Table 8. *Compositions of olivines analysed by electron microprobe. Fe, Ca, Al determined by direct analysis; other components calculated*

	Olivine tholeiite								Olivine basalt	Alkali olivine basalt	
Pressure (kb)	4.5	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Temp. (°C)	1,350	1,350	1,330	1,310	1,290	1,270	1,250	1,230	1,280	1,260	1,220
SiO_2	41.1	40.9	40.8	40.7	40.3	40.2	39.9	39.8	40.7	39.6	39.2
Al_2O_3	n.d.**	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
FeO	7.7	8.9	9.9	10.3	12.3	12.9	14.0	14.7	10.1	16.1	18.0
MgO	50.9	49.9	49.0	48.7	47.1	46.6	45.8	45.2	48.9	44.0	42.5
CaO	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
$\frac{100\ Mg}{Mg+Fe}$ (mol)	92.2	90.9	89.8	89.4	87.2	86.4	85.3	84.7	89.6	83.0	80.8
Mol. Proportions											
Fo	91.8	90.6	89.5	89.0	86.8	86.1	84.9	84.3	89.3	82.7	80.5
Fa	7.8	9.0	10.1	10.6	12.8	13.5	14.7	15.3	10.3	16.9	19.1
La	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Coexisting Crystalline phases	Nil	Nil	Nil	Nil	Opx*	Opx*	Opx* + Cpx	Opx + Cpx + ?Plag	Nil	Nil	Cpx*

* Denotes crystalline phase analyzed by electron microprobe.
** "not detected", i.e. $Al_2O_3 < 0.2\%$.

wall of the capsule were slightly poorer in iron than those near the centre of the capsule. As an example the FeO content of a large olivine grain (25 μ traverse) in the 10 kb, 1,350° C, olivine tholeiite run ranged from 9.3% FeO in the centre to 9.0% FeO at the edge and averaged 9.2% FeO. In the mount as a whole the mean FeO content of the crystals ranged from 9.2% FeO to 8.7% FeO in two crystals located near the capsule wall. The mean FeO content of all the crystals was 8.9%. The variation from 8.7% FeO to 9.3% FeO represents a change in the 100 Mg/Mg + Fe ratio from 91.1 to 90.5. Similarly the maximum variation in crystal composition in the olivine of the 10 kb, 1,260° C run on the alkali olivine basalt composition is from 15.5% FeO to 16.6% FeO with an average of 16.1% FeO. This variation represents a change in 100 Mg/Mg + Fe ratio from 83.6 to 82.4 with a mean of 83.0. Thus we consider that there is an uncertainty in composition of about ± 0.3% forsterite in olivines around Fo_{90} and about ± 0.6% forsterite in olivines around Fo_{80}. This uncertainty derives from real variations in 100 Mg/Mg + Fe ratio of crystals with position in the mount and may be a consequence of Fe loss to the Pt crucible at the margins of the sample or of small temperature gradients within the sample capsule.

k) Orthopyroxene Analyses

The analyses of orthopyroxenes listed in Table 9 also demonstrate an increase in FeO content and decrease in the 100 Mg/Mg + Fe ratio with decrease in temperature at a given pressure. The partition of Fe and Mg between liquid and liquidus crystals where orthopyroxene is the liquidus phase is similar to runs in which olivine is the liquidus phase (cf. Table 10). The orthopyroxenes are distinctive in all cases in having a moderate or high Al_2O_3 content, similar to or higher than that observed in enstatites of the Ol + Opx + Cpx + Sp assemblage of peridotite nodules, and higher than the Al_2O_3 contents of orthopyroxenes crystallizing at low pressure from basaltic or andesitic magmas. At any given pressure, the Al_2O_3 content of orthopyroxene increases with decrease in temperature, as long as no other co-existing Al_2O_3-rich phase appears. At constant temperature, the Al_2O_3 content of orthopyroxene increases with increase in pressure (cf. runs on olivine tholeiite at 1,400° C, 13.5 kb and 18 kb), provided closely similar phase assemblages are compared. Alternatively, comparing orthopyroxenes of similar 100 Mg/Mg + Fe ratios, those crystallized at higher pressure, have higher Al_2O_3 contents.

The series of analyses of orthopyroxenes from the olivine tholeiite composition at 13.5 kb best illustrate the change in orthopyroxene composition with increasing degree of crystallization. The liquidus orthopyroxene at 1,400° C contains only 3.8% Al_2O_3 but this increases to 7.8% Al_2O_3 in the 1,310° C run. The run at 1,290° C reverses this trend with a drop in Al_2O_3 to 6.4%. We attribute the lower Al_2O_3 content of the 1,290° C orthopyroxene to the first appearance of spinel as a co-existing phase — this will alter the partition relationship of Al_2O_3 between liquid and crystallizing orthopyroxene. The Al_2O_3 content of the liquidus orthopyroxene at 18 kb is greater than that of the liquidus orthopyroxene at 13.5 kb in both the olivine basalt and olivine tholeiite compositions. The contrast between the Al_2O_3 content of the orthopyroxene in the olivine basalt, 18 kb 1,340° C