Dating deformation along major Pamir shear zones with the Ar-Ar in-situ technique

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The Pamir–Hindu Kush orogen at the northwestern promontory of the Indo-Asian Collision Zone is one of the most active ones on Earth. Hugh gneiss domes that underwent amphibolite-facies metamorphism, e.g., the Shakdhara Dome in the South Pamir, the Muskol and Yazgulom domes in the Central Pamir were rapidly exhumed during Cenozoic times indicated by different cooling ages (Ar-Ar white mica and biotite, zircon and apatite Fission Track, zircon U-Th-He). Localized major shear zones e.g., the South Pamir and the Alichur shear zones in the South Pamir, and the Vanj-Badakhshan and the North Muskol shear zones in the Central Pamir, are largely involved in exhumation but their deformation age remains concealed.

Analysed shear-zone samples from the Pamir show kinematic indicators such as shear bands, S-C fabrics, white mica fish, and feldspar σ-clasts. In addition to samples that show dynamic recrystallization and mineral reactions indicating ductile deformation, we also dated samples that show mineral formation e.g., within tension gashes or mineralized fractures, during brittle deformation. The most common syn-kinematic minerals were white mica and K-feldspar, which are appropriate for Ar-Ar in-situ dating.

We performed Ar-Ar in-situ analyses at the Argon Lab Freiberg (ALF) of pre-, syn-, and post-kinematic minerals to determine the longevity and, in some cases, the termination of ductile and brittle deformation. We used various ablation modes to maximize signal intensity and therefore age precision on the one hand and to optimize age comparability within shear textures (e.g., shear bands, mica fish) on the other. We discuss these first results in the context of existing cooling ages of the gneiss domes to better constrain their exhumation and deformation history in the Pamir–Hindu Kush orogen.