Geochemical implications of carbonates with CO4 groups

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As the main oxidized carbon carriers in subducted slabs, carbonates are likely to play a key role in the deep carbon cycle. Knowledge of their mineral physics down to the core mantle boundary is thus of prime interest. Recent studies have evidenced a new family of carbonates [e.g. 1–3] in which carbon is tetrahedrally coordinated by oxygen atoms. However, the geochemical implications of these newly discovered phases are largely still to be explored. This is even more true in the light of a new oxygen valence state observed at lower mantle conditions [4-6].

In an experimental study [6], we showed the formation at high pressure and high temperature of a tetrahedral iron carbonate by reaction between pyrite-structured FeO2Hx and CO2. Here we discuss the role of this phase for carrying carbon down to the core mantle boundary and to induce release of hydrogen along the subducted path. We also investigate experimentally the coexistence of this tetrahedral carbonate with diamonds and iron oxides. We finally examine the implications of this new crystal chemistry of carbon for the redox states of iron, oxygen and hydrogen in the deep Earth.

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