Volcanoes

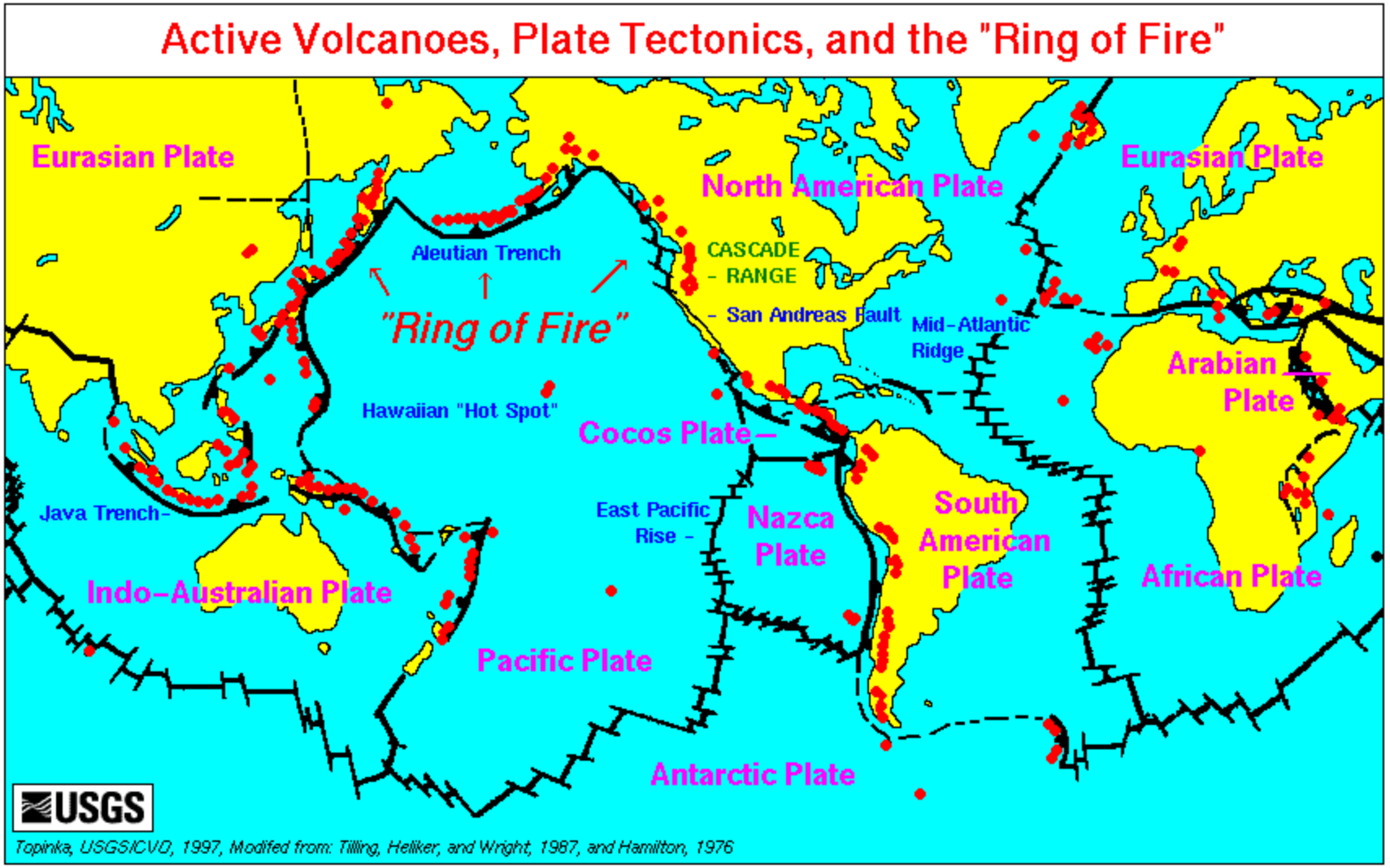
8th Grade Earth & Space Science - Class Notes

Zones of Volcanism

- ***Volcanism*** – describes all processes associated with the discharge of magma, hot fluids, and gases

- Most volcanoes form at plate boundaries.
- The majority form at convergent boundaries and divergent boundaries.

Zones of Volcanism



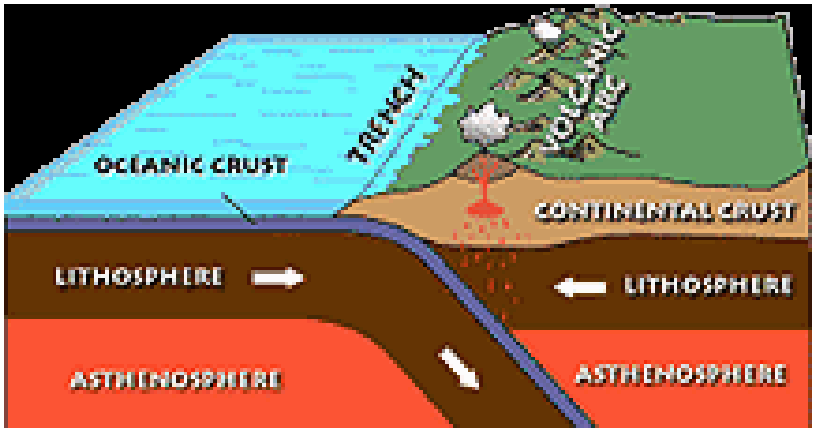
Convergent Volcanism

- Remember → In an oceanic-continental subduction zone, the denser oceanic plate slides under the continental plate into the hot mantle.

- Parts of the plate melt and magma rises, eventually leading to the formation of a volcano.

Convergent Volcanism

- Most volcanoes located on land result from oceanic-continental subduction.
- These volcanoes are characterized by explosive eruptions.

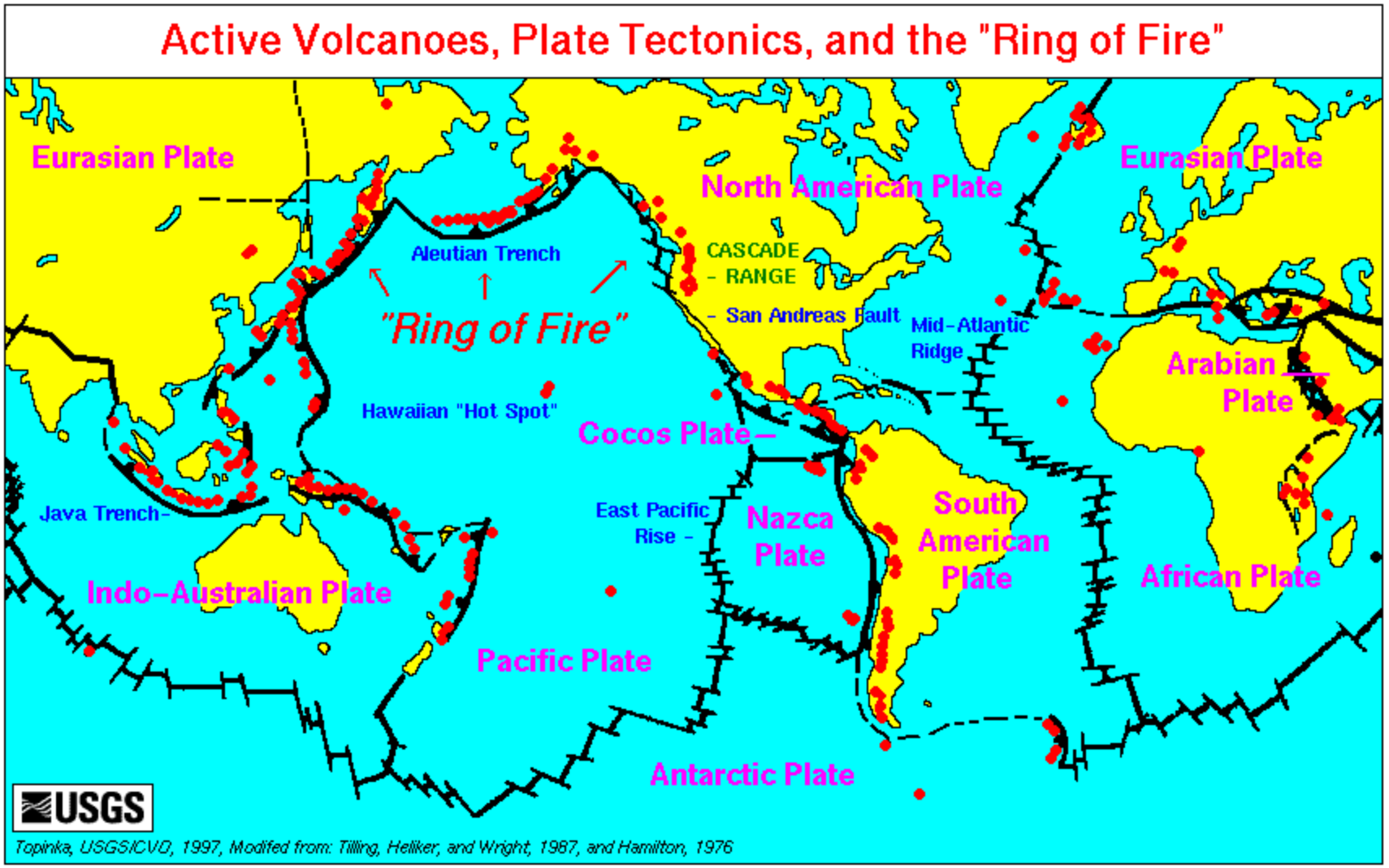


Two Major Belts

- The volcanoes associated with convergent plate boundaries form two major belts.

- The larger belt, the **Circum-Pacific Belt**, is also called the Pacific Ring of Fire. The outline of the belt corresponds to the outline of the Pacific Plate.

Two Major Belts

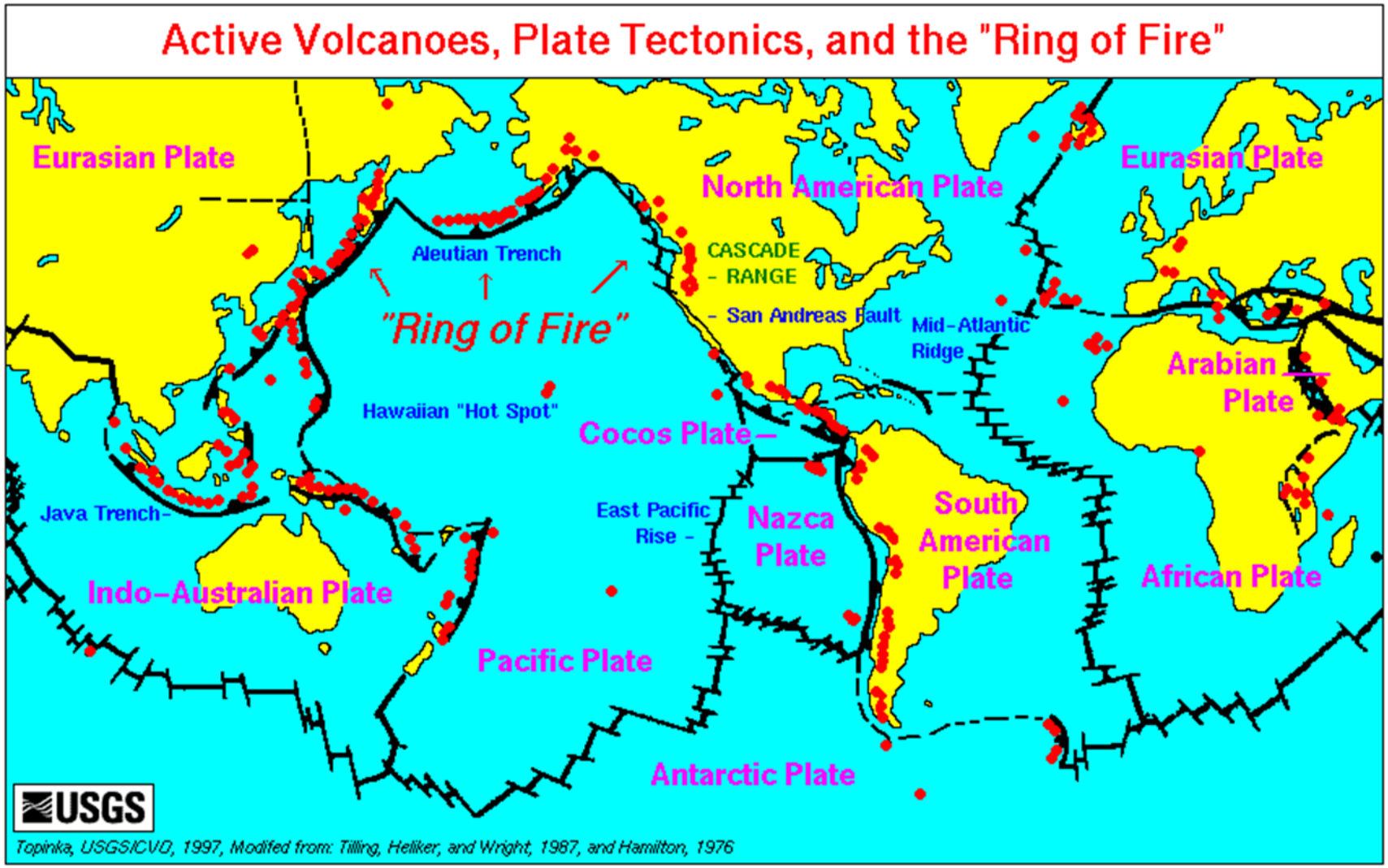


Two Major Belts

- The smaller belt is the **Mediterranean Belt**.

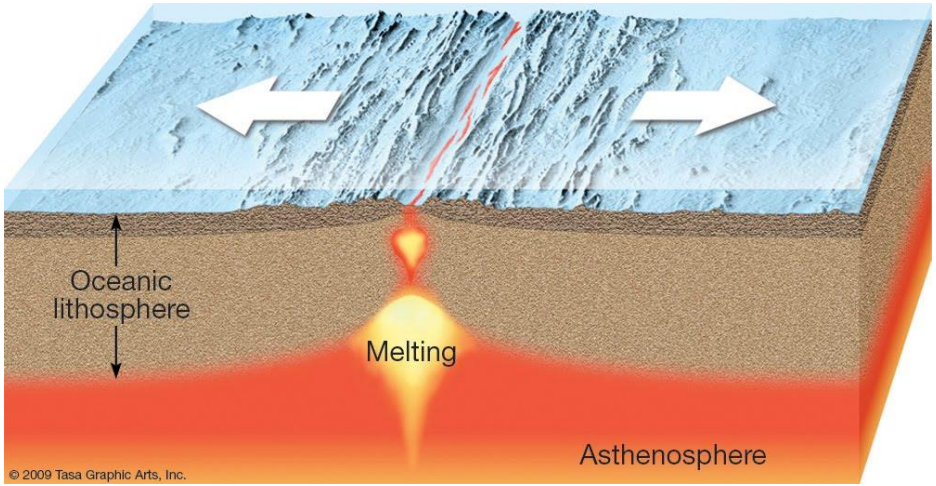
- Its general outline corresponds to the boundaries between the Eurasian, African, and Arabian plates.

Two Major Belts



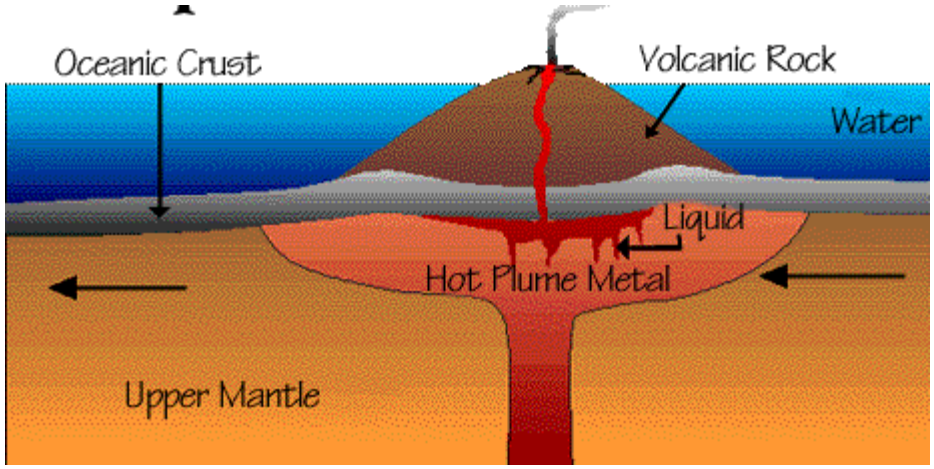
Divergent Volcanism

- Eruptions at divergent boundaries tend to be nonexplosive.
- Many occur along the Mid-Atlantic ridge.
- At the divergent boundary on the ocean floor, eruptions often form huge piles of lava called **pillow lava**.



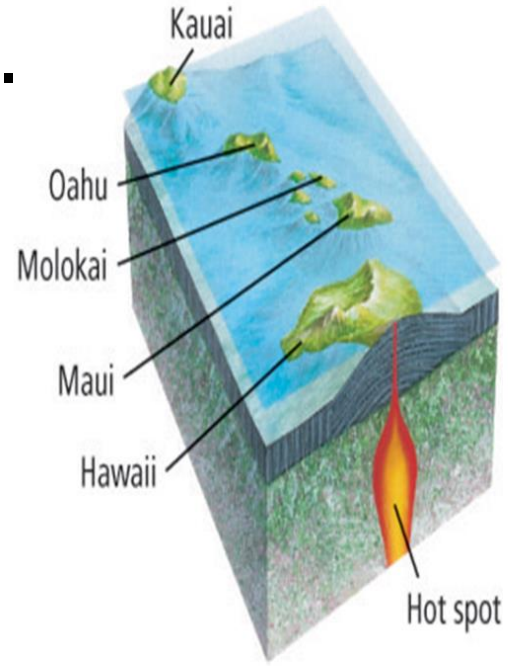
Hot Spots

- Some volcanoes form far from plate boundaries over **hot spots**.
- A hot spot is an unusually hot area in Earth's mantle where high-temperature plumes of mantle material rise toward the surface.



Hot Spots and Hawaii

- The Hawaiian islands are located over a plume of magma.
- The hot spot formed by the magma plume remained stationary while the Pacific Plate slowly moved northwest.



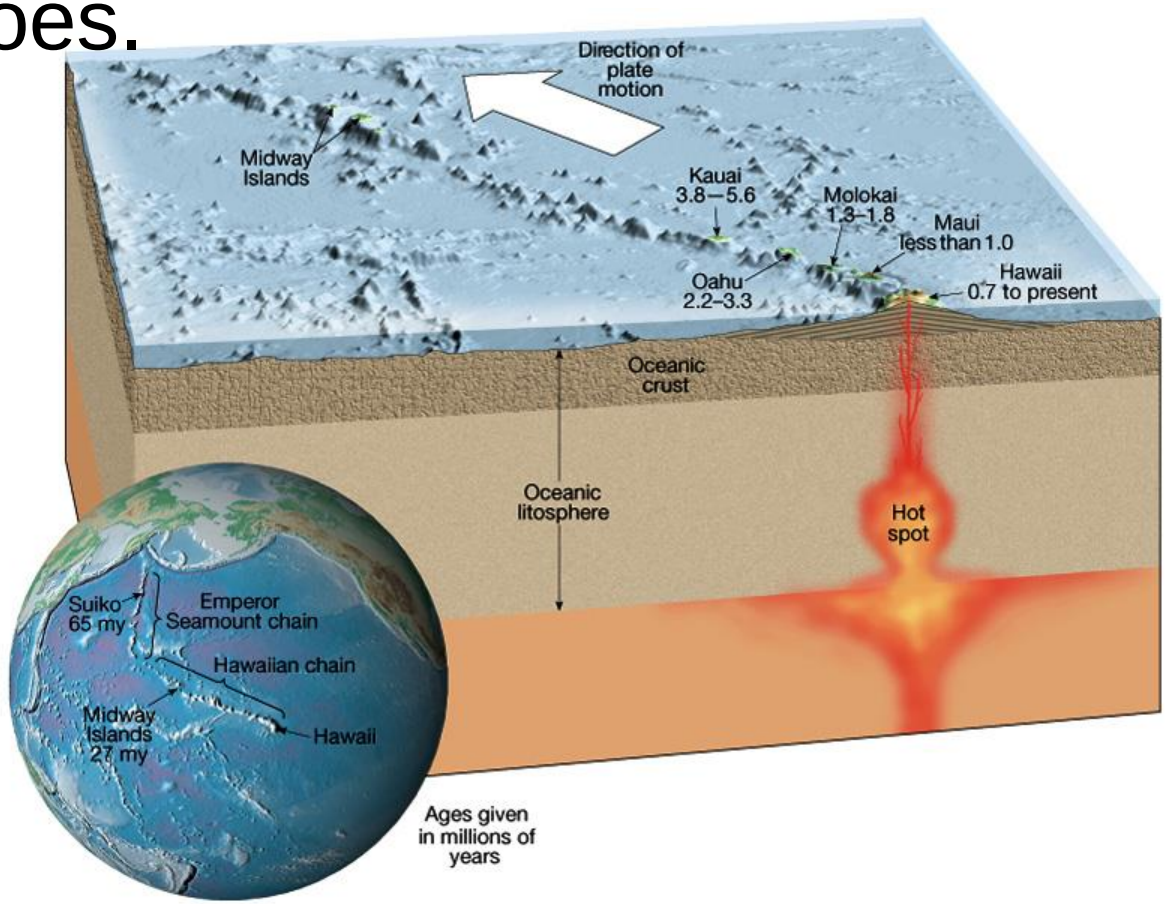
Hot Spots and Hawaii

- The volcanoes on the oldest Hawaiian island, Kauai, are inactive because the island no longer sits above the stationary hot spot.
- The world's most active volcano, Kilauea, on the Big Island of Hawaii, is currently located over the hot spot.

Lava flow at Kilauea

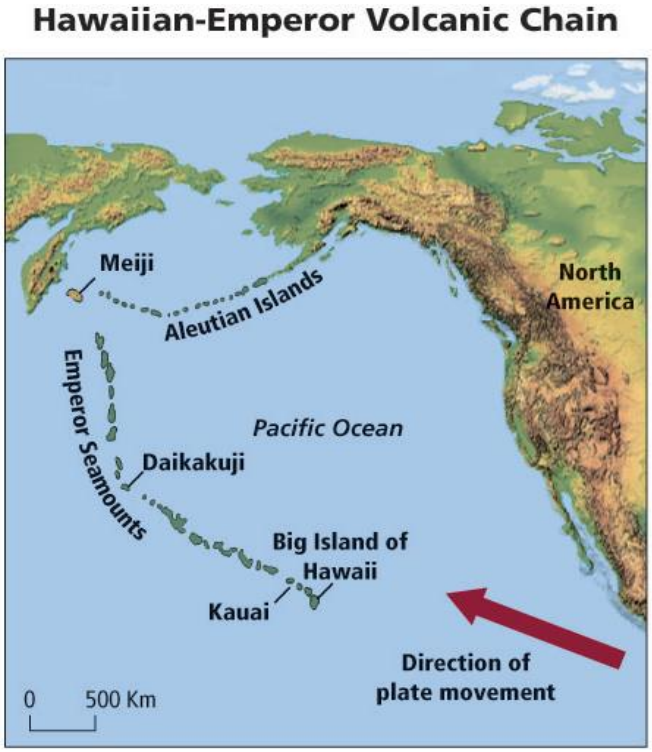
Hot Spots and Plate Movement

- The rate and direction of plate motion can be calculated from the positions of hot spot volcanoes.



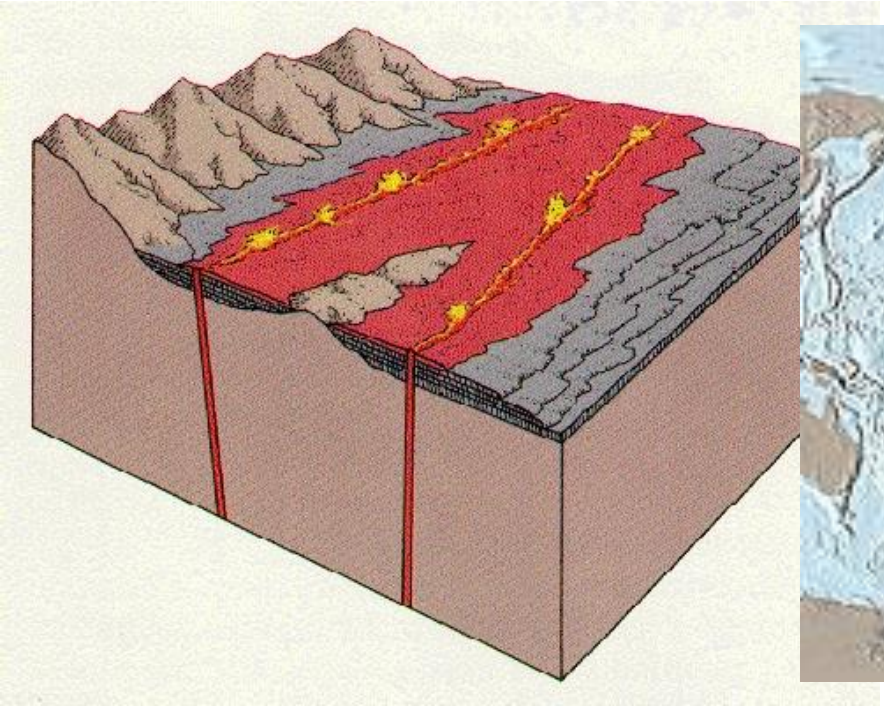
Hot Spots and Plate Movement

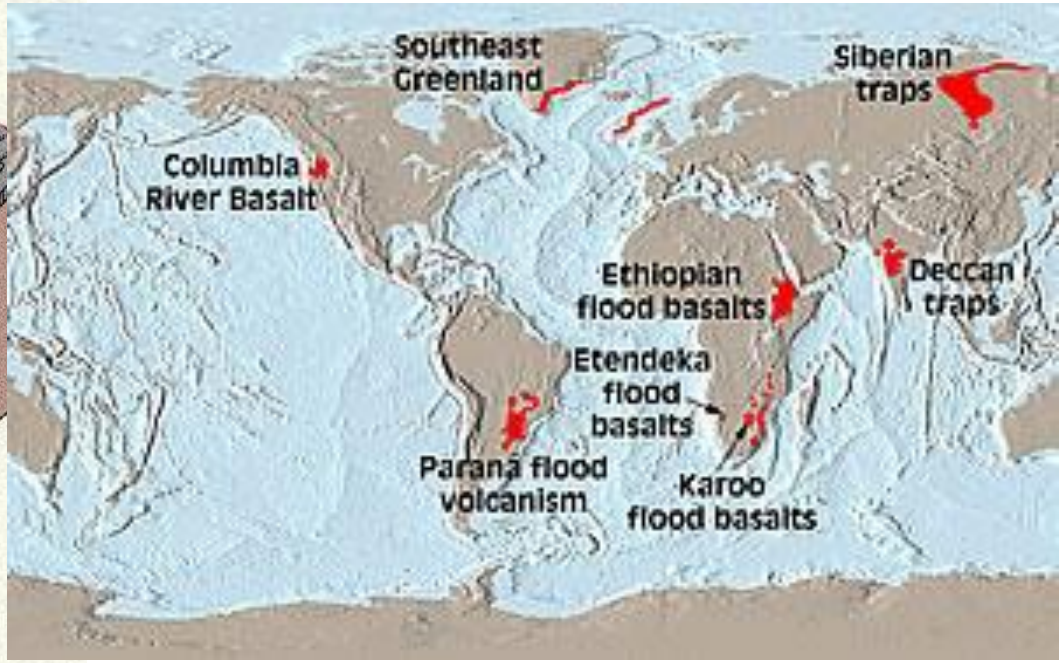
- The Hawaiian islands are at one end of the Hawaiian-Emperor volcanic chain. The oldest seamount, Meiji, is at the other end of the chain and is about 80 million years old.



Hot Spots and Flood Basalts

- Flood basalts form when lava flows out of long cracks in Earth's crust.
- These cracks are called fissures.

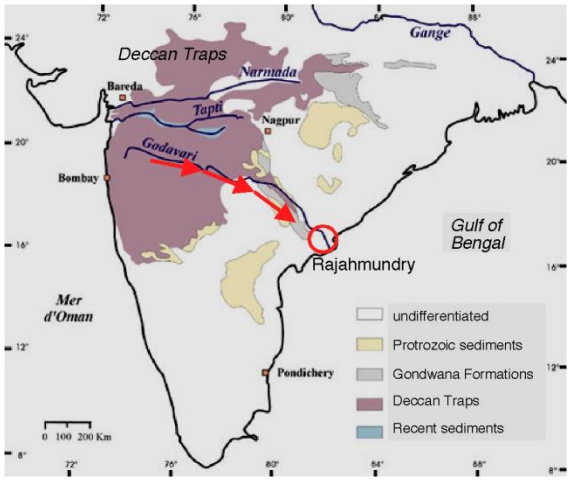




Columbia River Basalts

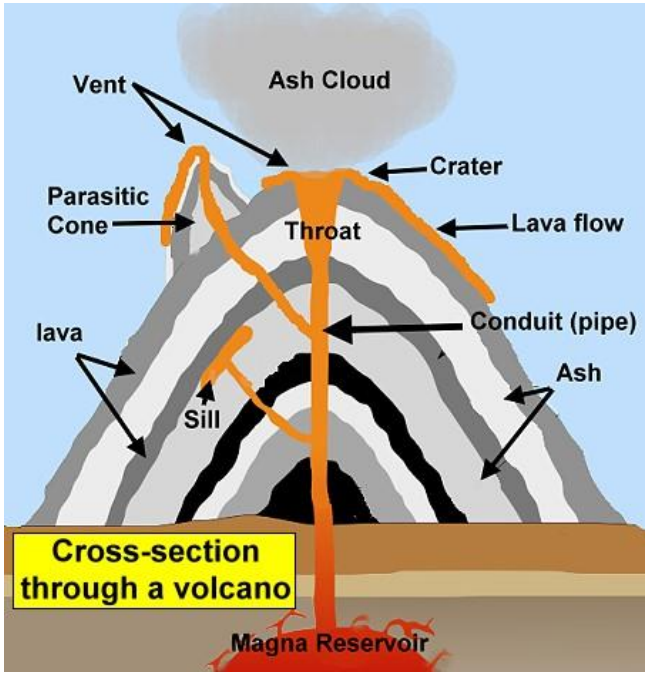
Deccan Traps

- About 65 M.Y.A. in India, a huge flood basalt eruption created an enormous plateau called the Deccan Traps. The volume of basalt in the Deccan Traps is estimated to be about 512,000 km^3.



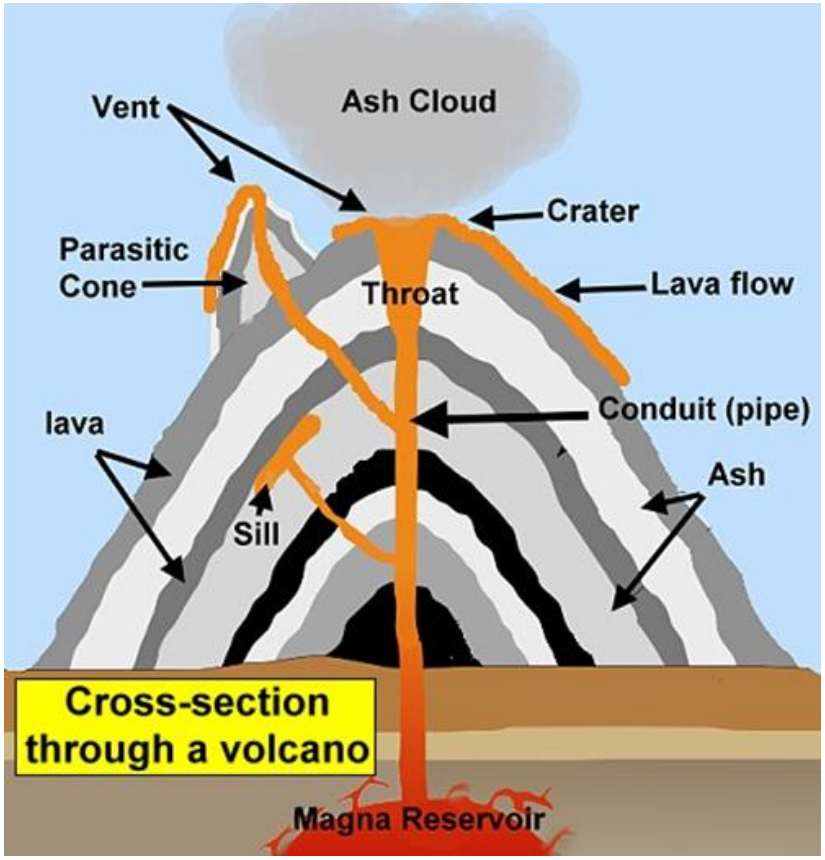
Parts of a Volcano

- **Conduit** – tube like structure that lava travels through to reach the surface
- **Vent** - opening that lava emerges through
- Over time, layers of solidified lava can accumulate to form a mountain known as a volcano.



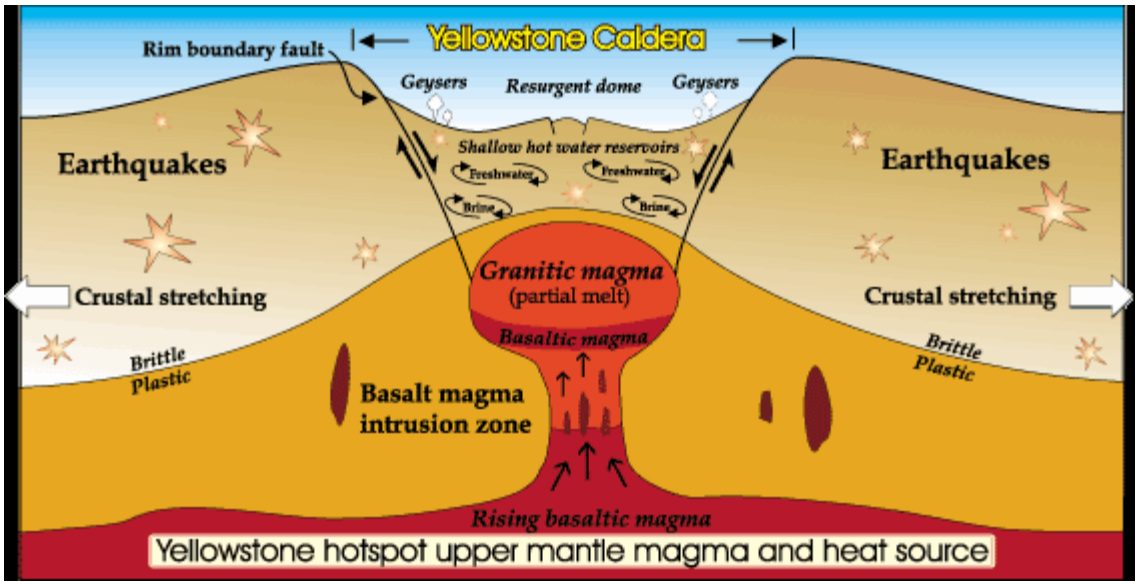
Parts of a Volcano

- **<u>Crater</u>** – bowl-shaped depression found at the top of the volcano surrounding the vent



Parts of a Volcano

- **<u>Caldera</u>** – large volcanic crater; often forms after the magma chamber beneath a volcano empties after a major eruption
  - the summit or side of the volcano collapses into the empty chamber and leaves a large, circular impression

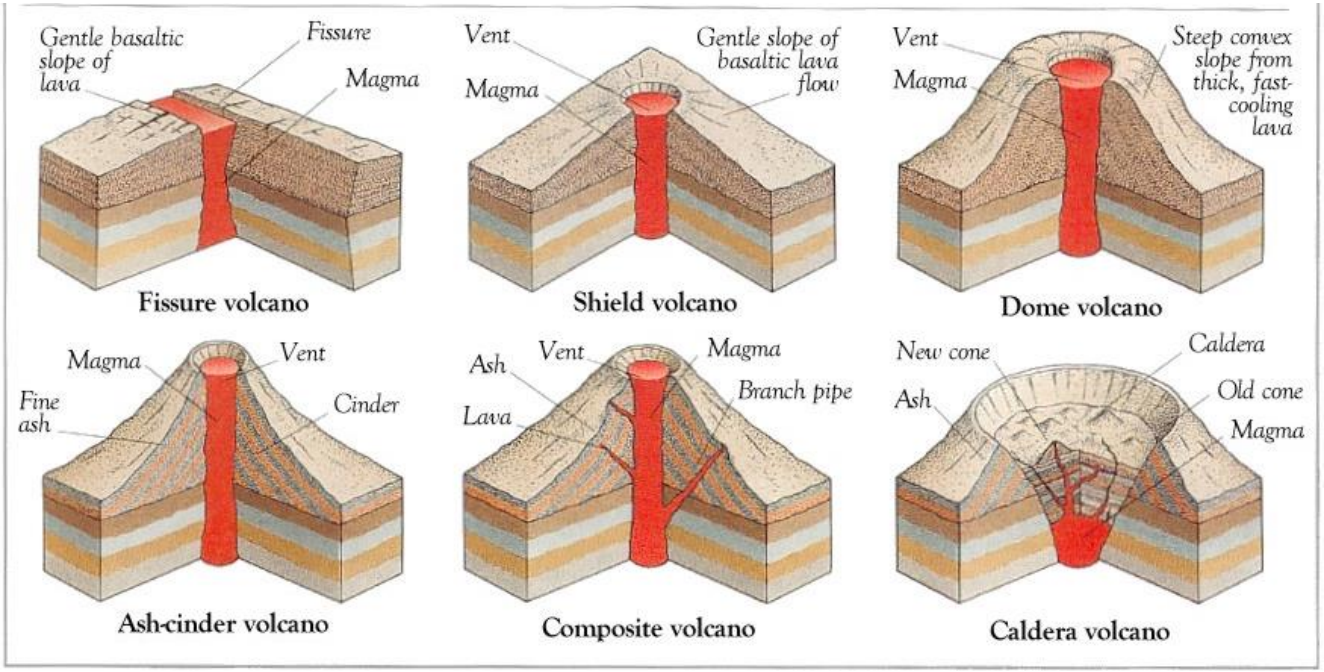


Crater Lake

Formed when Mount Mazama collapsed in approximately 5,677 B.C.

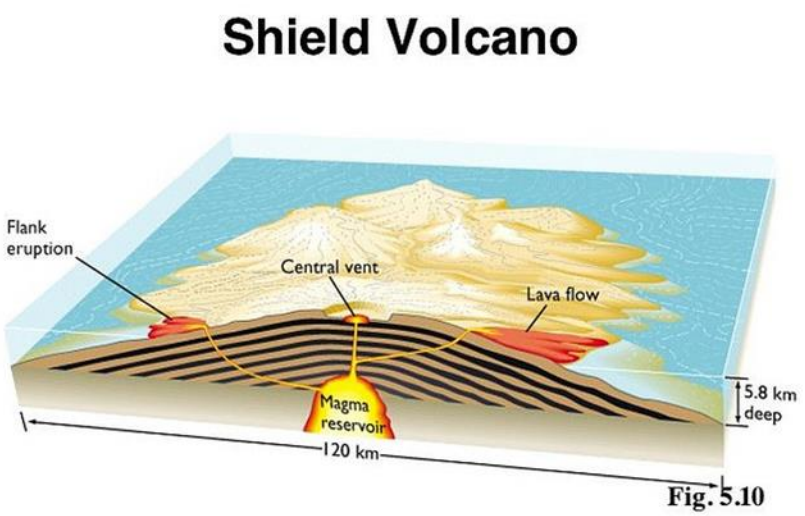
Types of Volcanoes

- The appearance of a volcano depends on two factors:
  - the type of material that forms the volcano
  - the type of eruptions that occur



Shield Volcanoes

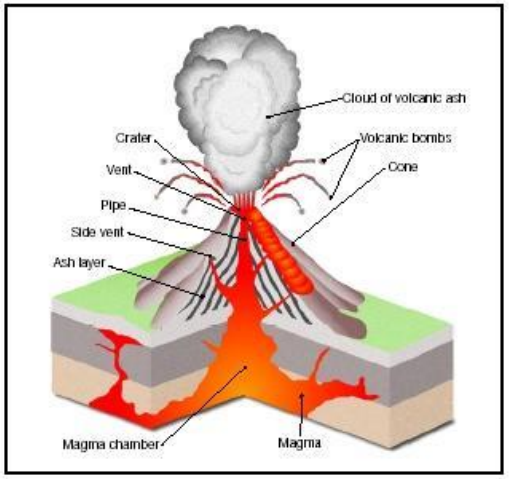
- Largest
- Long, gentle slopes
- Composed of layers of solidified basalt lava
- Quiet explosions



Mauna Loa in Hawaii

Cinder Cones

- Smallest, but steep
- Forms from small pieces of magma (tephra) that falls back to Earth and piles up around the vent
- Cone-shaped
- Usually basaltic lava
- Explosive eruptions

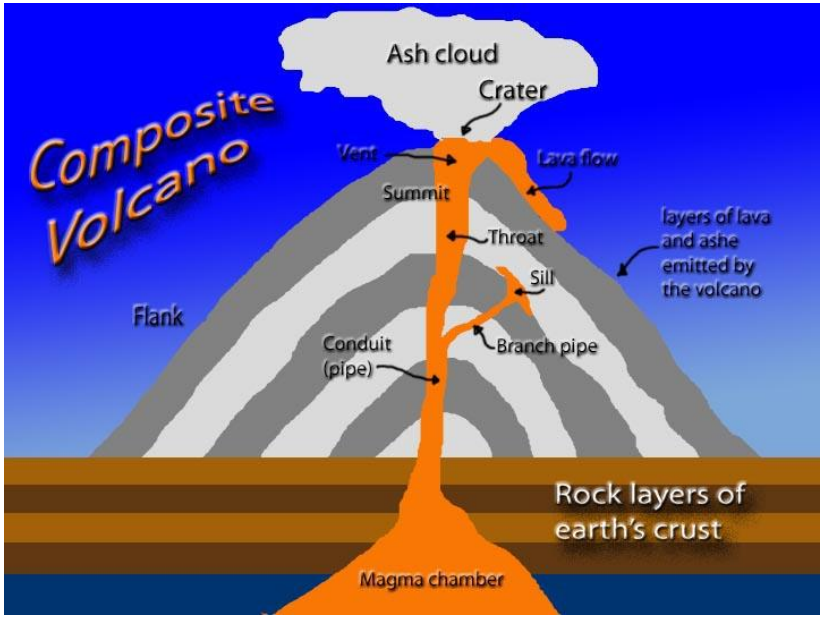


Cinder Cone at Lassen Park in California

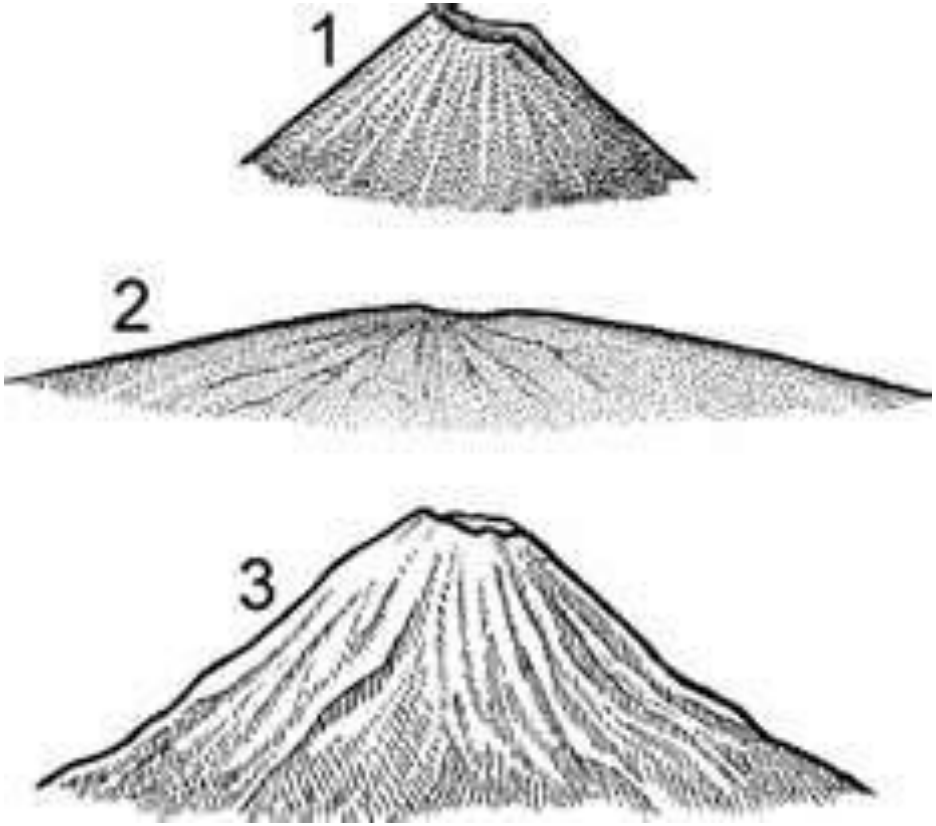
Composite Volcanoes

- Composed of layers of hardened chunks of lava from violent eruptions alternating with layers of lava that oozed downslope
- Cone-shaped but larger than cinder cones
- Also called “stratovolcanoes”
- Tend to have explosive eruptions with cycles of quiet

Mt. Rainer near Seattle



Identify the types of volcanoes.



Section 18.2 - Eruptions

8th Grade Earth & Space Science - Class Notes

Making Magma

- The type of eruption depends on the composition of the magma.

- Remember the formation of magma is effected by:
  - Temperature
  - Pressure
  - Water content
  - Chemical composition

Composition of Magma

- **Explosivity** – how a volcano erupts and how its magma flows

- Factors -
  - Interaction with overlying crus
  - Temperature
  - Pressure
  - Dissolved gases
  - Silica content

Dissolved Gases

- As the amount of gases increases, the magma's explosivity increases

- Important gases:
  - Carbon dioxide
  - Water vapor (most common
  - Sulfur dioxide
  - Hydrogen sulfide

Viscosity

- **Viscosity** – physical property that describes a material's resistance to flow

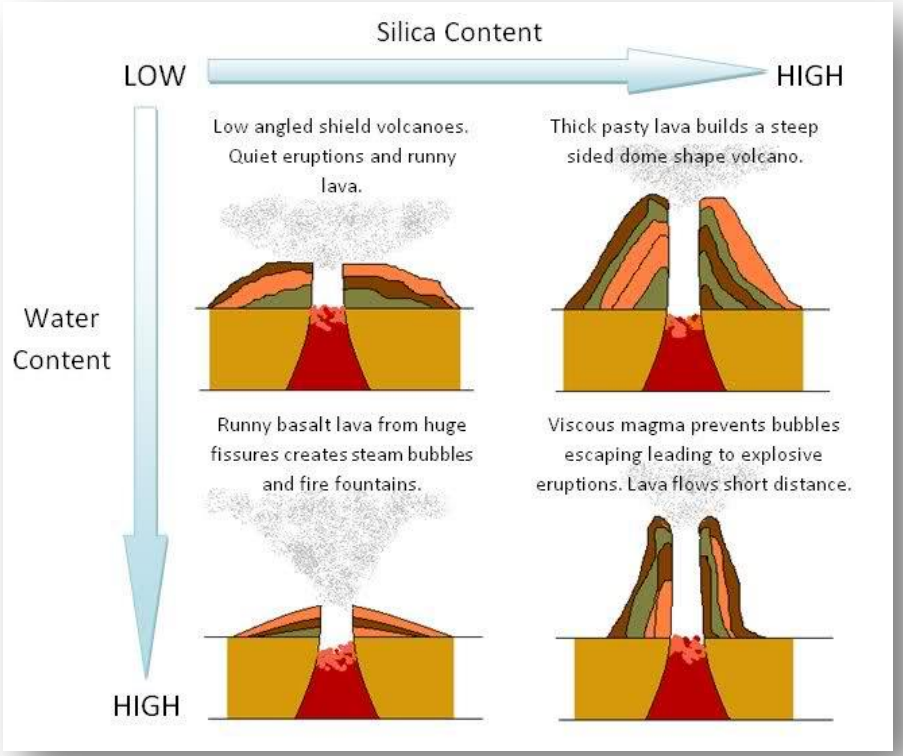
- Cooler magma = higher viscosity
- High silica = higher viscosity

- Higher viscosity tends to tra
  gases and produces explos
  eruptions

Types of Magma

- The silica content of magma determines not only its explosivity and viscosity, but also which type of volcanic rock it forms as it cools

- Three types:
  - Basaltic
  - Andesitic
  - Rhyolitic



Basaltic Magma

- Usually forms from rock in the upper mantle
- Less than 50% silica – low viscosity
- Gases escape easily
- Quiet eruptions

E[illegible] Kilauea, Surtsey

Basaltic lava flow from Kilauea in Hawaii

Andesitic Magma

- 50-60% silica
- Found along oceanic-continental subduction zones
- Forms from oceanic crust or oceanic sediments
- Intermediate viscosity
- Intermediate explosivity

Examples – Colima, Tambo

Andesitic magma flow from Colima in Mexico

Rhyolitic Magma

- Molten material that rises and is mixed with continental crust (rich in water and silica)
- More than 60% silica
- High viscosity
- Large amount of trapped gases
- Very explosive

Example – Chaiten in Chile

Photo taken of the 2008 eruption of Chaiten in Chile

Explosive Eruptions

- When lava is too viscous to flow freely from the vent, pressure builds up in the lava until the volcano explodes
  - There are two major effects from these types of eruptions – tephra and pyroclastic flows

- **Tephra** – erupted materials given off by the volcano; can be pieces of solidified lava or pieces of crust

Tephra

- **Tephra** – erupted materials given off by the volcano; can be pieces of solidified lava or pieces of crust

- Classified by size
- Smallest – ash
  - Can rise very far in the air
  - Threatens aircrafts
  - Can affect weather
- Largest – blocks
  - Can be as large as a car

Pyroclastic Flows

- **<u>Pyroclastic flow</u>** – rapidly moving clouds of tephra mixed with hot, suffocating gases
- Can reach temperatures of 1000°C
- Can move at more than 700 km/h

Pyroclastic flow rushes down side of Mayon Volcano, Philippines