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► **To cite this version:**

J H P de Bresser, G Trullenque, M R Drury. Evidence for r slip in calcite. EGU, Apr 2008, Vienna, France. hal-04166704

**HAL Id: hal-04166704**

**<https://hal.science/hal-04166704>**

Submitted on 20 Jul 2023

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## Evidence for $r\langle a \rangle$ slip in calcite

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Torsion deformation experiments performed on Carrara marble a few years ago (Pieri et al., 2001; *Tectonophysics* 330, 119-140) have shown the development, at high strain, of a lattice preferred orientation with a sharp single orientation component with the calcite  $r\{10\text{-}14\}$  plane parallel to the shear plane and the direction  $a\langle -12\text{-}10 \rangle$  parallel to the shear direction. This suggested that the  $r\langle a \rangle$  system is an important slip system in calcite, confirmed by results of plasticity models. However, the  $r\langle a \rangle$  system thus far has not been demonstrated to be operative in calcite, while slip on the  $r$ -plane in the  $\langle -2021 \rangle$  direction is well established. We performed direct shear experiments on single crystals of calcite and now found unequivocal evidence for  $r\langle a \rangle$ . Square samples of size  $8 \times 8 \times 0.5$  mm have been deformed in a direct shear piston configuration mounted in an axial loading set-up in a constant volume, internally heated argon gas medium deformation apparatus. Samples have been deformed to a shear strain of  $\gamma = 1.5$ , at a temperature of 1000 K, a confining pressure of 300 MPa and a shear strain rate of  $1.7 \times 10^{-4} \text{ s}^{-1}$ . The calcite samples were oriented such that either the  $r\langle -2021 \rangle$  or the  $r\langle a \rangle$  system was activated, given that the latter actually exists. Stress-strain curves show a yield point at about  $\gamma = 0.2$ , followed by a quasi-steady state part up to  $\gamma = 1.5$ . We have used Electron Backscatter Diffraction (EBSD) to analyze the deformed calcite single crystals. Results clearly show evidence for activity of the  $r\langle a \rangle$  system. At the conditions investigated, the  $r\langle a \rangle$  system is about 10% stronger than the classical  $r\langle -2021 \rangle$  system. Detailed misorientation analysis also demonstrated the local development of small subgrains and recrystallized grains. We are currently

analyzing rotation axes associated with the development of these subgrains.