GARNET EXSOLUTION FROM STRESSED ORTHOPYROXENE IN GARNET LHERZOLITE FROM THE MONASTERY MINE

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In a specimen of garnet lherzolite from the kimberlite of the Monastery Mine, O.F.S., South Africa, megacrysts of orthopyroxene up to 2 cm long are set in a finer-grained mosaic of olivine, clinopyroxene and garnet. The orthopyroxene crystals have been deformed, being bent along their C axes and exhibiting undulose extinction. Blebs, rods and platelets of garnet occur on (100) planes, generally at the point of maximum curvature, and very fine lamellae of ?clinopyroxene occur ubiquitously on (100) planes. Some more severely deformed orthopyroxene crystals are kinked on {100}[101] and garnet blebs along the kink junctions have coalesced to form continuous stringers of garnet (Fig. 1). A complete sequence can be traced from minute blebs appearing along minor dislocations to the continuous stringers of garnet, some of which separate thin rotated slices of the host pyroxene. The garnet appears to have exsolved from the orthopyroxene, and the occurrence of the garnet along dislocations suggests that this sub-solidus exsolution was induced by deformation of the host pyroxene in a non-isotropic stress field. This is similar to the origin proposed for garnet lamellae ("lamellae de démixtion") exsolved from tectonically-emplaced ultramafic rocks in the Bois des Feuilles, France (LASNIER, 1972) but differs from the garnet and clinopyroxene exsolved from orthopyroxene in garnet pyroxenites from Salt Lake Crater, Oahu, the origin of which is attributed to sub-solidus unmixing due to a drop in temperature (BEESON and JACKSON, 1970).

It should be noted that, in the Monastery Mine lherzolite, the composition of the exsolved garnet (MgO 20.9 - 21.4, CaO 4.7 - 5.1, Cr_2O_3 2.1 - 2.8 wt. %) is the same as that in the surrounding, finer-grained matrix. The composition of the host orthopyroxene (En_{94}, Al_2O_3 0.85, Cr_2O_3 0.22 wt. %) is not noticeably different from values previously reported for orthopyroxenes from garnet lherzolites.

The other phases in the peridotite are olivine (Fo_{92}), diopside (Na_2O 1.45, Al_2O_3 1.98, Cr_2O_3 1.47 wt. %), and picrochromite (MgO 12.9, FeO 17.3, Al_2O_3 15.2, Cr_2O_3 52.0 wt. %).

References

BEESON, M.H. and JACKSON, E.D. Min. Soc. America, Special Paper 3, 95 - 112, 1970.

LASNIER, B. Contr. Min. Petrol. 34, 29-42, 1972.

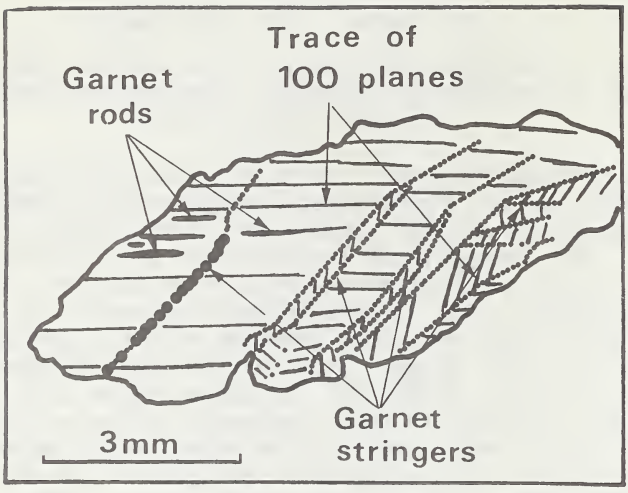

Fig. 1 - Sketch of kinked orthopyroxene in lherzolite BD1366 from the Monastery Mine, showing exsolved rods and coalescing stringers of garnet, and curvature and re-orientation of (100) planes.