Thermal Equation of State of Aluminum and Iron Enriched Silicate Perovskite *	X17B1

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The orthorhombic silicate perovskite is generally accepted to be the most dominant phase in Earths lower mantle. Accurate determination of its equation of state (EOS) is of fundamental importance for developing compositional and mineralogical models of the Earths interior. The EOS of (Fe,Mg)SiO_3 perovskite has been measured extensively ([1] and references therein), and the current interest has been focused on the role of Al and Fe^{3+} substitution in the perovskite structure. Indeed, in a recent study [2], the Al substitution in the perovskite structure has been demonstrated to have a significant effect on its thermal and elastic properties. This new finding requires adjustments in other components to match the perovskite properties with seismic observations. The effects of the simultaneous presence of Fe^{3+} and Al on the equation of states of the perovskite phase are important but still unknown.

In this study, pressure-volume-temperature measurements were carried out on two perovskite specimens with different concentrations of Al and Fe, synthesized at 27 GPa and 1973 K. The two-perovskite samples were loaded in boron-nitride capsules, separated by NaCl, which also served as internal pressure standard. The samples were first compressed at room temperature to 11 GPa, followed by heating to the maximum temperature of 873 K. Data were collected at 873 K and on cooling to minimize errors resulting from nonhydrostatic stress. This procedure was repeated 7-8 times at lower pressures to obtain sufficient data points for the EOS determination.

References:

[1] Fiquet G. et al., Phys. Earth. Planet. Int. 105, 21-31, 1998
[2] Zhang J. and Weidner, D.J. Science, 284, 782-784, 1999

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