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In-situ experiments on time dependent microcracking and cataclastic deformation in the dissolution/precipitation regime on a elastic/brittle salt

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Two types of in-situ deformation experiments were carried out at room P-T conditions on a very soluble elastic/brittle salt (sodium chlorate; $NaClO_3$) used as rock analogue material under conditions where dissolution/precipitation processes and water-assisted subcritical microcracking are the dominant deformation processes.

1 - Dead weight indentation experiments were carried out on two $NaClO_3$ single crystals. The boundary between the two crystals was studied and monitored with microscope during die experiments. Regular arrays of dissolution etch grooves, following crystallographic low index directions, developed on the surfaces of the crystals. These etch grooves developed into subcritical microcracks leading to time-dependent cataclastic deformation of the crystals.

2 - Thin plates of wet dense polycrystalline samples were deformed in pure shear. Irregular dissolution structures developed on the free grain surfaces in contact with the confining glass plates. These migrate on the surfaces of the grains and develop into microcracks, mostly oriented perpendicular to the local maximum compressive stress and following crystallographic orientations. The deepening and networking of these microcracks lead to fragmentation of the grains and thus grain size reduction of the sample.

This Study shows that time-dependent microcracking processes may play a more important role during compaction and deformation in upper crustal rocks than generally considered.