# Distinguishing carbonate and silicate metasomatisms in generating the mantle sources of alkali basalt in western Qinling, China

LI-QUN DAI*, ZI-FU ZHAO, YONG-FEI ZHENG

CAS Key Laboratory of Crust-Mantle Materials and Environments, School of Earth and Space Sciences, University of Science and Technology of China, Hefei 230026, China; emails: lqdai@ustc.edu.cn (L.-Q. Dai)

Crustal metasomatism by subduction is considered as an important mechanism for mantle heterogeneity through infiltration of different metasomatic agents into the mantle. During the subduction of oceanic crust (including oceanic basaltic rocks and seafloor sediments), both carbonate and silicate metasomatisms are expected to occur in oceanic subduction channel. This is demonstrated by an integrated study of major-trace elements, stable Mg isotopes and radiogenic Sr-Nd-Hf isotopes in Cenozoic and Mesozoic alkali basalts from the West Qinling orogen, China. Although the two periods of continental basalts show OIB-like trace element and relatively depleted Sr-Nd-Hf isotope compositions, they exhibit a series of differences in the other geochemical variables. The Cenozoic basalts exhibit low $SiO_2$ but high CaO and MgO concentrations, and high $CaO/Al_2O_3$ ratios but low $\delta^{26}Mg$ values of -0.54 to -0.32‰. They have relatively high abundances of melt-mobile incompatible trace element such as LREE and most LILE but low abundances of K, Pb, Zr, Hf and Ti, with high $(La/Yb)_N$ values but low Ti/Eu and Hf/Sm ratios. In contrast, the Mesozoic basalts show relatively high $SiO_2$ but low CaO and MgO concentrations, and low $CaO/Al_2O_3$ ratios but high $\delta^{26}Mg$ values of -0.35 to -0.21‰. They have relatively low abundances of melt-mobile incompatible trace elements such as LILE and LREE but relatively enriched in Zr, Hf and Ti, with low $(La/Yb)_N$ values but high Ti/Eu and Hf/Sm ratios. These observations indicate a significant difference in the composition of mantle sources between the two periods of alkali basalts. While the low $\delta^{26}Mg$ values for the Cenozoic basalts indicate involvement of the sedimentary carbonate in their mantle source, the high $\delta^{26}Mg$ values for the Mesozoic basalts point to a primary contribution from the silicate component. Metasomatic reaction of the depleted MORB mantle peridotite with carbonate and silicate melts, respectively, in the Paleotethyan oceanic subduction channel are responsible for the generation of their mantle sources. Therefore, the property of metasomatic agents in the mantle sources is the key to the composition of alkali basalts.