Paper No. 181-10

Presentation Time: 4:00 PM-4:15 PM

LONG-TERM EROSION RATES DERIVED FROM 10BE IN SEDIMENT FROM SMALL CATCHMENTS, NORTHERN FRONT RANGE AND SOUTHERN WYOMING

DETHIER, David P.1, OUIMET, Will1, BIERMAN, Paul2, and FINKEL, Robert C.3, (1) Department of Geosciences, Williams College, Williamstown, MA 01267, ddethier@williams.edu, (2) Geology, Univ of Vermont, Perkins Hall, Rm. 001, Burlington, VT 05405, (3) Center for Accelerator Mass Spectrometry, Lawrence Livermore National Lab, MS L-202, Livermore, CA 94550

Rates of long-term erosion across the Rocky Mountain region help to constrain the relative roles of tectonic uplift, climatic change and rock resistance in sculpting the modern landscape. We measured concentrations of cosmogenic nuclides in quartz extracted from stream sediment from 13 catchments to provide estimates of erosion rates at time scales from103 to 105 yr. Preliminary analysis of 10Be activity from small (< 50 km2), upland catchments in Colorado and Wyoming indicates that the landscape is lowering at rates between 14 and 250 m/MY in this semiarid area. We sampled basins that: (1) have not been glaciated; (2) have only small volumes of sediment stored beneath terraces and in colluvium, and (3) display minimal evidence for anthropogenic disturbance. We measured the 10Be content of the 250 to 710 mm sand fraction collected in cross-channel transects. Our initial data do not show strong influence of basin relief, average slope, drainage area, tectonic environment, or climate. However, the range of erosion rates from different lithologies suggests that relative rock resistance exerts strong control on landform evolution in the Rocky Mountain region. Catchments draining weathered Precambrian basement (granites and gneisses) typical of the northern Front, Laramie and Medicine Bow Ranges give erosion rates of 18 to 30 (24± 6; n=9) m/MY. Weakly lithified Middle and Upper Cenozoic basin fill is eroding at rates of 45 to 250 m/MY at sites in southern Wyoming and northern Colorado. Precambrian quartzite exposed in the eastern Uinta Mountains gave a rate of 14 m/MY, the lowest we measured. Erosion rates measured in upland granitic and gneissic catchments in Colorado are comparable to those measured in other non-orogenic areas such as the southern Appalachians. If our initial measurements for erosion rates of weakly lithified basin fill are typical, most of the middle and late Cenozoic fill in the greater Wyoming area could have been stripped in the past 5 to 10 million years.

2002 Denver Annual Meeting (October 27–30, 2002)

Session No. 181
Rocky Mountains IV: Tectonics, Climate Change, and the Late Cenozoic Evolution of the Rocky Mountains, Colorado Plateau, and Western Great Plains
Colorado Convention Center: C108/110/112
1:30 PM–5:30 PM, Tuesday, October 29, 2002