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Study on the Spatial Distribution, Petrological Characteristics and Petrogensis of Cenozoic Basalt in Xinchang Basin, Zhejiang Province

DUAN Zheng*, CHU Pingli, YU Minggang and ZHANG Xiang

Nanjing Center of China Geological Survey, *Nanjing* 210016

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Abstract: Aboundant researches on Cenozoic basalt in Southeastern China had been done in resent years, while it is mainly focused on the tholeiitic basalt, but with few studies on alkali basalt. There are large areas of emergence of Cenozoic basaltic volcanic rocks in Xinchang Basin, Zhejiang province and they exposed intensively along the continental margin extensional belt: Yuyao-Lishui Fault. The eruptive ages of the Cenozoic basalt range from Eocene to Pliocene (47.1-2.9Ma) with mainly of alkaline basalt. We found out the spatial distribution characteristics of the Cenozoic volcanic rocks in the basin according the field regional geological survey. Additionally, we made petrological and geochemical studies on the Cenozoic volcanic rocks from Xinchang Basin. Cenozoic volcanic activity in the study area can be divided into at least 2 periods of volcanic eruption cycles, and there exposed significant sedimentary stratums (diatomite layer) between each cycle.

The SiO_2 content of the Cenozoic basalt in Xinchang Basin range from 39.95% to 50.46%, and mainly fall into trachybasalt and basalt district, with few samples fall into basanite area on the TAS diagram. In generally, they enrich of MgO, TiO_2 and alkali but with low content of Al_2O_3, which is similar to the characteristics of intraplate basalt. All the samples of tholeiitic basalt show that with the increase of SiO_2, the MgO, CaO, MnO, TiO_2, K_2O and P_2O_5 decrease significantly, while Al_2O_3 showed a stable increasing trend, indicating that the magma of tholeiitic basalt experienced obvious crystallization differentiation, and the separated minerals were magnesium minerals (such as peridotite) and relatively potassium-rich alkaline minerals (such as leucite and nephrite). The ΣREEs of the samples vary between 107ppm and 383ppm, while the alkali basalt has higher ΣREEs in comparison with the tholeiiltic basalt and their REE model is characterized by enrichment in light REEs with no Eu anomaly or weakly positive Eu anomaly. Besides, the light REEs distribution curves of the alkali basalt are divergent obviously, which may be caused by partial melting of the mantle source region and the garnets stayed in the mantle as the residual minerals. Comparatively, the distribution curve of alkali basalt is generally more right-leaning than tholeiitic basalt, indicating that the degree of partial melting from the alkali basalt is lower and more incompatible elements derived into the melt during the melting process. Besides, all samples showed positive anomaly of Ta and Nb and obvious negative anomaly of Pb, high Ce/Pb, Nb/U ratio and low La/Nb ratio, which are similar to the intraplate basalt. On the other hand, the alkali basalt show more enrichment of LILEs (K, Rb, Ba, Th and Nb) than the tholeiitic basalt, which also implying that the degree of partial melting of alkali basalt is lower that that from tholeiitic basalt. Additionally, the HFSEs (Ti, P, Zr and Hf) show no obvious depletion, which are also similar to the intraplate basalt. The higher TiO_2 content, Nb/Ta and Zr/Ba also are implying that the alkali basaltic magma

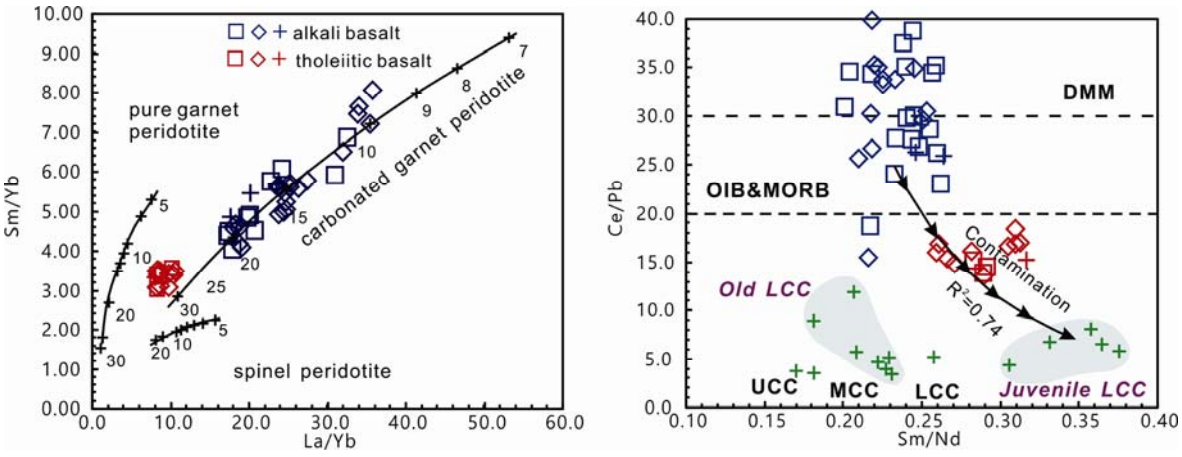

Fig. 1. The La/Yb - Sm/Yb and Sm/Nd - Ce/Pb diagram of Cenozoic basalt in Xinchang Basin, Zhejiang.

* Corresponding author. E-mail: dz19882010@163.com

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may be originated from the asthenosphere. Besides, the high abundance of transition elements such as V, Cr, Ni and Co indicates that the degree of crystallization differentiation of alkali basaltic magma is relatively lower.

In addition, the basalt containing xenolites of spinel lherzolite, peridotite garnet lherzolite and pyroxene megacrysts, and the formation temperature of the pyroxene megacrysts in basalt at 1324-1373 ℃ with the depth of 49-73 km. It is suggested that the Cenozoic basalt may be mainly derived from the upper of the mantle of the asthenosphere. Furthermore, the Cenozoic alkaline basaltic basalt may mainly originated from the carbonatization garnet peridotite partial melting process, which is close to the asthenosphere mantle, while the tholeiitic basalt may originated from the carbonatization garnet peridotite and contaminated with the juvenile crust during the rising stage according to the La/Yb - Sm/Yb and Sm/Nd - Ce/Pb diagram.

Combined with the REEs and major elements, it can be concluded that the Cenozoic basaltic magma in the study area originated from the asthenosphere, while the alkali basalt contaminated with less juvenile crust and lower melting degree of the asthenosphere mantle source, while the tholeiitic basalt has contaminated with more juvenile crust and higher melting degree of the asthenosphere mantle source.

Key words: Petrogensis, basalt, Cenozoic, Zhejiang

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About the first author

Duan Zheng, male, born in 1987, assistant researcher, majors in igneous petrology; Email: dz19882010@163.com; phone: 18013912739