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Rapid incision of Yulong Mountain since Quaternary: implication for the reorganization of the Yangtze River

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As integral components of Asian terrestrial dynamics, large river systems reflect the complex interplay between tectonic evolution (notably the India-Eurasia collision) and climatic forcing in shaping continental topography. The evolutionary history of Asia's largest river system, the Yangtze River, remains poorly constrained due to ongoing debates regarding the formation timing of Tiger Leaping Gorge - a critical geomorphic feature where the river abruptly transitions from southward to eastward flow (Zheng et al., 2015). Existing estimates for this pivotal event span from Eocene to Pleistocene ages, highlighting significant chronological uncertainties.

This study investigates the incision history of Yulong Mountain (elevation ~5400 m), the first major orographic barrier encountered by the Yangtze's eastward course, through apatite fission track (AFT) thermochronology. Our finding including: 1) an elevation transect across Yulong Mountain revealing a pronounced break-in-slope at ~2.8±0.3 Ma, interpreted as marking the onset of rapid fluvial incision, and 2) scattered AFT ages (~70 Ma) from river valley near Lijiang. These contrasting results suggest that the lower reaches of Yangtze drainage may established during the early Cenozoic, but the accelerated headward erosion through Yulong Mountain starts at late Pliocene (~2.8±0.3Ma), culminating in capture of the upper Yangtze reaches. The temporal correlation between this enhanced incision phase and Northern Hemisphere glaciation intensification (Zhang et al., 2001) implies climate-driven amplification of erosional processes during late Pliocene climatic reorganization.

By providing chronological constraints for the formation of the Tiger Leaping Gorge—a key event that enabled the Yangtze River to flow eastward—this study elucidates the tectonic-climatic interactions responsible for shaping major Asian drainage systems.

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[2] Zheng, H., 2015. Birth of the Yangtze River: age and tectonic-geomorphic implications. National Science Review, 2(4): 438-453.