Distinguishing between lithogenic and biologic processes in soils

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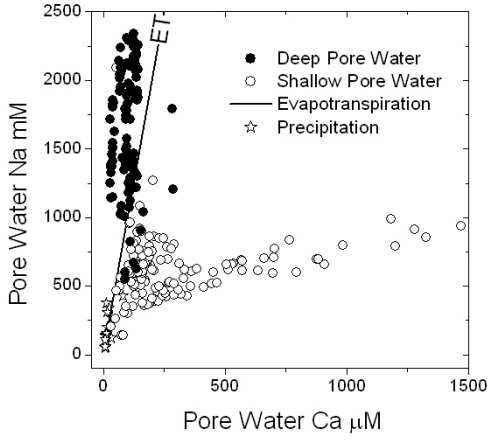
Recently it was been increasingly recognized that many geochemical processes observed in soils result from a combination of chemical weathering and biological cycling. This relationship is particularly important in understanding the distribution of inorganic macronutrients which are products of chemical weathering and are used extensively in the biosphere (Huntington, 2000; Meunier, 1999). Approaches to differentiating between these processes are being investigated in a soil chronosequence (65 to 260 kyrs) developed on silicic sediments contained on paleo-marine terraces near Santa Cruz California. An example of what we term the lithogenic/biogenic fractionation of two common solutes in pore water is shown in the following figure in which deep pore waters are dominated by high Na/Ca ratios reflecting plagioclase dissolution and the shallow pore waters are dominated by preferential cycling of Ca relative to Na in the grassland vegetation. The divergence between these ratios is the fractionation factor; the greater the angle, the greater the difference in chemcial behavior. This fractionation is discussed in terms of other major elements, Ge/Si ratios and the isotopes of Ca, Sr and Si.



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The effect of climate, vegetation, rock age, and human activity on basalt weathering rates in NE-Iceland

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The objective is to quantify the effect of climate, vegetation, soil, rock age, and human activity on the chemical and mechanical weathering rates of basalt and their relative role in the global carbon cycle. This study is based on 3 - 40 years monitoring of 8 catchments in NE-Iceland. This system is ideally suited to determine effects of various parameters on weathering rates as these catchements are 1) pristine, 2) drain a single rock type, and 3) are comprised of rocks that vary in age from 0 - 11 Myr. Moreover, Iceland, as the largest part of the mid-ocean rift system on Earth that is above sea level, is representative of the volcanic and tectonic active islands that contribute over 45% of suspended material to the oceans (Milliman and Syvitski 1992). In addition, the erection of hydropower plants in 2003, provides an unique opportunity to study the effect of dams on weathering processes.

The measured values of suspended and dissolved material concentration are combined with catchement runoff to estimate the daily dissolved and suspended element fluxes in each catchement during the last 4 decades. Seasonal variations for suspended flux are far greater than that of dissolved flux; suspended material flux varies by up to four orders of magnitude, whereas dissolved flux varies by only about one order of magnitude. Chemical and mechanical weathering rates decrease with rock age, but mechanical weathering decreases at a faster rate. Chemical weathering rates increase with increasing primary production and net ecological exchange of vegetation and biota in the catchments.

Reference

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