2006 Philadelphia Annual Meeting (22-25 October 2006)

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EROSION IN AN OLD DECAYING MOUNTAIN RANGE - THE APPALACHIANS

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The Appalachian Mountains, close to half a billion years old, stretch north-south along the eastern margin of North America rising nearly 2000 m above the adjacent piedmont. These inspirational peaks have motivated generations of geomorphologists to understand their behavior and longevity. Davis built his paradigm of landscape evolution here, seeing rejuvenation and dissected peneplains in accordant Appalachian summits. Nearly a century later, Hack looked at the world differently, seeing the aged mountains as a dynamic, steady-state system where topography was adjusted to rock strength. Neither scientist had any idea how rapidly the Appalachians were actually eroding.

Thanks to 10Be and thermochron data, we can now say for sure, the Appalachians are eroding only slowly. Long-term unroofing rates at widely scattered sample sites along the range are 10s of meters per million years. Cosmogenically determined erosion rates (integrated over 104 to 105 years) match well rates determined thermochronologically (integrated over 107 to 108 years). Intensive sampling of river sediment and 10-Be analysis of quartz that sediment contains have constrained basin-scale erosion rates for over 100 drainages all the way from Pennsylvania to North Carolina. In both the Great Smoky Mountains and in the Susquehanna River Basin, slope and erosion rate are positively

correlated; steep slopes erode more quickly than gentle slopes. In Shenandoah National Park, metabasalt and quartzite appear several times more stable than granites and siliciclastic rocks. The Blue Ridge escarpment is an impressive topographic feature, perhaps a survivor of continental break up, but cosmogenic and U/Th/He analyses identify the escarpment, despite its steepness, as a stable feature eroding <20 m/My.

While Appalachian erosion rates appear steady and slow over varying time scales, the incision rates of rivers crossing the range are decidedly varied. For example, 10Be dating of water polished bedrock surfaces along the Potomac and Susquehanna Rivers reveals rapid (m/ky) incision episodes over short (10 ky) intervals. Understanding how these local and regional base level falls affect the long-term megageomorphology of this ancient mountain range is a challenge Appalachian geomorphology now faces.

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