Evidence of Kimberlite-Grospydite Reaction

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Abstract. A xenolith from the kimberlite pipe of the Roberts Victor Mine, O.F.S. shows a marginal rim rich in garnet (PyroAlmSGro15), presumably resulting from reaction between the grospydite inclusion and kimberlitic host. Similarity between the reaction rim-garnets, and those of the common mafic inclusion of the Roberts Victor pipe, suggests that the rare grospydite inclusions are accidental xenoliths, not directly related in origin to the kimberlites in which they are found.

Inclusions in kimberlite rarely show high-temperature alteration which may be attributed to reaction between inclusion and host. The low-pressure fusion shown by some eclogites (Switzer and Melson, 1969) seems to have been merely the effect of isothermal melting during rapid elevation to sub-surface conditions; other alteration (serpentinisation, zeolitisation) the inclusion shares with the kimberlite itself (Williams 1932, vol. 1 p. 160).

The finding in the Roberts Victor Mine of an eclogitic rock showing a garnet-rich rim is thus of some interest. The inclusion (Harker Coll. no. 99371), oblate-spheroidal in shape and some 20 cms long, shows a surface mottled with well-polished pink garnet and patches of greenish alteration product: occasional pyrite incrustation is apparent. A sawn section reveals the garnet-rich rim to be some 10 mm thick. The interior of the inclusion resembles a typical Roberts Victor kyanite-eclogite, with rounded blue kyanite, garnet, and the pale-greenish material shown by Switzer and Melson (1969) to be a quench-product of melted omphacite. The core-garnet is distinctly darker than that of the rim, the division being sharp to within a millimetre (Fig. 1); occasionally the interface cuts across a single garnet crystal. In no case has rim-garnet been observed to interfinger along grain boundaries.

In thin-section the core rock shows all of the low-pressure melting features described by Switzer and Melson. Only relicts of omphacite remain in a fine-grained turbid matrix presumably composed of augite and albite or analcrite (Berg, 1968). In places a good quench-texture, with interlocking feldspar and pyroxene, or veins of uncrystallised glass, with feldspar phenocrysts, are seen. The kyanite, characteristically showing kink-bands and deformation lamellae, may also show melting, usually at the contacts with garnet; corundum, mullite and sapphire may be found in the glass so formed. Garnet itself is seamed by coarse veins of fine-grained quench-product; it is this which gives the black appearance in hand-specimen. The garnet rim is more than 90% garnet, showing markedly less alteration than the core-garnet. Omphacite in the rim is also less
Fig. 1. Photograph of sawn face of grossydiite inclusion, showing the contrast between the black, grossularite-rich core garnet and the fresher, pyrope-rich rim garnet. Pale areas are the products of high-level melting of pyroxene. The "bight" on the top right-hand corner represents a piece lost after the development of the main reaction rim.

altered than the interior pyroxene. Kyanite, corundum\textsuperscript{1} and spinel occur as inclusions of the rim-garnet: a notable texture comprises corroded kyanite surrounded by a corundum-garnet symplectite.

All parts of the inclusion are cut by zones of green or orange serpentine. This alteration, post dating the melting, was presumably connected with the late episode which resulted in the almost complete serpentinisation of the kimberlite matrix of the Roberts Victor Pipe.

**Analytical Data**

(a) *core*. A planimetric analysis of the core region made on a sawn face of the inclusion (2700 points) gave the volume proportions kyanite 10.1; Omphacite, 40.3; Garnet, 49.6.

Electron-probe analyses of garnets and pyroxenes, made following the method of Sweatman and Long (1969), are tabulated in Table 1, from left to right in order of diminishing distance from the outer edge. Some difficulty was encountered in selecting suitable omphacite points, as only remnants remain in the turbid quench-product of the late-stage melting of pyroxene. By using a defocussed beam of diameter some 50 microns, not unreasonable analyses were obtained; these however have oxide totals well exceeding 100%. Recalculation of the

\textsuperscript{1} Such rim-corundum is readily differentiated from the corundum of the late-melting stage, which occurs only in glass at the borders of kyanite (cf. Switzer and Melson, 1969, Fig. 5)