**Supplemental Table S1:** Representative phlogopite analyses from mantle xenoliths, megacrystals and from hornblendites investigated in this study.

| | FIN-01 | FIN-02 | 14649 | LB-33 | ELD-1 | ELD-2 | 120091- | FEN-MG |
|---|---|---|---|---|---|---|---|---|
| wt.% | | | | | | | | |
| $SiO_2$ | 41.22 | 41.13 | 40.30 | 38.32 | 40.74 | 39.86 | 38.82 | 39.55 |
| $Al_2O_3$ | 14.71 | 15.26 | 15.24 | 15.89 | 14.55 | 14.54 | 16.37 | 15.50 |
| $TiO_2$ | 0.90 | 0.92 | 3.50 | 6.42 | 4.74 | 4.52 | 5.17 | 3.93 |
| $Cr_2O_3$ | 1.59 | 1.60 | 1.29 | 1.55 | 0.21 | 0.18 | 0.38 | 0.00 |
| FeO | 2.79 | 3.07 | 6.05 | 3.22 | 6.82 | 7.26 | 8.17 | 8.79 |
| MgO | 24.78 | 24.82 | 21.20 | 21.43 | 21.90 | 21.39 | 19.07 | 20.39 |
| MnO | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 |
| CaO | 0.00 | 0.02 | 0.06 | 0.00 | 0.00 | 0.03 | 0.04 | 0.00 |
| $Na_2O$ | 1.37 | 1.36 | 1.19 | 0.96 | 1.14 | 1.16 | 0.69 | 0.70 |
| $K_2O$ | 8.53 | 8.51 | 8.55 | 9.25 | 9.04 | 8.81 | 9.11 | 9.11 |
| BaO | 0.34 | 0.34 | 0.42 | 0.31 | 0.16 | 0.23 | 0.48 | 0.56 |
| Cl | 0.11 | 0.01 | 0.04 | 0.01 | 0.00 | 0.02 | 0.04 | 0.05 |
| F | 0.23 | 0.33 | 0.18 | 1.96 | 0.51 | 0.57 | 0.19 | 0.19 |
| Total | 96.56 | 97.37 | 98.06 | 99.32 | 99.80 | 98.56 | 98.52 | 98.80 |
| Elements. atoms per formula unit based on 22 oxygen atoms | | | | | | | | |
| Si | 5.74 | 5.69 | 5.62 | 5.34 | 5.61 | 5.58 | 5.45 | 5.55 |
| Al | 2.42 | 2.49 | 2.50 | 2.61 | 2.36 | 2.40 | 2.71 | 2.56 |
| Ti | 0.09 | 0.10 | 0.37 | 0.67 | 0.49 | 0.48 | 0.55 | 0.41 |
| Cr | 0.18 | 0.18 | 0.14 | 0.17 | 0.02 | 0.02 | 0.04 | 0.00 |
| Fe | 0.33 | 0.36 | 0.71 | 0.38 | 0.78 | 0.85 | 0.96 | 1.03 |
| Mg | 5.15 | 5.12 | 4.40 | 4.45 | 4.49 | 4.46 | 3.99 | 4.26 |
| Mn | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ca | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Na | 0.37 | 0.36 | 0.32 | 0.26 | 0.30 | 0.31 | 0.19 | 0.19 |
| K | 1.52 | 1.50 | 1.52 | 1.65 | 1.59 | 1.57 | 1.63 | 1.63 |
| Ba | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.03 | 0.03 |
| Cl | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 |
| F | 0.10 | 0.14 | 0.08 | 0.86 | 0.22 | 0.25 | 0.08 | 0.09 |
| Cation Sum | 15.79 | 15.80 | 15.59 | 15.53 | 15.65 | 15.67 | 15.51 | 15.64 |

| wt.% | FEN-MG | EIF-02 | EIF-04 | 120091 | LB-49 | A1008 | Ol-P-2 l | EIF-01 | FEN-P-3 | V-P-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 39.55 | 37.28 | 39.19 | 38.78 | 41.2 | 36.67 | 39.54 | 36.98 | 38.60 | 38.36 |
| $Al_2O_3$ | 15.50 | 16.74 | 15.88 | 16.27 | 13.1 | 16.21 | 15.25 | 16.59 | 17.26 | 18.52 |
| $TiO_2$ | 3.93 | 4.06 | 4.63 | 5.39 | 4.0 | 4.32 | 4.66 | 6.10 | 4.62 | 2.17 |
| $Cr_2O_3$ | 0.00 | 0.00 | 0.36 | 0.17 | 0.7 | 0.00 | 0.69 | 0.05 | 0.05 | 0.04 |
| FeO | 8.79 | 10.18 | 7.99 | 8.36 | 7.3 | 12.64 | 8.30 | 8.86 | 7.13 | 6.25 |
| MgO | 20.39 | 18.85 | 19.76 | 18.65 | 22.0 | 17.37 | 20.62 | 18.57 | 19.97 | 21.82 |
| MnO | 0.03 | 0.09 | 0.06 | 0.03 | 0.0 | 0.11 | 0.07 | 0.07 | 0.03 | 0.03 |
| CaO | 0.00 | 0.04 | 0.15 | 0.05 | 0.0 | 0.02 | 0.00 | 0.02 | 0.04 | 0.05 |
| $Na_2O$ | 0.70 | 0.68 | 0.73 | 0.72 | 0.6 | 0.68 | 0.70 | 0.58 | 0.72 | 0.69 |
| $K_2O$ | 9.11 | 9.23 | 9.42 | 9.10 | 9.9 | 9.01 | 9.33 | 9.13 | 9.37 | 9.10 |
| BaO | 0.56 | 0.87 | 0.29 | 0.32 | 0.1 | 1.39 | 0.26 | 0.98 | 0.56 | 1.23 |
| Cl | 0.05 | 0.02 | 0.01 | 0.03 | 0.0 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 |
| F | 0.19 | 0.24 | 0.30 | 0.18 | 0.4 | 0.22 | 0.42 | 0.26 | 0.30 | 0.20 |
| Total | 98.80 | 98.27 | 98.77 | 98.04 | 99.3 | 98.66 | 99.84 | 98.21 | 98.67 | 98.46 |
| Elements. atoms per formula unit. based on 22 oxygen atoms | | | | | | | | | | |
| Si | 5.55 | 5.33 | 5.49 | 5.46 | 5.73 | 5.31 | 5.49 | 5.27 | 5.39 | 5.36 |
| Al | 2.56 | 2.82 | 2.62 | 2.70 | 2.15 | 2.76 | 2.50 | 2.78 | 2.84 | 3.05 |
| Ti | 0.41 | 0.44 | 0.49 | 0.57 | 0.42 | 0.47 | 0.49 | 0.65 | 0.49 | 0.23 |
| Cr | 0.00 | 0.00 | 0.04 | 0.02 | 0.08 | 0.00 | 0.08 | 0.01 | 0.01 | 0.00 |
| Fe | 1.03 | 1.22 | 0.94 | 0.99 | 0.85 | 1.53 | 0.96 | 1.06 | 0.83 | 0.73 |
| Mg | 4.26 | 4.02 | 4.13 | 3.92 | 4.56 | 3.75 | 4.27 | 3.94 | 4.16 | 4.54 |
| Mn | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 |
| Ca | 0.00 | 0.01 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 |
| Na | 0.19 | 0.19 | 0.20 | 0.20 | 0.16 | 0.19 | 0.19 | 0.16 | 0.20 | 0.19 |
| K | 1.63 | 1.68 | 1.68 | 1.64 | 1.76 | 1.66 | 1.65 | 1.66 | 1.67 | 1.62 |
| Ba | 0.03 | 0.05 | 0.02 | 0.02 | 0.00 | 0.08 | 0.01 | 0.05 | 0.03 | 0.07 |
| Cl | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | .00 |
| F | 0.09 | 0.11 | 0.13 | 0.08 | 0.18 | 0.10 | 0.18 | 0.12 | 0.13 | 0.09 |
| Cation Sum | 15.64 | 15.71 | 15.62 | 15.50 | 15.70 | 15.69 | 15.64 | 15.54 | 15.60 | 15.73 |