Geochronology and Petrogenesis of the Pillow Basalts in Western Karamay from West Junggar, NW China

YANG Gaoxue1,*, LI Yongjun1, TONG Lili1, SHEN Rui1, LI Ganyu1 and YANG Baokai2

1 School of Earth Science and Resources, Chang’an University, Xi’an 710054, Shaanxi, China
2 The Qingdao Geological Engineering Investigation Institute, Qingdao 266071, Shandong, China

Recently, we carried out the National Nature Science Foundation of China (No. 41530327) and focused on pillow basalts in western Karamay from West Junggar. The detailed geological survey at a scale of 1:500 distinguished an assemblage of accretionary complex in western Karamay. The accretionary complex consists of pillow basalt, mudstone, turbidite and abyssal radiolarian chert interlayered with tuff (Fig. 1a). The great concern in the study area is the large-scale pillow lava. Despite the deformation, these pillow structures are well preserved, generally 30–60 cm (some up to 120 cm) in length, with length to width ratio of around 1.2. Moreover, radial holes and amygdalae occur at cross section in pillows.

One sample from the pillows was chosen for age determination. The U–Pb isotope analytical results for 26 zircons can be divided into three groups (Fig. 1b): The first group has 206Pb/238U ages from 392 to 397 Ma, with a weighted mean value of 394.8 ± 6.0 Ma (n = 8, MSWD = 0.04); the second group has 206Pb/238U ages from 303 to 307 Ma, with a weighted mean age of 305.6 ± 3.4 Ma (n = 16, MSWD = 0.02); and the last one just has two ages, i.e., 1810 and 1812 Ma. Cathodoluminescence imaging and experimental records show that, the last group is probably xenocrysts, and the second one may represent a magmatic thermal event. Thus, the first group is interpreted as the crystallization time of the pillow lava. However, Zhu et al. (2007) suggested that the pillow lava was not formed later than the Early Cambrian (>517 Ma).

Geochemically, the pillow basalts are alkaline series, characterized by high TiO2 and FeO, low MgO, strong LREE enrichment, very weak or no Eu anomalies, and no obvious Nb, Ta negative anomalies, indicating typical oceanic island basalt (OIB) affinity (Fig. 1c). This is very similar to oceanic island basalts from Xigaze and Hawaii, probably formed in the ocean seamount and/or oceanic plateaus in oceanic plate. These observations, in combination with the Late Devonian–Early Carboniferous oceanic island basalts reported at Char in East Kazakhstan, indicate that these rocks could represent the remnants of oceanic islands/plateaus in the Paleo-Asian Ocean. Importantly, our study indicates that the OIBs in western Karamay from West Junggar may correlate to a Middle Devonian mantle plume-related magmatism within the Paleo-Asian Ocean. However, some researchers argued that the OIB lavas might have upwelled from a deep mantle via a slab window on the down-going slab.

Fig. 1. Field photograph (a), U–Pb concordia diagram of zircon grains (b), and chondrite-normalized rare earth element patterns (Sun and McDonough, 1989) (c) for the pillow basalts in western Karamay from West Junggar, NW China.

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

© 2015 Geological Society of China