Diversity and evolution of mantle sources of the Kilauea volcano, Hawaii

N. SHIMIZU[1], K. KOBAYASHI[2], E. NAKAMURA[2] AND M. KURZ[1]

[1]Woods Hole Oceanogr. Inst. (nshimizu@whoi.edu, mkurz@whoi.edu)
[2]ISEI, Okayama University, Japan (katsura@pheasant.misasa.okayama-u.ac.jp, eizonak@misasa.okayama-u.ac.jp)

Olivine-hosted melt inclusions from the 1960 picrite flow (MK91-8) of the Kilauea Volcano were analyzed for Pb isotopic compositions using the ISEI Cameca IMS 1270 with a multiple-collection system, using the techniques described by Kobayashi et al. (2004). Replicate analyses of a basalt glass standard with ~2ppm Pb yielded reproducibilities of 0.35% ($2\sigma_m$) for both $^{207}Pb/^{206}Pb$ and $^{208}Pb/^{206}Pb$ ratios. In-run precisions for the melt inclusions with Pb at 0.3-0.5 ppm ranged from 0.65-0.95% (2σ) for both isotopic ratios.

Salient features of the results are: (1) The ranges of Pb isotopic compositions ($^{207}Pb/^{206}Pb$ from 0.795 to 0.847; $^{208}Pb/^{206}Pb$ from 1.969 to 2.098) are greater than the three endmember compositions (Koolau, Loihi, Kea) proposed by Eiler et al. (1998), showing, in particular, that there is a radiogenic component ($^{207}Pb/^{206}Pb$=0.795, $^{208}Pb/^{206}Pb$=1.969), more radiogenic than any known Hawaiian lavas. (2) the radiogenic component, first observed in pre-shield stage (~270 ka) alkaline glasses from the Hilina Bench (Shimizu et al., 2001), shows that it has persisted throughout the evolution of the Kilauea magmatism. A similar composition was found in a melt inclusion from Mauna Loa (Kobayashi et al., 2004), indicating its ubiquitous, if not abundant, presence in the Hawaiian plume. (3) In the $^{207}Pb/^{206}Pb$ – $^{208}Pb/^{206}Pb$ space, the present results show two distinct mixing arrays (EM2-EM1, and HIMU-DMM), and indicate that the EM2 component plays important roles in the Hawaiian plume and that diversity of mantle sources involved in the Kilauea magmatism is much broader than whole-rock/glass based data suggests. It is also suggested that the source diversity has persisted through the evolution of magma types from alkaline to tholeiitic over the past 270 ka.

References

[1] Eiler et al. (1998) GCA,62,1977;
[2] Kobayashi et al. (2004) CG, 212, 143;
[3] Shimizu et al. (2001) EOS, 47, F1280.

Geochemical and isotopic characteristics of Cretaceous basalts in South China and constraint on Pacific plate subduction

W.F. CHEN, P.R. CHEN, X.S. XU AND M. ZHANG

State Key Laboratory of Mineral Deposit Research, Department of Earth Science, Nanjing University, Nanjing 210093, China (cwf_328@163.net)

Late Cretaceous Basalts (85~110Ma) distribute in the contemporaneous fault-bounded red basins and volcanic-sedimentary basins in South China (including Hunan, Jiangxi, Guangdong, Fujian, Zhejiang Provinces). They are divided into two groups delimited by Wuyi Shan Range, namely west area basalts (WABs) distributing over the west of Wuyi Shan Range and east area basalts (EABs) distributing over the east of Wuyi Shan Range respectively, and observed having distinct geochemical and isotopic characters.

WABs are characterized by low K_2O (0.44~3.17%), alkaline (K_2O+Na_2O=3.27~6.80%), Al_2O_3 (13.08~16.75%), but high MgO (5.13~8.78%) and TiO_2 (1.12~3.35%). WABs are similar to ocean-island basalts (OIB) or intraplate basalts on trace element compositions and isotopes: no negative Nb and Ta anomalies, low LILE/HFSE (e.g., Ba/Nb, Ba/Zr), relatively low $\sum$REE and La_N/Yb_N, high $\varepsilon_{Nd}(t)$ (-1.81~8.00).

In contrast, EABs display relatively high K_2O (0.55~ 4.86%), alkaline (2.95~7.55%) and Al_2O_3 (15.80~ 21.10%), low MgO (2.63~6.28%) and TiO_2 (1.19~1.86%), strong negative Nb and Ta anomalies, high LILE/HFSE, relatively high $\sum$REE and La_N/Yb_N, negative $\varepsilon_{Nd}(t)$ (-8.5~-1.22), similar to IAB (island arc basalts) or CAB (continental arc basalts).

Accordingly, geochemical and isotopic data suggest that two groups were derived from different mantle sources. WABs were probably generated under continental rifting tectonic environment related to asthenospheric materials upwelling, source of which was characterizd by mixing between EMⅡ and DM. EABs' source may be lithoshperic mantle which had ever been undergone metasomatism by fluid/melt derived from subducted Pacific plate.This indicates that subduction of a paleo-Pacific plate (Kula) beneath the Asian continent had ever been occurred during late Mesozoic period, but the areas of influence by subduction on the continent was only limited the east areas of Wuyi Shan Range.

Acknowledgement

This research was supported by National Natural Science Foundation (Grant Nos. 40132010 and 40125007).