



Westernmost Tian Shan (Uzbekistan): Magmatism and Exhumation

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The westernmost segment of the Tian Shan comprises the Ghissar–Alai Range of Tajikistan and Uzbekistan; its southwestern promontory contains the Baysunta crystalline massif. This orocline extends northwest of the Pamir and southeast of the Turan platform and forms the (north) western margin of the intra-orogenic Afghan–Tajik basin that was inverted during the India–Asia collision, mainly as a result of the gravitational collapse of the Pamir Plateau. The area contains Paleozoic slope and shelf clastics mantling crystalline basement rocks, altogether intruded by massif granitoids; it hides the cryptic Late Paleozoic South Ghissar suture. In Uzbekistan, the crystalline basement rocks of the westernmost Tien Shan are involved in the folding and thrusting of the Jurassic to Neogene sediments of the Afghan–Tajik basin, spectacularly proving thick-skinned deformation and demonstrating basement involvement below the Jurassic evaporate décollement underneath the Afghan–Tajik basin.

We sampled the crystalline basement rocks of the Tian Shan of Uzbekistan to constrain the formation of the enigmatic Baysunta block and date the crystallization and high-grade metamorphism of the granitoids and associated metamorphic rocks of the Ghissar range; we employed U–Pb zircon geochronology. To time the deformation and exhumation of the fold-and thrust belt of the westernmost Afghan–Tajik basin, we used apatite fission-track thermochronology.

Concordant U–Pb crystallization ages of zircons in the orthogneiss and paragneiss comprise 620 to 300 Ma; the Neoproterozoic ages imply a correlation of the Baysunta block with the Garm crystalline massif of the central Ghissar–Alai range of northeastern Tajikistan. The youngest zircon crystallization ages from granitoids are ~220 Ma, revealing enigmatically young magmatism, post-dating the last known collision event by >50 Ma. Together with 270–240 Ma meta-basaltic dykes and stocks in Tajikistan, they may trace a regional post-orogenic delamination event.

The apatite fission-track thermochronology suggests a two-phase exhumation history. Exhumation/cooling within the age range of ~17 and 4 Ma and clustering around 10 Ma date slip along the thick-skinned thrusts. This demonstrates the impact of the India–Asia collision on the edge of the Turan platform, far northwest of the western edge of the collision zone. Ages from the northwestern edge of the study area cover 197 to 69 Ma; they trace a fossil partial annealing zone. They show that the Tian Shan along the margin of the Turan platform was never covered by sedimentary rocks >3 km thick.