Geochronological Evidence for the Tectonic and Topographic Evolution of SE Tibet

P. Zeitler\textsuperscript{1}, M. Malloy\textsuperscript{1}, M. Kutney\textsuperscript{1}, B. Idleman\textsuperscript{1}, Y. Liu\textsuperscript{2}, W. Kidd\textsuperscript{3}, A. Booth\textsuperscript{4}

\textsuperscript{1}Lehigh University \hspace{1em} \textsuperscript{2}Chengdu Institute of Geology and Mineral Resources \hspace{1em} \textsuperscript{3}SUNY Albany \hspace{1em} \textsuperscript{4}Stanford University
Context and Location

Geodynamics of Indentor Corners:
4D evolution around plate “corner” nature, crust-mantle interactions erosion and tectonics (two scales)
Tsangpo
“Big Bend”
Knickzone

View to SW

1600 m
Zircon U-Pb (granites and basement)

Ages <10 Ma
$P-T-t$
Namche
Barwa –
Gyala Peri

\[ \text{garnet cores} \]
\[ \text{vapor absent melt} \]
\[ \text{In-situ monazite ages} \]
\[ \sim 10 \text{ Ma} \]
\[ \text{matrix monazite} \]
\[ \sim 6 \text{ Ma} \]
\[ \text{matrix sphene} \]
\[ \sim 3 \text{ Ma} \]
\[ \text{garnet rims} \]
\[ \text{Granite production} \]
\[ 1-9 \text{ Ma} \]
\[ \text{fluid inclusions} \]
\[ \text{He zircon} \]
\[ 0.3-0.8 \]
\[ \text{Ar-Ar biotite} \]
\[ 1-2 \text{ Ma} \]

~6 mm/yr
Knickzone Thermochronology

U-He zircon

Ages <3 Ma

Young ages leak outside massif – incision transient?

Ar-Ar biotite

Ages <3 Ma

Young ages only inside massif
Knickzone Thermochronology

U-He apatite (zircon in orange)

Apatite ages are old upstream of knickzone.
Regionally, K-spars tend to record slow to moderate cooling in interval 25 to 10 Ma. But outside massif, downstream of knickzone, samples like these record abrupt cooling pulse.
Thermal histories above and below NB knickzone
Barrier to incision at Namche Barwa

Incision wave bypasses NB massif
Active massif maintains 3000 meter base level for SE Tibet
River capture (T-po to B'putra?)

Youngest U-He apatite
5 Ma in valleys
Evidence from Biogeography

River capture (T-po to B’putra?)

~7 Ma

Molecular phylogeny, carp (genus Schizothorax)

Modern Erosion Rates, Detrital Thermochronology

50% of sediment flux at Pasighat is young
Must be from NB-GP massif (1800-5200 km²)
Implies 10 mm/yr (7-20) modern erosion rate
(50% of 210 Mt spread over 1800-5200 km²)
Erosion, or incision? (massif appears ‘stable’, but incision wave elsewhere)

Sediment flux is 210 Mt/yr at Pasighat in Siang (= lower Tsangpo)
Stream Power, Relief, and Geochronology Across Knickzone

Finnegan et al. (in press.)
Geol. Soc. Am. Bul