

Provenance of uppermost Carboniferous–Lower Triassic sandstones, Bogda Mountains, NW China: implication on late Paleozoic tectonic history of southern Central Asian Orogenic Belt

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ABSTRACT

The Permian-Triassic time is a critical stage in the Paleozoic continental amalgamation and Cenozoic orogenic reactivation of southern Central Asian Orogenic Belt (CAOB). Field, petrographic and detrital zircon U-Pb geochronological data of the uppermost Carboniferous–Lower Triassic sandstones from 3 sections in Bogda Mountains, greater Turpan-Junggar basin, NW China, are used to decipher the tectonic history. They are Tarlong-Taodonggou (TT) and Zhaobishan (ZBS) in the south and Dalongkou (DLK) in the north, 100 km apart and ~7,000 m in total thickness. Four petrofacies of 229 sandstones are defined using the abundance of volcanic, sedimentary, and metamorphic (with polycrystalline quartz) lithics. Petrofacies A ($LV_{73}LS_{21}(Qp+Lm)_6$) contains mainly volcanic lithics, indicating a volcanic arc as the main source. Petrofacies B ($LV_{14}LS_{41}(Qp+Lm)_{45}$) and Petrofacies C ($LV_{38}LS_{14}(Qp+Lm)_{48}$) contain mixed sedimentary, metamorphic, and volcanic lithics, indicating multiple sources. Petrofacies D ($LV_{11}LS_{82}(Qp+Lm)_7$) contains mainly sedimentary lithics with a trace amount of volcanic and metamorphic lithics, indicating local rift-shoulder sedimentary sources. Additionally, the U-Pb dates of 3505 detrital zircon grains of 35 sandstones were analyzed. The predominant Paleozoic zircon grains yield major age populations at ca. 360–280 Ma and 485–385 Ma. Precambrian dates are present, ranging from 542 Ma to 3329 Ma.

During Gzhelian–Asselian, andesite and basalt are the major source lithologies in TT. Zircon ages peak at ~300 Ma. During Sakmarian–Kungurian, basalt and andesite are the main source rocks in TT and ZBS; and zircon ages of both areas peak at ~300 Ma. The Roadian–Wordian is probably represented by a regional unconformity. The Guadalupian source lithology and zircon date show a major change. Andesite is the common and rhyolite and basalt minor source lithologies for TT and DLK; but rhyolite significant for ZBS. A unimodal peak at ~305 Ma occurs in TT; two peaks at 305 and 455 Ma with common Precambrian dates in ZBS; and peaks of 310–295 Ma in DLK. During Wuchiapingian–mid Olenekian, andesite and rhyolite are the common source lithologies for TT and DLK, and rhyolite as the primary volcanic lithology for ZBS. In TT, Wuchiapingian–Induan samples have a major age peak at ~300 Ma, and an Olenekian sample has two peaks at ~300 and ~450 Ma. In ZBS, the age pattern is similar to that of the Guadalupian sample. In DLK, samples have a major age peak at ~310 Ma and a minor peak at ~450 Ma. The comparable age clusters

identified by multi-dimensional scaling indicate that North Tianshan is the source for TT and ZBS during the latest Carboniferous–early Permian. But south Central Tianshan became the main source solely to ZBS. During late Permian–Early Triassic, both north and central Tianshan became the common sources to the three areas due to enhanced denudation. The source change in mid-Permian across a regional unconformity is synchronous with Paleo-Asian Ocean closure and arc-continent and continent-continent collisions, which occurred no later than Guadalupian.

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