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Geochronology and geochemistry of mafic-intermediate intrusions in the Eastern Tianshan, NW China: Implications for a tectonic transition from subduction to post-collisional extension

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This study presents new whole-rock geochemical, Sr-Nd and zircon U-Pb-Hf isotopic data for mafic-intermediate rocks from the Eastern Tianshan (NW China) to constrain the final closure of the Junggar Ocean between the Central Tianshan and Junggar terranes, which is essential in understanding the final assembly processes of the southern Central Asian Orogenic Belt. LA-ICP-MS U-Pb dating on selected igneous zircons yields well-constrained weighted mean 206Pb/238U ages of ca. 310 Ma and ca. 290 Ma, interpreted as the best estimates of the crystallization ages of the intrusions. Petrographic and geochemical analyses reveal that the Late Carboniferous samples are characterized by typical subduction-related signatures, low Sm/Yb (<2.0) but high Lu/Hf ($\geq$0.2) ratios and positive εNd(t) (+1.2 to +3.1) and zircon εHf(t) (+4.1 to +7.8) values, suggesting that their parental magmas were most likely emplaced in a continental arc setting, genetically related to the partial melting of a metasomatized mantle wedge in the spinel stability field. This consideration agrees well with the findings of Carboniferous ophiolitic and arc-related granitoids in the region, most probably resulted from the southward subduction of the Junggar oceanic plate. In contrast, the Early Permian samples show high TiO_2 (2.7-3.2 wt.%) contents with elevated Ti/V (86.0-115.1) and Zr/Y (4.9-9.3) ratios, OIB-like trace element patterns and high εNd(t) (+1.1 to +4.5) and zircon εHf(t) (+3.0 to +9.8) values, exhibiting close affinities to typical within-plate basalts. Combined with previous investigations, we suggest that the Early Permian mafic magmatism was most likely generated by the partial melting of an asthenospheric mantle source in the garnet stability field, plausibly triggered by upwelling of asthenosphere during the slab break-off of the Junggar oceanic plate, which is supported by the linear distributions of Permian post-collisional mafic-ultramafic rocks in the Eastern Tianshan. Therefore, our new data testify to a tectonic transition from Late Carboniferous oceanic subduction to Early Permian post-collisional extension in the Eastern Tianshan, probably as a result of the closure of the Junggar Ocean and subsequent arc-continent collision between the Central Tianshan and Junggar terranes that led to the final assembly of the Eastern Tianshan.