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下部マントル圧力下でのカルシウムシリケイトペロフスカイトの弾性波速度測定と最下部マントルの地震学的異常の解釈
Sound velocity measurements of CaSiO3 perovskite to 133 GPa and implications for lowermost mantle seismic anomalies

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We report the measurements of aggregate shear velocity (VS) of CaSiO3 perovskite (CaPv) at high pressure (P) between 33 and 133 GPa and room temperature (T) on the basis of Brillouin spectroscopy. The sample had a tetragonal perovskite structure throughout the experiments. The measured P?VS data show the shear modulus and its pressure derivative at ambient condition to be G0 = 115.8 GPa and G' = 1.20, respectively. The zero-pressure shear velocity is determined to be VS0 = 5.23 km/sec, in good agreement with the previous estimate inferred from ultrasonic measurements on Ca(Si,Ti)O3 perovskite at 1 bar. Our experimental results are also generally consistent with earlier calculations on tetragonal CaPv. According to the very recent predictions, such tetragonal CaPv has similar velocities to the cubic phase. These indicate that shear and longitudinal velocities of CaPv are much lower than those of the other lower mantle minerals such as MgSiO3-rich perovskite and ferropericlase. While primitive mantle includes certain amount of CaPv, a depleted peridotite (former harzburgite) layer in subducted oceanic lithosphere is deficient in CaPv and enriched in ferropericlase in the lower mantle. Such harzburgite exhibits 1.2% faster VS and 0.8% slower bulk sound velocity (VB) than the primitive mantle at lowermost mantle P-T conditions. The observed fast VS and slow VB anomalies in the D" layer underneath the circum-Pacific region may be attributed in large part to the presence of subducted harzburgitic materials.

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