# KYANITE ECLOGITES FROM THE ROBERTS VICTOR MINE

C.J. Hatton & J.J. Gurney

(Geochemistry Department, University of Cape Town, Rondebosch 7700, South Africa)

Kyanite has been observed in both group I and group II (Hatton & Gurney, 1977a) Roberts Victor eclogites. Several different types of occurrence can be noted within each group.

Homogeneous kyanite eclogites in group I.

(i) Trace amounts (less than 1%) of kyanite were observed in HRV26 (Figure 1,a), an eclogite of a composition very similar to the bulk of group I eclogites.
(ii) Approximately five percent kyanite occurs in grossular rich members JJG4 and JJG30 of the group I eclogites (Figure 1,b).
(iii) Abundant kyanite (greater than 10%) is present in kyanite eclogites PJL17, JJG88 and RV390/4 (Figure 1,c).

No group I garnet compositions have been found to lie between b and c in figure 1.

Homogeneous kyanite eclogites in group II.

Kyanite occurs in two fresh group II eclogites HRV147 and HRV272 (d and e respectively in figure 1). Limited compositional variation is found in these specimens.

Grosspydites.

Homogeneous grosspydites (garnet > 50% grossular, clinopyroxene and disthene = kyanite) are rare at Roberts Victor, although kyanite eclogite blebs in the inhomogeneous kyanite eclogites are of grosspydite composition. A unique grosspydite containing coesite and sanidine as accesory phases has been found (Smyth & Hatton, 1976). Coesite grosspydites probably are present (Smyth, 1977).

Inhomogeneous kyanite eclogites in group I.

The majority of kyanite bearing eclogites are of this type. Kyanite occurs in a discrete bleb together with grossular garnet and jadeitic clinopyroxene. Examination of a number of samples indicates that the kyanite eclogite bleb is entirely surrounded by ordinary eclogite. The compositional variation of garnet between kyanite eclogite and eclogite is illustrated for JJG143 (Figure 1, line 3) and HRV17 (Figure 1, line 2 and Figure 2). The vertical variation in mineralogy and mineralogical composition of HRV17 illustrated in figure 2 may be considered as a type sequence. A is an ordinary eclogite layer with equal amounts of pyropic garnet and diopsidic omphacite typical of group I eclogites. Layer D contains kyanite, grossular garnet and jadeitic omphacite. The interface A - D is marked by sharp compositional variation as illustrated by the accompanying graph of CaO content of garnet. C is a kyanite free, grossular garnet, jadeitic omphacite layer, again grading sharply into the pyrope garnet rich band $B_1$. The upper part of layer B contains equal amounts of pyropic garnet and diopsidic omphacite. Garnet and clinopyroxene compositions in layers A and B are similar. Garnet cores in A and B are CaO poor relative to rims (Figure 2), except for garnet close to the interface A - D which contains a CaO rich core. A possible explanation of this feature is that the garnet nucleated in layer D, settled and

continued to grow in the CaO poor layer A. It is implied that D lay above A, and hence that the garnet rich layer lay above the kyanite eclogite bleb. The presence of the garnet rich layer above the kyanite eclogite bleb is consistent with the following interpretation of the geometry of HRV30 (Figure 3). $K_D$ ratios (Raheim & Green, 1974) indicate that isobaric temperatures of equilibration were lower for the kyanite eclogite bleb than for surrounding eclogite. Incipient partial melting has been observed in kyanite eclogite (Switzer & Melson, 1969) but not, so far as is known, in ordinary eclogite. These latter two observations indicate that the solidus temperature of kyanite eclogite is lower than surrounding eclogite, hence the kyanite eclogite bleb may have been liquid while the garnet rich layer was in a semi-solid or plastic state. HRV30 consists of two discrete kyanite eclogite blebs in ordinary eclogite (Figure 3a) which coalesce within a distance of 10cm (Figure 3b). The coalesced kyanite bleb has a convex surface with the garnet rich layer which is thought to be caused by upward bulging of the liquid, and therefore less dense, kyanite eclogite bleb. The proposed orientation is consistent with that suggested for HRV17.

Inhomogeneous kyanite eclogites not related to group II or group I

Discrete kyanite eclogite blebs are found in medium grained (1.5mm compared to average group I grain size of 4mm) eclogites which are of similar geometry to group I inhomogeneous kyanite eclogites but which are more MgO rich in garnet eclogite compositions. Lateral variation in garnet composition in sample HRV116 (Figure 1, line 1) was found to follow a similar pattern to that observed for vertical variation in HRV17 (Figure 2). Garnet compositions in the kyanite blebs are similar to those in the group I inhomogeneous kyanite eclogites (Figure 1).

Conclusion

The discussion of the reverse zoning in garnets in HRV17 at interface A - D and of the geometry of HRV30 implied the coexistence of two liquids which are by definition, immiscible. The origin of kyanite eclogite blebs in Roberts Victor eclogites has been explained in other contexts (Lappin & Dawson, 1975; Chinner & Cornell, 1973; Cox, 1975) but the sharp interface between the grossular garnet, jadeitic clinopyroxene, kyanite bleb and surrounding eclogite; and the occurrence of kyanite eclogite in isolated blebs are consistent with the possibility that the inhomogeneous eclogites originated by processes of liquid immiscibility.

References

Chinner, G.A. and Cornell, D.H. Contrib. Mineral. Petrol, 45, 153 (1974)
Cox, K.C. Volume of abstracts, Kimberlite Symposium, Cambridge (1975)
Hatton, C.J. and Gurney, J.J. This volume (1977a)
Lappin, M.A. and Dawson, J.B. Phys. Chem. Earth, 9. 351 (1975)
Raheim, A. and Green, D.H. Contrib. Mineral. Petrol., 48, 179 (1974)
Smyth, J.R. Amer. Mineral in press (1977)
Smyth, J.R. and Hatton, C.J. Earth Planet, Sci. Letters, 34, 284 (1976)
Switzer, G. and Melson, W.G. Smithsonian Contrib. Earth Sciences, 1,1 (1969)

Figure Legends

Fig. 1. Ca-Mg-Fe plot of garnets. a,b,c (open circles) and d,e (filled squares) represent garnets in homogeneous kyanite eclogites. Lines 1,2,3 represent the range in garnet compositions in inhomogeneous kyanite eclogites.

Fig. 2. Explanation in text.

Fig. 3. Oblique lines - pyrope rich band. Dots - kyanite eclogite.

Figure 1.

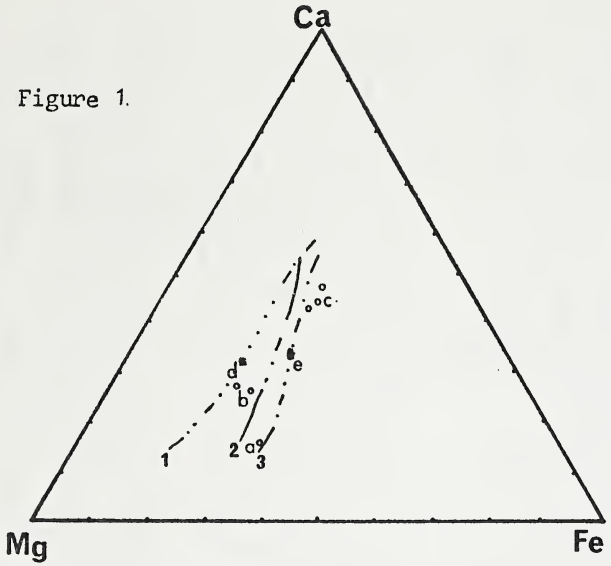
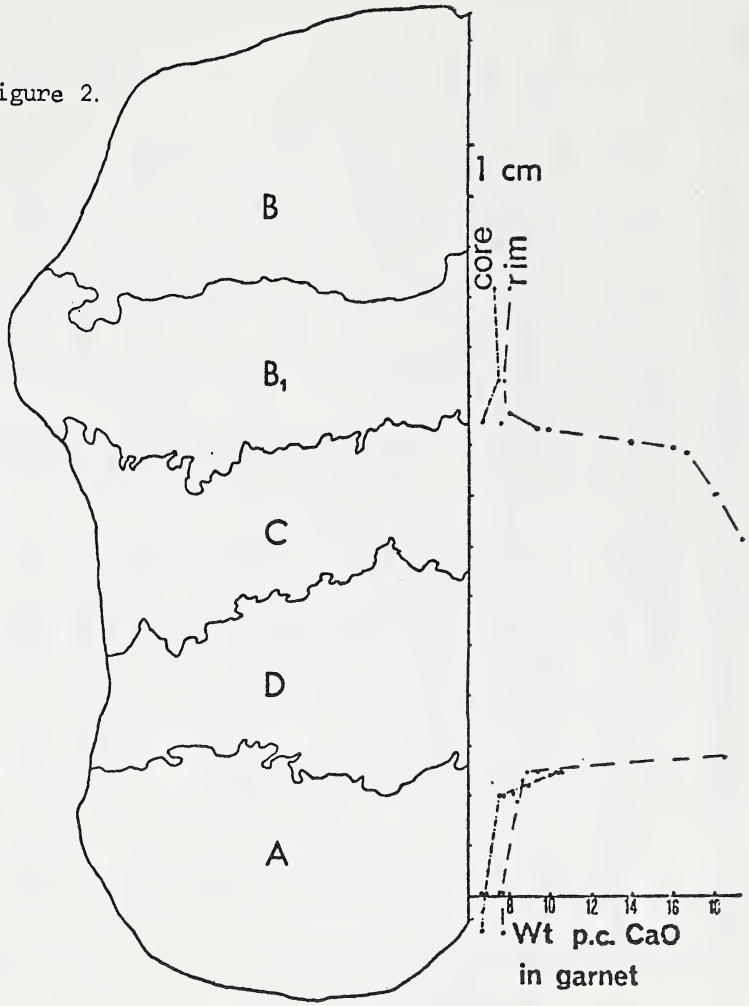



Figure 2.



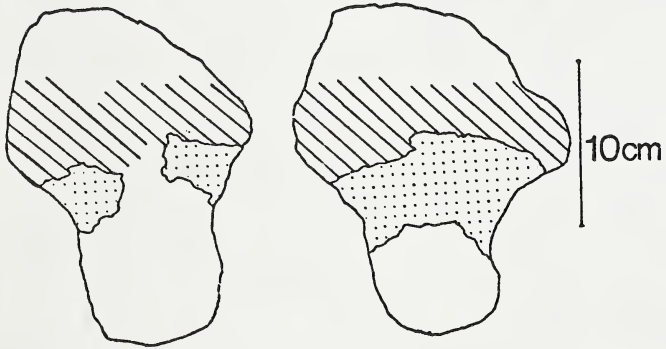




Figure 3. a b.