

SLOPE, STORAGE, AND SCALE: CONTROLS OVER SEDIMENT COMPOSITION IN STREAMS

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Slope is a primary control on sediment maturation trends in fluvial systems because it influences the development of alluvial storage. *In situ* weathering of sediments in alluvial storage leads to the progressive loss of less stable phases such as feldspar and rock fragments and the relative enrichment of the more stable phases such as quartz. High slope systems are characterized by less alluvial storage and more immature sediment defined by the abundance of less stable phases; low slope systems are characterized by abundant alluvial storage and mature sediments defined by a relative enrichment of stable phases. The current study examines the effects of slope and scale on maturation trends by assessing these relationships in a small, Appalachian watershed, and comparing the results to watersheds of different scales. The purpose is to assess the scale dependency of slope as a control on sediment compositional trends.

The 2.95 km² Mountain Lake Watershed, located in Greenville, SC, is a weathering-limited regime drained by two second-order streams, each less than 2.5 km in length. The average slope for the streams is about 65 m/km. The climate is subtropical and thin ultisols overlie sillmanite schists and biotite gniesses. Quantitative petrographic analyses of 20 stream sediment samples indicate immature sediments characterized by the presence of rock fragments, soil peds, weathering rinds, and alterites as well as primary minerals. Quartz constitutes less than 60% of sediment minerals. The lack of systematic

downstream changes in composition and texture indicates no sediment maturation, primarily because of the lack of alluvial storage in the watershed.

On a smaller scale, the consistent abundance of weathering rinds documented in this study indicates that such rinds in fresh sediments are lost somewhere between ~2 and 4 km. Considered on a larger spectrum, these results stand as an opposite end-member in contrast to several large scale studies of river systems in various climates. These larger studies show significant loss of less stable phases along the profile of a river, and draw a direct correlation drawn between the regional slope and the progressive maturation of the sediments.