2004 Fall Meeting
Cite abstracts as Author(s) (2004), Title, Eos Trans. AGU,
85(47), Fall Meet. Suppl., Abstract H51C-1156

AN: H51C-1156

Erosion Rates, Landscape Morphology, and Hillslope Processes in the Upper Beni River Region, Bolivian Andes

* Safran, E B safran@lclark.edu
Environmental Studies Program, Lewis and Clark College, Portland, OR 97219 United States
Whipple, K X kxw@mit.edu
Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA 02139 United States
Dunne, T tdunne@bren.ucsb.edu
Donald Bren School of Environmental Science and Management, University of California, Santa Barbara, Santa Barbara, CA 93106 United States
Bierman, P Paul.Bierman@uvm.edu
Department of Geology, University of Vermont, Burlington, VT 05405 United States
Aalto, R aalto@u.washington.edu
Department of Earth and Space Sciences, University of Washington, Seattle, WA 98195 United States
Caffee, M mcaffee@purdue.edu
Department of Earth and Atmospheric Sciences, Purdue University, West Lafayette, IN 47907 United States

Over the long term, rates of mountain erosion are controlled by rates of channel incision into bedrock. Channel incision rates are a function of discharge and local channel gradient, which reflects lithology and rock uplift rate. Other things being equal, patterns of channel gradient are indicators of relative channel incision rates. One useful metric of relative gradient is channel steepness index, k_s, the coefficient modifying a power law relationship between local channel gradient and contributing drainage area. In the Upper Beni River region of the Bolivian Andes, short-term, basin-averaged erosion rate correlates with channel steepness index. Erosion rates derived from analysis of in situ-produced ^10Be in alluvium range from 0.05 mm/yr to 1.35 mm/yr, and average over 10^2-10^4 years. Channel steepness index values, for a reference concavity of 0.45, are 100-200 in the headwaters of trans-range drainages, increase to 400-600, and then decrease to 40-100 downstream. Departures from this pattern occur in two channel networks with exceptionally large drainage areas whose headwaters have extended into the internally drained Altiplano on the Andean plateau. Patterns of channel steepness index, and by implication incision rate, appear primarily to reflect tectonic patterns and transient adjustment to those patterns by channel networks. Lithology exerts a weaker control on erosion rate but influences spatial patterns of hillslope geomorphic process. Neither channel steepness index nor basin-averaged erosion rate shows strong correlation with mean basin hillslope gradient or mean basin local relief because many hillslopes in the Upper Beni River region are at threshold values of slope and local relief. In addition,

some hillslopes appear to be in a transient state of adjustment to relatively rapid rates of channel incision.

2004 AGU Fall Meeting