Geophysical Research Abstracts, Vol. 7, 00505, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00505

Influence of water on post-spinel transformation in a peridotite mantle: in situ X-ray diffraction study

K. Litasov (1), E. Ohtani (1), A. Sano (1), A. Suzuki (1), K. Funakoshi (2)

(1) Inst. Mineral. Petrol. Econ. Geol, Tohoku Univ., Sendai, Japan (2) SPring-8, Japan Synchrotron Radiation Research Inst., Kouto, Hyogo, Japan (klitasov@ganko.tohoku.ac.jp / Fax: +81-22-217-6662)

The 660-km seismic discontinuity in the Earth's mantle is identified with the transformation of ringwoodite ($(Mg,Fe)_2SiO_4$-spinel) to $(Mg,Fe)SiO_3$-perovskite and (Mg,Fe)O-ferropericlase. It was suggested using quench experiments that the transformation boundary has significant negative Clapeyron slope (-3 MPa/K, Ito and Takahashi, 1989) responsible for depressions and elevations of the 660-km discontinuity in subduction zones and hot mantle plumes. Recent *in situ* X-ray diffraction studies indicate that negative slope of the boundary is much gentler (-0.4 to -1.3 MPa/K) (Fei et al., 2004; Litasov et al., 2005). Therefore there must be other factors resulting in significant depth variations of the 660-km discontinuity. In this study, we present the phase relations in hydrous pyrolite by *in situ* X-ray diffraction measurements to examine the influence of water on post-spinel transformation.

Experiments were carried out using Speed-1500 multianvil apparatus installed at BL04B1 at synchrotron radiation facility 'SPring-8' (Hyogo, Japan). Starting materials were synthetic glass representing CMFAS-pyrolite. 2 wt.% H_2O was added as $Mg(OH)_2$ adjusting the proportion of MgO. The AgPd capsule was used as a sample container. Co-doped MgO was used as the pressure medium and a cylindrical $LaCrO_3$ was used as the heater. Temperature was monitored with a WRe thermocouple. Different equations of state for Au and MgO were used for pressure calibration.

We observed that the post-spinel phase boundary is shifted to higher pressures by 0.6 GPa at 1473 K relative to anhydrous peridotite (Litasov et al., 2005). This displacement corresponds to about 15 km on the depth scale. If we assume that subducting slabs contain significant amount of water (1-2 wt.%) the half of the depressions of 660

km (up to 690-700 km) may be affected by water rather than temperature. It is now well resolved also that olivine-wadsleyite phase transition shifts to the lower pressure by 1-2 GPa if we add water (Smyth and Frost, 2002; Litasov and Ohtani, 2003). These two factors may suggest that there is no very cold subducting slabs, colder than 1350 K at 25 GPa, descending to the deep mantle.