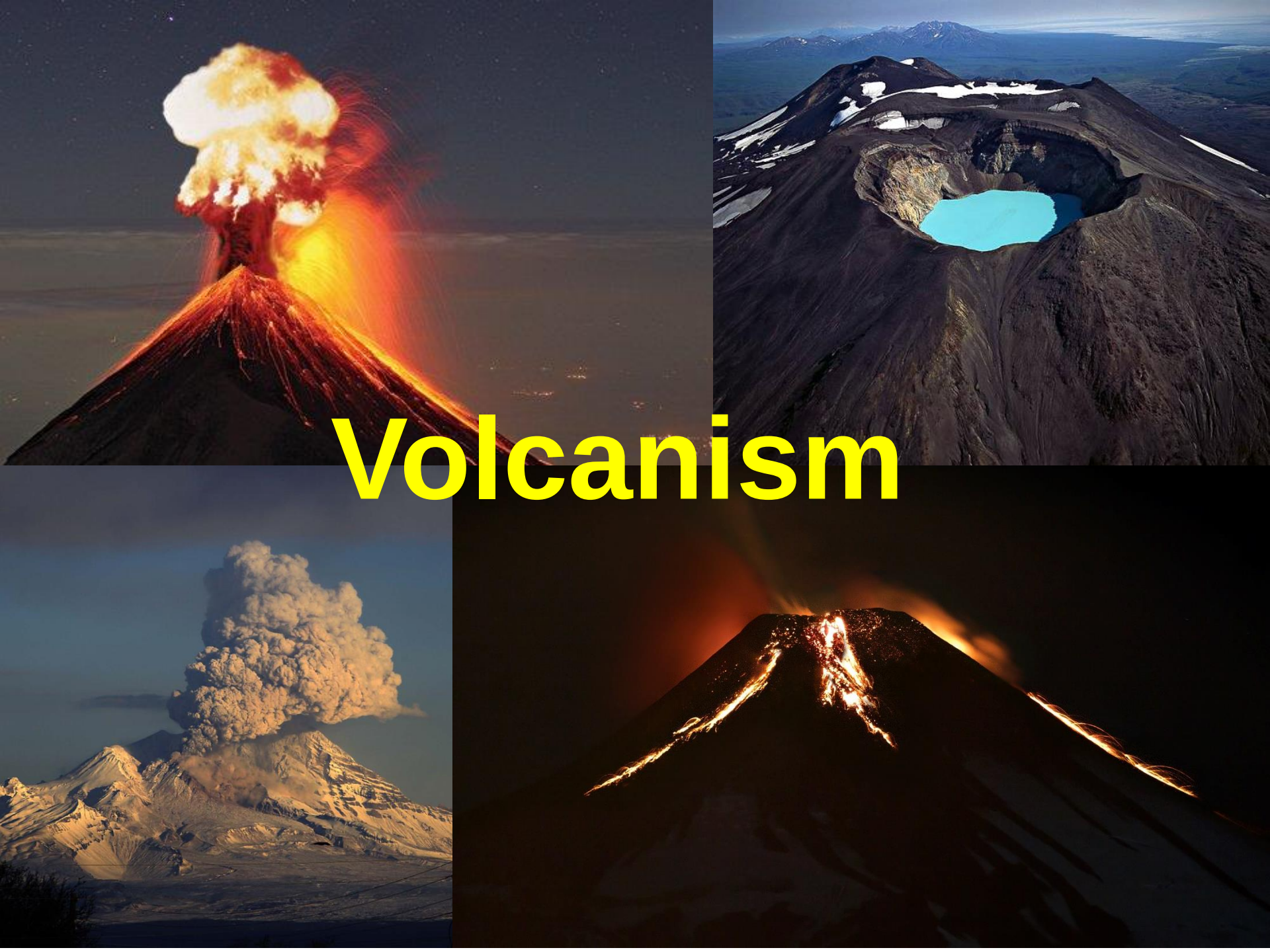
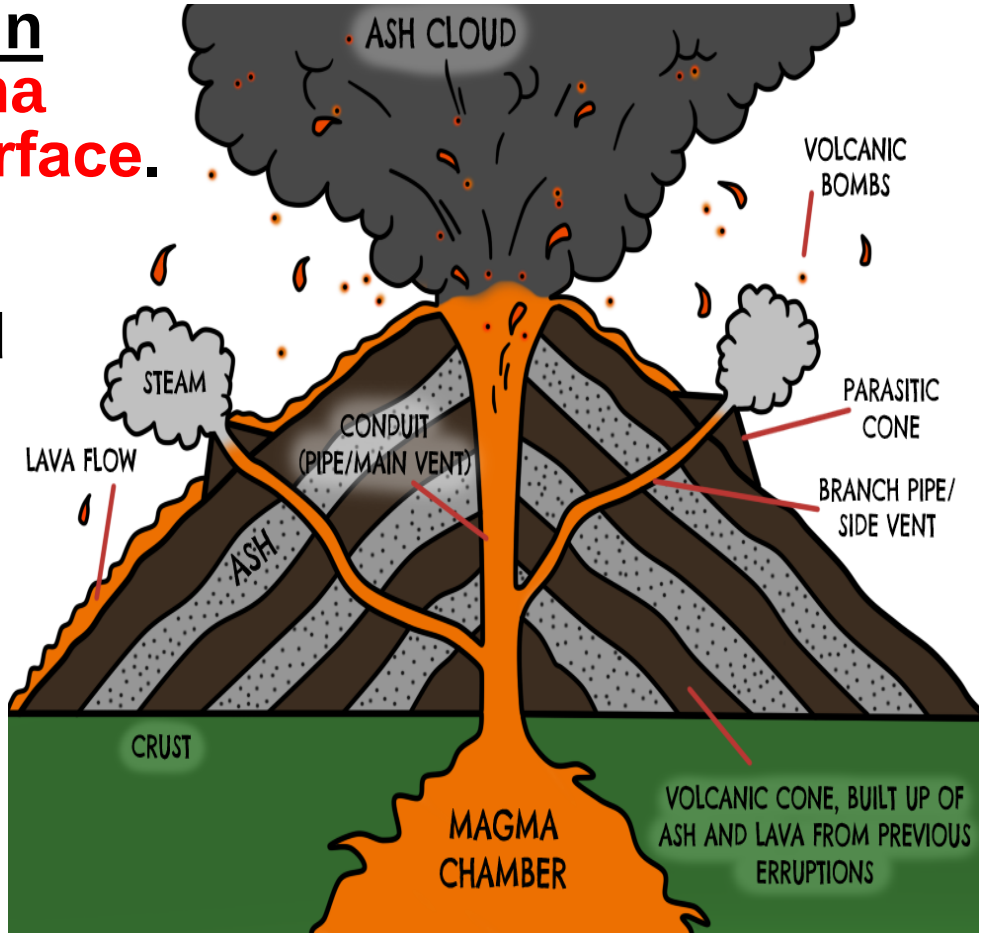


Volcanism

What is Volcanism?

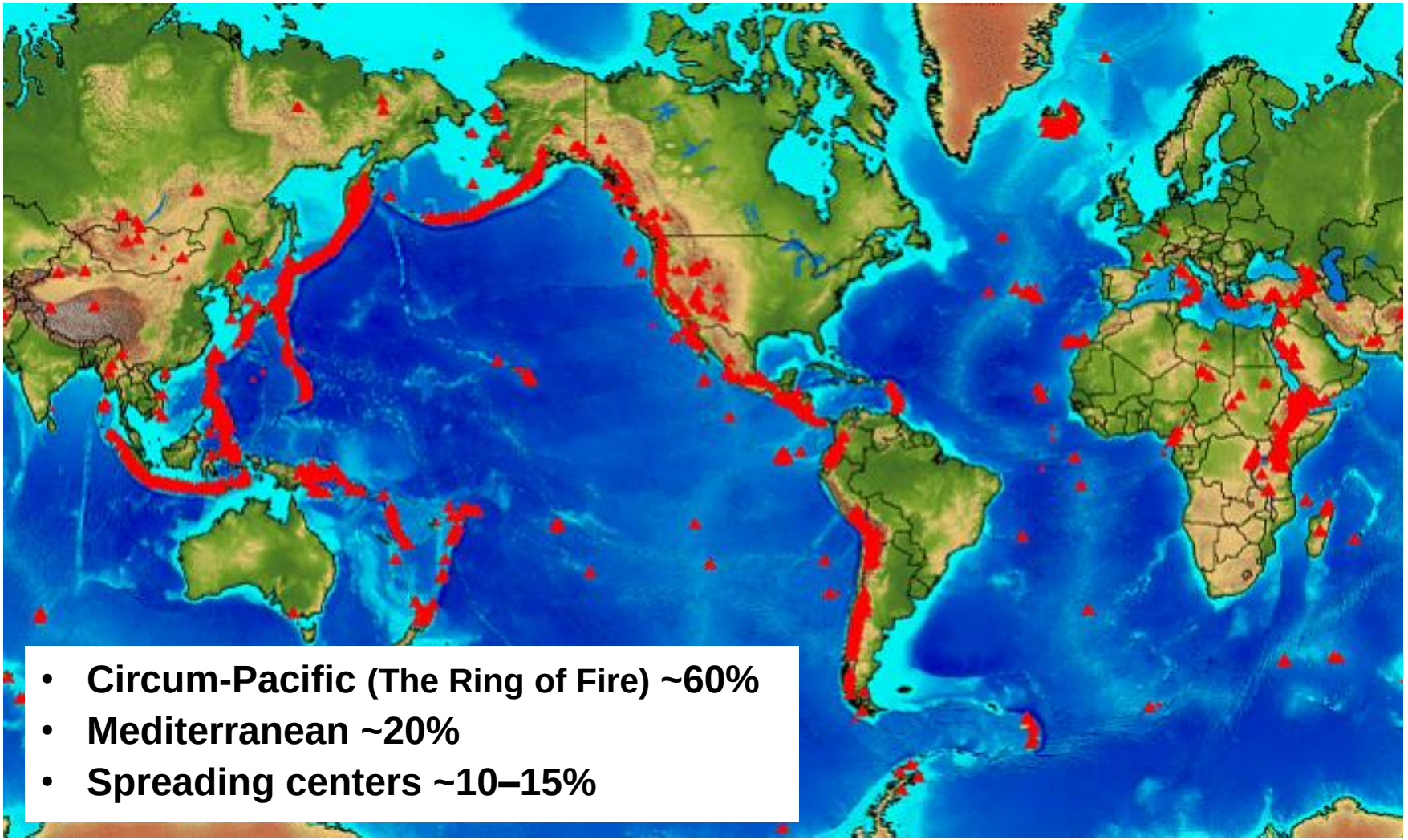
- A volcano is a mountain that forms when magma reaches the Earth's surface.
- Magma develops and collects in areas called magma chambers.
- Magma is less dense than the solid rock around it.
- Magma can also easily migrate (flow) if a structural zone allows movement.



- When a rupture on the crust is present, magma rises to the surface and escapes, resulting in volcanism.

Volcano Distribution

On Earth, volcanoes are generally found where tectonic plates are diverging or converging.



Volcanic Activity

- **Active - activity present in the last few centuries:**
  - **Mauna Loa, HI (current)**
  - **Mt. St. Helens, WA (1980)**

- **Dormant - "quiet" for the last hundreds to thousands of years, but still have potential to erupt:**
  - **Mt. Elbrus, Russia (~2000 years ago)**

- **Extinct - no eruption in historical times, unlikely to erupt again, no longer have a magma supply:**
  - **Castle Rock, Edinburgh, Scotland (~350 million years ago)**

Non-explosive Eruption

- Most volcanoes erupt basalt, a fluid low viscosity lava that erupts *effusively* (quietly) and forms *flows* with occasional *fountains*.

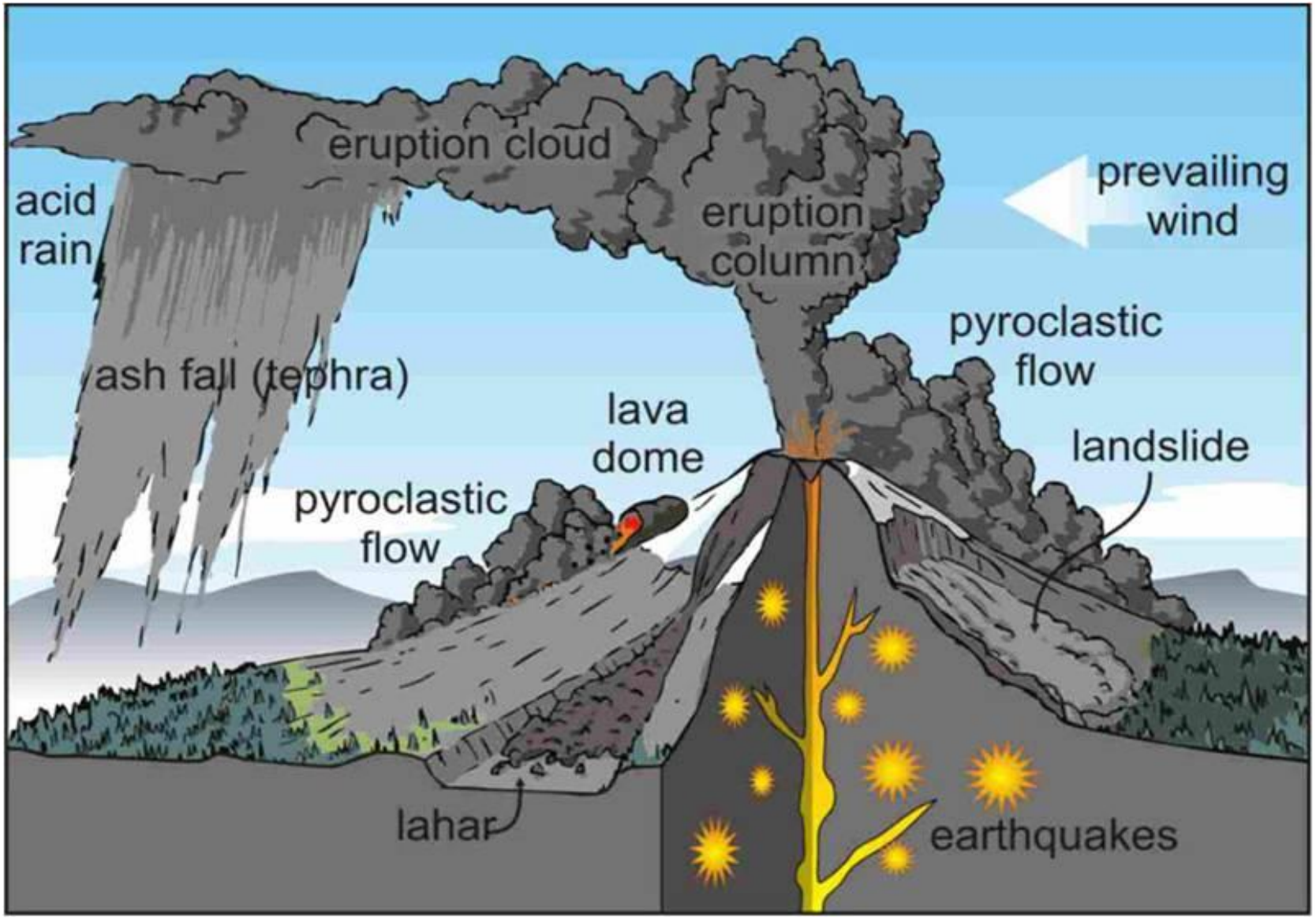
- Higher viscosity lava with low gas content produces bulging lava *domes*.

Explosive Eruption

Very high viscosity magma prevents the release of volcanic gases; gases accumulate and the magma pressure builds up… until it is blasted out in an explosion!

Explosive eruptions can send rocks, dust, gas and pyroclastic material up to 20 km into the atmosphere.

Explosive Eruption Diagram



Volcanic Eruption: Primary Effects

- **Three types of material expelled from volcanoes:**
  - **Lava ("liquid")**
  - **Ash, cinders, bombs ("solid")**
  - **Gases**

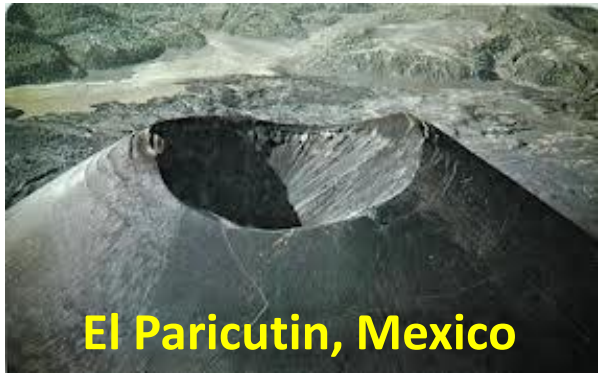
  HOMEWORK

- **An erupting volcano will produce a number of distinct landforms including:**
  - **Volcanic cones**
  - **Flood basalts**
  - **Calderas**

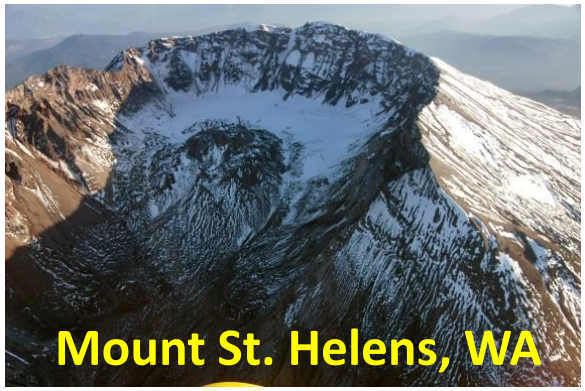
Volcanic Landforms: Cones

- **Shield volcanoes**
  - Multiple layers of basaltic lava
  - Shallow sides due to magma's low viscosity
  - Multiple "Gentle" eruptions

- **Cinder cones**
  - Layered ash and cinders
  - Smallest volcanic cone
  - Short, narrow cone, steep sides
  - Violent eruptions, often *single*

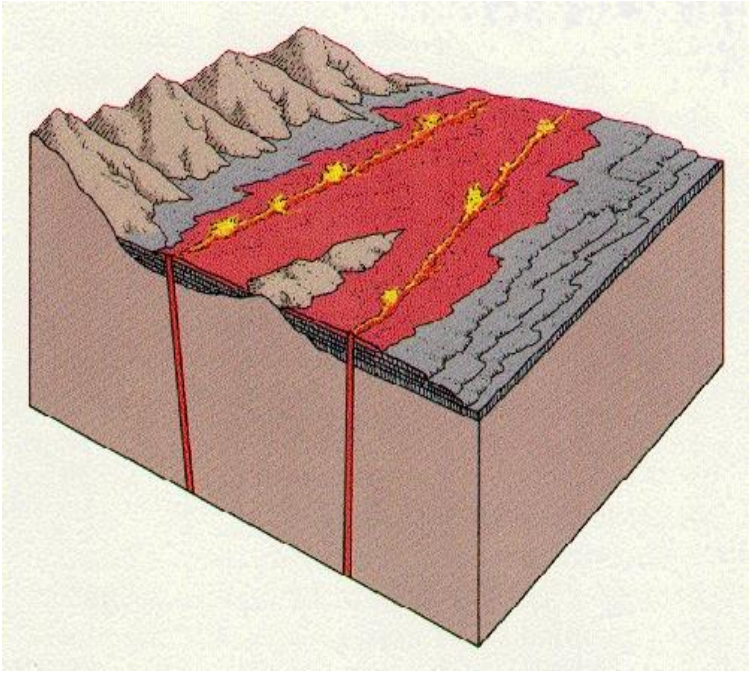


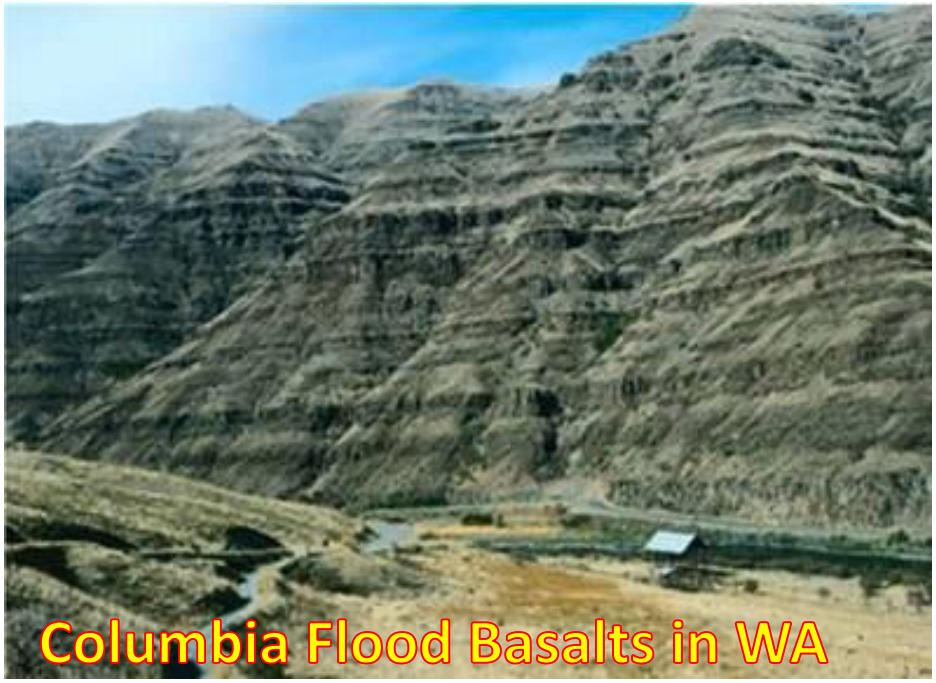
- **Composite cones (stratovolcanoes)**
  - Most common type
  - Layered ash, lava, and mud
  - Steep sides due to magma's high viscosity
  - Tall volcanoes – 1 to 2 miles high
  - Violent, often *catastrophic*, eruptions



Volcanic Landforms: Flood Basalts

- **Large (10-100 square miles) outpourings of very low viscosity basaltic lava**
- **Multiple, "quiet" eruptions**
- **Lava plateau forms**





<u>Flood basalt volcanism</u> has been connected to <u>major mass extinction events</u> in the past.

Volcanic Landforms: Calderas

(Spanish for "cooking pot")

Volcano rapidly empties its magma chamber, and support is lost. Overlying material collapses into the magma chamber: a caldera forms.

- **Explosive calderas**

  Silica-rich magma feeding these volcanoes has high viscosity; gases tend to become trapped at high pressure within the magma, resulting in explosion.

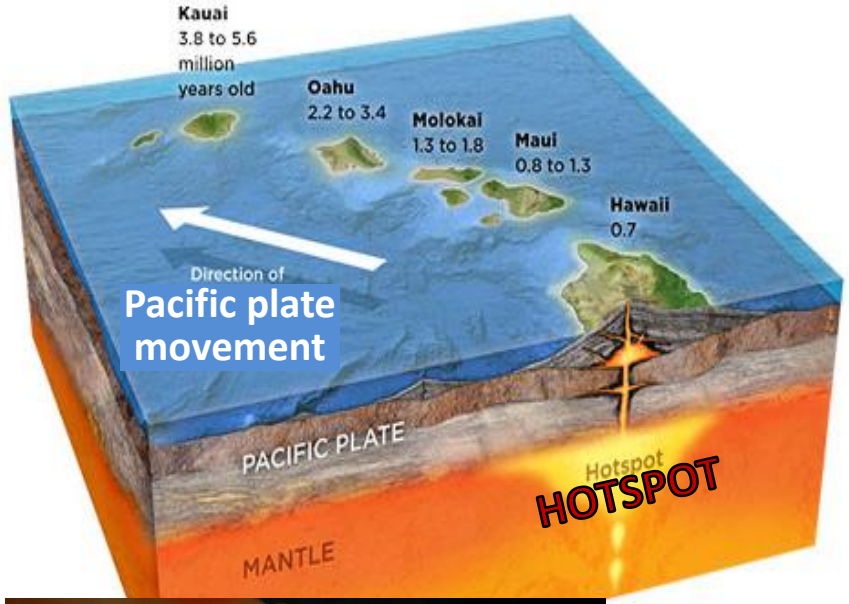
- **Non-explosive calderas**

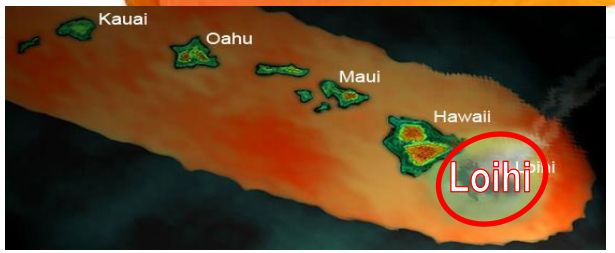
  Basaltic magma feeding these volcanoes is silica poor and much less viscous; the magma chamber is drained by large lava flows rather than by explosive events.

Hot Spot Volcanism

Hot spots are due to a **plume of hot magma** flowing up to the crust from the core-mantle boundary. This plume is for some reason sustained over long geologic periods.

Over time, the **tectonic plates of the Earth move over** these hot spots leaving a **trail of volcanoes**.





Hawaiian Islands Chain