The 514th Geodynamics Seminar

Sound velocities of Al,Fe-bearing bridgmanite in the Earth's lower mantle

Dr. Steeve Gréaux

(WPI postdoctoral fellow, ELSI-ES, GRC)

EHIME UNIVERSITY GRC GEODYNAMICS RESEARCH CENTER

2019.4.12 (Fri.)

Meeting Room #486, Science Research Bldg. 1, Ehime Univ.

Bridgmanite, formerly known as magnesium silicate perovskite is the most abundant mineral in the Earth's mantle, representing about 75% of the volume of the lower mantle, in between depths of 660 km and ~2700 km. Analyses of inclusions in deep diamonds combined with the results of high-pressure experimental studies suggested that natural bridgmanite may contain about 10% Fe^{2+}/Fe^{3+} and 5-7% Al_2O_3 in its structure. Therefore, because of its importance, there have been an extensive number of experimental and theoretical studies to obtain elasticity data on (Al,Fe)-bearing bridgmanite. Despite such efforts there are still only few experimental studies reporting the sound velocities of (Al,Fe)-bridgmanite because such measurements remain technically difficult. Recently, Kurnosov, et al. (2017) suggested that a high Fe^{3+}/Fe^{2+}ratio is required to match Preliminary Reference Earth Model (PREM) seismic profiles at depths lower than 1200 km on the basis of Brillouin measurements on (Al,Fe)-bearing bridgmanite single-crystal up to 40 GPa. But these conclusions were based on high-pressure measurements at room temperature, requiring a certain degree of assumptions on the temperature dependences of Bridgmanite's velocities. Here we present P- and S-wave velocity as well as density measurements on Al,Fe-bearing bridgmanite aggregates up to 30 GPa and 1400 K. The adiabatic bulk and shear moduli as well as their pressure and temperature derivatives were determined and compared with the existing literature. The seismic model derived from our velocities is discussed relative to the role of chemical composition on the elasticity of bridgmanite and its implication for the bulk composition of the Earth's lower mantle.

Contact : Masayuki Nishi, Ph.D. (e-mail: nishi@sci.ehime-u.ac.jp)