Geophysical Research Abstracts
Vol. 16, EGU2014-3990-1, 2014
EGU General Assembly 2014

Experimental study of the mechanism of the calcite-dolomite replacement

Teresita Moraila-Martinez (1), Kristina G. Dunkel (2), Andrew Putnis (1), and Christine V. Putnis (1)

(1) Institut für Mineralogie, University of Münster, Münster, Germany (t.moraila@uni-muenster.de), (2) Institute of Geosciences, University of Oslo, Oslo, Norway (kg.dunkel@gmail.com)

When a mineral comes into contact with a fluid with which it is out of equilibrium, it may be replaced by a phase with a different composition and crystal structure. The reaction mechanism generally involves a coupled dissolution and precipitation mechanism and may result in a pseudomorphic replacement (Putnis, 2009). The existence of sharp limestone-dolomite contacts in natural rocks suggests that this process may operate in the course of dolomitization during burial and diagenesis. The idealized mass balance reaction is generally written as $2CaCO_3+Mg2+\rightarrow CaMg(CO_3)2+Ca2+$. However, the mechanism and environmental settings of dolomitization, are still under discussion.

In order to explore the mechanism of replacement of calcite by dolomite, we performed hydrothermal experiments on marble cubes (Carrara, Italy) of different edge lengths (1.5 to 5 mm), which reacted with (Ca,Mg)Cl2 solutions of varying compositions, at temperatures between 160 and 200 °C for different duration times. The product phases were identified by X-ray diffraction (XRD), Raman spectroscopy, and electron microprobe analysis (EMPA), and the textural evolution was studied by scanning electron microscopy (SEM). The results show that the amount and type of reaction strongly depend on the Mg/Ca ratio, the fluid/rock ratio, the temperature, and the reaction time. Depending on the solution composition, the reaction rims of the marble cubes are made up of several layers containing dolomite with varying textures and porosities as well as magnesite, $MgCO_3$, in the outer rim. Fluid and mass transport along the grain boundaries controls the overall textural evolution and rate of dolomitization. The replacement reactions are pseudomorphic and take place by a coupled dissolution-precipitation mechanism.

Putnis A. Mineral Replacement Reactions. In: Thermodynamics and Kinetics of Water-Rock Interaction. Oelkers E. H & Schott J (eds). Reviews in Mineralogy & Geochemistry 30, 87-124 (2009)