

CH. 10.1

VOLCANO



Photo taken on August 27, 2005 @ 8h50 pm ©Arenal.net

Be able to...

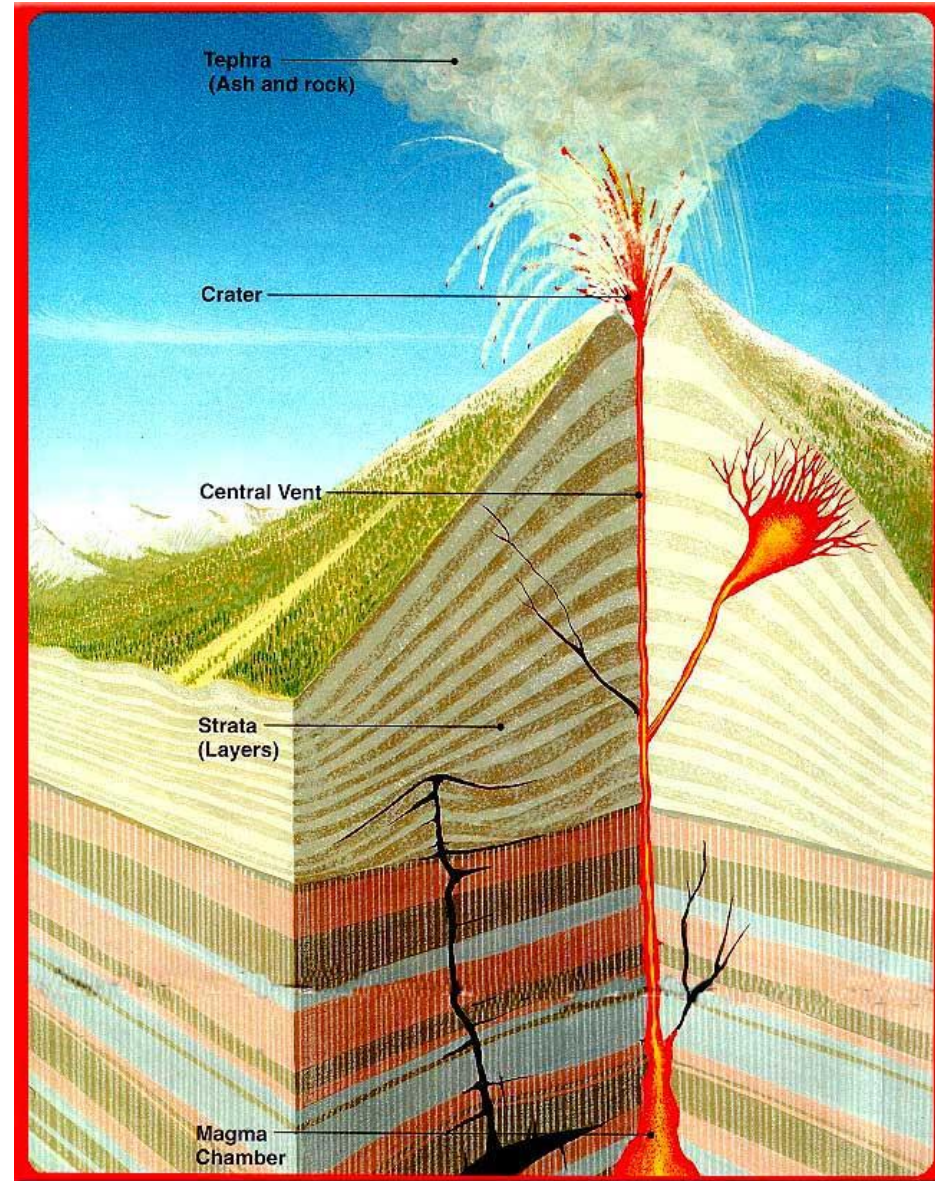
Explain the factors that determine the type of volcanic eruption.

List the 3 types of volcanoes

Describe the features of a volcano.

What is a Volcano?

- Volcanoes are sites where molten rock and other materials from Earth's mantle are released.
- Magma is less dense than Earth's crust so it rises to the surface.

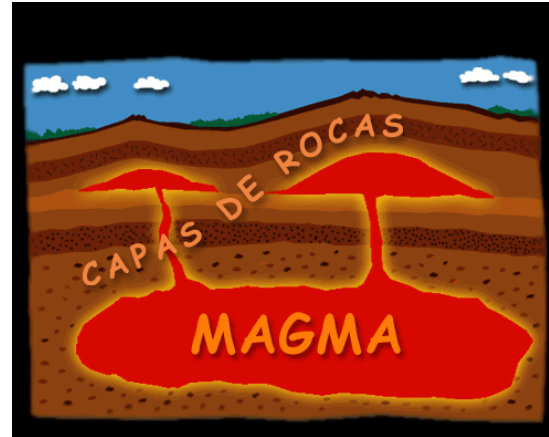


“MAGMA”



Magma vs. Lava

- Molten rock below Earth's surface is called magma.
- The magma that reaches the surface and erupts out of a volcano is called lava.



Anatomy of a Volcano

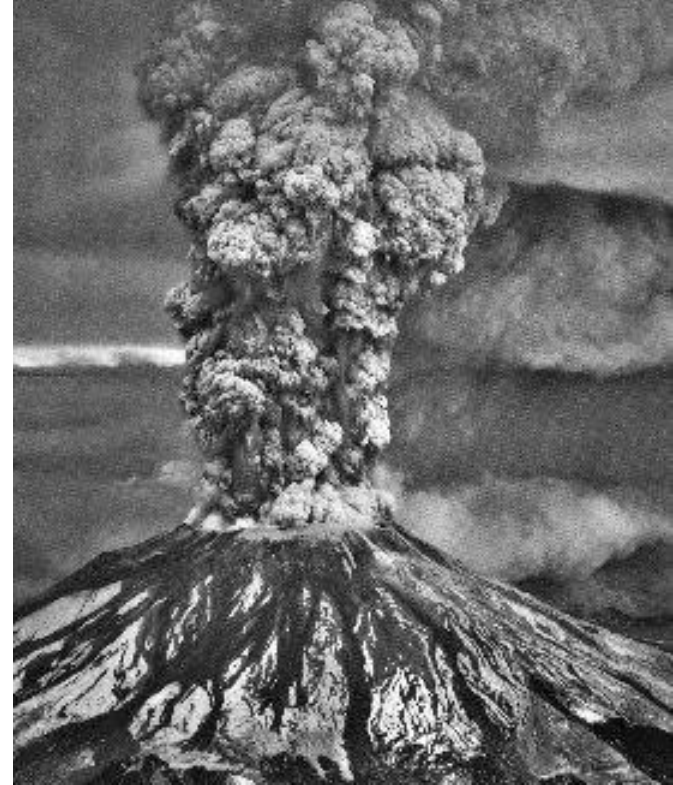
- A **crater** is the depression at the summit of a volcano or that which is produced by a meteorite impact.



Anatomy of a Volcano

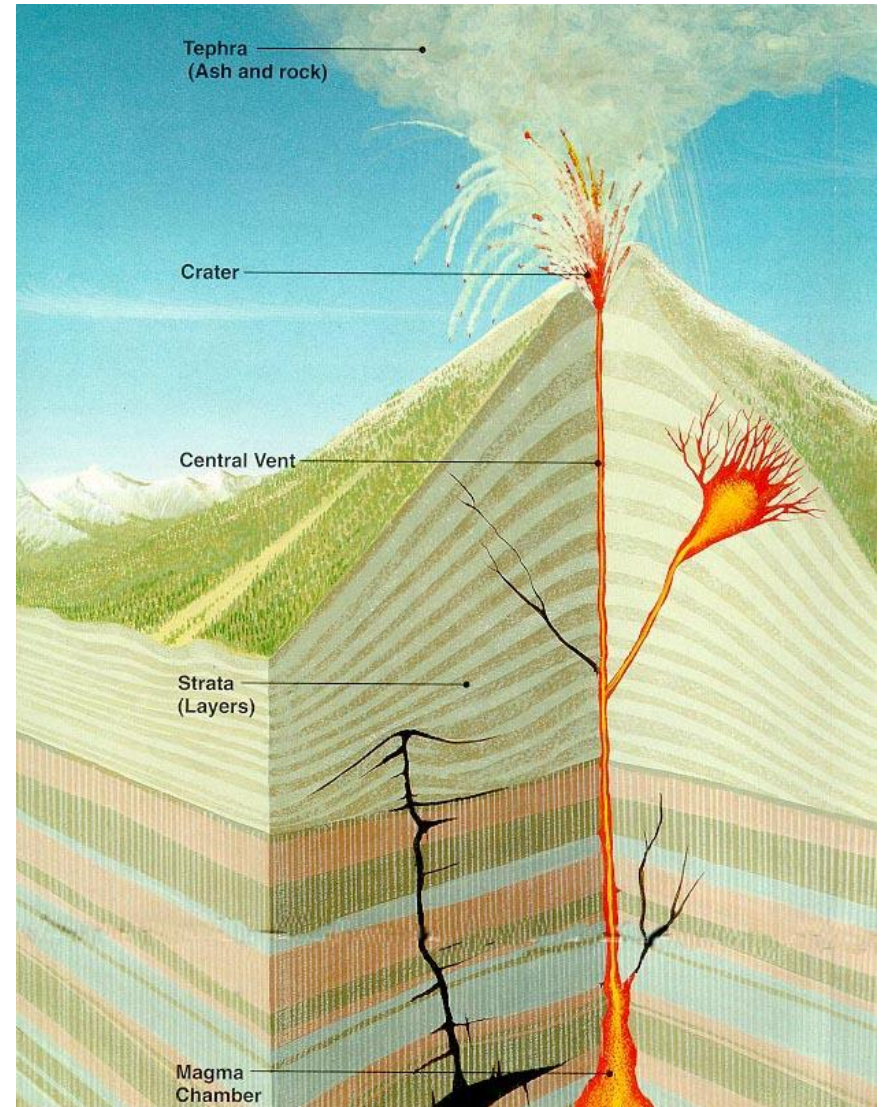
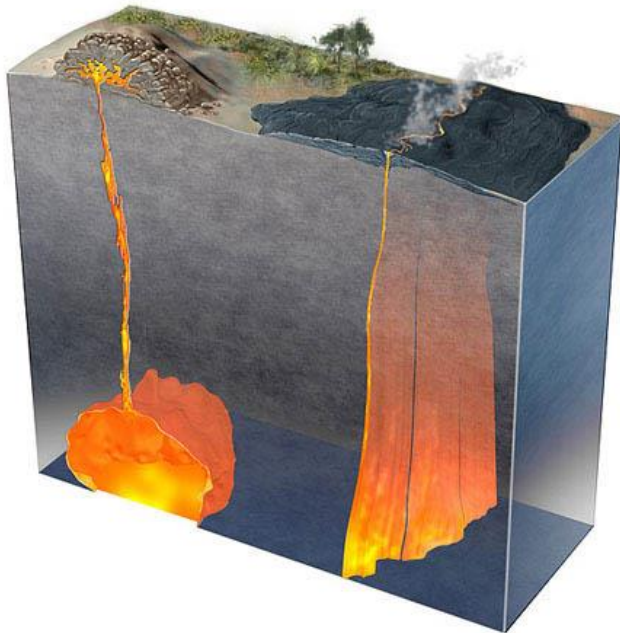
Volcanoes also release gases (*smoke*) and rock fragments into the air.

- **Pyroclastic material** (tephra)
 - fragments ejected, from the size of large rocks to dust particle-sized fragments (*ash*).



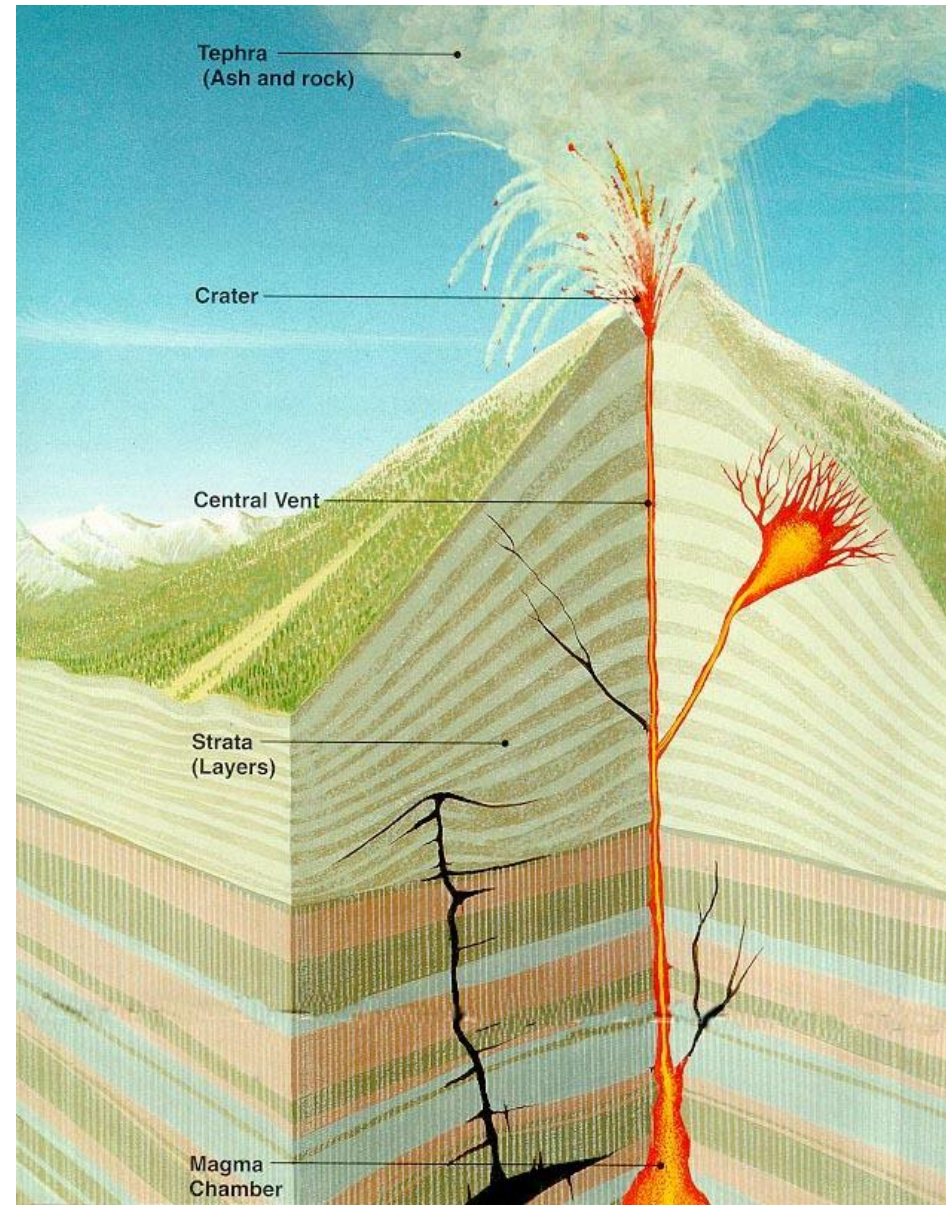
Anatomy of a Volcano

- Below ground, magma pools in pockets called **magma chambers**.



Anatomy of a Volcano

- The pathway that magma takes to Earth's surface are called **pipes**.
- A **vent** is an opening in the surface of Earth through which molten rock and gases are released.



Where do volcanoes occur?

- About half of the Earth's active volcanoes occur within the ***Ring of Fire***.
- *Around the Pacific Ocean.*

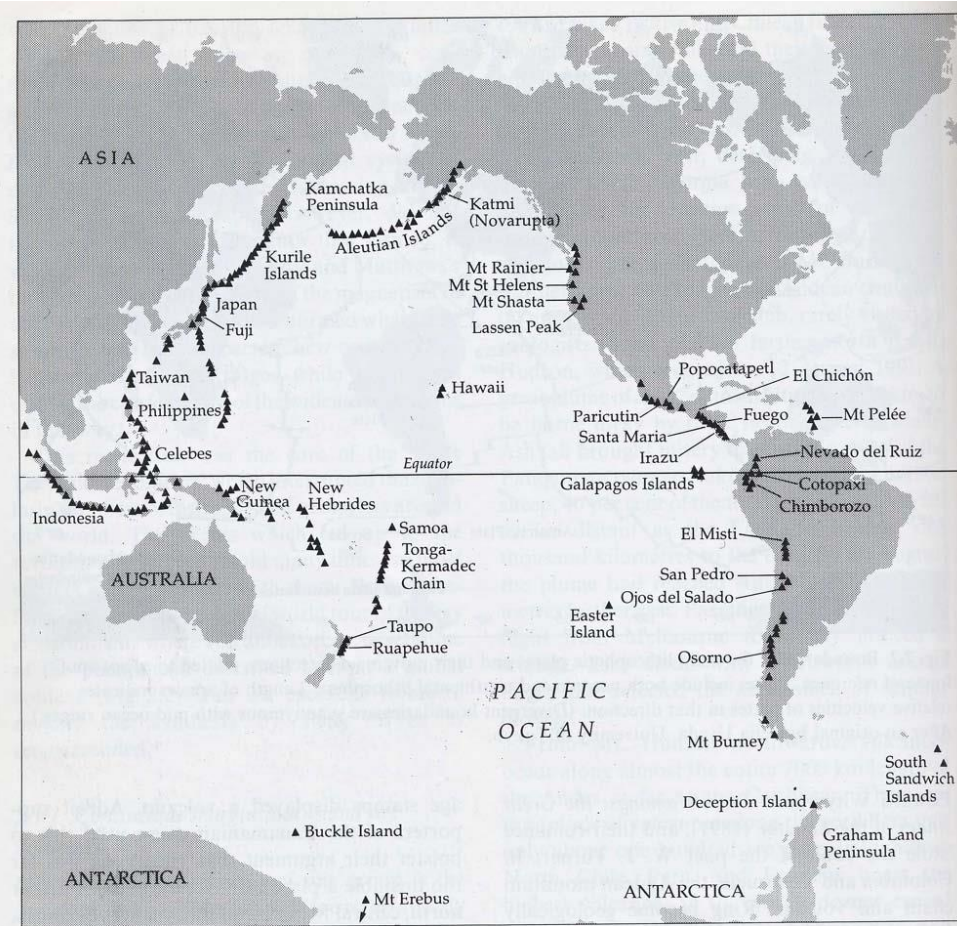
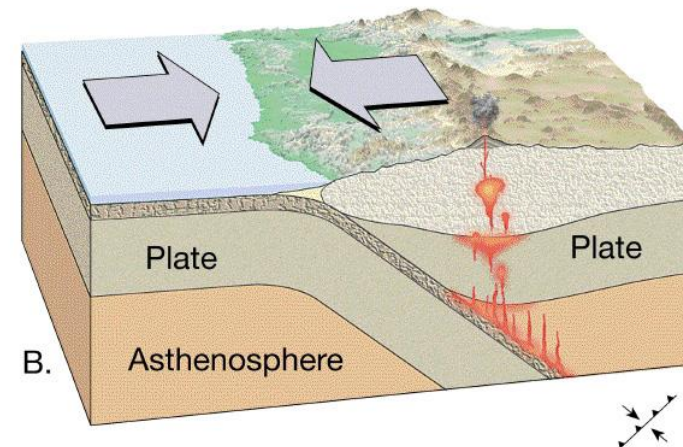
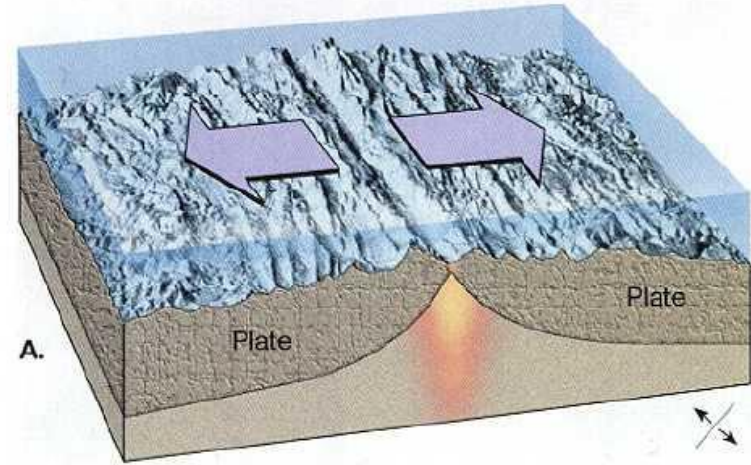


Fig. 2.3 Locations of some of the volcanoes of the circum-Pacific 'Ring of Fire' discussed in the text.

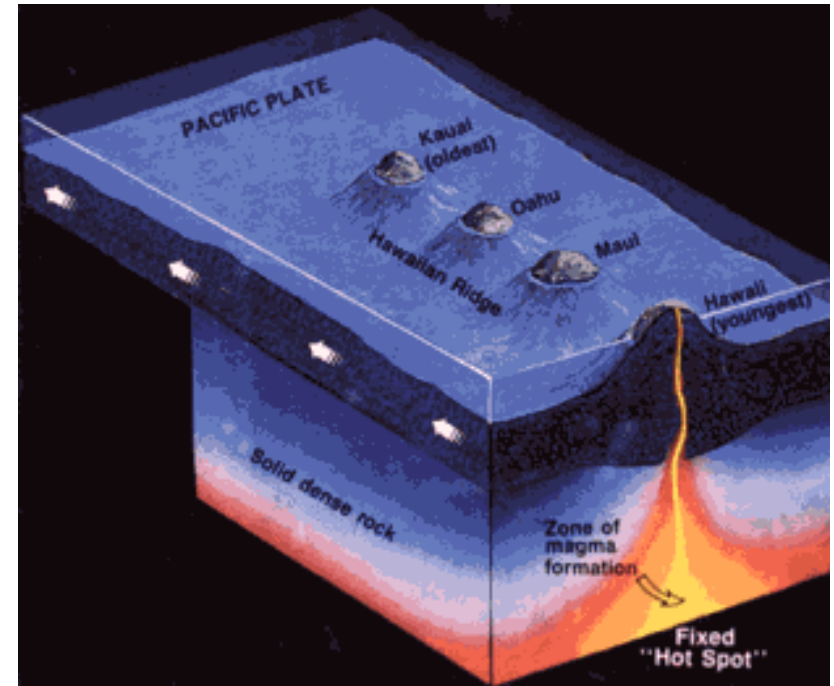
Where do volcanoes occur?

- Most volcanic activity is found at the edges of tectonic plates.
 - **Divergent boundaries**
 - 2 oceanic plates
 - Ocean ridge
 - » Most magma produced
 - **Convergent boundaries**
 - 2 oceanic plates
 - Volcanic island arc
 - oceanic & continent plate
 - Continent volcano arc



Where do Volcanoes Occur?

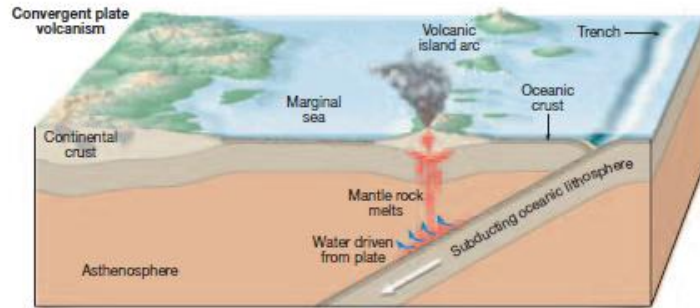
- Not at a plate boundary
 - Intraplate volcanism
- A big blob of magma rises to the surface as a ***mantle plume*** and becomes a ***hot spot***.
 - The Hawaii Islands formed this way.



- http://www2.wwnorton.com/college/geo/egeo/flash/2_10.swf
- <http://www.geo.wvu.edu/~dono van/geol101/animations/55.swf>

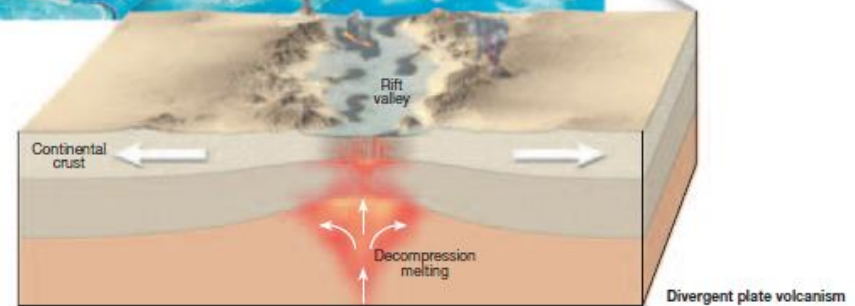
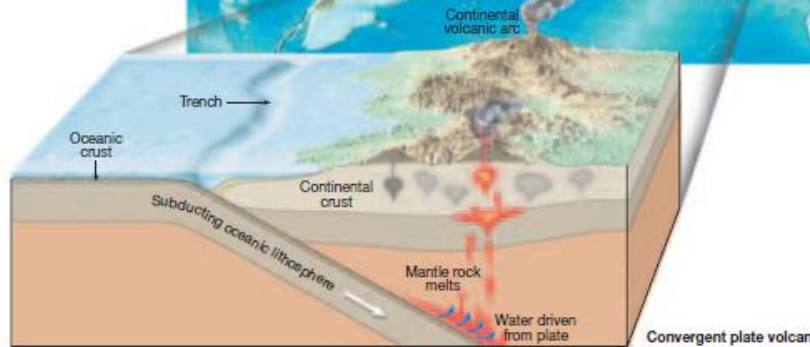
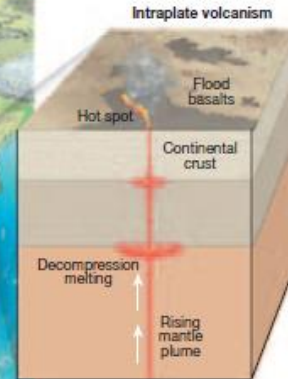
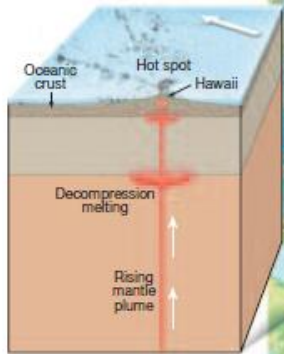
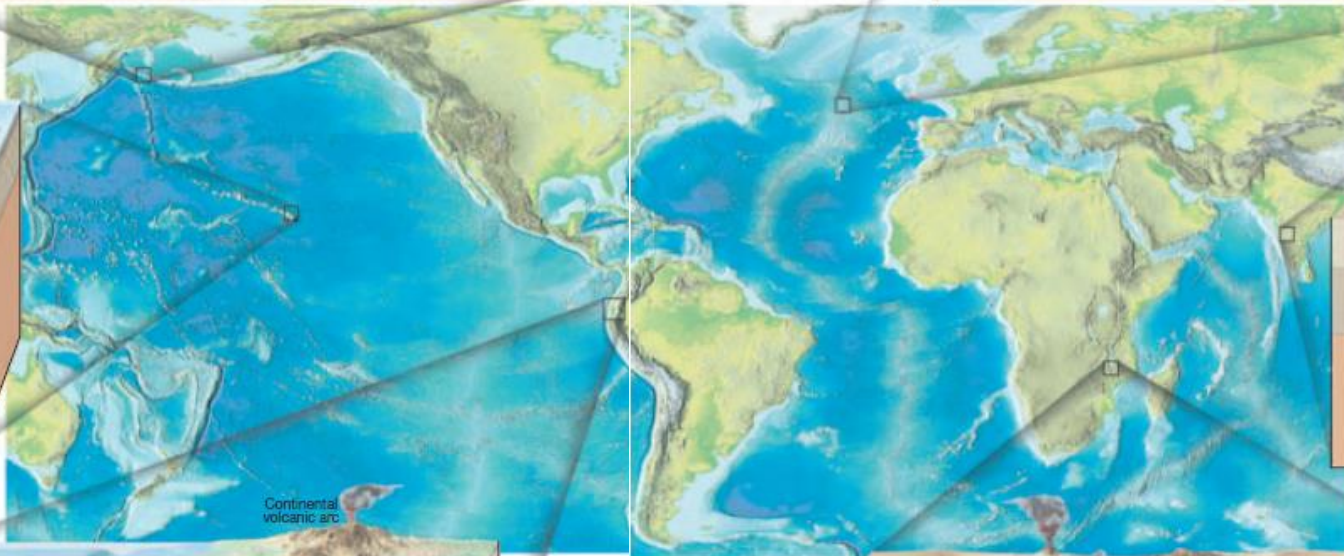
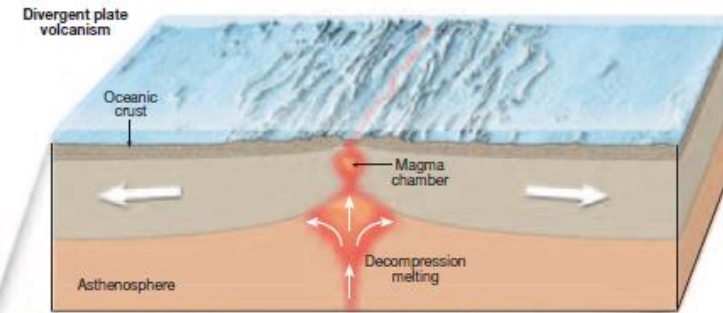
T-130

Three zones of volcanism



T-131

Three zones of volcanism



FACTORS AFFECTING ERUPTIONS

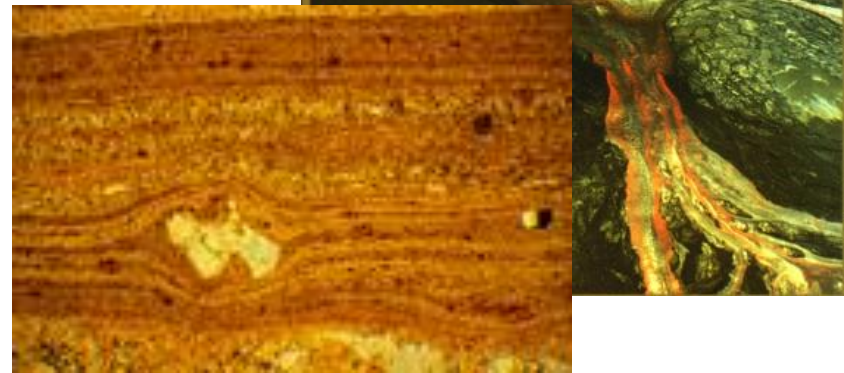
- **Factors that determine the violence of an eruption**
 - Composition of the magma (silica content)
 - Temperature of magma
 - Dissolved gases in the magma (%)
- **Viscosity of magma**
 - **Viscosity** (stickiness) is the measure of a material's resistance to flow.
 - Low viscosity = magma runs like water
 - High Viscosity = magma runs like syrup



3 TYPES OF MAGMA

(1st type) Basaltic (*mafic*) Magma

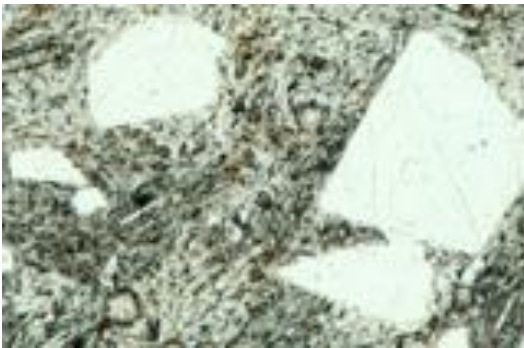
- Contains low amounts of silica
- High Temperature (1200°C)
- Low amount of gas
- Low viscosity – flows quickly *(like water)*
- Gases escape easily.
- Results in gentle eruptions.
- *Forms shield volcanoes*



3 TYPES OF MAGMA

(2nd type) Andesite Magma (*Granite-like*)

- Moderate silica amount
- Moderate Temp. 800-1000°C
- Moderate amount of gas
- Moderate Viscosity – flows slower. (*like oil*)
- Gases can't escape easily
- Results in moderate explosive eruptions. Eruptions will send solid particles into the air.
- *Forms Composite volcanoes*



3 TYPES OF MAGMA

(3rd type) Rhyolitic Magma (Granite-like)

- High silica amount
- Low temperature (750–850°C)
- High amount of gases
- High Viscosity – flows very slow. (*like honey*)
- Gases can't escape easily
- Results in moderate explosive eruptions. Eruptions will send solid particles into the air.
- **Forms Calderas, Pyroclastic Flows**

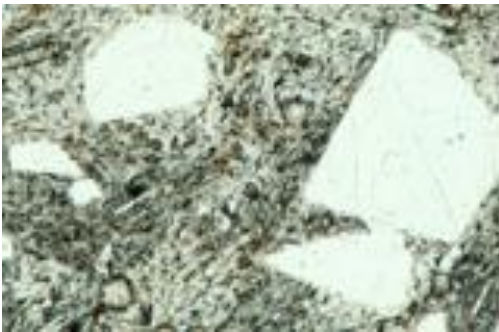


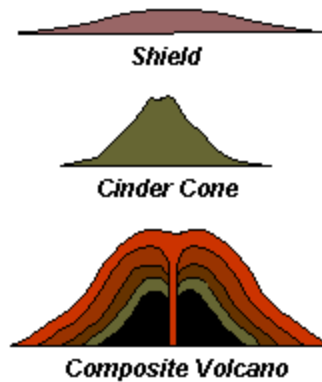
Table 1 Magma Composition

Composition	Silica Content	Viscosity	Gas Content	Tendency to Form Pyroclastics (ejected rock fragments)	Volcanic Landform
Basaltic	Least (~50%)	Least	Least (1–2%)	Least	Shield Volcanoes Basalt Plateaus Cinder Cones
Andesitic	Intermediate (~60%)	Intermediate	Intermediate (3–4%)	Intermediate	Composite Cones
Rhyolitic	Most (~70%)	Greatest	Most (4–6%)	Greatest	Pyroclastic Flows Volcanic Domes



Volcanic Types

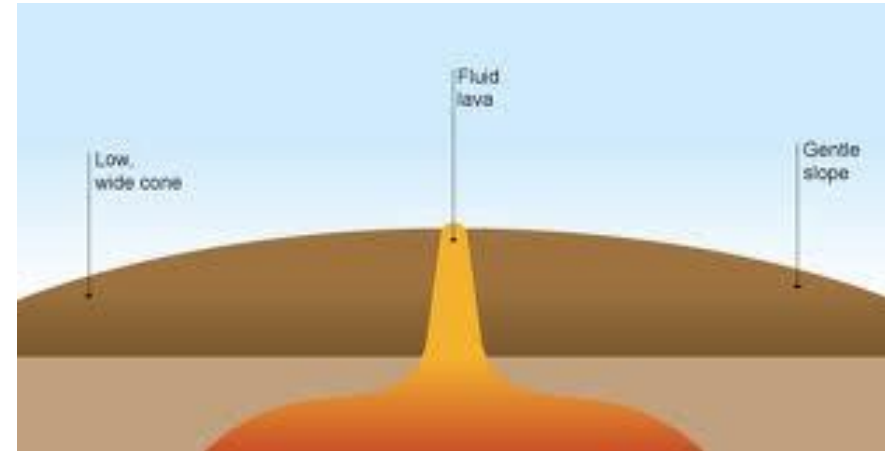
- The piles of volcanic materials, known as volcanic cones, are classified into 3 main types.



Volcanic Types

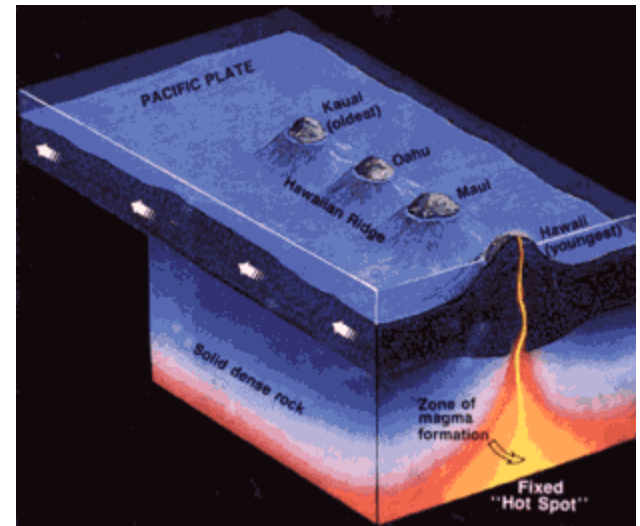
1) Shield Volcano

- Volcanic cones that are broad at the base and have gentle sloping sides.
 - Wider than tall
 - Fluid basaltic lava
- More quiet lava eruptions.
- *Example: Hawaiian Islands*



Hot Spots

- Most shield volcanoes form over **hot spots**.
- The Hawaii Islands formed this way.
- *Tip: Oldest island is Kauai*

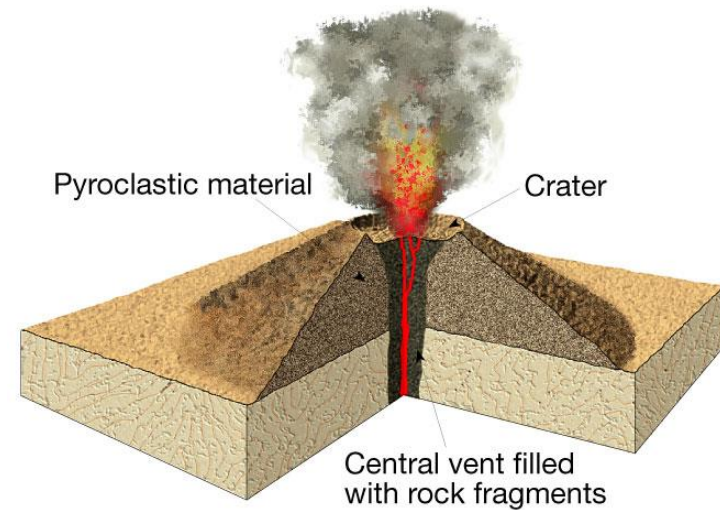


- http://www2.wwnorton.com/college/geo/egeo/flash/2_10.swf
- <http://www.geo.wvu.edu/~dono van/geol101/animations/55.swf>

Volcanic Types

2) Cinder Cones

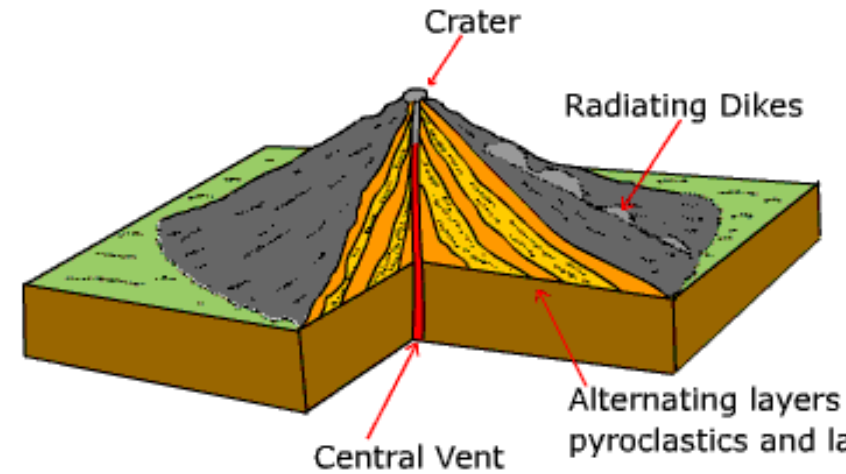
- Cinder cone is made of solid fragments ejected from the volcano
- Ejected fragments are the size of cinders.
 - Fine ash to pea-size or walnut size particles
- Gas-rich basaltic magma
- Usually a single eruption
- Have very steep slopes and rarely more than a few hundred meters high.
- *Example: Sunset Crater (AZ)*



Volcanic Types

3) Composite Cone (Stratovolcano)

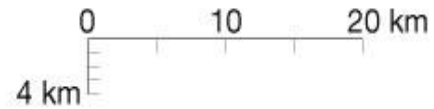
- Most violent type of activity
 - Gas-rich magma
 - High in silica
- High Viscosity magma
- Most are located around the Pacific Ocean (*Ring of Fire*)
- These volcanoes will have layers of lava and rock on top of each other.
- These develop into high, steep volcanic mountains.
- *Example: Mt. Saint Helens (WA)*



Profiles of Volcanic Landforms



Mauna Loa, Hawaii, a large shield volcano



Mount Rainier, Washington, a large composite cone



Sunset Crater, Arizona, a large cinder cone

Other Volcanic Landforms

CALDERAS

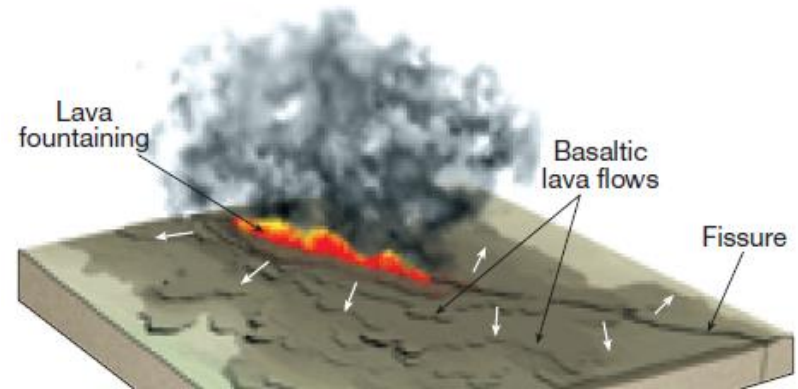
- When the magma chamber below the volcano is emptied, the volcanic cone may collapse.
- Leaving a large, basin-shaped depression called a **caldera**.
- Size can exceed 1 kilometer in diameter.



Other Volcanic Landforms

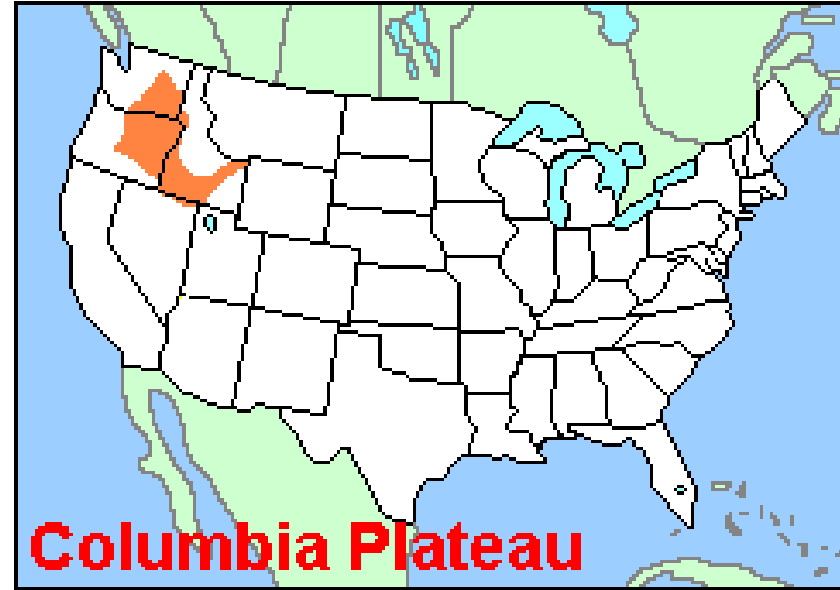
Lava Plateaus

- Fluid basaltic lava extruded from crustal fractures called **fissures**.
- Greatest volume of volcanic material comes from fissures.



Columbia Plateau

- *One of the worlds largest accumulations of lava.*
- *Over 500,000 square kilometers of the Earth's surface is covered by it.*
- *The topography here is dominated by geologically young lava flows that inundated the countryside with amazing speed, all within the last 17 million years.*





Predicting Eruptions



- Small earthquakes often increase before an eruption.
- An increase in strength of earthquakes.
- A slight bulging of the surface of the volcano.
- Changes in composition of gases given off.



Etna, Italy

- Elevation: 10,991 feet (3,350 m)



Pinatubo, Philippines

- **Elevation: 5248 ft (1600 m)**



Mount Hood, Oregon

- 11,237 feet, 3,426 m



Paricutin, Mexico

- Most of the explosive activity was during the first year of the eruption when the cone grew to 1,100 feet (336 m).



Cotopaxi, Ecuador

- **Elevation: 19,000ft (5,911m)**



Cotopaxi, Ecuador

Charles A. Wood

Mount St. Helens, WA

- **Elevation: 8,363 feet (2,549 m)**

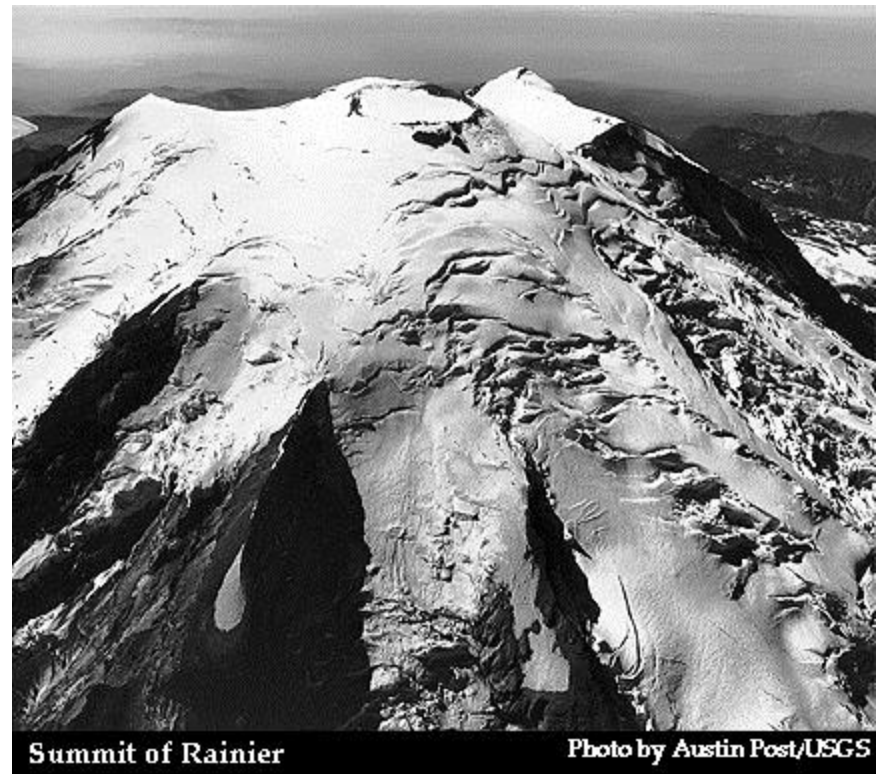


Photo by Robert E. Ford



Mount Rainier, Washington

- Elevation: 14,409 feet (4,392 m)



Summit of Rainier

Photo by Austin Post/USGS

Mauna Loa

- **Elevation: 13,681 feet (4,170 m)**
Island of Hawaii



Fuji, Honshu, Japan

- **Elevation: 3,776 m**



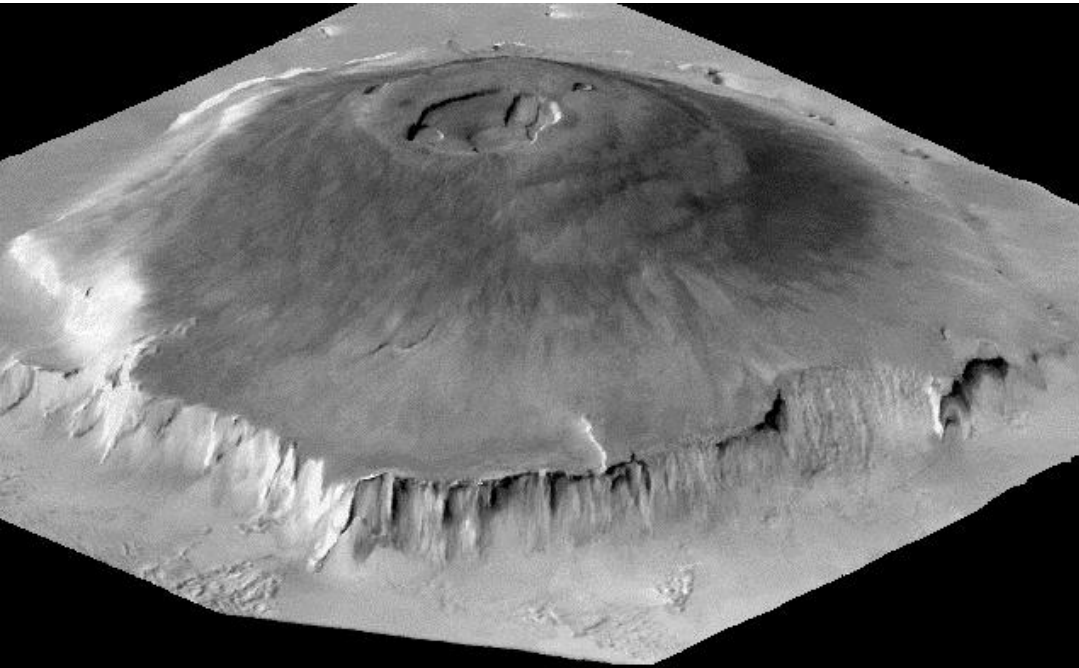
Shasta, California

- the second highest (14,161 feet, 4,317 m) mountain in the Cascade Range



Olympus Mons, Mars

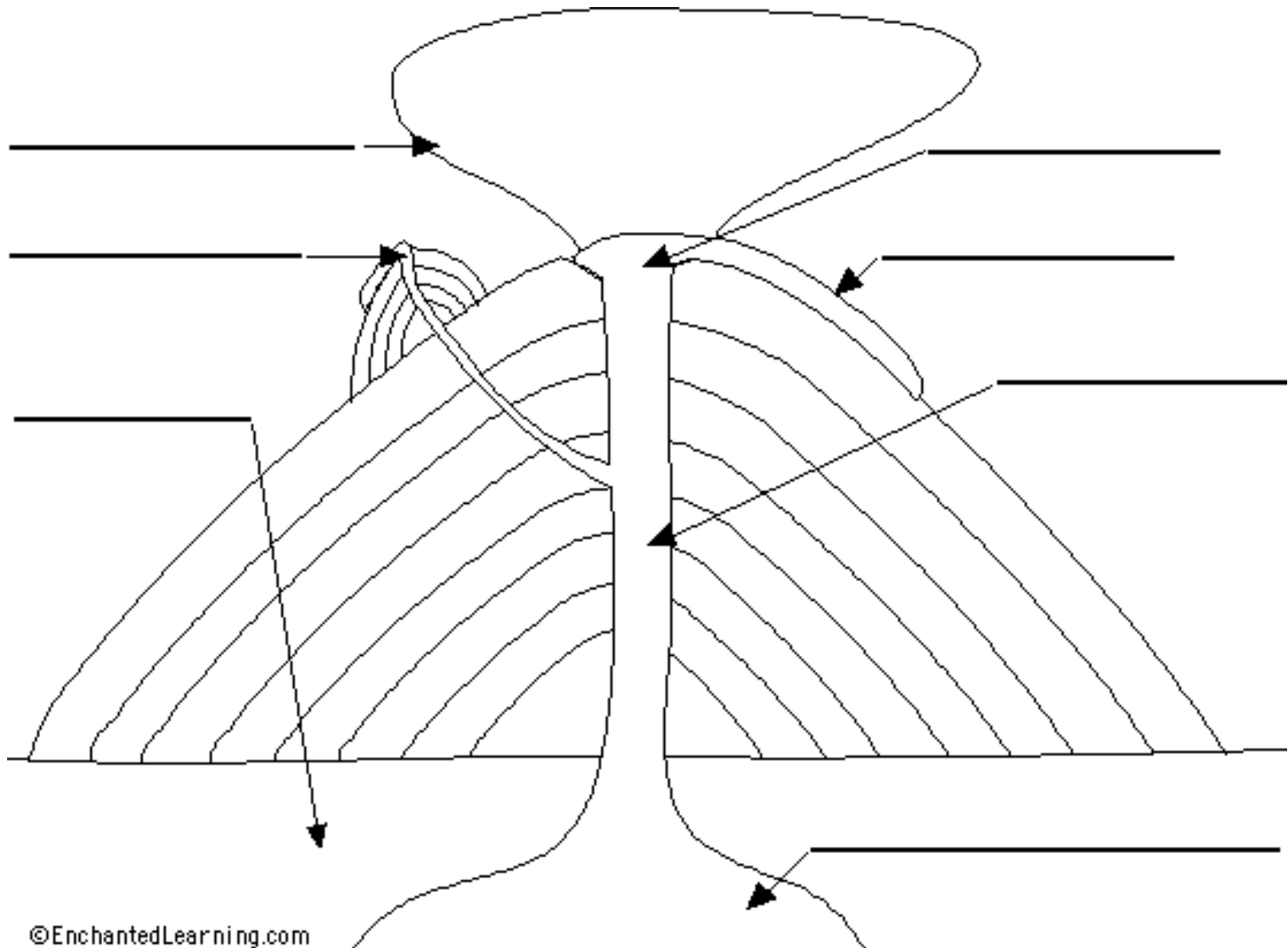
- The volcano is nearly 27 km high (85,000 ft or 16 mi) it is over 20 times wider (320 mi) than it is tall. Thus, most of the volcano has a fairly gentle surface slope

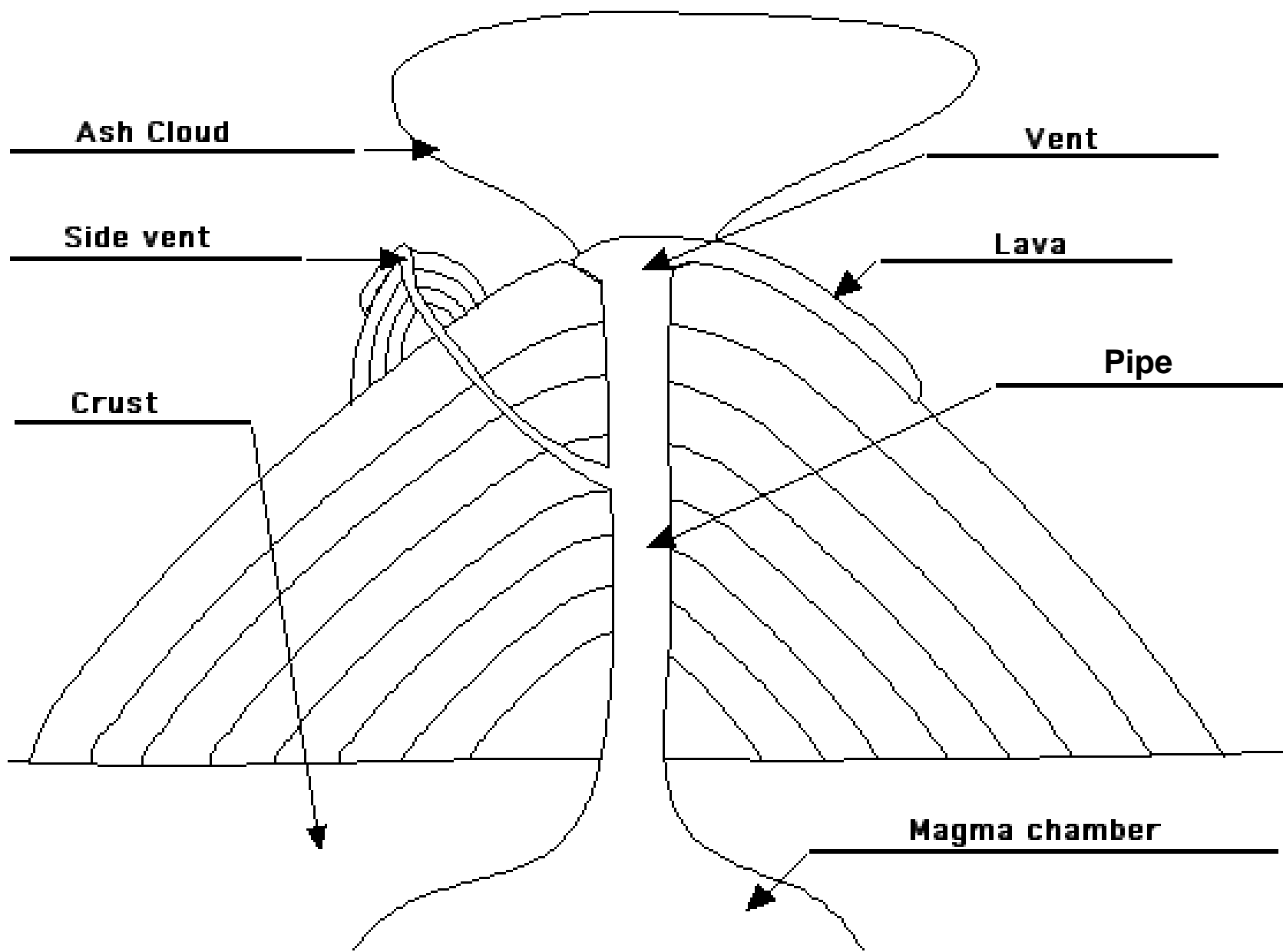


Kilauea, Hawaii



Label the parts of the Volcano





CH. 10.1

VOLCANO



Photo taken on August 27, 2005 @ 8h50 pm ©Arenal.net

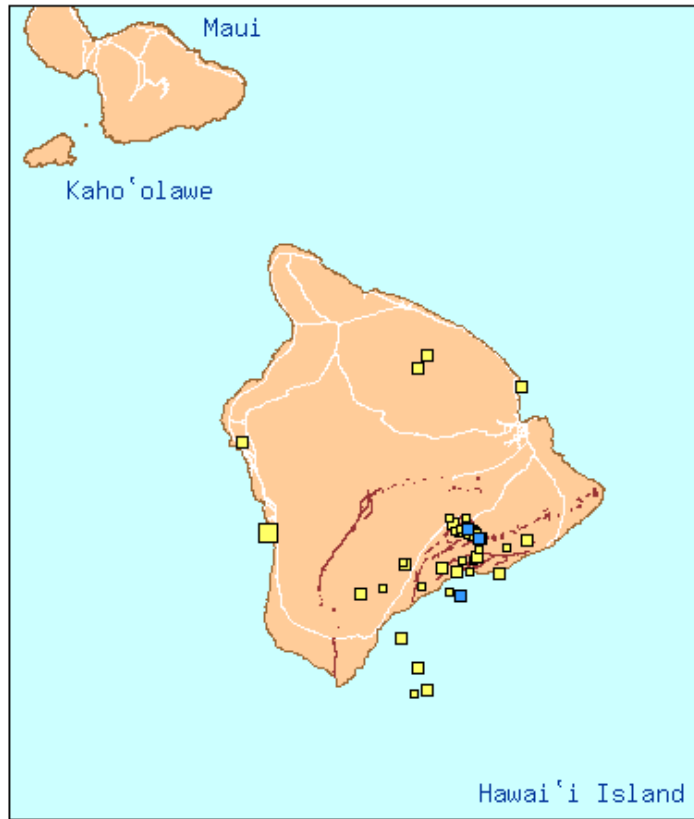
Be able to...

Explain the factors that determine the type of volcanic eruption.

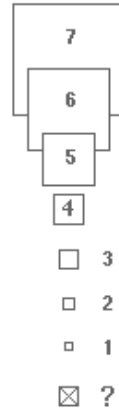
List the 3 types of volcanoes

Describe the features of a volcano.

Earthquakes from the Hawaiian Volcano Observatory Network



MAGNITUDE



■ LAST 2 HOURS

■ LAST 2 DAYS

■ LAST 2 WEEKS

0 20 km

0 20 mi

Tue Oct 9 2:00:47 HST 2012



Volcano Facts

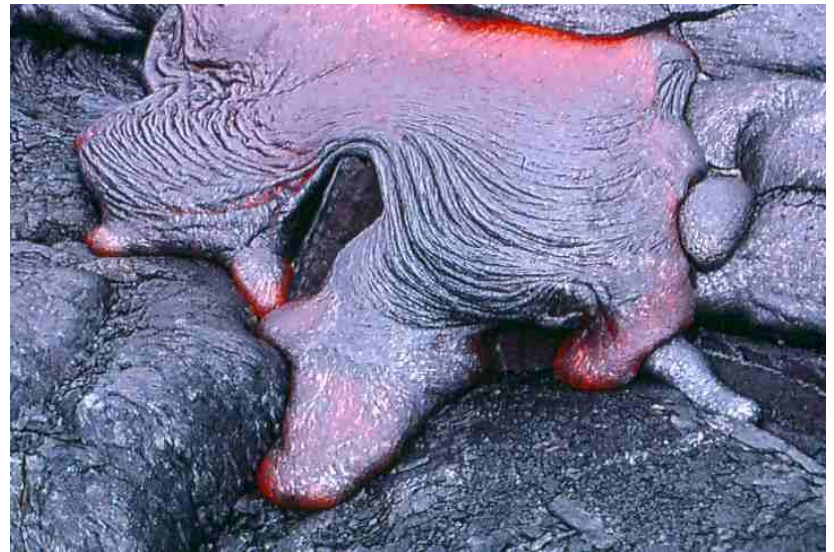
Mauna Kea

- The dormant volcano in the Hawaiian Islands which is, measuring from its base underwater to its tip, the tallest mountain in the world.
- 33,500 ft.



How Hot is Lava

- The temperature of basalt lava at Kilauea reaches 1,160 degrees Celsius (2,120 degrees Fahrenheit).



How fast can lava cool?

- Basaltic lava can form crust to walk on in 10-15 min, but may take months for the entire lava flow to cool. Some may take years.





How high can lava shoot?

- Lava fountains can propel lava 1,000 to 2000 feet above the volcano.



How fast does lava flow?

- Top speeds measured of lava flowing is 40 miles per hour.



Deadliest Volcanic Eruptions

Rank	Volcano	Year	Deaths
1.	Tambora, Indonesia	1815	92,000
2.	Krakatau, Indonesia	1883	36,417
3.	Mount Pelee, Martinique	1902	29,025
4.	Ruiz, Colombia	1985	25,000
5.	Unzen, Japan	1792	14,300
6.	Laki, Iceland	1783	9,350
7.	Kelut, Indonesia	1919	5,110
8.	Galunggung, Indonesia	1882	4,011
9.	Vesuvius, Italy	1631	3,500
10.	Vesuvius, Italy	79	3,360

Volcano Jokes



- What did the mama volcano say to the baby volcano?
- Don't erupt while I'm talking to you.
- What did one volcano say to the other volcano?
- I lava you.

