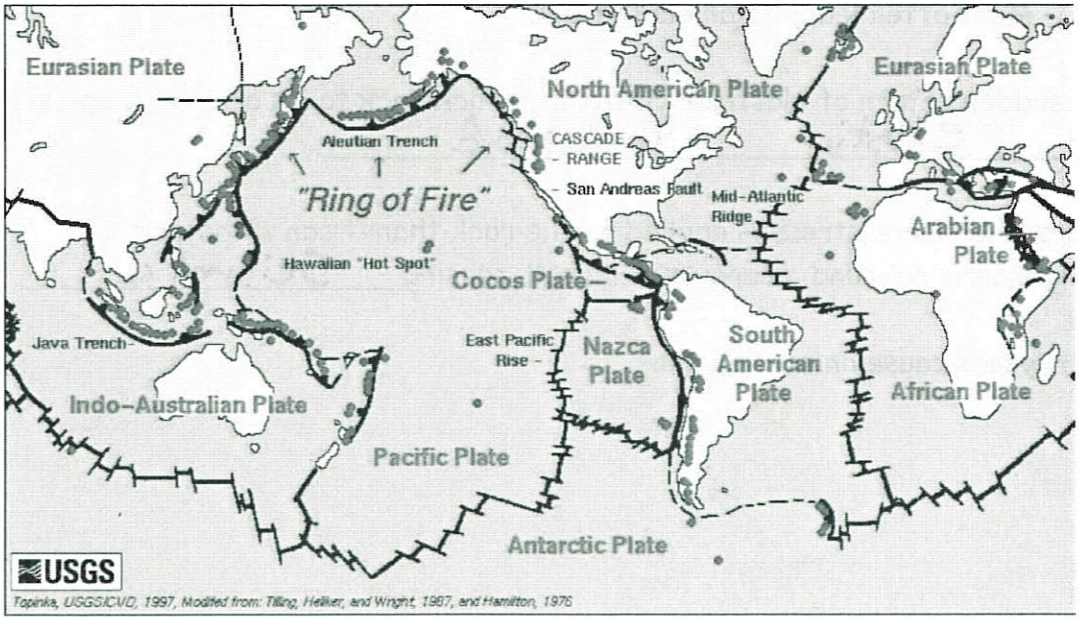
Earthquakes and Volcanoes

What are Earthquakes?

- Has anyone ever experienced an earthquake?

- The study of earthquakes is known as _____ and the scientists who study them are known as _____.
- Most earthquakes take place near the edges of tectonic plates, also known as a Boundary.
- We already know that tectonic plates move around and move in different directions and different speeds.
- What are the three ways tectonic plates may move in relation to one another?
- These movements create Faults in the Earth's crust
- A fault is [redacted]

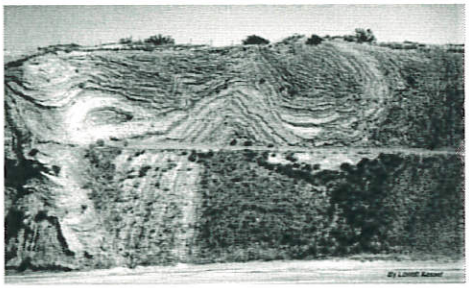
- Earthquakes occur here because of this sliding
- The largest and most active earthquake zone lies along the boundaries of the Pacific Plate
- This region is known as the _____ _____ _____.



What Causes Earthquakes?

-As tectonic plates push, pull, or slip past each other, Stress increases along the fault
-In response to this, the rock deforms
-Rock along a fault deforms in mainly two ways:

1. **Plastic Deformation**, deforms like a piece of molded clay
   - Does not lead to earthquakes



2. Elastic Deformation, rock stretches and breaks at some point
   - Think of as a stretched rubber band
   - When the rubber band breaks, it releases energy, broken pieces return to their unstretched shape
   - Most often leads to an earthquake

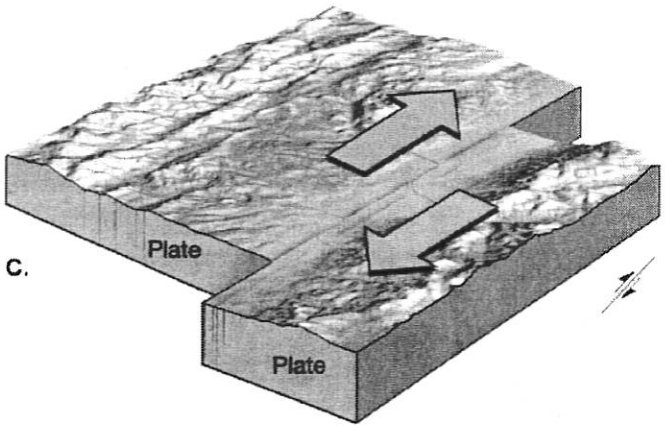
- The sudden return of elastically deformed rock back to its original shape is called elastic Rebound.

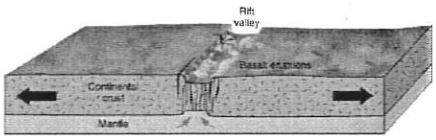
-Occurs when more stress is applied to the rock than it can withstand
-During elastic rebound, energy is released, causing Seismic waves.
-These waves cause an earthquake

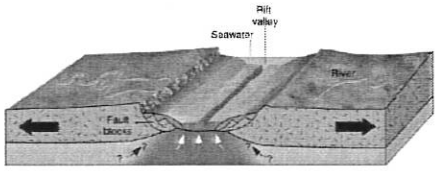
Earthquake Zones

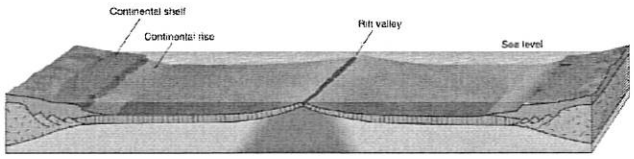
Name the type of boundary shown, type of motion and the type of fault pruduced there

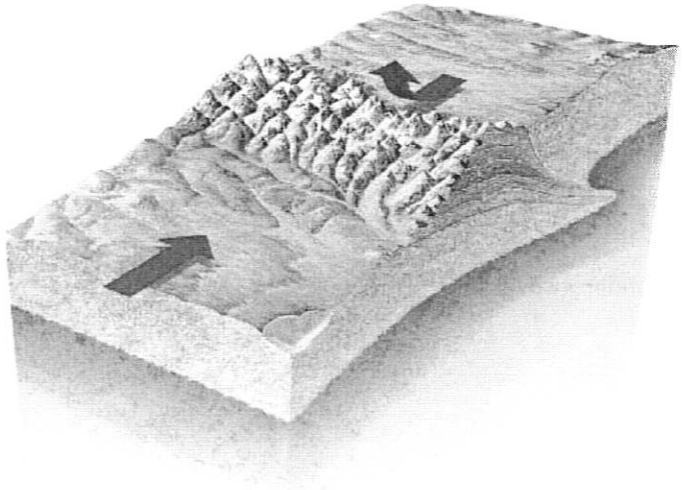
c.











-Earthquakes can happen at surface or far below

-Most happen in earthquake zones along tectonic plate boundaries

-An **earthquake zone** is a place where a large number of faults are located.

-San Andreas Fault is an example of quake zone

-NOT ALL FAULTS are located at tectonic plate boundaries!

-Quakes may happen along faults in middle of tectonic plates

How Earthquake Waves Travel

-Waves of energy that travel through Earth are called Seismic Waves.

-These waves that travel through the interior are called body waves.

-Waves that travel across the surface are called surface waves.

-There are two types of **body** waves:

- P waves and S waves

P Waves

-Also known as **p**rimary or **p**ressure waves

-travel through solids, liquids and gases

-Causes particles in rock to move in a back-and-forth direction

-Fastest seismic waves, so travel ahead of other waves

-first waves of quake to be detected

-Affects rock by momentarily changing the pressure inside it and deforming it. It reacts by springing back to its original shape.

S Waves

-When rock springs back to its original shape after side-to-side movement, S waves are created.

-Also called **S**hear Waves

-Second fastest seismic wave

-shear rock side to side, meaning they stretch the rock **sideways**

-Cannot travel through liquids

-slower, so arrive later, also referred to as **s**econdary waves

Surface Waves

-Move along Earth's surface

-Produces movement in upper few Km of crust

-Travel more slowly and can be more destructive

Earthquake Measurement

-Scientists use earthquake sensing instruments called a Seismographs to record seismic waves.

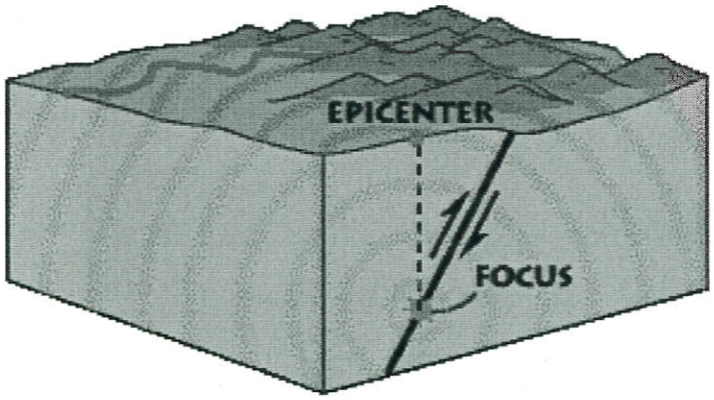
-Located at or near surface.

-When the wave reaches the instrument it creates a tracing of the earthquake motion called a Seismogram.

-Used to calculate when an earthquake began.

-Seismologists can find earthquakes start time by comparing seismograms and noting the **differences in arrival time of P and S waves**

-Can also be used to determine a quake's epicenter and focus



-The distance of the epicenter can be determined by the time it take the P and S waves to hit the seismograph.

-The distance can be determined by knowing the speed of the wave and doing a simple math calculation.

-Use a Time-Distance graph to the see the relation (See Earthquake Virtual Lab)

-The epicenter can be located by **triangulation** using data from three different seismograph locations.

Measuring Earthquake Strength

-Scientists use the Richter Scale to measure the ~~Magnitude~~ or Strength of earthquakes.

-Developed by Charles Richter in the 1930's

-Compares ground motion measured by seismographs

-Measure of an earthquakes strength is called magnitude

-Measures ground motion and adjusts for distance to find it's strength

-Each time the magnitude increases by one unit, the measured ground motion becomes 10 times larger

-Example: A magnitude 5.0 on the Richter Scale will produce 10 times as much ground motion as an earthquakes that measure 4.0 magnitude.

-So, an magnitude of 6.0 will produce 100 (10×10) times as much ground motion as a magnitude 4.0

Effects of Different-Sized Earthquakes

Magnitude	[illegible]
2.0	detected by seismographs
3.0	felt @ epicenter
4.0	felt by most people
5.0	Causes damage @ epicenter
6.0	Can cause widespread damage
7.0	great widespread damage