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Phanerozoic evolution of the North Tien Shan microcontinent

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The North Tien Shan microcontinent is the most prominent tectonic unit forming the basement of the north-eastern Kyrgyz Tien Shan orogen. The microcontinent can be traced further north through Kazakhstan, to the Stepnyak terrane, and in fact seems to form a continuous continental fragment, the Stepnyak-North Tien Shan microcontinent (SNT). The SNT is underlain by Precambrian crystalline basement, with a (meta)sedimentary – (meta)volcanic cover. The sequence is extensively intruded by several magmatic arcs and post-collisional plutons. In this study the NTS crystalline basement and intrusives were targeted for multi-method geochronologic investigation to constrain its Phanerozoic evolution. For this purpose we revisit several sample profiles in the northeastern Kyrgyz Tien Shan, in the broad vicinity of the Issyk-Kul basin. Similar rock-types from the bordering accretionary wedges and suture zone of the Kyrgyz-Terskey and the Dzhalaïr-Naiman terranes are involved in this study as well. Zircon U/Pb, several Ar systems, fission-track thermochronometers and apatite (U-Th-Sm)/He are applied to single rock samples. These methods provide an age array that pinpoints several Phanerozoic thermo-tectonic events that affected the basement rocks in an absolute time-frame.

The main regional intrusion phase (magmatic arc) is constrained by zircon U/Pb (SHRIMP) to be Late Ordovician – Early Silurian (447-432 Ma), with smaller post-collisional plutons of Late Permian age (around 290 Ma). Biotite $^{40}\text{Ar}/^{39}\text{Ar}$ dating shows rapid Devonian cooling of the rocks, followed by a Permian-Triassic cooling phase (K-feldspar $^{40}\text{Ar}/^{39}\text{Ar}$ and titanite fission-track dating). There is clear evidence for protracted Mesozoic reactivation and further exhumation of the basement in the Triassic, Late Jurassic and Late Cretaceous (apatite fission track – AFT, and apatite (U-Th-Sm)/He – AHe, dating and modeling). In distinct areas, Neogene ages (AFT and AHe) constrain the Late Cenozoic cooling and associated denudation of the basement in the framework of the building modern Tien Shan orogen.