

[S-CG09_28PM1]Deep Carbon Cycle

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Volatiles including carbon and hydrogen have strong impacts on various phenomena, such as material and geochemical circulations in global earth, and mantle convection and dynamics of the earth's interior and deep life. We welcome contributions on volatiles in the earth from wide range of disciplines such as geodynamics, volcanology and petrology, mineral physics, isotope geochemistry, and biogeoscience.

3:54 PM - 4:00 PM

[SCG09-P02_PG]The reaction between MgCO_3 and SiO_2 at high pressure and temperature and genesis of ultra-deep diamonds

3-min talk in an oral session

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Carbon, one of the important light elements for the Earth science, is reserved in the deep part of the Earth. The evidence of the deep carbon is found in ultra-deep diamonds or estimations of carbon fluxes between the surface and interior of the Earth. Subducting slabs are considered as an important C-source of the Earth. Following reactions of MgCO_3 and SiO_2 are potentially important in the slabs descending into the deep mantle: MgCO_3 (magnesite) + SiO_2 \rightarrow MgSiO_3 (perovskite) + CO_2 + C (diamond) + O_2 . These reactions can play a fundamental role in the deep carbon cycle. In this work, we investigated the reaction between MgCO_3 and SiO_2 up to about 80 GPa and 3000 K using a laser-heated diamond anvil cell combined with in-situ synchrotron X-ray diffraction (XRD) technique and Raman spectroscopy. The starting material is the powered 1:1 (in mole fraction) mixture of natural magnesite (Brazil, Bahia) and reagent α -quartz. 5 wt.% platinum powder was added to the sample mixture in order to absorb laser and estimate the pressure in the sample chamber. NaCl, KCl or SiO_2 glass powder was stuffed into the sample chamber as pressure media. XRD patterns of high P-T samples and recovered samples were acquired at beamline BL10XU of SPring-8. Raman spectroscopy was carried out to high-pressure conditions. Raman spectroscopy was also conducted for the recovered samples. In the present results made at about 70 GPa, diamond and MgSiO_3 perovskite are detected at temperatures greater than 1750 K. The high P-T XRD patterns in the experiments at 50-60 GPa and 2000-3000 K show the appearance of a small amount of MgSiO_3 perovskite. Our study demonstrated that formation of diamonds was confirmed in the range of 1300-1500 km depth of the lower mantle in subducting slabs due to the reaction of MgCO_3 with SiO_2 and the breakdown of CO_2 . This phase relations have a possibility to explain one of the origins of diamonds from the lower mantle.