



UNIT - 8

VOLCANOES

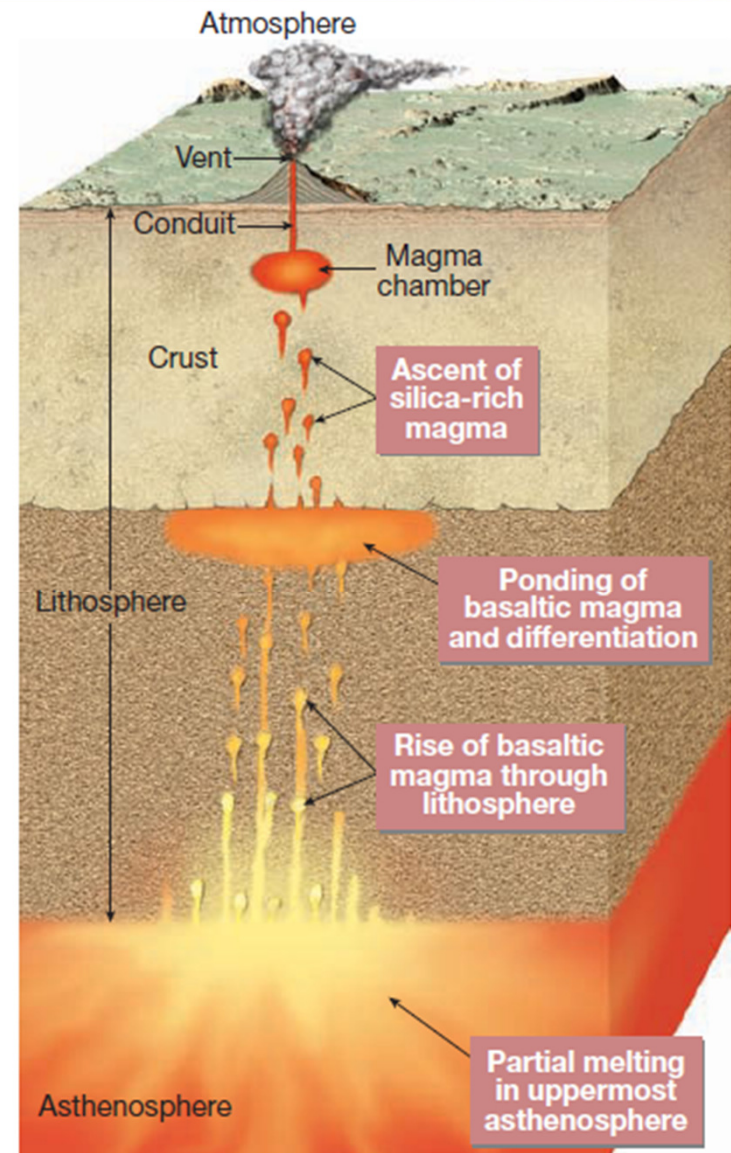
WHAT IS A MAGMA

- Magma is a mixture of molten rock, volatiles and solids that is found beneath the surface of the Earth.
- In some instances, it solidifies within the crust to form **plutonic rocks**. In others, it erupts onto the Earth's surface to form **volcanic rocks**



MAGMA BEHAVIOUR

- The magma cools as it enters shallower and cooler levels of the Earth.
- Second, pressure drops because the weight of overlying rock decreases.
- Cooling tends to solidify the magma, but decreasing pressure tends to keep it liquid.



TYPES OF MAGMA

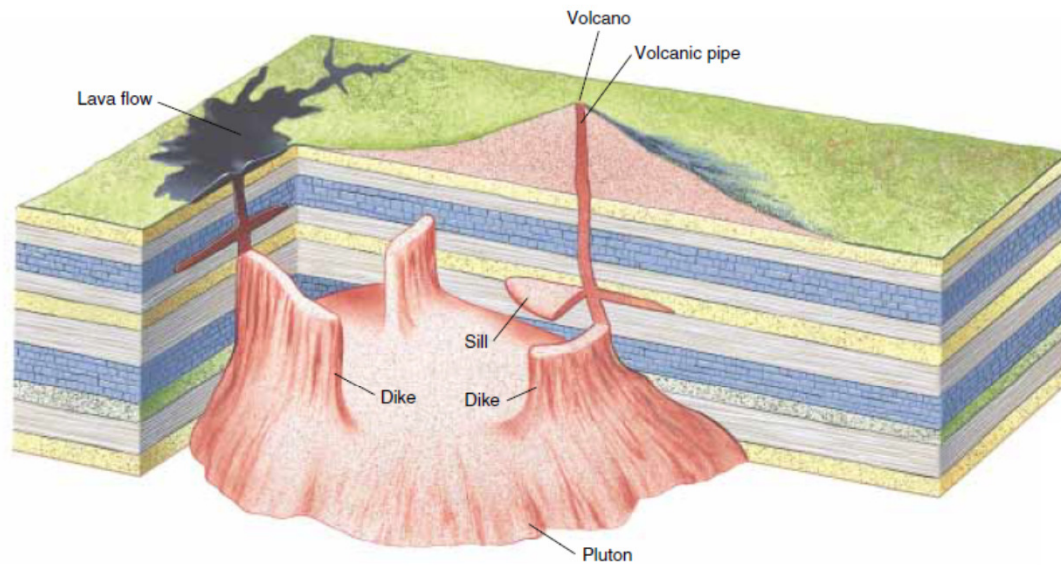
Magma Type	Solidified Rock	Chemical Composition	Temperature	Viscosity	Gas Content
Basaltic	Basalt	45-55 SiO ₂ %, high in Fe, Mg, Ca, low in K, Na	1000 - 1200°C	Low	Low
Andesitic	Andesite	55-65 SiO ₂ %, intermediate in Fe, Mg, Ca, Na, K	800 - 1000°C	Intermediate	Intermediate
Rhyolitic/ Granitic	Rhyolite	65-75 SiO ₂ %, low in Fe, Mg, Ca, high in K, Na.	650 - 800°C	High	High

- Higher SiO₂ (silica) content magmas have higher viscosity than lower SiO₂ content magmas (viscosity increases with increasing SiO₂ concentration in the magma).
- Lower temperature magmas have higher viscosity than higher temperature magmas (viscosity decreases with increasing temperature of the magma).

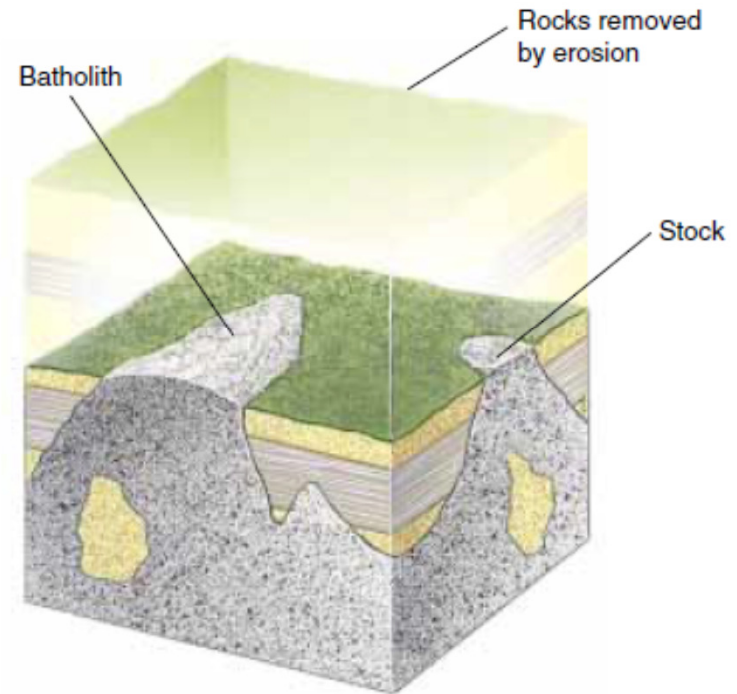
PLUTONS

- In most cases, granitic magma solidifies within the Earth's crust to form a pluton.
- A **batholith** is a pluton exposed over more than 100 square kilometers of the Earth's surface.
- A **stock** is similar to a batholith but is exposed over less than 100 square kilometers.

PLUTONS



BATHOLITH AND STOCK

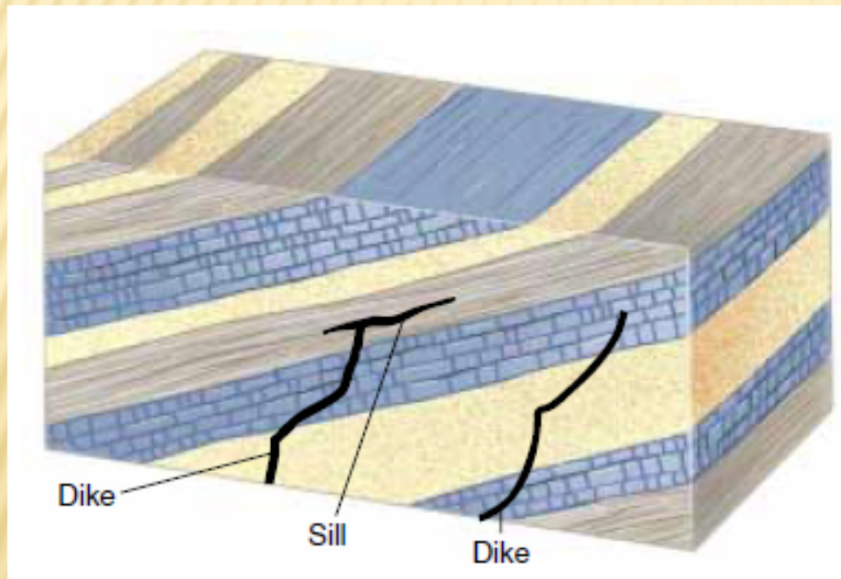


PLUTONS

- A **dike** is a tabular, or sheet like, intrusive rock that forms when magma oozes into a fracture. Dikes cut across sedimentary layers or other features in country rock and range from less than a centimeter to more than a kilometer thick.
- Magma that oozes between layers of country rock forms a sheet like rock parallel to the layering, called a **sill**.

PLUTONS

DIKE



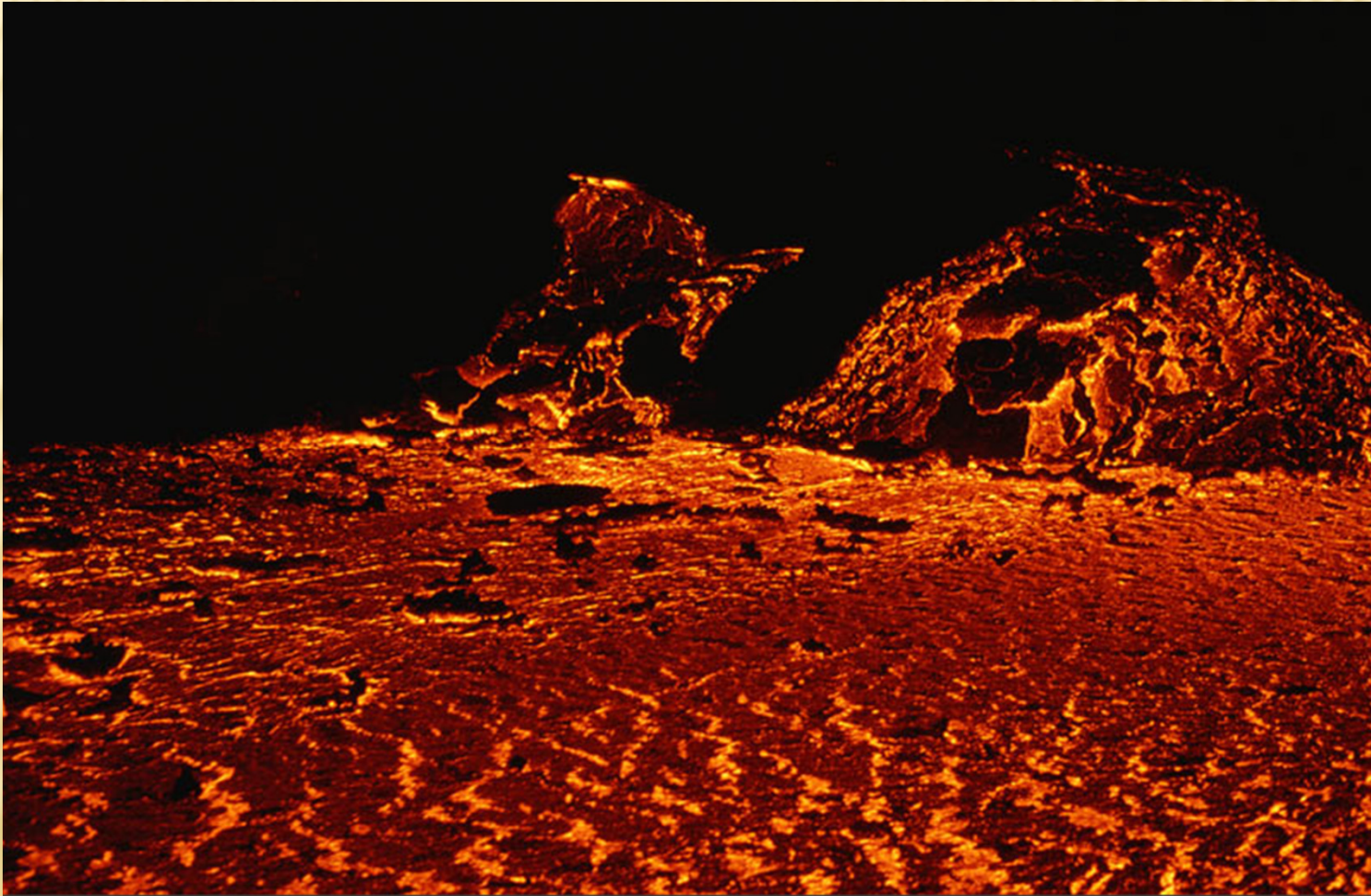
SILL



VOLCANIC ROCKS AND VOLCANOES

- The material erupted from volcanoes creates a wide variety of rocks and landforms, including **lava plateaus** and several types of **volcanoes**.
- **Lava** is fluid magma that flows onto the Earth's surface. Lava generally comes on to the earth's surface through volcanoes.
- A **volcano** is an opening, or rupture, in a planet's surface or crust, which allows hot magma, volcanic ash and gases to escape from below the surface

VOLCANIC ROCKS AND VOLCANOES



LAVA

VOLCANIC ROCKS AND VOLCANOES



VOLCANO

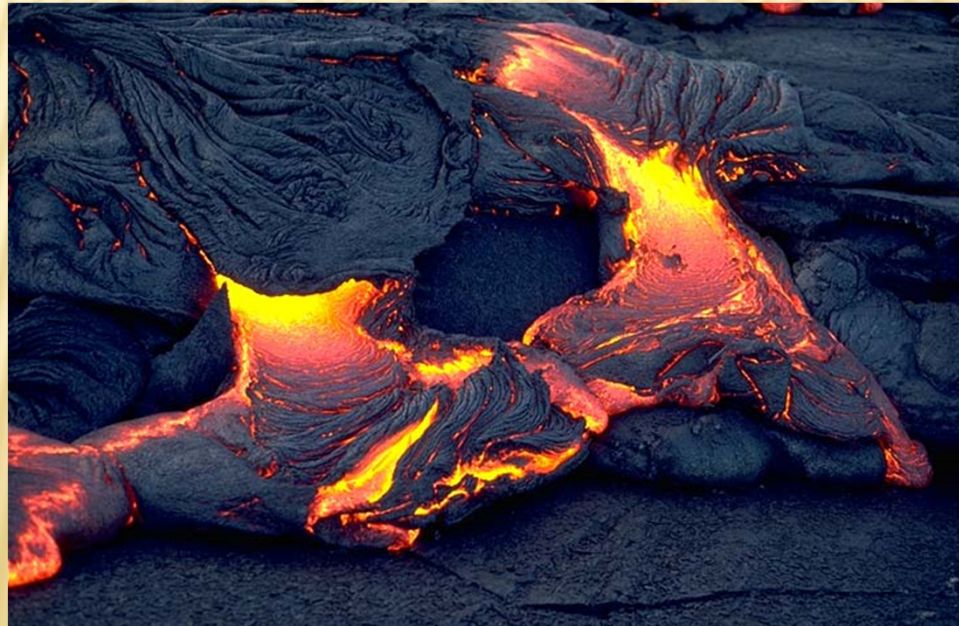
TYPES OF LAVA

- **A'a**: Pronounced “ah-ah”, this is a basaltic lava that doesn't flow very quickly. These types of lava erupt at temperatures above 1000 to 1100 degrees C



TYPES OF LAVA

- **Pahoehoe**: Pronounced “pa-ho-ho”, this type of lava is much thinner and less viscous than a’ā. It can flow down the slopes of a volcano in vast rivers. Pahoehoe erupts at temperatures of 1100 to 1200 degree C



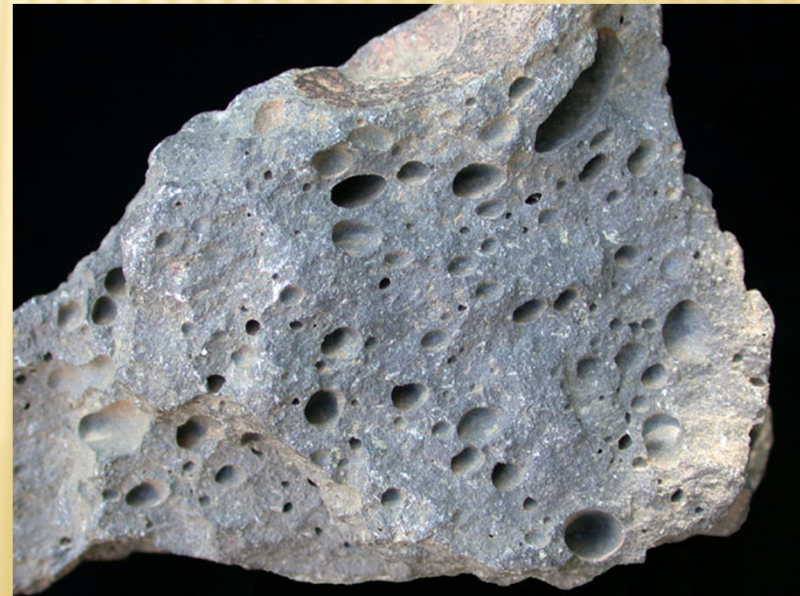
TYPES OF LAVA

- **Pillow Lava:** Pillow lava is typically found erupting from underwater volcano vents.



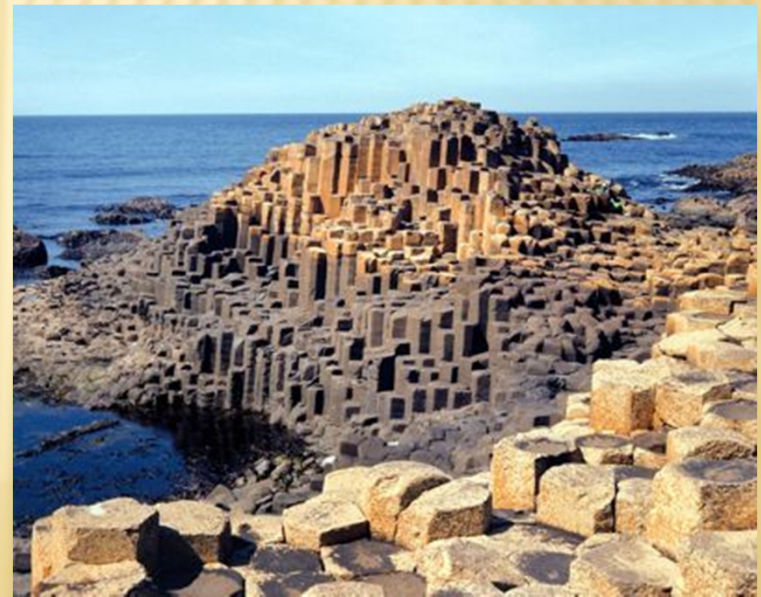
STRUCTURES IN VOLCANIC ROCKS

- When lava cools, escaping gases such as water and carbon dioxide form bubbles in the lava.
- If the lava solidifies before the gas escapes, the bubbles are preserved as holes called **vesicles**



STRUCTURES IN VOLCANIC ROCKS

- Hot lava shrinks as it cools and solidifies. The shrinkage pulls the rock apart, forming cracks that grow as the rock continues to cool. Such cracks, called **columnar joints**



PYROCLASTIC ROCKS

- ✖ If a volcano erupts explosively, it may eject both liquid magma and solid rock fragments. A rock formed from particles of magma that were hurled into the air from a volcano is called a **pyroclastic rock**
- ✖ The smallest particles is called **volcanic ash**



PYROCLASTIC ROCKS

- **Cinders** vary in size from 2 to 64 millimeters



PYROCLASTIC ROCKS

- Particles greater than 64 mm in diameter are called **volcanic bombs**



FISSURE ERUPTIONS AND LAVA PLATEAUS

- The gentlest type of volcanic eruption occurs when magma comes out from the cracks in the land surface called **fissures** and flows over the land like water.
- Basaltic magma commonly erupts in this manner because of its low viscosity



FISSURE ERUPTIONS AND LAVA PLATEAUS

- Some times fissures extend for tens or hundreds of kilometers and pour thousands of cubic kilometers of lava onto the Earth's surface.
- A fissure eruption of this type creates a **flood basalt**, which covers the landscape like a flood



FISSURE ERUPTIONS AND LAVA PLATEAUS

- Many such eruptions may occur in rapid succession and to create a **lava plateau** covering thousands of square kilometers



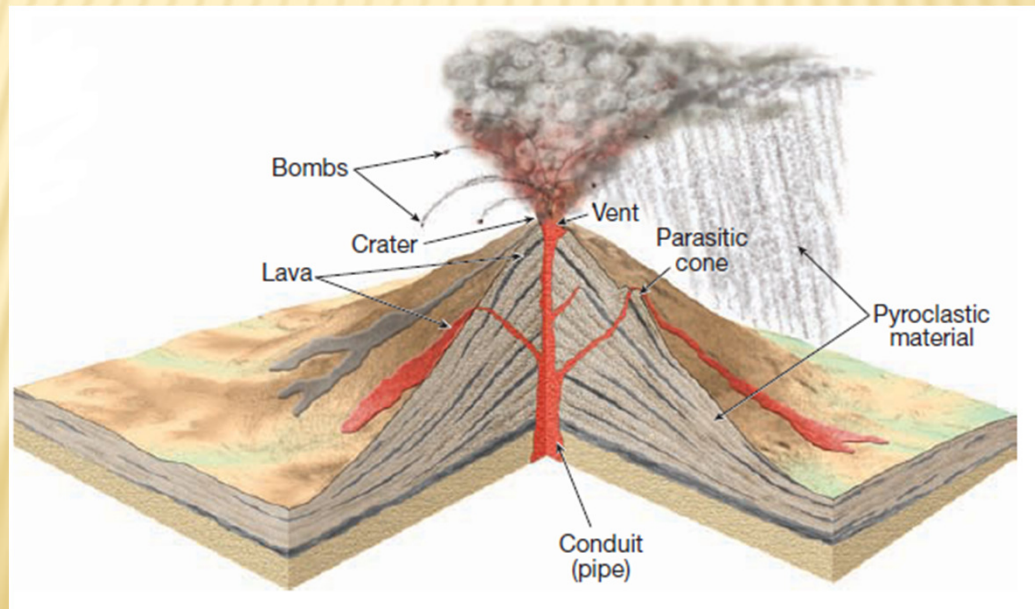
VOLCANOES

- If lava is too viscous to spread out as a flood, it builds a hill or mountain called a **volcano**.



VOLCANOES

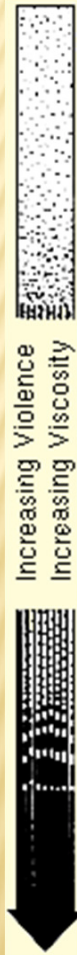
- Volcanoes differ widely in shape, structure, and size.
- Lava and rock fragments commonly erupt from an opening called a **vent**.
- The vent joins the **crater** which is a bowl shaped depression present at the top of the volcano.



VOLCANO TYPES BASED ON ACTIVITY

- An **active volcano** is one that is erupting or is expected to erupt
- A **dormant volcano** is one that is not now erupting but has erupted in the past and will probably do so again
- An **extinct volcano** is one that is expected never to erupt again

TYPES OF VOLCANOES



TYPE OF VOLCANO	FORM OF VOLCANO	SIZE	TYPE OF MAGMA	STYLE OF ACTIVITY	EXAMPLES
Basalt plateau	Flat to gentle slope	100,000 to 1,000,000 km ² in area; 1 to 3 km thick	Basalt	Gentle eruption from long fissures	Columbia River Plateau
Shield volcano	Slightly sloped, 6° to 12°	Up to 9000 m high	Basalt	Gentle, some fire fountains	Hawaii
Cinder cone	Moderate slope	100 to 400 m high	Basalt or andesite	Ejections of pyroclastic material	Parícutín, Mexico
Composite volcano	Alternate layers of flows and pyroclastics	100 to 3500 m high	Variety of types of magmas and ash	Often violent	Vesuvius, Mount St. Helens, Aconcagua
Caldera	Cataclysmic explosion leaving a circular depression called a caldera	Less than 40 km in diameter	Granite	Very violent	Yellowstone, San Juan Mountains

TYPES OF VOLCANOES



BASLAT PLATEAU

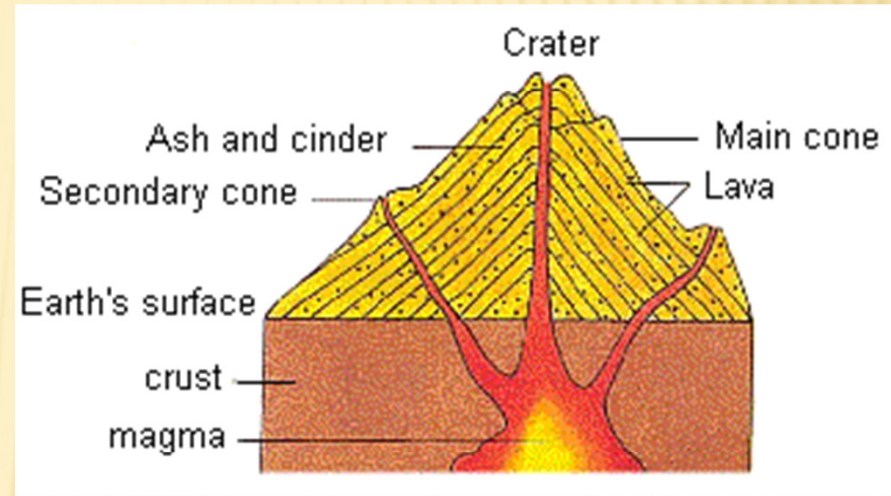


SHIELD VOLCANO

TYPES OF VOLCANOES



CINDER CONE



COMPOSITE VOLCANO



CALDERA

DISTRIBUTION OF WORLD VOLCANOES

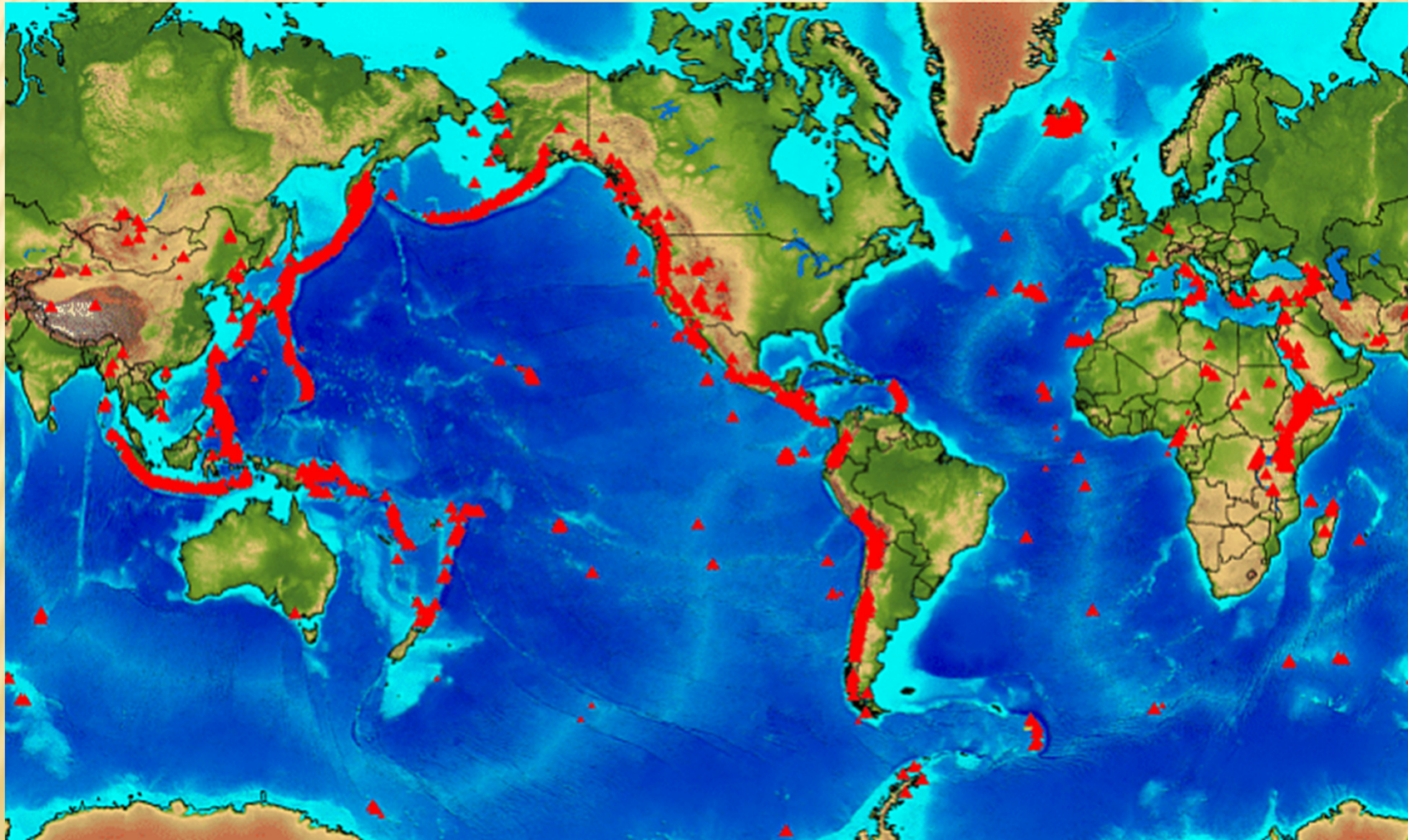


PLATE TECTONICS AND VOLCANIC ACTIVITY

- Most active volcanoes are associated with plate boundaries.
- Active areas of volcanism are found along mid-ocean ridges where seafloor spreading is occurring (divergent plate boundaries),
- in the vicinity of ocean trenches where one plate is being subducted beneath another (convergent plate boundaries), and
- In the interiors of plates themselves (intraplate volcanism). Rising plumes of hot mantle rock are the source of most intraplate volcanism.

OCCURRENCE AND PREDICTION OF VOLCANOES

- Volcanic eruptions are common near a **subduction zone**, **near a spreading center**, and at a **hot spot over a mantle plume** but are rare in other tectonic environments.
- Eruptions on a continent are often violent, whereas those in oceanic crust are gentle. Such observations form the basis of regional predictions of volcanic hazards.
- Short-term predictions are made on the basis of earthquakes caused by magma movements, swelling of a volcano, increased emissions of gas and ash from a vent, and other signs that magma is approaching the surface