High pressure and high temperature in situ X-ray observation of hydrous wadsleyite, $Mg_{1.75}SiO_4H_{0.5}$ under the condition of the mantle transition zone

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Preliminary high pressure and high temperature in situ X-ray observations of hydrous wadsleyite, $Mg_{1.75}SiO_4H_{0.5}$ were carried out using a combination of the synchrotron radiation and a large volume multianvil high pressure device (SPEED-1500). We made one run during this beam time.

Hydrous wadsleyite was, in advance, synthesized from the mixture of MgO, $Mg(OH)_2$ and SiO_2 powders as a composition of Mg/Si=1.75 and H_2O=5 wt % using a multi-anvil high pressure apparatus (ORENGE-2000) in Ehime University. The sample was sealed in Pt capsule to avoid H_2O loss during the experiment. The synthesis condition was 15 GPa, 1200℃ and 30 min. The recovered sample was characterized by a conventional x-ray diffraction and an EPMA. Almost crystals were hydrous wadsleyite, and a small amount of clinopyroxene was coexisted in the charge. The lattice parameters were a=8.252(1), b=11.550(3) and c=5.680(1)Å, respectively, and the chemical composition was ~1.8 of the Mg/Si and the deficit of EPMA weight total was ~3 wt%, which corresponds to the H_2O content.

In the in situ experiment, pressures were applied first at a ram load of 500 ton (~16GPa), and then temperatures were increased to 800℃ to release the deviatric stress (Fig. 1). In this experiment, NaCl was used as a pressure marker, and the pressures were calculated by Decker scale. After releasing the deviatric stress, the X-ray diffraction patterns of the sample were collected every 100℃ from 800℃ to room temperature for 300 seconds. Then we tried to release the pressure at 600 ℃ by decreasing the ram load from 500 to 250 ton (~15GPa), and collected the diffraction patterns at 800, 400, 200 and 25 ℃. In this beam time, two beam dumps were occurred (total 5 hours), so we can not collect enough data to determine the equation of state of hydrous wadsleyite. We will continue this type of experiments in the next beam time.

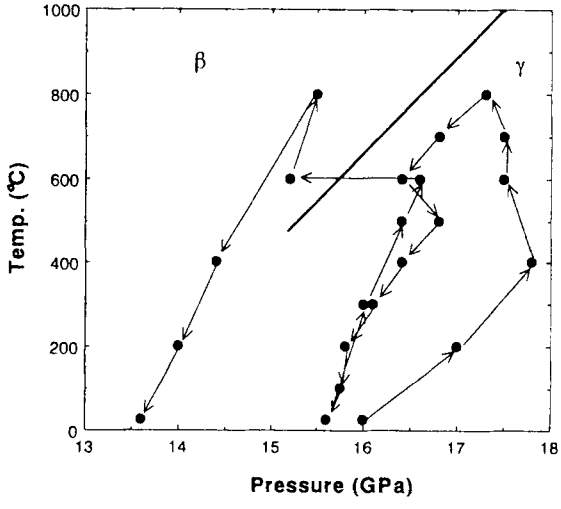

Fig. 1 P-T path in the present experiment. A bold line represents the β-γ phase boundary in Mg_2SiO_4 from Akaogi et al. (1989).