

The fate of structure-bound Mn²⁺ during the decomposition of dolomite and in the resulting conversion products: An EPR study

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ABSTRACT

Dolomite from the Jhamarkotra phosphate mine (India) contains 680 ppm Mn²⁺ as indicated by electron-spin resonance spectroscopy (EPR). Dipolar broadening of the EPR signal prevents a quantitative assignment of Mn²⁺ to the Ca and Mg sites. Upon heating to 700 °C, over 99% of the dolomite is decomposed and all the Mn²⁺ is released from the dolomite structure. Approximately 95% of the original Mn²⁺ is oxidized and forms Mn-oxide. The remaining Mn²⁺ preferentially migrates into CaO. This behavior is interpreted by the Goldschmidt rule stating that smaller ions are taken up at the sites of larger ions. During subsequent hydration of CaO into Ca(OH)₂, the Mn²⁺ remains stable. The protection of Mn²⁺ against oxidation is explained by the topotaxial alteration of the host minerals. Carbonation of the Ca(OH)₂ leads to Mn²⁺ oxidation caused by the dissolution of the hydroxide prior to the formation of CaCO₃. Divalent Mn monitored by EPR can be used to unravel the behavior of trace elements on the molecular level during mineral alteration.