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Evolution of early karst: impact of mineralogy on the development of preferential flowpaths in carbonates.

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Study of the geometry, flow and solute transport changes in a single fracture during dissolution constitutes base for understanding the formation of complex karstic system. Factors influencing the development of preferential flow patterns in facture are complex and involve knowledge of the chemical composition of the input water, the dissolution kinetics of carbonate minerals in CO2-H2O system, the flow rate and the rock lithology. Experimental and modelling efforts have been done over the past years to understand positive feedback mechanisms that determine the evolution of fracture aperture. But the majority of the experimental works and numerical simulation refer to relatively simple rock mineral assemblage (e.g. pure limestone) even though natural rocks present a large spectrum of mineralogical assemblage. The influence of the mineralogical composition of the rock is therefore often underestimated. We carried out dissolution experiments by percolating CO2-rich water through several fractured samples of carbonate, specifically examining the evolution in the geometry and hydraulic properties in relation with the rock mineralogy. Rate of dissolution and permeability changes were evaluated throughout the experiment. In addition, the changes in fracture geometry and related parameters were reported from synchrotron 3D X-ray microtomography experiments. The results show that the mineralogy of the rock matrix has a significant influence on the dissolution rates and transport process within the fracture. Although the formation of preferential flowpaths can be characterized by Peclet and Damköhler numbers in relative pure limestone, their formation is not favoured in argillaceous carbonate.