GARNET PERIDOTITE XENOLITHS IN MINETTE FROM THE NAVAJO VOLCANIC FIELD

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Small and variably altered xenoliths of spinel and garnet peridotite are present in many of the minette/trachybasalt volcanic centers of the Four Corners area. Unaltered garnet peridotite xenoliths 1-30 cm in diameter, however, are relatively common at the Thumb, a small neck 21 km SW of Shiprock. Temperatures and pressures of equilibration were estimated for 47 of these rocks using pyroxene compositions and the experimental data of Mori & Green (1975) and Akella (1976). Pressures estimated are within the range 45-52 kb, indicating that only a very limited vertical interval was sampled by the eruption. Temperature estimates of 980-1385°C display little correlation with pressure, but have general correlations with xenolith chemical compositions and textures (Fig. 1). The most depleted rocks (CPX Ti/Cr ≤ 0.1) have protogranular to weakly porphyroclastic textures and equilibrated at the lowest temperatures - close to the continental geotherm calculated by Clark & Ringwood (1964). Less depleted rocks (CPX Ti/Cr between

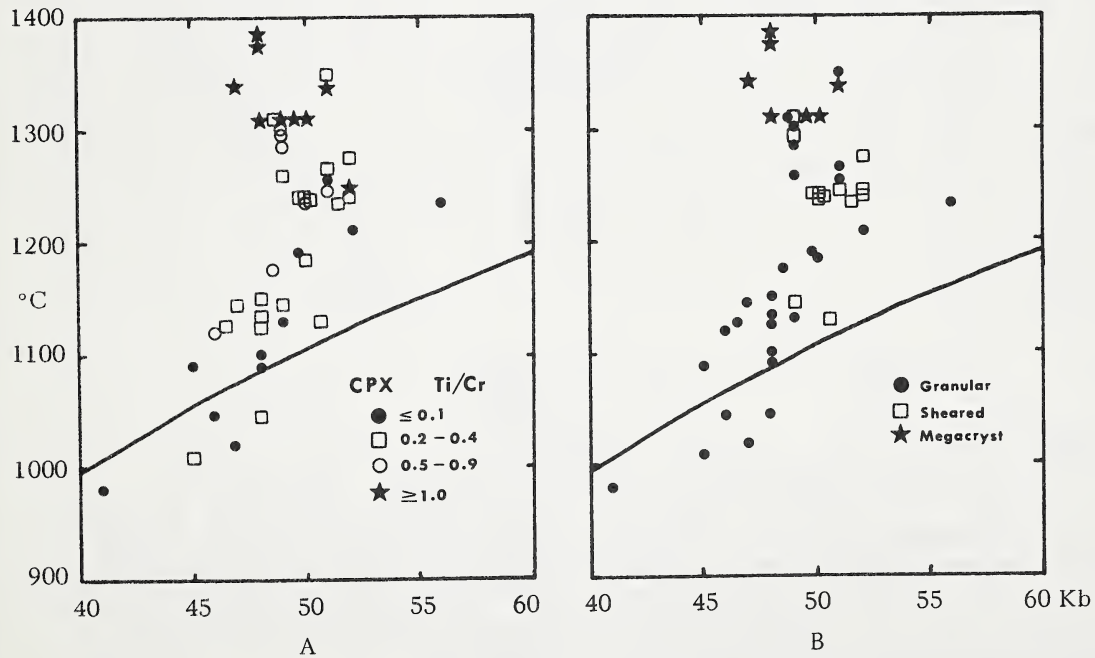

Fig.1 Relations of temperature and pressure estimates for garnet peridotite peridotite xenoliths from the Thumb to compositions of clinopyroxenes (A) and xenolith textures (B). Curved line represents continental shield geotherm.

0.1 and 1.0) yield temperatures mostly above this geotherm and have protogranular to mosaic textures. The least depleted rocks (CPX Ti/Cr$\geq$1.0) equilibrated at 1250-1385°C and include 2 mosaic texture lherzolites and 7 ultracoarse-grained ($\leq$9 cm) nodules containing various assemblages of CPX, GA, OPX, OL, ILM, and Phlogopite. Following the model of Green and Gueguen (1974), it is proposed that these xenoliths are derived from the top of a mantle diapir which brought material from a warmer deeper part of the mantle into an overlying region which had previously been extensively depleted by partial melting.

Phlogopite is present in many of the lower temperature peridotites and in the high-temperature megacryst nodules. Texturally the phlogopite appears to be secondary in some peridotites, but plots of phlogopite vs. CPX Ti/Cr and Fe/Mg (Figs. 2 and 3) are roughly linear, indicating some chemical communication between phlogopite and the anhydrous phases.

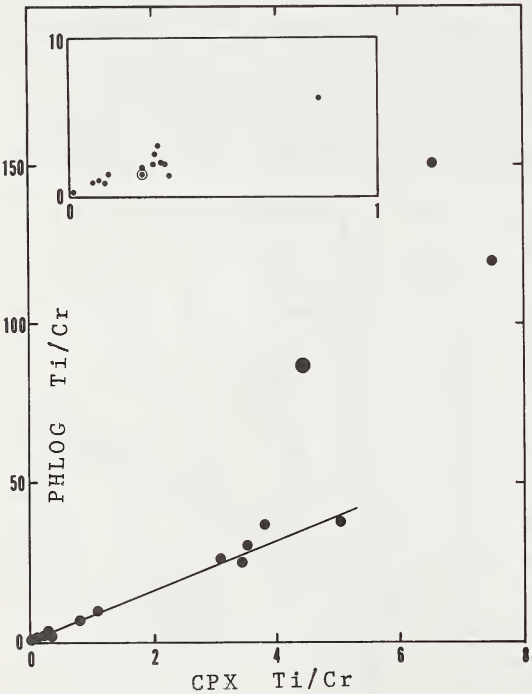

Fig.2 Phlogopite Ti/Cr vs. CPX Ti/Cr in garnet peridotite xenoliths (CPX Ti/Cr < 1.0) and megacryst xenoliths from the Thumb. Inset shows enlargement of peridotite values. Large symbol is average of Thumb phenocrysts. Circled point is garnet lherzolite from Shiprock (Baldridge, et al., 1975).

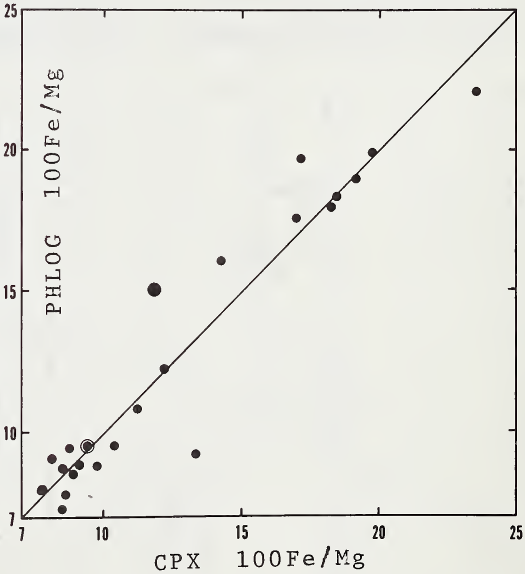

Fig.3 Phlogopite Fe/Mg vs. CPX Fe/Mg in garnet peridotite (CPX Fe/Mg < 0.14) and megacryst xenoliths from the Thumb and Shiprock.

Sr analyses of peridotite CPX (Fig. 4) indicate that the minette (with 87Sr/86Sr = 0.7056 - 0.7081) did not equilibrate with its peridotite xenoliths, but must have originated at some greater depth. The megacryst clinopyroxenes have not been analyzed for Sr, but are similar in major and rare earth element composition to clinopyroxenes in the most iron-rich lherzolites and are thus probably related to these rocks rather than to the minettes. The correlation of Sr content with 87Sr/86Sr in the clinopyroxenes suggests that these rocks are related by a common geochemical history despite the wide variations in their other chemical parameters.

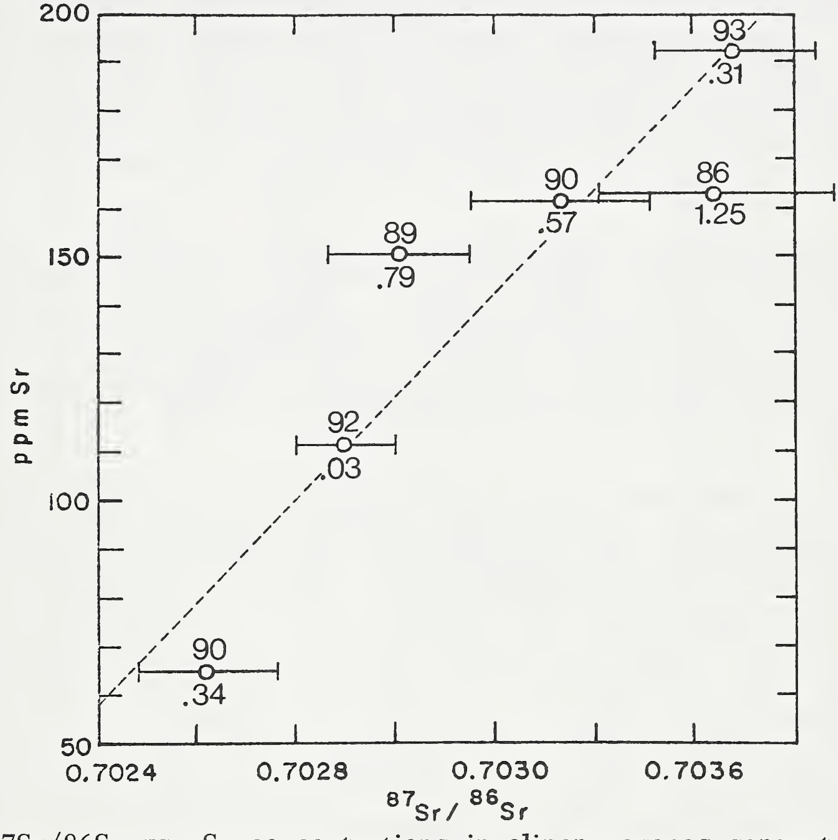

Fig. 4 87Sr/86Sr vs. Sr concentrations in clinopyroxenes separated from six garnet peridotite xenoliths from the Thumb. Error bars represent two times standard error of the mean on each side of data points, based on counting statistics. Numbers above points give CPX 100Mg/(Mg+Fe). Numbers below points are CPX wt.% TiO_2/Cr_2O_3.

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