Geochemical properties of river water from the Okayama and Tottori Prefectures, Japan

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In order to investigate the effects of human activity and natural environments, we collected more than 700 river water samples from 539 locations in the Okayama and Tottori Prefectures, Japan. The pH, EC, and water temperature were measured on site, and the major dissolved components, trace element (47 elements) concentrations, and O-H-S-Sr isotope ratios were measured in the laboratory after filtering with 0.2 μm acetate cellulose disposable filter.

The high-resolution geochemical maps constructed using the data revealed that the concentration of many elements correlates with the geochemical characteristics of the rocks exposed in the area. For example, Ca concentration is high in the western Okayama Prefecture where limestones are widely exposed. High concentrations of elements such as Rb, Cs, V and Si are observed around Mt. Daisen of dacitic volcanic rocks in the Tottori Prefecture. Ni and Cr concentrations are high in the Maniwa and Niimi Cities of the Okayama Prefecture where ultra-mafic rocks distribute. These geographical variations exceed seasonal variation and thus we attribute this to the chemical weathering of watershed rocks.

Geographical variation is also seen in various isotopic signatures. The oxygen and hydrogen isotope ratios display a clear altitude effect. The d-excess, on the other hand, displays sharp contrast between the northern Okayama and Tottori Prefectures (>20 ‰), and the southern Okayama Prefecture (5~15 ‰). The accumulation of new sulfur isotopic data revealed that the $\delta^{34}S$ is particularly high in the central to western Tottori Prefecture, and low in the Okayama Prefecture. The Tottori river water with high $\delta^{34}S$ may be ascribed to sulfur originating from combusted Chinese coals and sea-salt during the winter with high rainfall. Since felsic igneous rocks widely distributed in the Okayama Prefecture have low SO_4 concentration, it is likely that the Okayama river water is enriched in artificial sulfur of domestic origin, whose $\delta^{34}S$ is about 0 ‰.

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