Chapter 11

Earthquakes and Volcanoes

Earthquakes

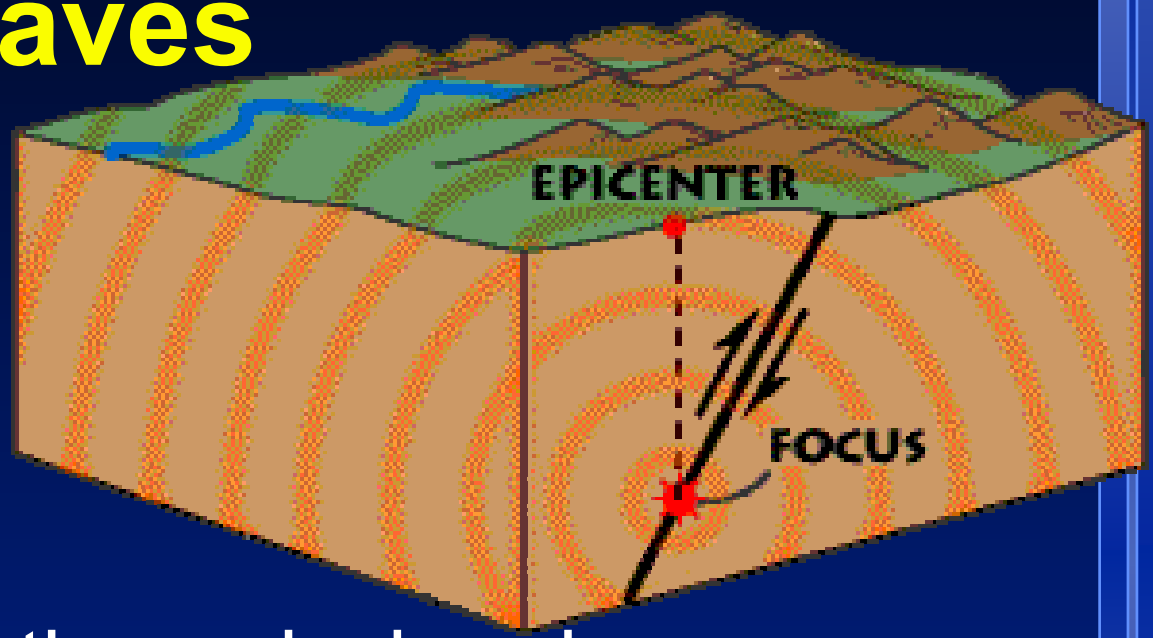
- The shaking caused by the sudden movement of the crust
- Scientists estimate that over one million earthquakes happen every year.
- Approximately one earthquake every thirty seconds.
- Most so small that no one notices them are recorded by seismographs.

- Several thousand per year actually move the surface of the Earth.
- About 20 per year cause severe changes in the Earth's surface.
- These have the potential to cause serious damage to buildings and dramatic loss of life in populated areas.

Seismic Waves

- Waves travel from the break outward.
- Main cause is faulting.
- If they occur on the ocean floor they can cause giant waves called tsunamis
  - Travel at 700-800km/hr
  - 10 to 20 meters high when they hit the coast.

Seismic Waves



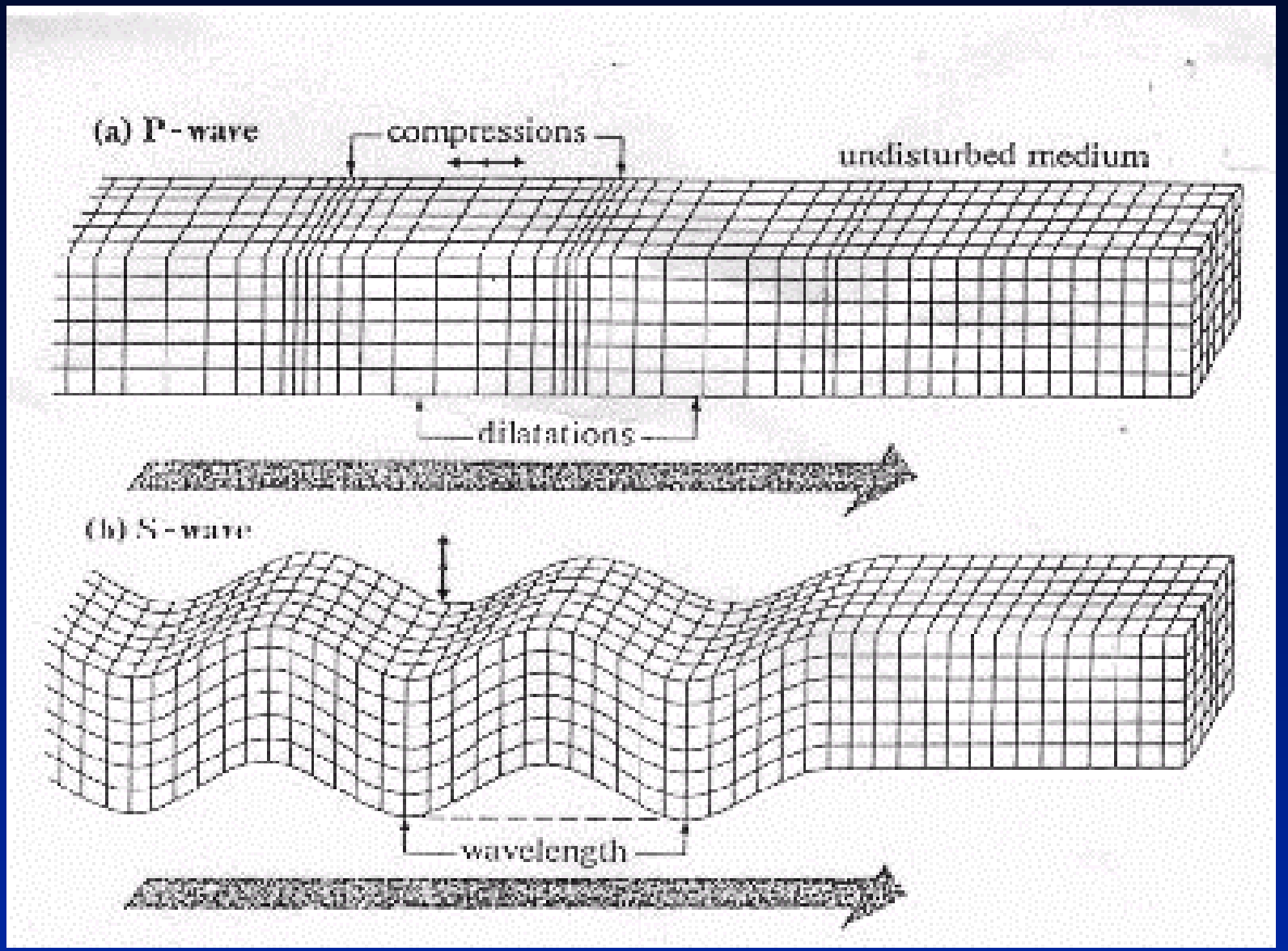
- Focus- where the rocks break
  - below ground
- Epicenter- the surface directly above the focus.
- Where shaking is worst

Seismic waves

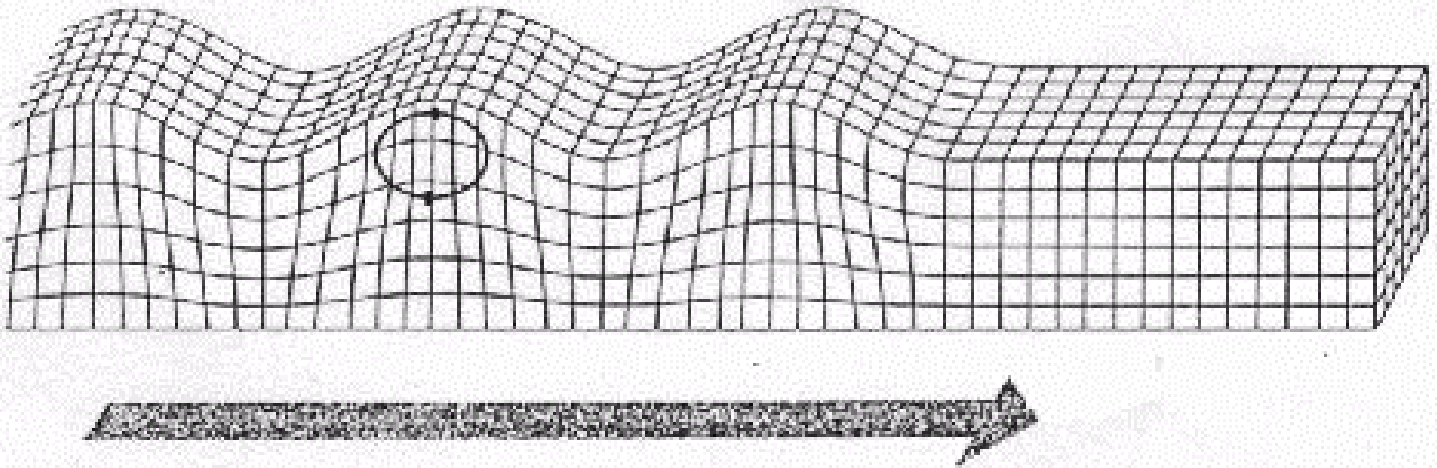
- Three types
- Primary waves- P waves
  - Fastest
  - Travel through solid, liquid, and gases
  - Pressure wave
- Secondary waves- S waves
  - slower
  - Don’t go through liquids
  - Shear waves - side to side

Seismic waves

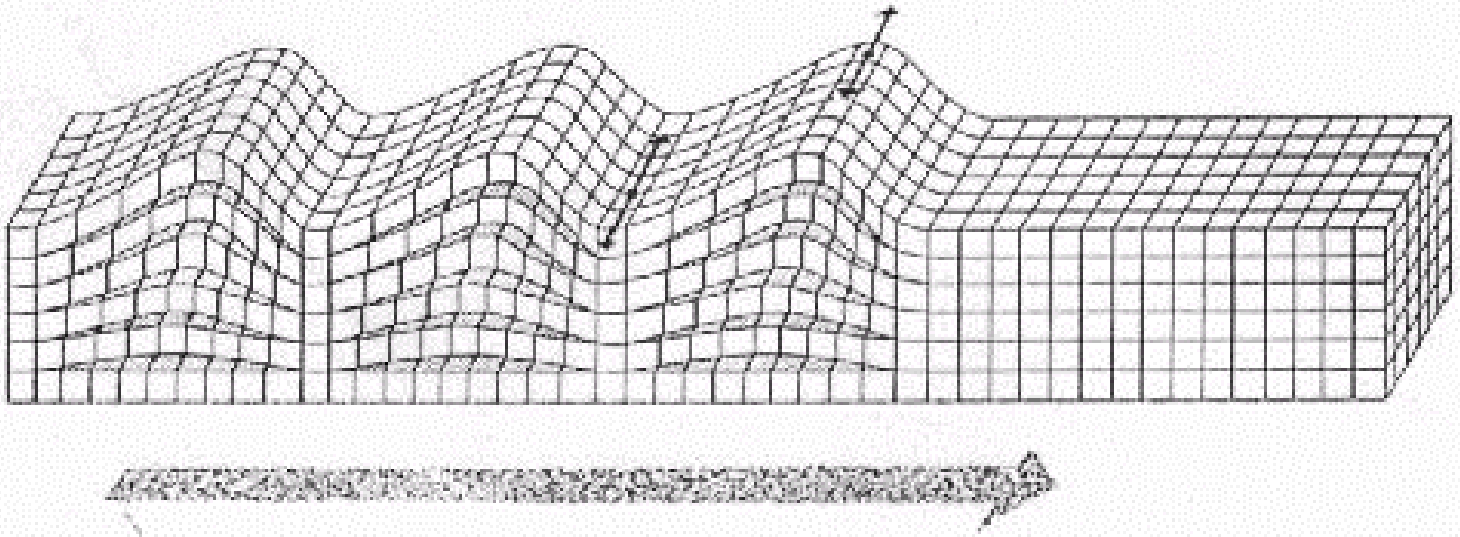
- Surface waves- L waves
  - slowest
  - Move like ocean waves - rise up and down
  - cause the most damage

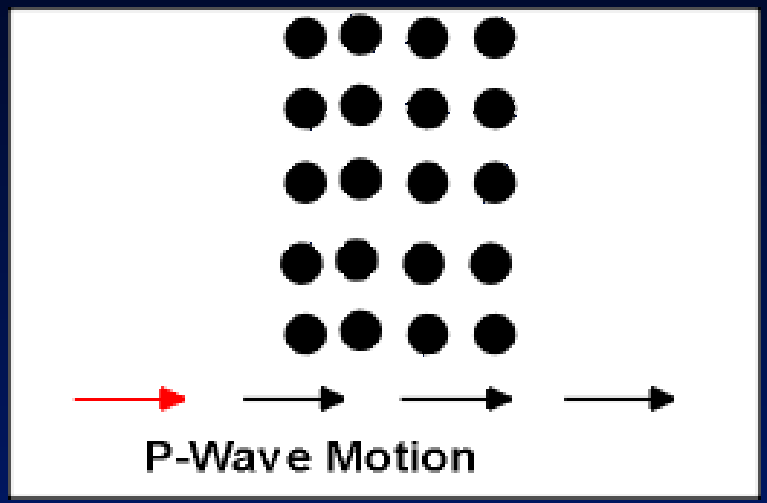

(a) P - wave
compressions
undisturbed medium
dilatations
(b) S - wave
wavelength

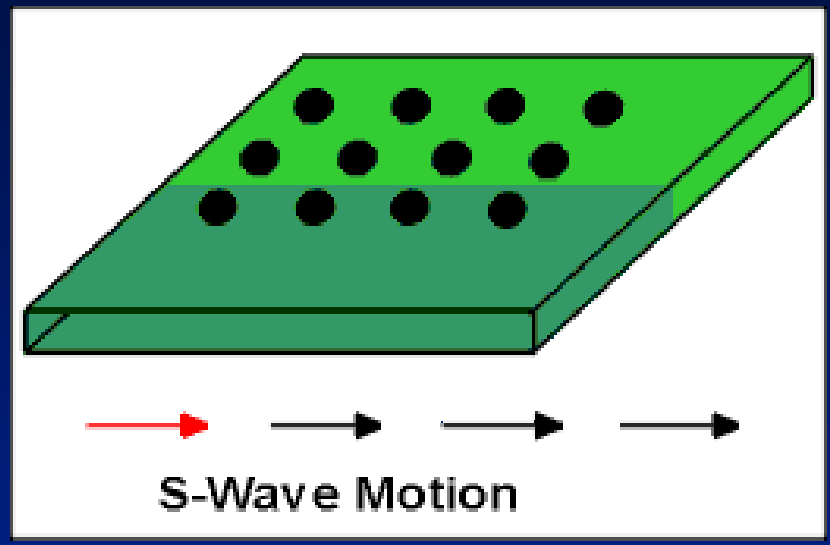
(c) Rayleigh wave

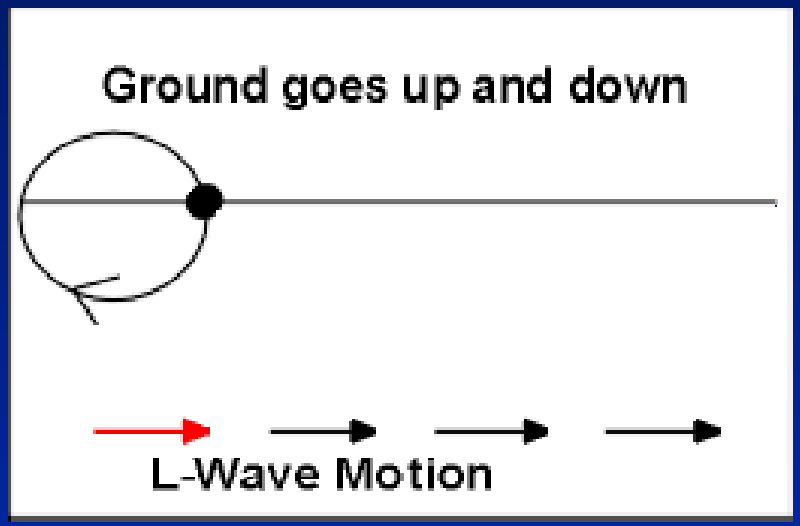


(d) Love wave



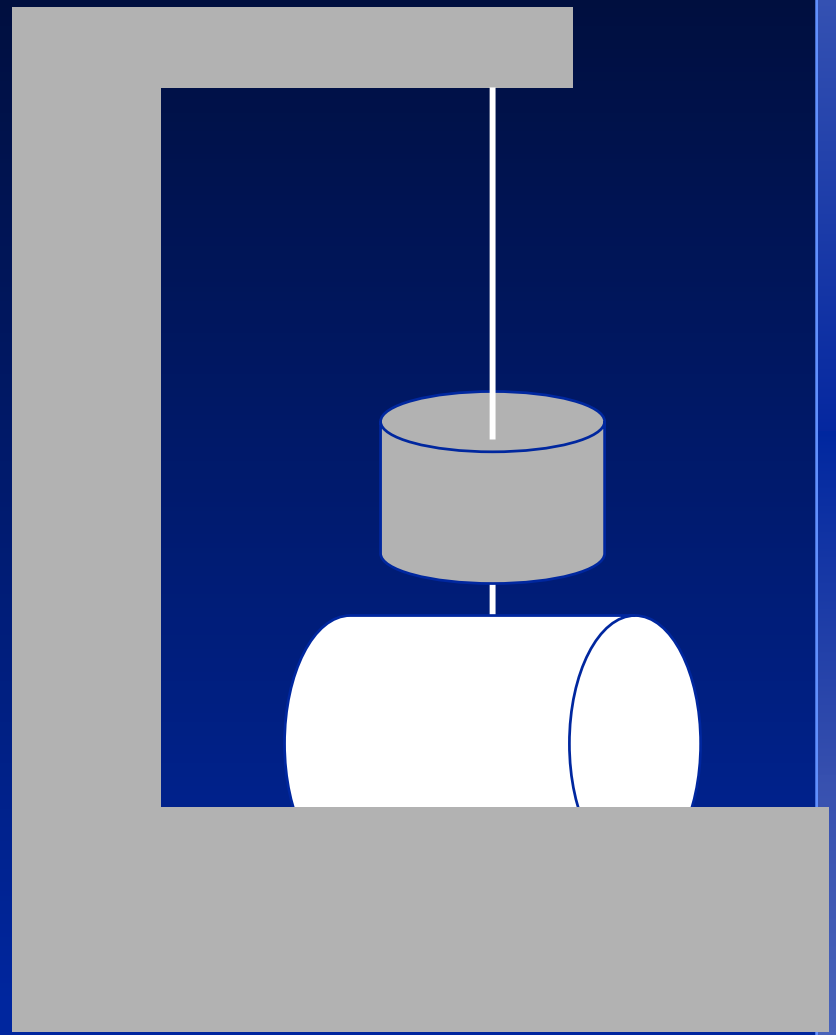

P-Wave Motion

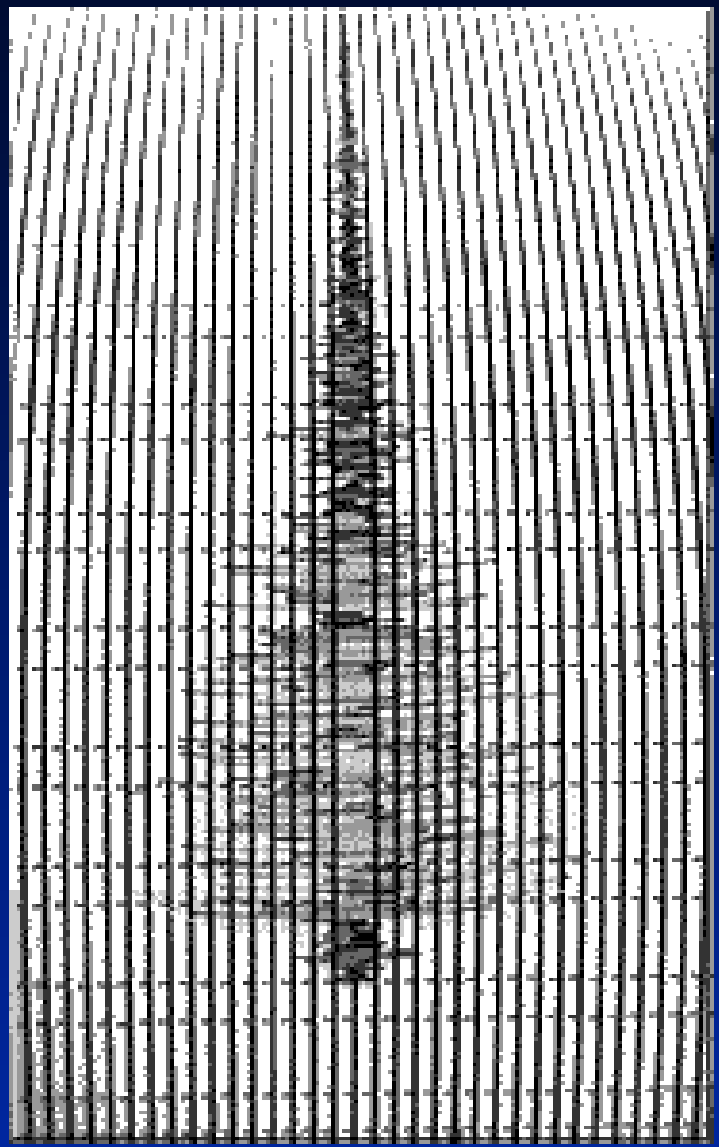

S-Wave Motion


Ground goes up and down
L-Wave Motion

Seismograph

- Detects and measures seismic waves
- Seismogram is the record made by it
- Studied by a seismologist
- Flat line - no motion
- Bigger waves, stronger quake





Richter scale

- How we compare the strength of earthquakes
- Not a machine
- Number from 1 to 10
- Higher number stronger earthquake.
- Every 1 number higher is 10 times stronger
- Bigger than 6 very destructive

Predicting Earthquakes

- To be useful must predict
  - where
  - when
  - how strong
- Not very good
- make buildings differently in earthquake areas
- Trying by measuring motion of earth, speed of waves, tilt of earth, electricity

Volcanoes

- Magma- melted rock below the surface
- Lava- when it reaches the surface
- Volcano - where lava reaches the surface
- Lava lets us see what is below the crust
- Different types of lava
- Dark colored, runny lava flows quietly
- Light colored hardens inside, pressure builds and it explodes.
- Gas bubbles can form pumice and scoria

Rock fragments

- Thrown out in eruptions
- Different sizes
- Volcanic dust- like flour
- Volcanic Ash- grains of rice
- Cinders- about the size of a golf ball
- Volcanic bombs- a few centimeters to several meters across

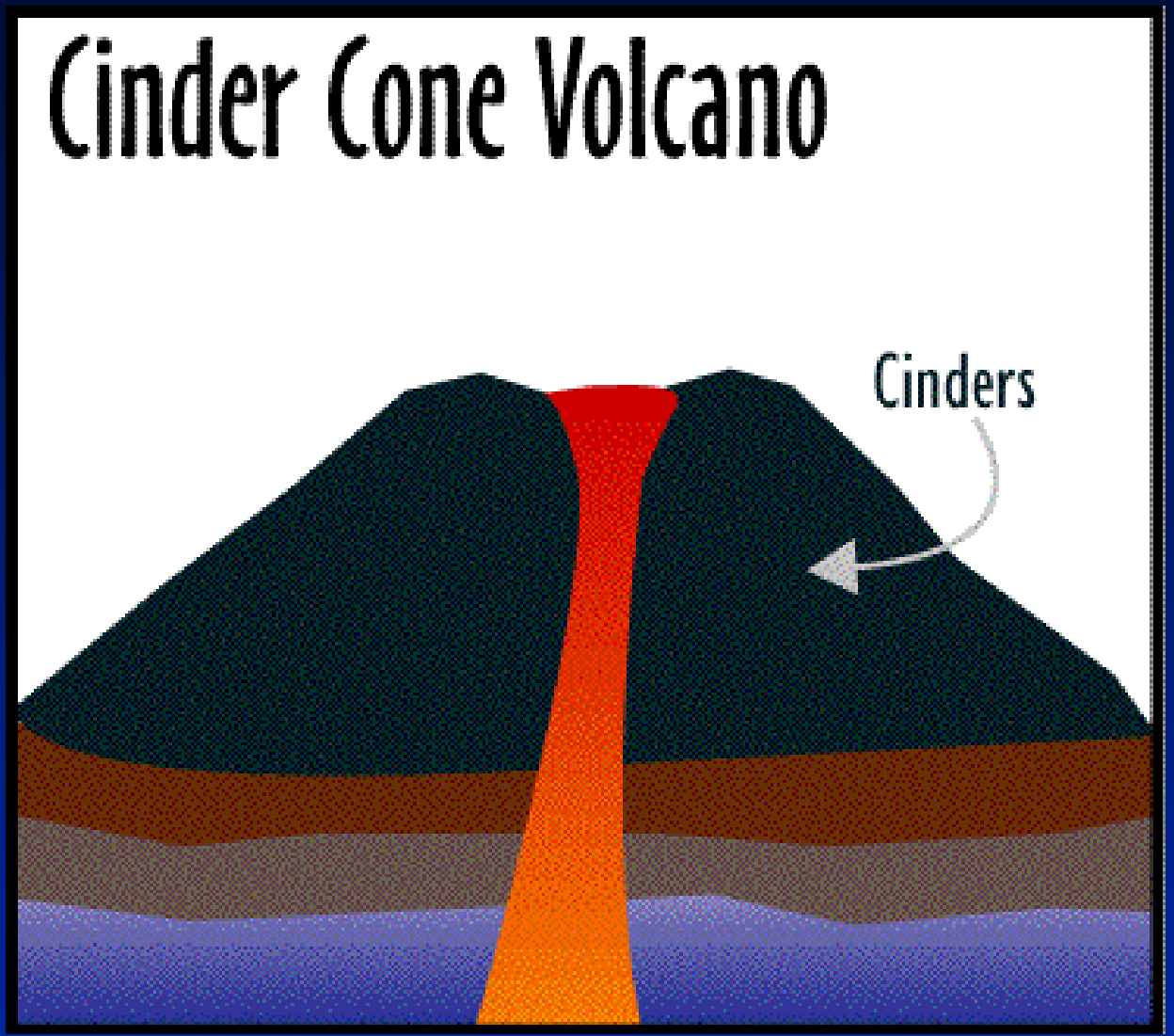
Types of Volcanoes

- Three different types
- Cinder cone formed by piling up rock fragments from explosive eruptions
- Narrow base and steep sides
- Shield volcanoes runny lava pouring out covers the ground in layers
- large area, gentle slope - Hawaii

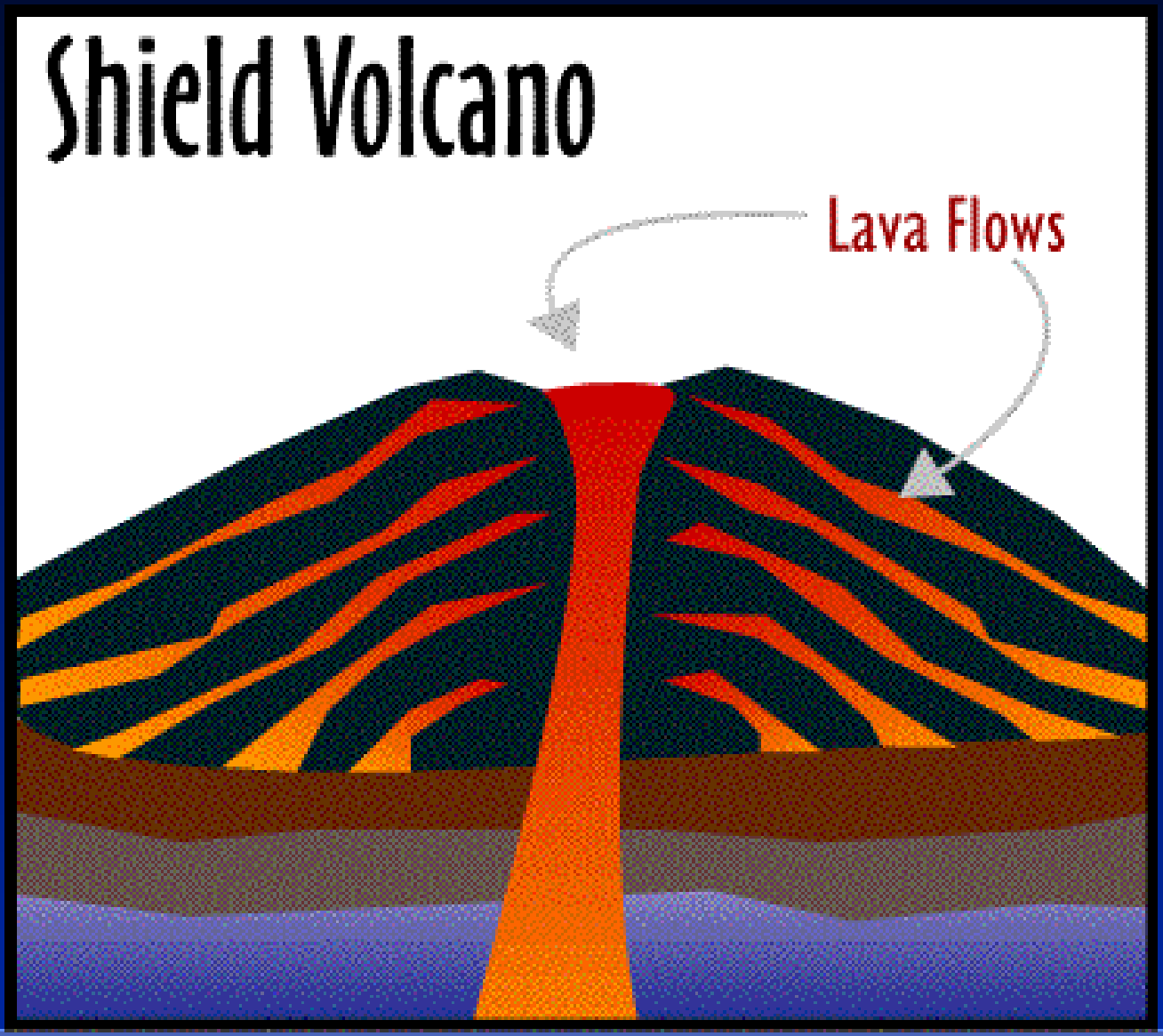
Types of Volcanoes

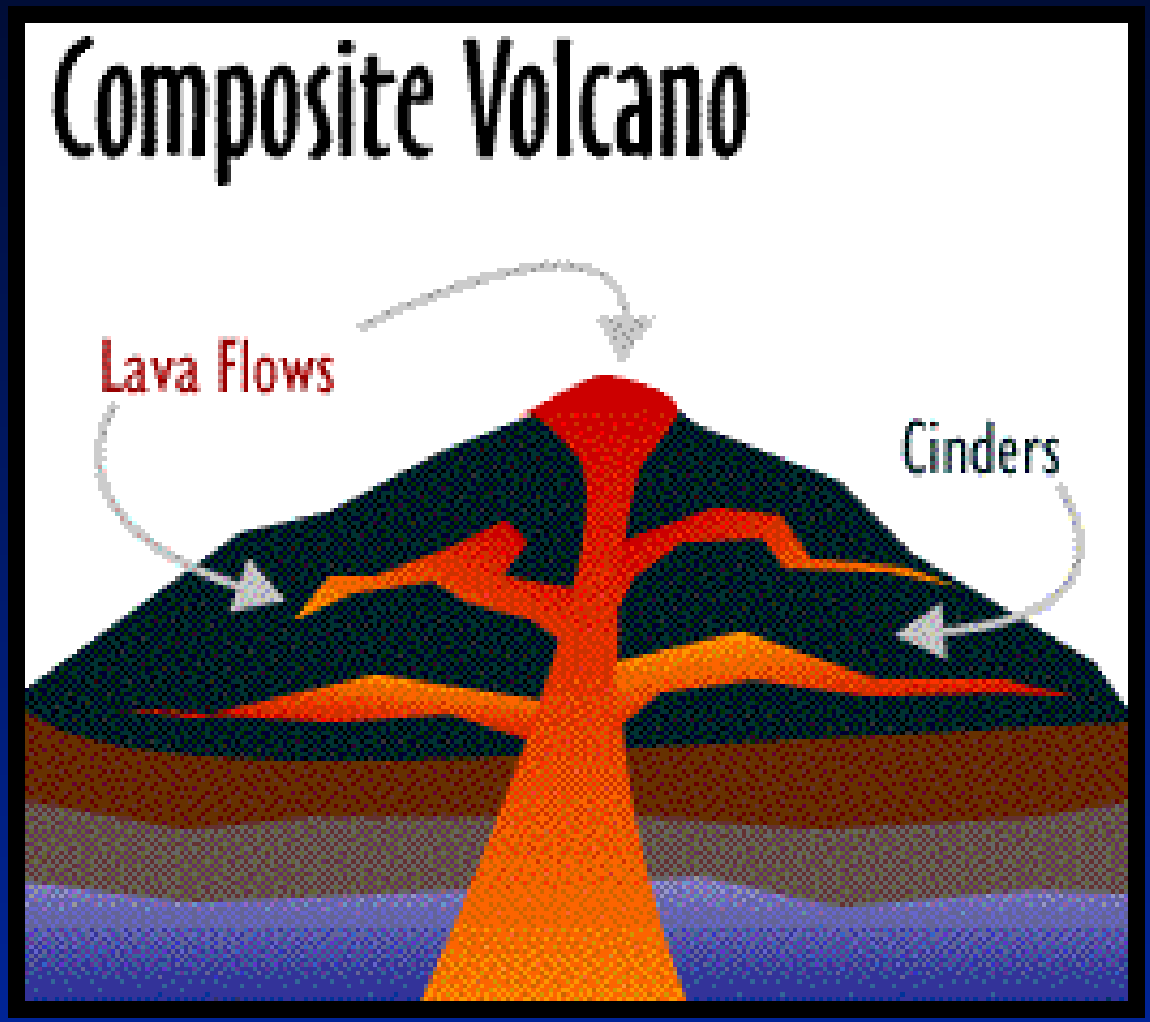
- Composite Volcano- Alternating layers of rock caused by alternating types of eruptions
- Explosive lays down rocks
- then covered by lava,
- Another explosion,
- More lava
- etc.
- large cone shaped mountain forms

Cinder Cone Volcano



Shield Volcano




Composite Volcano
Lava Flows
Cinders

Volcano Parts

- Vent- The pipe that the lava flows through
- Crater- funnel shaped pit at the top of a volcano
- Caldera- If the walls of the crater collapse and the crater becomes very large.

Volcano Zones

- Ring of Fire- all the way around the Pacific Ocean
- Through the Mediterranean Sea
- Mid-Atlantic Ridge- Underwater Mountain range down the middle of the Atlantic Ocean