Geochemical study of ultramafic xenoliths in alkali basalts from South Korea

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Ultramafic xenoliths present in alkali basalts at four locations in South Korea -Boun, the Gansug area, Baegryung Island and Cheju Island- are mostly spinel lherzolites composed of olivine, ortho-pyroxene, clinopyroxene and spinel. A subordinate amount of spinel harzburgites and pyroxenites are also found. Estimated T using various thermometers range from 870℃ to 1100℃ and equilibrium pressures derived from Mercier (1980) fall within the range of 12 to 22kb.

Major, compatible and moderately incompatible trace element contents of whole rocks vary systematically from fertile lherzolite to refractory harzburgite. Systematical variations in mineral and whole rock compositions are the characteristics of restites derived from partial melting and melt extraction followed by sub-solidus equilibration and annealing

Calculated oxygen fugacities using thermodynamic oxybarometers calibrated by O'Neill and Wall (1987), Ballhaus et al. (1991), and Nell and Wood (1991) range from -1.5 to 0.5 log units relative to FMQ buffer. So, the dominant fluid phases in the uppermost mantle beneath S. Korea are probably CO_2 and H_2O, not CH_4 or H_2.

Sr and Nd isotopic ratios of whole rocks and clinopyroxene separates from spinel lherzolites display wide variation from MORB-like to near bulk-earth estimates along the MORB-OIB mantle array. This isotopic heterogeneity shows a marked contrast to the nearly uniform isotopic compositions of the host alkali basalts. These differences between mantle xenoliths and host basalts indicate that the xenoliths can not be refractory restites after the extraction of host alkali basalts. Accordingly, the peridotite xenoliths are accidental mantle fragments.