Single-crystal elastic properties of $Mg_{0.88}Fe_{0.12}Si_{0.09}Al_{0.11}O_3$ – bridgmanite at high pressure

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$MgSiO_3$ bridgmanite is widely accepted to be the dominant phase in the Earth's lower mantle where it coexists with ferropericlase. Chemical substitutions in $MgSiO_3$ bridgmanite involving Al and Fe may contribute to seismic velocity anomalies observed in the Earth's lower mantle [1-3]. The effect of these substitutions on the elastic properties of bridgmanite at high pressures and temperatures need to be better constrained experimentally in order to interpret seismic data.

In this study two differently oriented single-crystals of magnesium silicate brigmanite containing some Fe and Al have been double-side polished and cut using the focused ion beam (FIB) technique as two semi-disks. Both semi-disks were loaded in one diamond anvil cell with helium as a pressure medium. Simultaneous measurements of density and sound velocities have been made on both crystals at high pressures and room temperature using single-crystal X-ray diffraction and Brillouin spectroscopy in order to obtain self-consistent data, which do not depend on a pressure scale. The data at each pressure were fitted for both crystals simultaneously in order to reduce correlations of Cij constants. The orientation matrix and cell parameters for each crystal at every pressure point were refined using in-situ x-ray diffraction measurements. From sample densities obtained from x-ray diffraction data and simultaneous measurements of the adiabatic bulk modulus obtained from Brillouin measurements, it was possible to calculate the absolute pressure for all our experimental points. This approach allowed the elastic properties of bridgmanite to be determined as a function of primary pressure, i.e. without resort to a secondary pressure standard. This consequently provides a more reliable data set to be compared with seismic data for the lower mantle.

[1] Ni *et al.* (2005), *Geophys. J. Int.* **161**, 283–294. [2] Masters *et al.* (2000), *AGU Monograph Series*, **117**, 63–87. [3] Garnero *et al.* (2005), *The Geological Society of America Special Paper,* **430**, 79–101.