



Spatial clustering of natural dams at the Tibetan Plateau margin in rivers draining the Himalayan syntaxes

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Despite numerous studies on the age and formation of the Tibetan Plateau, the erosional decay of its margins remains largely unexplored. Pronounced aridity and localised high rates of rock uplift are two conventional ways to explain the limited efficacy of fluvial bedrock incision in dissecting the Plateau's rim. Yet evidence remains scarce to argue that these controls are solely responsible for limiting the knickpoint retreat of some of Asia's largest rivers into the plateau interior. Here we point out a striking spatial coincidence of the Tibetan Plateau margin and clusters of large natural dams along the Indus and Yarlung Tsangpo, the two major rivers draining the Himalayan syntaxes. The Yarlung Tsangpo and its tributaries near Namche Barwa are largely influenced by several hundreds of large moraine dams clustered at the plateau margin. Similarly, the upper Indus is riddled by hundreds of large natural dams mainly formed by $>250 \text{ km}^3$ of debris from catastrophic rock avalanches, forming one of the largest clusters of giant landslide dams known worldwide. We present and discuss a model in which natural dams contribute to protecting bedrock from fluvial incision and headward knickpoint migration, thereby helping stabilise the margin of the Tibetan Plateau in concert with the effects of aridity and localised rock uplift. Based on a comparison of the eastern and western Himalayan syntaxes, we (1) propose that a zone of high susceptibility to natural river damming that develops along the plateau rim helps retard river incision, and (2) test the hypothesis that whether such dams dominantly form by glaciers or landslides depends on regional moisture availability.