

## **A study on the discharge of base cation in mountainous catchments, considering the variation and component of cation adsorption pool in soil**

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The objective of this study is to clarify base cation discharge processes in the view of soil column, slope, and catchment scale in mountains, considering the variation and component of cation adsorption pool in soil.

In order to examine the base cation discharge processes with a mountain scale, the hydrogeochemical investigations were conducted at four small headwater catchments, in Kanto Mountains, Japan. The elevation of each catchment is ranged 700 to 1900 m. Each catchment is covered by coniferous forest and underlain by the same granodioritic bedrock. The solute concentrations of spring water and soil water increased as the elevation decreased. Cation and SiO<sub>2</sub> concentrations of soil water were related to organic acid concentrations, which were estimated from cation-anion balances, in the surface soil layer ( $10 \text{ cm} \leq D \leq 50 \text{ cm}$ ) whereas bicarbonate concentrations in the deeper soil layer ( $75 \text{ cm} \leq D$ ). Organic acid concentrations in the surface soil layer showed not only seasonal variations but also variations depending on altitude change. There were no apparent differences in CO<sub>2</sub> concentrations in the soil air among the four catchments. These results suggest that the contribution of organic acids to dissolution processes of cation and Si in the surface soil layer whereas CO<sub>2</sub> in the deeper soil layer. Soil temperature as an index of altitude controlled biochemical processes that produced organic acids, and affected the cation dissolution process indirectly in the surface soil layer. On the other hands, soil temperature controlled the reaction rate of chemical weathering directly in the deeper soil layer.

Cation discharge processes in a small catchment were monitored at Takehara experimental catchment in Hiroshima Prefecture. During rainfall events K<sup>+</sup>, Ca<sup>2+</sup> and Mg<sup>2+</sup> ratio of stream water became bigger against Na<sup>+</sup>. Such flushing of Ca<sup>2+</sup> indicated the contribution of shallow subsurface flow through surface soil layer with higher Ca<sup>2+</sup> concentration. During base flow period Na<sup>+</sup> and Si ratio became bigger against Ca<sup>2+</sup>. The water flow pathway through deeper soil layer contributed to Na<sup>+</sup> discharge. These results suggest that spatial and temporal variation in exchangeable base cation has significant role to solute discharge processes in acidic soil.

Cation discharge processes with a small slope scale were monitored at an experimental slope in Takehara experimental catchment. Exchangeable base cation were varied seasonally depending on the soil pH. Exchangeable Ca<sup>2+</sup> was dominant in cation pool and the variation at surface soil. Base cation dissolution rate in soil layer can be estimated correctly with determining the variation in cation pool. The rates were estimated smaller in Ca<sup>2+</sup> and Mg<sup>2+</sup> that variations in cation pool were significant.

From the results of this study it is suggested that the importance of determining base cation discharge processes with various scales for model simulations.

**Key words:** mountain catchment, base cation, ion exchange, weathering, discharge