The persistence of rapid exhumation in the eastern Himalayan syntaxis

Karl A. Lang

Abstract
The eastern Himalayan syntaxis is one of the most dynamic regions of Earth's surface where Quaternary erosion rates up to 10 mm/yr have been focused within a narrow ~200 km^2 area. Erosion is focused around a ~2 km knickzone on the Yarlung River coincident with an active crustal-scale antiform, the Namche Barwa massif. The coincidence of active rock uplift and rapid erosion has been hypothesized to result from feedbacks between surface and crustal processes that may amplify and sustain rapid rock exhumation over multimillion-year timescales; a metaphorical tectonic 'aneurysm.' My research investigates the origins and persistence of such feedbacks with a detailed interpretation of Quaternary and Neogene foreland basin deposits. I use detrital zircon U-Pb geochronology to reconstruct a ~12 Ma history of syntaxial river drainage evolution – testing the hypothesis that such feedbacks may have initiated in response to a major capture event along the Yarlung River. This work is complemented with additional fission-track double-dating of the same zircon grains and supplementary $^{40}Ar/^{39}Ar$ analyses of detrital muscovite to establish the pre-Quaternary onset of rapid rock exhumation rates. Additional zircon U-Pb analyses of Quaternary flood deposits elucidate a potential mechanism to sustain high erosion rates despite obvious evidence for glacial damming of the Yarlung in the Quaternary. Our results indicate that rapid exhumation of the Namche Barwa massif by an antecedent Yarlung River has been sustained since at least 5 Ma, potentially in part by large-magnitude Quaternary flood events. These results suggest that the high topographic relief and prodigious sedimentary efflux presently observed from the eastern syntaxis may in fact be a long-lived feature of the eastern Himalayan landscape.