

The experimental study of Re and Os scavenging from seawater to sediments

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Rhenium and osmium abundances have been reported to be approx. 8 pg/g and 0.01 pg/g in seawater and 20-190 ng/g and 0.2 -0.7 ng/g in black shale, with (Re-187)/(Os-188) ratios of approx. 4300 in seawater and 500-1500 in black shale. These data indicate (Re-187)/(Os-188) fractionation during Re and Os removal from seawater to black shale. Here, the experimental study of Re and Os removed from seawater to sediments was examined using radioactive nuclides Re-183 and Os-185, which were obtained from Au target irradiated with C-12 or N-14 ions by the RIKEN Ring Cyclotron. In the sorption experiments using Re-183 and Os-185 on Tokyo Bay sediments (total organic carbon content = 2.07%) and synthetic seawater system at different Eh conditions, removal behavior of Os from seawater into sediments was shown to be different from that of Re. Osmium was removed into sediments even under mild oxic condition (Eh = 300 mV and pH 7.5), but not removed into sediments free from organic carbon by ignition. This suggests that Os in seawater directly interacts with organic matter in sediments. On the other hand, it is suggested that removal of Re into sediments depends on anoxic conditions rather than existence of organic matter.

In addition, Os species in the sediments under anoxic conditions was examined by XAFS. XANES spectra suggested that the oxidation number of Os adsorbed on the sediments was +3, even though Os was doped into synthetic seawater as Os(IV)Cl₆²⁻ and Os(VIII)O₄. However, EXAFS analysis indicated that Os in these sediments may be +4. Although this discrepancy of estimated oxidation number of Os has not been explained yet, these results indicate that Os is reduced to +3 or +4 in the sediments under anoxic conditions.