those by ^{27}Al-NMR. In $AlCl_3$ solution, main aluminum species in solution is $[Al(OH)_2(H_2O)_2]^+$. In the case of seawater with high concentration of chloride, this species $[Al(OH)_2(H_2O)_2]^+$ has been estimated to exist as main species. Because chloride ion is low Lewis base, the bonding of aluminum and chloride is so weak while the concentration of chloride is very high and that of aluminum is very low in seawater. It should be expected that further studies on the speciation for other various metals, such as iron, manganese, and so on, give us great information on the chemistry of seawater.

In seawater, calcium and strontium ions have been considered to be separated as free ion, however, silica species could make complexes with calcium and strontium ions in aqueous solution. In sweater, the concentration of calcium ion is so high, the complex of silica with calcium was directly observed from fast-atom-bombardment mass spectrometry (FAB-MS). As the concentration of strontium is very low, 90 μ mol/L, the complex of silica with strontium could not be observed in mass spectra. However, silica could be main anion species in seawater as well as organic anions.