

Distinguishing Between Lithogenic and Biogenic Processes in Soil Weathering Environments

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Common elemental weathering products, including Ca, K, Si and P, are also important macronutrients for vegetation. In mass balance and source to sink studies it is often difficult to separate lithogenic from biogenic processes controlling these elemental distributions. An example of the importance of this separation is shown in the Figure for pore waters in a soil chronosequence near Santa Cruz California. High Na/Ca ratios at > 1 m depth correspond to the progressive weathering of plagioclase while low Na/Ca ratios at < 1 m correspond to the preferential uptake of Ca to Na in the vegetation. For elements which behave similarly in one or both environments, i. e., Sr/Ca, such fractionation is much less.

The use of elemental and isotopic ratios are considered as tools for discriminating between lithogenic and biogenic processes in the Santa Cruz soils which are dominated by a Mediterranean climate with distinct seasonal precipitation and growth cycles of grassland vegetation. Ge/Si and $\delta^{30}\text{Si}$ exhibit variations corresponding to phytolith production and dissolution while $\delta^{44}\text{Ca}$ variations reflect biomass production and degradation in the shallow soils and feldspar weathering at depth. Mass balance models are constructed for mineral nutrients based on these and other discrimination techniques.

