Volcanism

- Processes which lead to the extrusion of lava, gases, and pyroclastic materials onto the surface and into the atmosphere
- Active volcanoes
- Dormant volcanoes
- Extinct volcanoes

Volcanic Gases

- 50 to 80% is water vapor, also carbon dioxide, nitrogen, sulfur dioxide, hydrogen sulfide, carbon monoxide
- Gases contained in rising magma expand and can contribute to violent explosions

• Volcanic Gases
  - Many fatalities have resulted from exposure to toxic gases, or suffocation from the displacement of oxygen by denser volcanic gases

Volcanism and Volcanoes

- Lava Flows
  - Paths are predictable
  - Rarely a danger to human life
  - Two types are recognized from Hawaiian flows: pahoehoe and aa
Volcanism

- Lava Flows
  - Columnar joints occur in cooling lavas
  - Pillow lava forms during sub-sea eruptions

Pyroclastic materials are deposited as solid fragments of explosive volcanism
- Ash
- Lapilli
- Bomb, block

What are Volcanoes?

- Conical mountains formed around a vent where lava, gases, and pyroclastic materials are erupted
  - Variations in lava composition and other factors distinguish three types
  - Most have a central crater, while calderas and fissures are also common

Calderas form when an emptied magma chamber collapses

What are Volcanoes?

- Shield Volcanoes
  - Low, rounded profiles; slope angles 2-10°; composed of numerous flows of mafic composition and little explosive activity
  - Largest of all volcanoes

Cinder Cones
- Composed of pyroclastic materials that accumulate around the vent; steep slopes (33°)
- Usually short-lived and may represent final eruptive stages
**What are Volcanoes?**

- Composite Volcanoes
  - Also called stratovolcanoes, are composed of alternating layers of pyroclastics and lava flows
  - Composition is intermediate, with andesite common
  - Eruptions are infrequent, violent, and may involve lahars

- Lava Domes
  - High-viscosity, felsic magmas move slowly upward to form steep-sided lava domes
  - Sudden collapse or explosive eruption may cause a néée ardent to move rapidly downslope, incinerating everything in its path

**Do all Eruptions Build Up Volcanoes?**

- Fissure Eruptions and Basalt Plateaus
  - Columbia River basalts flowed from fissures to cover large areas in WA and OR
  - Low viscosity, mafic lavas spread out and built up a basalt plateau

- Pyroclastic Sheet Deposits
  - Cover large areas with felsic ash and welded tuff
  - Appear to issue from fissures associated with caldera formation

**How Large is an Eruption and How Long Does It Last?**

- Eruptions are ranked by the volcanic explosivity index or VEI
  - Ranges from 0 (unexplosive) to 8 (megacolossal)
  - Based on volume of material explosively ejected, height of eruption plume
  - Volume of lava, human and property damage are not considered
  - Duration is widely variable, from days to years

**Is it Possible to Predict Eruptions?**

- Volcano monitoring
  - Physical and chemical changes
    - Tiltmeters, seismic activity, past history
    - Changes in magnetic and electrical fields
    - Gas emissions, groundwater level and temp
  - While timely warnings have been issued in the past, volcanoes remain unpredictable and only a few are regularly monitored
**Distribution of Volcanoes**

- Most are at or near plate boundaries
  - Circum-Pacific, Mediterranean, and mid-oceanic linear trends are recognized

**Plate Tectonics, Volcanoes, and Plutons**

- **Igneous Activity at Convergent Plate Boundaries**
  - Composite volcanoes found in the circum-Pacific and Mediterranean belts; partial melting produces intermediate/felsic magmas, lava domes, and violent eruptions

- **Intraplate Volcanism**
  - Occurs as a plate moves over a stationary 'hot spot'

**Plate Tectonics, Volcanoes, and Plutons**

- **Divergent Plate Boundaries and Igneous Activity**
  - Ocean crust is primarily basalt and gabbro
  - Emplaced as vertical dikes, gabbro plutons, and pillow lava
  - Mid-Atlantic Ridge, East Pacific Rise, Indian Ridge are examples

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