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# マントルウェッジにおけるかんらん岩の加水反応速度に関する実験的研究
# Experimental study on the hydration rates of peridotites in the mantle wedge condition

中谷 貴之 [1*], 中村 美千彦 [1]
Takayuki Nakatani[1*], Michihiko Nakamura[1]

[1] 東北大学大学院理学研究科地学専攻
[1]Department of Earth Science, Graduate School of Science, Tohoku University

Although hydration of mantle wedge is a key process in understanding the nature of magmatism in subduction zones, the hydration rate of peridotites has been poorly constrained. Two extreme cases can be considered in terms of equilibration degree between the fluid and rocks. The first is the equilibrium case, in which the hydration rate is fast and H2O is fixed as hydrous minerals as soon as the fluid is supplied. The other is the disequilibrium case, in which the fluid ascends without hydrating solid matrices. Based on a numerical model, Iwamori (1998) showed that distribution of H2O in subduction zones is significantly affected by the extent to which the fluid-rock interaction proceeds. The hydration rate of mantle rocks is thus a primary parameter in the control of H2O transport in subduction zones. In order to obtain the hydration rates of peridotites under mantle wedge conditions, we have conducted hydration experiments using a piston-cylinder apparatus at 580 degC and 1.3 GPa for 4-20 days. Starting materials were prepared from the crushed powder (75-125 micrometer in diameter) of a San Carlos lherzolite xenoliths. The starting materials were put in Ag capsules with 15 wt% distilled water.

In the experimental condition, antigorite (high-T serpentine) is expected to be the stable serpentine phase (Ulmer and Trommsdorff, 1995). We found with Raman spectroscopy, however, that the synthesized serpentine mineral was not antigorite but lizardite (low-T serpentine), which is consistent with its platy shape. The high Al2O3 content (6-9 wt%) in the serpentine mineral probably stabilized Al-lizardite to higher temperature (Caruso and Chernosky, 1979). The degree of reactions was obtained by measuring the area fractions of relict minerals on BSE images of polished surfaces of the run charges. The degree of reaction basically followed an interface controlled rate law. The migration velocity of reaction front, G, was estimated to be 1.23 - 3.18 micrometers per day.

By using these values and the estimated range of porous flow velocities, we obtained the nondimensional time for local chemical equilibration. It is inferred that the mostly complete hydration reaction can be established in the porous flow. This result indicates that slab-derived water should be fixed quickly in the convecting mantle wedge mainly as serpentine and carried down to ca. 150 km, i.e., the stability limit of antigorite or aluminous lizardite.

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