



Late Paleozoic to Mesozoic tectonic evolution of the Chinese western Tianshan Orogen: Integrating detrital zircon provenance analysis with regional magmatic, stratigraphic, and tectonothermal evidence

Yigui Han and Guochun Zhao

Department of Earth Sciences, The University of Hong Kong, Pokfulam Road, Hong Kong, China (hanyigui@connect.hku.hk)

The convergence between the Tarim Craton and the southwestern margin of the Central Asian Orogenic Belt in the late Paleozoic resulted in the closure of the South Tianshan (STS) Ocean and a continent-continent collision that formed the western Tianshan Orogen in NW China. Recent intensive studies in this region have produced a great deal of new data, and also many competing tectonic interpretations, especially regarding the subduction polarity and closure time of the STS Ocean and the initial uplift of the western Tianshan Orogen. To address the controversy, this study presents a systematic provenance analysis of detrital zircons from Carboniferous to Mesozoic sedimentary strata distributed in the northern Tarim and STS regions. In combination with recent data of regional magmatism, sedimentation, and tectonothermal activity, we propose a tectonic model that can reconcile most of important geological events during late Paleozoic to Mesozoic time in the western Tianshan region.

U-Pb dating of detrital zircons from Carboniferous and Permian strata in the northern Tarim and STS regions yielded consistent age patterns, i.e. two prominent populations at 270-305 Ma and 400-500 Ma, and some peaks clustering at 600-1200 Ma, ~ 1.9 Ga, and ~ 2.5 Ga. The scarcity of 310-380 Ma zircons in the two regions and contemporaneous passive margin sedimentation support a northward subduction of the STS oceanic crust. The closure of the ocean and continental collision probably occurred in the late Carboniferous, as indicated by a significant decrease of zircon $\varepsilon_{\text{Hf}}(t)$ values at ~ 310 Ma and coeval (ultra-)high pressure metamorphic events. Detrital zircon age data also indicate that the foreland region (i.e. the northern Tarim and STS) had not received sediments from the upper plate throughout the late Carboniferous to Middle Triassic, implying insignificant surface uplift and erosion during and after collision. To interpret this, a plume-modified orogenic model is introduced, partially because of the rough synchronicity of the collision event and the initiation of the Tarim mantle plume at the end of Carboniferous.

Detrital zircon age dating of Late Triassic and younger sedimentary successions in the northern Tarim and STS regions detects a sudden appearance of abundant exotic detrital zircons with ages of 310-390 Ma and 220-260 Ma. This suggests a simultaneous shedding of detritus from the Central Tianshan-Yili Block to the north and the western Kunlun Orogen to the south, since 310-390 Ma and 220-260 Ma magmatism primarily occurred in these two regions, respectively. Such a provenance change in the Middle Triassic also coincided with the shift of local paleocurrent directions and the onset of large-scale tectonothermal activities in the western Tianshan, which together suggest that the initial surface uplifting and denudation of the western Tianshan range occurred since the Middle Triassic. This event likely resulted from the far-field effect of the collision between the Qiangtang Block and the southern margin of the Tarim Craton.

Acknowledgments: NSFC projects 41190070 and 41190075.