WEATHERING IN THE SUBTROPICAL ENOREE RIVER BASIN, SOUTH CAROLINA, USA

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The effect of watershed spatial scale on chemical weathering is inadequately known for subtropical environments. In order to determine the relationship between watershed scale and weathering chemistry, the Enoree River basin was sampled at seven different spatial scales ranging from second-order watersheds smaller than 2 km^2 to a sixth order watershed of 1840 km^2. The second-order watersheds are characterized by weathering-limited environments, and higher-order watersheds are characterized by transport-limited environments. All streams drain high-grade metamorphic bedrock with some igneous intrusions of primarily felsic composition.

Water samples were collected on a weekly to monthly basis. Samples were filtered, preserved, and stored following standard methods. Temperature, pH, Eh, and conductivity were measured in the field. Turbidity was measured in the lab. Anion concentrations were measured using colorimetric methods and major cation and silica concentrations were measured using ICP-AES methods. All samples are mixed cation-bicarbonate facies; variation in chemistry with time is the result of dilution of base flow by rain events. All samples have a high Na/Ca ratio and relatively low TDS, characteristic of siliceous rocks.

The results show an increase in total dissolved solids and a decrease in the silica to alkali ratio as the watershed scale increases. Samples collected in a small, mountainous, weathering-limited second-order watersheds had total dissolved solid concentrations of about 20 mg/L. These streams are characterized by a Si:(Na+K) slightly below, but parallel to the 2:1 line representing weathering of rocks to kaolinite. XRD analyses of soils from this watershed showed that kaolinite is the main weathering product. Samples collected from higher order watersheds of the Enoree river had total dissolved solid concentrations increasing from 30 to 70 mg/L. These samples plot below the 2:1 line suggesting that soils should contain cation-enriched clays. Mineral stability diagrams show that all water samples plot in the kaolinite field, but trend toward the kaolinite-smectite boundary as watershed size increases.