Topic:

Volcanic Activity & Construction Due to Volcanic Activity

Topic Contents

- **VOLCANIC ACTIVITY:** Opening in the earth's crust from which molten lava ejected.
- **MAGMA:** Molten rock below the ground.
- **VOLCANOLOGY:** Study of volcanoes.
- **CLASSIFICATION OF VOLCANOES:** Three categories: Active, Dormant and Extinct.
- **WHERE THEY TAKE PLACE?** Mostly formed on land but some are on the oceanic floor.
- **MAGNITUDE:** All volcanic eruptions vary in strength. Some are very strong and may cause a swear damage but some are less strong.
- **VOLCANIC ERUPTION:** Process of discharging lava from a volcanic vent.
- **TYPES OF ERUPTION:** Hydrothermal, Phreatic, Phreatomagmatic, Lava, Vulcanian eruption, Strombolian and Hawaiian eruption.
- **PLATE TECTONICS:** A theory that explains about the lithosphere of earth divided into different plates.
- **TYPES OF PLATE TECTONIC BOUNDARIES:** Three types.

1. **CONVERGENT BOUNDARIES:** Where two plates are moving toward each other.
2. **DIVERGENT BOUNDARIES:** Where two plates are moving away from each other and new crust is forming from magma.
3. **TRANSFORM BOUNDARIES:** Where plates slide sideways past each other.

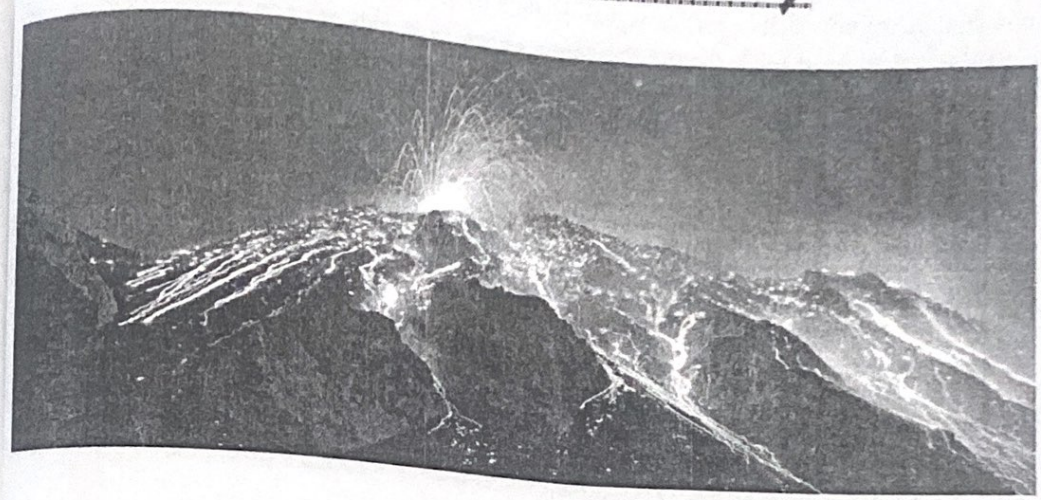
CONSTRUCTION DUE TO VOLCANIC ACTIVITY:

Multiple shapes are with different sizes. But here we discuss four main formations.

- **CRATER:** A bowl-shaped depression at the top of the volcanic vent.
- **CALDERA:** A bigger depression on the top of the magma chamber.
- **LAVA DOME:** A large, mound-shaped protrusion that formed by viscous lava.
- **LAVA PLATEAU:** Area with a small elevation from surrounding that is formed with lava.

Comment:

Volcanic Activity



The word volcano is derived from Latin word **"Vulcanus"** means "burning mountain". Vulcanus was originated from **"Volcan"** that was the Roman god of fire. The Romans first used the term to describe Mount Etna; a volcanic mountain they believed was the forge of Vulcan. The ancient Greeks thought that the god of Fire, Hephaestus, lived beneath Mt. Etna.

➢ Definition:

- A volcanic activity is an opening, or rupture, in a planet's surface or crust, which allows hot magma, ash and gases to escape from below the surface.
- An opening in the earth's crust from which molten lava rock fragments, ashes, dust, and gases are ejected from below the earth's surface.

➢ Magma:

Magma is the name for that molten rock when it's below ground. Scientists call it **lava** once that liquid rock erupts from the ground and may start flowing across Earth's surface. It's still "lava" even after it's cooled and solidified.

➢ Volcanology:

The study of volcanoes is called volcanology.

What is a Volcano?

A volcano is a vent or 'chimney' that connects molten rock (magma) to the Earth's surface. It includes the surrounding cone of built-up material. Deep inside the earth, between the molten iron core and the thin crust at the surface, there is a solid body of rock called a **mental.** When rock form the mental melts, moves to the surface through the crust, and releases pent-up gases, volcanoes erupt. Extremely high temperature and pressure cause the rock to melt and become liquid rock or **magma.** When a large body of magma has formed, it rises through the denser rock layers towards earth's surface. Magma that has reached the surface is called **lava.**

Classification of Volcanoes

We can classify volcanoes into three categories that are following.

- Active:

  A volcano is active if it erupt lava, releases gas or shows seismic activity.

- Dormant:

  Dormant is a volcano that has not erupted for a considerable length of time.

- Extinct:

  Extinct is a volcano that shows no any evidence of erupting again.

Where Volcanoes Take Place?

Most volcanoes are formed on land, but there are some volcanoes that are on the ocean floor. Some of these volcanoes emerge from the water because they are very high. Volcanic eruptions occur only in certain places and do not occur randomly. This is because the Earth's crust is broken into a series of slabs known as tectonic plates. These plates are rigid, but they "float" on a hotter, softer layer in the Earth's interior. As the plates move, they spread apart, collide, or slide past each other.

- Volcanoes take place at destructive plate boundaries and constructive plate boundaries.
- 1,500 active volcanoes exist across our planet, according to scientists at the U.S. Geological Survey (USGS).
- About 500 volcanoes have erupted since humans have been keeping records.
- Of all volcanoes that have erupted in the past 10,000 years, 10% reside in the United States.

- Most of them exist in Alaska (Aleutian Island chain), in Hawaii and in the Cascade Range of the Pacific Northwest.
- **Mount Kilauea, in Hawaii, is the most active volcano on Earth because it has been erupting since 1983.**

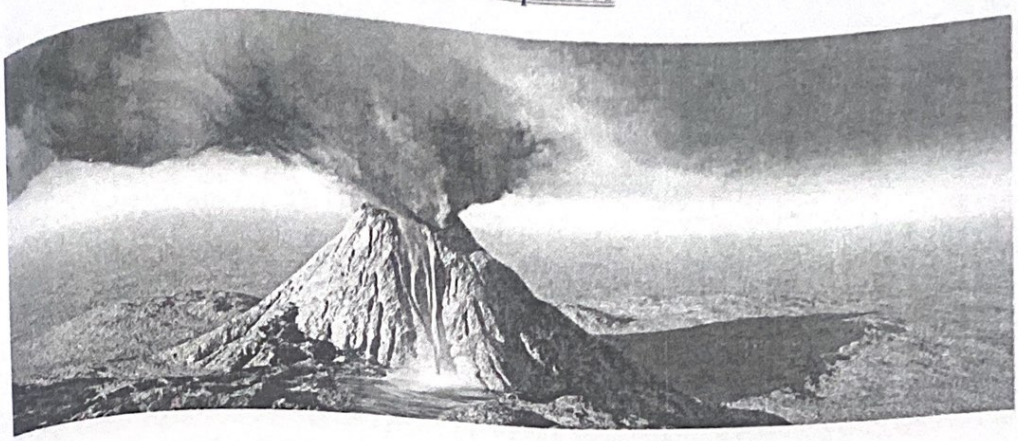
The Magnitude of Volcanoes

When there is an earthquake, little vents are created in which magma is allowed to form. This is pushed up through these vents and towards the crust of the volcano. Steam vents are created when the magma reaches a certain level and reaches a boiling point which begins the eruption. The eruption might result in a total eruption. This is when gas driven explosion send magma to the volcano's crust creating lava outpouring from the volcano. Some eruptions are not as strong as others. All volcanic eruptions can vary in strength; with some not reaching any civilians or causing too much damage. However, others can spread over a vast area, sometimes reaching several miles from the volcano. Some eruptions do not always contain lava flow or lava fountains which aren't always very dangerous. However, some eruptions can be on a huge scale, very violent and very, very dangerous with explosions heard from the volcano.

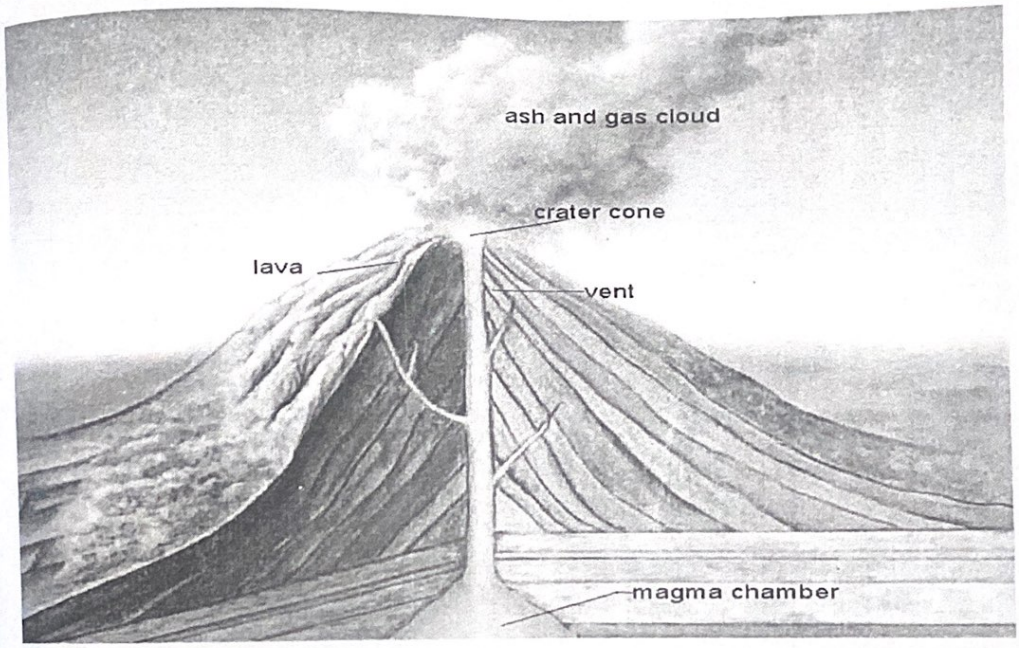
Some eruptions can be passive and not very dangerous however; some are explosive and can be very and high dangerous. Some volcanoes do not just erupt from their peeks, some can have eruptions at any part of the mountain, and it's not just the peeks that are the most deadly for volcano eruptions. One of the biggest and well known eruptions was in Pompeii.

The entire city of Pompeii was buried when the volcano at Pompeii erupted. However, this is only one example of a type of eruption; another type of eruption is in Norway, a volcano that had been dormant for years suddenly became active, however, the local towns were evacuated and the volcano erupted. However, there was no great scale eruption. Lava flowed but didn't reach the town, this was a very small eruption compared to many others.

Volcanic Eruption



Volcanic eruptions happen when lava and gas are discharged from a volcanic vent. Volcanoes are often cone-shaped, but they can take other shapes too. The melted rock that spills out of the crater on the top of the volcano is called lava. The lava destroys everything in its path because it is very, very hot.



A volcano erupts when magma and gases find a way to escape, so they burst to the surface through a vent. An eruption can be quite gentle or very violent.

❖ Types of Eruption

There are some types of volcanic eruption which are following.

1. Hydrothermal Eruption:

Hydrothermal eruption is an eruption driven by the heat in hydrothermal systems. Hydrothermal eruptions pulverize surrounding rocks and can produce ash, but do not include magma. These are typically very small eruptions.

2. Phreatic Eruption:

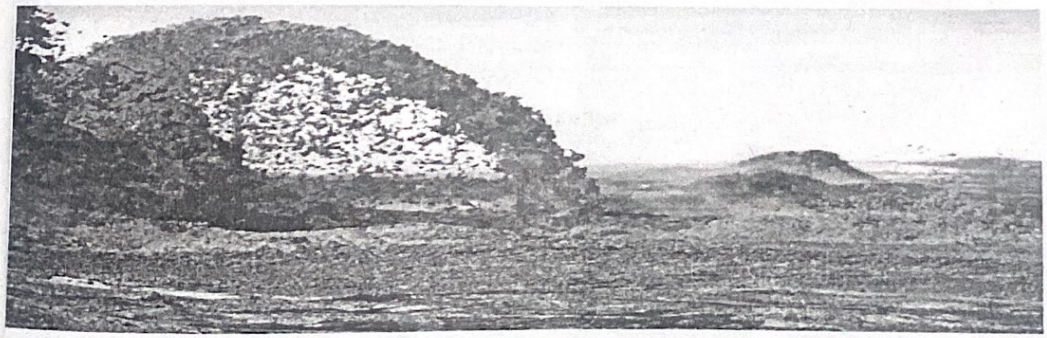
Phreatic eruption is an eruption driven by the heat from magma interacting with water. The water can be from groundwater, hydrothermal systems, surface runoff, a lake or the sea. Phreatic eruptions pulverize surrounding rocks and can produce ash, but do not include new magma.

3. Phreatomagmatic Eruption:

An eruption resulting from the interaction of new magma or lava with water and can be very explosive. The water can be from groundwater, hydrothermal systems, surface runoff, a lake or the sea.

4. Lava:

Lava is molten rock erupted at the ground surface. When molten rock is beneath the ground, it is called magma. Lava can reach an amazing heat possibly even **2000 degrees Fahrenheit**; sometimes it can be even higher than that. Lava can actually destroy everything in its path, even an entire village.



- **Lava flows** are the effusive (non-explosive) outpourings of lava, and usually flow slower than walking pace.
- **Lava fountains** are a fountain of runny lava fragments from a vent or line of vents (a fissure). They can form spatter piles, and if the fragments accumulate fast enough, they can form lava flows.
- **Lava domes** are mounds that form when viscous lava is erupted slowly and piles up over the vent, rather than moving away as a lava flow. They are generally caused by viscous, thick, sticky lava that has lost most of its gas. They can range in volume from a few cubic meters to cubic kilometers.

5. Strombolian and Hawaiian eruptions:

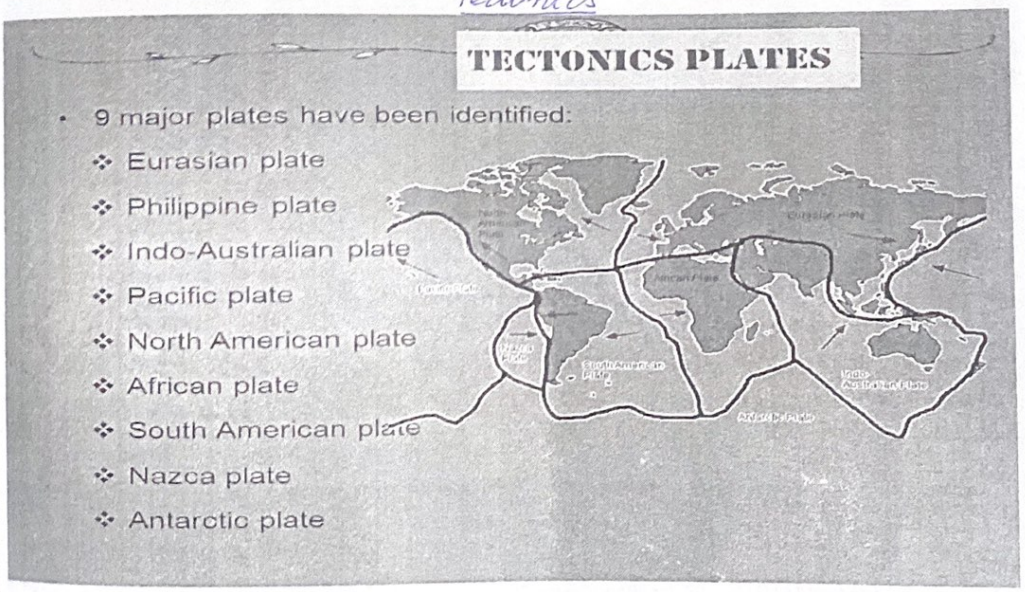
These are the least violent types of explosive eruptions. Hawaiian eruptions have fire fountains and lava flows, whereas Strombolian eruptions have explosions causing a shower of lava fragments.

6. Vulcanian eruptions:

Vulcanian eruptions are small to moderate explosive eruptions, lasting seconds to minutes. Ash columns can be up to 20 km in height, and lava blocks and bombs may be ejected from the vent.

Plate Technotics

Tectonics



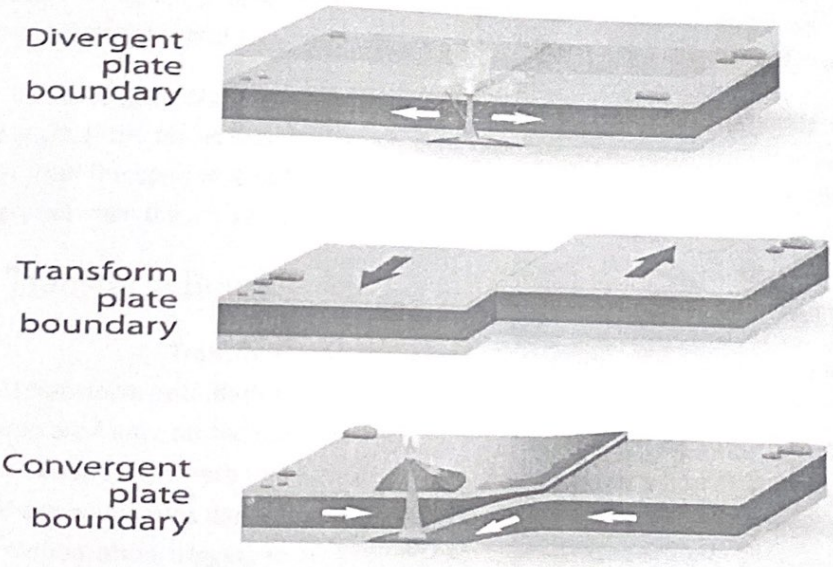
A **theory** in geology, the lithosphere of the earth is divided into a small number of plates which float on and travel independently over the mantle and much of the earth's seismic activity occurs at the boundaries of these plates.

Volcanoes are generally found where tectonic plates are diverging or converging. Volcanoes can also form where there is stretching and thinning of the Earth's crust. Volcanoes can be caused by mantle plumes. There are a few handfuls of major plates and dozens of smaller, or minor, plates. Six of the majors are named for the continents embedded within them, such as the North American, African, and Antarctic plates. Though smaller in size, the minors are no less important when it comes to shaping the Earth.

The plates make up Earth's outer shell, called the lithosphere. (This includes the crust and uppermost part of the mantle.) Churning currents in the molten rocks below propel them along like a jumble of conveyor belts in disrepair. Most geologic activity stems from the interplay where the plates meet or divide. The movement of the plates creates **three** types of tectonic boundaries: **convergent,** where plates move into one another; **divergent,** where plates move apart; and **transform,** where plates move sideways in relation to each other.

"They move at a rate of one to two inches (three to five centimeters) per year."

THREE TYPES OF PLATE BOUNDARY



1. Convergent Boundaries:

Where plates serving landmasses collide, the crust crumples and buckles into mountain ranges. India and Asia crashed about 55 million years ago, slowly giving rise to the Himalaya, the highest mountain system on Earth. As the mash-up continues, the mountains get higher. Mount Everest, the highest point on Earth, may be a tiny bit taller tomorrow than it is today.

These convergent boundaries also occur where a plate of ocean dives, in a process called **subduction,** under a landmass. As the overlying plate lifts up, it also forms mountain ranges. In addition, the diving plate melts and is often spewed out in volcanic eruptions such as those that formed some of the mountains in the Andes of South America. At ocean-ocean convergences, one plate usually dives beneath the other, forming deep trenches like the Mariana Trench in the North Pacific Ocean, the deepest point on Earth. These types of collisions can also lead to underwater volcanoes that eventually build up into island arcs like Japan.

2. Divergent Boundaries:

A tectonic **boundary** where two plates are moving away from each other and new crust is forming from magma that rises to the Earth's surface between the two plates. At divergent boundaries in the oceans, magma from deep in the Earth's mantle rises toward the surface and pushes apart two or more plates. Mountains and volcanoes rise along the seam. The process renews the ocean floor and widens the giant basins. A single mid-ocean ridge system connects the world's oceans, making the ridge the longest mountain range in the world.

On land, giant troughs such as the Great Rift Valley in Africa form where plates are tugged apart. If the plates there continue to diverge, millions of years from now eastern Africa will split from the continent to form a new landmass. A mid-ocean ridge would then mark the boundary between the plates.

3. Transform Boundaries:

Transform boundaries are places where plates slide sideways past each other. At **transform boundaries** lithosphere is neither created nor destroyed. Many transform boundaries are found on the sea floor. The San Andreas Fault in California is an example of a transform boundary, where two plates grind past each other along what are called strike-slip faults. These boundaries don't produce spectacular features like mountains or oceans, but the halting motion often triggers large earthquakes, such as the 1906 one that devastated San Francisco.

Construction Due to Volcanic Eruption

After a volcanic eruption, formation of landforms occurred. The processes for building new land are called **constructive forces**. Three of the main constructive forces are **crustal deformation, volcanic eruptions,** and **deposition of sediment.** But here we only discuss about the construction after a volcanic eruption.

Volcanoes come in all shapes and sizes. Here follows some things are discussed that formed after a volcanic activity.

➢ Crater:

On many volcanoes, there is a **crater**, which is a bowl-shaped depression at the top of a volcano caused by past volcanic eruptions.

Craters can be thought of as the volcano 'blowing its lid' because it is where volcanic materials, such as ash, lava and rock fragments, are released. A volcanic crater is relatively small, usually spanning about a half a mile in diameter or less, and can fill with water to form a crater lake.

➢ Caldera:

A volcano sits on top of a magma chamber. If a volcanic eruption causes the magma chamber to empty, the volcano can implode, forming a larger depression known as a **caldera**. So a caldera can be defined as a large volcanic crater formed by the collapse of the central part of the volcano.

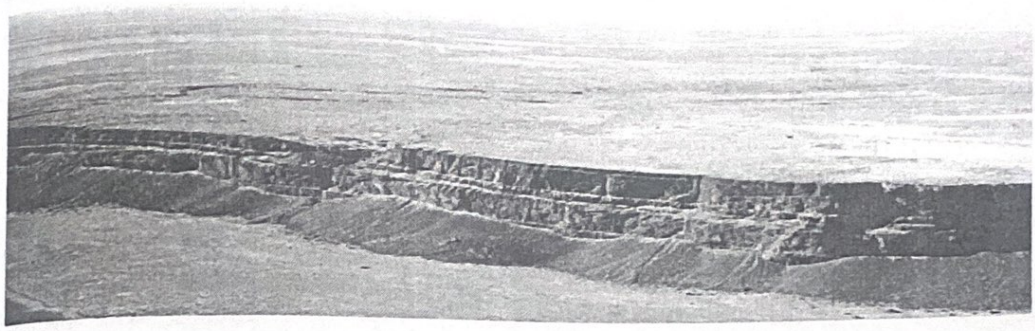
The term 'caldera' comes from the Latin language and means 'cooking pot.' While a caldera would make an awfully big pot of soup, you can see how the large bowl shape of a caldera, along with the smoky look of the ash cloud rising above it after an eruption, could prompt the name.

➢ Lava Dome:

The viscosity of the lava that erupts from a volcano can lead to the creation of different volcanic landforms. If lava that erupts through a vent is highly viscous or thick, it will not flow very easily. This may result in a **lava dome**, which is a large, mound-shaped protrusion formed by viscous lava.

➢ Lava Plateau:

A plateau in general is an area which is raised to a small elevation from the surrounding regions with usually steep edges or sometimes a normal decline. Lava plateaus are slow accumulations of lava eruptions from old volcanic regions or eruptions from open cracks or craters. The continuous flow of lava is made to get accumulated in the nearby places. This gradually starts to cool, which later become as solid rocky structures. Many plateaus form as magma deep inside the Earth pushes toward the surface but fail to break through the crust. Instead, the magma lifts up the large, flat, impenetrable rock above it.



The Creative Side of Volcanoes:

Over 7,000 years ago Mount Mazama, an Oregon volcano, collapsed leaving Crater Lake, a major tourist attraction. Similar lakes exist in other locations around the world. Over millions of years, underwater eruptions in the Pacific Ocean caused lava to build up gradually, causing the Hawaiian Islands to form above sea level. Every island consists of at least one volcano. Volcanoes continue to help shape the ocean's landscape. For example, an eruption south of Tokyo in 2013 created an island that could get bigger if more eruptions occur. Ash combined with other volcanic particles propelled into the atmosphere can help create brilliant sunsets around the world.

VOLCANIC ACTIVITIES AND FOLDING & UNFOLDING OF EARTH

Volcanic eruption:

A volcanic eruption occurs when hot materials are thrown out of a volcano. Lava, rocks, dust, and gas compounds are some of these ejecta.

Some eruptions are terrible explosions that throw out huge amounts of rock and volcanic ash and kill many people. Some are quiet outflows of hot lava.

Volcanic explosivity index:

- The volcanic explosivity index (commonly shortened VEI) is a scale, from 0 to 8, for measuring the strength of eruptions. It is used by the Smithsonian Institution's Global Volcanism Program.
- It operates in a way similar to the Richter scale for earthquakes.

Types of Volcanic Eruptions:

Volcanologists classify eruptions into several different types. Some are named for particular volcanoes where the type of eruption is common; others concern the resulting shape of the eruptive products or the place where the eruptions occur. Here are some of the most common types of eruptions.

Hawaiian Eruption:

In a Hawaiian eruption, fluid lava is thrown into the air in jets from a vent or line of vents (a fissure) on the flank of a volcano. The jets can last for hours or even days, a phenomenon known as fire fountaining. Because these flows are very fluid, they can travel miles from their source before they cool and harden.

Hawaiian eruption. In a Hawaiian eruption, fluid lava is ejected from a vent as fire fountains or lava flows. The 1969 eruption at Mauna Ulu, a vent of Kilauea Volcano in Hawaii, was a spectacular example of fire fountaining.

Two excellent examples of these are the 1969-1974 Mauna Ulu eruption on the volcano's flank, and the 1959 eruption of the Kilauea Iki Crater at the summit of Kilauea. In both of these eruptions, lava fountains reached heights of well over a thousand feet.

Strombolian Eruption:

Strombolian eruptions are distinct bursts of fluid lava from the mouth of a magma-filled summit conduit. The explosions usually occur every few minutes at regular or irregular intervals. The explosions of lava, which can reach heights of hundreds of meters, are caused by the bursting of large bubbles of gas, which travel upward in the magma-filled conduit until they reach the open air.

Strombolian eruptions are often associated with small lava lakes, which can build up in the conduits of volcanoes. They are one of the least violent of the explosive eruptions, although they can still be very dangerous if lava flows reach inhabited areas. Strombolian eruptions are named for the volcano that makes up the Italian island of Stromboli, which has several erupting summit vents. These eruptions are particularly spectacular at night, when the lava glows brightly.

Vulcanian Eruption:

A Vulcanian eruption is a short, violent, relatively small explosion of viscous magma. This type of eruption results from the fragmentation and explosion of a plug of lava in a volcanic conduit, or from the rupture of a lava dome (viscous lava that piles up over a vent). Vulcanian eruptions create powerful explosions in which material can travel faster than 350 meters per second (800 mph) and rise several kilometers into the air.

Vulcanian eruptions may be repetitive. They are named for the Italian island of Vulcano.

Lava Domes:

Lava domes form when very viscous, rubbly lava (usually andesite, dacite or rhyolite) is squeezed out of a vent without exploding. The lava piles up into a dome, which may grow by inflating from the inside or by squeezing out lobes of lava (something like toothpaste coming out of a tube). These lava lobes can be short and blobby, long and thin, or even form spikes that rise tens of meters into the air before they fall over. Lava domes may be rounded, pancake-shaped, or irregular piles of rock, depending on the type of lava they form from.

What Determines Eruption Type?

The crystal and gas content and temperature of a magma help determine a volcano's eruption style.

- Crystals in magma make it more viscous, so magma with a high crystal content is more likely to explode than flow.

- Gases create explosions if they cannot easily escape from viscous magma, but they can also be released without explosions (or with only minor ones) from fluid magma.

- High-temperature magmas usually erupt effusively, while low-temperature magmas cannot flow easily and are more likely to erupt explosively.

Folding and Unfolding

Diastrophic processes - folding and faulting occur when pressure deep within the lithosphere cause the earth's **surface to buckle, bend and even split apart.**

Folding **- when the earth's crust is** pushed up from its sides and it occurs at a very slow rate.

Fold mountains occur where the crust is pushed up as plates collide which causes the crust to rise up in folds.

Examples: Andes, Himalayas, Juras in Switzerland, Appalachians

Types of Folds

- Anticline- the peak or hill of folded rock layers
- Syncline - the trough or valley of folded rock layers
- Tight fold - a sharp-peaked anticline fold
- Overfold - bending or warping of folding rock layers
- Recumbent fold - a fold that is bent so much that it is no longer vertical.
- Nappe - a fold that has overturned so much the rock layers have fractured.

Unfolding

- When tension and compression associated with plate movement is so great those blocks of rock fracture or break apart.
- Process can occur very rapidly
- This rapid movement causes the ground to shake and vibrate, resulting in earthquakes.

Types of Unfolding

- Normal - rocks move away from each other due to land moving apart.
- Rift valley/graben -two normal faults occur parallel to each other and the land sinks between the two faults
- Reverse Fault - opposite of normal; rocks are compressed such that one plate moves up while the other descends below it
- Horst - land rises between parallel faults.
- Tear fault/strike-slip - two plates slide laterally past each other.