Geodynamics Seminar

第328回ジオダイナミクスセミナー

Superplasticity in hydrous melt-bearing dunite: Implications for shear localization in Earth's upper mantle

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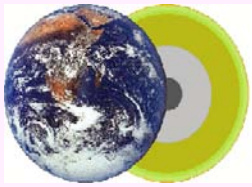
主催：愛媛大学地球深部ダイナミクス研究センター
日時：5/11（金）午後 4時30分～
場所：総合研究棟 4F 会議室



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Abstract

Deformation experiments on hydrous melt-bearing dunite (olivine + 4 vol.% orthopyroxene + 4 vol.% clinopyroxene with less than 2.5 vol.% of the melt phase) were conducted at pressures of 1.3−5.7 GPa and temperatures of 1270−1490 K in order to explore the effect of intergranular fluids on the plastic flow of olivine in Earth's upper mantle. The strain rate was proportional to steady-state creep strength to the 2.1 power, and the creep strength markedly increased with increase in grain size. Developments of the crystallographic preferred orientation of olivine and flattening of olivine grains were hardly observed even after 33−55 % shortening of the samples. These observations show that grain boundary sliding (GBS) dominated the deformation of olivine (i.e., superplasticity). The creep strength of hydrous melt-bearing dunite was 2−5 times lower than that of melt-free dunite. The dependence of creep rate on melt fraction is known to be expressed empirically as , where α is a constant and ϕ is the melt fraction. The experimentally obtained value of α was in the range of 150−230, corresponding to 5−7 times the reported values for the olivine−basalt system at 0.3 GPa (i.e., creep strength of dunite was efficiently reduced by the hydrous melt). Superplasticity is the dominant creep mechanism of olivine in fluid-bearing fine-grained peridotites under low-temperature and high-stress conditions (i.e., peridotite shear zones in the upper mantle). Superplasticity induced by geological fluids would play an important role in the shear localization (and thus initiation of subduction) in the upper mantle.

詳細は当センターホームページ: http://www.ehime-u.ac.jp/~grc/をご覧ください
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