

12.113

Pre-midterm outline

Fall 2005

1 Stress

Forces, tractions.

Mohr circles

Homogeneous, heterogeneous stress.

Isotropic, deviatoric stress.

Pressure.

Stress ellipsoid, principal axes of stress.

Material from Lab 1.

2 Strain

Measures of strain (stretch, elongation, etc.)

Special states of strain: pure shear, simple shear, dilatation.

Homogeneous, heterogeneous strain.

The strain ellipsoid, principal axes of strain.

Progressive deformation (shortening, elongation and rotation of material lines during protracted strain history).

3 Rheology

Elastic, brittle, viscous, plastic, viscoelastic, etc.

Newtonian viscous, power-law viscous.

Controls on deformation.

Rheology (strength) as a function of depth in the Earth.

Problems with scaling experimental results to natural, geological systems.

3.1 Controls on deformation of a rock.

Temperature.

Fluid pressure.

Confining pressure.

Strain-rate.

Material or mineralogy.
Pre-existing anisotropy.

4 Brittle deformation

Mohr-Coulomb failure.
Effect of fluid pressure.
Failure on pre-existing fractures or creation of new fracture.
Extension fractures vs. shear fractures.
Relationship between orientation of faults and orientation of principal stresses.

5 Faults

Classification.
Slip vs. separation.
Fault rocks: fractures, breccia, gouge, slickensides, slicken striae.
Determining slip direction.
Faults and stratigraphy: growth strata, omission or repetition of units.