Geology 3063
Exam 2
October 29, 1999

Instructions.

1. Place all books and notes on the floor.
2. Read each question carefully, then read it again.
3. **Think** before you write.
4. Organize your thoughts and outline your answer mentally before writing. If you are not certain, put your ideas down on the back of the page before proceeding.
5. Answer the questions in the space provided. You may use the backs of the pages to outline and doodle.
6. You have 60 minutes. All exams must be turned in by 10:00am. You are responsible for pacing yourself.
7. Proceed when ready.

This too shall pass

20points 1. You are working as an independent consultant on a case involving the Nuclear Regulatory Commission and the Federal Emergency Mananagement Agency. The case involves the placement of a nuclear generation plant on the southern side of the island of Hawaii. The fate of the case rests in your hands. Here is the information as you know it.

- The site is on the hanging wall of a straight normal fault that extends from the surface to a depth of 4,000 meters.
- The fault crops out on the side of the island, and shows signs of historic displacement on the order of 100 meters. The fault is dipping at an angle of 70 degrees at the surface, and apparently holds that dip throughout the rock volume.
- The rock volume in question can be approximated as a nearly triangular volume that is $2km$ wide at the location of the plant, $15km$ long and $4km$ deep. The calculated rock volume is $60km^3$.
- The density of basalt is roughly $3\frac{g}{cm^3}$.
- The plant will add a mass roughly equivalent to $5km^3$ of additional basalt.
- The current state of stress on the fault is thought to be within 10% of the "failure point" for the system.

  The NRC contends that the additional load will not have a significant effect on the state of stress on the fault. FEMA contends that the additional load will cause a catastrophic failure that could cost thousands of lives.

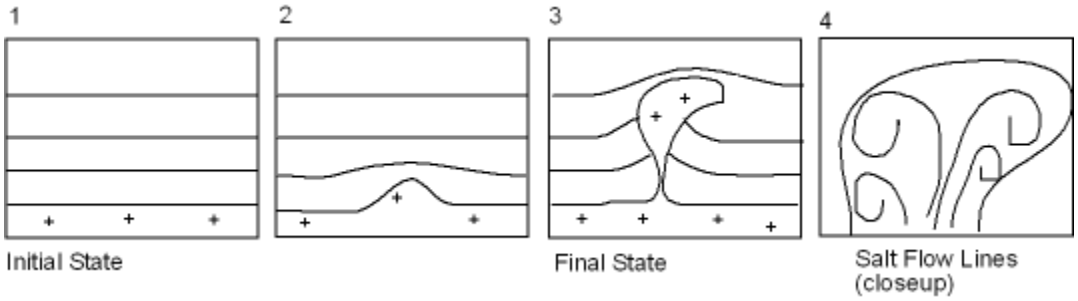
  a. Determine the state of stress on the fault (ignoring lithostatic stress) for the current system, and for the system after the construction of the plant.

  b. Present a recommendatation to the court regarding the wisdom of constructing the plant based on your calculations.

20 points 2. Determine the stress on the base of a lithospheric plate that has the dimensions of $2000km \times 1000km \times 50km$ where the average density of the plate is $2.7\frac{g}{cm^3}$. How easy would it be to move that plate using edge forces?

20 points 3. Fully describe and classify the sample at the front of the room?

20 points 4. Given a salt diapir that rises from a depth of 10,000 feet to a final resting depth of 2,000 feet – the sequence of development, and internal geometry are shown in the figure. How would you describe the overall strain displayed? ... the strain seen by just the diapir? ... the strain in one small volume of the diapir?



20 points 5. What is the significance of the displacement vector in "measuring" the strain preserved in the sample at the front of the room?