Geochemical characteristics of mantle xenoliths from Quaternary alkaline lavas, southern Ethiopia

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The Quaternary alkaline basalts from the East African Rift in southern Ethiopia contain mantle xenoliths. The mantle peridotites are important to investigate the evolution of the lithosphere mantle beneath this region, where plume-induced magmatism has occurred.

To characterize the petrographical and petrological nature of these xenoliths, we have undertaken microscopic observation and analysis of major and trace elements contents of clinopyroxene separates and whole-rock samples. Total 7 samples studied are very fresh, and all are spinel lherzolites. Xenoliths can be divided into two types: anhydrous and hydrous (including amphibole and phlogopite) spinel lherzolites. The occurrence of hydrous minerals suggests that they had been metasomatized. Both types have protogranular to equigranular texture. The compositions of spinel (Cr# 0.062-0.117, Al_2O_3 59-64 wt%) and diopside (Mg# 88.4-91.7, Al_2O_3 5-7 wt%) indicate that the peridotite xenoliths are fertile and less experienced partial melting. The equilibrium temperature calculation yields 822-1040 °C. The whole-rock major element compositions (MgO 35-39 %, CaO 3.9-5.6 %, Al_2O_3 2.5-4.2 %) overlap the slightly depleted primitive mantle compositions. There are no remarkable differences in the compositions of minerals and whole-rock among the two types of xenoliths. The trace element compositions of diopside separates and whole-rock samples show diverse (flat to slightly depleted) chondrite-normalized REE patterns. The only one sample, which has pargasite vein, is LREE-enriched. It suggests that they had metasomatized by different degree of magma infiltration. They have higher Ti/Eu and lower (La/Yb)n, implying that the metasomatic agent was silica-rich melt (or fluid) rather than carbonate-rich fluid.