Adsorption and Desorption Behavior of Radioactive Cesium to Suspended Particles in Seawater

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Radioactive cesium (RCs) adsorbs strongly to phyllosilicates such as clay minerals by the formation of inner-sphere complex. RCs flows into river because of erosion of surface soil. It is possible that a large amount of Cs can be desorbed from the suspended particles in seawater due to high concentration of cations including stable Cs in seawater. In this study, we have measured solid-water distribution coefficient (Kd) of Cs to suspended and sinking particles recovered from seawater by adsorption and desorption experiments. The Kd values to suspended particles in river and seawater were simulated by General Adsorption Model (GAM) so that we can compare Kd obtained by this experiment with that calculated by GAM. Final purpose of this study is to estimate the amount of RCs desorbed into seawater from suspended particles with RCs transported from river water to seawater.

Scanning Transmission X-ray Microscopy (STXM) analysis showed that Al (= phyllosilicate) was covered with organic matter, which was found to be fulvic acid based on carbon K-edge XANES. After removing organic matter, inner-sphere complex component for Cs became larger except for the marine suspended particles. This meant that organic matter blocks strong adsorption of Cs to clay mineral as inner-sphere complex. Except for the marine suspended solids, the particles with higher concentration of organic matter had the lower Kd. This result is consistent with the result of Cs L3-edge EXAFS, which suggested that organic matter blocks adsorption of Cs to clay minerals. In desorption experiment, the particle with higher concentration of organic matter showed higher desorption rate of RCs. This suggests that Cs can adsorb more strongly on clay minerals with lower concentration of organic matter. Kd determined in this experiment was similar to Kd estimated from GAM. From the Kd of GAM, the rate of desorption of Cs from particulate matters transported from river water to seawater was calculated to be 98.9%. Thus, 1.1% of Cs in the sinking particles can be transported to marine sediments.