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The role of dolomite content on the mechanical strength in dolomite-limestone composites

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Variably dolomitized limestone samples from the Rundle Group in Western Alberta, Canada were deformed under a variety of confining pressures and at room temperature in a triaxial rock press. The aim of this research is to establish the mechanical behaviour and brittle constitutive laws of limestone and dolomite composites. Sample protoliths were selected for their similar grain sizes and grain size distributions, low porosity and low silica content in order to best examine relationships between these parameters and the distribution of strain between the dolomite and calcite.

Increasing dolomite content increases the strength of the composites, however textural controls (porosity and grain size) also affect the mechanical strength. Microstructural analysis of deformed samples shows that at approximately thirty to forty-five weight-percent dolomite grains are interconnected via a dolomite grain network that provides a load-bearing capacity to the dolomite. This load-bearing capacity correlates to dramatic jumps in the strength of dolomite–limestone composites observed with increasing confining pressures.

Inherent weaknesses in calcite grains such as twin planes and cleavage intersections are exploited by fractures resulting in reduced peak strengths of calcite-rich composites. Calcite generally absorbs strain and distributes it into finer spaced fracture networks than in dolomite. At high concentrations of dolomite and at high confining pressure (100MPa) dolomite will fracture and disaggregate along cleavage. Comminuted dolomite grains commonly show a larger distribution of sizes and have more irreg1ar shapes than contiguous comminuted calcite grains. Comminuted calcite particles are commonly much smaller than comminuted dolomite grains and show more regular shapes and an even grain size distribution.