Geophysical Research Abstracts, Vol. 7, 05392, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05392

Coupling between erosion and tectonics at intermediate scales of the Himalayan orogen, Sutlej River, NW India

P. Upton (1), R.C. Thiede(2), B. Bookhagen(2), P.O. Koons (1) and M.R. Strecker (2)

(1) Department of Earth Sciences, University of Maine, Orono, ME 04469, USA, (2) Institute of Geosciences, University of Potsdam, Postfach 60 15 53, Potsdam, 14415 Germany

Along the Himalayan Front, areas subjected to concentrated precipitation and enhanced river erosion coincide with rapid exhumation as indicated by young mineral cooling ages. Field observatios, thermochronology, and numerical modeling of the Himalayan syntaxes have shown that tectonic and fluvial erosion processes are coupled through a positive feedback. However, focused fluvial erosion is not only limited to rivers feed by large catchment areas in the hinterland as observed along the both syntaxes, but occurs in regions subjected to focused orographic precipitation along the Himalayan front. We are testing the strength of the proposed feedback between focused orographic precipitation and exhumation using the Sutlej River (NW-India) as our study area. Where the Sutlej River crosses the High Himalaya, active deformation and rapid rock uplift coincides with high relief, high monsoonal precipitation (c. 2.5 m/yr), steep river gradients and slope angles that predispose these rocks to effective mass removal. Field evidence, Ar/Ar, and apatite fission track dating suggest a strong interaction between rapid erosion and localized exhumation concentrated in an 80 km-wide sector including rocks of the Higher and Lesser Himalayan crystalline. But how this inhomogeneous distribution of precipitation affects mountain building processes of the Himalayan range is still controversial.

Using three-dimensional mechanical models, we are investigating the interplay between tectonic forcing, topographic stresses and climatically driven denudation of material from the Sutlej Valley. The steep relief formed by the incising Sutlej River leads to significant stress weakening, reducing its contribution to the overall strength of the lithosphere, predisposing deformation to focus into this region. However, first model results indicate that the strength of the basal decollment (Main Himalayan Thrust, MHT) plays a significant role in the spatial distribution of deformation and rock up-

lift within the orogenic wedge above the MHT. An inferred crustal ramp or duplex structure along the MHT, c. 150km north of the Himalayan mountain front, focuses rock uplift above this step. We suggest that this scenario forms the basis for a complex interaction between tectonic and surficial processes, where rock uplift provides an effective orographic barrier. The barrier intercepts and focuses monsoonal precipitation leading to enhanced surface processes in a narrow sector in the orogen. Here, effective erosional exhumation is documented by Pleistocene AFT ages irrespective of structurally controlled boundaries, but limited to a 50x50km area of high precipitation, suggesting a climatic forcing of the locus of deformation and uplift.