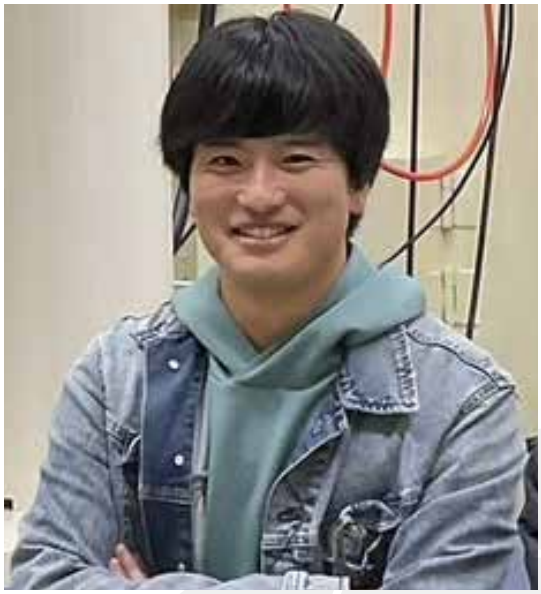
THE GEODYNAMICS SEMINAR

No 647



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2025.12.19 (Fri.) 16:30 ~

Venue: Meeting Room #486

Science Research Bldg. 1, 4th floor.

Ehime Univ.

Keywords

1. Deep earthquake
2. Olivine phase transition
3. Ringwoodite

Deformation of metastable olivine under the pressure-temperature conditions of the deep subducted slabs

The frequency of deep-focus earthquakes increases with depth from ~400 km to a peak at ~600 km. This increase is caused by the faulting triggered by the phase transition of olivine to wadsleyite (and/or ringwoodite) at the surface of the metastable olivine wedge (MOW) (Ohuchi et al., 2022). On the other hand, seismological observations show that the seismicity decreases abruptly at depths below ~600 km. This observation could be explained by the fact that MOW cannot survive at depths below 630 km because of the kinetic boundary of olivine-ringwoodite transition (Kubo et al., 2009). However, this hypothesis is still unclear because the number of previous experimental studies on mantle olivine are very limited due to the difficulty of the experimental techniques on high-pressure generation. In this study, we conducted in situ uniaxial deformation experiments on mantle olivine aggregates at pressures of 22-25 GPa and temperatures of 1120-1220 K (i.e., P-T conditions of deep subducted slabs) using a D-DIA apparatus at BL04B1/SPring-8. Acoustic emissions (AEs) were recorded by using six sensors glued on the sides of the second-stage anvils. Neither formation of faults nor vigorous AEs radiations were observed. Microstructures of the recovered samples showed the formation and interconnection of veins filled with the ringwoodite nanograins (diameter of 50-300 nm) on olivine subgrain/grain boundaries. Our results suggest that the olivine-ringwoodite transition under a significant overpressure (i.e., at depths below ~600 km) results in homogeneous deformation (i.e., absence of shear localization) due to the interconnection of veins filled with the ringwoodite nanograins.

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