【Grant-in-Aid for Scientific Research (S)】

Science and Engineering (Mathematical and Physical Sciences)

Title of Project : Physical properties of uppermost mantle structure and the Mohorovicic seismic discontinuity

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Research Area : Mathematical and Physical Sciences
Keywords : Earth and Planetary Science, Geology, Ocean-floor Science, Lithosphere, Mantle

【Purpose and Background of the Research】

We study the physical properties (e.g., the development of textures, elastic properties, electron conductivity, and permeability) of mantle-derived materials (i.e., rocks) such as trench peridotites in the Izu–Bonin–Mariana Trench and peridotites in the Oman ophiolite of the Arabian Peninsula in order to understand the structural development of the uppermost mantle and the Mohorovicic seismic discontinuity within the lithospheric mantle of Earth.

The trench peridotites in the Izu–Bonin–Mariana Trench preserve the uppermost mantle structures that formed during fore-arc spreading at the time of the initiation of subduction of the Pacific plate beneath the Philippine Sea plate.

The peridotites in the Oman ophiolite represent the uppermost lithospheric mantle of an oceanic plate that formed at a fast-spreading ridige such as those in the eastern part of the Pacific plate. We investigate the physical factors controlling the structural development of the uppermost mantle by comparing these two types of the peridotites.

【Research Methods】

We use a polarizing microscope to analyze thin sections of the peridotites oriented parallel to the lineation and perpendicular to the foliation, thereby revealing their microstructures, including grain size, grain shape, and mineral modes.

Electron microscopes can be used to measure the crystallographic orientations and chemical compositions of rock-forming minerals such as olivine, pyroxene, and spinel, by which we determine environmental conditions (e.g., temperature and pressure) as well as volatile contents (e.g., water and carbon dioxide).

In the field, we study the physical properties of the crust–mantle boundary by logging bore holes drilled by the Oman Drilling Project. We use the submersible *Shinkai6500* to explore the fore-arc mantle exposed at the deepest ocean floor in the Izu–Bonin–Mariana trench.

Our goal is to construct the best lithological model of the uppermost mantle based on these data.

【Expected Research Achievements and Scientific Significance】

We will obtain the most relevant data in Earth Science in terms of understanding the uppermost mantle and the Mohorovicic seismic discontinuity. We will then develop the most advanced physical model of the seismic velocity structure of oceanic plates, such as the Pacific plate, based on marine geophysical observations. Furthermore, we will support the Mantle Drilling Project, which aims to understand the uppermost lithospheric mantle of the Pacific plate, a typical oceanic plate on Earth.

【Publications Relevant to the Project】

Michibayashi, K. et al., **2016**. Natural olivine crystal-fabrics in the western Pacific convergence region: a new method to identify fabric type. ***Earth and Planetary Science Letters***, 443, 70-80.

Harigane, Y., **Michibayashi, K.** et al., **2013**. The earliest mantle fabrics formed during subduction zone infancy. ***Earth and Planetary Science Letters***, **377-378**, 106-113.

Michibayashi, K. and Oohara, T., **2013**. Olivine fabric evolution in a hydrated ductile shear zone at the Moho Transition Zone, Oman Ophiolite. ***Earth and Planetary Science Letters***, **377-378**, 299-310.

【Term of Project】 FY2016-2010

【Budget Allocation】 141,700 Thousand Yen

【Homepage Address and Other Contact Information】

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