

# Role of grain crushing in the alteration of mechanical and flow properties of sandstones during mechanical failure

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## Sustaining Injectivity

Understanding the role of grain crushing enables knowledge of permeability and porosity evolution, and is the first step in designing the injection process so it can be sustained over time.

## Storage Efficiency

The same understanding of permeability and porosity evolution enables evaluating storage efficiency.

## Controlling Emergence

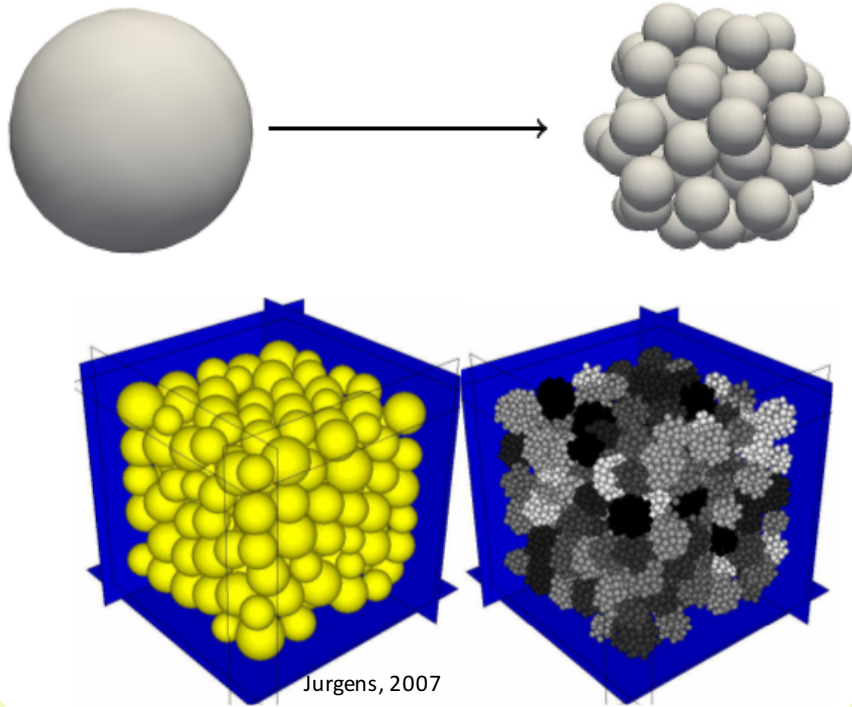
We expect to quantify new emerging patterns that exist only because of coupled interplay of grain crushing and the evolution of mechanical and flow properties of the rock.



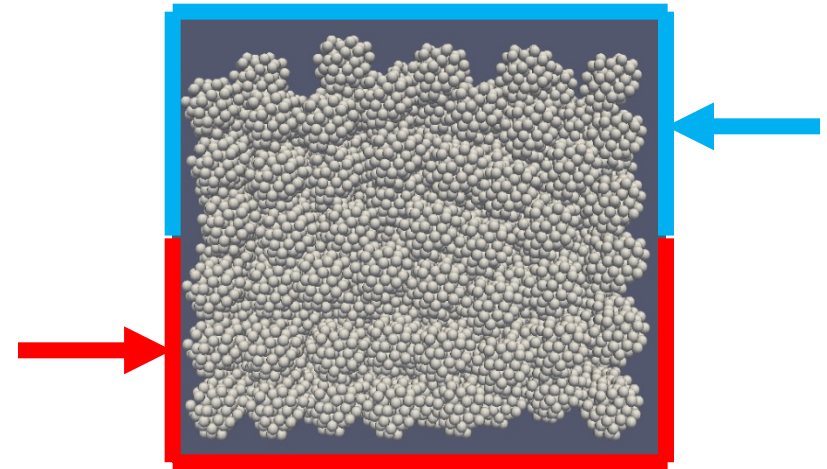
# Objectives and Methods

- Understand the alteration of flow and mechanical properties of sandstones after shear failure.

Microscopic model setup



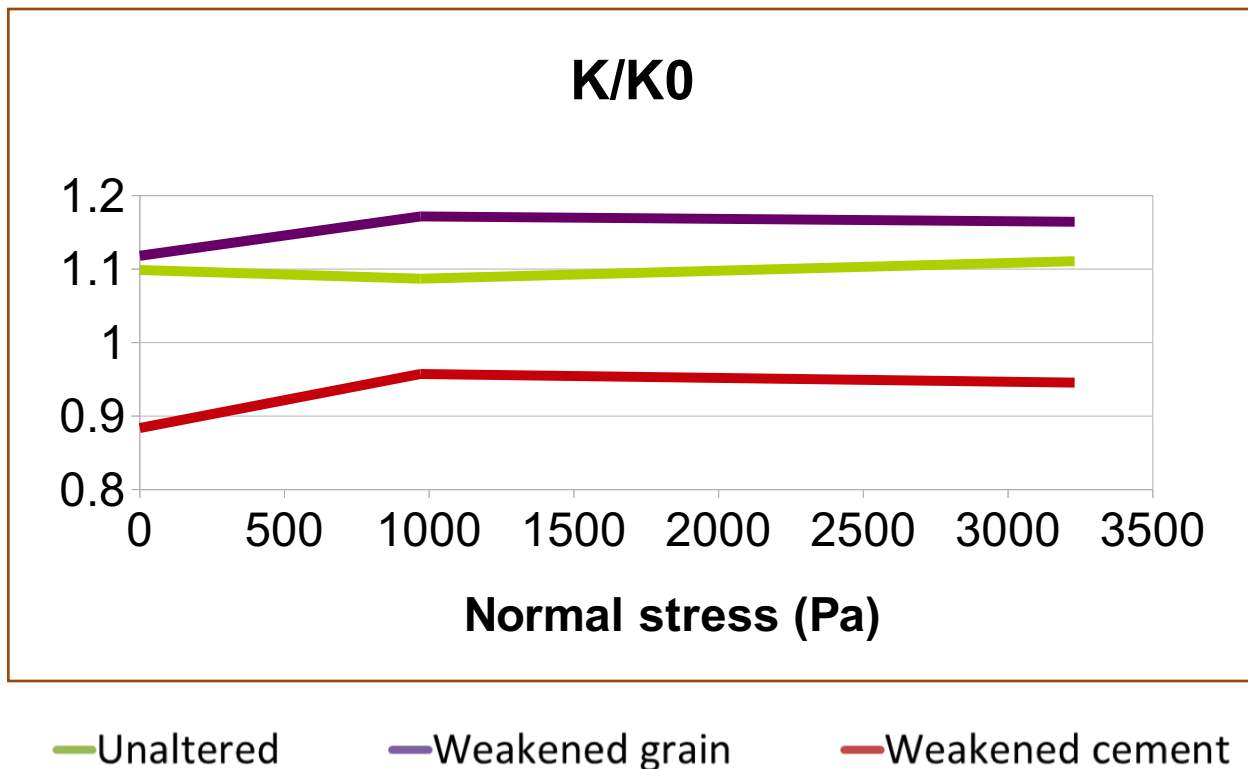
Direct shear loading



- Study the effect of weakening of the cement versus the weakening of sand grains.
- Quantify the alteration results in terms of permeability, stress-strain response, and cement vs. grain failure.

# Results

- Weakening the cement eliminates grain crushing.
  - Cement breakage only led to grain rearrangement and noncataclastic shear bands, whose permeability is similar to the host rock.
- Weakening sand grains sometimes leads to increased cement failure.



# Planned Manuscripts

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## “Role of Grain Crushing in the Alteration of Mechanical and Flow Properties of Sandstones during Mechanical Failure”

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