Vulcanism

• All phenomena connected with the origin and movement of molten rock
  • Volcanic Eruptions
  • Intrusive vulcanism
• Active volcanoes - erupted at least once in the last 10,000 years
  – 550 active volcanoes
  – 10% in the United States
  – 80% in the Pacific Ring of Fire
• Volcanic Activity primarily at plate boundaries
Volcanoes 101

• Forms at the end of a central vent or pipe
  • Rises from mantle through the crust
• Magma chamber stores magma until eruption occurs
• Thermal springs and geysers
• Earthquakes
• Lava - molten magma that is extruded onto the surface of the earth
  • Can be fluid or thick when it reaches the surface
  • Very hard and dense when cooled
• Pyroclastic material - debris thrown into the air by volcanic explosions
  • Rock fragments, lava, ash, dust, etc..
Volcanic Activity

• All volcanoes are temporary features
  • Few years to thousands of years
• A couple new volcanoes every year
• Magma carries important elements for plant growth
  – Eroded over time or blasted as ash into the atmosphere
• 3 primary landforms
  • Lava flows
  • Volcanic peaks
  • Calderas
Types of Volcanic Peaks

- Shield Volcano
  - Built upon layer after layer of solidified lava
  - Never steep sided
  - Can be high elevation
  - Fluid eruptions
  - Slow lava flow
  - Manua Loa, Hawaii
• Composite Volcano
  • Steep sided
  • Sides made of alternating layers of pyroclastic material and lava
  • Explosive eruptions
  • Mount Rainier and Mount St. Helens
• Lava Domes
  • Small, Irregular shape
  • Thick pasty lava
  • Explosive eruptions
  • Mount Lassen
  • May develop within composite volcano
• Cinder cones
  • Smallest type of volcanic mountain
  • Most common type
  • Formed of pyroclastic material
  • Less than 1500 feet tall
Calderas

- Uncommon
- Deep basin shaped depression
- Caused by volcanic explosion or collapse
- Crater Lake
  - 7700 years ago
The Long Valley Caldera

- 760,000 ya
  - Ash from LA to Kansas, Mexico to Wyoming
- 1500 sq mile lava flow
- No recent eruption

Signs of Activity
- Earthquakes
- Thermal springs
- Resurgent dome
- Trees dying
- Exposed vents
Volcanic neck

• A small, sharp spire rising from surrounding land
• The pipe of an old volcano filled with solidified lava
• Erosion removed less resistant material surrounding it
Lava Flows

- Spreads outward from volcanic crater or fissure
- Cools and solidifies
- Resembles stratification of sediment
- Irregular and fragmented landscape
- Most extensive flows from mantle plumes and mid-ocean ridges
- Flood basalt is a vast accumulation of lava built up covering tens of thousands of square miles
Batholiths

- Subterranean igneous body of indefinite depth and enormous size
- Foundation for many mountain ranges
- Uplifted and eroded
- Exposed at high elevations
• **Volcanic Dikes**
  • Long, thin nearly vertical
  • Magma forced up along a vertical crack
  • Resistant to erosion
  • Fissure vents

Lava tube
  • Formed by lava moving beneath the surface
  • Allows lava to flow distances without cooling
  • Once cooled, often forms caves
Volcanic Hazards

• Eruption Column
  • Pyroclastic material
  • Up to 15km away

• Volcanic gases
  • Acid rain
  • Lower global temperatures
• Pyroclastic flow
  • High speed avalanches of hot gas, ash and rock fragments
  • 1902 Martinique 28000 killed

• Lava flows
  • Most property damage
  • Destroys everything in its path
• Lahar
  • A loose mantle of ash and pyroclastic flow on the slopes of a volcano mobilized by heavy rain or snow melt
  • Very common
  • 20,000 killed in Columbia by an eruption 30 miles away
Hawaii Volcanoes National Park

- **Mauna Loa**
  - World’s largest shield volcano
  - “inactive” since 1984

- **Kilauea**
  - Has been erupting since 1984
  - History of explosive eruptions
  - Lava fountains and flows
  - Active slow lava flows
  - Destroyed several towns
  - 509 acres of new land
Mount Saint Helens

- 1980 Washington
- 1600 times the power of atomic bomb dropped on Hiroshima
- Elevation reduced by nearly 1300 feet
- More than $1 billion in damages
- 57 deaths
- Pyroclastic flows up to 6 miles away
- Lahars damaged 200 homes and 160 miles of highway
- Continues to show activity
Krakatau

- Indonesia 1883
- 13,000 times as powerful as the atomic bomb dropped on Hiroshima
- 36,000 - 120,000 deaths
- Several Tsunamis
  - Up to 100 feet tall
  - As far away as Africa
- Island sunk into the crater
- Global temperature decrease for 5 years
- Ash spread around the world
- New lava dome formed (rising 18 feet per year)