

Carbonate-metal reactions in the mantle

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Carbonates are important carbon-bearing phases in the mantle. While their role in upper mantle petrologic processes has been well studied, their importance in the lower mantle is less understood. The stability of carbonates in the lower mantle depends on a host of factors including pressure, temperature, oxygen fugacity, and reactions with surrounding mantle phases. We present carbonate-metal reaction experiments on the Fe-Si-Ca-C-O system to 60 GPa and 2000 K to understand the stability of carbonates in the presence of metal in the lowermost mantle. We find that calcite reacts with iron-silicon alloy to form calcium silicate perovskite (CaSiO_3) and iron carbide (Fe_3C) at depths extending to the mid-mantle. We have determined the temperature dependence of this reaction and evaluate its implications for the chemistry of carbon in Earth's mantle.