Supplement of

Equation of state and sound wave velocities of fayalite at high pressures and temperatures: implications for the seismic properties of the martian mantle

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Figure S1. Tons-Temperature space sampled during our experiment.
Figure S2. Top: Variation of the sample’s length during the experiment. Bottom: Pressures (blue, left scale) and temperatures (red, right scale) of the experiment.
Figure S3. Two examples of measured $d$ spacings as a function of $1 - 3 \cos^2 \psi$, $\psi$ being the detector azimuth, for different $hkl$ planes. These plots allow to calculate $d$ spacings at hydrostatic pressure and differential stress. Top corresponds to diffractogram #26 and bottom to #104 in Table S1.
Figure S4. Fayalite pressure calculated from Eq. 3 as a function of pressure from NaCl unit-cell volumes. Grey line shows 1:1 ratio.
Table S1: Pressure and stress data obtained from X-ray diffraction on Fa and NaCl. $P_{\text{Fa}}$ is corrected for differential stress following Eq. 3. $P_{\text{NaCl}}$ is the pressure from Brown’s EoS (1999), $t_{\text{Fa}}$ and $t_{\text{NaCl}}$ are stresses calculated using the Singh’s method (Singh et al., 1998). The # column is the Fa diffraction reference number.

| #  | $P_{\text{Fa}}$ (GPa) | $P_{\text{NaCl}}$ (GPa) | $t_{\text{NaCl}}$ (GPa) | $t_{\text{Fa}}$ (GPa) |
|----|-----------------------|--------------------------|--------------------------|-----------------------|
| 20 | 4.91 ± 0.43           | 4.79 ± 0.37              | −0.022 ± 0.014           | −0.20 ± 0.05          |
| 22 | 4.28 ± 0.34           | 4.08 ± 0.27              | −0.047 ± 0.014           | −0.35 ± 0.06          |
| 24 | 3.69 ± 0.29           | 3.40 ± 0.20              | −0.064 ± 0.031           | −0.51 ± 0.06          |
| 26 | 3.24 ± 0.24           | 2.87 ± 0.15              | −0.116 ± 0.027           | −0.67 ± 0.06          |
| 28 | 4.82 ± 0.41           | 4.68 ± 0.34              | 0.058 ± 0.013            | −0.15 ± 0.06          |
| 30 | 4.12 ± 0.32           | 3.89 ± 0.24              | −0.033 ± 0.014           | −0.37 ± 0.06          |
| 32 | 3.55 ± 0.27           | 3.19 ± 0.17              | −0.068 ± 0.019           | −0.60 ± 0.08          |
| 34 | 3.34 ± 0.27           | 2.96 ± 0.15              | −0.126 ± 0.033           | −0.70 ± 0.08          |
| 38 | 6.76 ± 0.65           | 7.00 ± 0.56              | 0.057 ± 0.013            | 0.41 ± 0.08           |
| 39 | 6.82 ± 0.65           | 7.05 ± 0.56              | 0.057 ± 0.015            | 0.40 ± 0.07           |
| 42 | 6.47 ± 0.56           | 6.68 ± 0.49              | 0.021 ± 0.013            | 0.33 ± 0.06           |
| 44 | 6.08 ± 0.51           | 6.26 ± 0.42              | −0.013 ± 0.013           | 0.26 ± 0.07           |
| 46 | 5.79 ± 0.46           | 5.88 ± 0.37              | −0.033 ± 0.018           | 0.10 ± 0.07           |
| 48 | 5.47 ± 0.41           | 5.49 ± 0.32              | −0.047 ± 0.017           | −0.02 ± 0.07          |
| 50 | 5.19 ± 0.37           | 5.13 ± 0.28              | −0.073 ± 0.023           | −0.15 ± 0.07          |
| 52 | 4.96 ± 0.34           | 4.87 ± 0.26              | −0.092 ± 0.024           | −0.23 ± 0.06          |
| 56 | 6.55 ± 0.64           | 6.76 ± 0.53              | 0.065 ± 0.012            | 0.37 ± 0.09           |
| 58 | 6.17 ± 0.54           | 6.34 ± 0.46              | 0.012 ± 0.015            | 0.27 ± 0.06           |
| 60 | 5.83 ± 0.49           | 5.94 ± 0.40              | −0.025 ± 0.015           | 0.15 ± 0.07           |
| 62 | 5.49 ± 0.45           | 5.53 ± 0.35              | −0.047 ± 0.016           | 0.01 ± 0.08           |
| 64 | 5.12 ± 0.38           | 5.12 ± 0.30              | −0.074 ± 0.018           | −0.07 ± 0.06          |
| 66 | 4.83 ± 0.37           | 4.76 ± 0.26              | −0.085 ± 0.025           | −0.19 ± 0.08          |
| 68 | 4.64 ± 0.33           | 4.53 ± 0.24              | −0.103 ± 0.025           | −0.28 ± 0.07          |
| 72 | 5.96 ± 0.58           | 6.12 ± 0.48              | 0.076 ± 0.016            | 0.31 ± 0.08           |
| 74 | 5.58 ± 0.51           | 5.69 ± 0.41              | 0.023 ± 0.011            | 0.19 ± 0.09           |
| 76 | 5.23 ± 0.46           | 5.29 ± 0.35              | −0.021 ± 0.017           | 0.07 ± 0.09           |
| 78 | 4.89 ± 0.40           | 4.89 ± 0.30              | −0.042 ± 0.020           | −0.04 ± 0.08          |
| 80 | 4.55 ± 0.34           | 4.48 ± 0.26              | −0.070 ± 0.014           | −0.18 ± 0.07          |
| 82 | 4.25 ± 0.33           | 4.11 ± 0.22              | −0.098 ± 0.023           | −0.31 ± 0.08          |
| 84 | 4.03 ± 0.30           | 3.83 ± 0.20              | −0.118 ± 0.025           | −0.42 ± 0.07          |
| 88 | 5.33 ± 0.48           | 5.42 ± 0.42              | 0.057 ± 0.013            | 0.20 ± 0.05           |
| 90 | 4.91 ± 0.44           | 4.97 ± 0.36              | 0.012 ± 0.011            | 0.10 ± 0.08           |
| 92 | 4.57 ± 0.39           | 4.57 ± 0.30              | −0.028 ± 0.023           | −0.03 ± 0.06          |
| 94 | 4.22 ± 0.33           | 4.17 ± 0.26              | −0.047 ± 0.017           | −0.13 ± 0.05          |
| 96 | 3.90 ± 0.32           | 3.78 ± 0.22              | −0.054 ± 0.015           | −0.24 ± 0.09          |
| 98 | 3.60 ± 0.26           | 3.42 ± 0.19              | −0.089 ± 0.021           | −0.35 ± 0.05          |
|100| 3.42 ± 0.24           | 3.18 ± 0.16              | −0.105 ± 0.028           | −0.46 ± 0.05          |
|104| 4.57 ± 0.44           | 4.62 ± 0.36              | 0.050 ± 0.011            | 0.13 ± 0.07           |
|106| 4.20 ± 0.37           | 4.21 ± 0.30              | −0.001 ± 0.013           | 0.02 ± 0.06           |
|108| 3.86 ± 0.31           | 3.82 ± 0.25              | −0.020 ± 0.012           | −0.08 ± 0.05          |
|110| 3.52 ± 0.28           | 3.42 ± 0.21              | −0.034 ± 0.017           | −0.18 ± 0.05          |
|112| 3.23 ± 0.25           | 3.05 ± 0.17              | −0.046 ± 0.020           | −0.33 ± 0.05          |
|116| 2.76 ± 0.20           | 2.46 ± 0.13              | −0.075 ± 0.039           | −0.53 ± 0.04          |

(To be continued)
| #  | $P_{Fa}$ (GPa) | $P_{NaCl}$ (GPa) | $t_{NaCl}$ (GPa) | $t_{Fa}$ (GPa) |
|----|----------------|-----------------|-----------------|--------------|
| 120| 3.57 ± 0.33    | 3.58 ± 0.27     | 0.050 ± 0.013   | 0.06 ± 0.05  |
| 122| 3.22 ± 0.27    | 3.18 ± 0.22     | 0.004 ± 0.011   | −0.05 ± 0.04 |
| 124| 2.92 ± 0.22    | 2.81 ± 0.18     | −0.012 ± 0.011  | −0.17 ± 0.03 |
| 126| 2.61 ± 0.20    | 2.44 ± 0.15     | −0.024 ± 0.015  | −0.27 ± 0.04 |
| 128| 2.31 ± 0.18    | 2.09 ± 0.12     | −0.045 ± 0.016  | −0.38 ± 0.04 |
| 130| 2.05 ± 0.17    | 1.77 ± 0.09     | −0.067 ± 0.023  | −0.50 ± 0.05 |
| 132| 1.87 ± 0.15    | 1.53 ± 0.08     | −0.091 ± 0.026  | −0.59 ± 0.04 |
| 136| 2.55 ± 0.22    | 2.42 ± 0.16     | 0.051 ± 0.011   | −0.14 ± 0.05 |
| 138| 2.20 ± 0.19    | 2.05 ± 0.12     | −0.010 ± 0.010  | −0.24 ± 0.05 |
| 140| 1.91 ± 0.16    | 1.67 ± 0.09     | −0.037 ± 0.021  | −0.40 ± 0.05 |
| 142| 1.60 ± 0.14    | 1.30 ± 0.07     | −0.065 ± 0.017  | −0.51 ± 0.05 |
| 144| 1.40 ± 0.13    | 1.06 ± 0.05     | −0.085 ± 0.023  | −0.59 ± 0.05 |
| 148| 1.78 ± 0.14    | 1.59 ± 0.10     | 0.042 ± 0.014   | −0.23 ± 0.03 |
| 150| 1.44 ± 0.13    | 1.23 ± 0.07     | −0.032 ± 0.010  | −0.34 ± 0.05 |
| 152| 1.13 ± 0.10    | 0.87 ± 0.05     | −0.077 ± 0.011  | −0.48 ± 0.04 |
| 154| 0.94 ± 0.12    | 0.62 ± 0.03     | −0.102 ± 0.024  | −0.58 ± 0.06 |
| 156| −0.02 ± 0.05   | 0.00 ± 0.00     | 0.024 ± 0.013   | 0.05 ± 0.04  |
References

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Singh, A., Balasingh, C., Mao, H.-k., Hemley, R., and Shu, J.: Analysis of lattice strains measured under nonhydrostatic pressure, J. Appl. Phys., 83, 7567–7575, 1998.