# 24.10.17 earth science: earthquakes and tsunamis

As plates move past each other, they create fault lines (cracks)
Three types: slip faults (side to side) and transform (vertical) faults (normal-falling or thrusting-rising)

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The San Andreas Fault caused the 1906 quake, which moved 7 meters (22 feet) in one slip and devastated San Francisco:

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What the San Andreas Fault looks like from the air:

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Thrust (vertical) faults caused the Bali quake and tsunami: (look this up on youtube)

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Remember earthquake waves:
P and S waves:

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P waves are faster than S waves:

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We can use this difference to calculate epicenter (surface location) and hypocenter (actual center under the surface):
Recall epidermis is your skin (epi=top, dermis = skin), a hypodermic needle goes under (hypo) your skin (dermis)

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AP exam question:

- How much stronger is a magnitude 7 quake than a magnitude 6?
- 7 to 5?
- 7 to 4?

**More on tsunamis:**

- Nuuanu slide: Look up on Wikipedia, how big was the tsunami, where and when?
- What is our biggest tsunami threat now?
- Where did the 1946 and 1960 Hilo tsunamis come from?
- Why is this important to you?

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Check this out:

- Why would anyone living east of the interstate-5 corridor be concerned?
- Look at the dates on this diagram:

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Historic data shows subduction zone quakes that would create a tsunami 1000' high or more on the Pacific northwest coast, flooding everything west of I-5.

Here's how we know what is going on to form the Andes:

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Look at all of the earthquakes (red dots) as the plate subducts

Two things to take-away about subduction zones:
1. subduction zones create ANDESITIC (pointy) volcanoes, which are high in silica, and sticky like thick pancake batter.
2. subduction zones create lots of deep-focus earthquakes.

**Play time:**

- Look at the HPA Pacific Tsunami Warning Center (PTWC) seismograph here: http://www.fdsn.org/networks/detail/PT/
- Look for the HPAH station-where is this?
- Why are the stairs to the nurse's office in such strange angles?
- Our Elab quake network here: https://shakenet.raspberryshake.org/
  - look for "station view" and zoom in
  - jump in the elab, and see if R160F moves
  - go into the monlab and find the same one
  - why is it not showing up on the PTWC seismic sensor?
  - why does your jumping NOT cause an alert?
- Hawaii quakes here:https://earthquake.usgs.gov/earthquakes/map/?extent=-69.225,-230.44922&extent=70.25945,-69.43359

Click on some earthquakes and note the depth and the seismic image.

Key earth science points:

- All elements up to Iron on the periodic table came from the big bang
- Earth was formed from materials created by first generation stars going supernova
- The core of the earth is made up of a rotating solid core surrounded by a liquid core
- The inner core creates our magnetic field, which reverses periodically
- Layers: crust-mantle-outer core-inner core
- Uranium in the core produces heat that travels to the surface by convection
- Tectonic plates on the surface move on top of the sticky asthenosphere because of this convection
- Spreading zones are were these plates are created, subduction zones are where they dive under others
- Subduction zones create trenches in the ocean and andesitic volcanoes (sticky lava, pointy cones)
- Hot spots in the crust can create basaltic volcanic islands like the one we are on (runny lava, broad cones)
- Earthquakes include P (primary, compression) waves and S (secondary, shear) waves
- P waves are faster and go through solids and liquids, S waves only travel through solids

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