



Late Cretaceous to Cenozoic exhumation of the Fuping Complex, Trans-North China Orogen: New insights from apatite and zircon (U-Th-(Sm))/He and apatite fission track analyses

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The Fuping Complex, located in the Trans-North China Orogen (TNCO), is considered the most promising site for studying the Mesozoic-Cenozoic uplift, denudation and lithospheric thinning of the Eastern North China Craton (ENCC). At present, low-temperature thermochronological data (especially the (U-Th)/He system) from the Fuping Complex are scarce, resulting in lingering questions regarding the cooling history of the upper crust below ~ 200 °C. This systematic study firstly uses zircon and apatite (U-Th)/He thermochronology and apatite fission track thermochronology to better understand the thermal and exhumation histories of the Fuping Complex and the crust-mantle interactions. The weighted average values of the zircon and apatite (U-Th)/He ages are 70.3-79.9 Ma and 15.1-26.8 Ma, respectively. The apatite fission track ages range from 41.9 ± 3.0 to 51.9 ± 2.3 Ma, with mean track lengths between 11.22 ± 2.39 μm and 13.31 ± 1.65 μm . Three distinct episodes of cooling at 100-50 Ma, 46-38 Ma and after ~ 25 Ma are revealed by the joint inverse modeling of these data with QTQt software. The first two cooling events were driven by deep asthenospheric upwelling and the development of shallow extension in association with the subduction of the Pacific Plate. The third cooling event, during the late Cenozoic, resulted from the combined distant effects of the collision of the Indian and Eurasian plates and the rollback of the subducting Pacific Plate. The good correlation between tectonic uplift and lithospheric thinning in the ENCC provides new insights into the deep dynamic mechanisms in an extensional environment using the thermal and denudation responses of the shallow crust.