

Geochemical comparison of adsorped elements on sediments with dissolved ones in the river waters of Tohoku area

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River sediment adsorbs many elements on its surface, which is considered to affect the chemical composition of the river water. However, there are few studies regarding the geochemical relationship between the sediment and the water in the river system.

To evaluate the role of the adsorbed elements on the geochemical properties of fresh water, we sampled sediments and waters at 342 sites in the rivers of Iwate and Miyagi prefectures of northeastern Japan. Approximately 10g of sediment particles (less than 2 mm) were reacted with 50 ml of 2 mol/L ammonium acetate solution for 2 hours. The solution was subsequently diluted by a factor of 25 using 1% nitric acid, and the concentrations of 51 elements were determined using Agilent7500cx ICP-MS.

The concentration of most elements in adsorped solution (ADS) increased with that of ambient river water (RW), while the adsorption coefficient of ADS to RW (ADS/RW) decreased. This result indicates that sediment has a limitation with respect to the adsorption capacity. The adsorption coefficient of most cations was greater than 1.0, whereas that of anions such as V and B was low. It was particularly high for heavy metals and rare-earth elements, reflecting their strong partitioning on the surface of the sediment. The adsorption coefficient of REEs decreased with the atomic number with positive Ce anomaly and negative Eu anomaly, indicating the REE fractionation in the aquatic system.

As the study area is composed of a variety of rock types, including volcanic to plutonic rocks, and metamorphic to sedimentary ones, the observed result is not attributed to the geological heterogeneity. It is likely that the adsorption of elements on the sediment surface plays a dominant role on the geochemical composition of the river water.

Keywords: river water, sediment, geochemistry