

### \*\*\*\* Study Sessions:

**MONDAY, APRIL 28<sup>TH</sup>; 6:00-8:30 PM; WEBSTER 16**

**THURSDAY, MAY 1<sup>ST</sup>; OPTIONAL ATTENDANCE - CLASS TIME**

**FRIDAY, MAY 2<sup>ND</sup>; 2:00-3:00 PM; WEBSTER 17**

### Chapter 8: Earthquakes (continued)

- ❖ Why would earthquakes with nearly the same intensities (magnitude) produce such different results?
  - *Ground material!*
  - *What kind of shaking*
  - *How buildings are built/quality of materials*
  - The ground can amplify the shaking.
    - Building on bedrock is the best
    - Building on landfill is the worst (San Francisco Airport)
      - Amplifies most and collapses on itself
    - Building on mud is bad
      - Mud liquefies
  - Liquefaction
    - Ex. Loma Prieta (1989)
    - Clay grains are aligned like a card house (deck of cards)
      - True quicksand
  - Depth of focus
    - Kobe and Northridge (10 mi & 11 mi respectively)
  - Duration of shaking
    - Kobe (20 sec) and Northridge (15 sec)
      - Shorter than Nisqually but were combined with lack of proper building codes

### Video on Earthquakes

- ❖ Northridge
  - Los Angeles:
    - Many injured, 57 dead
    - January 17, 1994
    - Same date and magnitude as Japan earthquake
    - 11 freeways down - those specifically that had not been strengthened for earthquakes
  - Kobe:

- 15 miles underground
- Up and down then sideways (wave types)
- Morning Show was first anyone saw of Japan's
- Seismometers - 3 to 5 around Kobe, knocked out in Kobe
- Broken gas mains started intense fires everywhere in Kobe
- Epicenter - just southwest of Kobe
- Hundreds died in fires alone
- Even emergency tanks underground were not enough for firefighters for the large amount of fires
- Nagata - market arcade surrounded by houses. Many dead in homes. Worst damage. Arcade was built extremely strong and held up; fed homeless following earthquake, etc.
- Entire community burnt to ground. >1000 people died.
- Nothing like this since WWII
- Tiles on roofing - heavy to protect against typhoons
  - Walls made of straw and mud
  - Stone ornament on every roof - heavy
  - Lethal for many
- > 5,400 dead, 300,000 without homes, 1,000,000 without food/water
- Cost: \$147,000,000,000 of damage
- Shifted port-trade to Taiwan and North Korea
  - Liquefaction of Kobe's docks
  - Only 3 shipping ports left after earthquake
- Bridge to island nearby
  - Epicenter directly below
  - Island shifted - bridge will need to be 1 meter longer
  - Bridge did not fall
- Mountains to north... alluvium basin to south
  - Waves hit mountains and are reflected back - intersections cause extreme damage

#### o Causes & Similarities:

- Whole of Japan crisscrossed by faults and sits next to four plates that come together
- Both rather unlikely earthquakes; neither city lies on a fault exactly
- New fault found in Kobe by professor at a Japanese university
- Recently calculated that blind faults are located everywhere around LA
- Shaking in Kobe ~ shaking in northern part of San Fernando Valley
- Building "melting" usually caused by first floor failures (open lobbies, garages, offices, etc.)
  - Some due to "soft floor" in the middle of a building - building "pancaking"

- o Nearly an hour to pinpoint epicenter; computer basically said, “ground moving in too many places all at once so this is obviously not possibly happening”
  - Seismometers of both Japan and America were not sophisticated enough to cope with the size and intensity of these earthquakes
- o “Earthquakes do not kill people, buildings do.”
- o Early detection already in place
  - Kobe - as soon as P-wave is detected *all trains brought to a stop*
- o Tiny seismometers - automobile airbag technology; not sensitive enough for small normal ground motion, but great for huge shakes
- o Smart Meters - Tokyo Gas. Shuts off gas to house as soon as shaking starts
  - Prevent fires
- o