Geochemical and isotopic study of river water from the Okayama and Tottori Prefectures, Japan.

*Katsuyuki Yamashita[1], Takahiro Kamei[1], Keisuke Kishimoto[1], Masahiko Mori[1], Yuga Kishimoto[2], Aya Ooi[2], Ayaka Onishi[2], Yoko Kurihara[2], Miyake Ryota[2], Ryosuke Yamano[2], Hitoshi Chiba[1], Takanori Nakano[3], Ki-Cheol Shin[4]

1. Graduate School of Natural Science and Technology, Okayama University, 2. Department of Earth Sciences, Okayama University, 3. Ono City, 4. Research Institute for Humanity and Nature

Geochemical and isotopic properties of river water are influenced by various processes such as evaporation, interaction with rocks and soils, and input from human activities. In order to understand the cause of geochemical variation observed in river water from the Okayama and Tottori Prefectures, Japan, we have collected over 700 samples from 539 locations over the past ten years. All samples were filtered with 0.2 μm acetate cellulose disposable filter prior to the analyses for major dissolved components, trace element concentration, and O-H-S-Sr isotopes. The data from these analyses were used to construct high-resolution geochemical maps of the two Prefectures. Many elements, such as Ca, Rb, Cs, V and Si show geographic variations that are consistent with the geochemistry of the rocks exposed in the area. For example, high concentration of Ca is observed in the western Okayama Prefecture where limestones are widely exposed, and high concentrations Rb, Cs, V and Si are observed around Mt. Daisen of dacitic volcanic rocks. These regional variations exceed seasonal variation and thus we attribute this to the chemical weathering of watershed rocks.

Regional variation is also seen in various isotopic signatures. New Sr isotope data show that $^{87}Sr/^{86}Sr$ is low (<0.706) in the area near Mt. Daisen and Hiruzen, where Quaternary volcanic rocks are exposed. On the other hand, $^{87}Sr/^{86}Sr$ in excess of 0.709 is seen in areas where Paleozoic sedimentary rocks distribute. Such correlation between $^{87}Sr/^{86}Sr$ and the average age of rocks exposed in the area supports the idea that Sr (and perhaps Ca) in the river water is largely derived from rocks and soils in the vicinity of the river. The sulfur isotopic signature ($\delta^{34}S$), on the other hand, is high (>12‰) in the central to western Tottori Prefecture, and low in the Okayama Prefecture (<6‰). The high $\delta^{34}S$ seen in the river water from the Tottori Prefecture may be ascribed to sulfur originating from combusted Chinese coals and sea-salt during the winter with high rainfall. The $\delta^{34}S$ of the river water from the Okayama Prefecture tends to converge to ~0 ‰as the SO_4 concentration increases. This correlation may imply that Okayama river water with low $\delta^{34}S$ is enriched in artificial sulfur of domestic origin (e.g. sulfur released from breakdown of fertilizer), whose $\delta^{34}S$ is about 0 ‰.

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