

SIT040-P10

Room:Convention Hall

Time:May 23 10:30-13:00

## Melting experiment of hydrous upper mantle and origin of Mg- and Si-rich cratonic mantle

Mariko Iehisa<sup>1\*</sup>, Kyoko Matsukage<sup>1</sup>

<sup>1</sup>GRC.Ehime University

Mantle peridotite xenoliths from kimberlite pipes, which derived from the deep upper mantle up to ~250km depth from Archean cratons, give us some direct information about the geochemical evolution of crustal and mantle materials in interior of our planet. These peridotite xenoliths sometimes have unusual chemical, modal, and textural compositions (e.g., Boyd, 1989; Boullier and Nicolas, 1975). Garnet peridotites from more than 80 km in depth have quite different chemistry from shallow mantle, such as oceanic and arc area (e.g., Dick et al., 1984; Boyd, 1986; Arai, 1994). For example, in oceanic peridotites from mid-ocean ridges, the chemical variation of shallow mantle can be explained by process of partial melting of pyrolitic lherzolite and subsequent melt extraction at depth of 30-80 km. The estimated maximum degree of melting (~30 %) of residual peridotite and the chemical feature of the constituent minerals, that was depleted in incompatible element (SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO) with respect to compatible elements (MgO, Cr<sub>2</sub>O<sub>3</sub>), indicate that the partial melting occurred at almost dry condition. On the other hand, the cratonic peridotites mainly consist of olivine, orthopyroxene, garnet and clinopyroxene, and characterized the extremely high amount of orthopyroxene (= high amount of SiO<sub>2</sub> component) with high Mg# (= Mg/(Mg + Fe) atomic ratio) (e.g., Boyd, 1989). These high-Si and -Mg harzburgite/lherzolite could not explain as residue of dry partial melting and melt extraction process (Walter, 1998). Here, based on melting experiments at high pressure, we suggest possibilities of the Si- and Mg-rich cratonic peridotites as residues by partial melting of pyrolitic lherzolite at hydrous condition at depth of 200-300 km.

Starting material is a pyrolite + H<sub>2</sub>O. The powder of Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, CaCO<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub>, Cr<sub>2</sub>O<sub>3</sub>, Na<sub>2</sub>CO<sub>3</sub>, K<sub>2</sub>CO<sub>3</sub>, and NiO was mixed, and degas at 1273 K and the ambient pressure in atmosphere. Then it was melted at 1773 K and quenched to form glass in the reducing furnace where the oxygen fugacity was controlled to QFM buffer. Finally, powder of MgO and Mg(OH)<sub>2</sub> is added to be the water contents of starting material as 2wt% and 8wt%. Experiments were performed by using multi Anvil type high-pressure apparatus (ORENGE 1000) of the Ehime University at the temperature of 1273-1872 K at the pressure of 5GPa and 7GPa.

In our experimental conditions, All products show a partial melting. The residual mineral assemblage is olivine + opx + cpx + garnet at lower temperature. At the experiments with 2 wt% H<sub>2</sub>O, the solid phases resolved to liquid as a next order, cpx, garnet, opx and olivine. On the other hand, the experiments of 8 wt% H<sub>2</sub>O the stability field of opx become wider with increasing pressure. It is noted that the liquidus phase not become olivine but opx at 7GPa. Actually, the opx/ol ratio of cratonic mantle xenoliths is known to be higher than that of mantle xenolith in other regions, and our results imply that water greatly influenced continental generation in the early earth. If our conclusion is correct, the Earth's mantle is very heterogeneous in water content, and water was one of the important components for formation of continental craton at early Earth.

Keywords: hydrous pyrolite, high pressure and temperature experiments, continent, craton, partial melting