Cenozoic exhumation history of Yazgulem gneiss dome, Pamir, Tajikistan: India-Asia collision

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Abstract

Central Asia offers the most spectacular area in active intra-continental deformation. In the Pamir, at the northwestern edge of the Tibetan Plateau, the Cenozoic orogeny formed high-relief mountains of about 500 km north-south extent. High-grade metamorphic and associated igneous rocks covers about 30% of the surface exposure of the Pamir. These rocks exhumed in Cenozoic syn-orogenic domes, which provide an opportunity to look into the deeper crust of the Asian plate.

High- to- low temperature geo-thermochronology data show that the exhumation of the Yazgulem dome occurred between ~22–5 Ma at temperatures ranging from 600°C to ~100°C. Tectonic exhumation along the dome bounding normal faults caused rapid cooling (~ 50°C/Ma) between ~21-14 Ma. This phase of cooling was related to N-S extension coeval with ~N-S convergence between India and Asia. This rapid cooling is followed by a state of transition from rapid to slow cooling (~20°C/Ma in the time range of ~14-11 Ma) which is the end of tectonic denudation at the end of normal-slip along the dome bounding faults. A phase of slow cooling or even reheating between ~15-3 Ma may be related to resumed ~N-S shortening (thrust faulting) along the dome margins which is explained by the AFT young ages along the northern and southern hanging wall of the dome as compared to the dome interior. All confined track-length distributions and the HeFty models from the Yazgulem dome suggest an increased cooling since 5–2 Ma, mostly since 3–2 Ma. These increased cooling rates may signify the change to the neotectonics stress field in the Central Pamir, after cessation of the South Pamir Shear zone. The neotectonic stress field comprises strike-slip and—more rarely—normal faults, indicating ~east-west extension together with ~north-south shortening.