Report for the Joint Use/Research of the Institute for Planetary Materials, Okayama University for FY2024

05/31/2025

Category: ☑International Joint Research ☐General Joint Research ☐Joint Use of Facility ☐Workshop

Name of the research project: Phase relations in MgO-SiO_2-FeO-Al_2O_3-H_2O systems up to uppermost lower mantle conditions: Towards understanding precise water cycle and distribution in the mantle.

Principal applicant: Jintao Zhu

Affiliated institution and department: School of Earth and Space science, Peking University

Collaborator

Name: Takayuki Ishii

Affiliated institution and department:

Research report:

Purpose:

To determine the phase relations of FeO-MgO-Al_2O_3-SiO_2-H_2O system and hydrous pyrolite system under water-undersaturated conditions.

Actually conducted research:

High pressure experiments under 12-27 GPa and 800-1400 °C;

X-ray diffraction analysis;

Back-scattered electron images observations.

Research outcomes:

We provide a new water distribution model in wet slabs under water-undersaturated condition. Water-undersaturated condition doesn't change dehydration

temperature much, but affect the pressure stability of hydrous minerals in MgO-SiO_2-H_2O systems. Addition of FeO, Al_2O_3 slightly increases the dehydration temperature. PhD has enlarged stability, but it will react with NAMs to form SuB at high temperature.

We have partly published our experimental results:

1) **J. Zhu**, R. Tao, T. Ishii, D. Ikuta, W. Xu, L. Zhang, Y. Su, R. Liu, Z. Jin. Iron hydride (FeH_x) as a crucial intermediate in transformation of subducted H_2O to abiotic H_2 in Earth's deep mantle, *SCIENCE CHINA Earth Sciences*, 2025, 68, https://doi.org/10.1007/s11430-024-1544-6.
2) T. Ishii, **J. Zhu**, E. Ohtani. Limited water contents of wadsleyite and ringwoodite coexisting with hydrous minerals in cold subducting slabs, *Earth and Planetary Science Letters*, 2025, 658, 119310. https://doi.org/10.1016/j.epsl.2025.119310.