

The origin of alkali basalts in Nanjing area, eastern China

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Neogene to Quaternary alkaline basalts are distributed around Nanjing area, eastern China, about 2000 km to the west of Japan Trench. Previously, the origin of volcanism was attributed to a plume upwelling originated in the deep earth like the ocean island basalt since this area is detached from a subduction zone and the alkaline basalts are geochemically indistinguishable from ocean island alkaline basalts. However, since the Pacific Sea Slab in the mantle transition zone beneath Nanjing area has been found by seismic tomography (e.g., Fukao *et al.*, 1992), the influence of stagnant Pacific slab has been considered as a potential origin for the alkaline basalts. In this study, we measured whole-rock major and trace element compositions of the Nanjing basalts by an X-ray fluorescence spectrometer (XRF) and major element compositions of phenocrysts in these basalts by electron probe micro analyzer (EPMA) and discussed the source mantle compositions of the basalts.

Whole-rock MgO and SiO₂ contents and FeO*/MgO of the Nanjing basalts are 3.3 –12 wt%, 42 –54 wt%, and 1.1 –2.2, respectively, showing relatively differentiated compositions. Nanjing alkaline basalts are rich in whole-rock FeO* content (7.8-14.5 wt%) and poor in CaO (4.1-9.3 wt%) and Al₂O₃ contents (13.1-17.8 wt%), being plotted in the end-member compositional field of Cenozoic alkaline basalts in China. Especially, the extremely high-FeO, low-CaO, and low-Al₂O₃ samples are separated from compositional fields of melts originated in peridotites or fractionated melts from the partial melt of peridotites, suggesting mafic lithology for their source mantle lithology.

Nanjing basalts commonly contain olivine and clinopyroxene phenocrysts and relatively differentiated samples have small amount of plagioclase phenocrysts in addition to olivine and clinopyroxene. Magnesium number ($Mg\# = 100Mg/(Mg + Fe)_{mol}$) of clinopyroxene phenocryst cores range from ~70 to 91, but most clinopyroxene phenocrysts have $Mg\# \sim 80$. Forsterite content ($Fo\# = 100Mg/(Mg + Fe)_{mol}$) of olivine phenocryst cores range from <60 to 92 and show strong two peaks at ~80 and ~90. Especially, high $Fo\# (>85)$ olivine phenocrysts contain 2000 –3500 ppm Ni, which is higher than olivine compositions crystallized from melts originated in peridotite (Sobolev *et al.*, 2007).

These discriminating whole-rock and mineral compositions of the Nanjing alkaline basalts imply that these alkaline basalts are originated in pyroxenite source mantle. Sobolev *et al.* (2005) considered eclogites originated in a recycled oceanic crust in an upwelling mantle from core-mantle boundary as the origin for large volcanisms in intraplate tectonic settings such as Hawaii. Beneath the eastern margin of the Eurasian continent, harzburgite plumes derived from the Pacific stagnant slab have been suggested to ascend together with oceanic crust in the stagnant slab from the mantle transition zone to form a non-peridotite partial melts. Origin of the Nanjing alkaline basalts could be explained by the same model.

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