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Late Cambrian SSZ-type Ophiolites in Acite Zone, East Kunlun Orogen of Northern Tibet Plateau: Insights from Zircon U-Pb Isotopes and Geochemistry of Oceanic Crust Rocks

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1 Introduction

East Kunlun orogen(EKO) stretching more than 1000 km in E-W extension is located in the western segment of Central Orogen Belt(COB), China(Xu et al., 2006, Li et al., 2014). There outcropped Cambrian ophiolites recording the tectonic evolution history of a Proto-Tethys ocean lying in the northern edge of Gondwana Continent during Early Paleozoic era(Li et al., 2013a,b).

The Acite Ophiolitic mélange is located in the eastern section of EKO, western COB. Detailed geological mapping revealed that Acite Ophiolitic mélange mainly include mantle peritotites, metabasalts, metagabbros, metabasaltic andesites and marbles(originally neritic marine limestone) (Fig. 1a,b), which are crucial for understanding the possible progressive evolution process of supra-subduction zone(SSZ) forearc magmas for Acite ophiolite.

2 Geochemical Results and Tectonic Magmatic Process

Based on the geochemical data, its upper oceanic crust units of Acite ophiolites are divided into three subtypes: (1) Morb-like forearc basalts(FABs), (2) Low Titanium tholeiitic gabbros(LTGs), and (3) Normal Calcic-alkaline basaltic andesites (CABs). The Morb-like forearc basalts(FABs) have comparatively higher TiO_2 concentrations (1.13–1.42 wt.%), show almost flat REE patterns with $(La/Yb)_N$ ranging from 1.05 to 1.96. In the

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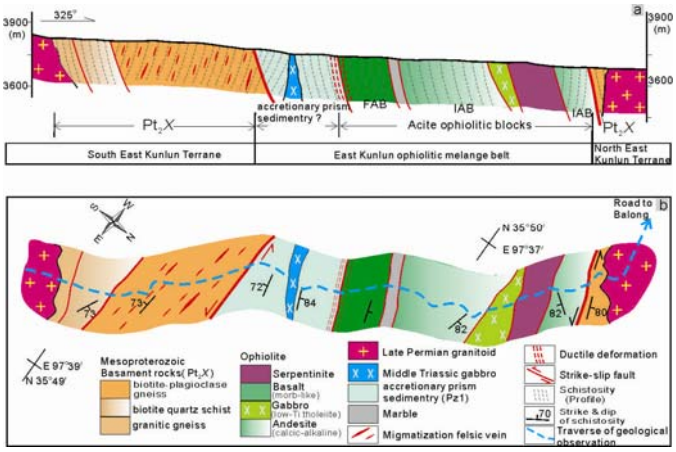

Fig. 1. Detailed geological profile(a) and corresponding traverse geological map(b) across the central East Kunlun fault zone, showing Acite ophiolitic mélange and surrounding rocks.

N-MORB normalized trace element patterns, the FABs display flat distributions of HFSE(such as Nb, Ta, Zr, Hf and Ti) except varying enrichment in LILE and Pb. FABs εNd(t=512Ma) values range from +4.0 to +4.8. These features above are similar to composition of Izu-Bonin-Mariana forearc basalts(FABs), west Pacific Ocean, suggesting a depleted mantle source with little or no fluid contribution form subduction slab. Low Titanium tholeiitic gabbros(LTGs) are characterized by higher contents of MgO(8.85–9.95 wt.%), lower concentration of TiO_2(0.29–0.50 wt.%), roughly equal to those of boninite-like rocks, and were classified as sub-alkaline tholeiitic series. They also show LREE-depleted pattern as compared to their HREE($(La/Yb)_N$=0.20–0.33), however

having comparatively lower total REE content than that of FABs. In the N-MORB normalized trace element patterns, LTGs samples display flat distributions of HFSE except varying large ion lithophile elements(Cs, Rb, Ba, etc.) enrichment and mildly depletion of Nb and Ta. LTGs εNd(t=512Ma) values range from +7.4 to +8.4. These features show that LTGs magmas originated from a progressively depleted mantle source with minimal fluids influence on their source. On the contrary, normal Calcic-alkaline basaltic andesites (CABs) having higher SiO_2 contents(50.47–70.92wt.%) and medium TiO_2 contents(0.44-1.70wt.%), were classified as sub-alkaline Calcic-alkaline series. They have higher total REE contents ranging from 107.83 to 146.43 ppm, with $(La/Yb)_N$ ratios ranging from 3.95 to 12.04. In the NMORB normalized trace element patterns, CABs are characterized by enrichment of large ion lithophile elements (Cs, Rb, Ba, Sr and Pb) and depletion of Nb, Ta, and Ti, which were suggestive of a normal island arc rocks in supra subduction zone. CABs have negative εNd(t) values ranging from -9.8 to -10.5, which are likely suggestive of enriched mantle source affected mainly by sediment-derived melt/fluids. Rocks association of FABs, LTGs and CABs above, together with the tectonic discrimination plot using trace elements suggest a forearc-incipient arc settings above the supra-subductipn zone. Combined with the progressively systematic variation for TiO_2, MgO, REE and □Nd(t), together with the previous tectonic models, we preliminarily present a progressive evolution process of Morb-like forearc basalts(FABs) to Low-Ti tholeiitic gabbros(LTGs) and then normal Calcic-alkaline basaltic andesites(CABs) above a north-dipping supra-subduction zone during early Cambrian(ca. 512Ma), reminiscent of the modern forearc oceanic crust in the Izu-Bonin-Mariana and Tonga-Kermadec subduction factories. Our new data and model have important implications for the initial subducion constraints of oceanic crust and tectonomagmatic evolution of supra-subduction zone concerning the Proto-Tethys ocean in East Kunlun Orogen(EKO).

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