

# Melting experiment of hydrous peridotite and the mantle and the magma at early Earth

# Sachiko Kato[1]; Eiji Ohtani[2]; Tomoaki Kubo[1]; Tadashi Kondo[3]

[1] Tohoku Univ; [2] Institute of Mineralogy, Petrology, and Economic Geology, Tohoku University; [3] Sci., Tohoku Univ.

In the early stage of the Earth, partial melting might have occurred at higher pressures and fractionation of minerals while the cooling of the magma ocean might have made the layer structure of the Earth.

Ringwood (1979) and Abe and Matsui (1985) pointed out that there is a possibility of the existence of water in Magma Ocean. Therefore it is important to investigate the melting relation at high pressure under the hydrous conditions.

We conducted melting experiments of the primitive peridotite containing 2 wt% water, using the Kawai-anvil apparatus with 8 mm tungsten carbide edge length at Tohoku university. The pressure calibration curve used in this study is the ones reported by Asahara (1999). We synthesized the starting material of which composition is reported by Xue et al. (1990), and water is given as  $\text{Al}(\text{OH})_3$ . The double capsule with outer platinum capsule and inner rhenium capsule was used to enclose the water and prevent loss of Fe. AgPd or AuPd capsules were also used. Experiments were conducted at 4, 6 and 7 GPa and from 1250 to 1700 °C.

Liquidus phase is olivine at each pressure. Expansion of the stability field of opx was observed compared to the anhydrous peridotite (Walter, 1998). Solidus temperature decreases by about 200 °C compared to the dry solidus. We calculated the NiO partition coefficient of olivine/melt and it has a negative dependency in temperature. It means that NiO contents in olivine generated under hydrous and lower temperature conditions are high.

We considered the low-temperature cratonic peridotite that was generated in the Archean. The low-temperature cratonic peridotite has low contents of incompatible elements such as Fe and Al, and has a granular texture. Low-temperature cratonic peridotite in South Africa has much orthopyroxene; its average content is 32 wt% (Boyd and Merztnan, 1987). The partial melting of hydrous peridotite makes it possible to generate the residue that has the composition of low-temperature cratonic peridotite. Cratonic peridotite in South Africa is enriched in NiO, though the mode of olivine is low. The partition coefficient at low temperatures can explain the quantity of NiO in cratonic peridotite.

Opx contents in cratonic peridotite are different by locality; for example, the average content of Opx in cratonic peridotite in Canada is 12 wt% (Schmidberger and Francis, 1999). Cratonic peridotites that have low opx contents, were generated under the anhydrous condition, and those that have higher opx contents, was generated under the hydrous condition.

Therefore we can conclude that water was localized in the primitive mantle.