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Triassic Magmatism in Southern Beishan Orogen, Northwest China: Zircon U–Pb Geochronology, Petrogenesis and Tectonic Implications

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Abstract : The tectonic evolution of the Beishan orogen, which forms part of the Central Asian Orogenic Belt, remains debated. This study reports the identification of three Triassic granitic plutons representing two distinct stages of magmatism in southern Beishan orogen. Zircon U–Pb dating constrains the early stage as 238–237 Ma and the late stage as 229–227 Ma. The granitoids belong to high-K calc-alkaline and shoshonitic series and exhibit alkalic-calcic and calc-alkalic features, and are weakly peraluminous rocks. Most of these granitoids are highly fractionated I-type and A-type granites. They have relatively high Isr values (0.7049–0.7086) and weak negative εNd(t) values of −1.5 to −2.1, with young Nd model ages of 1.04–0.91 Ga, indicating a crustal contribution. They also show markedly positive zircon εHf(t) values (+3.4 to +11.8) and two-stage Hf model ages of 1.06–0.69 Ga, indicating a mixture of mantle and crustal components. The lithospheric mantle beneath this region incorporating older subducted materials was metasomatized by fluids or melts. Partial melting of the metasomatized lithospheric mantle resulted in underplated magmas, which provided the heat and material input to generate the granitoids. The Middle Triassic granitic plutons show moderate negative Eu anomalies, enrichment of LILEs and depletion in Nb, Ta, and Ti suggesting partial melting of crustal components in response to the underplated mantle-derived magmas, probably linked to lithospheric delamination and asthenospheric upwelling. The Late Triassic granitic plutons show characteristics of post-orogenic granite with strong negative anomalies of Eu, Ba, Nb, Sr, P, and Ti, indicating fractional crystallization and crustal contamination during the emplacement process.

Keywords : Triassic, magmatism, geochronology, petrogenesis, Beishan orogen
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