Poster #154

Shale Weathering in the East River Watershed

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Much of the East River watershed is underlain by the Mancos shale, which may release biogeochemically significant quantities of organic carbon, nitrogen, metals, salinity and other constituents through abiotic and microbially mediated weathering reactions. The shale weathering team is assessing the extent and timing of nutrient and metal inputs to the river, identifying the dominant water–rock interaction locations above and below the water table, and developing models for weathering reactions. This work contributes to the organo-mineral and nitrogen cycle components of the SFA research plan.

Work initiated in the 2016 field season performed essential shale characterization, identified candidate water chemistry and isotopic signatures of shale weathering, and installed sampling infrastructure. A 4-inch OD x 8.5-m core from the hillside transect will provide a detailed sedimentary sequence and estimates of fracture density and fracture surface weathering extent with depth. We performed elemental, mineral, and imaging analyses as well as carbon and nitrogen isotope measurements of shale samples from outcrops throughout the watershed and 1” cores drilled from bedrock along the East River. The shale hosts abundant pyrite in forms ranging from dispersed framboidal aggregates, pyritized burrows and millimeter-thick seams. Associated metal sulfides include discrete nanoscale particles of CdS (probably greenockite). Shale water samples showed a high sulfate concentration and $\delta^{34}S$ of -23‰ indicating oxidation of sedimentary pyrite, providing a tracer for shale-sourced sulfate in the watershed (streams range in $\delta^{34}S$ from -15 to +5). We installed vertical and horizontal water sampling ports into shale bedrock at several locations to enable monitoring of seasonal variations in water content and chemistry, isotopes including H_2O, Sr, and U, and microbial community composition.

Ongoing and planned work will study shale weathering processes through complementary efforts. Laboratory column studies will assess the effect of shale metamorphism on weathering and carbon release. Batch incubations will assess the potential for carbon and metal release through microbial reactions. Metagenomic analysis of fluids from pyrite-rich locations will establish the communities hypothesized to initiate the weathering process. High-resolution imaging will determine if weathering pathways follow the same sequence in soil- versus ground water-dominated zones. Detailed studies of nitrogen content, speciation and isotopic composition in rock and fluids will evaluate the potential for *in situ* nitrification.