Supplementary Material for:

**Unravelling the effects of melt-mantle interactions on the gold fertility of magmas**

***By***

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This supplementary Materials file includes:

* Supplementary Table 1. Chemical composition of olivine, orthopyroxene, and spinel used for the calculation of the peridotite oxygen fugacity.
* Supplementary Table 2. Summary of parameters used for the determination of the oxygen fugacity of the peridotite and oxygen fugacity results expressed as log units above the fayalite-magnetite-quartz buffer.
* Supplementary Table 3. Chemical composition of armalcolite.
* Supplementary Table 4. Stoichiometric calculation of armalcolite end members.
* Supplementary Table 5. Chemical composition of apatite.
* Supplementary Figure 1. Thin section scans showing the distribution of the interstitial network of glassy veinlets.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Weight %** | | | | | | | | | | | |
|  | **Na2O** | **MgO** | **SiO2** | **Al2O3** | **FeO** | **MnO** | **NiO** | **K2O** | **Cr2O3** | **CaO** | **TiO2** | **Total** |
| 1 | 0.03 | 49.27 | 41.31 | 0.05 | 8.91 | 0.16 | 0.42 | b.d.l. | 0.04 | 0.09 | 0.01 | 100.29 |
| 2 | 0.02 | 50.02 | 40.67 | 0.03 | 9.31 | 0.14 | 0.40 | b.d.l. | b.d.l. | 0.10 | 0.02 | 100.71 |
| 3 | 0.01 | 49.68 | 40.86 | 0.02 | 8.93 | 0.12 | 0.41 | b.d.l. | b.d.l. | 0.15 | b.d.l. | 100.18 |
| 4 | 0.01 | 50.26 | 40.90 | 0.01 | 8.90 | 0.16 | 0.41 | b.d.l. | 0.01 | 0.14 | b.d.l. | 100.80 |
| 5 | b.d.l. | 50.02 | 40.47 | b.d.l. | 9.33 | 0.16 | 0.36 | b.d.l. | 0.04 | 0.14 | b.d.l. | 100.52 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0.09 | 33.79 | 54.93 | 3.93 | 5.72 | 0.14 | 0.10 | b.d.l. | 0.64 | 0.51 | 0.06 | 99.91 |
| 2 | 0.09 | 34.02 | 55.30 | 3.37 | 5.85 | 0.15 | b.d.l. | 0.01 | 0.53 | 0.60 | 0.06 | 99.98 |
| 3 | 0.08 | 34.20 | 56.62 | 0.71 | 5.86 | 0.19 | b.d.l. | 0.01 | 0.39 | 1.60 | 0.50 | 100.16 |
| 4 | 0.05 | 34.06 | 54.74 | 3.97 | 5.83 | 0.17 | b.d.l. | 0.01 | 0.63 | 0.42 | 0.04 | 99.92 |
| 5 | 0.05 | 34.06 | 54.74 | 3.97 | 5.83 | 0.17 | 0.09 | b.d.l. | 0.63 | 0.42 | 0.04 | 100.00 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0.03 | 19.94 | 0.07 | 46.49 | 12.36 | 0.12 | 0.36 | b.d.l. | 18.16 | 0.01 | 0.16 | 97.70 |
| 2 | b.d.l. | 19.85 | 0.07 | 46.40 | 12.28 | 0.12 | 0.39 | b.d.l. | 18.49 | b.d.l. | 0.14 | 97.74 |
| 3 | 0.05 | 19.48 | 0.08 | 48.68 | 11.93 | 0.11 | 0.31 | b.d.l. | 17.83 | 0.05 | 0.20 | 98.72 |
| 4 | b.d.l. | 19.19 | 0.03 | 46.80 | 11.92 | 0.14 | 0.24 | b.d.l. | 19.43 | b.d.l. | 0.05 | 97.80 |
| 5 | b.d.l. | 19.85 | 0.07 | 46.40 | 12.28 | 0.12 | 0.39 | b.d.l. | 18.49 | b.d.l. | 0.14 | 97.74 |

**Supplementary table 1**. Chemical composition of olivine, orthopyroxene, and spinel used for the calculation of the peridotite oxygen fugacity. Data taken from Tassara et al. (2017). b.d.l. is below detection limit.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Temperature (K)** | **Pressure (bar)** | **Olivine** | | **Orthopyroxene** | | **Log a (Fe3O4)** | **ΔFMQ\*** |
| **XFeOl** | **XMgOl** | **XFeM1** | **XFeM2** |
| 1 | 1293 | 13600 | 0.09 | 0.91 | 0.08 | 0.08 | -1.917 | 0.6 |
| 2 | 1293 | 13600 | 0.09 | 0.91 | 0.09 | 0.09 | -1.950 | 0.8 |
| 3 | 1293 | 13600 | 0.09 | 0.91 | 0.09 | 0.08 | -2.310 | 0.0 |
| 4 | 1293 | 13600 | 0.09 | 0.91 | 0.08 | 0.09 | -2.235 | 0.1 |
| 5 | 1293 | 13600 | 0.09 | 0.91 | 0.08 | 0.09 | -1.950 | 0.5 |

**Supplementary table 2**. Summary of parameters used for the determination of the oxygen fugacity of the peridotite and oxygen fugacity results expressed as log units above the fayalite-magnetite-quartz buffer. \*The estimated error propagated from the EPMA analysis 0.3. XFeOl and XMgOl refer to the atomic ratio of Fe2+/(Mg+Fe2+) and Mg/(Mg+Fe2+) in olivine respectively. (XFeM1)Opx and (XFeM2)Opx refer to the atomic fractions of Fe in the M1 and M2 sites of orthopyroxene and were calculated following the methods in Wood et al. (1990). a(Fe3O4 in Sp) is activity of magnetite, Fe3O4, in spinel.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Weight %** | | | | | | | | | | | | | | | | | | | | | |
| **SiO2** | | **TiO2** | | **Al2O3** | | **Cr2O3** | | **FeO** | | **MnO** | | **MgO** | | **NiO** | | **CaO** | | **Total** | | |
| Arm 1 | 0.1 | | 74.39 | | 0.59 | | 2.10 | | 10.05 | | 0.09 | | 12.59 | | 0.11 | | 0.05 | | 100.07 | | |
| Arm 2 | 0.11 | | 75.01 | | 0.61 | | 1.73 | | 10.25 | | 0.09 | | 12.41 | | 0.1 | | 0.08 | | 100.39 | | |
| Arm 3 | 0.08 | | 71.29 | | 0.75 | | 2.16 | | 11.27 | | 0.08 | | 11.56 | | 0.08 | | 0.35 | | 97.62 | | |
| Arm 4 | 0.37 | | 71.92 | | 0.43 | | 2.03 | | 11.01 | | 0.07 | | 12.04 | | 0.06 | | 0.06 | | 97.99 | | |
| Arm 5 | 0.16 | | 72.18 | | 0.73 | | 2.78 | | 9.81 | | 0.09 | | 12.39 | | 0.06 | | 0.07 | | 98.26 | | |
| Arm 6 | 0.20 | | 72.06 | | 0.82 | | 2.78 | | 9.77 | | 0.07 | | 12.06 | | 0.06 | | 0.06 | | 97.87 | | |
| Arm 7 | 0.19 | | 71.91 | | 0.68 | | 2.76 | | 9.88 | | 0.08 | | 11.98 | | 0.06 | | 0.07 | | 97.60 | | |
| Arm 8 | 0.11 | | 72.20 | | 0.55 | | 2.25 | | 11.02 | | 0.10 | | 11.94 | | 0.11 | | 0.18 | | 98.46 | | |
| Arm 9 | 0.13 | | 72.33 | | 0.72 | | 2.36 | | 10.78 | | 0.09 | | 11.86 | | 0.10 | | 0.18 | | 98.54 | | |
| Arm 10 | 0.18 | | 72.37 | | 0.50 | | 2.16 | | 11.29 | | 0.08 | | 11.67 | | 0.11 | | 0.21 | | 98.57 | | |
| Arm 11 | 0.41 | | 71.51 | | 0.81 | | 2.40 | | 10.87 | | 0.09 | | 11.55 | | 0.10 | | 0.21 | | 97.94 | | |
| Arm 12 | 0.14 | | 72.29 | | 0.84 | | 1.94 | | 11.22 | | 0.09 | | 11.77 | | 0.08 | | 0.35 | | 98.72 | | |
| Arm 13 | 0.18 | | 72.21 | | 0.46 | | 2.30 | | 10.93 | | 0.09 | | 11.92 | | 0.08 | | 0.09 | | 98.26 | | |
| Arm 14 | 0.13 | | 72.59 | | 0.71 | | 2.02 | | 10.45 | | 0.09 | | 12.02 | | 0.26 | | 0.13 | | 98.40 | | |
| Arm 15 | 0.22 | | 72.36 | | 0.97 | | 2.62 | | 9.88 | | 0.10 | | 12.04 | | 0.06 | | 0.09 | | 98.33 | | |
| Arm 16 | 0.66 | | 72.67 | | 0.76 | | 1.05 | | 9.83 | | 0.08 | | 12.78 | | 0.07 | | 0.19 | | 98.09 | | |
| **Std Dev** | 0.02 | | 0.03 | | 0.02 | | 0.02 | | 0.15 | | 0.02 | | 0.11 | | 0.02 | | 0.02 | |  | | |
|  | | **Atoms per formula unit (a.p.f.u.)** | | | | | | | | | | | | | | | | | | | | | |
| **Si** | | **Ti** | | **Al** | | **Cr** | | **Fe** | | **Mn** | | **Mg** | | **Ni** | | **Ca** | | **Total** |
| Arm 1 | | 0.003 | | 1.943 | | 0.024 | | 0.058 | | 0.292 | | 0.003 | | 0.652 | | 0.003 | | 0.002 | | 3.002 |
| Arm 2 | | 0.004 | | 1.952 | | 0.025 | | 0.047 | | 0.297 | | 0.003 | | 0.640 | | 0.003 | | 0.003 | | 2.996 |
| Arm 3 | | 0.003 | | 1.924 | | 0.032 | | 0.061 | | 0.338 | | 0.002 | | 0.618 | | 0.002 | | 0.013 | | 3.016 |
| Arm 4 | | 0.013 | | 1.925 | | 0.018 | | 0.057 | | 0.328 | | 0.002 | | 0.639 | | 0.002 | | 0.002 | | 3.011 |
| Arm 5 | | 0.006 | | 1.934 | | 0.030 | | 0.078 | | 0.292 | | 0.003 | | 0.658 | | 0.002 | | 0.003 | | 3.006 |
| Arm 6 | | 0.007 | | 1.938 | | 0.034 | | 0.078 | | 0.292 | | 0.002 | | 0.643 | | 0.002 | | 0.002 | | 2.999 |
| Arm 7 | | 0.007 | | 1.941 | | 0.029 | | 0.078 | | 0.296 | | 0.002 | | 0.641 | | 0.002 | | 0.003 | | 2.999 |
| Arm 8 | | 0.004 | | 1.941 | | 0.023 | | 0.064 | | 0.329 | | 0.003 | | 0.637 | | 0.003 | | 0.007 | | 3.011 |
| Arm 9 | | 0.005 | | 1.940 | | 0.030 | | 0.066 | | 0.322 | | 0.003 | | 0.631 | | 0.003 | | 0.007 | | 3.007 |
| Arm 10 | | 0.006 | | 1.946 | | 0.021 | | 0.061 | | 0.337 | | 0.003 | | 0.622 | | 0.003 | | 0.008 | | 3.007 |
| Arm 11 | | 0.015 | | 1.930 | | 0.034 | | 0.068 | | 0.326 | | 0.003 | | 0.618 | | 0.003 | | 0.008 | | 3.004 |
| Arm 12 | | 0.005 | | 1.938 | | 0.035 | | 0.055 | | 0.334 | | 0.003 | | 0.626 | | 0.002 | | 0.013 | | 3.012 |
| Arm 13 | | 0.006 | | 1.944 | | 0.019 | | 0.065 | | 0.327 | | 0.003 | | 0.636 | | 0.002 | | 0.003 | | 3.007 |
| Arm 14 | | 0.005 | | 1.947 | | 0.030 | | 0.057 | | 0.312 | | 0.003 | | 0.639 | | 0.007 | | 0.005 | | 3.005 |
| Arm 15 | | 0.008 | | 1.936 | | 0.041 | | 0.074 | | 0.294 | | 0.003 | | 0.639 | | 0.002 | | 0.003 | | 2.999 |
| Arm 16 | | 0.023 | | 1.941 | | 0.032 | | 0.029 | | 0.292 | | 0.002 | | 0.677 | | 0.002 | | 0.007 | | 3.005 |

**Supplementary table 3**. Chemical composition of armalcolite.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Molecular Proportion** | **X** | **R2O3.TiO2** | **MO.2TiO2** | **Ti left** | **FeO.2TiO2** | **Fe2O3.TiO2** | **FeO** | **Fe2O3** |
|
| Arm 1 | TiO2 | 0.9313 | 0.3380 | 0.0196 | 0.6321 | 0.2796 | 0.2795 | 0.00005 | 10.0423 | 0.0086 |
| R2O3\* | 0.0196 | - | 0.0196 | - | - | - | - |  |  |
| MO† | 0.3160 | - | - | - | - | - | - |  |  |
| FeO | 0.1399 | - | - | - | - | 0.1398 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 2 | TiO2 | 0.9390 | 0.3364 | 0.0174 | 0.6321 | 0.2896 | 0.2896 | 0.00000 | 10.4035 | 0.0000 |
| R2O3\* | 0.0174 | - | 0.0174 | - | - | - | - |  |  |
| MO† | 0.3160 | - | - | - | - | - | - |  |  |
| FeO | 0.1427 | - | - | - | - | 0.1448 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 3 | TiO2 | 0.8925 | 0.3467 | 0.0216 | 0.5906 | 0.2803 | 0.2692 | 0.01113 | 9.6706 | 1.7774 |
| R2O3\* | 0.0216 | - | 0.0216 | - | - | - | - |  |  |
| MO† | 0.2953 | - | - | - | - | - | - |  |  |
| FeO | 0.1569 | - | - | - | - | 0.1346 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 4 | TiO2 | 0.9004 | 0.3441 | 0.0176 | 0.6032 | 0.2795 | 0.2706 | 0.00898 | 9.7199 | 1.4337 |
| R2O3\* | 0.0176 | - | 0.0176 | - | - | - | - |  |  |
| MO† | 0.3016 | - | - | - | - | - | - |  |  |
| FeO | 0.1532 | - | - | - | - | 0.1353 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 5 | TiO2 | 0.9036 | 0.3434 | 0.0254 | 0.6211 | 0.2571 | 0.2517 | 0.00535 | 9.0429 | 0.8549 |
| R2O3\* | 0.0254 | - | 0.0254 | - | - | - | - |  |  |
| MO† | 0.3106 | - | - | - | - | - | - |  |  |
| FeO | 0.1366 | - | - | - | - | 0.1259 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 6 | TiO2 | 0.9021 | 0.3398 | 0.0263 | 0.6042 | 0.2716 | 0.2715 | 0.00009 | 9.7547 | 0.0151 |
| R2O3\* | 0.0263 | - | 0.0263 | - | - | - | - |  |  |
| MO† | 0.3021 | - | - | - | - | - | - |  |  |
| FeO | 0.1360 | - | - | - | - | 0.1358 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 7 | TiO2 | 0.9002 | 0.3396 | 0.0248 | 0.6010 | 0.2744 | 0.2742 | 0.00021 | 9.8493 | 0.0328 |
| R2O3\* | 0.0248 | - | 0.0248 | - | - | - | - |  |  |
| MO† | 0.3005 | - | - | - | - | - | - |  |  |
| FeO | 0.1375 | - | - | - | - | 0.1371 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 8 | TiO2 | 0.90386 | 0.34490 | 0.02024 | 0.60461 | 0.27901 | 0.26980 | 0.00921 | 9.6926 | 1.4706 |
| R2O3\* | 0.02024 | - | 0.02024 | - | - | - | - |  |  |
| MO† | 0.30231 | - | - | - | - | - | - |  |  |
| FeO | 0.15332 | - | - | - | - | 0.13490 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 9 | TiO2 | 0.90542 | 0.34304 | 0.02254 | 0.60040 | 0.28248 | 0.27661 | 0.00586 | 9.9374 | 0.9363 |
| R2O3\* | 0.02254 | - | 0.02254 | - | - | - | - |  |  |
| MO† | 0.30020 | - | - | - | - | - | - |  |  |
| FeO | 0.15003 | - | - | - | - | 0.13831 | - |  |  |

**Supplementary table 4**. Stoichiometric calculation of armalcolite end members. Calculation of compositions from EPMA following the procedures of Bowles (1988). \*R2O3 = Al2O3 + Cr2O3 + V2O3; †MO = MgO + MnO + CaO.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Molecular Proportion** | **X** | **R2O3.TiO2** | **MO.2TiO2** | **Ti left** | **FeO.2TiO2** | **Fe2O3.TiO2** | **FeO†** | **Fe2O3†** |
|
| Arm 10 | TiO2 | 0.9060 | 0.3426 | 0.0191 | 0.5918 | 0.2950 | 0.2886 | 0.00638 | 10.3683 | 1.0188 |
| R2O3\* | 0.0191 | - | 0.0191 | - | - | - | - |  |  |
| MO† | 0.2959 | - | - | - | - | - | - |  |  |
| FeO | 0.1571 | - | - | - | - | 0.1443 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 11 | TiO2 | 0.8953 | 0.3432 | 0.0238 | 0.5858 | 0.2857 | 0.2801 | 0.00558 | 10.0642 | 0.8912 |
| R2O3\* | 0.0238 | - | 0.0238 | - | - | - | - |  |  |
| MO† | 0.2929 | - | - | - | - | - | - |  |  |
| FeO | 0.1512 | - | - | - | - | 0.1401 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 12 | TiO2 | 0.9049 | 0.3459 | 0.0211 | 0.6014 | 0.2825 | 0.2721 | 0.01040 | 9.7753 | 1.6610 |
| R2O3\* | 0.0211 | - | 0.0211 | - | - | - | - |  |  |
| MO† | 0.3007 | - | - | - | - | - | - |  |  |
| FeO | 0.1569 | - | - | - | - | 0.1361 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 13 | TiO2 | 0.9040 | 0.3427 | 0.0197 | 0.5992 | 0.2852 | 0.2788 | 0.00637 | 10.0158 | 1.0166 |
| R2O3\* | 0.0197 | - | 0.0197 | - | - | - | - |  |  |
| MO† | 0.2996 | - | - | - | - | - | - |  |  |
| FeO | 0.1521 | - | - | - | - | 0.1394 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 14 | TiO2 | 0.9087 | 0.3414 | 0.0203 | 0.6106 | 0.2779 | 0.2735 | 0.00436 | 9.8264 | 0.6961 |
| R2O3\* | 0.0203 | - | 0.0203 | - | - | - | - |  |  |
| MO† | 0.3053 | - | - | - | - | - | - |  |  |
| FeO | 0.1455 | - | - | - | - | 0.1368 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 15 | TiO2 | 0.9059 | 0.3400 | 0.0267 | 0.6049 | 0.2743 | 0.2740 | 0.00027 | 9.8430 | 0.0437 |
| R2O3\* | 0.0267 | - | 0.0267 | - | - | - | - |  |  |
| MO† | 0.3024 | - | - | - | - | - | - |  |  |
| FeO | 0.1375 | - | - | - | - | 0.1370 | - |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| Arm 16 | TiO2 | 0.9097 | 0.3424 | 0.0144 | 0.6450 | 0.2503 | 0.2425 | 0.00780 | 8.7120 | 1.2455 |
| R2O3\* | 0.0144 | - | 0.0144 | - | - | - | - |  |  |
| MO† | 0.3225 | - | - | - | - | - | - |  |  |
| FeO | 0.1369 | - | - | - | - | 0.1213 | - |  |  |

**Supplementary table 4 (continued)**. Stoichiometric calculation of armalcolite end members. Calculation of compositions from EPMA following the procedures of Bowles (1988). \*R2O3 = Al2O3 + Cr2O3 + V2O3; †MO = MgO + MnO + CaO.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Weight %** | | | | | | | | | | | | |
| **Ap2** | | **Ap5** | | **Ap6** | | **Ap8** | | **Ap9** | | **Ap10** | | |
| **Conc** | **Std Dev** | **Conc** | **Std Dev** | **Conc** | **Std Dev** | **Conc** | **Std Dev** | **Conc** | **Std Dev** | **Conc** | **Std Dev** |
| **SiO2** | 0.46 | 0.03 | 1.54 | 0.04 | 0.81 | 0.032 | 0.56 | 0.03 | 0.50 | 0.03 | 0.38 | 0.03 |
| **Al2O3** | 0.03 | 0.02 | 0.19 | 0.02 | 0.16 | 0.02 | 0.09 | 0.02 | 0.07 | 0.02 | 0.16 | 0.02 |
| **FeO** | 0.48 | 0.10 | 0.26 | 0.08 | 0.32 | 0.09 | 0.34 | 0.09 | 0.33 | 0.09 | 0.32 | 0.09 |
| **MgO** | 0.50 | 0.04 | 1.50 | 0.05 | 0.85 | 0.04 | 0.52 | 0.03 | 0.47 | 0.03 | 0.33 | 0.03 |
| **CaO** | 53.03 | 0.84 | 53.17 | 0.82 | 53.18 | 0.84 | 53.96 | 0.83 | 53.77 | 0.83 | 53.31 | 0.82 |
| **K2O** | 0.01 | 0.04 | b.d.l. | - | b.d.l. | - | 0.02 | 0.04 | 0.02 | 0.04 | b.d.l. | - |
| **Na2O** | 0.09 | 0.04 | 0.08 | 0.035 | 0.12 | 0.04 | 0.14 | 0.04 | 0.14 | 0.04 | 0.14 | 0.04 |
| **P2O5** | 41.33 | 0.49 | 40.61 | 0.48 | 40.93 | 0.49 | 41.50 | 0.48 | 41.22 | 0.48 | 41.61 | 0.48 |
| **Ce2O3** | 0.59 | 0.15 | 0.80 | 0.15 | 0.69 | 0.15 | 0.82 | 0.15 | 0.86 | 0.15 | 0.80 | 0.15 |
| **La2O3** | b.d.l. | - | b.d.l. | - | b.d.l. | 1.51 | 0.10 | 1.37 | b.d.l. | - | b.d.l | - |
| **Cl** | 0.18 | 0.03 | 0.18 | 0.03 | 0.13 | 0.08 | 0.16 | 0.03 | 0.12 | 0.03 | 0.11 | 0.03 |
| **F** | 3.80 | 0.46 | 3.78 | 0.41 | 3.97 | 0.44 | 3.81 | 0.42 | 3.81 | 0.41 | 3.91 | 0.41 |
| **SO3** | 0.01 | 0.02 | b.d.l. | - | 0.01 | 0.02 | 0.02 | 0.02 | 0.00 | 0.02 | 0.04 | 0.02 |
| **O = F, Cl** | 1.64 | | 1.63 | | 1.70 | | 1.64 | | 1.63 | | 1.67 | | |
| **OH wt.%** | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | |
| **Total** | 98.87 | | 100.48 | | 99.48 | | 100.39 | | 99.68 | | 99.73 | | |
| **S (µg/g)** | 41.04 | | b.d.l. | | 59.56 | | 74.08 | | b.d.l. | | 169.17 | | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Atoms per formula unit (a.p.f.u.)** | | | | | | | | | | | | |
| **Si** | 0.078 | | 0.258 | | 0.137 | | 0.094 | | 0.085 | | 0.064 | | |
| **Al** | 0.006 | | 0.037 | | 0.032 | | 0.018 | | 0.014 | | 0.032 | | |
| **Fe** | 0.068 | | 0.036 | | 0.045 | | 0.048 | | 0.047 | | 0.045 | | |
| **Mg** | 0.127 | | 0.374 | | 0.215 | | 0.130 | | 0.119 | | 0.083 | | |
| **Ca** | 9.673 | | 9.539 | | 9.653 | | 9.722 | | 9.760 | | 9.662 | | |
| **K** | 0.002 | | 0.000 | | 0.000 | | 0.004 | | 0.004 | | 0.000 | | |
| **Na** | 0.030 | | 0.026 | | 0.039 | | 0.046 | | 0.046 | | 0.046 | | |
| **P** | 5.957 | | 5.757 | | 5.871 | | 5.908 | | 5.912 | | 5.959 | | |
| **Ce** | 0.037 | | 0.049 | | 0.043 | | 0.050 | | 0.053 | | 0.050 | | |
| **La** | - | | - | | - | | 0.006 | | - | | 0.019 | | |
| **Cl** | 0.052 | | 0.051 | | 0.037 | | 0.046 | | 0.034 | | 0.032 | | |
| **F** | 2.046 | | 2.002 | | 2.127 | | 2.026 | | 2.041 | | 2.092 | | |
| **S** | 0.001 | | - | | 0.002 | | 0.002 | | - | | 0.005 | | |
| **OH** | - | | - | | - | | - | | - | | - | | |

**Supplementary Table 5**. Chemical composition of apatite.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Weight %** | | | | | | | | | | | | |
| **Ap13** | | **Ap14** | | **Ap15** | | **Ap17** | | **Ap18** | | **Ap21** | | |
| **Conc** | **Std Dev** | **Conc** | **Std Dev** | **Conc** | **Std Dev** | **Conc** | **Std Dev** | **Conc** | **Std Dev** | **Conc** | **Std Dev** |
| **SiO2** | 0.36 | 0.03 | 0.30 | 0.02 | 0.47 | 0.03 | 0.72 | 0.03 | 0.32 | 0.02 | 0.37 | 0.03 |
| **Al2O3** | 0.04 | 0.02 | 0.03 | 0.02 | 0.03 | 0.02 | 0.09 | 0.02 | 0.05 | 0.02 | 0.17 | 0.02 |
| **FeO** | 0.33 | 0.09 | 0.37 | 0.09 | 0.39 | 0.09 | 0.4 | 0.09 | 0.54 | 0.09 | 0.32 | 0.09 |
| **MgO** | 0.43 | 0.03 | 0.4 | 0.03 | 0.45 | 0.03 | 0.68 | 0.04 | 0.43 | 0.03 | 0.36 | 0.03 |
| **CaO** | 54.2 | 0.84 | 54.13 | 0.83 | 54.41 | 0.84 | 53.68 | 0.83 | 53.69 | 0.83 | 53.9 | 0.85 |
| **K2O** | b.d.l. | - | 0.02 | 0.04 | b.d.l. | - | b.d.l. | - | b.d.l. | - | b.d.l. | - |
| **Na2O** | 0.06 | 0.03 | 0.10 | 0.03 | 0.06 | 0.03 | 0.09 | 0.03 | 0.03 | 0.03 | 0.07 | 0.04 |
| **P2O5** | 41.65 | 0.49 | 42.53 | 0.49 | 41.98 | 0.49 | 42.43 | 0.49 | 43.05 | 0.50 | 42.54 | 0.5 |
| **Ce2O3** | 0.68 | 0.14 | 0.54 | 0.14 | 0.67 | 0.14 | 0.71 | 0.14 | 0.35 | 0.13 | 0.58 | 0.15 |
| **La2O3** | b.d.l. | - | b.d.l. | - | b.d.l. | - | b.d.l. | - | b.d.l. | - | b.d.l. | - |
| **Cl** | 0.14 | 0.03 | 0.13 | 0.03 | 0.10 | 0.02 | 0.10 | 0.02 | 0.11 | 0.02 | 0.10 | 0.02 |
| **F** | 3.64 | 0.41 | 3.79 | 0.41 | 3.76 | 0.41 | 3.46 | 0.40 | 3.14 | 0.39 | 3.89 | 0.44 |
| **SO3** | 0.01 | 0.02 | b.d.l. | - | b.d.l. | - | 0.01 | 0.02 | 0.02 | 0.02 | b.d.l. | - |
| **O = F, Cl** | 1.56 | | 1.62 | | 1.60 | | 1.48 | | 1.35 | | 1.66 | | |
| **OH wt.%** | 0.04 | | 0.00 | | 0.00 | | 0.26 | | 0.54 | | 0.00 | | |
| **Total** | 100.27 | | 100.71 | | 100.72 | | 100.88 | | 100.37 | | 100.65 | | |
| **S (µg/g)** | 43.04 | | b.d.l. | | b.d.l. | | 44.55 | | 62.56 | | b.d.l. | | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Atoms per formula unit (a.p.f.u.)** | | | | | | | | | | | | |
| **Si** | 0.061 | | 0.050 | | 0.079 | | 0.119 | | 0.053 | | 0.062 | | |
| **Al** | 0.008 | | 0.006 | | 0.006 | | 0.018 | | 0.010 | | 0.033 | | |
| **Fe** | 0.046 | | 0.052 | | 0.055 | | 0.055 | | 0.075 | | 0.045 | | |
| **Mg** | 0.108 | | 0.099 | | 0.112 | | 0.168 | | 0.106 | | 0.089 | | |
| **Ca** | 9.772 | | 9.667 | | 9.744 | | 9.538 | | 9.543 | | 9.623 | | |
| **K** | - | | 0.004 | | - | | - | | - | | - | | |
| **Na** | 0.020 | | 0.032 | | 0.019 | | 0.029 | | 0.010 | | 0.023 | | |
| **P** | 5.935 | | 6.002 | | 5.941 | | 5.957 | | 6.046 | | 6.001 | | |
| **Ce** | 0.042 | | 0.033 | | 0.041 | | 0.043 | | 0.021 | | 0.035 | | |
| **La** | - | | - | | - | | - | | - | | - | | |
| **Cl** | 0.040 | | 0.037 | | 0.028 | | 0.028 | | 0.031 | | 0.028 | | |
| **F** | 1.938 | | 1.998 | | 1.988 | | 1.815 | | 1.647 | | 2.050 | | |
| **S** | 0.001 | | - | | - | | 0.001 | | 0.002 | | - | | |
| **OH** | 0.023 | | - | | - | | 0.157 | | 0.322 | | - | | |

**Supplementary table 5 (continued).** Chemical composition of apatite.

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**Supplementary Figure 1.** Thin section scans showing the distribution of the interstitial network of glassy veinlets. Protogranular to porphyroclastic lherzolite with abundant silicate glass distributed along grain boundaries (yellowish veinlets). Ol: olivine; Opx: orthopyroxene; Cpx: clinopyroxene.