



Reaction enhanced large strain deformation: decarbonation of dolomite in torsion experiments.

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We performed torsion experiments using a Paterson rig apparatus on cylindrical samples of natural specimen of pure dolomite (<0.3 wt % of impurities on XRF analysis), drilled on a block of the Dolomia Principale formation, from Mt. Frerone (Adamello group, Italian Alps).

The experiment shown here was run at 800°C, 300 MPa confining pressure under vented conditions, up to a bulk strain of about $\gamma = 1$, which was reached after about 90 minutes.

Deformation localized near both porous spacers placed at the end of the specimen, and was accompanied by a remarkable grain size reduction.

The low permeability during the fast deformation experiment created a gradient of PCO_2 , generated by the decarbonation of dolomite. For these conditions the nominal equilibrium PCO_2 should be around 70 MPa, but at the spacer interface the CO_2 was free to escape, triggering the reaction:



The reaction occurred at the extremities of the samples; in those zones grains became $< 1 \mu\text{m}$ in size and of different minerals, as suggested by the different grey levels in backscattered images. Even with a JEOL JXA 8200 superprobe, the beam size was not small enough to analyse the ultra fine matrix, giving mixed compositions.

In the other part of the sample dolomite, calcite and an MgO phase (brucite or periclase) were recognized. Here deformation was also accommodated by brittle fracturing, whose orientation was consistent with the sense of shear.

We concluded that the reaction produced a weaker matrix in which deformation could localize. Moreover, the very fine grain size was probably produced during the decarbonation reaction, and was kept small by the deformation due to pinning between the different phases.