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High-angle normal faulting at the Tangra Yumco graben (southern Tibet) since ∼15 Ma

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Several active graben systems in Tibet and the Himalaya are the expression of ongoing E-W extension, but the significance and history of normal faulting in this large region are still debated (e.g. Ratschbacher et al., 2011). Here, we present geo- and thermochronological data for a granite intrusion in the footwall of an active high-angle normal fault at the Tangra Yumco graben to constrain the onset and history of normal faulting. Crystallization of the granitic rocks occurred 87 ± 1 Ma ago, as revealed by U/Pb zircon dating. Following an initial phase of rapid cooling from magmatic temperatures, a later phase of slow cooling is recorded by Rb/Sr biotite ages between ∼72 and ∼60 Ma (Wolff et al., in press). The elevation dependence of the Rb/Sr ages suggests that cooling was controlled by erosion, which proceeded at a rate of ∼0.05 km/Ma during the latest Cretaceous and early Paleocene. The subsequent history of normal faulting is recorded by zircon (U-Th)/He ages of 12.5 ± 1.1 and 9.7 ± 0.7 Ma, apatite fission track ages between 10.8 ± 1.7 and 7.8 ± 1.2 Ma, and apatite (U-Th)/He ages from 4.9 ± 0.4 to 3.0 ± 0.2 Ma (Wolff et al., in press). Thermokinematic modeling of these age data indicates that normal faulting started 14.5 ± 1.8 Ma ago at a rate of ∼0.3 km/Ma and accelerated to ∼0.7 km/Ma in the Pliocene. Our age constraint for the initiation of faulting supports a widespread onset of rifting in Tibet at ∼15–10 Ma, as reported for other graben systems (e.g. Ratschbacher et al., 2011; Sundell et al., 2013; Styron et al., 2015). Finally, we suggest that the distribution of high-angle and low-angle normal faults is controlled by their position relative to the India-Asia convergence vector and by lateral variations in the thermal state of the lithosphere.

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