The 5th Global-COE (23rd GRC) International Frontier Seminar

March 3rd, 2009, from 16:00, at the room #101

Effects of hydration on the elastic properties of transition zone minerals

Prof. Steven D. Jacobsen

Department of Earth and Planetary Sciences, Northwestern University, USA

Water, dissolved as hydroxyl into the solid silicate minerals of the upper mantle, can reduce elastic wave speeds through associated defects. Efforts are underway to use new mineral physics data on how hydration affects mineral elasticity to interpret regional seismic tomography images showing potential spatial variability in mantle hydrogen content. Because the water storage capacity of olivine, wadsleyite, and ringwoodite approaches one weight percent at depths of 300-660 km, the effects of hydration on the elastic properties of transition zone minerals are needed to evaluate seismic anomalies that are not easily explained by temperature anomalies alone. I review recent and forthcoming mineral physics data on the high-pressure elastic properties of hydrous olivine, hydrous wadsleyite, and hydrous ringwoodite measured using Brillouin spectroscopy and GHz-ultrasonic interferometry. Beneath the eastern US, a recent tomographic study [*Van der Lee et al., 2008, EPSL 273, 15-27*] reveals a large low S-wave anomaly above subducted oceanic lithosphere, which is interpreted to have derived from subducted oceanic lithosphere during Farallon subduction from west. Because the eastern-US tomography study is situated away from active plate boundaries and known sources of heat anomalies, the region provides an ideal location to test hydration effects on mineral velocities through forward modeling of the mineral physics data. Elevated pressure derivatives of the moduli for hydrated mantle phases reduces expected anomalies at depth and predicts possible velocity crossovers at 3-5 GPa for olivine and 8-12 GPa for wadsleyite and ringwoodite. The results suggest that low-velocity anomalies above subducted slabs beneath 300 km depth, if explained by hydration, require major influence of anelasticity. Alternatively, one may interpret the low-velocity anomalies as caused by factors other than hydration.

3 March 2009 16:00-17:00
Room 101, Kogi-to Bldg
Faculty of Science
Ehime University

Global COE
DEEP EARTH MINERALOGY
EHIME UNIVERSITY JASRI, UNIV.TOKYO, SBU
EHIME UNIVERSITY
GRC
GEODYNAMICS RESEARCH CENTER

Contact: T. Irifune
irifune@dpc.ehime-u.ac.jp
http: //www.ehime-u.ac.jp/~grc