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HYDROUS MELTING OF LHERZOLITE AND CRATONIC MANTLE

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Mantle peridotite xenoliths from kimberlite pipes at craton sometimes have unusual chemical, modal, and textual compositions [1, 2]. The cratonic mantle, which consist mainly of olivine, orthopyroxene, garnet and clinopyroxene, are characterized the high amount of orthopyroxene (=high-Si) with high Mg# (= Mg/(Mg + Fe) atomic ratio) [1]. Here, based on melting experiments of hydrous pyrolitic lherzolite at upper mantle conditions, we suggest possibilities of the Si- and Mg-rich cratonic peridotites as residues by partial melting of lherzolite at hydrous condition at depth of more than ˜140 km. Starting materials are pyrolitic lherzolite + H2O. The powder of SiO2, TiO2, Al2O3, Cr2O3, Fe2O3, CaCO3, Na2CO3, K2CO3, and NiO was mixed, and degas at T = 1273 K and ambient pressure in atmosphere. Then it was melted at 1773 K and quenched to form glass in a 1-atm furnace (Prof. Kawasaki's laboratory in Ehime University) with oxygen fugacity controlled at the QFM buffer using CO2/H2 gas mixture. Finally, powders of MgO and Mg(OH)2 are added to be the water contents of starting material as 2 wt% and 8 wt%. Experiments were performed by using multi anvil type high-pressure apparatus (ORENGE 1000) of the GRC in Ehime University at the temperature of 1273-1873 K at the pressure of 3-8 GPa. In our experimental conditions, all products contains liquid phase. The residual mineral assemblage is olivine + opx + cpx + garnet at lower temperature. At the experiments with 2 wt% H2O, the solid phases resolved to liquid as a next order, clinopyroxene, garnet, orthopyroxene and olivine. In the experiments of 8 wt% H2O, stability field of olivine shrinks and that of orthopyroxene expands with increasing pressure. It is noted that the liquidus phase is not olivine but orthopyroxene at pressure higher than 6 GPa. Actually, the opx/ol ratio of cratonic mantle xenoliths is known to be higher than that of mantle xenolith in other regions [e.g., 1, 8], and our results imply that water greatly influenced for generation of cratonic mantle at 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 continent(s) at early Earth.

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