The genesis of low-temperature cratonic peridotite

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Low-temperature cratonic peridotite was generated in Archean, and its genesis is important for understanding the thermal state of primitive earth.

Low-T cratonic peridotite is enriched in SiO2, and the mode of opx is higher than upper mantle peridotites. Previous study suggested that low-T cratonic peridotite is a melting residue of anhydrous primitive peridotite at high pressure, and the extracted melt was komatiitic (Boyd, 1990). This can't explain the enrichment of SiO2 in residue. Melting experiment of pyrolite at hydrous conditions showed that opx is more stable than at the anhydrous condition (Mibe, 1994). So, we conducted melting experiments of primitive peridotite containing 2wt% water, using the Kawai-anvil apparatus. Experiments were conducted at 4 and 6 GPa, and from 1200 to 1700 ℃.

All of the run products are polished and compositions of the melt and crystals were identified with the wave dispersive electron microanalyzer and the energy dispersive electron microanalyzer. Modes of crystals and melt were determined by the mass balance calculation.

Solidus temperature of hydrous peridotite decreases by about 200 ℃ compared to the anhydrous peridotite. Expansion of the stability field of opx was observed, however, it is not clear whether water is effective or not due to absorption of iron into the capsule.

The residue has the low-T cratonic peridotitic composition and the melt was komatiitic in composition at 4 GPa, temperature range of 1300 to 1400 ℃, and 6 GPa, temperature range of 1500 to 1650 ℃.

Low-T cratonic peridotite is enriched in NiO, though the mode of opx is high. We calculated the NiO partition coefficient of olivine/melt and opx/melt at the hydrous condition and low temperature. The NiO partition coefficient of olivine/melt under the hydrous condition determined in this work is greater than that under the anhydrous condition (Taura et al., 1998). The NiO partition coefficient of olivine/melt might have negative temperature-dependency. The result implies that the NiO content in the opx-rich residual crystals at the hydrous and low temperature conditions is higher than that at the dry condition and high temperature. This supports the hydrous genesis of low-T cratonic peridotite.