High pressure experiments of continental barzburgite:implications for X-discontinuity

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There is no consensus about origin of the X-discontinuity which is seismically observed at ˜300 km depth in the upper mantle (Deuss & Woodhouse, 2002) One of the possible candidate for the X-discontinuity is a phase transformation from orthopyroxene (Opx) to high pressure clinoenstatite (HP-CE) in depleted mantle composition (harzburgite). We studied nature of X-discontinuity by means of experimental petrology.

The PHN1569 is the most depleted continental harzburgite with largest amount of Opx. Synthetic PHN1569 continental harzburgite was used as a starting material. The starting material was synthesized from a mixture of reagents(SiO2,Al2O3,Cr2O3,Fe2O3,Mg

The high pressure experiments were conducted using a 1000ton multi anvil apparatus (SPI-1000) installed at Tokyo Institute of Technology.

Chemical compositions of minerals in recovered sample were analyzed by using EPMA. For identification of Opx and HP-CE, Raman spectrometer was used.

The Opx-HP-CE phase transformation occurred at around 10 GPa. Weight fraction of Opx (or HP-CE) at this pressure was about 40%.

Kung et al. (2005) determined the seismic velocities of Opx and HP-CE by in-situ ultrasonic measurements at high-P and high-T. Based on present results and the ultrasonic measurements (Kung et al., 2005), The jumps of seismic velocities are estimated to be ˜1.6% for Vp and ˜3.1% for Vs.

Therefore, there is possibility that Opx-HP-CE phase transition is responsible for the X-discontinuity at ˜300 km depth in depleted mantle.