

High-pressure deformation experiments on peridotite gouges under hydrothermal conditions, using a deformation-DIA apparatus

*仙場 真紀¹、平内 健一¹、大内 智博²、道林 克禎³

*Maki Semba¹, Ken-ichi Hirauchi¹, Tomohiro Ohuchi², Katsuyoshi Michibayashi³

1. 静岡大学理学部地球科学科、2. 愛媛大学地球深部ダイナミクス研究センター、3. 名古屋大学大学院環境学研究科地球環境科学専攻地質・地球生物学講座岩石鉱物学研究室

1. Department of Geosciences, Faculty of Science, Shizuoka University, 2. Geodynamics Research Center, Ehime University, 3. Department of Earth and Planetary Sciences, Nagoya university

In subducting oceanic plates, the focal depth of intraslab earthquakes is deeper (>40 km) than that of interplate earthquakes. Since the normal stress on faults (e.g., outer-rise faults) hosting the intraslab earthquakes is too high to generate brittle shear failure, there may be some mechanisms to weaken effective fault strength. In addition, the hypocenter distribution of intraslab earthquakes forms double-planed structure of the deep seismic zone, and the location of the lower plane is in accord with the stability limit of serpentine (antigorite), suggesting shear deformation of antigorite-bearing peridotite gouges in the presence of hydrothermal water. Here, in order to understand the influence of hydrous minerals on the fault strength, we performed deformation experiments on simulated peridotite gouges with compositions of dunite (100% olivine) and harzburgite (70% olivine/30% orthopyroxene) under hydrothermal conditions, using a deformation-DIA apparatus. The experiments were conducted at a temperature of 580°C, a confining pressure of 2.5 GPa, and shear strain rates of 2.70×10^{-5} to 1.03×10^{-4} s⁻¹. In the deformed peridotite gouges, localized shear zones such as R₁ and B shears were observed, and these shears were accompanied with newly formed hydrous phases (serpentine or talc). Olivine grains have a crystal preferred orientation characterized by a slip system of [001] (010). These results indicate that semi-brittle flow is a major deformation mechanism of the peridotite gouges. Considering low coefficients of friction of serpentine and talc, we can suggest that the infiltration of seawater along outer-rise fault planes and subsequent hydrothermal alteration result in effective shear strengths low enough to produce intraslab earthquakes.

キーワード：変形DIA装置、かんらん岩、蛇紋岩化作用、摩擦強度

Keywords: deformation-DIA apparatus, peridotite, serpentinization, frictional strength