Internally consistent high-pressure elasticity of single-crystal $(Mg,Fe)_2SiO_4$ wadsleyite

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The interpretation of seismic observations related to the upper layer of the transition zone in Earth's mantle requires detailed knowledge about the elastic behavior of wadsleyite, β-$(Mg,Fe)_2SiO_4$. However, the effect of iron on the elastic moduli of wadsleyite remains controversial between different experimental approaches [1].

We will present internally consistent high-pressure measurements of the elastic constants for wadsleyite with a chemical composition relevant for the transition zone ($(Mg_{0.89}Fe_{0.11})_2SiO_4$, 0.2 wt-% H_2O) using Brillouin spectroscopy and single-crystal X-ray diffraction. Semicircular disks were cut from perpendicularly oriented single-crystal thin sections with a focused ion beam [2], and two platelets of complementary orientations were loaded together into the same pressure chamber of a diamond-anvil cell (fig. 1). In this way, uncertainties inherent to multiple cell loadings can be avoided, and correlations between individual elastic constants are reduced.

The obtained elastic constants of wadsleyite are internally consistent and will provide improved constraints on the compositional effects on elastic moduli and elastic anisotropy.

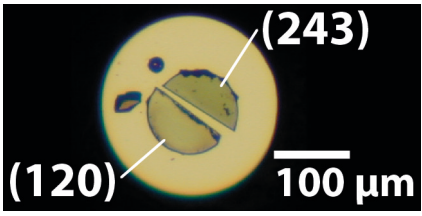

Figure 1: View into the sample chamber of a diamond-anvil cell loaded with two semicircular disks cut from wadsleyite single crystals with indicated orientations; also visible are a ruby sphere (top) and a chip of Sm:YAG (left) for pressure determination.

[1] Wang, Bass & Katsura (2014), *Phys. Earth Planet. Inter.* **228**, 92-96. [2] Marquardt & Marquardt (2012), *Am. Mineral.* **97**, 299-304.