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Thermotectonic evolution of the northern Kyrgyz Tien Shan intrusives

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The northern Kyrgyz Tien Shan (nKTS) encloses a large number of granitoid intrusions. These plutons intruded during the Palaeozoic and are geodynamical related to either Caledonian or Hercynian collisions. The most voluminous, i.e. the Caledonian intrusion phase is associated with the evolution and closure of the Early Palaeozoic Terskey Ocean (branch of the Turkestan Ocean). Hercynian plutons, smaller in both abundance and dimensions, are thought to have formed during the final closure of the Turkestan Ocean when the Tarim microcontinent eventually collided with the Kazakhstan plate. In the Late Palaeozoic – Early Mesozoic, the nKTS experienced tectonic quiescence. This geodynamic environment abruptly changed in the Mesozoic, when the Central Asian Orogenic System - including the nKTS - was reactivated as an intracontinental orogen (Cimmerian orogeny). The granitoids embedded in the basement record this phase as a cooling event. This cooling is a consequence of denudation and exhumation of the nKTS basement associated with this orogeny. The Late Mesozoic – Early Cenozoic introduced again a period of thermal stability. In the Cenozoic, a new phase of cooling, linked to renewed denudation as a tectonic far-field effect of the India-Eurasia collision, affected the nKTS basement.

In this study, we dated each of the aforementioned events and reveal the thermotectonic history of the nKTS granitoids from emplacement to exhumation. Zircon SHRIMP and LA-ICP-MS U/Pb concordia ages suggest a Middle to Late Ordovician crystallization age (440-470 Ma) for the Caledonian intrusion phase, however the presence of additional Early Ordovician - Cambrian U/Pb samples, points towards a more prolonged production of granitoids during the entire Early Palaeozoic. Hercynian samples are constrained to the Late Carboniferous – Permian (260-300 Ma). 40Ar/39Ar stepwise heating plateau-ages (biotite: 400-440 Ma; K-feldspar: 235-375 Ma) bear witness to rapid Silurian - Early Devonian post-magmatic cooling of the granitoids, followed by a more modest rate of cooling during the Late Devonian until the Late Triassic. Low-temperature techniques such as Apatite Fission Track (AFT) and Apatite (U-Th-Sm)/He (AHe) thermochronology where used to date the Meso-Cenozoic reactivation (i.e. cooling) phases. Most AFT and AHe ages cluster in the Late Jurassic - Cretaceous (90-160 Ma) while Cenozoic ages (25-60 Ma) pinpoint the most recent exhumation.