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Plio-Pleistocene N-S extension at the southern margin of the Tibetan Plateau as evidenced from fluvial incision patterns and thermochronology

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The southern edge of the Tibetan Plateau is defined by an abrupt morphologic change from the low-relief Tibetan Plateau to the high peaks, rugged topography and deep gorges of the Himalaya. It seems likely that the South Tibetan fault system (STFS), a family of predominantly top-to-the-north normal faults that can be traced for more than 2,000 km along strike near the crest of the Himalaya, helped define the active southern margin of the Tibetan Plateau in the Early Miocene. Inasmuch as the majority of mapped strands of the STFS ceased activity by the Middle Miocene, the contribution of this fault system to the margin's modern form is unclear. Several fundamentally different models have been proposed to explain the location and persistence of the modern plateau margin (erosional retreat, uplift over a crustal ramp, renewed normal faulting), but given limitations of available data uncertainty and debate remains. While numerous studies have utilized thermochronology to examine the exhumation history of the Himalaya, few have done so with respect to variations across the Himalaya-Tibetan Plateau. In this work, we examine the nature of the plateau margin where it is well-defined in the Nyalam valley of south-central Tibet. We employ several thermochronologic datasets (with a closure temperature range of $\sim$ 70°C - 300°C) in conjunction with river incision patterns inferred by the longitudinal profile of the Bhote Kosi River. The results reveal an abrupt increase in cooling rate at $\sim$ 3.5 Ma, restricted in space to south of a sharp increase in river gradient that likely reflects an increase in rock uplift rate. Margin retreat models cannot explain the coincidence of these two discontinuities, while uplift over a midcrustal ramp does not account for the abruptness of the change. The simplest explanation, consistent with the known thermal and geomorphic data, is differential uplift across young (Pliocene-Quaternary) normal faults setting the location and nature of the physiographic transition at the southern margin of the Tibetan Plateau in this location.