The effect of iron on the elastic properties of wadsleyite at the transition zone condition

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Wadsleyite is believed to be the major component in the upper part of the transition zone. To interpret seismic models in terms of mineralogy and chemical composition, the elastic bulk and shear moduli of wadsleyite and its derivatives as a function of pressure, temperature and Fe concentration are the critical parameters in extrapolating laboratory results to mantle conditions. However, former studies [ex. *Liu et al.* , 2009] on wadsleyite were performed at low pressure (<12 GPa) and temperature (<1100 K) and their extrapolations to the seismic models in transition zone condition are difficult because derivatives of the elastic moduli function to pressure and temperature are non-linear. On the other hand, Fe effect on the seismic velocities has never been systemically studied and poorly constrained.
In this study, we employed ultrasonic method combined with multi-anvil apparatus and in-situ X-ray observations developed by *Higo et al.* [2008] to investigate the elastic properties of wadsleyite at high temperature and pressure. The elastic bulk and shear moduli with diverse Fe concentration (Fe#=0 and 10) have been determined up to 1700K and 20 GPa. Based on our results, derivatives of seismic velocities observed among locations at the transition zone depth could be explained by Fe content variation in wadsleyite except the wedge mantle, which is consistent with the conclusion from electrical conductivities [*Yoshino et al.*, 2009].

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