Geophysical Research Abstracts
Vol. 19, EGU2017-13043, 2017
EGU General Assembly 2017

Sr isotope characterization of atmospheric inputs to soils along a climate gradient of the Chilean Coastal Range

Ralf Oeser (1), Jan A. Schuessler (1), Geerke H. Floor (1,3), Friedhelm von Blanckenburg (1,2)

(1) Earth Surface Geochemistry, GFZ German Research Center for Geosciences , Potsdam, Germany (oeser@gfz-potsdam.de), (2) Institute of Geological Science, Freie Universität Berlin, Berlin, Germany, (3) Institute of Life Science and Chemistry, Utrecht University of Applied Sciences, Utrecht, The Netherlands

The rate and degree of rock weathering controls the release, distribution, and cycling of mineral nutrients at the Earth's surface, being essential for developing and sustaining of ecosystems. Climate plays an important role as water flow and temperature determine both the biological community and activity, and also set the speed of weathering. Because of this double control by climate, the impact of biological activity on rock weathering and the feedbacks between the geosphere and the biosphere under different climatic conditions are not well understood. We explore the impact of biota on rock weathering in the four EarthShape primary study areas which are situated along the Chilean Coastal Range, featuring an outstanding vegetation gradient controlled by climate, ranging over 2000 km from hyper-arid, to temperate, to humid conditions. The study sites are within 80 km of the Pacific coast and are located in granitic lithology. Moreover, the sites were unglaciated during the last glacial maximum. However, as substrates get depleted in mineral nutrients, ecosystems are increasingly nourished by atmospheric inputs, sources, such as solutes contained in rain, dust, and volcanic ash.

We aim to quantify the primary nutrient inputs to the ecosystem from these different potential sources. Radiogenic strontium (Sr) isotope ratios are a powerful tool to trace chemical weathering, soil formation, as well as cation provenance and mobility [1]. We determined ^{87}Sr/^{86}Sr ratios on bulk bedrock, saprolite, and soil and performed sequential extractions of the the easily bioavailable soil phases up to 2 m depth on two soil depth profiles in each of the four study sites.

Our first results from the La Campana study site indicate that the radiogenic Sr isotope ratios of saprolite samples decrease from 0.70571 (n = 4) at the base of the profile to lower values of 0.70520 (n = 4) at the top of the immobile saprolite, indicating increasing biotite weathering. ^{87}Sr/^{86}Sr increases in the mobile soil layer to 0.70571 (n = 25). We find that atmospheric sources (^{87}Sr/^{86}Sr$_{seawater}$ = 0.709234; [2]) contribute about 13 % of Sr to the soil and are a minor but not negligible fraction in comparison to weathering supply from saprolite. Furthermore, the ^{87}Sr/^{86}Sr ratios determined for saprolite samples are in good agreement with the values reported for the local Illapel Plutonic Complex [3]. Hence, the top-soil atmospheric inputs are potentially influencing the plant's strategies of nutrient uplift, ultimately controlled by the plants' nutrient demand as a function of climate.

[1] Capo, R. C., Stewart, B. W., and Chadwick, O. A., 1998, Strontium isotopes as tracers of ecosystem processes: theory and methods: Geoderma, v. 82, no. 1-3, p. 197-225.

[2] DePaolo, D. J., and Ingram, B. L., 1985, High-resolution stratigraphy with strontium isotopes: Science, v. 227, no. 4689, p. 938-941.

[3] Parada, M. A., Nyström, J. O., and Levi, B., 1999, Multiple sources for the Coastal Batholith of central Chile (31–34˚S): geochemical and Sr–Nd isotopic evidence and tectonic implications: Lithos, v. 46, no. 3, p. 505-521.