## Iron-carbonate interaction in the lower mantle and at the core-mantle boundary

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The presence of carbonates in the deep Earth strongly depends on the oxygen fugacity, controlled by oxidation state of iron in minerals and melts. A large part of the lower mantle can be significantly reduced with detectable amount of Fe<sup>0</sup>. Therefore, subducted carbonates would interact with Fe<sup>0</sup> dispersed in the ambient mantle. However, the mechanism of this interaction remains controversial. We investigated the MgCO<sub>3</sub>-Fe<sup>0</sup> system at 70-145 GPa and 800-2600K using in situ X-ray diffraction in a diamond anvil cell. MgCO<sub>3</sub> crystals and Fe foil (99,9%) were used as the starting materials. Formation of wustite (FeO), ferropericlase ( $Mg_{0.6}Fe_{0.4}$ )O, carbide ( $Fe_7C_3$ ) and diamond was observed. Three different modifications of FeO were detected: B1 at T = 1100-2600K and 70-145 GPa, rB1 at T<1100 K and P<136GPa; and B8 at P = 143-145 GPa. Interestingly, we observed coexistence of wüstite and ferropericlase, which may suggest an existence of immiscibility gap in FeO-MgO system at P > 70 GPa. Mg-carbonate reduction can be presented by following reaction:  $6MgCO_3 + 19Fe = 8FeO + 10(Mg_{0.6}Fe_{0.4})O + Fe_7C_3 + 3C$ . The formation of diamond was confirmed by TEM study of run products at 100-145 GPa. The studied carbonate-iron reaction supports formation of the (Fe,Mg)O, carbide and diamond in the lower mantle and at the Earth's core-mantle boundary indicating that subducted carbonates transported to the core-mantle boundary would be reduced to carbide or diamond. Similar reaction may occur in the Fe-CaMg-carbonate systems. Using these data we propose that core-mantle boundary is important to produce diamond and Fe-carbide.

Keywords: Mg-carbonate, carbide, diamond, lower mantle, core-mantle boundary