Geophysical Research Abstracts
Vol. 13, EGU2011-8489, 2011
EGU General Assembly 2011

Widespread, Synchronous, Large-Magnitude Exhumation of the Deep Pamir

Bradley Hacker (1), Lothar Ratschbacher (2), Michael Stearns (1), Jennifer McGraw (1), Stübner Konstanze (3), Andrew Kylander-Clark (1), Jörg Pfänder (2), Carsten Weise (2), Vladislav Minaev (4), Mustafo Gadoev (4), and the Ilhomjon Oimahmadoc (4) and the TIPAGE Team

(1) University of California, Santa Barbara, United States (hacker@geol.ucsb.edu), (2) Geowissenschaften, TU Bergakademie Freiberg, Freiberg, Germany, (3) Georg-August-Universität Göttingen, Abt. Sedimentologie/Umweltgeologie, Germany, (4) Tajik Academy of Sciences, Institute of Geology and Seismology, Dushanbe, Tajikistan

Thermobarometry and thermochronology provide insight into the formation and exhumation histories of the high-grade crustal domes across the Pamir. P-T histories were reconstructed from thermobarometry based on major elements and pseudosections. Intrusion, recrystallization, and cooling histories were determined by SIMS and LA-MC-ICP-MS U-Th-Pb zircon, monazite, titanite, and rutile; Rb-Sr mica;40Ar/39Ar hornblende and mica; apatite fission-track, and (U-Th)/He apatite dating.

For the northern Pamir Kurgovat dome we find peak conditions of 600–650 °C and 6.5–8.2 kbar. Hornblende and biotite 40Ar/39Ar ages indicate that this metamorphism is Jurassic and Early Cretaceous (ca. 200 and ca. 130 Ma), overprinting Devonian arc intrusions (350 Ma U-Pb zircon).

The western central Pamir Yazgulom dome yields P-T conditions of 575 °C and 9.4 kbar; U-Pb zircon ages of 21–18 Ma from igneous rocks, a U-Pb titanite age of 19 Ma and 40Ar/39Ar biotite ages of 17–16 Ma tightly constrain an early Miocene exhumation. The eastern central Pamir Muskol and Sares domes yield hotter P-T conditions of 700–800 [U+F0B0]C and 9.1–11.7 kbar, and U-Pb zircon ages as young as 23-17 Ma, U-Pb titanite ages of ca. 17 Ma, 40Ar/39Ar hornblende ages of 22–15 Ma, and 40Ar/39Ar mica ages of 19–13 Ma indicate an essentially identical exhumation history; U-Pb zircon and titanite ages indicate a Triassic magmatic protolith, intruding Paleozoic meta-sedimentary strata.

The enormous Shakhdara dome in the southwestern Pamir gives higher peak metamorphic conditions at 6.5–14.6 kbar and 700¬–800 ºC. U-Pb zircon ages indicate ca. 1.8 and 2.5 Ga basement, strongly remobilized by 134–73 Ma Cretaceous magmatism. U-Pb metamorphic zircon ages at 22-12 Ma, U-Pb titanite ages of 18–10 Ma, 40Ar/39Ar biotite ages of 18–10 Ma, and apatite fission-track ages of 8–5 Ma imply an early to late Miocene exhumation.

These data, combined with those of earlier studies (e.g., Hubbard, 1989; Schwab et al., 2004; Robinson et al., 2007), indicate that the bulk of the Pamir high-grade crystalline rocks were once at ∼35 km depth, and were exhumed to shallow crustal levels over a relatively narrow interval (5–10 Myr) in the early to middle Miocene (∼20–10 Ma). This dramatic exhumation occurred broadly synchronously over much (200 km N–S, 500 km E-W) of the active India–Asia collision zone at this latitude, and was coeval with the eruption of crustal xenoliths from depths of 90 km in the SE Pamir (Hacker et al., 2005), suggesting a direct link to probable continental lithosphere subduction beneath the Pamir.