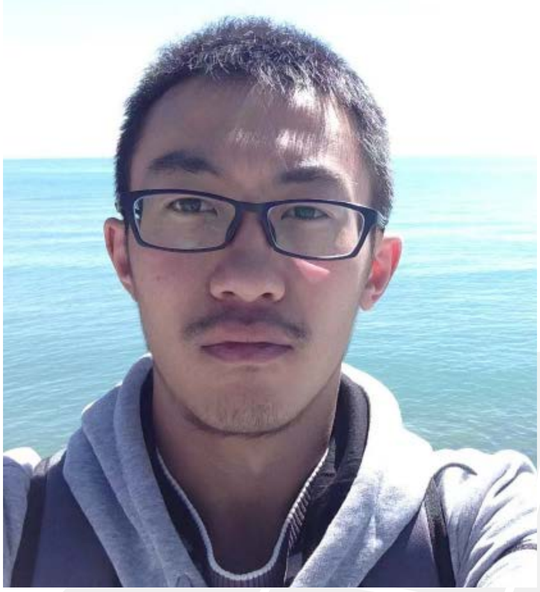
THE GEODYNAMICS SEMINAR № 604



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2023.12.01 (Fri.) 16:30 ~

Venue: Meeting Room #486

Science Research Bldg. 1, 4th floor.
Ehime Univ.

Keywords: 1. Phase D
2. Mantle transition zone
3. Seismic anisotropy

Crystallographic-preferred orientation of phase D at high pressure and high temperature and implications for seismic anisotropy in the mid-mantle

The lower mantle transition zone (LMTZ) and upper lower mantle (ULM) are known to be anisotropic. Although ringwoodite, composing 80% of the LMZ, is a prime candidate, it cannot fully explain these phenomena due to its elastic and plastic properties. Other minerals like bridgmanite, akimotoite, and phase D could play a significant role, especially under dominant dislocation creep. Investigating their rheological properties is crucial for understanding the dynamics of the deep mantle.

Phase D, a dense hydrous magnesium silicate, remains stable up to 2000 °C and 26 GPa, generating significant research interest as a potential water carrier to the lower mantle. However, experimental challenges have hindered rheological studies under deep mantle conditions.

In this study, a series of deformation experiments, including uniaxial and simple shear, were conducted to examine the Lattice Preferred Orientation (LPO) of phase D (both Mg-phase D and MgAl-phase D) under LMTZ conditions. The LPO, developed at 20 GPa and 800-1000 °C where dislocation creep predominates, suggests that the slip systems of phase D are <10-10>(0001) and <11-20>(0001), with the fabric strength being proportional to the strain. No preference was observed between these two slip directions, even with shear strain up to 1.5.

Our findings suggest that the observed seismic anisotropy in LMZ and ULM can be partly attributed to the LPO developed by deformation in subducting slabs, especially if higher strain could be obtained. Additionally, this study provides a plausible reference for high-pressure and temperature deformation experiments on hydrous minerals when using a multi-anvil apparatus."

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