Exhumation of the eastern Lhasa block, southern Tibet, inferred from low temperature thermochronometry and thermokinematic modeling

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The eastern Lhasa block marks the transition from the internally drained interior to the rapidly incising edge of the Tibetan Plateau and is characterized by 1-1.5 km of relief, superimposed on a mean eastern plateau elevation of ~4.5 km. To explore the erosional response of the Lhasa block to evolving tectonic and climatic conditions of the Himalaya-Tibet orogen, we conducted apatite and zircon (U-Th)/He as well as apatite $^4He/^3He$ analyses on granites of the Gangdese batholith from a 1.1 km elevation transect at the eastern headwaters of the Lhasa River. Apatite (U-Th)/He ages from the transect are relatively invariant with elevation (11-15 Ma), and inverse modeling of $^4He/^3He$ data indicate at least 2km of exhumation over ~3 Ma in the middle Miocene, followed by slow to negligible erosion rates to the present. However, zircon (U-Th)/He ages have a strong age-elevation relationship from 15 to 40 Ma. 1D thermal modeling suggests low and high elevation samples experienced different cooling paths, but 3D thermal modeling suggests that topographic effects on the shape of isotherms alone cannot account for the different histories. We explore other scenarios that produce differential cooling histories across the elevation transect. Regional tilting could result in differential cooling and is supported by N-S asymmetry of the position of the main divide, but is difficult to reconcile with the known structural evolution of the Lhasa Block. Alternatively, topographic evolution through local drainage divide migration may occur independently of regional tilting and on much shorter length scales, which has implications for the evolution of the regional drainage network. We will present results of 3D thermokinematic modeling and discuss potential implications for the topographic evolution of the eastern Lhasa block.