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Volcanoes and volcanic hazard
VOLCANO

An opening in the earth, usually raised, through which gases and lava escape from the earth’s interior.
**VOLCANIC STRUCTURES - DEFINITIONS**

**Crater** - circular depression in the ground caused by volcanic activity. It surrounds a volcanic vent.

**Vent** - An opening in Earth's surface through which volcanic materials escape. There are a main vent and secondary vents.

**Volcanic cone** – the hill built by ejecta from a volcanic vent, piling up around the vent in the shape of a cone with a central crater.

**Secondary or Parasitic Cone** - A small cone-shaped volcano formed by an accumulation of volcanic debris.

**Caldera** - Large depression produced following an eruption by the collapse of the roof of a magma chamber. Usually circular or horseshoe shaped when viewed from above.

**Summit** - Highest point; apex.

**Flank** - The side of a volcano.

**Conduit** - An underground passage Magma travels through.

**Magma chamber** - Reservoir in which magma is accumulated and stored. Located within the structure of a volcano a few kilometers from the surface.
VOLCANIC CONE
PARASITIC OR SECONDARY CONES
CALDERA
VOLCANIC PRODUCTS - DEFINITIONS

**Magma** - molten rock beneath Earth's surface

**Lava** – magma that has reached the Earth’s surface is called lava.

**Basalt** - Volcanic rock poor in silica but rich in magnesium, iron, and calcium. The most common volcanic rock.

**Lava flow** – stream of molten rocks

**Aa lava** - basaltic lava having a rough surface.

**Pahoehoe lava** - basaltic lava having a smooth or billowy surface.
AA LAVA
**Ash** - Fragments of lava or rock smaller than 2 mm in size that are blasted into the air by volcanic explosions.

**Lapilli** - Latin word meaning "small stone". Small fragments of lava (between 2mm and 6.4 cm across) shot into the air during eruptions when still molten.

**Bomb** - Fragment of magma varying in diameter from a 6.4 cm to few meters ejected into the air during a volcanic explosion.

**Pumice** - Frothy volcanic rock heavily vesicled formed by the expansion of gas in erupting lava.

**Tephra** - Generic term used for all pyroclastic materials of all sizes when ejected from a volcano. (Greek word for ashes)
Geyser - Intermittent vertical jet of water produced by the heating of underground water by geothermal activity.

Volcanic gas - The principal components of volcanic gases are water vapour (H₂O), carbon dioxide (CO₂), sulfur dioxide (SO₂) or hydrogen sulfide (H₂S), etc.

VOG - A blended word derived from the words volcanic and smog. VOG is formed by sulfur dioxide (and other gases) that mix with oxygen and moisture in direct sunlight during volcanic activity.
**Eruption column** - Vertical cloud of gas and pyroclastic fragments that forms during explosive eruptions and can reach stratospheric heights.

**Ash Cloud** - A cloud of ash formed by volcanic explosions.

**Pyroclastic flow** - Mixture of fragmented volcanic materials and gas traveling at high speeds down the slope of a volcano. It is formed during an eruption or following the collapse of a lava dome.

**Lahar (Mudflow)** - Indonesian word for a volcanic mud flow usually formed when an eruption melts part of a glacier (or snow) on a volcano. These flows involve large quantities of volcanic material (ash, blocks) and can move at high speeds. Sometimes it is triggered by an earthquake.

**Fall deposit** - Layer of fragmentary volcanic material created by fall from an eruption column or during an explosive eruption.

**Tuff** - Deposited pyroclastic rock that has consolidated.
ERUPTION COLUMN AND ASH CLOUD
PYROCLASTIC FLOW
LAHAR
Active Volcanoes
A volcano will be classified as an active volcano if at the present time it is expected to erupt or is erupting already
Dormant Volcanoes

A volcano that is not erupting or predicted to erupt in the near future. However, it has done so in recordable history. A dormant volcano is also expected to have an eruption sometime in the future.

The last major event was on December 16, 1707
Extinct Volcanoes

An extinct volcano is a volcano that no one expects will ever have another eruption

CHAINE DES PUYS
TYPE CLASSIFICATIONS

Classification of volcanoes can be done because of the type of composition and structure of the volcano.
1) A shield volcano is dome shaped and low. These volcanoes are mountains that have been shaped by the flows and can cover larger areas.
2) The simplest form of volcanoes would be the cinder cone type. These volcanoes have erupted from one single vent and a bowl shaped crater will be found in the summit.
3) The most common type is the strato or composite volcano. These are tall mountains that have steep sides and which have alternated lava and ash layers
• Describe the differences between Volcano A and Volcano B
  A = narrower/B = wider
  A = smaller/B = larger
  A = shorter/B = taller
  A = steeper/B = gentler,
  A = concave / B = straight slopes,
  A = lava and ash /B = just lava or B = doesn’t have ash,
  A = two vents or parasitic/secondary cone / B = one vent,
  A = narrow crater / B = wide crater,

• Give reasons for the differences described
  A = more viscous and slower lava,
  A = possibly more silicic lava,
  A = acid lava (andesite or rhyolite),
  B = basic lava (basalt),
  A = lava at lower temperature,
  A = more explosive,
  A = lava solidifies/cools more quickly,
  A = lava doesn’t flow as far,
  A = less volume of lava/magma,
CINDER CONE VOLCANOES

The main feature of cinder cone volcanoes is their conical shape together with steeply angled sides. Cinder cone volcanoes have relatively small ones.

Paricutin
Paricutin is a cinder cone located in Mexico and first started developing on a farm in 1943. Paricutin was active for nine years, during which time it destroyed the nearby town San Juan and covered a large area of around a hundred square miles with ash.
Types of magma and lava

Basaltic magma = little amount of silica so fluid lava (basalt)

Silicic magma = huge amount of silica so pasty or thick lava (andesite or rhyolite)
Types of Volcanic Eruptions

- Hawaiian Eruptions
  - Fluid lava

- Icelandic Eruption

- Strombolian Eruptions

- Vulcanian Eruption
  - Pasty lava

- Plinian Eruptions

- Pelean Eruptions

- Surtseyan Eruptions
  - Hydromagmatic eruption
Hawaiian Eruptions

The Hawaiian eruption will have fluid lava, which is sent into the air from the vent or the line of vents in jets. In these types of volcanic eruptions, the jets could last for several hours which is called a “lava fountain.” If the lava is flowing fast enough it could travel several miles before it hardens after cooling down.

The reason why these types of volcanic eruptions are called Hawaiian eruptions is because of the Kilauea volcano which can be found on Hawaii’s Big Island.
Icelandic Eruption

The Icelandic type is characterized by effusions of molten basaltic lava that flow from long, parallel fissures. Such outpourings often build lava plateaus. Lava Plateau is a wide, flat surface formed when lava is expelled from long narrow openings in the crust and spreads rapidly. Layers are formed by multiple eruptive events.
Strombolian Eruptions
A Strombolian eruption is a type of eruption that could be classified as **low level**. These types of volcanic eruptions were named after the Stromboli volcano in Sicily, which experienced this type of ejection several times. A Strombolian eruption is a **very distinct burst of lava** that takes place at the mouth of a lava filled summit conduit. However, because the eruption does not strongly affect the conduit system, these eruptions can last a long time. The Stromboli volcano in Italy has actually been producing these types of volcanic eruptions for **thousands of years**.
Vulcanian Eruption
Another one of the short but violent types of volcanic eruptions is the Vulcanian eruption. These eruptions can create extremely powerful explosions. These eruptions are caused by either a lava dome rupturing or when a plug of the lava from a volcanic conduit fragments and explodes. These types of volcanic eruptions are named after the small volcano found on Vulcano, an island in Italy.
Plinian Eruptions

The most spectacular and most violent of all types of volcanic eruptions is what is known as a Plinian eruption. This type of eruption happens when gassy magma is fragmented and associated with very viscous magma. The combination releases a huge amount of energy, which will create an eruption column which will contain ash, gas and could rise up to an altitude of 50 kilometers at very high speeds. These types of volcanic eruptions are named after Pliny the Younger who was a Roman historian that made the comparison back in 79 A.D. when Mount Vesuvius erupted so Plinian eruptions were named after him. These types of eruptions do happen and the one that took place at Mount St. Helens in 1980 is one of the best examples. They are extremely dangerous and destructive and could destroy the entire top of the mountain. Ash and lava bombs can land several miles away from the volcano.
Pelean Eruptions

A **Pelean eruption** is associated with explosive outbursts that generate **pyroclastic flows**. Pelean eruptions are named for the destructive eruption of **Mount Pelée** on the Caribbean island of Martinique in 1902.
Surtseyan Eruptions

The Surtseyan eruption is a **hydromagmatic eruption**. The lava or magma will interact with water in an explosive manner. When the water expands and turns into **steam**, any water that touches the hot lava will explode creating **plumes of ash, scoria and steam**.

In 1963, a Surtseyan eruption took place in **Surtsey** and that is where the name comes from.
Specific:

Pyroclastic flows kill/crush/injure/burn people
Mudflows/ lahars destroy buildings/homes
Mudflows/ lahars inundate farmland/destroy crops/damage factories
Pyroclastic flows/ mudflows/ lahars occur without warning/at great speed
Volcanic bombs destroy/damage/burn buildings
Ash clouds destroy/damage/burn farmland
Ash clouds reduce visibility
Poison from toxic fumes suffocates/chokes people (breathing difficulties)
Lava flows destroy buildings/towns/forests
General:

damaged/destroyed buildings;
towns to evacuate;
destruction of forests/trees;
loss of farmland/crops;
disruption of transport;
tourists unlikely to visit;
factories destroyed;
jobs lost;
wildlife/habitats/ecosystems/food chains destroyed
OPPORTUNITIES

Soils are fertile/can be used for farming so yields of crops are high;
It is possible to generate electricity from the volcano (using geothermal power);
The volcano attracts tourists and people can get jobs as tour guides;
The volcano provides raw materials such as sulphur;
Scientists/geologists study the volcano.
The landslide and eruption of Mount St. Helens on May 18, 1980, demonstrated how a volcano can collapse catastrophically, fill an adjacent river valley with rocks and debris, and generate a destructive lahar.

EXAMPLE: MT SAINT HELENS

61 deaths;
Suffocation by toxic fumes;
Communications disrupted by floodwaters, washing away roads/railway bridges;
Every tree within 250 km sq blast zone destroyed;
Spirit Lake filled in.
MT SAINT HELENS - TOURISM