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SPATIAL VARIATIONS IN MOBILE REGOLITH THICKNESS, METEORIC ^{10}BE CONCENTRATION, AND SEDIMENT STORAGE IN THE BOULDER CREEK CRITICAL ZONE OBSERVATORY: IMPLICATIONS FOR LANDSCAPE EVOLUTION AND HILLSLOPE SEDIMENT TRANSPORT

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The Boulder Creek Critical Zone Observatory (BcCZO) aims to understand the history, architecture, and evolution of hillslopes found within the diverse topography and climate regimes of the Colorado Front Range. Here, we present the results of a systematic study which aims to document spatial patterns of mobile regolith thickness, meteoric ^{10}Be concentrations, and sediment storage in the Gordon Gulch watershed of the BcCZO. Gordon Gulch lies within the unglaciated portion of the BcCZO and is hypothesized to be in long-term steady state evolution. This small, 3.7 km^2 watershed is characterized by mixed bedrock-soil mantled hillslopes, with intermittent bedrock outcrops (tors) on ~10% of slopes. Varying fracture spacing and rock strength of the local bedrock, topographic slope and curvature, and hillslope aspect provide distinctive lenses to interpret the evolution of the hillslopes. Our analysis of over 200 soil pits reveals high variability in mobile regolith thickness, which we define as the depth to immobile weathered bedrock and/or saprolite. In general, the mobile regolith cover is thinner on the south-facing slopes than on the north, and a thickening of mobile regolith occurs on the toes of steep north-facing slopes. Furthermore, the upper portion of Gordon Gulch has, on average, greater thicknesses than the lower portions of the watershed. We combine our analysis of regolith thicknesses on hillslopes with mapping of toe-slopes, alluvial fans, stream terraces, and gulley fills to build a sediment budget for the watershed. In addition, meteoric ^{10}Be analysis and carbon-14 dating provide constraints of the age, rates, and timing of sediment transport, storage, and removal from the watershed. Initial meteoric ^{10}Be results indicate that total pit inventories are higher on south-facing hillslopes than on north-facing hillslopes, implying longer residence times on the south-facing hillslopes. These data suggest that erosion and hillslope sediment transport are more efficient on north-facing slopes. This conclusion is supported by our mapping within the lower Gordon Gulch stream valley, which indicates a larger volume of sediment is stored within Holocene alluvial fans and toe-slopes at the base of north-facing slopes than within similar features at the base of south-facing slopes.

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T5. Critical Zone Processes
Tuesday, 19 March 2013: 1:30 PM-5:55 PM

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