

Geochemical and isotope systematics of Asahi and Yoshii rivers

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We have undertaken a detailed geochemical and isotopic analysis of water samples collected from the Asahi and Yoshii rivers of the Okayama Prefecture, Japan. More than 300 samples were collected from the rivers and their tributaries during March 2011 to January 2014. In several locations, samples were collected periodically in order to monitor the long-term fluctuation of the geochemical properties. All samples were filtered with 0.2 μm filter prior to the analyses for major dissolved constituents (F, Cl, NO₃, SO₄, Br, PO₄, Ca, Mg, Na, K), trace elements and O-H-Sr-S isotopes.

Based on the results obtained so far, we have constructed a high-resolution geochemical map of the rivers covering central to eastern Okayama Prefecture. The map shows that the concentrations of most major dissolved constituents, as well as the O-H-Sr isotope ratios changes systematically from the upstream towards the downstream. For example, the deuterium excess (DE) is generally high in the upstream (>20) and gradually decreases towards the downstream (<12). This difference in the DE exceeds the seasonal variation observed in locations where the long-term monitoring was conducted. Thus, the regional change in the DE is interpreted to be the result of different air mass contributing to the meteoric water of different locations.

The Ca, Sr, and Ba concentrations are generally low in the upstream and gradually increase towards the downstream. The ⁸⁷Sr/⁸⁶Sr also changes from approximately ~ 0.705 and ~ 0.706 in the headwaters of the Asahi and Yoshii rivers, respectively, to ~ 0.708 in the areas close to the Seto inland sea. The shift in the Sr isotope ratio seems to correlate well with the change in the ages of the rocks exposed in the river basin. This implies that these variations are likely related to the water-rock interactions.

The concentrations of other important dissolved constituents such as the NO₃ and SO₄ tend to increase abruptly in the densely populated regions. This is also accompanied by a shift in the S isotopic composition. These variations may reflect a change in the degree of human influence such as breakdown of fertilizers used for agricultural activities.

Keywords: Geochemical map, Asahi River, Yoshii River