GEOL 15 Mid-Term II Study Guide Fall 2013

(Lectures 13-21; Activities 5-9)

Course Learning Outcomes

1. Apply the scientific method and scientific reasoning to critically evaluate geologic phenomena.
2. Communicate the basic elements of plate tectonic theory and apply these concepts in describing how earthquakes, or other geologic hazards, impact both humanity and the natural environment.
3. Apply physical science principles to describe how energy is transmitted through geologic systems.

Content and Study Questions

Earthquake Size (magnitude): What is "earthquake magnitude?" Are there different magnitude scales? Which is the best scale? How can the magnitude be determined? What is a nomogram? How are distance, magnitude, and seismic wave amplitude related? Can you use a nomogram to determine the earthquake magnitude? What is the "slip rate" of a fault? How is the fault slip rate related to earthquake hazard?

Earthquake Cycles: What is a model for the earthquake cycle we discussed for the 1906 San Francisco earthquake? What is the earthquake cycle? What are the parts/steps in the earthquake cycle (e.g. coseismic)? What happens during each of these parts of the cycle? Can you describe the earthquake cycle at a subduction zone (discussing the steps of the cycle, what happens at the fault at each step, what happens in the crust at each step, and how does the crust deform vertically and horizontally at each step)? How does a subduction zone earthquake cause a tsunami? What sedimentary evidence exists for subduction zone earthquakes?

Focal Mechanisms: What is a focal mechanism (what does it represent)? Can you draw a focal mechanism (from above) for a strike slip, reverse/thrust, and normal earthquakes? How many options are there in a focal mechanism for different faults? What additional information do you need to interpret the fault and earthquake motion? Can you tell the difference between a right-

lateral and a left-lateral strike slip earthquake focal mechanism? Why do we get strike slip earthquakes (instead of reverse/thrust earthquakes) in the Gorda plate?

Paleoseismology: What is paleoseismology? Why do people study paleoseismology? What is the time span for available seismic data (how long back in history have we been collecting seismic information on seismometers)? What is a fault trench? What happens along a fault during an earthquake (that we study when we trench faults)? What is a colluvial wedge? How are air photos helpful for paleoseismologists? What is the name of a fault that has been trenched in California? What is an earthquake recurrence interval? Are there ways to practice paleoseismology other than trenching faults? Do you have an example?

Geodesy: What is geodesy? What type of earth system phenomena can be measured with geodetic techniques? How can GPS be used for geodetic analysis? Can we tell something about the earthquake cycle with geodetic data? What is a GPS motion rate? How would you estimate the rate of movement for a GPS site? What would you expect for a GPS site to do through the earthquake cycle? Do you know of some examples where GPS measurements suggest the fault is still slipping (what part of the cycle is that?) or that the fault is locked (what part of the cycle is that?)? Are there ways to take GPS measurements from a large region (like northern California and southern Oregon) and tell something about the different faults that control that motion? (do you remember that vector addition was used to remove Cascadia from overall GPS data to determine San Andreas motion, or vice versa)? Can we use GPS data on the North America plate, during an earthquake in the Gorda plate, to determine something about the fault between the plates (Cascadia subduction zone fault)?