**Ziberna L., Green E.C.R. and Blundy J.D.**

**Multiple-reaction geobarometry for olivine-bearing igneous rocks**

**American Mineralogist**

# Supplementary Material 1

Experimental database

**Table S1.1** Reference list of the phase equilibrium experiments used in this work

| Code | Citation | Code | Citation |
|---|---|---|---|
| 1 | Almeev et al. 2007 | 20 | Husen et al. 2016 |
| 2 | Andujar et al. 2015 | 21 | Juster and Grove 1989 |
| 3 | Baker and Stolper 1994 | 22 | Kawamoto 1996 |
| 4 | Barclay and Carmichael 2004 | 23 | Kennedy et al. 1990 |
| 5 | Bartels et al. 1991 | 24 | Kinzler and Grove 1992 |
| 6 | Blatter et al. 2013 | 25 | Mahood and Baker 1986 |
| 7 | Borghini et al. 2010 | 26 | Mandler et al. 2014 |
| 8 | Borghini et al. 2011 | 27 | Moore and Carmichael 1998 |
| 9 | Chalot-Prat et al. 2010 | 28 | Nekvasil et al. 2004 |
| 10 | Chalot-Prat et al. 2013 | 29 | Parat et al. 2014 |
| 11 | Di Carlo et al. 2006 | 30 | Pichavant and MacDonald 2007 |
| 12 | Draper and Johnston 1992 | 31 | Pichavant et al. 2002 |
| 13 | Feig et al. 2006 | 32 | Sack et al. 1987 |
| 14 | Feig et al. 2010 | 33 | Scoates et al. 2006 |
| 15 | Grove and Bryan 1983 | 34 | Sisson and Grove 1993 |
| 16 | Grove and Juster 1989 | 35 | Takagi et al. 2005 |
| 17 | Grove et al. 1997 | 36 | Toplis and Carroll 1995 |
| 18 | Grove et al. 2003 | 37 | Wagner et al. 1995 |
| 19 | Hamada and Fuji 2008 | | |

**Additional filtering of the experimental dataset used for avP calculations**

Other than excluding experiments containing clinopyroxene with low-Ca compositions and experiments at 1-atm pressure (which reduced the initial dataset from 397 to 244 experiments), we additionally applied the following filters to avoid low-quality microprobe analyses and exclude samples with significant inhomogeneities in mineral compositions:

- Check on mineral formula, total cations, apfu: 4.95 < sum < 5.05 for plagioclase (5 oxygens), 2.97 < sum < 3.03 for olivine (4 oxygens), 3.97 < sum < 4.10 for clinopyroxene (6 oxygens), 2.90 < sum < 4.00 for spinel (4 oxygens).
- Contaminated analyses: spinel $SiO_2$ > 3.0 wt%.
- Excessively high uncertainties on mineral compositions (relative standard deviations on oxide wt% from multiple electron microprobe analyses): olivine FeO > 10% or MgO > 10%, spinel FeO > 10% or $Al_2O_3$ > 10%, clinopyroxene MgO > 10% or $Al_2O_3$ > 30%, plagioclase CaO > 10% or $Al_2O_3$ > 10%.

These filters produced a final dataset of 209 experiments containing the subset COlP. Of these experiments, 62 contain the subset SCOlP.

**Table S1.2** Refined database of phase equilibrium experiments containing the sub-assemblage SCOlP, listed in order of increasing *P*. The results of avP calculations using SCOlP equilibria (see text) are also reported.

| Index | Run label | Reference | Dur h | Phases[1] | *ΔNNO*[2] | $H_2O$[3] wt% | $T_{exp}$ ˚C | $P_{exp}$ kbar | $\overline{P}$ kbar | $\sigma_{\overline{P}}$ kbar | $\sigma_{fit}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LA0766 | PEM22-6 | Moore and Carmichael (1998) | 48 | ol+sp+cpx+pl+melt+fl | 2.7 | n.a.[4] | 1075 | 0.61 | 0.47 | 2.03 | 1.43 |
| LA0639 | 1140mf #23 | Grove et al. (1997) | 66 | ol+sp+cpx+pl+melt+fl | 0.0 | n.a.[4] | 985 | 1.00 | 1.75 | 2.32 | 1.57 |
| LA0640 | 1140mf #26 | Grove et al. (1997) | 44 | ol+sp+cpx+pl+melt+fl | 0.0 | n.a.[4] | 955 | 1.00 | 3.07 | 1.92 | 1.51 |
| LA0659 | 1544m #7 | Grove et al. (1997) | 21 | ol+sp+cpx+pl+melt+fl | 0.0 | n.a.[4] | 1030 | 1.00 | 2.45 | 1.21 | 0.98 |
| LA1463 | 692Ja-29 | Mandler et al. (2014) | 48 | ol+sp+cpx+pl+ilm+melt+ap+fl | 0.0 | n.a.[4] | 970 | 1.00 | 0.60 | 2.78 | 1.81 |
| LA1464 | 692Ja-38a | Mandler et al. (2014) | 51 | ol+sp+cpx+pl+ilm+melt+ap+fl | 0.0 | n.a.[4] | 950 | 1.00 | -0.32 | 5.15 | 3.27 |
| LA1465 | 692Ja-45 | Mandler et al. (2014) | 45 | ol+sp+cpx+pl+ilm+melt+ap+fl | 0.0 | n.a.[4] | 935 | 1.00 | 3.31 | 2.62 | 2.09 |
| LA1846 | Exp.#13 | Wagner et al. (1995) | 24 | ol+sp+cpx+pl+melt+fl | 0.0 | 4.2[4,5] | 1035 | 1.00 | 2.26 | 1.17 | 0.81 |
| LA1849 | Exp.#8 | Wagner et al. (1995) | 23 | ol+sp+cpx+pl+melt+fl | 0.0 | 2.4[4,5] | 985 | 1.00 | 2.64 | 2.21 | 1.69 |
| LA0990 | #58 | Feig et al. (2006) | 70 | ol+sp+cpx+opx+pl+hb+melt | n.a. | n.a. | 980 | 1.01 | 2.76 | 1.40 | 1.15 |
| LA0980 | #48 | Feig et al. (2006) | 82 | ol+sp+cpx+pl+melt | 2.0 | 0.9[5] | 1160 | 1.02 | 3.40 | 1.21 | 0.94 |
| LA0981 | #49 | Feig et al. (2006) | 82 | ol+sp+cpx+pl+melt | 1.7 | 0.6[5] | 1160 | 1.02 | 3.40 | 1.21 | 0.84 |
| LA1741 | ShR660 | Husen et al. (2016) | 64 | ol+sp+cpx+pl+melt | n.a. | 0.4[5,6] | 1100 | 1.02 | 2.03 | 1.51 | 1.27 |
| LA0442 | 79-35g#4 | Sisson and Grove (1993) | 24 | ol+sp+cpx+pl+melt+fl | 0.0 | n.a.[4] | 1050 | 2.00 | 3.26 | 1.24 | 0.42 |
| LA0443 | 79-35g#11 | Sisson and Grove (1993) | 41 | ol+sp+cpx+pl+melt+fl | 0.0 | n.a.[4] | 1035 | 2.00 | 3.77 | 1.34 | 1.09 |
| LA0444 | 79-35g#10 | Sisson and Grove (1993) | 45 | ol+sp+cpx+pl+melt+fl | 0.0 | n.a.[4] | 1025 | 2.00 | 4.30 | 1.48 | 1.29 |
| LA0445 | 79-35g#12 | Sisson and Grove (1993) | 62 | ol+sp+cpx+pl+melt+fl | 0.0 | n.a.[4] | 1000 | 2.00 | 2.52 | 1.32 | 0.97 |
| LA0450 | 82-66#7 | Sisson and Grove (1993) | 72 | ol+sp+cpx+pl+hb+melt+fl | 0.0 | n.a.[4] | 965 | 2.00 | 6.09 | 2.28 | 2.16 |
| LA0468 | 82-66+Ab#1 | Sisson and Grove (1993) | 44 | ol+sp+cpx+pl+melt+fl | 0.0 | n.a.[4] | 965 | 2.00 | 1.86 | 1.75 | 1.20 |
| LA0471 | 82-66+NaOH#1A | Sisson and Grove (1993) | 49 | ol+sp+cpx+pl+hb+melt+fl | 0.0 | n.a.[4] | 965 | 2.00 | 3.67 | 1.52 | 1.28 |
| LA0785 | 64 | Takagi et al. (2005) | 32 | ol+sp+cpx+opx+pl+melt+fl | 1.3 | 4.3[4] | 1030 | 2.00 | 0.46 | 2.10 | 1.19 |
| LA1477 | MJS05#6 | Parat et al. (2014) | 96 | ol+sp+cpx+pl+melt+fl | 2.6 | 4.8[4,5] | 1000 | 2.00 | 4.16 | 2.32 | 1.92 |
| LA1478 | MJS05#7 | Parat et al. (2014) | 96 | ol+sp+cpx+pl+melt+fl | 2.4 | 3.2[5] | 1000 | 2.00 | 4.21 | 2.14 | 1.87 |
| LA1553 | #791 | Hamada and Fuji (2008) | 24 | ol+sp+cpx+pl+melt | -0.1 | n.a. | 1060 | 2.00 | 2.65 | 2.68 | 2.02 |
| LA1747 | ShR654 | Husen et al. (2016) | 70 | ol+sp+cpx+pl | n.a. | 0.0[5] | 1100 | 2.01 | 1.88 | 1.52 | 1.25 |
| LA1762 | ShR354 | Husen et al. (2016) | 70 | ol+sp+cpx+pl+melt | n.a. | 0.1[5] | 1100 | 2.01 | 2.23 | 2.15 | 1.74 |
| LA1746 | ShR658 | Husen et al. (2016) | 64 | ol+sp+cpx+pl | n.a. | 0.0[5] | 1075 | 2.02 | 2.95 | 1.62 | 1.46 |
| LA0953 | #11 | Feig *et al.* (2006) | 30 | ol+sp+cpx+pl+melt+fl | 3.0 | 1.3[4,5] | 1060 | 2.03 | 2.26 | 1.23 | 0.90 |

**Table S1.2** Continued

| Index | Run label | Reference | Dur h | Phases[1] | $\Delta NNO$[2] | $H_2O$[3] wt% | $T_{exp}$ ˚C | $P_{exp}$ kbar | $\overline{P}$ kbar | $\sigma_{\overline{P}}$ kbar | $\sigma_{fit}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LA0969 | #31 | Feig et al. (2006) | 43 | ol+sp+cpx+pl+hb+melt+fl | 3.6 | 1.7[4,5] | 980 | 2.03 | 1.85 | 1.46 | 0.89 |
| LA1749 | ShR674 | Husen et al. (2016) | 68 | ol+sp+cpx+pl+melt | n.a. | 0.8[5,6] | 1175 | 2.03 | 2.90 | 1.53 | 1.33 |
| LA0946 | #3 | Feig et al. (2006) | 20 | ol+sp+cpx+pl+melt | 2.6 | 0.4[5] | 1100 | 2.03 | 2.34 | 1.96 | 1.60 |
| LA0947 | #5 | Feig et al. (2006) | 60 | ol+sp+cpx+pl+melt | 2.4 | 0.2[5] | 1100 | 2.03 | 1.85 | 2.03 | 1.59 |
| LA0967 | #25 | Feig et al. (2006) | 42 | ol+sp+cpx+pl+melt+fl | 3.6 | 3.3[4,5] | 1020 | 2.04 | 2.04 | 1.54 | 1.01 |
| LA1517 | #502 | Hamada and Fuji (2008) | 24 | ol+sp+cpx+pl+melt | 1.1 | n.a. | 1100 | 3.00 | 3.11 | 1.47 | 1.23 |
| LA0510 | 2380 | Blatter et al. (2013) | 72 | ol+sp+cpx+pl+melt | 2.1 | 2.1 | 1025 | 4.00 | 4.66 | 1.41 | 1.46 |
| LA0511 | 2391 | Blatter et al. (2013) | 72 | ol+sp+cpx+pl+melt | 2.1 | 2.1 | 1050 | 4.00 | 4.39 | 1.54 | 1.52 |
| LA0512 | 2389 | Blatter et al. (2013) | 15 | ol+sp+cpx+pl+melt | 1.5 | 2.1 | 1075 | 4.00 | 4.72 | 1.75 | 1.88 |
| LA1765 | ShR359 | Husen et al. (2016) | 70 | ol+sp+cpx+pl+melt | n.a. | 0.4[5,6] | 1100 | 4.01 | 3.80 | 1.47 | 1.41 |
| LA1064 | 1 | Kawamoto (1996) | 44 | ol+sp+cpx+pl+melt | 1.3 | 1.0 | 1125 | 5.00 | 4.83 | 3.26 | 3.65 |
| LA2668 | N12 | Chalot-Prat et al. (2013) | 24 | ol+sp+cpx+opx+pl+melt | n.a. | 0.0 | 1200 | 5.00 | 6.43 | 1.73 | 1.62 |
| LA2677 | N85 | Chalot-Prat et al. (2013) | 72 | ol+sp+cpx+opx+pl+melt | n.a. | 0.0 | 1160 | 5.00 | 7.05 | 1.26 | 1.32 |
| LA2678 | N86 | Chalot-Prat et al. (2013) | 72 | ol+sp+cpx+opx+pl+melt | n.a. | 0.0 | 1160 | 5.00 | 6.29 | 1.02 | 0.46 |
| LA2853 | FLZ10 | Borghini et al., (2010) | 520 | ol+sp+cpx+opx+pl | n.a. | 0.0 | 1100 | 5.00 | 7.14 | 0.86 | 0.87 |
| LA2867 | DLZ10 | Borghini et al., (2010) | 520 | ol+sp+cpx+opx+pl | n.a. | 0.0 | 1100 | 5.00 | 7.38 | 1.62 | 1.78 |
| LA1003 | #79 | Feig et al. (2006) | 64 | ol+sp+cpx+pl+melt+fl | 3.2 | 3.1[4,5] | 1060 | 5.02 | 6.13 | 1.36 | 1.68 |
| LA1004 | #80 | Feig et al. (2006) | 64 | ol+sp+cpx+opx+pl+melt | n.a. | n.a. | 1060 | 5.02 | 4.05 | 1.01 | 0.98 |
| LA1005 | #81 | Feig et al. (2006) | 64 | ol+sp+cpx+opx+pl+melt | n.a. | n.a. | 1060 | 5.02 | 4.67 | 1.26 | 1.31 |
| LA0997 | #73 | Feig et al. (2006) | 68 | ol+sp+cpx+opx+pl+melt | n.a. | n.a. | 1100 | 5.02 | 4.51 | 1.04 | 1.10 |
| LA2855 | FLZ3 | Borghini et al. (2010) | 308 | ol+sp+cpx+opx+pl | n.a. | 0.0 | 1100 | 6.00 | 7.54 | 0.87 | 0.92 |
| LA0504 | 2374 | Blatter et al. (2013) | 72 | ol+sp+cpx+opx+pl+melt | 2.0 | 2.1 | 1050 | 7.00 | 6.09 | 1.49 | 1.81 |
| LA0505 | 2379 | Blatter et al. (2013) | 15 | ol+sp+cpx+pl+melt | 1.5 | 2.1 | 1100 | 7.00 | 5.92 | 1.72 | 2.08 |
| LA1570 | #887 | Hamada and Fuji (2008) | 12 | ol+sp+cpx+opx+pl+melt | 0.7 | n.a. | 1060 | 7.00 | 4.77 | 1.62 | 1.52 |
| LA2857 | FLZ7 | Borghini et al. (2010) | 408 | ol+sp+cpx+opx+pl | n.a. | 0.0 | 1150 | 7.00 | 7.15 | 0.89 | 0.77 |
| LA2870 | DLZ7 | Borghini et al. (2010) | 408 | ol+sp+cpx+opx+pl | n.a. | 0.0 | 1150 | 7.00 | 6.40 | 0.92 | 0.85 |
| LA2643 | M96 | Chalot-Prat et al. (2010) | 24 | ol+sp+cpx+opx+pl+melt | n.a. | 0.0 | 1240 | 7.50 | 5.79 | 0.89 | 0.46 |
| LA2644 | M97 | Chalot-Prat et al. (2010) | 24 | ol+sp+cpx+opx+pl+melt | n.a. | 0.0 | 1240 | 7.50 | 6.69 | 0.95 | 1.16 |
| LA2650 | K98 | Chalot-Prat et al. (2010) | 72 | ol+sp+cpx+opx+pl+melt | n.a. | 0.0 | 1220 | 7.50 | 6.95 | 0.83 | 0.47 |

**Table S1.2** Continued

| Index | Run label | Reference | Dur h | Phases[1] | *ΔNNO*[2] | $H_2O$[3] wt% | $T_{exp}$ ˚C | $P_{exp}$ kbar | $\overline{P}$ kbar | $\sigma_{\overline{P}}$ kbar | $\sigma_{fit}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LA2651 | N55 | Chalot-Prat et al. (2010) | 72 | ol+sp+cpx+opx+pl+melt | n.a. | 0.0 | 1210 | 7.50 | 6.23 | 0.85 | 0.58 |
| LA2652 | N56 | Chalot-Prat et al. (2010) | 72 | ol+sp+cpx+opx+pl+melt | n.a. | 0.0 | 1210 | 7.50 | 7.54 | 0.81 | 0.43 |
| LA2860 | FLZ2 | Borghini et al. (2010) | 377 | ol+sp+cpx+opx+pl | n.a. | 0.0 | 1100 | 8.00 | 8.37 | 0.80 | 0.67 |
| LA2873 | FLZ15 | Borghini et al. (2011) | n.a. | ol+sp+cpx+opx+pl | n.a. | 0.0 | 1150 | 8.00 | 8.42 | 0.81 | 0.79 |
| LA0495 | 2363 | Blatter et al. (2013) | 15 | ol+sp+cpx+opx+pl+melt | 1.6 | 2.1 | 1095 | 9.00 | 8.19 | 0.95 | 1.35 |

[1] ol – olivine; sp – spinel (either magnetite- or Cr/Al-rich); cpx – clinopyroxene; opx – orthopyroxene; pl – plagioclase; hb – hornblende; ilm – ilmenite; ap – apatite; grt – garnet; fl – fluid.
[2] *ΔNNO* as reported in the source paper or recalculated after O'Neill and Pownceby (1993).
[3] Estimated bulk $H_2O$ content in the experimental run.
[4] $H_2O$-saturated runs as reported in the source papers.
[5] Calculated as $H_2O^{melt}$ (wt%) * melt fraction; note that if hb is present in the assemblage this estimate is only a minimum.
[6] Estimated maximum value, see Husen et al. (2016)