The 405th Geodynamics Seminar

Reaction between magnesite and reduced C-H-O fluid Under high pressure and high temperature

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Abstract

Recent studies on diamond inclusions and high pressure experiments suggest that C-H-O fluid composed of a mixture of H_2O, CO_2, CH_4, etc. is produced and cycled in the Earth's interior. Recent experimental study revealed that the composition of C-H-O fluid depends largely on the surrounding oxygen fugacity. In the lower mantle condition, CH_4 is likely to be dominant (Frost and McCammon. 2008), and lower-mantle diamonds may be formed under the influence of such a reducing C-H-O fluid. In this study, we examined the reaction between magnesite, the most stable carbonate specie at high pressure, and reduced C-H-O fluid at pressures corresponding to mantle transition zone to lower mantle condition (18-30 GPa, 1800-2000 K) based on laser-heated DAC experiments.

The results of the XRD pattern and Raman spectra show that magnesite was decomposed into periclase (MgO), brucite ($Mg(OH)_2$) and diamond (graphite). In-situ XRD observation indicates that brucite formed as a metastable intermediate phase which eventually transform to periclase. The formation of periclase was observed not only at lower mantle conditions (30 GPa), but also at mantle transition condition (18 GPa). Descriptive studies on inclusions in lower-mantle diamonds reported that the most dominant mineral phase is periclace (about 60%), which is, however, not consistent with the result of experimental study using pyrolite composition where Mg-perovskite is the most dominant. Our result implies that some of the periclase inclusions in those diamonds might have formed as a result of the reaction between Mg-rich carbonate and reduced C-H-O fluid. This means that the information obtained from diamond inclusion does not necessarily reflect the balk composition of the lower mantle. Furthermore, the formation of periclace at shallower condition (18 GPa) suggests that such formed periclase inclusions in diamonds may not be used as indicator of lower-mantle origin.

詳細は当センターホームページ：http://www.ehime-u.ac.jp/~grc/をご覧ください
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