Volcanism is a geological process where hot molten rock from underneath the earth reaches the surface through an opening in the ground. The most recognizable form of an opening is a **volcano** where molten material flows out onto the surface during a **volcanic eruption**.

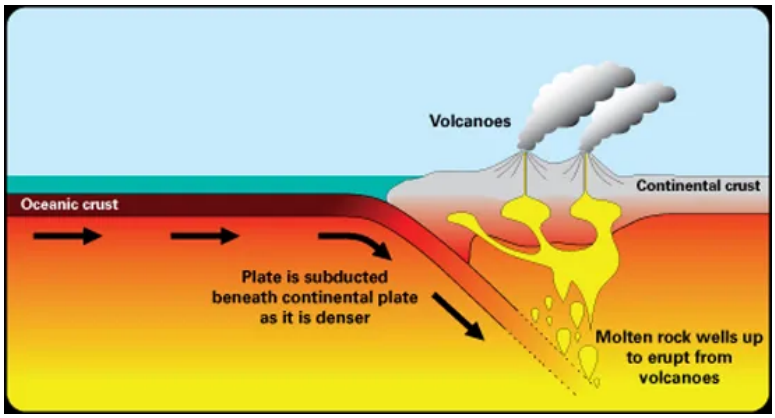
An **eruption** describes how the molten material was ejected; whether it was violent (explosive eruptions), non-explosive (effusive eruptions), or what caused the eruption (hydrothermal, phreatic, phreatomagmatic, etc.).

The hot, molten material is called **magma** when it's still underground and **lava** when it reaches the surface.

How Volcanoes Are Formed.

The formation of volcanoes is deeply tied with the theory of plate tectonics. There are three main ways magma can rise to form volcanoes:

1. Convergent boundaries.

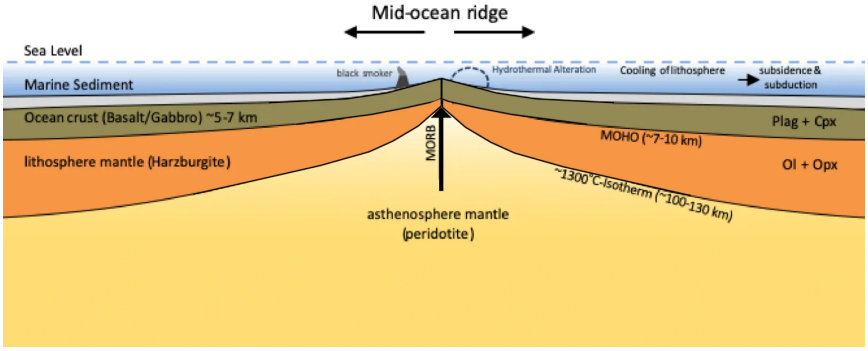


Credit: British Geological Survey

As previously discussed, a process called partial melting occurs in subduction zones, responsible for heating and partial melting of the rocks in the overlying plate.

This is caused by the **introduction of volatiles** (seawater, water from minerals, and other fluids) from the oceanic lithosphere, which lowers the melting temperature of the surrounding rocks. The molten rock then starts to ascend to the surface in the form of volcanic activity.

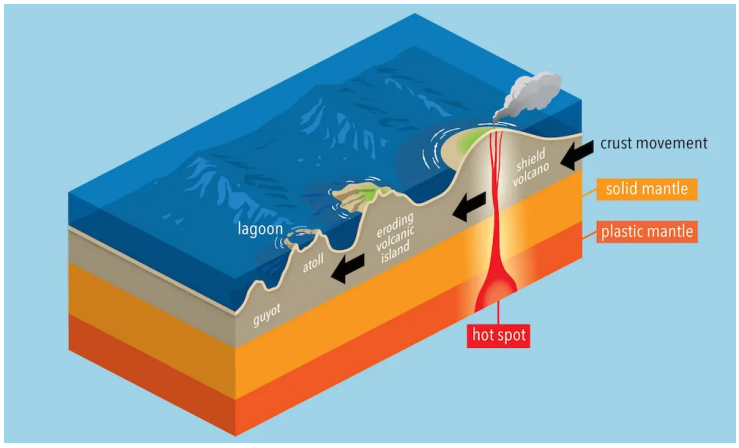
2. Divergent boundaries



Credit: BrucePL/Wikimedia Commons

When plates move apart, there is a **reduction of pressure** in the lithosphere, allowing for magma in the asthenosphere to rise and induce partial melting of the surrounding rocks. A good example of divergent boundary-produced volcanism can be found in the Mid-Atlantic Ridge.

3. Hotspots and mantle plumes



Source: https://manoa.hawaii.edu/exploringourfluidearth/

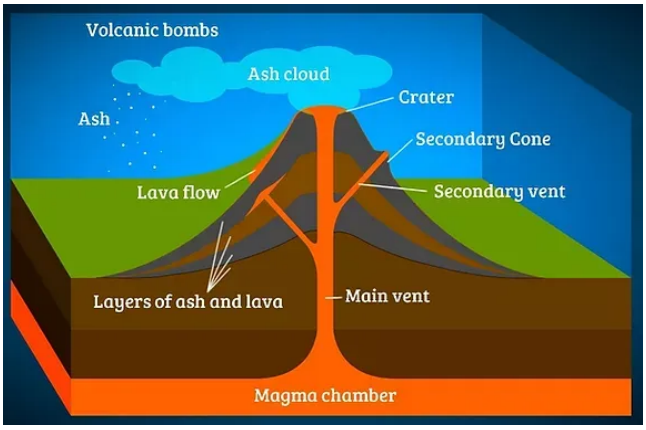
Mantle plumes are areas where the mantle rises towards the surface, originating from deep within the mantle. A **hotspot** is the surface manifestation of a mantle plume.

Unlike the other two ways, volcanism at hotspots does not occur at plate boundaries. As plates move above a hotspot, the **increase in temperature** induces partial melting and generates hotspot volcanism.

The most famous example of hotspot volcanism is the Hawaiian-Emperor Seamount Chain.

Volcano Morphology

Different types of volcanoes have different shapes and sizes. However, most volcanoes share certain characteristics. Here is the anatomy of a generalized volcano.



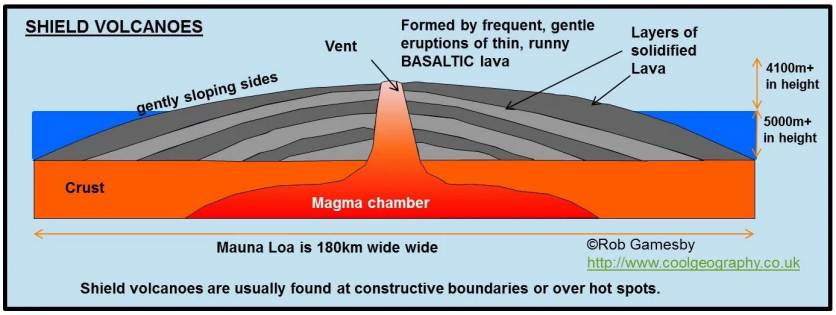
Credit: 3DGeography

1. **Magma chamber** – the reservoir of molten material in the Earth crust; replenished with magma from a deeper reservoir in the mantle
2. **Main vent** – the pathway for magma to come the surface
3. **Crater** – bowl-shaped depression located at the summit of the volcano that serves as the opening of the volcano to the Earth's surface

4. **Secondary cone** – smaller parasitic volcanoes that feed on the same magma chamber as the main volcano through secondary vents; usually emits volcanic gas called **fumaroles**
5. **Pyroclastic materials** – any kind of volcanic material that is extruded by a volcano such as bombs, blocks, ashes, and others

Types of Volcano

1. Shield volcanoes



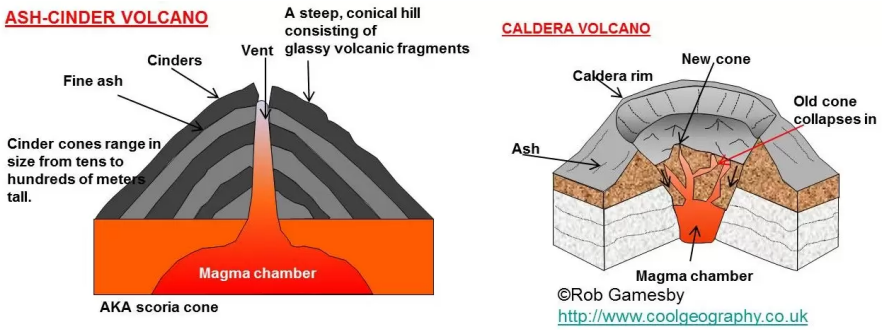
Credit: Rob Gamesby/CoolGeography

Shield volcanoes are large dome-shaped volcanoes that have broad gentle slopes and large craters. The largest volcano on Earth, Mauna Loa in Hawaii, is a shield volcano.

These volcanoes get their broad form due to the accumulation of layers of runny, fast-moving **basaltic lava flows**.

Shield volcanic eruptions are typically gentle and non-explosive, consisting of lava fountains, lava flows, and rarely any pyroclastic materials.

2. Cinder cones

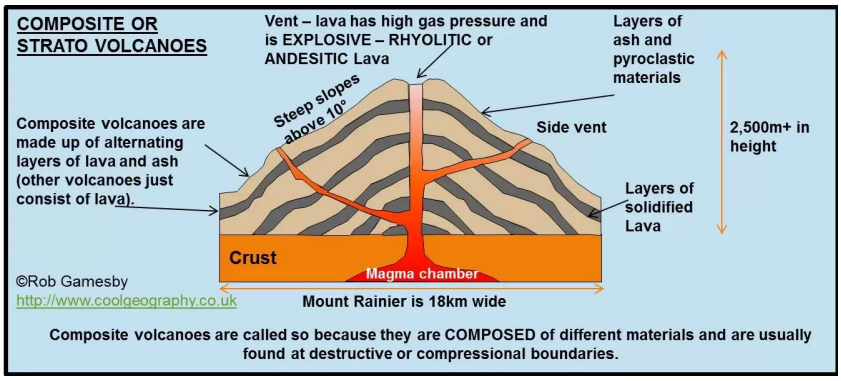


Credit: Rob Gamesby/CoolGeography

Cinder cones (also known as **scoria cones** or **ash-cinder cones**) are steeper and have smaller craters than shield volcanoes. They are usually made up of loose pyroclastic material called **scoria**, a dark-colored igneous rock that is highly vesicular (has lots of vesicles or cavities) made from extruded basaltic magma.

Cinder cone eruptions are moderately explosive, with lava coming from inside the vent or at the base of the volcano. Cinder cones usually have a short lifespan and are the most common types of volcanoes.

3. Composite volcanoes or Stratovolcanoes



Credit: Rob Gamesby/CoolGeography

A composite volcano is probably the most recognizable form of the volcano, with its symmetrical steep-sided cone-shaped morphology. Alternating layers of viscous **andesitic lava flows**, volcanic ash, and cinders are responsible for its shape.

Eruptions tend to be violently explosive and can cause lava flows, pyroclastic flows, large ash clouds, and even lahar. Famous examples of stratovolcanoes are Mt. Fuji in Japan and Mt. Mayon in the Philippines.

Credit: Pete Kelly / Alamy Stock Photo

When a particularly explosive eruption occurs, the stratovolcano could collapse and form a large depression called a **caldera**. Our very own Taal Volcano is a good example of a caldera filled in by water, creating the Taal Lake.

Volcano-related Hazards.

Volcanoes can be deadly forces of nature and impacts of volcanic hazards have been well-documented throughout the years. Here are some of the common volcanic hazards:

1. Pyroclastic Flow.

A pyroclastic flow is a rapidly-moving current consisting of hot gases and tephra (volcanic material) driven by gravity. They are also known as ***nuée ardentes*** (French term meaning “glowing cloud”). Pyroclastic flows usually accompany explosive eruptions.

2. Lahars.

Lahar flows occur when volcanic material becomes saturated with water, possibly from rainfall or melted ice, and rapidly descends down steep volcano slopes.

This type of volcanic hazard is particularly dangerous because it can happen even when a volcano is not erupting. The lahar flows during and after the 1991 Mt. Pinatubo Eruption is a good example of the destructive power that lahar flows can bring.

3. Lava flows

Depending on the viscosity of the lava, lava flows can spread out over large distances. Runny lava flows spread out more quickly before they solidify, compared to viscous lava.

Due to extreme temperatures (from 600C to 1000 C), lava flows cannot be easily diverted or stopped. Fortunately, most lava flows can be outrun by a person on foot.

There are three main types of lava flows. The first one is called **aa flows** (pronounced as “ah-ah”) and is characterized by spiky and rough surfaces. The second one is called **pahoehoe flows** (pronounced as “pa-hoy-hoy”) and is described as having a “rope-y” appearance with smooth surfaces. The last one occurs when lava is extruded along the oceanic ridge, producing smooth rounded shapes called **pillow lavas**.

Volcanoes in the Philippines are classified as **active** (erupted within the last 600 years), **potentially active**, and **inactive**. As of 2020, there are 24 active volcanoes out of 407 volcanoes in the Philippines (Delos Reyes, 2018).