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Mg/Ca/Sr isotope systematics in a weakly acidified headwater catchment near the Czech–Austrian border underlain by base-poor paragneiss

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Monthly monitoring of hydrochemical inputs and outputs in the forested headwater catchment Na Lizu (southern Czech Republic) has been under way for the past 28 years. With retreating acidification, a small but statistically significant decrease has been observed for Mg and Ca deposition and also Mg and Ca export *via* runoff. Annual runoff flux of Mg was six times higher than atmospheric Mg input. Annual runoff flux of Ca was three times higher than atmospheric Ca input. For Sr, both fluxes were nearly identical. The bedrock contained 2.22 wt. % of MgO and 1.87 wt. % of CaO. $^{26}Mg/^{24}Mg$, $^{44}Ca/^{40}Ca$, and $^{87}Sr/^{86}Sr$ isotope ratios were determined for 10 ecosystem compartments (open-area precipitation, spruce canopy throughfall, four types of spruce tissues, soil, soil solutions, runoff, and bulk bedrock), and six minerals (apatite, muscovite, biotite, orthoclase, plagioclase, ilmenite). Over 97 % of all Mg in fresh paragneiss was stored in biotite, and 99 % of all Ca was stored in plagioclase. Nearly 93 % of all bedrock Sr was bound to plagioclase, with the remaining 7 % stored in orthoclase. For all three base cations, isotope composition of throughfall and runoff was statistically indistinguishable. Bulk bedrock Mg and Ca isotope ratios were also statistically indistinguishable from those of runoff. Bulk-rock $^{87}Sr/^{86}Sr$ ratios were significantly higher, compared to those of runoff and throughfall. In vertical soil profiles, the isotopically heaviest Mg was found at the depth of 5 cm below the transition from organic to mineral horizons, whereas the isotopically heaviest Ca was found in the topmost litter layer. The highest $^{87}Sr/^{86}Sr$ ratio was that in the deepest mineral horizon. Individual bedrock minerals were characterized by an extremely wide range of Mg/Ca/Sr isotope composition but the main carrier of each of these base cations was isotopically similar to runoff. The isotope systematics at Na Lizu did not permit to quantify the atmospheric contribution of Mg/Ca/Sr to runoff. It contrasted with strongly acidified, spruce die-ack affected catchments in the northern Czech Republic where atmospheric inputs of Mg and Ca containing ash from coal-fired power plants may have played a larger role in runoff generation.