



*Supplement of*

**Elasticity of  $\text{CaSiO}_3$ – $\text{CaTiO}_3$  perovskite at lower-mantle pressures**

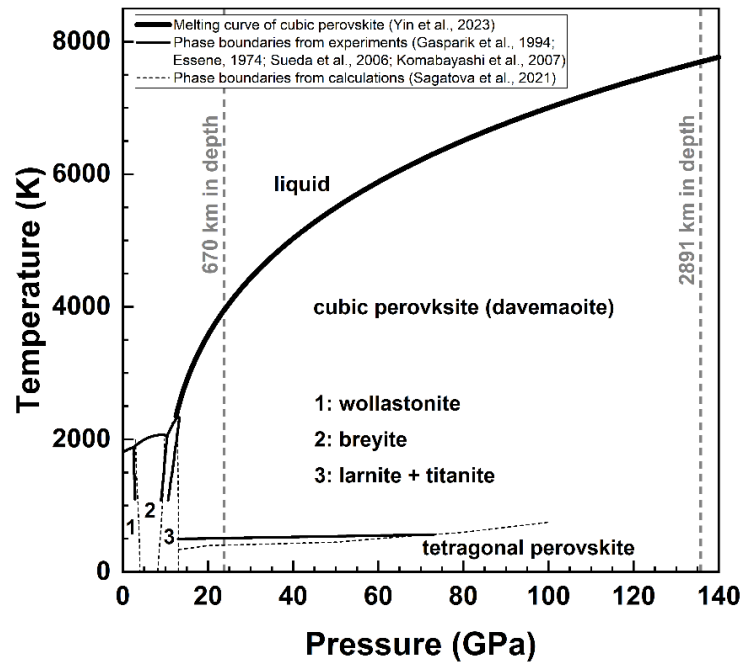
**Ye Wu**

*Correspondence to:* Ye Wu (yew@whut.edu.cn)

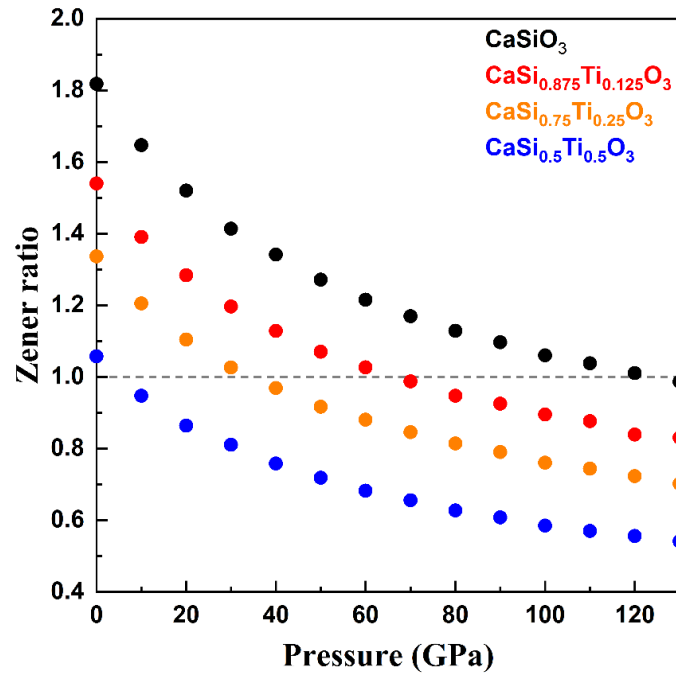
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**Table S1**  $C_{ij}$  matrices of  $\text{CaSiO}_3$ ,  $\text{CaSi}_{0.875}\text{Ti}_{0.125}\text{O}_3$ ,  $\text{CaSi}_{0.75}\text{Ti}_{0.25}\text{O}_3$ , and  $\text{CaSi}_{0.5}\text{Ti}_{0.5}\text{O}_3$  at 30 GPa and 130 GPa.

| <b><math>\text{CaSiO}_3</math> (30 GPa)</b>                                 |        |        |        |        |        | <b><math>\text{CaSiO}_3</math> (130 GPa)</b>                                 |         |         |        |        |        |
|-----------------------------------------------------------------------------|--------|--------|--------|--------|--------|------------------------------------------------------------------------------|---------|---------|--------|--------|--------|
| 622.23                                                                      | 242.59 | 242.59 | 0      | 0      | 0      | 1248.88                                                                      | 455.13  | 455.13  | 0      | 0      | 0      |
| 241.94                                                                      | 621.95 | 241.94 | 0      | 0      | 0      | 455.21                                                                       | 1249.19 | 455.21  | 0      | 0      | 0      |
| 243.17                                                                      | 243.17 | 622.99 | 0      | 0      | 0      | 455.40                                                                       | 455.40  | 1249.13 | 0      | 0      | 0      |
| 0.04                                                                        | 0.03   | 0.03   | 268.35 | 0      | 0      | 0.04                                                                         | -0.10   | -0.10   | 391.53 | 0      | 0      |
| 0.17                                                                        | 0.20   | 0.17   | 0      | 268.35 | 0      | 0.27                                                                         | 0.31    | 0.27    | 0      | 391.46 | 0      |
| -1.81                                                                       | -1.81  | -1.56  | 0      | 0      | 268.32 | -0.10                                                                        | -0.10   | -0.07   | 0      | 0      | 391.61 |
| <b><math>\text{CaSi}_{0.875}\text{Ti}_{0.125}\text{O}_3</math> (30 GPa)</b> |        |        |        |        |        | <b><math>\text{CaSi}_{0.875}\text{Ti}_{0.125}\text{O}_3</math> (130 GPa)</b> |         |         |        |        |        |
| 627.64                                                                      | 230.98 | 230.98 | 0      | 0      | 0      | 1260.22                                                                      | 440.57  | 440.57  | 0      | 0      | 0      |
| 230.98                                                                      | 627.62 | 230.98 | 0      | 0      | 0      | 440.57                                                                       | 1260.22 | 440.57  | 0      | 0      | 0      |
| 230.98                                                                      | 230.98 | 627.63 | 0      | 0      | 0      | 440.58                                                                       | 440.58  | 1260.24 | 0      | 0      | 0      |
| -0.01                                                                       | 0      | 0      | 237.34 | 0      | 0      | 0.01                                                                         | 0.01    | 0.01    | 340.48 | 0      | 0      |
| -0.01                                                                       | 0      | -0.01  | 0      | 237.33 | 0      | 0.01                                                                         | 0.01    | 0.01    | 0      | 340.48 | 0      |
| -0.02                                                                       | -0.02  | -0.01  | 0      | 0      | 237.34 | 0.01                                                                         | 0.01    | 0.02    | 0      | 0      | 340.49 |
| <b><math>\text{CaSi}_{0.75}\text{Ti}_{0.25}\text{O}_3</math> (30 GPa)</b>   |        |        |        |        |        | <b><math>\text{CaSi}_{0.75}\text{Ti}_{0.25}\text{O}_3</math> (130 GPa)</b>   |         |         |        |        |        |
| 633.76                                                                      | 221.08 | 221.08 | 0      | 0      | 0      | 1271.54                                                                      | 426.13  | 426.13  | 0      | 0      | 0      |
| 221.10                                                                      | 633.81 | 221.10 | 0      | 0      | 0      | 426.13                                                                       | 1271.54 | 426.13  | 0      | 0      | 0      |
| 221.09                                                                      | 221.09 | 633.80 | 0      | 0      | 0      | 426.14                                                                       | 426.14  | 1271.53 | 0      | 0      | 0      |
| 0.02                                                                        | 0.01   | 0.01   | 211.81 | 0      | 0      | 0                                                                            | 0.09    | 0.09    | 296.79 | 0      | 0      |
| -0.01                                                                       | 0.01   | -0.01  | 0      | 211.76 | 0      | 0.02                                                                         | -0.17   | 0.02    | 0      | 296.80 | 0      |
| 0                                                                           | 0      | 0.01   | 0      | 0      | 211.76 | -0.03                                                                        | -0.03   | -0.22   | 0      | 0      | 296.81 |
| <b><math>\text{CaSi}_{0.5}\text{Ti}_{0.5}\text{O}_3</math> (30 GPa)</b>     |        |        |        |        |        | <b><math>\text{CaSi}_{0.5}\text{Ti}_{0.5}\text{O}_3</math> (130 GPa)</b>     |         |         |        |        |        |
| 630.81                                                                      | 206.62 | 206.62 | 0      | 0      | 0      | 1281.07                                                                      | 405.94  | 405.94  | 0      | 0      | 0      |
| 206.62                                                                      | 630.81 | 206.62 | 0      | 0      | 0      | 405.93                                                                       | 1281.06 | 405.93  | 0      | 0      | 0      |
| 206.67                                                                      | 206.67 | 630.76 | 0      | 0      | 0      | 405.94                                                                       | 405.94  | 1281.07 | 0      | 0      | 0      |
| 0.06                                                                        | 0.06   | 0.06   | 171.98 | 0      | 0      | 0.01                                                                         | 0.01    | 0.01    | 236.89 | 0      | 0      |
| -0.09                                                                       | -0.14  | 0.09   | 0      | 172.22 | 0      | 0                                                                            | 0.01    | 0       | 0      | 236.89 | 0      |
| -0.11                                                                       | -0.11  | -0.11  | 0      | 0      | 172.00 | 0                                                                            | 0       | 0.01    | 0      | 0      | 236.88 |



**Figure S1.** The P-T phase diagram of  $\text{CaSiO}_3$ . Phase boundaries of  $\text{CaSiO}_3$  solid phases from experiments and predictions are plotted in solid and dashed lines, respectively (Essene, 1974; Gasparik et al., 1994; Komabayashi et al., 2007; Sagatova et al., 2021; Sueda et al., 2006). The thick solid line is the predicted melting curve of cubic perovskite (davemaoite) (Yin et al., 2023).



**Figure S2.** Zener ratios of cubic  $\text{CaSiO}_3$ - $\text{CaTiO}_3$  perovskites at high pressures. Black, red, orange, and blue circles represent  $\text{CaSiO}_3$ ,  $\text{CaSi}_{0.875}\text{Ti}_{0.125}\text{O}_3$ ,  $\text{CaSi}_{0.75}\text{Ti}_{0.25}\text{O}_3$ , and  $\text{CaSi}_{0.5}\text{Ti}_{0.5}\text{O}_3$ , respectively. The dashed line indicates elastic isotropy.