Geochemical and isotopic analyses of river waters from the Okayama Prefecture, Japan.

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We have undertaken detailed geochemical and isotopic analyses of river waters from the Asahi, Yoshii, and Takahashi River systems of the Okayama Prefecture, Japan. A total of 537 samples were collected from 381 locations in Okayama and neighboring prefectures. In some locations, samples were collected periodically over a period of 4~5 years to monitor the long-term fluctuation of the geochemical signatures. All samples were filtered prior to the analyses of the major dissolved components, trace element concentrations, and O-H isotopes. For some samples, S and Sr isotopes were also determined.

Using the data obtained in this study, we constructed high-resolution geochemical maps of the rivers, which were then used to explore the geochemical and isotopic nature of the river systems. The results show that O-H isotopes display a regional variation that exceeds the seasonal variation. The deuterium excess is high in the upstream of the river systems near the Chugoku-mountains, and gradually decreases towards the downstream.

The concentrations of the major dissolved components and trace elements also display a regional variation. For example, the Ca concentration is highest in the areas where limestones are exposed, indicating that breakdown of $CaCO_3$ has a significant impact on the Ca concentration of the river waters. The Sr concentration follows a similar pattern. The Sr isotopic signature is low in the area where the Quaternary volcanic rocks are exposed, and high in the areas where the Carboniferous to Jurassic sedimentary rocks are exposed. Such a geographical correlation between the Sr isotopic signature and rocks exposed in the area imply that the breakdown of Ca, Sr bearing minerals has an important impact on the geochemistry of the river waters.

The concentration of SO_4 is lowest in the northern region of the Okayama prefecture near the Chugoku-mountains, but gradually increases in the areas south of Tsuyama and Kuse basins. The increase in SO_4 is accompanied by shift in sulfur isotopic composition towards ~0‰. This correlation may imply that decomposition of fertilizers used in agricultural activities is, at least in part, responsible for the change in the SO_4 concentration.

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