

Stable Strontium Isotope fractionation during Pedogenic processes

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Previous stable Sr isotope data ($\delta^{88/86}\text{Sr}$) showed that rivers are generally enriched in ^{88}Sr relative to their source rocks, suggesting that geochemical processes on land fractionate Sr isotopes. However, the exact fractionation mechanisms remain insufficiently constrained, limiting our ability to use $\delta^{88/86}\text{Sr}$ values as a tracer for terrestrial processes. This study investigates the mechanism and extent of stable Sr isotope fractionation during pedogenic processes in mountain soils subjected to varying degrees of rainfall-driven leaching. Soil samples were collected along a rain traverse in Israel ranging from 350 to 950 $\text{mm}\cdot\text{yr}^{-1}$, together with local dust, which may be an important source material for soils in this region. The chemical, mineralogical, and Sr isotope compositions ($\delta^{88/86}\text{Sr}$ and $^{87}\text{Sr}/^{86}\text{Sr}$) of the soils were determined.

Preliminary results show that $\delta^{88/86}\text{Sr}$ values of bulk soil samples range from 0.096 ‰ to 0.250 ‰. The $\delta^{88/86}\text{Sr}$ values of dust samples (0.192 ‰ - 0.232 ‰) fall within the range of bulk soils, although tending towards its upper end. In contrast, three out of four $\delta^{88/86}\text{Sr}$ values measured in carbonate bedrocks are higher than the bulk soils. This may suggest a greater contribution of Sr from dust to these soils than from the bedrock. In addition, a negative correlation between the Al_2O_3 and CaO content of the bulk soils was observed. This trend generally follows the rainfall trend and is thus interpreted to represent the preferential dissolution of carbonate materials, enriching the soils with residual Al-clays. However, the $\delta^{88/86}\text{Sr}$ values of the bulk soils do not follow the Al_2O_3 -CaO trend. This suggests that factors other than preferential leaching of carbonate minerals control the $\delta^{88/86}\text{Sr}$ values of these soils. To identify these factors, further investigation targeting specific soil fractions, including the silicate, carbonate, and exchangeable phases, is planned.