



## **Experimental study of the mechanism and sequence of calcite-dolomite replacement**

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For many years the formation, mechanism and environmental settings of dolomite formation have been under discussion, mainly because dolomite is commonly found in ancient rocks, whereas it is rarely present in modern sediments. The most favoured hypothesis is the 'dolomitization' of limestone by Mg-bearing aqueous solutions [1,2]. The existence of sharp limestone-dolomite contacts in natural rocks suggests that dolomitization involves a coupled dissolution-precipitation process.

For a better understanding of the replacement mechanism of calcite by dolomite we performed hydrothermal experiments using Carrara marble cubes of 1.5 mm size, that reacted with 1M (Ca,Mg)Cl<sub>2</sub> solutions with a Mg:Ca ratio of 3, at 200°C for different duration times (10, 20, 40, 50 and 58 days). After reaction, the product phases were characterized using Raman spectroscopy, electron microprobe analysis, and scanning electron microscopy.

After reaction, the external morphology of the samples was preserved. Back-scattered images revealed two replacement end products: dolomite and magnesite. Grain boundaries of the samples were maintained. Shorter time duration experiments resulted in the replacement reaction occurring mainly along grain boundaries, whereas in longer duration time experiments more replacement was located in the core of the sample. In this type of reaction, grain boundaries are very important for the replacement to occur, acting as fluid pathways, allowing the infiltration of the solution further from the rock surface, enhancing fluid permeability within the sample and allowing further replacement reactions to occur.

1. Kaczmarek S.E., Sibley D.F. On the evolution of dolomite stoichiometry and cation order during high temperature synthesis experiments: An alternative model for geochemical evolution of natural dolomites. *Sedimentary Geology*. 240, 30-40 (2011).
2. Etschmann B., Brugger J., Pearce M.A., Ta C., Brautigan D., Jung M., Pring A. Grain boundaries as microreactors during reactive fluid flow: experimental dolomitization of a calcite marble. *Contributions to Mineralogy and Petrology*. 168:1045 (2014).