

THE DISTRIBUTION OF SOME TRANSITION ELEMENTS
BETWEEN COEXISTING MINERAL PHASES IN NODULES
FROM SOUTH AFRICAN KIMBERLITES.

P. SUDDABY, DEPT., OF GEOLOGY, IMPERIAL COLLEGE,
LONDON.

Most models for the composition of the upper mantle have emphasised the importance of the phases olivine, clinopyroxene, orthopyroxene and garnet, which in different combinations give rise to the suites of peridotitic and eclogitic nodules found in Kimberlites. As Boyd (1970) indicated, although the geological literature contains a number of analyses of these rock types and of individual minerals, there are very few analyses of all the coexisting minerals from individual nodules and therefore little may be deduced about the partitioning of elements between these phases.

The co-existing minerals from a number of peridotite and eclogite nodules from various South African localities have therefore been analysed using the electron microprobe. Most of the analysed nodules are from the well known 'Williams' (1932) collection but others are from the British Museum (Natural History). Many of the nodules are remarkable for the chemical homogeneity of their minerals both within grains and from grain to grain and these are taken to represent equilibrium assemblages.

The partitioning of iron, manganese and nickel relative to magnesium is shown to decrease in the following ways:-

Fe/Mg	Garnet > Olivine > Enstatite > Diopside
Mn/Mg	Garnet >> Enstatite >? Diopside > Olivine
Ni/Mg	Olivine > Enstatite > Garnet

The abundance of chromium decreases in the order Garnet, Diopside, Enstatite, Olivine.

The partition coefficients for chromium $K_{CR}^{GNT-OPX}$, $K_{CR}^{GNT-CPX}$ and $K_{CR}^{CPX-OPX}$ lie in the ranges 10-16, 1.3-2.9 and 5.0-9.2 respectively.

On the basis of the limited data available these figures appear to have a bimodal distribution. The detection of small quantities of chromium in the olivines of some nodules confirms the work of Sobolev (1972) who suggests that this indicates low fO_2 by the presence of the Cr^{2+} ion.

All the phlogopite that has been analysed so far contains less chromium than the coexisting clinopyroxene and it is suggested that this indicates a secondary origin even when the textural evidence is uncertain.

In the specimens so far analysed it has not been possible to detect potassium in the diopside as has been reported by Sobolev (1972) and Boyd (1970) from other localities.

References:-

- Boyd (1970) Papers from the GEOPHYSICAL LABORATORY No1572
Sobolev (1972) Abstracts of the 24th IGC, Section 2.