Outline of Lecture 14 (5-14-02)

I) Current Event: M_W=5.2 earthquake about 3 km south of Gilroy along the Sergent Fault.

II) Review of possible driving forces for plate tectonics
   1) Slab pull: We have already shown that the negative buoyancy force from a 100 km thick subducting plate may by itself have enough energy to drive convection at a rate comparable to current plate tectonic motions: remember that there appears to be a significant correlation between % of subduction along the circumference of a plate and the rate of plate motion.
   2) Ridge Push: Though in isostatic equilibrium there still exists a positive potential energy at the ridge that is acting to push down (and away) the oceanic lithosphere: Why is it likely that this is not the only driving force?
   3) Mantle Drag: This may be specific to individual continents and probably does not play much of a role under oceans as the thick asthenosphere may significantly decouple plates
   4) Suction: Thought to occur along the pacific where it has been observed that the subduction zones move seaward over time. Where may this lost mantle go?

III) Rock Rheology
   1) Definition?
   2) Solid mechanics
      A) stress-strain relationship for elastic solids:
         i) What happens to a brittle material that surpasses its failure strength?
         ii) What happens to a semi-ductile material once it passes its yield strength?
      B) Where does this brittle-ductile transition occur in the crust?
         i) Remember the brittle-ductile transition is dependent on the time periods at which we are looking.
         ii) This is viscosity dependent. What is controlling viscosity as a function of depth?
         iii) Generally speaking, how does crustal strength change with depth?
         iv) How is it different between continental and oceanic crust?
      C) 2-D relationship between normal and shear stresses using Mohr's Circles
         i) How are maximum, \( \sigma_1 \) and minimum, \( \sigma_2 \) normal stresses related to normal, \( \sigma_n \) and shear, \( \sigma_s \) stresses on a plane at any given angle, \( \theta \) relative to the maximum stress?
         ii) What are the mean and differential stresses?
         iii) How would you draw the relationship onto a Mohr's Diagram?
         iv) What is the failure envelope? Eqn?
         v) How does this relate to internal friction?