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RAPID COSMOGENIC NUCLIDE DERIVED EROSION RATES ON THE GRAND STAIRCASE, SOUTHERN UTAH, USA: STRONG LITHOLOGIC CONTROL ON EROSION PATTERNS OR AN ARTIFACT OF NON-UNIFORM DISTRIBUTION OF QUARTZ AND CLIFF-SLOPE TOPOGRAPHY

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Recently measured ^{10}Be concentrations in sediment sampled in headwaters of large tributaries to the Colorado River on the Grand Staircase (GS) are low, suggesting erosion rates higher (3x or more) than small, steep tributaries within Grand Canyon (GC). Either formation of GC has been associated with a deceleration in incision rate or GS landscape features bias ^{10}Be-derived erosion rates. Individual basins contain variable bedrock. Cliff bands are common in the topography and streams contain fine-grained arroyo fill deposits with possible eolian input. We present remote and field observations and data as well as emerging determinations of quartz yield to determine whether the detrital ^{10}Be concentrations could be sufficiently biased to create a false impression of temporally decreasing erosion rates during the formation of GC.

These data are intended to test whether the GC could reflect either a period of increased baselevel fall or simply the lower erodibility of Paleozoic and older rocks. Spatial erosion rate patterns are expected to be diagnostic of baselevel history, with landscape elements farther upstream representing older rates of baselevel fall. Landforms analogous to GC can be produced by incision through weak rock layers (Cenozoic and Mesozoic) overlying stronger rock (Paleozoic and older). When tributaries encounter the underlying hard rock, a slope-break knickpoint (KP) forms and establishes a stable local baselevel. An expanding plateau bench (Kaibab plateau) grows headward as channels cut down only as far as this local baselevel. The erosion rate of the headwaters, upstream of this expanding plateau surface (i.e., the GS), will not change until the expanding plateau consumes the entire catchment. Importantly this is true regardless of the evolution of mainstem incision rate, so long as the mainstem continues to incise into the underlying hard rock and causes tributaries to steepen in response to either greater rock strength, increased mainstem incision rate, or both. Because headwater catchments record a memory of the baselevel fall rate prior to contact with harder rock, a space-for-time substitution is possible.

Session No. 92

T42. Landscape Evolution through the Lens of Cosmogenic Nuclides
Monday, 20 October 2014: 8:00 AM-12:00 PM

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