2004 Denver Annual Meeting (November 7–10, 2004)

Paper No. 118-9

Presentation Time: 1:30 PM-5:30 PM

EXTREME LOCALIZED EROSION IN THE EASTERN HIMALAYAN SYNTAXIS: RESULTS OF FISSION-TRACK AND U-PB ICP/MS DATING OF DETRITAL ZIRCONS FROM BRAHMAPUTRA RIVER SANDS

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Vigorous erosion during mountain building is now recognized as important to many components in the Earth system, including geodynamics, landscape evolution, chemical cycling, and geological hazards. Using two independent techniques, U-Pb Laser-Ablation ICP/MS and fission-track dating of detrital zircons, we demonstrate ~50% of the sediment flux in the Siang River, a principal tributary of the Brahmaputra River, is derived from ancient gneisses exposed in the deep (>6,000 m) Tsangpo gorge in Tibet. The Tsangpo gorge, a region of extraordinarily rapid rock uplift and cooling, is only 2% (~5,600 km^2) of the Tsangpo-Siang drainage basin. These results point to extremely localized and rapid erosion and sediment evacuation.

In detail, U-Pb data reflect the complex basement geology of the Himalaya and southern Tibet. However, rocks of the Namche Barwa-Gyala Peri massifs exposed in the vicinity of the Tsangpo gorge are composed almost entirely of basement gneisses about 500 Ma. In contrast, rocks upstream from the gorge are mostly Mesozoic. Only 24% of the detrital zircon grains in the Siang River are < 200 Ma, whereas upstream from the Tsangpo gorge 56% of the zircons are < 200 Ma. Our U-Pb analyses suggest 45-50% of the sediment flux in the Siang River is most certainly derived from the old basement rocks exposed in the Tsangpo gorge between the massifs of Namche Barwa and Gyala Peri.

Detrital zircon fission-track ages from sediment samples from the Siang River are exceptionally young. Using BINOMFIT (Brandon, 1996), 47% of the grains have a mean age of only 0.6 Ma. This young population is not present in sediment samples from streams feeding into the gorge, and indicates kilometers of rock have been eroded in a fraction of a million years at prodigious rates on the order of 10 mm/yr, about 5 times the average for the Himalayas.

These extreme rates are consistent with existing sediment flux measurements, and they provide strong support for previous inferences of rapid erosion and sediment evacuation from the eastern Himalayan syntaxis. These findings of highly localized rapid erosion have rich implications for studies in diverse fields including crustal deformation, engineering estimates of sediment yields in the context of hydroelectric development, and flood management. Notably, our results lead us to question assumptions common in modern models of active orogens.

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General Information for this Meeting

Session No. 118--Booth# 15
Geomorphology (Posters)
Colorado Convention Center: Exhibit Hall
1:30 PM-5:30 PM, Monday, November 8, 2004

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