

Volcanoes and Earthquakes

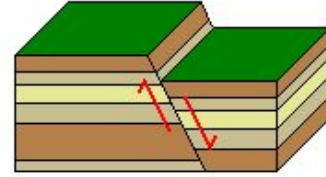
Types of Stress

- Force that change shape and volume of rock over millions of years
 1. Tension-pulls crust stretches it in the middle so that it is thinner
 2. Compression-squeezes rock together and pushes rock together and up
 3. Shearing-pushes a mass of rock in two opposite directions and slips apart

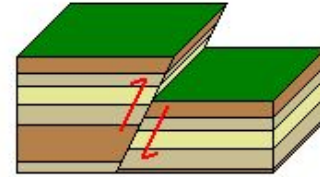
Normal Faults

- Tension
- Hanging wall lies above
- Footwall lies below
- Hanging wall slides downward during motion
- Diverging plate boundary
- Rio Grande rift valley

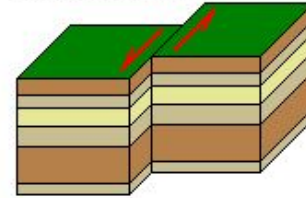
A normal fault



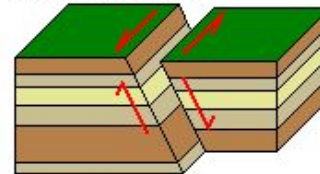
A reverse fault



A strike-slip fault

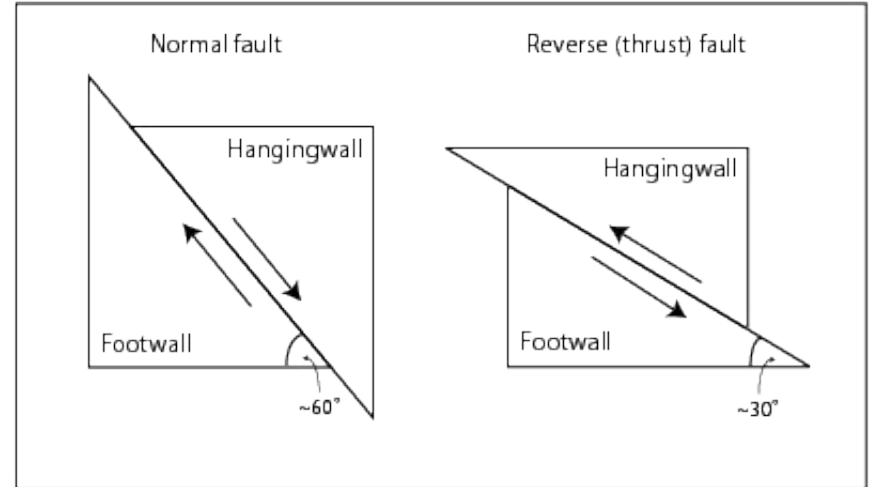


An oblique fault



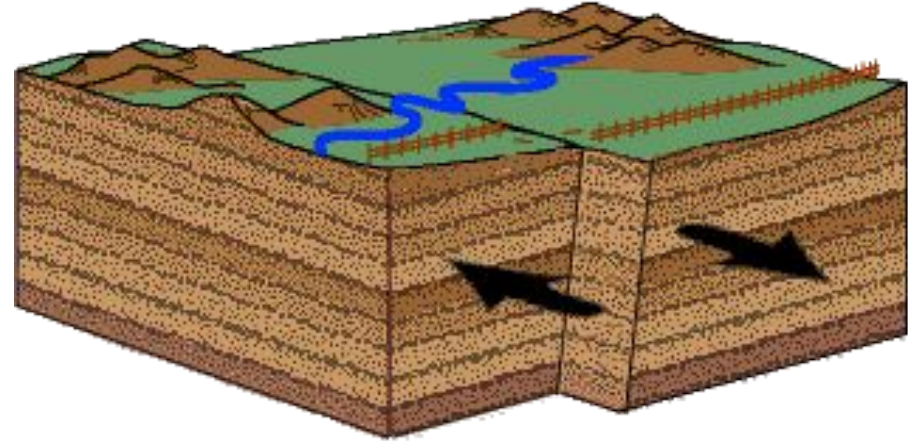
Reverse Fault

- Compression
- Blocks move in opposite directions
- Footwall moves downward and hanging wall slides upward
- Convergent boundary
- Rocky Mountains



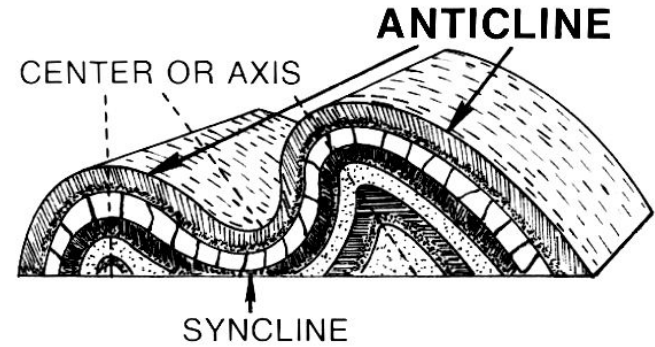
Strike-Slip Fault

- Shearing
- Slip past each other sideways, with little up or down motion
- Transform boundary
- San Andreas fault

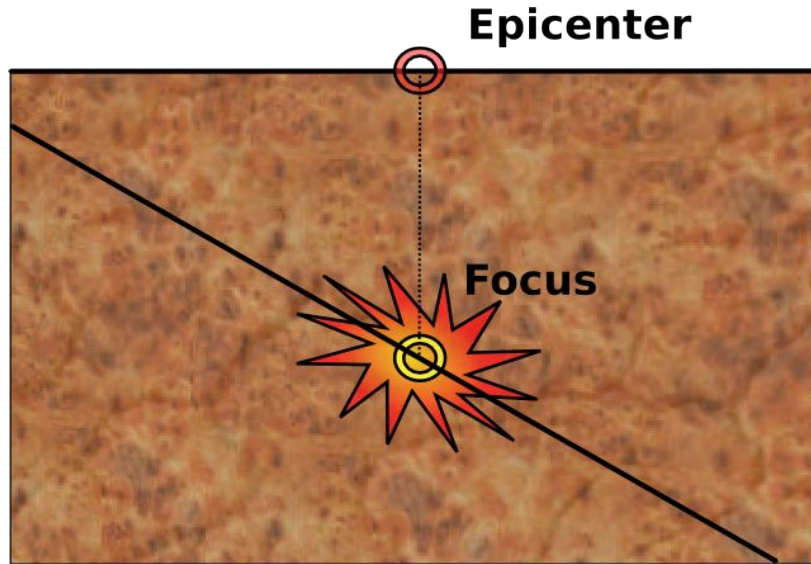


Changing Earth's Surface

- Anticline-fold that bends upward (mountains)
- Syncline-downward bend (valley)
- Folded mountains
- Fault-block mountain: two normal faults form parallel to each other and block between the two moves upward
- Plateau-large area of land that is elevated high above sea level



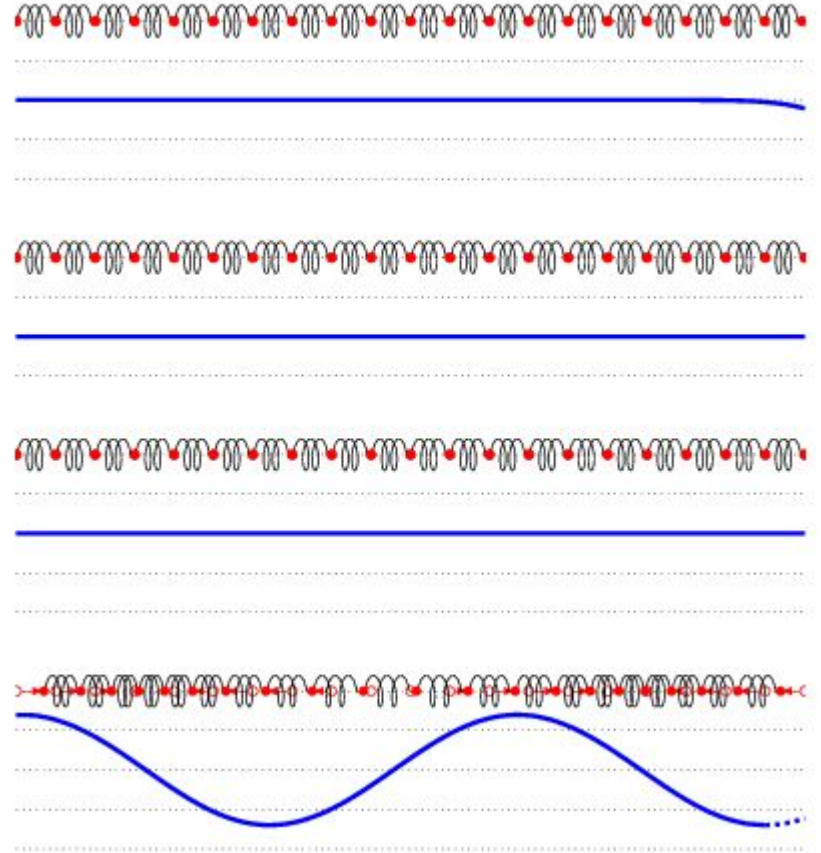
Earthquake



- Shaking and trembling that results from the movement of rock beneath Earth's surface

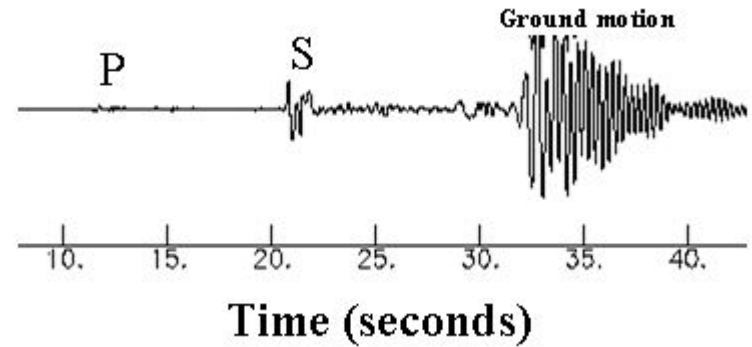
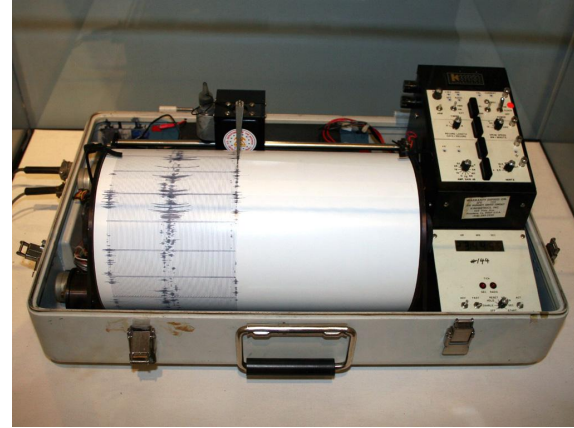
Types of Seismic Waves

- Carry energy away from focus
- P waves
 - Compress and expand like an accordion
 - Damage buildings
 - Vibrate back and forth
 - Travel through solids and liquids
- S waves
 - Vibrates side to side and up and down
 - Shake structures violently
 - Travel through solids only
- Surface waves
 - Move more slowly
 - Severe ground movements
 - Wavelike motion



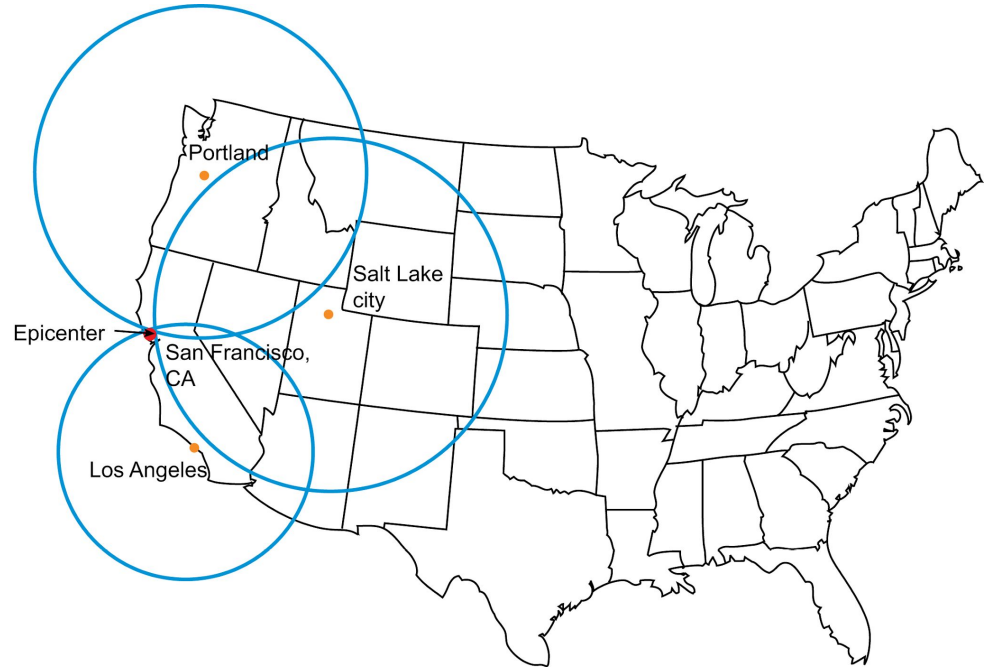
Measuring Earthquakes

- Mercalli scale
 - Rate earthquakes according to the level of damage
 - Different ratings at different locations
- Richter scale
 - Magnitude-size of earthquake
 - Rating of earthquake's magnitude based on size of seismic waves
 - Seismograph
 - Accurate for small nearby earthquakes
- Moment magnitude scale
 - Rating system that estimates the total energy released
 - Rate all sizes near or far



Locating the Epicenter

- Use seismic waves to locate earthquake's epicenter
- Seismic waves travel at different speeds
- P waves arrive first followed by S waves
- Draw three circles from seismic waves
- Where the three circles meet is epicenter

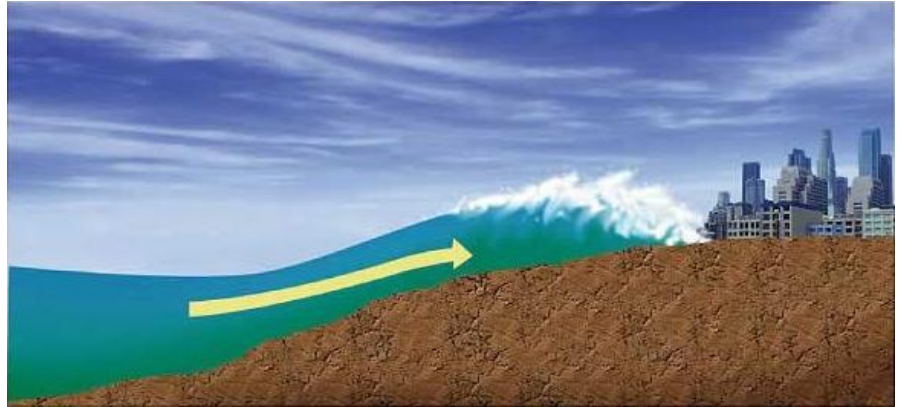


Monitoring Earthquakes

- Seismographs
- Tiltmeters
 - Measure vertical movement
 - Two bulbs with liquid similar to carpenter's level
- Creep meters
 - Measures horizontal movement
 - Wire stretched across a fault with a weight on a scale
- Laser-ranging devices
 - Measures horizontal movement
 - Times laser as it travels to reflector and back
- GPS satellites
- Predict: map faults, monitor friction and stress
- Risk: high risk on west coast of US

How Earthquakes Cause Damage

- Shaking
 - Triggers landslides and avalanches
 - Damage buildings, topple utility poles, and fracture gas and water mains
- Liquefaction
 - Earthquake's violent shaking suddenly turns loose soft soil into liquid mud
- Aftershocks
 - Earthquake that follows an earthquake
- Tsunamis
 - Water displaced by the earthquake on ocean floor and causes a large wave



Earthquake Safety

- Drop, cover, and hold
- Prepare
 - First aid kit, canned food, water, batteries
- Indoors
 - Crouch beneath a sturdy table or desk
 - Crouch against inner wall, away from the outside
 - Cover head and neck
 - Avoid glass
- Outdoors
 - Move to an open area
 - Avoid vehicles, power lines, trees, and buildings
 - Sit down

Earthquake-safe house

- Fasten furniture to studs
- Secure brick chimneys with wooden brackets
- Remove heavy items from above beds
- Use plywood panels to strengthen walls
- Use metal connectors in house's frame
- Strap the water heater to the wall
- Bolt house to foundation
- Base-isolated building
 - Rests on shock-absorbing rubber pads or springs

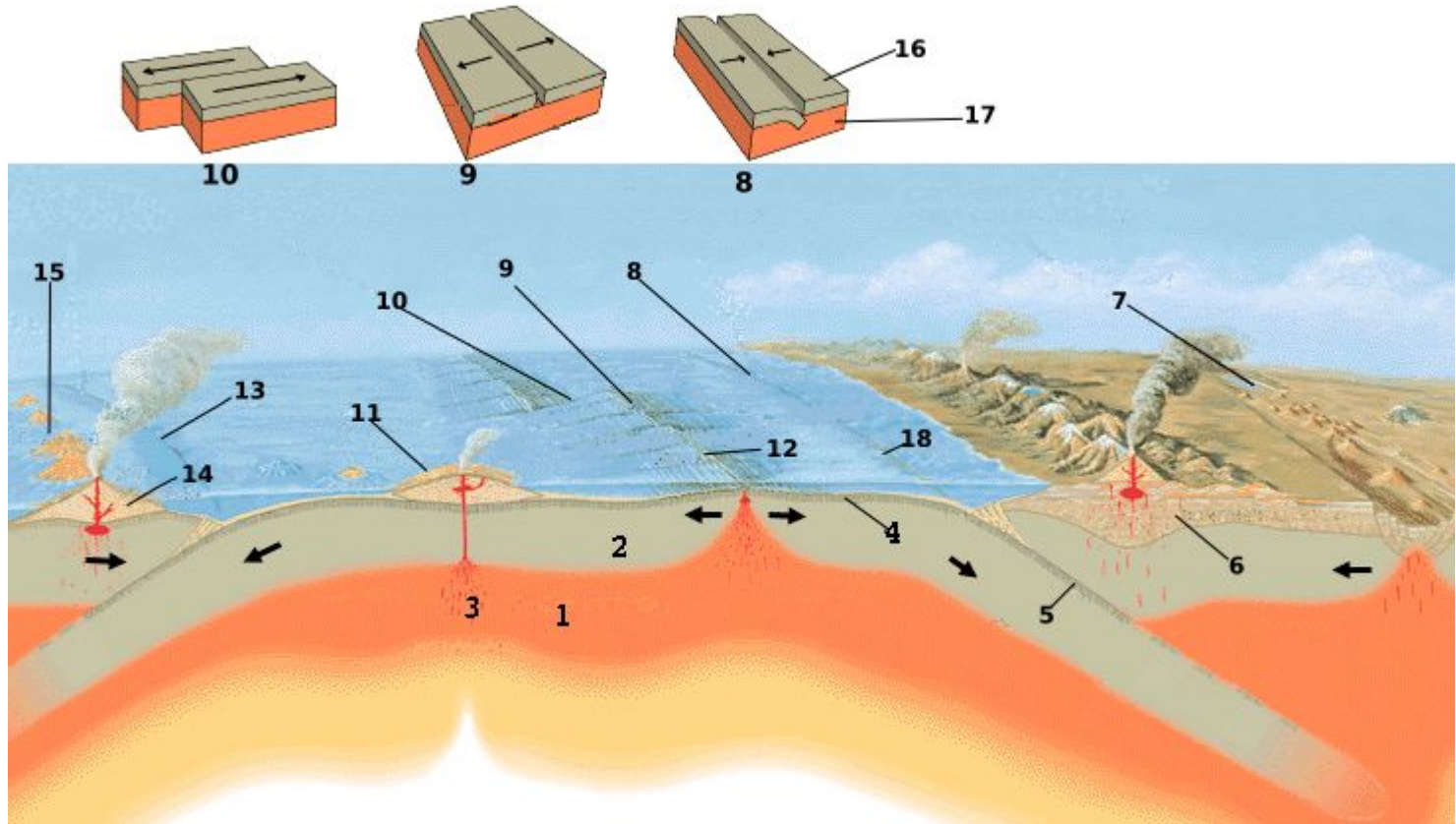
Volcano

- Weak spot in crust where molten material or magma comes to surface
- Magma- molten mixture of rock-forming substances, gases, and water from mantle
- Lava- what magma becomes when it reaches the surface
- Lava cools to form rock

Volcanoes

- Lava cools to form rock
- Form around plate boundaries
 - Diverging boundaries
 - Rift valley
 - Great Rift Valley in Africa
 - Converging boundaries
 - Deep-ocean trench
 - Subduction occurs
 - Two ocean plates converge
 - Island arcs form
 - Japan, New Zealand, Caribbean Islands
 - Oceanic and continental crust to form Andes
- Ring of fire





Hot Spot Volcanoes

- Area where material from deep within the mantle rise and then melts forming mantle
- Volcano forms above hot spot
- Hawaiian Islands

Properties

Physical Properties

- Characteristic of a substance that can be observed or measured without changing its composition
- Density
- Hardness
- Melting point
- Boiling point
- Magnetism
- Viscosity
- State of matter

Chemical Properties

- Property that produces a change in the composition of matter
- Ability to burn
- Ability to combine or react with other substances
- Can tell if this happens because it changes color, produces a gas, or forms a new solid substance

Viscosity

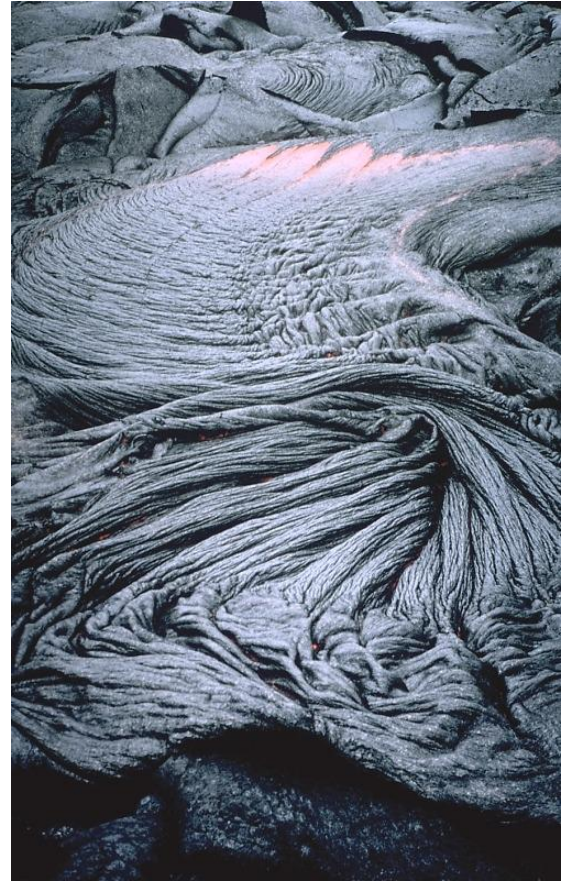
- Resistance of a liquid to flow

Silica:

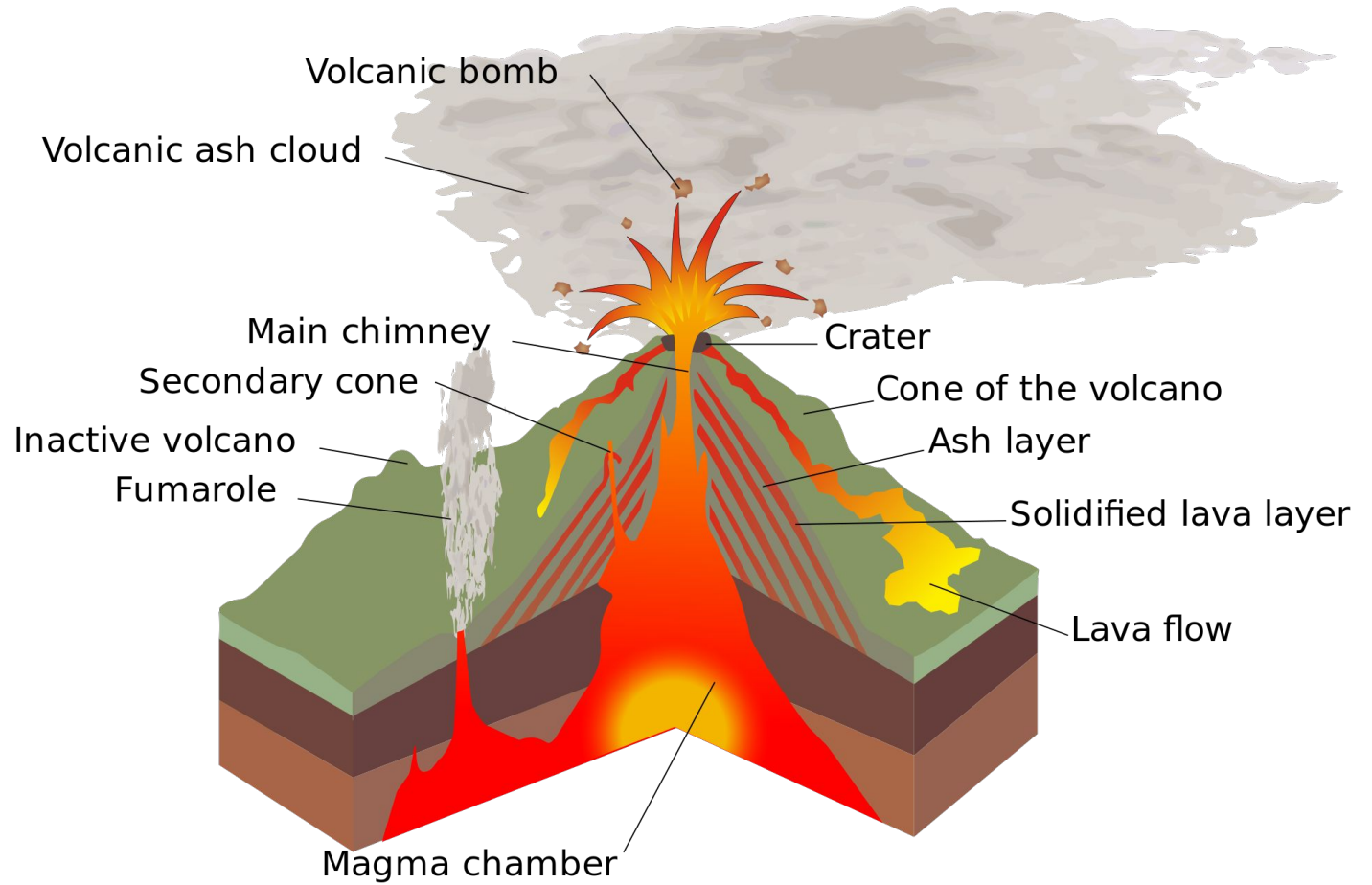
- Made up of oxygen and silicon
- Most abundant materials in crust
- Ranges from 50-70% in magma

- Greater viscosity
 - Flows slower
 - Ex: honey
 - More silica
 - Lava is too sticky and light colored
 - Rock called rhyolite
 - Temperature decreases
 - Aa
- Lower viscosity
 - Flows faster
 - Ex: water, rubbing alcohol, and vinegar
 - Less silica
 - Dark-colored lava
 - Rocks similar to basalt
 - Temperature is hotter
 - Pahoehoe

Lava (Aa and Pahoehoe)



Volcano



Volcanic Eruption

- Carbon dioxide gas builds up and pressure is increased
- Dissolved gases expand and exert force
- Quiet
 - Low in silica
 - Low viscosity
 - Flows easily
 - Formed Hawaiian Islands (Big Island)
- Explosive
 - High in silica
 - Builds up clogging it like a cork in a bottle
 - Mt. St. Helens
 - Volcanic ash-fine, rocky particles
 - Cinders-pebble size
 - Bombs-large pieces
 - Pyroclastic flow-hurls hot gases, ash, cinders, and bombs
 - Obsidian and pumice form

Stages of Volcanic Activity (Life Cycle)

- Active: live volcano is one that is erupting or has shown signs that it may erupt in the near future
- Dormant: volcano that they expect to awaken in the near future and become active
- Extinct: dead volcano that is unlikely to erupt

Shield Cone Volcano

- Quiet eruptions gradually build up a gently sloping mountain
- Hawaiian Islands

Draw a Picture:

Composite Volcanoes

- Quiet eruptions alternate with explosive eruptions forming layers of lava and ash
- Mount Fuji in Japan
- Mount St. Helens in Washington

Draw:

Cinder Cone Volcano

- Ash, cinders, and bombs erupts explosively to form a cone-shaped hill
- Magma is high viscosity
- Paricutin in Mexico

Draw:

Lava Plateaus

- Made up of many layers of thin, runny lava that erupt from long cracks or fissures in the ground
- Columbia plateau

Draw:

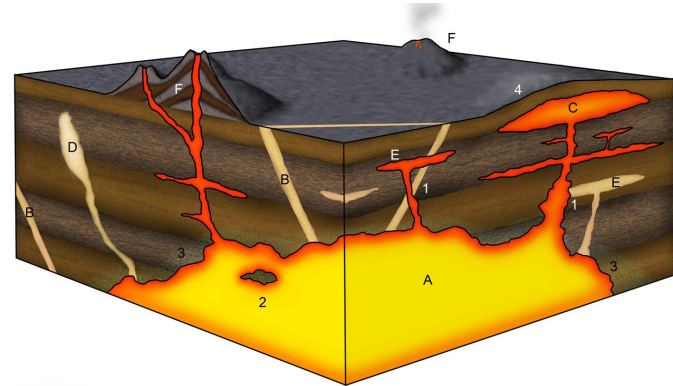
Caldera

- Huge hole left by the collapse of a volcanic mountain
 - Whole is filled with pieces of volcano that have fallen inward as well as lava and ash
 - Crater Lake
1. Composite volcano explodes and lava flows partially empty out magma chamber.
 2. The roof of the magma chamber collapses, forming a caldera.
 3. Small cinder cone forms in caldera, which partly fills with water.



Landforms from Magma

- Volcanic neck-magma hardens in pipe
- Dike-magma that forces itself across rock layers (slants)
- Sill-squeezes horizontally between rock layers
- Batholiths-mass of rocks formed when magma cools inside of crust
- Dome mountains-uplift pushes a batholith or smaller body of hardened magma toward surface



Geothermal Activity

- Magma heats underground water
- Hot springs
 - Hot water rises to surface and collects in natural pool
- Geysers
 - Rising hot water and steam becomes trapped
 - Pressure builds until sprays
- Geothermal energy

