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Reconstructing the Growth of High Topography Across Eastern Tibet in Space and Time

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How Tibet grew–when, where, and how its crust thickened and elevations rose remains one of the fundamental and hotly debated questions of continental tectonics and lithospheric geodynamics. New results indicate that the eastern margin of the present-day plateau adjacent to the Sichuan Basin, the Longmen Shan, has had a longer and more complex history of uplift than previously recognized. The consensus of the past decade that high topography in the eastern Tibetan Plateau developed largely, if not entirely, since the Late Miocene appears to be incorrect. Rather, our recent results indicate that regions of the eastern Tibet margin adjacent to the Sichuan Basin experienced a two-stage history of rapid exhumation (and by proxy, uplift) that began in Oligocene time. This revised uplift/exhumation history is documented in one region of the plateau margin but its regional extent and tectonic significance needs to be assessed. Here we present thermochronological results from two additional age-elevation transects that in combination with our existing results allow us to evaluate the timing and spatial distribution of exhumation across the plateau margin. Preliminary results from thermochronologic sampling and thermal modeling along a transect from the Sichuan Basin margin into the interior of the plateau indicate a complex history of timing and magnitudes of exhumation (and by proxy uplift). We have conducted preliminary analyses of fission-track ages of both zircon and apatite from the Xuelongbao Massif, immediately west of the Wenchuan-Maowen fault system. Our preliminary results from this massif are striking. Zircon fission-track ages from the summit of the massif at ~5500m are Late Cenozoic in age (~25 Ma) and become systematically younger toward the base of the transect. In contrast to the Pengguan Massif immediately east, where ZFT ages throughout the 3+km vertical section are >250 Ma. These imply exhumation from substantially greater depth during Cenozoic time in the Xuelongbao. In addition, preliminary modeling of the age-elevation array implies the possibility of an acceleration in exhumation at ca. 15 Ma - perhaps reflecting the period of recent major uplift/exhumation seen further to the east in the Pengguan Massif. Results from multiple thermochronologic systems for sampled transects further west are consistent with (1) initiation of rapid exhumation at ~ 25-30 Ma, and (2) decreasing depth of exhumation away from the plateau margin. Despite the spatial scale of our project being limited to a region of the eastern Tibetan plateau, our results specifically address when large-scale continental deformation began in the eastern plateau, whether it was continual or pulsed (in space and time), and the specific rates at which exhumation (and by proxy crustal uplift) occurred.

Key words: Tibet uplift, thermochronology, exhumation

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