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天然で変形したオリビンの転位芯に認められる鉄の濃集
Iron concentration around dislocation in naturally deformed olivine

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The concentration of specific atom on dislocation core can be caused by pipe diffusion and Cottrell atmosphere. Both the phenomena are important for the property of materials including rocks and minerals. As an example of the former, Fe concentration has been reported in the naturally deformed olivine (e.g. Plumper et al., 2011). Pipe diffusion is important for atomic migration during various reactions in the Earth, such as metasomatism and serpentinization. On the other hand, Kitamura et al. (1986) and Ando et al. (2001) have reported Fe concentration in the mantle-derived olivine caused by Cottrell atmosphere. The Cottrell atmosphere strongly influences plasticity of materials in the low strain rate regime. Therefore, the discovery of Cottrell atmosphere from the mantle-derived olivine indicates that the effect on the plasticity of olivine is important to understand mantle dynamics under very low strain rate condition. However, the possibility of pipe diffusion cannot be neglected completely to explain the observations of Kitamura et al. (1986) and Ando et al. (2001). Here, we carried out more detailed chemical composition analysis of the mantle-derived olivine to assess whether the Fe concentration on dislocation core is a common phenomenon, and to clarify the exact mechanism of the Fe concentration, *i.e.* Cottrell atmosphere or not.

We studied two types of peridotites, which are xenolith-type in basalt (Takashima, Megata, Kurose and Salt Lake) and alpine-type (Uenzaru and Horoman) by using EPMA and ATEM techniques. EPMA and ATEM analyses show Fe concentration at dislocations in all the studied samples, which suggests that it is a common phenomenon in mantle peridotites. Fe-enrichment at the rim of olivine grains and other major element concentration on dislocations, which are general features of pipe diffusion, cannot be observed. Therefore, the mechanism of Fe concentration on dislocation core in olivine grains is possibly derived by Cottrell atmosphere, not pipe diffusion.

Ando et al. (2001) Nature, 414, 893; Kitamura et al. (1986) Proc. Japan Acad., 62, 149; Plumper et al. (2011), Contributions to Mineralogy and Petrology, 163, 701.

Keywords: Cottrell atmosphere, olivine, dislocation