Titanite geochronology from the mid to lower crust of the Pamir plateau, eastern Tajikistan.

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The Pamir plateau contains large exposures of the mid–lower crust, depths not widely exposed in the Tibetan plateau. Determining the spatial and temporal patterns of crustal thickening across the Pamir plateau is critical for understanding how orogenic plateaux are constructed. The dome cores consist of upper amphibolite grade para- and orthogneisses and schists, with the characteristic peak mineral assemblage of kyanite + biotite + garnet ± muscovite in pelites. Thermobarometry indicates peak conditions of 600–750°C and 6–10 kbar, representing exhumation depths of 20–40 km (McGraw et al., in review). U-Pb ages of titanite from orthogneisses from the Pamir domes were determined to investigate the timing of thickening of the mid to lower crust. The closure temperature of titanite (~650–700 °C) makes it an especially useful geochronometer for dating high-grade metamorphism. Ages were obtained using laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) following the acquisition of backscattered electron maps to characterize grain zoning and guide LA-ICP-MS spot placement. Ages range from 40 to 10 Ma and define two populations of ~40–32 Ma and ~19–10 Ma. The older ages are restricted to the central Pamir and the youngest ages come from the southern Pamir. We provisionally interpret the oldest ages to indicate titanite growth during burial and the youngest to reflect closure during exhumation. This spatial pattern suggests is consistent with a general pattern of northward plateau propagation and southward-propagating exhumation. These results do not support plateau propagation via westward lower-crustal flow from the topographically higher Tibetan plateau.

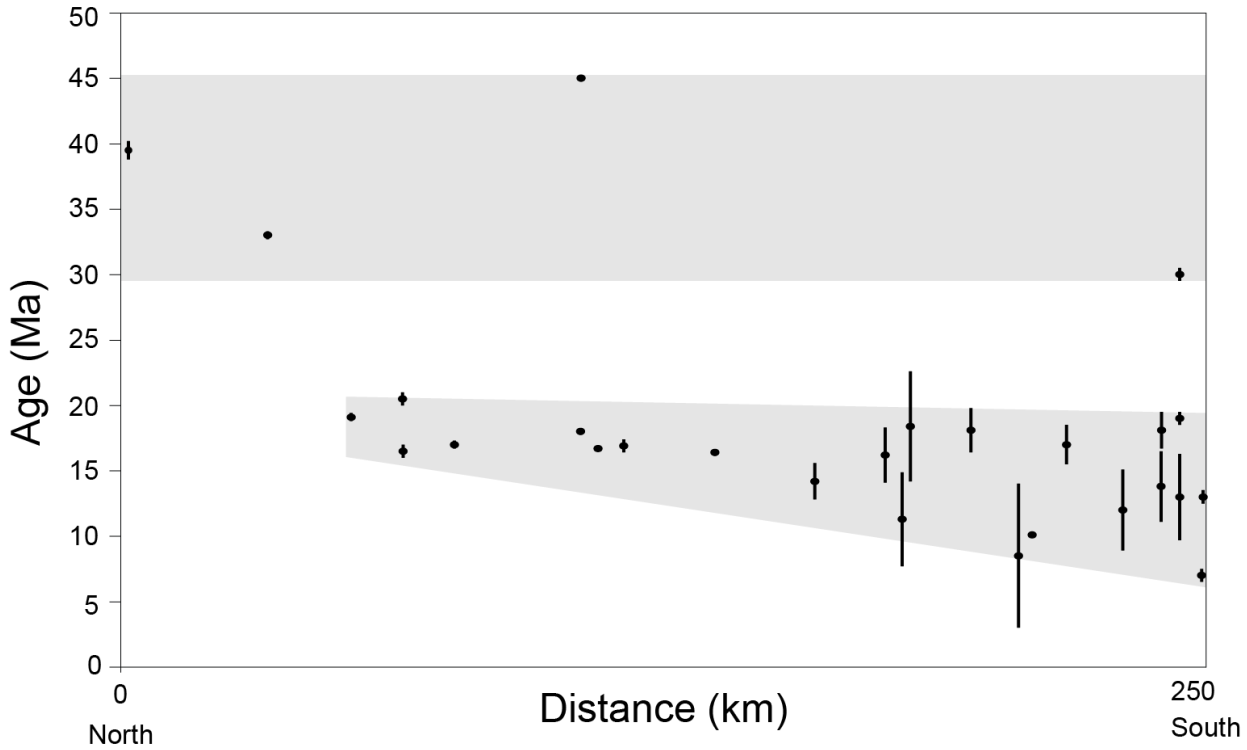

Figure 1. U-Pb titanite ages arranged from north to south on an orogen perpendicular transect. Error bars are 2σ uncertainties. The shaded regions represent interpreted populations of older crystallization ages and younger cooling ages.

References

McGraw, J., Hacker, B.R., Ratschbacher, L., Stuebner, K., Welse, C., Gloaguen, R., Gadoev, M. Oimahmadoc, I., and Minaev, V., 2011, Cenozoic deep crust exposed in the Pamir Collision Zone: Geology, in press.