

## The effect of temperature and cation ordering on the HP behavior of dolomites

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Dolomite  $[\text{CaMg}(\text{CO}_3)_2]$  is the most abundant double carbonate in nature. A fully ordered dolomite usually found in nature consists of alternated calcium and magnesium layers separated by  $\text{CO}_3^{2-}$  groups. Desordered Ca and Mg distributions over crystallographic sites as induced by high P - T conditions give rise to differently ordered configurations [1]. The stability field of dolomite covers a wide P - T range [2],[3], taking the mineral part in many geological processes significantly influenced by its physical and chemical properties. HP studies on dolomite are nowadays an attractive research field as it has been claimed as a carbon carrier mineral phase into the deep upper mantle by subducting lithospheric plates [4],[5]. Stability of dolomite under HP conditions is influenced by several parameters among which the mineral crystallographic characteristics may have an important rule. This paper would provide insights into the baric behaviour of dolomite as a function of temperature and cation distribution in the crystal structure.

The compressional behaviour of two different samples, one, a fully-ordered and stoichiometric dolomite and the other one an ex situ thermally treated was studied were used up to  $\sim 15$  GPa at ID09-A beamline at ESRF (Grenoble, France). SC-XRD experiments were carried out with a Diamond Anvil Cell apparatus, charged with Ne as pressure-transmitting medium and ruby as pressure calibrant. The unit cell parameters of ordered dolomite were measured up to 12 GPa at room temperature and up to 10 GPa at  $300^\circ\text{C}$ ; lattice parameters of ex situ thermally treated dolomite were measured up to 12 GPa.

Normalised cell parameters were used to calculate mean linear compressibility of a and c axes which shown a strong anisotropic behaviour being c-axis approximately three times more compressible than the a one. Volume variation with P was analysed by a least-square fit of Birch-Murnaghan equation of state approximated at the second order. P-V data were fit by using EoSFit software [6].  $K_0$  was found to be 94.3(7) and 91(1) GPa for natural dolomite at room conditions and  $300^\circ\text{C}$  respectively whereas  $K_0 = 85(2)$  was calculated for the disordered sample. An increase of volume compressibility of dolomite was observed as a consequence of temperature and cation disorder. Whereas the anisotropic axial compressibility scheme was observed for all samples, regardless of temperature and degree of order.

These measurements allow to clarify the strong discrepancies found in literature about bulk modulus of ordered dolomite, and to follow the evolution of the structure with pressure.

[1] Zucchini et al. (2012) *Phys. Chem. Mineral.*, 39, 319-328, [2] Buob et al. (2006) *American Mineralogist*, 91, 435-440; [3] Hammouda et al. 2011, *Contrib. Mineral. Petrol.* 161, 439-450 [4]; Kerrick and Connolly 2001 *Nature*, 411, 293-296; [5] Zhu and Ogasawara 2002 *Geology*, 30, 947-950; [6] Angel (2000) *Reviews in Mineralogy and Geochemistry*, 41