EARTHQUAKES

I. INTRO TO EARTHQUAKES

- Why do we care?
  - Natural disasters that happen all over
- What causes earthquakes?
  - Motion along faults
  - Elastic deformation- stress ~ friction; features are starting to give a little
- How frequent are earthquakes?
  - Small ones are incredibly common; large ones not really
- The point of movement
  - Focus- point on fault line where movement actually occurs (2-20 km deep)
  - Epicenter- point of focus on the surface
  - Rocks behave in a brittle fashion, so earthquakes can happen
- Movements before & after
  - Foreshocks- small earthquakes that happen before the main earthquake; rock's attempt to release some energy; sometimes the foreshock is the earthquake
  - Aftershocks- small earthquakes that happen after the main earthquake; rock's attempt to get rid of leftover energy; aftershocks can occur far away from focus because rocks far away have to adjust after earthquake

II. SEISMIC WAVES

- 3 main types- all will be present at an earthquake
- 1. P (primary) waves- fastest moving waves (~6 km/s); compressional waves; can move through all materials
- 2. S (secondary) waves- slower than P waves (~3 km/s); will cause vertical motion as it moves through material (shear wave); can't move through fluids
  - S wave shadow zone- place where S waves can't reach; opposite side of Earth where earthquake occurs

- 3. L (long/surface) waves- slow waves; complex 3D motion (vertical & horizontal); tend to stay close to the surface of the earth

III. MEASUREMENT & DETECTION

- Seismographs are outdated; they are mostly used to show kids on field trips cool stuff; the needle on them doesn't move, the paper & frame move because of seismic waves
- Seismometer- want to set up in groups of 3 so they will measure movement from east to west, north to south, and up to down
- Where did it happen?
  - Key to finding the focus is that the different waves travel at different speeds
  - Typically only look at P & S waves
  - Can draw circles with radius of distance to find location of focus
- How big was it?
  - Mercalli Index- roman numerals; measures amount of property damage done by earthquake; useful when dealing with aftermath
  - Richter Scale- measures amount of ground shaking that occurs; most famous but not really used by scientists anymore because it depends on how close you were to the focus
  - Moment Magnitude- measures amount of movement at the focus; more useful because you're dealing with 1 location & can be measured after earthquake is over
- Quakes & Plates
  - Faults occur in sets, trace plate boundaries
  - Deep earthquakes happen at subduction zones & usually have large magnitudes
  - Some quakes occur far from plate boundaries
  - Risk assessment map: Charleston has highest risk on east coast of US; map based on past earthquakes

        - Intraplate quake- New Madrid, Missouri in 1811-12; 1st request for disaster relief in US; Reelfoot Rift quit pulling apart but is still capable of seismic activity
- Predicting Earthquakes
    - Difficult because every fault is different (Haiti one was spot on but many aren't caught & some that are predicted never happen) & many factors to take into account
- Damage Control
    - Building codes
        - 1972 California law- cannot build directly on fault line
    - Site selection
        - Bay Bridge is built on bedrock because it is one of the safest things you can build on
    - Liquefaction- waterlogged sediment knocks buildings over or sucks them in