Brittle deformation and faulting
Lecture 11.1 - Rock deformation

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Goals of this lecture

- Present the main *rock deformation mechanisms*

- Review *elastic deformation*
There are five words used to describe rock deformation that are frequently misused, confused and poorly understood:

- Brittle
- Ductile
- Elastic
- Plastic
- Viscous
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Deformation ‘types’

Deformation mechanisms
Terminology, clarified

- ‘Type’ of deformation
  - **Brittle**: Fracture of rock with possible slip along the fracture surface (fault); Relatively low T and P, large forces or rapid imposed deformation
  - **Ductile**: Flow or coherent change in the rock in the solid crystalline state; Relatively high T and P, small forces, slow imposed deformation
Terminology, clarified

• Deformation mechanism (or law)
  • Elastic: Lecture sets 5-6
  • Plastic: This lecture set
  • Viscous: Lecture set 12
What is the stress-strain relationship for elastic materials?
Elasticity

\[ \sigma \propto \varepsilon \]

- **Stress** is proportional to strain
- For 1-D normal stress
  \[ \sigma_{xx} = E \varepsilon_{xx} \]
  - \( E \) : Young’s modulus (1D)
  - \( G \) : Shear modulus (1D)
- If stress \( \to 0 \), strain \( \to 0 \) (recoverable)

Twiss and Moores, 2007

\[ \text{Slope} = E \text{ or } 2G \]
Let’s see what you’ve learned…

• If you’re watching this lecture in Moodle, you will now be automatically directed to the quiz!

• Reference(s):