Influence of lithology on streamwater chemistry

P. KRAM

Czech Geological Survey, 11821 Prague 1, Czech Republic (pavel.kram@geology.cz)

Twenty small catchments, each underlain by geochemically contrasting rock types, were studied in the lithologically diverse Slavkov Forest, northwestern Czech Republic. The area was not glaciated and is overlain by soil derived from the local bedrocks. The catchments have similar elevation (around 700 m asl), mean air temperature (around 6°C), precipitation (around 800 mm yr^{-1}), atmospheric deposition, and vegetation cover, but contrasting bedrocks (Table 1). All catchments are forested by Norway spruce (*Picea abies* (L.) Karsten) plantations. Streams of the Slavkov Forest experienced anthropogenic acidification due to large industrial emissions of SO_2 [1]. Two catchments underlain by leucogranite and serpentinite are in the Czech GEOMON network of intensively studied catchments [2].

Contrasting streamwater compositions were generated mainly by differences in chemical weathering [3]. Very low pH and ANC were found in the streams draining leucogranite (Table 1). Granitic catchments exhibited low acid neutralizing ability potential. Catchments underlain by mica schists, gneisses, amphibolites and neovolcanites showed medium to high neutralizing potential. Serpentinite streamwater exhibited the highest pH, ANC and Mg concentrations and consequently extremely low Ca/Mg and K/Mg ratios.

Bedrock	N	Area	ANC	pH	Ca/Mg	K/Mg
Leucogranite	4	0.5	-30	4.4	4.5	1.0
Granite	3	0.7	-3	4.8	3.4	0.3
Mica schist	2	0.2	+50	5.5	2.3	0.4
Gneiss	2	0.3	+120	5.8	1.3	0.6
Amphibolite	4	0.5	+300	6.5	2.3	0.2
Neovolcanite	2	0.2	+700	6.3	4.1	0.1
Serpentinite	3	0.2	+850	7.2	0.1	0.01

Table 1: Mean streamwater chemistry of catchments. N = number of catchments, mean area in km^2, ANC = Gran titration acid neutralizing capacity in ueq L^{-1}, element mass ratios in g g^{-1}.

This study was supported by the European Commission Grant 244118 SoilTrEC.

[1] Majer *et al.* (2005) *Environ. Pollution* **135**, 17–28. [2] Oulehle *et al.* (2008) *Ecosystems* **11**, 410–425. [3] Hruska & Kram (2003) *Hydrol. Earth System Sci.* **7**, 525–539.

Organic matter-mineral interactions with depth across a substrate age gradient in Hawai'i

MARC G. KRAMER[1], OLIVER A. CHADWICK[2] AND AARON THOMPSON[3]

[1]Department of Earth and Planetary Sciences, University of California, Santa Cruz, CA
[2]Geography Department, University of California, Santa Barbara, CA
[3]Department of Crop and Soil Science, University of Georgia, Athens, GA

We examined the composition of organic matter and its interaction with soil minerals across a substrate age gradient in Hawai'i. Our objectives were to (1) determine the type of soil organic matter (SOM) that accumulates with depth (2) assess interactions between soil minerals and organic matter and (3) assess the possible mechanisms for SOM accumulation. Sequentially deeper soil samples were collected from 6 sites across a substrate age gradient (300y - 4.1My) of mantle-derived lava. The sampling sites all have similar rainfall (2500 mm MAP), vegetation and topographic position. Samples from major diagnostic soil horizons were analyzed for ^{15}N stable isotope ratios and carbon composition using ^{13}C NMR. The crystallinity of soil minerals was assessed by comparing elemental release during sequential acid-ammonium oxalate (AAO) and citrate-bicarbonate dithionate (CBD) extractions. Across intermediate aged sites (20Ky-350Ky), we found the most isotopically enriched SOM pools accumulated in surface mineral horizons (Bh horizons) where alkyl abundance (based on NMR) was notably high. Intermediate age sites (20Ky-350Ky) contained increasing amounts of AAO-extractable minerals (e.g. short-range ordered minerals) with depth. A corresponding shift, at depth, of decreasing ^{15}N values, increasing C/N ratios and ^{13}C NMR composition toward a carboxyl-carbonyl form was observed in association with increasing AAO-extractable mineral abundance. We conclude that alkyl-rich SOM in surface mineral soil horizons accumulated largely as a result of soil microbial transformation mechanisms and possibly from interaction with nanoscale Fe-Al-(oxy)hydroxides. At greater depth, an increasingly labile, hydrophilic (carboxyl-carbonyl rich) SOM form—likely to have originated from dissolved organic carbon (DOC) leached from upper organic soil horizons—was strongly correlated with the AAO extractable minerals. This is consistent with the formation and persistence of allophane at depth in these andic soils.