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TEMPORALLY AND SPATIALLY UNIFORM RATES OF EROSION IN THE GREAT SMOKY MOUNTAINS

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Cosmogenic, fission track, and sediment yield data indicate that the Great Smoky Mountains are eroding at a similar rate, about 30 m My^{-1}, over both time and space. The Smokies rise >1500 meters above adjacent valleys. Relief over most of the range is significant with very steep slopes feeding sediment into deeply incised river valleys. Mean annual rainfall is about 200 cm; the slopes are soil covered and heavily vegetated.

We measured ^{10}Be in sediment (n=22) from seven Great Smoky Rivers and in bedrock (n=2) from outcrops on a hill slope and on the main drainage divide. Results suggest spatially homogeneous erosion (on the 10^4 to 10^5 year time scale). Bedrock outcrops (22±4 m My^{-1}) are more stable than drainage basins as a whole (31±6 m My^{-1}), consistent with the exposure of sampled rock above the soil-mantled hill slopes. There is no correlation between rates of erosion and basin drainage area, maximum relief, average elevation, and orientation. The lowest erosion rates were calculated for a slope bedrock out crop and a first order stream on the Raven Fork drainage basin (□~19 m My^{-1}). Samples from other first order streams (n=9, 1-11 km^2) yielded higher model erosion rates (29±3 m My^{-1}) that approached more closely the values calculated for samples from outlet streams of large basins (31±6 m My^{-1}, n=7, 64-191 km^2). The highest erosion rates (□~37 m My^{-1}) were calculated for the Little Pigeon drainage basin, which is otherwise similar to the many rivers that drain the Smokies.

Fission track studies by Naeser et al. (1999) imply time averaged (late Triassic to recent) denudation rates for the Great Smoky Mountain between 25-40 m My^{-1}. Sediment yield data collected during the 1930's by the U.S. Geological Survey for some rivers in the Smokies indicate, when considered as rock-surface erosion rates, denudation at rates between 21 and 65 m My^{-1}; these historical rates likely reflect post colonial deforestation. Comparison of cosmogenic erosion rates with fission track and sediment yield data suggests that erosion rates have been similar over the 10^2 to 10^7 year time scales. The spatial and temporal uniformity of erosion rates preclude rapid recent uplift and incision and suggest landscape equilibrium with lithology and structural setting.

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General Information for this Meeting

Session No. 133--Booth# 55
Quaternary Geology/Geomorphology (Posters) I
Hynes Convention Center: Hall D
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