Geochemical characterization of subsurface variation on contrasting hillslope aspects, Boulder Creek Critical Zone Observatory

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Critical Zone Evolution

The Critical Zone (CZ) is the system of coupled chemical, biological, physical, and geologic processes operating together to support life at the Earth's surface [1]. Within the CZ, geochemical weathering develops a zone of both elemental cycling and physical alteration leading to porosity and permeability variations. Understanding geochemical cycling within the CZ is integral to developing models of these variations. Most geochemical CZ studies, however, focus on shallow (< 2 m) investigations, and do not penetrate the active weathering front. In order to cultivate a understanding of how coupled biogeochemical and hydrological processes affect the transport of material through soil and weathing profiles, an evaluation of depth-dependent geochemical processes in deep weathering profile is needed.

Study Questions and Methodological Approach

Samples of weathered material from five boreholes, 7.3 to 13 m in depth, on contrasting hillslope aspects in the Gordon Gulch watershed of the Boulder Creek Critical Zone Observatory were collected. Analysis of these samples using: (1) x-ray diffraction, (2) total organic carbon, (3) sequential extractions, (4) bedrock petrography, and (5) qualitative analyses, will provide insight into coupling of hydrologic, geologic, and biological processes that take place in the active weathering front, encompassed within the CZ. Depth-dependent mass transport of elements within the heterogeneous weathering profile will be calculated and correlated to observe biogeochemical characteristics.

Results from this study will provide a better understanding of overall CZ evolution in mountainous watersheds. Expected outcomes for this project are: (1) continuation of significant geochemical weathering processes at depths below 2 m, and (2) deeper sustainment of the weathering front on south-facing slope.

[1] Anderson (2007) *Elements* **3,** 307-314.