

Stable Mg isotope ratios help in identifying base cation sources of stream water in the boreal Krycklan catchment (Sweden)

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The knowledge of the sources of base cations in streamwater is a prerequisite to assess potential effects of changing environmental conditions such as changing rainfall, weathering or groundwater fluxes on cation export with stream water. This study use stable Mg isotopes to identify sources in the well-studied forested catchment of Krycklan located on gneissic bedrock covered by quaternary sediments in Sweden. Samples were collected from open field rain, throughfall, stream, soil, rock and litterfall. The $\delta^{26}\text{Mg}$ values of these samples was determined and the contributions of different sources to Mg fluxes in the streamwater were determined from the variation of the Mg isotope and Sr/Mg ratios.

The results show an overall variation of 1.10‰ between all samples. Mg isotope ratios displays little variation in the streamwater and soil solution, except during snowmelt periods. During this period, a large portion of the annual runoff occurs. Mg in the streamwater is explained as a mixture of three pools (open field rain, soil solution and groundwater) with the latter two influenced by catchment processes. Mg in streamwater mainly derived from the groundwater, with a contribution ranging from 12 to 63% to Mg fluxes. Open field rain dominates Mg fluxes in streamwater during spring flood (78%) and may contribute significantly during larger summer and autumn rainfall events. Soil solution input to streamwater range from 16 to 59% of Mg fluxes in streamwater. Our results demonstrate that $\delta^{26}\text{Mg}$ values together with Mg concentrations and Sr/Mg ratios can be used to constrain the Mg sources of streamwater and quantify weathering release rates, ranging in this catchment from 0.52 to 1.178 kg Mg.ha⁻¹.yr⁻¹

Key words: Magnesium, Stable isotope, Streamwater, Silicate Weathering, Forest, Catchment, Krycklan, Sweden.

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