Deciphering Chemical Fluxes and Reaction Rates from Regolith Weathering Profiles

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Contemporary and long-term chemical weathering are defined respectively in term of changes in solute and solid state compostions with depth in a regolith. An increase in the mineral weathering rate R increases the rate of change in these concentrations with depth while increases in the weathering velocity ω decreases the change (see Figure insert). The solid-state weathering velocity is the rate at which the weathering front propagates through the regolith and the solute weathering velocity is equivalent to the rate of pore water flow.

A spreadsheet model is used to quantitaively assess measured weathering gradients in a soil chronosequence near Santa Cruz, California both in tems of spatial and temporal variations. A best fit to a 227 kyr solid state profile (solid line in Figure) indicates that ω is dependent on the product of fluid flow and the ratio of the masses of solubized feldspar to total feldspar in the regolith. The slope of the profile b is dependent principally on R while the approach to protolith concentrations at depth is dependent on an expression describing near- field saturation effects.