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Tectonomagmatic Process of High-titanium Alkaline Gabbros of Qingshuiquan Ophiolite in the Kunzhong Tectonic Mélange of East Kunlun Orogen

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Abstract: Early Paleozoic ophiolites, outcropping in the East Kunlun orogenic belt, record the tectonic evolutionary history of Proto-Tethys ocean lying in the northern Tibet Plateau during late Neoproterozoic-early Paleozoic era (Li et al., 2013; Dong et al., 2018). These ophiolites have been dismembered tectonically into several discrete ophiolitic massifs, namely, Qingshuiquan ophiolite, Tatuo ophiolite, Acite ophiolite, Hatu ophiolite, Aqikekulhu ophiolite, etc. Though considerable work has been done previously for the Qingshuiquan ophiolites (Yang et al., 1996; Wang et al., 1999; Long et al., 2004; Feng et al., 2015), the formation setting and petrogenesis are still controversial. Qingshuiquan ophiolites located in the Kunzhong tectonic mélange, were tectonically enclosed in Paleoproterozoic Baishahe Group. They mainly consist of serpentinized peridotite, meta-gabbro and meta-basalt (Fig. 1).

Zircons from the gabbros of Qingshuiquan ophiolite yields a LA-ICP-MS age of 480Ma, representing the crystallization age. Geochemically, the gabbros are charactered by lower contents of SiO_2 (46.46-51.09%), medium MgO (2.53-3.82%) and relatively higher contents of TiO_2 (2.12-3.68%), showing characteristics of alkaline gabbros on the SiO_2 vs. Na_2O+K_2O diagram (Jensen, 1976) and Nb/Y vs. Zr/Ti diagram (Winchester et al., 1977). Especially, the TiO_2 content is more than that of arc lavas (<1.0%) and mid-ocean ridge basalts (=1.5%), and similar with the plume-related intra-plate basalts and the slab windows-related basalts in the southern Patagonia of South American and Baja California. The more higher TiO_2 values probably suggest an deeper asthenospheric mantle. On the Ti vs. V diagram, all samples plot into the OIB area. The total REE content of the gabbros range from 36.93 to 220.19 ppm, the ratios of LREE/HREE range from 4.27 to 10.16, with the average value 5.81. In Chondrite-normalized REE patterns, the samples exhibit an enrichment of light rare earth elements (LREE) relative to heavy rare earth elements (HREE), and the Chondrite-normalized REE pattern lying between reference line of EMORB and OIB. The primitive mantle-normalized trace element patterns display enrichment of

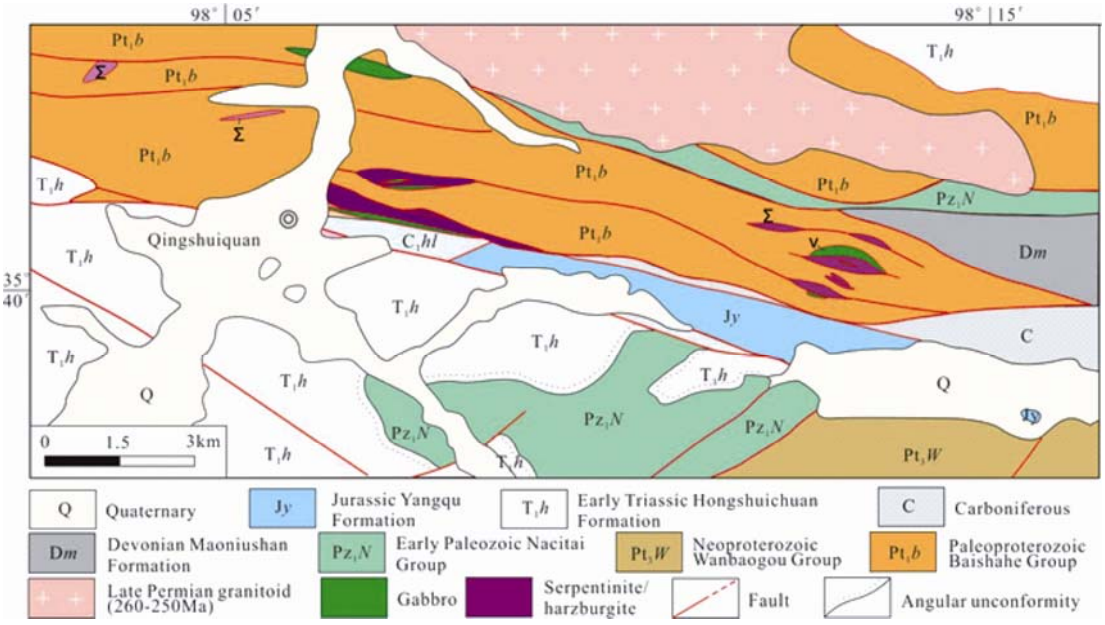

Fig. 1. Geological map of Qingshuiquan ophiolite and adjacent area.

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large-ion lithophile elements (LILEs) and high field strength elements (HFSEs, especially for Nb, Ta and Ti), resembling the ocean island basalts and enriched mid-ocean ridge basalts. Relatively higher Th/Yb and Ta/Yb ratios further suggest an fertile mantle source. The relatively low $\varepsilon_{Nd}(t)$ values ranging from –3.04 to –3.57, could indicate minor contamination of sub-lithosphere mantle and subduction sediments. Additionally, the Sm vs. Sm/Yb diagram shows that the gabbros melt were generated from approximately 5-10% partial melting of a spinel-garnet lherzolite mantle source (Aldanmaz et al., 2000).

Globally, the southern Patagonia in South American is characterized by large exposoures of alkaline basaltic rocks, exhibiting trace element and isotopic characteristics like those of with-plate OIB-type basalts (D`Orazio et al., 2001). Some workers also documented similar high- titanium OIB-type basaltsoccurred in ancient active continental margin in Chinese Altai (Ma et al., 2018), South Qiangtang (Gao et al., 2019), Bangong-Nujiang zone (Fan et al., 2018) and South China (Wang et al., 2018). These OIB-type basalts were argued to generate in ocean ridge subduction-related tectonic setting along the active continental margin. Considering the specific prtrogenesis of the Qingshuiquan gabbros, we preliminarily propose that the research area underwent process of slab-window relevant to the oceanic ridge oblique subduction during early Ordovician (ca. 480 Ma).

Key words: East Kunlun, Qingshuiquan, Alkaline gabbros, Ophiolites, Slab window

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References

Dong, Y.P., He, D.F., Sun, S.S., Liu, X.M., Zhou, X.H., Zhang, F.F.,Yang, Z., Cheng, B., Zhao, G.C., and Li, J.H., 2018. Subduction and accretionary tectonics of the East Kunlun orogen, western segment of the Central China Orogenic System. *Earth-Science Reviews*, 186: 231–261.

Feng, H.B., Meng, F.C., Li, S.R., and Jia, L.H., 2015. Characteristics and tectonic significance of chromites form Qingshuiquan serpentinite of East Kunlun, Northwest China. *Acta Petrologica Sinica*, 31(8): 2129–2144(in Chinese with English abstract).

Li, R.B., Pei, X.Z., Li, Z.C., Sun, Y., Pei, L., Chen, G.C., Chen, Y.X., Liu, C.J., and Wei, F.H., 2013. Regional tectonic transformation in East Kunlun orogenic belt in Early Paleozoic: Constraints from the geochronology and geochemistry of Helegangnaren alkali-feldspar granite. *Acta Geologica Sinica* (English Edition), 87(2): 333–345.

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