MAJOR AND TRACE ELEMENT CHEMISTRY OF GARNET AND SPINEL PERIDOTITES FROM THE LASHAINE VOLCANO, TANZANIA

J. M. Rhodes, Lockheed Electronics Corporation, Houston, TX 77058 and
J. B. Dawson, Dept. of Geology, University of St. Andrews, Fife, Scotland

Whole rock analyses, together with determination of the trace elements Rb, Sr, Y, Zr, Nb, Ga, Ni and Cr are reported for twenty, extremely fresh, peridotite xenoliths, together with the host ankaramite and associated carbonatite tuff, from the Lashaine volcano in northern Tanzania. Included for comparison is an analysis of a garnet lherzolite from Matsoku in eastern Lesotho. These xenoliths are inferred to be derived from the garnet peridotite zone of the upper mantle from depths of about 150 km.

The chemical data indicate that two distinct groups of peridotite inclusions have been sampled. One group, the garnet peridotites, is characterized by lower MgO, Mg/Mg+Fe ratios and Ni, and by higher concentrations of SiO_2, Al_2O_3, CaO, K_2O, Cr_2O_3 and lithophile trace elements than the other group, the spinel peridotites. Both groups contain lherzolite and harzburgite variants reflecting internal differences in the CaO/Al_2O_3 ratio. A single inclusion of wehrlite with a markedly lower Mg/Mg+Fe ratio (0.85 versus 0.91-0.93) has a distinctive mineralogy and mineral assemblage.

The mean compositions for the two groups are:

Garnet peridotites: SiO_2 43.7, TiO_2 0.07, Al_2O_3 1.63, total Fe as FeO 6.78, MnO 0.13, MgO 44.5, CaO 1.09, Na_2O 0.11, K_2O 0.09, P_2O_5 0.06, NiO 0.22, Cr_2O_3 0.49 wt. percent and Rb 3.6, Sr 14.9, Y 0.9, Zr 4.6, Nb 1.4, Ga 2.8 ppm.

Spinel peridotites: SiO_2 42.3, TiO_2 0.06, Al_2O_3 0.43, total Fe as FeO 7.07, MnO 0.12, MgO 47.7, CaO 0.58, Na_2O 0.07, K_2O 0.03, P_2O_5 0.02, NiO 0.26, Cr_2O_3 0.28 wt. percent and Rb 1.7, Sr 11.6, Y 0.6, Zr 3.8, Nb 1.2, Ga 2.2 ppm.

The K_2O and Rb content of the garnet peridotites is higher than is typical for peridotite inclusions but compares closely with the few values published for garnet peridotite inclusions in kimberlite. These high values do not result from contamination, since the rocks are remarkably fresh, and the other trace elements, particularly Nb are too low to be reconciled with appreciable ankaramite contamination. A few samples have unusually high Sr concentrations (>100 ppm) that are unaccompanied by significant increases in other lithophile elements. Most of this Sr is concentrated along grain boundaries and is probably derived from the associated carbonatite.

In comparison with other data available for garnet peridotites, some peridotite inclusions, and inferred mantle compositions, the Lashaine xenoliths appear to be samples of depleted mantle, the garnet peridotites being less depleted than the spinel peridotites. Assuming that the ankaramite host rock is a primary partial melt, complimentary to the depleted peridotite inclusions, then these data can be used to

place limits on the composition of the undepleted upper mantle below the Lashaine volcano.