

## Effects of bedrock geology on streamwater chemistry in forested watersheds; using Sr isotope ratio as geological index

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In forest ecosystems, bedrock plays a very important role in mineral sources to forest soils through weathering. However, many catchment-scale comparative studies do not take geological differences within or between forested watersheds into account. Sr isotope ratios ( $^{87}\text{Sr}/^{86}\text{Sr}$ ) of rocks and soils are known to depend on geology in spite of the site history, and the Sr isotope ratio of streamwater is influenced by bedrock and/or soil. Then in this study, the  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios of soil extracts and streamwater were measured in order to understand the bedrock contribution to streamwater chemistry. Moreover, we compared the Sr isotope ratio of the streamwater between watersheds to understand whether the geological difference reflects the weathering-derived solutes in streams.

This study was carried out in the Japanese cedar plantations in Nara Prefecture, central Japan. There are more than 33 watersheds adjacent, each of which stand ages are 1 years to 88 years in 2003. Streamwater samples were collected from the watersheds every 2 weeks in 2002-2003. Major ion concentrations ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cl}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ) were analyzed by ion chromatography, and total concentrations of Si and Sr were measured by ICP. Based on this result, 6 watersheds aged 2, 4, 14, 29, 40 and 88 years and the main river (Kanno Riv.) were selected and sampled in August, 2003, for Sr isotope analysis. Moreover, a soil profile was established within every 5 watersheds aged 4, 14, 29, 40 and 88 years, and three soil samples were randomly collected in the soil layers 0-10, 10-30 and 30-50 cm in each profile in July, 2003. Soil samples were extracted with 150 ml of 1 M ammonium acetate. Before measuring the Sr isotope ratio, streamwater and soil extract samples were filtered with 0.45  $\mu\text{m}$  disposable syringe filter. The Sr isotope ratios of samples were determined using a Finnigan MAT thermal ionization mass spectrometer.

Sr isotope ratios of streamwater were consistently lower than that of soil extracts in most watersheds. This suggests that Sr in streamwater is provided from soil layer deeper than 50 cm. Sr isotope ratio of streamwater had no relation with forest stand ages, while they were strong relationships with the topographic position of the watersheds, that is, the ratios of streamwater in the left bank of Kanno River were significantly lower than those in the right bank. It is suggested that Sr isotope ratio of streamwater reflects bedrock geology, rather than stand ages. In addition, Sr isotope ratio at Kanno River was intermediate between those in the left bank and the right bank, which indicates that mixing process of lower value of isotopic ratios of left bank and higher ratios of right bank occurs. Moreover, the concentrations of  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{SO}_4^{2-}$  and  $\text{NO}_3^-$  in streamwater drained from the left bank tends to be higher than ones from the right bank. It is concluded that geological difference between right and left bank of Kanno River, demonstrated by Sr isotope ratio should influence streamwater chemistry.