

Inclusion Bearing Cr-poor and Cr-rich Garnet Megacrysts from the Group II Swartruggens Kimberlite

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Kimberlite occurrences near Swartruggens consist of a number of fissure intrusions which were classified as phlogopite kimberlite and lamprophyre by Skinner and Scott (1979). The lamprophyre dykes are barren of diamond while mining of the kimberlites has been in progress since their discovery in 1933. The age of the kimberlite has been established as 150 my by Allsopp and Kramers (1977). No published data exist on mantle xenoliths from this locality and previous visits to the dump heaps yielded very few samples. In this study approximately five hundred garnet megacrysts were obtained from the oversize diamond recovery table courtesy of the mine manager Mr Davidson during October 1993. During processing for electron microprobe analyses, a number of samples were found to contain inclusions of clinopyroxene and orthopyroxene within the garnet host. Electron microprobe analyses of sixty-seven mono-mineralic garnets, nine garnets with clinopyroxene and orthopyroxene inclusions, two garnets containing orthopyroxene inclusions and twenty-two garnets containing clinopyroxene inclusions are discussed in this study.

Cr-poor garnet megacrysts have been described from a number of Group II kimberlites (Daniels and Gurney, 1989; Moore and Gurney 1991; Smith, personal communication) whereas only a limited number of clinopyroxene megacrysts from Group II kimberlite are known. These include clinopyroxene megacrysts and clinopyroxene inclusions in garnet megacrysts from the Lace kimberlite (Smith et. al. 1995; Bell et. al. 1995) and an unusual assemblage from the Kalkput kimberlite in the Karoo (de Bruin, 1995). In this study consideration is given to a large number of clinopyroxene samples that are clearly associated with garnet megacrysts in a Group II kimberlite. The presence of orthopyroxene megacrysts in a Group II kimberlite is reported for the first time.

The mineral chemistry of the garnet megacrysts and inclusions of clinopyroxene and orthopyroxene from Swartruggens are shown on a Ca-Mg-Fe ternary diagram (Figure 1). The megacryst phases are in turn subdivided into Cr-poor and Cr-rich associations on the basis of their chemistry. A clear separation is evident between Cr-poor and Cr-rich groups of the garnet host and the accompanying clinopyroxene and orthopyroxene inclusions where the Cr-poor groups show distinct Fe enrichment relative to the Cr-rich group. A group of samples are of an intermediate nature between the Cr-poor and Cr-rich groups but were found to have closer affinities to the Cr-poor group.

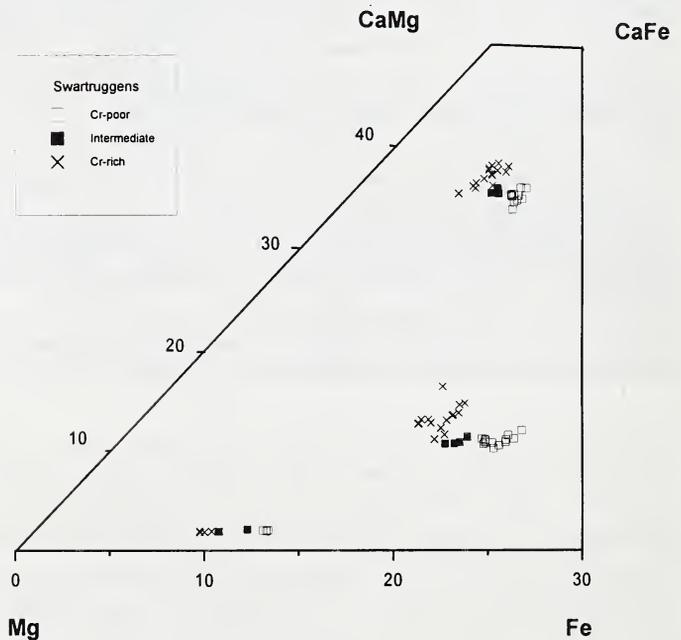
In Figure 2a comparison is made between the compositions of clinopyroxene megacrysts derived from Group II kimberlites and those found at Monastery (Jacob, 1977). It can clearly be seen that the Cr-rich megacrysts from Swartruggens overlap in composition with the two samples from Lace and that a large degree of overlap is found for samples from Kalkput. This clearly shows that the megacrysts from Group II kimberlites have a tendency to be Mg#-rich and, to a lesser extent, to be Cr-rich (Figure 2b). The compositional spread of the Swartruggens Cr-poor megacryst group illustrates the presence of a truly subcalcic clinopyroxene megacryst population in a Group II kimberlite.

References

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Figure 1. The mineral composition in terms of Ca-Mg-Fe components of garnets megacrysts and coexisting clinopyroxene and orthopyroxene inclusions from the Swartruggens kimberlite.



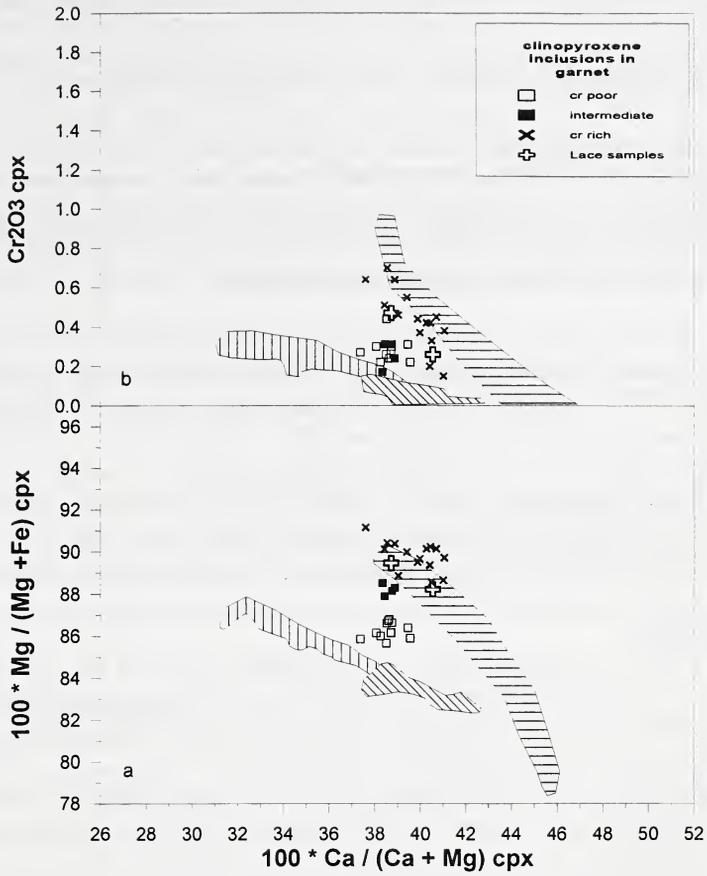


Figure 2 . Ca# vs Mg# (a) and Ca# vs Cr_2O_3 for clinopyroxene inclusions in garnet megacrysts from the Swartuggens kimberlite. The compositional range for clinopyroxene megacrysts from Monastery (Jacob, 1977) is shown as areas outlined by vertical and diagonal shading, while that from Kalkput (de Bruin 1995) is shown as vertical shading. Two clinopyroxene megacrysts from Lace (Smith, et.al 1995) are shown by large open crosses.