

## PROBLEM SET 2: LITHOSPHERIC STRESS AND STRAIN

EAS 4312/6312: Geodynamics

Assigned: 9/23/13  
Due: 9/30/13

NAME: \_\_\_\_\_

OTHERS CONSULTED: \_\_\_\_\_

**A note about your homework:** Please be neat and organized! Once you have found a way to the answer, please rewrite it in an orderly fashion so that others can follow your steps, and put a box around your final solution, when appropriate. Include this page as the cover, show all of your work, and list all who helped with this set, including your instructor. *An answer with incorrect or absent units will be considered wrong!*

### Strain

1. Volumetric strain of diagenesis.
  - (a) What is the simple equation that defines the total dilatation of a rock that is subjected to sufficient pressure to entirely close (collapse) its pore space? This equation should be written in terms of its porosity,  $\phi$ , defined as the volumetric fraction of pore-space in a material.
  - (b) What is the dilatation of a closed sandstone with 20% porosity?
2. Horizontal crustal strains.
  - (a) Determine the horizontal strain rate field described in problem 2-29 of Turcotte and Schubert?
  - (b) What are the first 2 invariants to the strain rate field (using the same equations as the strain field)? Note that you will need to assume there is no strain in the vertical direction.
3. Determine the mean slip rate and orientation of the San Andreas Fault using:
  - (a) GPS velocity information for station OVRO described in Problem 2-33 (T&S)
  - (b) GPS velocity information for station MOJA described in Problem 2-34 (T&S)
  - (c) What could differences between the two results represent?

### Additional Problems for Graduate Section

#### Elasticity and Flexure

4. A homeowner wants to build a Japanese garden in his backyard. A critical feature of this garden is a planned 4 m basaltic plank acting as a bridge across a stream. The plank is pinned on both ends (allowing rotation but no vertical motion). Assuming basalt will fail in tension at 5 MPa, determine the minimum allowable plank thickness if:
  - (a) It is a decorative bridge not meant to support weight other than its own.
  - (b) The bridge is one meter wide and needs to support the maximum of either an 80 kg person standing, or a 40 kg child vertically jumping 0.5 m high at its center (acting as a line load).