**Supplementary materials for**

**Composition of the Core from Gallium Metal-Silicate Partitioning Experiments**

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This document includes tables S1 and S2 which consists of EPMA analyses of our piston-cylinder experiments.

**Table S1**: Average element compositions of the quenched silicate melts determined by EPMA.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Run #** | MORB FeSi 70 | MORB FeSi 80 | MORB FeSi 85 | MORB FeSi 90 | MORB FeSi 95 | MORB Fe5wt.% | MORB FeS1 | MORB FeS2 | MORB FeS3 | MORB FeS4 | MORB FeS5 | MORB FeS7 |
| ***EPMA (wt. %)*** | *N = 25*a | *N = 32* | *N = 44* | *N = 41* | *N = 38* | *N = 21* | *N=34* | *N=33* | *N=31* | *N=32* | *N=23* | *N=39* |
| Na2O | 2.30(0.35)b | 2.50(0.64) | 2.2(0.41) | 2.22(0.60) | 2.31(0.85) | 2.39(1.62) | 1.74 (0.95) | 2.02 (0.96) | 0.84 (0.45) | 1.63 (0.76) | 2.14 (1.21) | 2.64 (1.32) |
| MgO | 33.38(3.7) | 32.84(5.17) | 32.33(3.41) | 33.25(6.31) | 33.28(7) | 33.9(8.57) | 35.33 (5.13) | 34.12 (4.86) | 35.45 (4.48) | 34.54 (3.07) | 34.72 (5.86) | 30.13 (8.03) |
| Al2O3 | 12.48(1.49) | 12.51(1.36) | 13.17(0.86) | 12.91(2.83) | 13.36(3.03) | 9.64(2.29) | 10.03 (2.62) | 10.12 (1.78) | 10.60 (2.51) | 9.78 (1.78) | 10.17 (2.23) | 10.43 (2.03) |
| SiO2 | 44.35(0.93) | 43.66(2.51) | 44.03(1.47) | 42.40(0.85) | 37.7(1.2) | 33.79(1.91) | 33.60 (1.95) | 33.13 (1.53) | 32.62 (1.80) | 32.73 (1.25) | 32.53 (1.67) | 32.30 (1.75) |
| K2O | 0.58(0.08) | 0.66(0.21) | 0.53(0.13) | 0.59(0.15) | 0.6(0.17) | 0.57(0.3) | 0.45 (0.19) | 0.49 (0.18) | 0.36 (0.12) | 0.46 (0.12) | 0.50 (0.24) | 0.61 (0.26) |
| CaO | 7.75(1.09) | 7.86(1.31) | 7.69(0.86) | 7.74(2.03) | 8.38(2.49) | 7.33(3.38) | 5.99 (1.98) | 6.77 (2.10) | 6.34 (2.16) | 6.48 (1.34) | 6.98 (2.38) | 8.32 (3.28) |
| FeO | 0.11(0.11) | 0.28(0.15) | 0.38(0.12) | 0.76(0.24) | 3.41(0.43) | 9.69(2.15) | 8.77 (1.47) | 9.17 (1.55) | 9.12 (1.41) | 9.50 (0.92) | 9.00 (1.64) | 10.52 (1.92) |
| TiO2 | 0.73(0.09) | 1.18(0.2) | 1.34(0.14) | 1.30(0.31) | 1.38(0.3) | 1.18(0.41) | 1.09 (0.33) | 1.16 (0.28) | 1.11 (0.31) | 0.84 (0.16) | 1.16 (0.31) | 1.34 (0.45) |
| SO2 | 0.02(0.02) | 0.02(0.01) | 0.03(0.01) | 0.04(0.02) | 0.18(0.05) | 0.89(0.23) | 0.26 (0.14) | 0.49 (0.22) | 0.35 (0.17) | 0.24 (0.07) | 0.74 (0.44) | 1.4 (0.36) |
| Ga2O3 | 0.024(0.017) | 0.024(0.011) | 0.025(0.008) | 0.035(0.017) | 0.175(0.048) | 0.964(0.273) | 0.45 (0.13) | 0.50 (0.10) | 0.64 (0.15) | 0.46 (0.10) | 0.71 (0.16) | 1.35 (0.31) |
| Total | 101.8(0.47) | 101.82(0.54) | 101.69(0.56) | 101.2(0.85) | 100.68(1.04) | 99.42(0.56) | 97.71 (0.76) | 97.98 (0.74 | 97.45 (0.87) | 96.67 (0.47) | 98.65 (0.67) | 99.03 (0.43) |
| **Run #** | MORB FeS8 | MORB FeS9 | MORB FeS10 | MORB FeS11 | MORB FeS12 | MORB FeS13 | MORB FeS14 | MORB Fe | MORB FeSSi5 | MORB FeSSi6 | MORB FeSSi10 | MORB FeSSi11 |
| ***EPMA (wt. %)*** | *N=20* | *N=18* | *N=24* | *N=24* | *N=22* | *N=23* | *N=22* | *N=15* | *N=20* | *N=20* | *N=24* | *N=20* |
| Na2O | 3.11 (1.10) | 2.97 (1.58) | 2.68 (1.40) | 2.16 (1.48) | 1.86 (0.96) | 1.80 (0.78) | 2.05 (1.39) | 1.43 (0.74) | 1.84 (0.68) | 2.21 (0.92) | 2.20 (0.90) | 2.24 (0.56) |
| MgO | 29.48 (5.68) | 29.73 (7.78) | 31.43 (6.25) | 35.33 (8.10) | 35.64 (5.33) | 36.83 (4.77) | 33.88 (8.75) | 40.40 (4.27) | 37.90 (5.42) | 38.56 (6.89) | 35.89 (7.06) | 40.01 (2.93) |
| Al2O3 | 10.66 (1.87) | 11.03 (2.26) | 10.97 (2.19) | 9.97 (2.39) | 9.38 (1.68) | 9.04 (1.67) | 10.46 (3.36) | 8.94 (2.58) | 9.83 (2.08) | 11.66 (3.44) | 11.07 (3.26) | 9.67 (1.80) |
| SiO2 | 32.10 (1.63) | 32.03 (1.88) | 31.33 (1.84) | 33.58 (2.17) | 33.11 (1.43) | 33.73 (1.43) | 32.63 (2.85) | 35.35 (1.73) | 35.56 (1.86) | 39.21 (1.29) | 39.93 (0.81) | 36.28 (1.40) |
| K2O | 0.69 (0.20) | 0.65 (0.27) | 0.62 (0.26) | 0.54 (0.30) | 0.49 (0.22) | 0.43 (0.18) | 0.50 (0.30) | 0.39 (0.19) | 0.45 (0.15) | 0.51 (0.19) | 0.69 (0.23) | 0.65 (0.14) |
| CaO | 9.03 (2.27) | 8.87 (3.18) | 7.92 (2.26) | 6.96 (3.28) | 6.73 (2.19) | 6.22 (1.93) | 6.98 (3.37) | 5.40 (1.51) | 6.53 (1.98) | 7.30 (2.60) | 7.73 (2.25) | 7.86 (1.46) |
| FeO | 10.92 (1.65) | 10.57 (2.15) | 10.39 (1.97) | 9.16 (2.30) | 9.21 (1.63) | 9.16 (1.65) | 10.02 (2.46) | 7.80 (0.97) | 6.47 (1.00) | 2.79 (0.39) | 3.08 (0.32) | 4.03 (0.60) |
| TiO2 | 1.44 (0.29) | 1.40 (0.39) | 1.31 (0.34) | 1.23 (0.47) | 1.15 (0.29) | 1.03 (0.27) | 1.16 (0.47) | 0.97 (0.31) | 1.05 (0.28) | 1.21 (0.39) | 1.19 (0.35) | 1.20 (0.17) |
| SO2 | 0.84 (0.31) | 0.79 (0.30) | 0.87 (0.63) | 0.54 (0.33) | 0.59 (0.28) | 0.56 (0.32) | 0.57 (0.32) | 1.11 (0.62) | 0.60 (0.17) | 0.63 (0.23) | 0.97 (0.28) | 2.00 (0.57) |
| Ga2O3 | 0.55 (0.13) | 0.71 (0.17) | 0.74 (0.19) | 0.54 (0.15) | 0.58 (0.12) | 0.55 (0.11) | 0.80 (0.29) | 0.28 (0.09) | 1.27 (0.38) | 0.33 (0.11) | 0.38 (0.15) | 1.08 (0.22) |
| Total | 98.81 (0.66) | 98.77 (0.48) | 98.26 (0.63) | 100.01 (0.60) | 98.75 (0.42) | 99.35 (0.79) | 99.05 (1.04) | 100.98 (0.38) | 101.50 (1.47) | 104.40 (0.57) | 103.15 (0.82) | 105.02 (1.25) |

a Number of analyses; b Values in parentheses are errors given as two standard deviations for EPMA.

**Table S1.** continued

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Run #** | HP-BT1 | HP-BT2 | HP-BT3 | HP-BT4 | HP-BT5 |
| ***EPMA (wt. %)*** | *N = 22* | *N = 21* | *N = 25* | *N = 20* | *N = 28* |
| Na2O | 3.1 (0.08) | 2.98 (0.06) | 3.08 (0.09) | 2.80 (0.10) | 3.02 (0.10) |
| MgO | 11.66 (0.37) | 12.40 (0.31) | 11.81 (0.43) | 12.48 (0.37) | 11.89 (0.81) |
| Al2O3 | 14.66 (0.08) | 14.24 (0.08) | 14.46 (0.11) | 14.11 (0.14) | 14.00 (0.73) |
| SiO2 | 46.87 (0.87) | 45.48 (0.66) | 46.21 (0.68) | 45.11 (0.65) | 45.71 (0.68) |
| K2O | 0.65 (0.02) | 0.64 (0.02) | 0.64 (0.03) | 0.62 (0.03) | 0.66 (0.03) |
| CaO | 9.42 (0.11) | 9.26 (0.07) | 9.29 (0.12) | 9.20 (0.14) | 9.20 (0.07) |
| FeO | 12.04 (0.22) | 12.25 (0.21) | 12.15 (0.29) | 12.41 (0.37) | 12.19 (0.17) |
| TiO2 | 1.57 (0.07) | 1.54 (0.09) | 1.51 (0.07) | 1.56 (0.09) | 1.48 (0.08) |
| SO2 | 0.12 (0.01) | 0.15 (0.01) | 0.16 (0.01) | 0.22 (0.02) | 0.26 (0.01) |
| Ga2O3 | 0.54 (0.02) | 00.62 (0.02) | 0.87 (0.02) | 1.22 (0.02) | 1.39 (0.07) |
| Total | 100.64 (0.89) | 99.57 (0.87) | 100.18 (1.11) | 99.72 (0.98) | 99.80 (1.85) |

**Table S2.** Average element compositions of the metallic melt determined by EPMA.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Run #** | MORB FeSi 70 | MORB FeSi 80 | MORB FeSi 85 | MORB FeSi 90 | MORB FeSi 95 | MORB Fe5wt.% | MORB FeS1 | MORB FeS2 | MORB FeS3 | MORB FeS4 | MORB FeS5 | MORB FeS7 |
| ***EPMA (wt.%)*** | *N = 24*a | *N = 31* | *N = 26* | *N =27* | *N = 23* | *N = 21* | *N = 5* | *N = 5* | *N = 20* | *N = 20* | *N = 20* | *N = 22* |
| O | - | - | - | - | - | - | 0.46 (0.12) | 0.9 (0.14) | 0.6 (0.09) | 0.11 (0.05) | 2.22 (0.4) | 3.9 (0.3) |
| S | - | - | - | - | - | - | 7.5 (0.16) | 11.56 (0.3) | 8.5 (0.2) | 4.1 (0.3) | 21.44 (0.4) | 28.28 (0.26) |
| Si | 16.39(0.24)b | 8.18(0.18) | 4.76(0.13) | 1.38(0.05) | Bd | Bd | b.d. | b.d. | b.d. | b.d. | b.d. | b.d. |
| Fe | 72.17(0.49) | 81.44(0.63) | 84.41(0.85) | 89.46(0.71) | 91.52(0.67) | 93.02(0.61) | 88.12 (1) | 83.35 (1.78) | 87.4 (0.59) | 93.02 (1.13) | 75.58 (1.06) | 67.12 (1.04) |
| Ga | 8.62(0.2) | 9.18(0.10) | 7.99(0.08) | 8.47(0.05) | 6.16(0.04) | 6.33(0.05) | 2.06 (0.01) | 1.68 (0.05) | 1.9 (0.04) | 2.36 (0.05) | 0.8 (0.04) | 0.52 (0.3) |
| Total | 97.18(0.6) | 98.8(0.71) | 97.16(0.86) | 99.31(0.72) | 97.74(0.69) | 100.66(0.29) | 98.17 (0.43) | 97.51 (0.84) | 98.46 (0.42) | 99.60 (0.91) | 97.07 (0.66) | 100.00 (0.62) |
| **Run #** | MORB FeS8 | MORB FeS9 | MORB FeS10 | MORB FeS11 | MORB FeS12 | MORB FeS13 | MORB FeS14 | MORB Fe | MORB FeSSi5 | MORB FeSSi6 | MORB FeSSi10 | MORB FeSSi11 |
| ***EPMA (wt.%)*** | *N = 5* | *N = 5* | *N = 5* | *N = 5* | *5* | *5* | *5* | *5* | *10* | *14* | *8* | *10* |
| O | 1.04 (0.1) | 1.57 (0.18) | 1.75 (0.22) | 0.9 (0.2) | 1.07 (0.37) | 1.34 (0.26) | 1.29 (0.07) | 0.16 (0.03) | 0.69 (0.09) | 0.43 (0.03) | 0.64 (0.07) | 0.91 (0.11) |
| S | 14.27 (0.43) | 17.41 (0.47) | 17.50 (0.43) | 10.06 (0.2) | 12.67 (0.56) | 13.9 (0.32) | 15.92 (0.13) | 0.26 (0.01) | 12.92 (0.9) | 12.06 (0.46) | 16.29 (1.19) | 19.41 (0.57) |
| Si | b.d. | b.d. | b.d. | b.d. | b.d. | b.d. | b.d. | b.d. | Bd | Bd | Bd | Bd |
| Fe | 82.40 (0.81) | 77.90 (1.75) | 77.06 (1.03) | 86.28 (0.75) | 83.74 (0.95) | 80.97 (1.02) | 80.89 (0.57) | 96.10 (1.21) | 80.14 (0.7) | 80.65 (0.45) | 77.62 (0.62) | 73.99 (0.39) |
| Ga | 1.40 (0.06) | 1.24 (0.04) | 1.12 (0.05) | 1.88 (0.03) | 1.76 (0.04) | 1.47 (0.03) | 1.26 (0.03) | 2.57 (0.01) | 4.63 (0.16) | 6.36 (0.17) | 5.3 (0.29) | 4.43 (0.19) |
| Total | 99.12 (0.45) | 98.14 (0.85) | 97.57 (0.33) | 99.15 (0.45) | 99.26 (0.49) | 97.75 (0.63) | 99.36 (0.30) | 99.10 (0.89) | 98.40 (0.21) | 99.50 (0.30) | 99.85 (0.16) | 98.75 (0.23) |
| **Run #** | HP-BT1 | HP-BT2 | HP-BT3 | HP-BT4 | HP-BT5 |
| ***EPMA (wt.%)*** | *N = 16* | *N = 24* | *N = 21* | *N = 24* | *N = 30* |
| O | 0.39 (0.09) | 0.45 (0.04) | 1.32 (0.19) | 1.29 (0.11) | 1.32 (0.10) |
| S | 4.31 (2.55) | 9.95 (0.21) | 14.56 (0.32) | 23.49 (0.45) | 26.98 (0.66) |
| Si | b.d. | b.d. | b.d. | b.d. | b.d. |
| Fe | 92.71 (2.55) | 86.86 (0.26) | 79.93 (0.57) | 73.16 (0.59) | 69.55 (0.80) |
| Ga | 2.41 (0.27) | 1.89 (0.02) | 1.94 (0.04) | 0.82 (0.05) | 0.73 (0.11) |
| Total | 99.81 (0.46) | 99.16 (0.19) | 97.77 (0.29) | 98.77 (0.54) | 98.60 (0.56) |

a Number of analyses; b Values in parentheses are errors given as two standard deviations for EPMA.