**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period\_\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

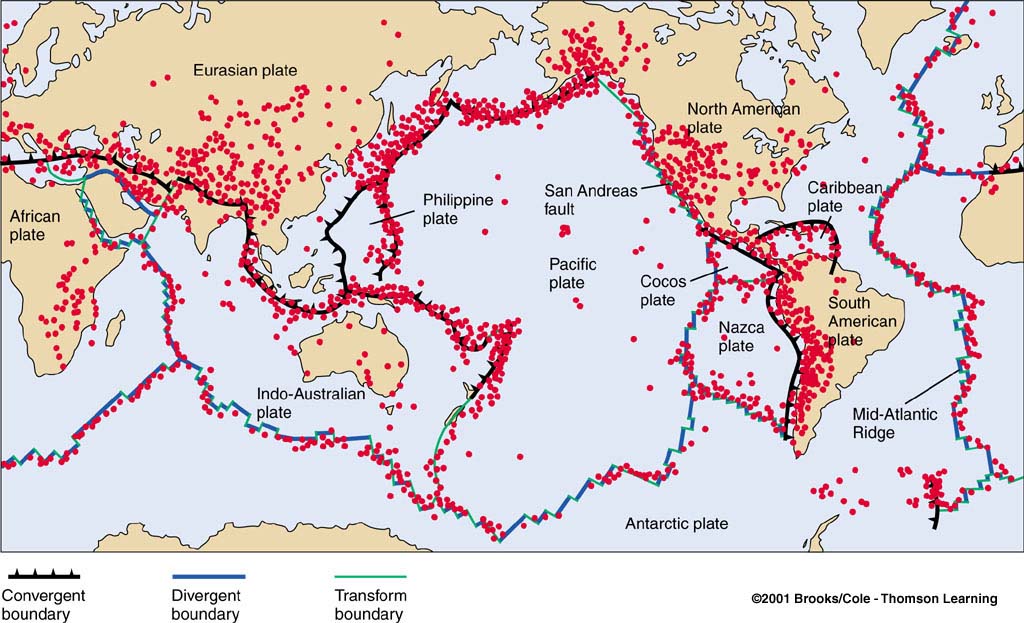
Geology-UNIT Guided Notes

Earthquakes

Text reference: ch 8 pg 217-232

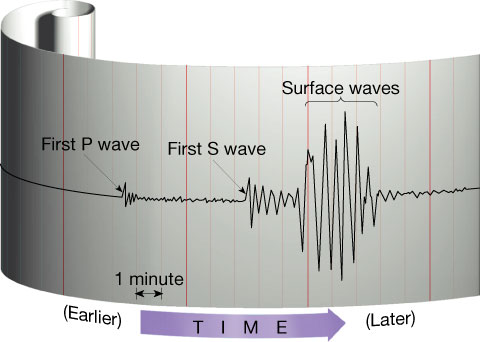
Section 1: What is an Earthquake?

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: vibration of earth produced by the rapid release of \_\_\_\_\_\_\_\_\_\_\_
* Often caused by slippage along break in the earth’s \_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: point within earth where the EQ starts; the \_\_\_\_\_\_\_\_\_ of the Earthquake
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: location on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_the focus
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: \_\_\_\_\_\_\_\_\_\_\_\_\_ in the earth where \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has occurred
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Most EQs are produced by the rapid release of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ stored in rock that has been subjected to great forces
  + As rock is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, it \_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_ elastic energy. Once the rock is strained \_\_\_\_\_\_\_\_\_\_\_\_\_\_ its breaking point, it ruptures and release the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the form of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(seismic waves) of earthquakes
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: small earthquakes \_\_\_\_\_\_\_\_\_\_a major earthquake
  + Can happen \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ before the major quake
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: movements that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a major earthquake
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the major EQ
  + Can sometimes \_\_\_\_\_\_\_\_\_\_\_\_\_ structures weakened by the major earthquake
* Earthquake Zones
  + \_\_\_\_\_\_\_\_ of all occur in circum \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Most result from \_\_\_\_\_\_\_\_\_\_\_\_\_\_ margin activity
  + \_\_\_\_\_\_\_\_\_ occur in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_ occur in the interiors of plates and on spreading ridge centers



Section 2: Earthquake Waves

* Measuring Earthquake Instruments
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: instruments that record EQ waves
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: traces of amplified, electronically recorded ground motion made by seismographs



*Types of Waves*

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ waves (\_\_\_\_ waves)
  + Travel along earth’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Especially damaging to buildings
  + \_\_\_\_\_\_\_\_\_ destructive of the 3 types of waves
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ movement (think of ocean wave movement)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_waves
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ motion
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ waves-material is moved in the \_\_\_\_\_\_\_\_ direction as the wave moves
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_ moving wave
  + Travel through \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_waves
  + \_\_\_\_\_\_\_\_\_\_\_\_\_ than \_\_\_\_\_\_ waves, \_\_\_\_\_\_\_\_\_\_\_\_ than \_\_\_\_\_\_\_\_\_\_\_\_ waves
  + Travel through \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ only
  + Move \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(90 degrees) to wave movement

*Locating an EQ’s Epicenter*

* \_\_\_\_\_\_ waves arrive \_\_\_\_\_\_, then \_\_\_\_\_ waves, then \_\_\_\_\_\_\_\_\_\_\_\_\_
* Earthquake distance
  + Epicenter is located using the difference in the arrival times of \_\_\_\_\_\_\_\_\_\_\_\_\_ wave recordings which are related to distance
* Earthquake direction
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ graphs from \_\_\_\_\_\_\_\_ or more seismograph can be used to find the exact location of an earthquake epicenter

Section 3: measuring Earthquakes

* Two different types of measurements: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Intensity: based on \_\_\_\_\_\_\_\_\_\_\_\_ of ground shaking on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Varies from place to place within disturbed region depending on the location of the observer with the respect to the EQ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Magnitude: related to the amount of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at the hypocenter of the earthquake
  + Based on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of EQ waves recorded on instruments

*Scales*

* Richter Magnitude Scale
  + Range from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + <2.0:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + ~4.0:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + 6.0-6.9:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + 7.0-7.9:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + 8.0-9.9:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + 10+:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Modified Mercali Intensity Scale
  + Developed in \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_ Different Levels:
  + I:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + II:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + III:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + IV:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + V:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + VI:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + VII:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + VIII:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + IX:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + X:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + XI:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + XII:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Moment Magnitude
  + Derived from the amount of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_that occurs along the fault zone
  + Most widely used measurements for EQS because it is the only magnitude scale the estimates \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by earthquakes
  + Measures very large earthquakes
  + Calculated by different factors including
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      * A x B x C=measure of how much energy rock can \_\_\_\_\_\_\_\_\_ before it slips and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy during an earthquake

Section 4: Destruction from Earthquakes

* Damage to buildings and other structures from earthquake waves depends on several factors including:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Factors that determine structural damage:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Most serious safety threat
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Saturated material turns to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Underground objects may float to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Occurs when \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ saturated with \_\_\_\_\_\_\_\_\_\_\_ are shaken by EQ waves
* Tsunamis
  + Japanese for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Causes:
    - Triggered by an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Occurs where a slab of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is displaced \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ along a fault
    - Can also occur when the vibration of a EQ sets an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in motion
  + A tsunami is generated by movement of ocean floor. The \_\_\_\_\_\_\_\_\_of a wave moving across the ocean is related to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Tsunami Warning System
  + Large EQs are reported to Hawaii from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Although tsunamis travel quickly, there is sufficient time to evacuate all but the area \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the epicenter
  + On average only \_\_\_\_\_\_\_\_\_\_\_\_\_ destructive tsunamis worldwide per year
  + ON average, only \_\_\_\_\_\_\_ tsunami every \_\_\_\_\_\_ years causes major damage and loss of life
* Predicting Earthquakes
  + Short range:
    - Not successful yet
  + Long range forecasts
    - Data can be important for updating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Scientists don’t yet understand enough about how and where earthquakes occur will occur to make accurate long term predictions
    - A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an area along a fault where there has not been EQ activity for a long period of time
* Other Dangers
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:
    - Results from the violent shaking of EQs, causing the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on slopes to fall
    - The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cause of structural damage
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:
    - In the San Francisco earthquake of 1906, most of the destruction was caused by fires that started when gas and electrical lines were cut