Strength of the Earth, The Problem:

1) Readings for Lecture 1:

Evans, B., Rheology of rocks in natural tectonic processes, Article 6.15.1.3. in Tectonics and Geodynamics Theme, edited by B. DeVivo, K. Stuewe & B. Grasemann, in Encyclopedia of Life Support Systems, EOLSS Publishers, Oxford UK, 2002.

Kohlstedt, D. L., B. Evans, and S. M. Mackwell, Strength of the lithosphere: Constraints imposed by laboratory experiments, J. Geophys. Res., 100, 17,587-17,603, 1995.

2) Background

   a) Stress

   i)   Tensor Representation
   ii) Symmetry
   iii) Equilibrium
   iv) Stresses in Earth
   v)   Pressure
   vi) Fluid Pressure
   vii) Deviatoric Stresses
   viii)   Effective Pressure

   b) Strain

   i)   Deformation Gradient Tensor
   ii) Strain, Rotation, Displacement
   iii) Normal and Shear Strain

   c) Volumetric Strain

   d) Background References:

[*Malvern*, 1969; *Means*, 1976; *Nye*, 1957]

3) Deformation mechanisms:

a) "Plastic

    i)
    ii)
    iii)
    iv)

b) "Brittle"

    i)
    ii)
    iii)
    iv)

4) Deformation modes:

What deformation features are observed on hand, field, and global scale?

a) Faulting

    i) Stable, Unstable
    ii) Seismic; aseismic

b) Localized:

    i) Shear banding
    ii) Compaction banding
    iii) Dilation banding

c) Distributed:

    i) Pervasive
    ii) Folding

5) Scaling:

Does the strength of the Earth vary with increasing time, strain rate, depth, and spatial scale of the feature?

6) Reading Assignment: [*Jackson*, 2002]

7) Bibliography:

Jackson, J. (2002), Strength of the continental lithosphere: Time to abandon the jelly sandwich?, GSA Today, 12, 4-10.

Malvern, L. E. (1969), Introduction to the Mechanics of a Continuous Medium, Prentice Hall, Englewood Cliffs, NJ.

Means, W. D. (1976), Stress and Strain, 338pp pp., Springer-Verlag, New York.

Nye, J. F. (1957), Physical Properties of Crystals, 322 pp., Oxford University Press, Oxford, UK.