Research Advances

Alkaline Basalts in the Bayingou Ophiolitic Mélange of Northern Tianshan Mountains: Origination from Seamounts?

YANG Gaoxue[1, 2, *], LI Yongjun[1,2], TONG Lili[1,2], LI Ganyu[1], SHEN Rui[1] and LI Zhao[1]

1 *School of Earth Science and Resources, Chang'an University, Xi'an* 710054*, Shaanxi, China*
2 *Key Laboratory for the Study of Focused Magmatism and Giant Ore Deposits, MLR, Xi'an* 710054*, Shaanxi, China*

Objective

The Bayingou ophiolitic mélange is located in Northern Tianshan Mountains of the southern Central Asian Orogenic Belt which is the largest accretionary orogen among the European, Siberian, Tarim and North China cratons. The Bayingou ophiolitic mélange provide a critical geological record for unraveling regional tectonic history and testing different tectonic models. However, previous studies were mainly concentrated on geochronology, rock combination, structural feature and geochemistry of ophiolite, with little attention to oceanic island basalts in the Bayingou ophiolitic mélange. Therefore, in this study, we focus on pillow basalts from ophiolitic mélange.

Methods

With aims of providing constraints on magma source and petrogenesis, an integrated study of petrology, geochemistry and whole rock Sr–Nd isotopes has been carried out on pillow basaltic lava of the Bayingou ophiolitic mélange (Fig. 1a).

Results

The pillow basalts occur as tectonic blocks within the mélange, and are associated with tuffs, siliceous mudstones and radiolarian cherts. Geochemically, all pillow basalts are characterized by alkaline affinity with high concentrations of TiO_2 (2.23–3.78 wt.%), LREE enrichment and HREE depletion, very weak or no Eu anomalies, and no obvious Nb, Ta and Ti negative anomalies, indicating typical OIB affinity (Fig. 1b and c). Isotopically, the basalts display a narrow range of Sr–Nd isotopic compositions, with high initial $^{87}Sr/^{86}Sr$ ratios (0.70432–0.70472), and positive $\varepsilon Nd(t)$ values (3.5–4.6). This is similar to alkaline basalts from the Karamay and Darbut ophiolitic mélanges in West Junggar and show typical OIB affinity with little or no continental crust contamination, indicating formation of the pillow basalts in intra-oceanic setting.

Conclusions

(1) Alkaline oceanic island basalts (OIBs) were distinguished from the Bayingou ophiolitic mélange. (2) In combination with Late Devonian–Early Carboniferous oceanic island basalts reported at West Junggar, indicate that these rocks may represent remnants of oceanic seamounts/plateaus in Paleo-Asian Ocean. (3)The pillow basalts may derived from a depleted MORB mantle enriched by an EM II component which is from upwelling

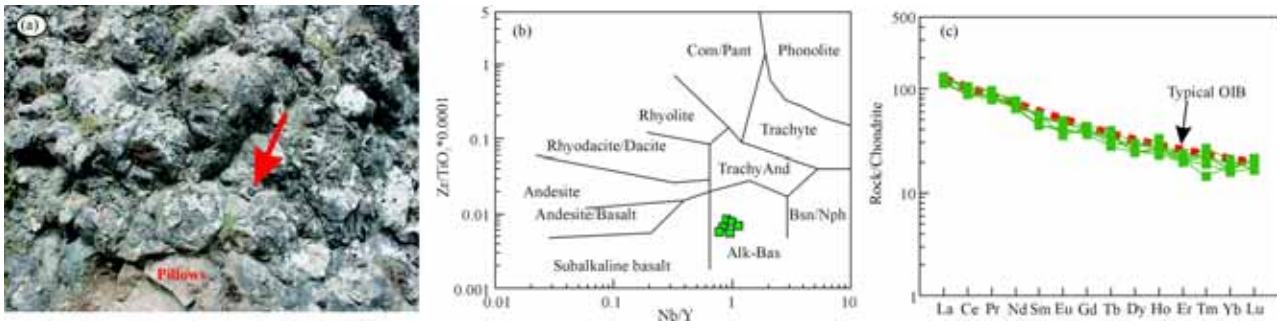

Fig. 1. Field photograph (a), geochemical Zr/TiO_2 vs. Nb/Y classification diagram (b), and Chondrite-normalized rare earth element patterns (c) for the pillow basalts in the Bayingou ophiolitic mélange.

* Corresponding author. E-mail: mllygx@126.com

of the lower mantle through plume. (4) Seamounts may be a significant source of material to the "subduction factory". They not only affect mantle geochemistry due to its entrained enriched geochemical characteristics, but also play a significant role on geochemistry of arc and back-arc lavas.

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