2007 GSA Denver Annual Meeting (28–31 October 2007)

Paper No. 190-3

Presentation Time: 8:35 AM-8:55 AM

A GEOCHRONOLOGIC GLIMPSE INTO HOW ANCIENT MOUNTAIN RANGES ERODE

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The continents are filled with long-dead mountain ranges. Although the active tectonism that built these ranges ceased tens to hundred of millions of years ago, the mountains remain as steep, dramatic landscape features, barriers to transportation, and the source of many geologic hazards including flash floods and debris flows.

The Appalachian Mountains are a prime example of such a decay-phase orogen, a range that has long attracted the interest of geomorphologists. Today, new geochronologic tools including thermochronology and cosmogenic nuclides allow us to understand how rapidly the Appalachian Mountains have eroded and are eroding.

10-Be analysis of > 250 sediment samples from outcrops, hillslopes, and drainage basins at a variety of scales and at locations from Pennsylvania south to Georgia indicates that the Appalachian Mountains are eroding only slowly, on the order of a few tens of meters per million years. In places as geomorphically distinct as the Valley and Ridge of Pennsylvania, the Great Smoky Mountains of North Carolina, Virginia's Shenandoah Mountains, and the Blue Ridge Escarpment, integrated erosion rates are similarly low when considered both over the cosmogenic and thermochronologic (fission track and some U/Th/He data) time scales.

Although there is a positive relationship between drainage basin average slope and erosion rate and perhaps a slight dependence of erosion rate on lithology, the overall similarity in cosmogenically and thermochronologically modeled erosion rates over more than 1000 km is striking and argues for the importance of a large scale isostatic response to erosion, enabled by a thickened crustal root, as the driver of continued uplift. Perhaps the most important finding revealed by these new geochronologic techniques is that feedbacks between mass loss at the surface and compensation at depth have provided geologists a field laboratory where one parameter, rock uplift rate, has likely been relatively steady over time and space.

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General Information for this Meeting

Session No. 190
Using Geochronology to Build Better Records and Solve Geomorphic and Paleoclimate Questions—Recent Advances and Findings
Colorado Convention Center: 407
8:00 AM-12:00 PM, Wednesday, 31 October 2007