GEOCHEMICAL CHARACTERISTICS OF MANTLE XENOLITHS FROM THE UDACHNAYA KIMBERLITE PIPE.

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Geochemical characterization of kimberlite-borne mantle xenolith suites is essential for understanding processes and evolution of the continental lithosphere. The present study was undertaken to provide a comprehensive trace element data base for a suite of xenoliths from a single kimberlite pipe. Emphasis is placed on documentation of trace element abundances in garnets and diopsides in peridotitic xenoliths with a range of pressure and temperature conditions from the Udachnaya kimberlite pipe where an isotopic study of xenoliths (Pearson et al., 1995) and a trace element study of diamond inclusion garnets (Shimizu et al., this volume) are ongoing.

A Cameca IMS 3f ion probe at Woods Hole Oceanographic Institution was used with a spatial resolution of approximately 20 μm for REE (La, Ce, Nd, Sm, Eu, Dy, Er, Yb) and 8 μm for Ti, V, Sr, Y, and Zr. Analytical uncertainties range from 10 ~ 20 % for REE and 5 ~ 10 % for the other trace elements.

Peridotite xenoliths analyzed (a total of ~30) include coarse-grained spinel peridotites, and garnet peridotites with both granular and sheared textures. Trace element abundance patterns of garnets (deep red in color) and diopsides in high-temperature peridotites are similar to those of the southern African counterparts (e.g., Shimizu, 1975), whereas some high-temperature sheared peridotites (e.g., Uv121/91: 1259°C, 6.5 GPa; Pearson et al., 1995) contain purple garnets with sinuous REE patterns typical of low-temperature coarse peridotites in southern Africa. There is a group of coarse garnet peridotites which are extremely depleted in REE and other trace elements. Both garnet and diopside are light REE-depleted, concentrations between 0.05 and 2 times chondrite, and extremely low concentrations for Ti (~10 ppm in both garnet and diopside) and Sr (0.5 ppm in diopside). Garnet peridotites with these characteristics have not been encountered in the Kaapvaal craton.

Distributions of trace elements between garnets and diopsides as well as zoning patterns of garnets will be used to discuss timing and processes responsible for the present-day mineral chemistry in the xenoliths.

Pearson, D. G., Shirey, S. B., Carlson, R. W., Boyd, F. R., Pokhilenko, N. P. and Shimizu, N. (1995) Geochim. Cosmochim. Acta, 59, 959-977.
Shimizu, N. (1975) Earth Planet. Sci. Lett., 25, 26-32.