

# Late Paleozoic magmatism, tectonic evolution, and metallogenesis in the Aqishan-Yamansu belt, Eastern Tianshan: Constraints from the Bailingshan intrusive complex

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The Aqishan-Yamansu belt, Eastern Tianshan is characterized by voluminous Late Paleozoic intermediate to felsic igneous rocks and associated magmatic-hydrothermal Fe (-Cu) deposits during the evolution of Kangguer Ocean. A systematic study has been conducted on the Bailingshan intrusive complex, which is composed of dioritic to granitic rocks and spatially associated with many Fe and Fe-Cu deposits, as a representative to investigate the correlations between magmatism, petrogenesis, tectonic evolution, and mineralization of the Aqishan-Yamansu belt, Eastern Tianshan. Zircon U-Pb dating results indicate that the Bailingshan intrusive complex has three magmatic phases: a ca. 329–323 Ma early diorite (enclave) phase, a ca. 318–313 Ma biotite diorite-monzogranite-granodiorite phase, and a ca. 308–297 Ma granodiorite-granite phase.

The ca. 329–323 Ma dioritic rocks show calc-alkaline affinities, exhibit large ion lithophile elements (LILEs) enrichment and high field strength elements (HFSEs) depletion, and have high MgO (3.38–4.50 wt%) and Mg<sup>#</sup> values (49–52), with depleted  $\epsilon_{\text{Hf}}(t)$  (10.28–15.70) and  $\epsilon_{\text{Nd}}(t)$  values (6.5–6.9), crust-derived Nb/Ta and Y/Nb ratios, low Th/Yb and Th/Nb, and high Ba/La ratios, which suggests they were sourced from a depleted mantle wedge metasomatized by slab-derived fluids and crustal contamination. However, integrating our new data and previous published data, the ca. 318–313 and 329–297 Ma Bailingshan granitoids were derived from re-melting of juvenile lower crust and mantle-derived mafic-intermediate igneous rocks, with mantle components playing a more prominent role in the formation of the younger and more felsic rocks.

In combination of published data, we propose that the Aqishan-Yamansu belt was a fore-arc basin underwent basin extension (ca. 350–320 Ma) and inversion (ca. 320–300 Ma) when the Kangguer oceanic slab subducted beneath the Yili-Central Tianshan block. Due to slab steepening and rollback followed by slab breakoff and rebound, the ongoing southward subduction of the Kangguer oceanic slab resulted in the closure of the Aqishan-Yamansu fore-arc basin (ca. 320–300 Ma), accompanied by emplacement of the main phase of the Bailingshan granitoids and contemporary Fe and Fe-Cu mineralization.