

# Earth Science

## Chapter 5 Earthquakes

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The diagram illustrates four types of stress acting on a block of material, shown in cross-section with three layers: green (top), brown (middle), and grey (bottom). Blue arrows indicate the direction of the applied stress.

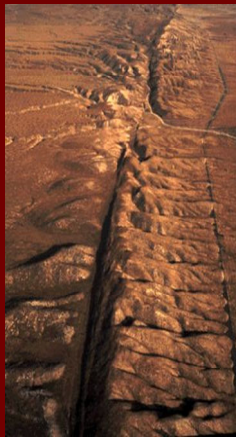
- Before stress:** A rectangular block with no visible deformation.
- Compression:** The block is being pushed together from the top and bottom, resulting in a shorter, wider shape.
- Tension:** The block is being pulled apart from the top and bottom, resulting in a longer, narrower shape.
- Shearing:** The block is being pushed in opposite directions from the top and bottom, resulting in a distorted, parallelogram-like shape.

# Faults & Folds

- **Fault** - a break in the rock layer of the crust where rock surfaces slip past each other.
- **Fold** - Forces on the rock layer are not fast or strong enough to break or snap the rock but simply bends the rock layer

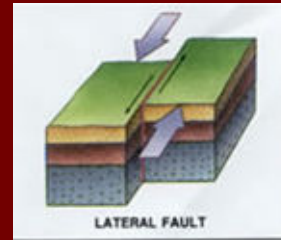
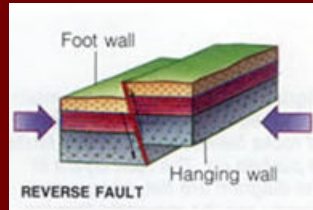
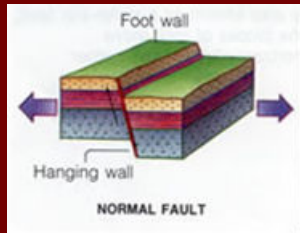
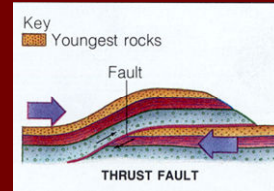


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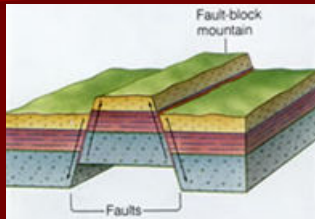
## 3 Types of Faults

- Depends on the type of **Stress** applied to the rock layer
- Foot wall & Hanging wall
- Fault Types:
  - **Tension** causes a **normal** fault.
  - **Compression** causes **reverse** faults.
  - **Shearing** creates **strike-slip/lateral** faults.
  - **Thrust Fault** – caused by major compressional forces pushing the hanging wall completely on top of the foot wall.

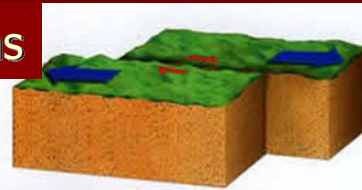
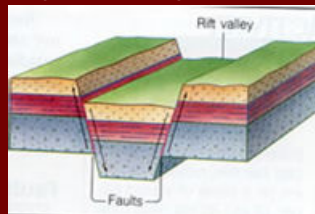


## Fault Types & Land Forms

When two reverse faults cut through a block of rock, fault movements may push up a fault-block (typed lecture notes are wrong)



When two normal faults cut through a block of rock, fault movements may push up a rift valley



### Strike-slip fault



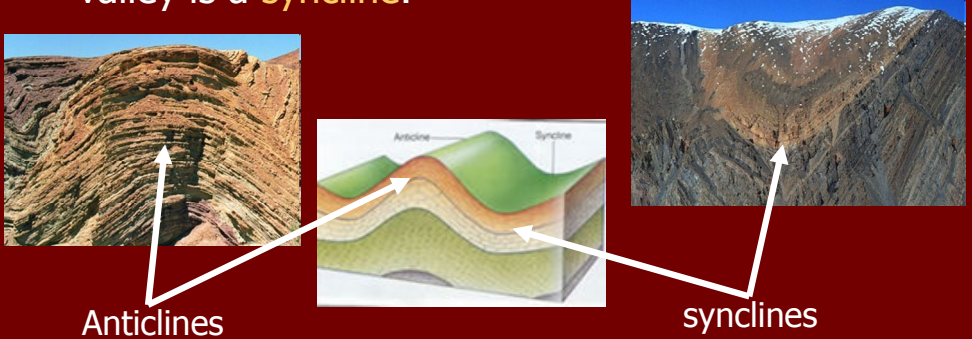
### Reverse fault



### Normal fault

# Rock Layers That Fold

- Caused by **Compression** type forces
- A fold in rock that **bends upward** into an arch is an **anticline**.
- A fold in rock that **bends downward** to form a valley is a **syncline**.



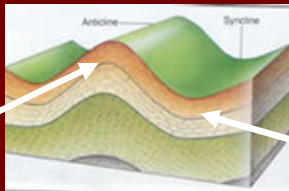
Anticlines

synclines

- Caused by **Compression** type forces
- A fold in rock that **bends upward** into an arch is an **anticline**.
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## Anticlines



synclines

# Earthquake!!

- A shaking and trembling that results from the sudden movement of part of the Earth's crust.
- Similar to ripples from a pebble in a pond
- Usually occur along a fault
- More than 1 million per year on the planet
- Entire fault doesn't all move at the same time. Energy is released at different places at any one time



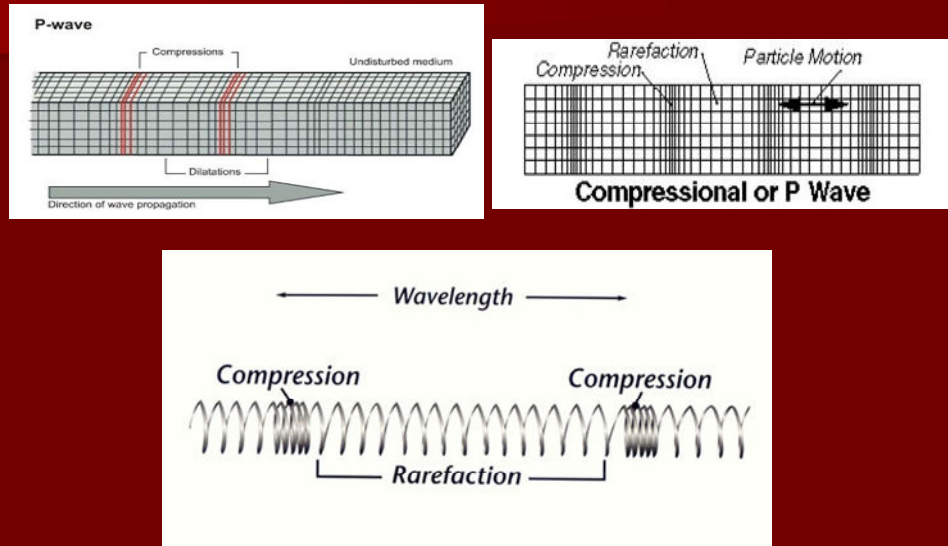


# Earthquake Terms

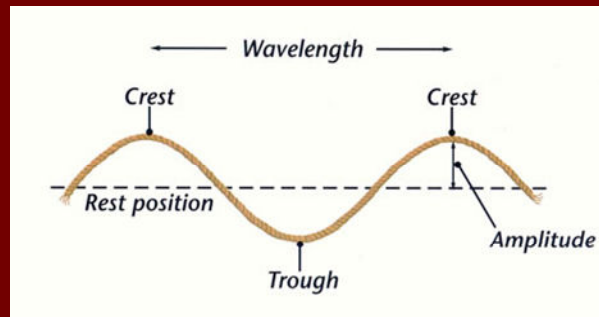
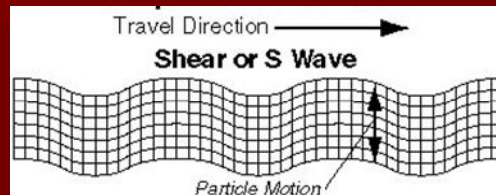
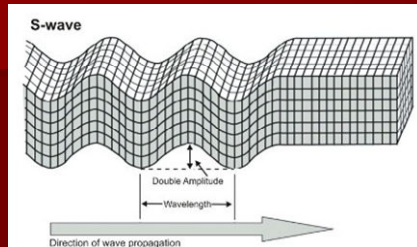
- **Focus:** (aka hypocenter) the point underground where the release of stress is located
- **Epicenter:** the point on the earth's surface directly above the focus
- **Aftershock:** an earthquake that occurs after a larger earthquake in the same area.
- **Liquefaction:** earthquake's violent shaking suddenly turns loose, soft soil into a liquid-like slurry.
- **Seismic waves:** carry energy from an earthquake away from the focus
  - P waves
  - S waves
  - L waves



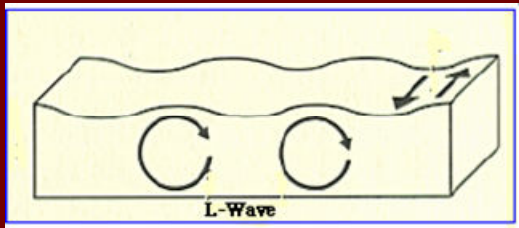
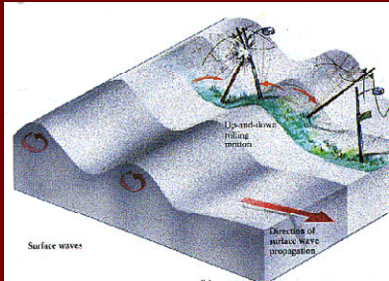
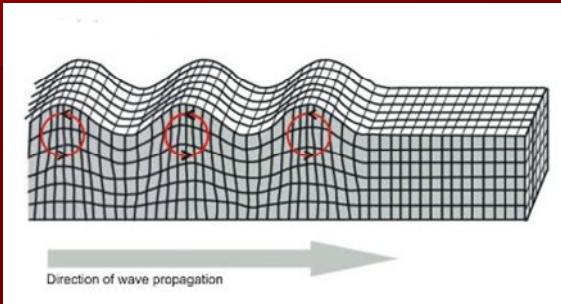
## Primary Waves: P waves



## Secondary Waves: S Waves

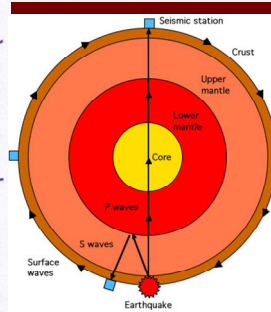
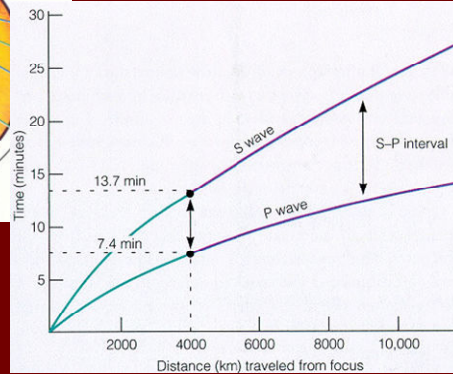
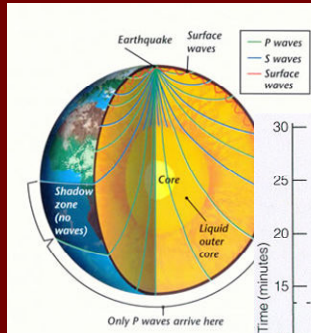


## Surface Waves: L Waves



## Seismic Wave Movements

- P waves travel thru solid & liquid.
- P waves arrive first then come the S waves
- S waves reflect off the liquid outer core



## Earthquake Strength & Intensity

- **Richter Scale** - rating of an earthquake's magnitude based on the size of the earthquake's seismic waves ( 1 – 10)
- **Mercalli Scale** - rate earthquakes according to the level of damage at a given place. ( I – XII)
- **Moment Magnitude Scale** - rating system that estimates the total energy released by an earthquake

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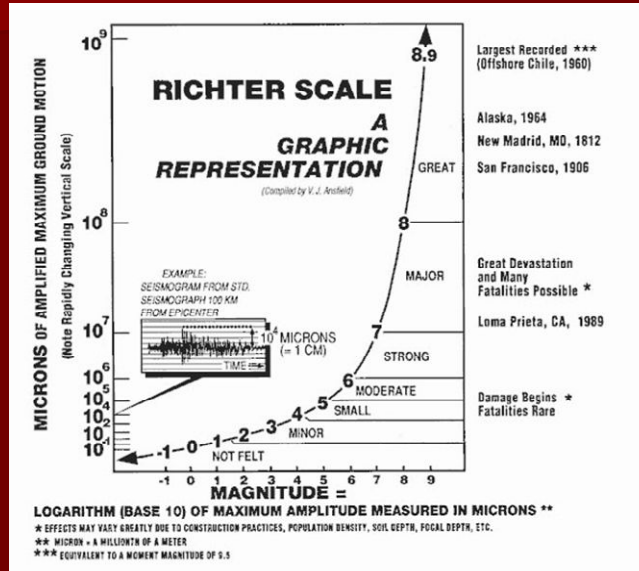
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## Richter Scale

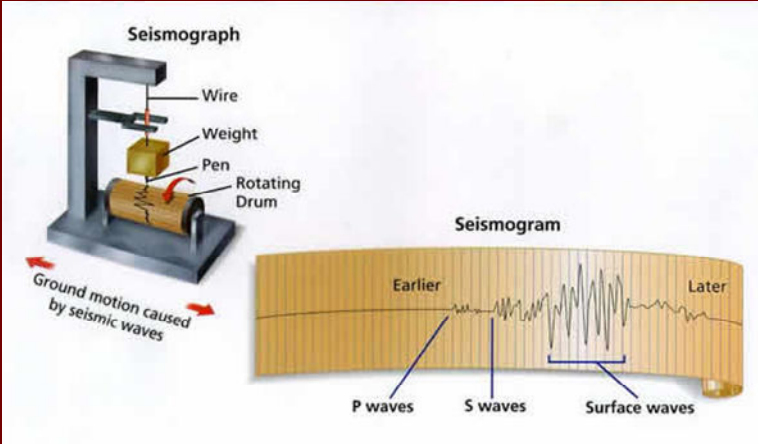
- Most commonly used scale
- Each number represents a magnitude 10x greater than previous number.





# Seismograph

- A Seismograph detects and measures intensity of the earthquake
  - A Record of an earthquake is a **seismogram**

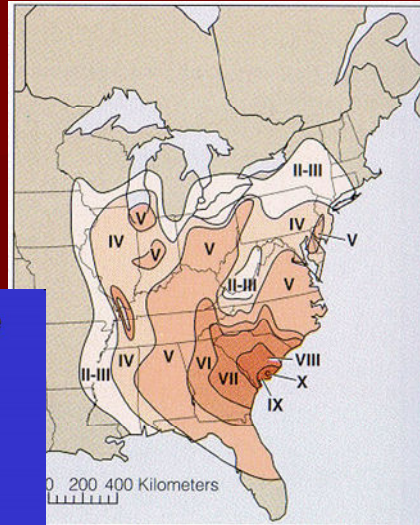
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## Mercalli Scale

- rate earthquakes according to the level of damage at a given place. ( I – XII)

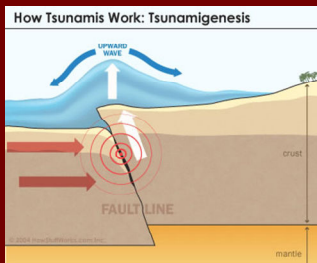
### Modified Mercalli Intensity Scale

- I Not felt
- II Felt only by persons at rest
- III–IV Felt by persons indoors only
- V–VI Felt by all; some damage to plaster, chimneys
- VII People run outdoors, damage to poorly built structures
- VIII Well-built structures slightly damaged; poorly built structures suffer major damage
- IX Buildings shifted off foundations
- X Some well-built structures destroyed
- XI Few masonry structures remain standing; bridges destroyed
- XII Damage total; waves seen on ground; objects thrown into air



## Tsunamis – “Tidal Wave”

- Tsunami - a large water wave caused by an under sea earthquake.
- When an earthquake jolts the ocean floor, plate movement causes the ocean floor to rise slightly and push water out of its way.



**Tsunamis**



That's it !!  
Let's go home....

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