

Table 9. Compositions of orthopyroxenes analyzed by electron microprobe. Fe, Ca, Al determined by direct analysis, other components calculated assuming ideal orthopyroxene composition

| | Olivine tholeiite | | | | | | | | | | Olivine basalt | | | Alkali olivine basalt |
|---|-------------------|-------|--------------|-------|-------|-------|-------|---------------|-------|-------|----------------|-------|-------|-----------------------------|
| Pressure (kb) | 9.0 | 9.0 | 9.0 | 13.5 | 13.5 | 13.5 | 13.5 | 13.5 | 18.0 | 18.0 | 13.5 | 18.0 | 18.0 | 13.5 |
| Temp. (°C) | 1,290 | 1,270 | 1,250 | 1,400 | 1,380 | 1,350 | 1,310 | 1,290 | 1,420 | 1,400 | 1,320 | 1,340 | 1,335 | 1,290 |
| SiO ₂ | 54.5 | 53.9 | 52.9 | 55.9 | 54.4 | 53.8 | 52.5 | 53.1 | 54.9 | 53.4 | 53.8 | 51.8 | 54.3 | 50.6 |
| Al ₂ O ₃ | 4.9 | 5.4 | 6.9 | 3.8 | 5.7 | 6.0 | 7.8 | 6.4 | 5.1 | 7.3 | 6.4 | 10.0 | 5.9 | 10.6 |
| FeO | 7.8 | 8.3 | 9.1 | 5.5 | 6.5 | 7.2 | 8.7 | 9.7 | 5.8 | 6.4 | 6.6 | 6.5 | 6.4 | 9.7 |
| MgO | 30.0 | 29.6 | 28.5 | 32.8 | 31.2 | 30.2 | 28.3 | 28.3 | 32.0 | 30.4 | 30.3 | 29.5 | 30.8 | 26.6 |
| CaO | 2.9 | 2.8 | 2.6 | 2.0 | 2.2 | 2.8 | 2.7 | 2.5 | 2.2 | 2.5 | 2.9 | 2.2 | 2.6 | 2.5 |
| 100 Mg Mg + Fe (mol) | 87.3 | 86.4 | 84.9 | 91.4 | 89.6 | 88.2 | 85.3 | 83.9 | 90.8 | 89.5 | 89.1 | 89.0 | 89.6 | 83.0 |
| <i>Mol. Proportions</i> | | | | | | | | | | | | | | |
| Ens | 78.1 | 77.0 | 74.4 | 84.5 | 80.6 | 78.1 | 74.1 | 74.2 | 82.5 | 78.6 | 78.4 | 76.2 | 79.8 | 69.9 |
| Fs | 11.3 | 12.1 | 13.3 | 8.0 | 9.4 | 10.5 | 12.7 | 14.3 | 8.3 | 9.2 | 9.6 | 9.4 | 9.3 | 14.3 |
| Wo | 5.5 | 5.3 | 5.0 | 3.7 | 4.2 | 5.2 | 5.1 | 4.8 | 4.0 | 4.7 | 5.4 | 4.2 | 4.8 | 4.8 |
| Al ₂ O ₃ | 5.1 | 5.6 | 7.3 | 3.8 | 5.8 | 6.2 | 8.1 | 6.7 | 5.2 | 7.5 | 6.6 | 10.2 | 6.1 | 11.0 |
| <i>Coeexisting Crystalline phases</i> | | | | | | | | | | | | | | |
| | Ol* | Ol* | Ol* + Cpx | Nil | Nil | Cpx | Cpx* | Cpx + Sp** | Nil | Cpx* | Nil | Nil | Cpx* | Cpx* |

* Denotes crystalline phase analyzed by electron microprobe.

** Spinel has approximately 14% FeO, 70 ± 5% Al₂O₃ < 1.3% CaO.(Calculated composition assuming FeAl₂O₄, MgAl₂O₄ solid solution 14% FeO, 67.3% Al₂O₃, 18.7% MgO.)

Table 10. Comparison of 100 Mg/Mg+Fe⁺⁺ values of liquidus olivine and liquidus orthopyroxene crystals

| | Liquidus olivine | | | Liquidus orthopyroxene | | |
|-----------------------|------------------|------------|-------------------------------|------------------------|------------|-------------------------------|
| | Pressure (kb) | Temp. (°C) | 100 Mg Mg+Fe ⁺⁺ | Pressure (kb) | Temp. (°C) | 100 Mg Mg+Fe ⁺⁺ |
| Olivine Tholeiite | 4.5 | 1350 | 92.2 | 13.5 | 1400 | 91.4 |
| ” ” | 9 | 1350 | 90.9 | 18 | 1420 | 90.8 |
| Olivine Basalt | 9 | 1280 | 89.6 | 13.5 | 1320 | 89.1 |
| ” ” | | | | 18 | 1335 | 89.6 |
| ” ” | | | | 18 | 1340 | 89.0 |
| Alkali Olivine Basalt | 9 | 1260 | 83.0 | 13.5 | 1290 | 83.0 |

(10% Al₂O₃) run and the 1,335° C (5.9% Al₂O₃) run is not readily understood but may be an effect of the presence of aluminous clinopyroxene (9.9% Al₂O₃) in the 1,335° C run and its absence in the 1,340° C run.

The CaO content of the orthopyroxene is lower (2.0–2.2% CaO) in runs in which there is no co-existing clinopyroxene and increases to 2.5 or 2.8% CaO in these runs in which stable clinopyroxene occurs. This is shown by the olivine tholeiite runs at 13.5 kb and 18 kb and the olivine basalt runs at 18 kb but the olivine basalt 13.5 kb 1,320° C run and the 9 kb olivine tholeiite runs are exceptions to this generalization.

Table 11. Compositions of clinopyroxenes analyzed by electron microprobe. Fe, Ca, Al determined by direct analysis, other components calculated assuming ideal clinopyroxene composition and little or no Na or Ti substitution

| | Olivine tholeiite | | Olivine basalt | Alkali olivine basalt | | |
|--------------------------------|-------------------|------------|----------------|-----------------------|------------|------------|
| | Pressure (kb) | Temp. (°C) | Temp. (°C) | Pressure (kb) | Temp. (°C) | Temp. (°C) |
| Pressure (kb) | 13.5 | 18.0 | 18.0 | 9.0 | 13.5 | 18.0 |
| Temp. (°C) | 1,310 | 1,400 | 1,335 | 1,220 | 1,290 | 1,320 |
| Analysis No. | 1 | 2 | 3 | 4 | 5 | 6 |
| SiO ₂ | 49.3 | 52.3 | 50.7 | 49.4 | 49.2 | 49.1 |
| Al ₂ O ₃ | 11.3** | 7.3 | 9.9 | 9.0 | 11.2 | 11.0 |
| FeO | 8.3 | 6.0 | 5.5 | 9.5 | 9.0 | 7.6 |
| MgO | 21.2 | 25.1 | 23.1 | 16.9 | 20.9 | 19.5 |
| CaO | 9.9 | 9.3 | 10.8 | 15.2 | 9.7 | 12.8 |
| 100 Mg Mg+Fe | 82.1 | 88.2 | 88.2 | 76.1 | 80.6 | 82.1 |
| <i>Mol. Proportions</i> | | | | | | |
| Ens | 56.5 | 66.0 | 61.0 | 46.1 | 56.0 | 52.5 |
| Fs | 12.4 | 8.8 | 8.1 | 14.5 | 13.5 | 11.3 |
| Wo | 19.1 | 17.6 | 20.6 | 29.5 | 18.6 | 24.6 |
| Al ₂ O ₃ | 12.0 | 7.6 | 10.3 | 9.9 | 11.9 | 11.6 |
| <i>Coexisting</i> | | | | | | |
| Crystalline phases | Opx* | Opx* | Opx* | OI* | Opx* | Nil |

* Denotes crystalline phase analyzed by electron microprobe.

** Doubtful value, possibly too high due to interference from glass. Crystals are very small.