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KIMBERLITES NEAR ORRORDO, SOUTH AUSTRALIA: APPENDIX

by B.H. SCOTT SMITH, R.V. DANCHIN, J.W. HARRIS and K.J. STRACKE

1 SUMMARY

It has been shown in this study (Scott Smith et al., in press) that the kimberlite intrusions north of Orroroo can be subdivided into three main groups primarily from the abundances and chemistry of their indicator minerals. The relevant information is summarised below:

Group 1 - comprises K1, K2, K3, K8, K9
- all fall on one strike line
- petrography of some surface samples shows that they are altered phlogopite-bearing kimberlite
- K3 is dated at 170 my
- contains abundant peridotitic and a few eclogitic garnets
- ilmenite is rare
- chromites are common and many of the grains have compositions similar to chromites found as inclusions in diamonds
- a few diamonds were recovered
- magnesio-wustite was found as an inclusion in a diamond

Group 2 - comprises K5 and K6
- the strike of K5 is similar to that of the other intrusions but K6 has a slightly different strike direction
- K5 has been dated at 170 my
- contains rare garnets which are cluster group 19 types (after Danchin and Wyatt, 1979)
- ilmenite is extremely abundant, K5 contains ilmenite with high Cr_2O_3 and medium MgO while K6 contains grains with high Cr_2O_3 and low MgO
- only a few aluminous Cr-spinels occur
- no diamonds were recovered
- a few garnet-spinel-clinopyroxene ultramafic microxenoliths were recovered and the garnets and spinels are similar in composition to the few grains found in the heavy mineral concentrate
- samples examined petrographically are heavily altered but do contain phlogopite and olivine pseudomorphs. The phlogopite may be different in habit to that in Groups 1 and 3

Group 3 - comprises K4, K7, K12, K13
- diamond drill core from K7 is hypabyssal calcite, phlogopite kimberlite and surface samples from K4 are altered but very similar
- the kimberlitic matrix mineral chemistry and whole-rock geochemistry of drill core from K7 are similar to kimberlites elsewhere
- contains common garnets which are mostly peridotitic in composition although a few eclogitic grains also occur
- ilmenite is common, the majority having high MgO and fairly low Cr_2O_3 and are therefore different from Group 2 ilmenites
- chromite appears to be absent
- some diamonds were recovered and appear to be more abundant in these dykes than in Group 1
- magnesio-wustite and enstatite were found as inclusions in diamond

2 RESULTS

Additional photographs, diagrams and data to those included in Scott Smith et al. (in press) are presented here.

Fig. 1. Sample K7900A from the core of K7 in the Orroroo Province
Field of view = 1.6 mm. Plane polarised light. Serpentinised, euhedral microphenocrysts of olivine (o) with a few fresh remnants present. The olivines are set in a finer grained groundmass composed of phlogopite, perovskite, spinel, carbonate, serpentine and apatite.

Fig. 2. Sample K7900B from the core of K7 in the Orroroo Province.
Field of view = 0.6 mm. Plane polarised light. This part of the sample occurs close to that shown in Fig. 1 but the olivine pseudomorphs have become opaque through the presence of variable but often abundant amounts of black material which may be graphite. The groundmass shown here includes phlogopite, carbonate, serpentine, perovskite and apatite.

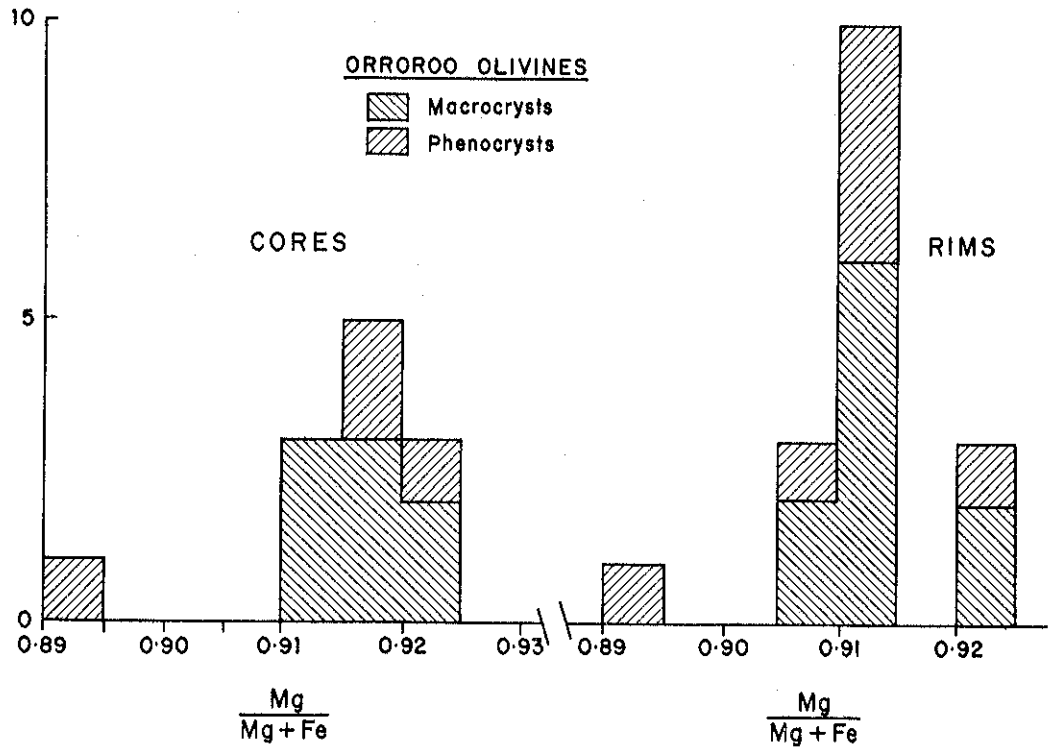

Fig. 3. Frequency distribution diagrams for the compositions of cores and rims of olivines represented by the Mg/(Mg+Fe) atomic ratios.

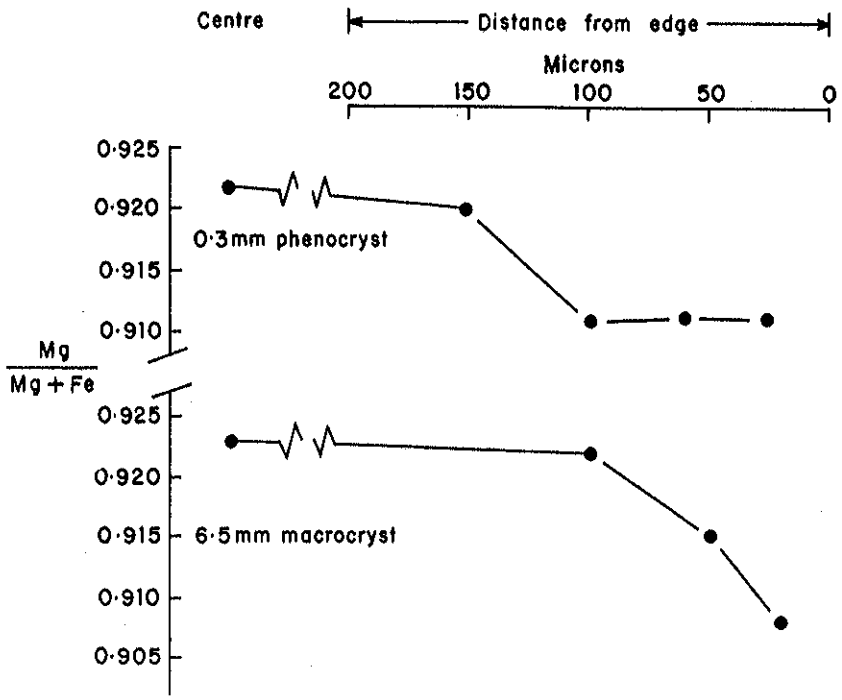

Fig. 4. Compositional zoning within olivines from Orroroo.
Vertical axis represents the composition in terms of Mg/(Mg+Fe) atomic ratios. Horizontal axis gives distance from edge of crystal.

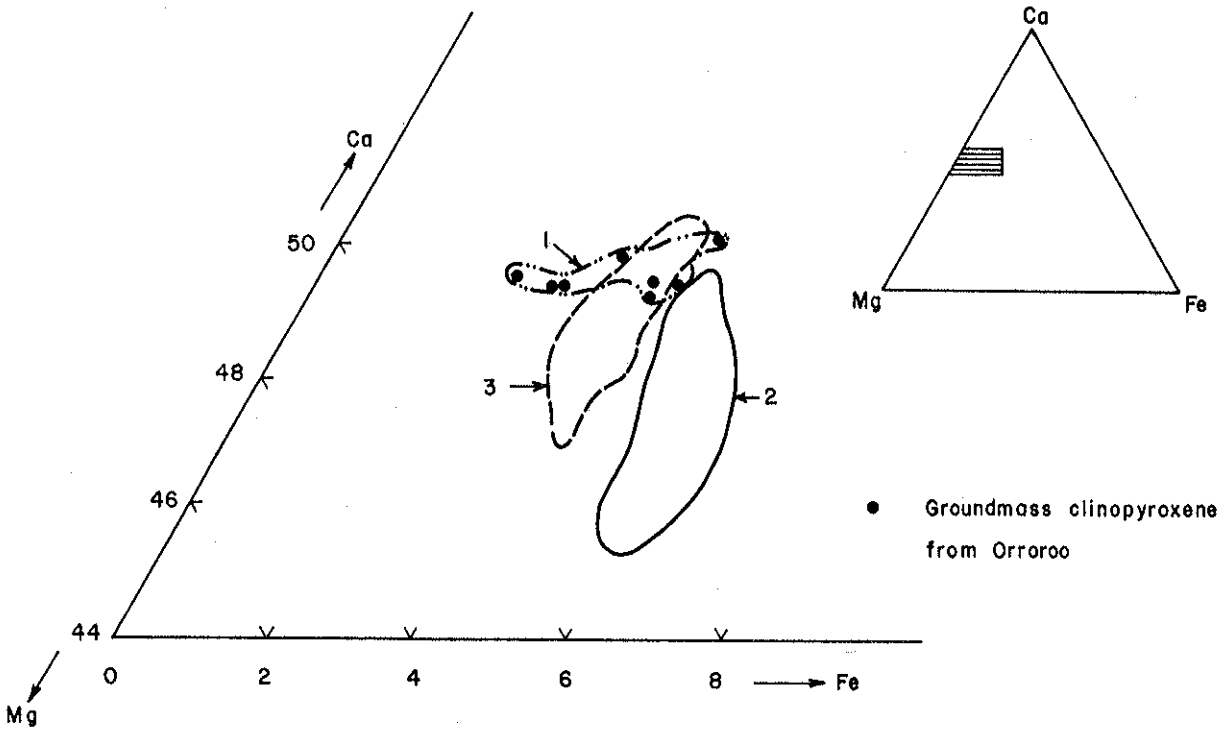

Fig. 6. Ca-Mg-Fe atomic proportions plot of groundmass clinopyroxenes from Orroroo together with compositional fields for other kimberlites.
Field 1 = Orroroo kimberlites. Field 2 = Roberts Victor, New Elands, Zout en Zuur in South Africa (Dawson et al., 1979) and Pyramidfjeld in Greenland (Emeleus and Andrews, 1975). Field 3 = Main, Change House and Normal kimberlites, Swartruggens, South Africa (Skinner and Scott, 1979).

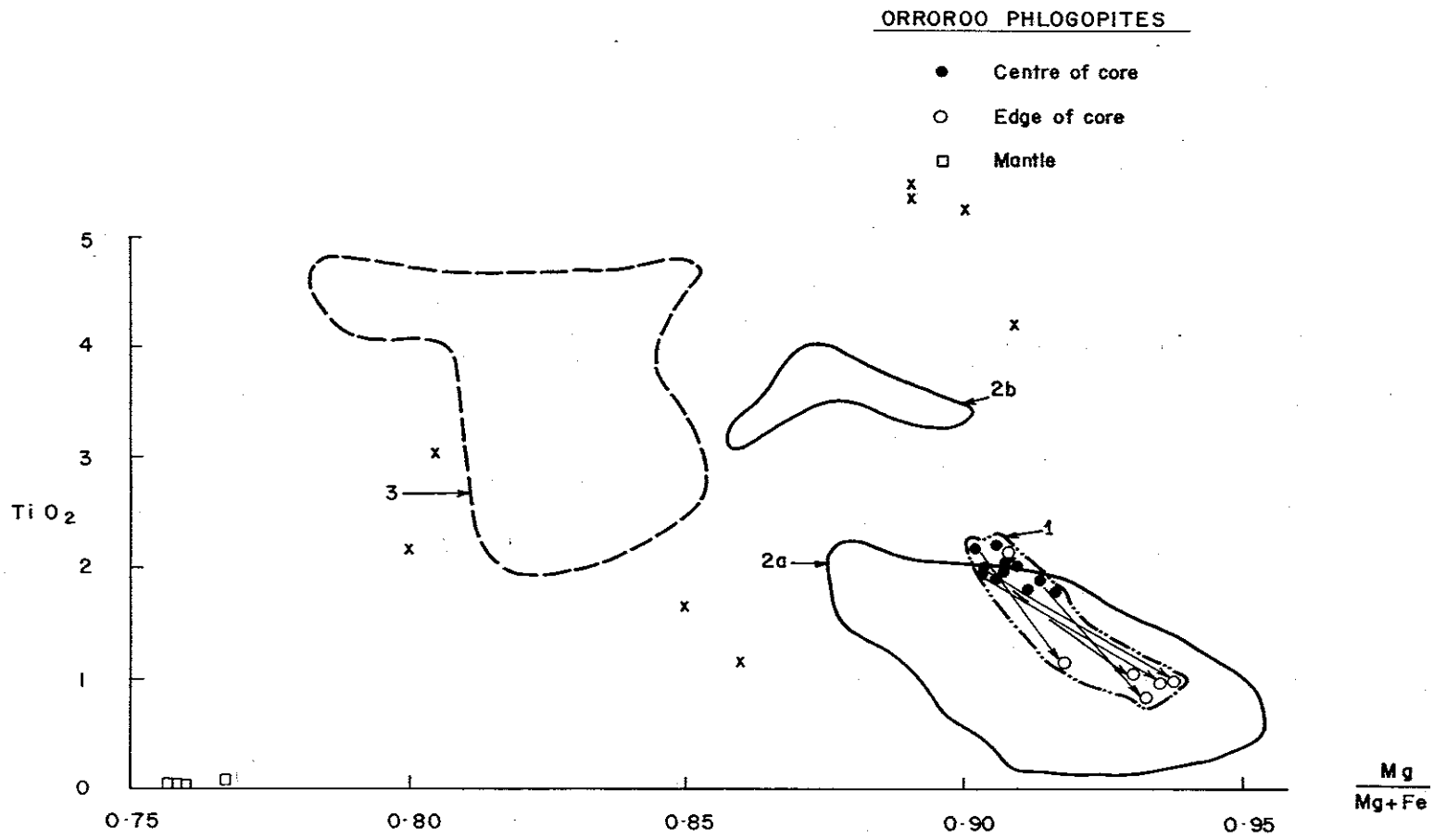

Fig. 5. TiO_2 wt% versus Mg/(Mg+Fe) atomic ratio for phlogopites from Orroroo and other kimberlite occurences.

Field 1 = rims and edges of normally pleochroic cores of groundmass phlogopites from the drill core of K7 at Orroroo. (The reversely pleochroic tetraferriphlogopite mantles are also shown although they do not fall within field 1).

Field 2 = main compositional field for phlogopites from other kimberlite occurences. The data used are from Swartruggens (Skinner and Scott, 1979), several kimberlites on Somerset Island (Clarke and Mitchell, 1975; Mitchell, 1978, 1979) from Greenland (Emeleus and Andrews, 1975) and type 2 or normal micas from Saltpeterpan, Zout en Zuur, Star, Swartruggens, Lovedale, Monteleo, Roberts Victor and Excelsior, all in South Africa and Upper Canada Mine dyke in Ontario (Smith et al., 1978). Most of the points fall in field 2a. All analyses from Upper Canada Mine and one from Tunraq, Somerset Island, fall in field 2b. Outliers are shown by crosses.

Field 3 = kimberlite dykes from Holsteinsborg, Greenland (Scott 1977, 1981). The field shown here represents only the main concentration of a wide range of compositions.

TABLE 1

Chemistry of olivine and its pseudomorphs from Orroroo

Sample Number	K7900A				K7900B					
Mineral	Olivine		Serpentine		Clay	Serpentine				
Analysis Number	82-25	82-26	82-27	82-28	82-29	81-909	81-911	82-53	82-54	82-55
SiO_2	40.92	40.84	38.82	39.15	47.58	40.40	39.27	39.76	41.71	39.66
TiO_2	ND	0.01	ND	ND	ND	0.01	0.03	0.01	0.02	0.01
Al_2O_3	0.01	0.01	0.08	0.01	0.01	0.26	0.31	0.29	0.14	0.30
Cr_2O_3	ND	ND	ND	ND	ND	ND	0.04	0.01	0.01	0.04
FeO	8.08	8.89	7.70	6.16	7.62	8.26	9.19	8.63	6.83	8.92
MnO	0.11	0.18	0.08	0.03	0.01	0.19	0.22	0.20	0.16	0.20
NiO	0.42	0.22	0.58	0.33	0.38	0.41	0.50	0.45	0.40	0.59
MgO	51.09	50.54	34.88	37.46	24.13	34.12	34.18	33.31	33.07	33.17
CaO	ND	0.17	0.08	0.04	0.24	0.11	0.11	0.10	0.11	0.09
Na_2O	0.01	ND	0.03	0.01	0.07	0.02	0.05	0.01	0.01	0.03
K_2O	ND	0.02	0.02	0.01	0.25	0.02	0.04	0.03	0.01	0.04
TOTAL	100.64	100.88	82.27	83.20	80.29	83.80	83.94	82.80	82.47	83.05
Atomic ratio										
Mg/(Mg+Fe)	0.919	0.910	0.890	0.916	0.850	0.880	0.869	0.873	0.896	0.869

82-25 - Fresh remnant at centre of 2.7 mm anhedral olivine macrocryst; 82-26 - 25 microns from original edge of 82-25, again fresh remnant; 82-27 - pale green serpentine after olivine, defocussed beam; 82-28 - an early alteration crack within the olivine pseudomorph which is now composed of serpentine and some brown material, defocussed beam; 82-29 - secondary material with very deep orange-brown colour, defocussed beam; 81-909 - an olivine pseudomorph containing abundant opaque material; 81-911 - virtually opaque 0.23 mm subhedral olivine pseudomorph; 82-53 - opaque area of 0.31 mm subhedral olivine pseudomorph, defocussed beam; 82-54 - other half of some olivine pseudomorph as 82-53 where composed of pale green serpentine with only a slight dusting of opaque material, defocussed beam; 82-55 - opaque, 0.23 mm, euhedral olivine pseudomorph, defocussed beam.
ND = not detected.