Geophysical Research Abstracts
Vol. 20, EGU2018-18381, 2018
EGU General Assembly 2018

Geochemical Approach to Quantifying Atmospheric Dust Input to Alpine Soils in the Uinta Mountains, USA

Emmet Norris, Jeffrey Munroe, and Peter Ryan
Department of Geology, Middlebury College, Middlebury, USA (enorris@middlebury.edu)

Geochemical comparison of atmospheric dust and local bedrock allows for the quantification of exogenous versus endogenous inputs to alpine soils. We applied this approach in the Uinta Mountains, part of the Rocky Mountain system in the western USA. Largely homogenous, quartzite-dominated bedrock of the Uinta Mountains is depleted in key environmental nutrients, and thought to be insufficient to support the productive ecosystem of high alpine tundra meadows. Wind-transported mineral dust is known to be a significant contributor of nutrients in other alpine regions. A network of passive and active dust collectors has sampled contemporary dust deposition in the Uinta Mountains since 2011. This dust is notably enriched in calcium, strontium and rubidium relative to bedrock. Samples of surface soil and deeper soil horizons, from four locations at the eastern end of the Uinta range, were collected in 2016, providing a perspective on the dust content of alpine soils in this region. Grain size analysis of 41 samples reveals that soil A-horizons are composed of 13.0 to 87.0% silt (mean of 67.2%), whereas B- and BC-horizons contain 13.0 to 68% silt (mean of 38.8%). This difference, which is significant (P=0.000), supports previous reports of a ubiquitous loess cap averaging 18 cm thick at the eastern end of the Uinta Mountains. XRF analysis of soil, dust and bedrock samples from one location demonstrates A-horizon enrichment in strontium of 450-480%, and 460-540% in rubidium, relative to bedrock. In contrast, samples from deeper soil horizons are 120-320% enriched in strontium and 250-440% in rubidium. Bedrock is 98% SiO_2, whereas A-horizon samples are $\sim$80% SiO_2. Aluminum (as $Al2O_3$) is enriched 800% in A-horizon and 600% in deeper horizons relative to bedrock. Analysis of the average strontium values in soil horizons as a mixture of bedrock and dust end members demonstrates that A-horizons are composed of 63% dust, with just 37% local material. In contrast, deeper soil horizons are composed of 57% dust and 43% bedrock. Future work will refine these estimates with additional elements.