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Determination of the reaction boundary $MgCO_3$ + SiO_2 = $MgSiO_3$ + CO_3 in the upper mantle conditions

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Subducting slab consists of three layers; marine sediment, MORB and peridotite. The carbonates exist marine sediment, which transport CO_2 to Earth interior. It is important to clarify the stability and decarbonation conditions of carbonates under high pressure. Previous studies indicate that magnesite is only stable carbonate mineral in the mantle above ˜5 GPa, because the following reactions should occur with increasing pressure, $2CaCO_3$ + $2MgSiO_3$ = $CaMg[CO_3]_2$ + $CaMg[SiO_3]_2$, and then $CaMg[CO_3]_2$ + $MgSiO_3$ + $MgCO_3$ + $CaMg[SiO_3]_2$. Still more, Isshiki et al. (2003) determined that magnesite would be stable in the mantle up to core-mantle boundary condition. However, there are few studies for the reaction of carbonate and silicate under high pressure. Here, we determined the reaction boundary; $MgCO_3$ (magnesite) + SiO_2 (coesite) = $MgSiO_3$ (enstatite) + CO_2 between 4-9 GPa. This reaction indicates that carbon is transported by slab in carbonate minerals. On the other hand, magnesite reacts with coesite in the ascending hot plume at upper mantle conditions. The details of the experimental results will be presented.

Keywords: magnesite, decarbonation, carbon cycle, deep Earth