Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30833

Nutrient Pathways in Plants of the World's Driest Desert (Atacama Desert) revealed by Trace Elements and Sr Isotopes

MS. KATRIN MORR[1], CARSTEN MÜNKER[1], FRANK WOMBACHER[1], JULIA BECHTELER[2], DIETMAR QUANDT[3] AND MARIA WIERZBICKA-WIECZOREK[1]

[1]University of Cologne
[2]University of Munich
[3]University of Bonn

The Atacama Desert in Chile, the driest non-polar desert on Earth, represents a remarkable natural habitat to explore plant nutrient acquisition strategies and their interplay with soil geochemistry. We determined isotope analyses of 87Sr/86Sr together with major and trace element data (e.g., Mg, P, Na, Ca, REEs) for plants and associated soils. The desert shrub *Huidobria chilensis* (Loasaceae) was chosen for this case study.

The aim is to evaluate the bioavailability of critical elements and highlight the effect of soil mineralogy on selective nutrient uptake. Our findings reveal that plants exhibit Sr isotope signatures distinct from those of bulk soils, suggesting a selective uptake of nutrients from specific mineral phases. Leaching protocols were employed to isolate and measure their distinct isotopic and elemental compositions and thereby unravel the contributions of individual mineral phases.

Water-soluble minerals such as nitrates and chlorides were dissolved, followed by dissolution of sulfates at pH-neutral condition using ion exchange resin. The remaining material was then treated with weak HCl to target phosphates or similar compounds. In a final step, the silicate matrix was fully digested in HF-HNO_3.

A comparison of the different soil leachates and *H. chilensis* tissue reveals that the water soluble and sulfate fractions of the soil both share almost identical Sr isotopic compositions to those of the plant leaves tissue. These mineral fractions contribute between four and ten weight percent to the soils. In contrast, the HCl-soluble and silicate fractions closely resemble the Sr isotope compositions of the bulk soil, as they host most of the Sr inventory in the soil. This observation indicates that critical nutrient elements of *H. chilensis* are primarily absorbed from the salt- and gypsum-rich phases. Regardless of the bulk soil, we conclude that isotopic signatures of the plants are largely independent from the influence of the bulk soil isotope compositions.