

E-content module

Class: B. Sc. 1st Semester

***Course Title: Physical and Structure
Geology***

Course Code: 1GELTC0101

UNIT-2

2.3 Volcanoes: types, products and causes of volcanism and impacts.

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- INTRODUCTION
- CLASSIFICATION OF VOLCANOES
- CAUSES OF VOLCANIC ACTIVITY
- VOLCANIC FEATURES
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1. INTRODUCTION

A volcano is a vent/rupture in the crust of earth that allows hot lava, volcanic ash, and gases to escape from a magma chamber

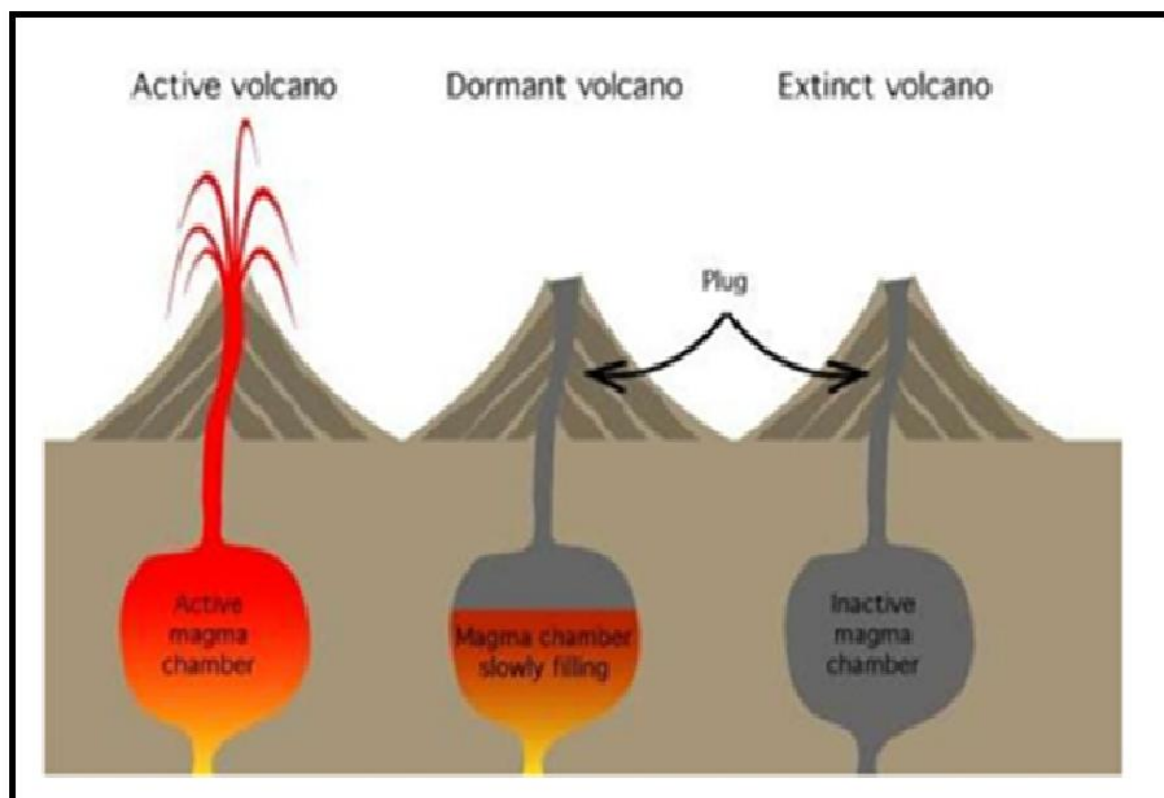
below the surface. When material comes out through volcanic vent it piles up around the vent in the shape of a cone which is called Volcanic **Cone**". The volcanic Eruption took place with the formation of magma in the lower section of the earth's crust. The earth's crust is made up of massive hard, rigid slabs called plates, which fits together like a jigsaw manner. The friction during the movement of these plates causes volcanic eruptions. The magma from magma chamber comes out through the openings/weaker zones of the crust. These volcanic activities varies in mode of eruption and their intensity..

2. **CLASSIFICATIONS**

Base on mode of eruption

Based on frequency of eruptions			Based on Mode of eruption	
1	Active volcanoes	Erupt frequently or have erupted recently or are in action currently. (Barren Island). 50-60 volcano can erupt yearly.	Centre type eruption	Eruption through a vent. Forms different types of hills or conical forms. Most of the volcanoes of the world are of this type

2	Dormant	Not erupted in recent times but can erupt at any time in future. Mouna kea in Big island	Fissure type eruption	Magma flows through deep elongated crack. Forms thick horizontal sheet of lava. Example: Deccan traps
3	Extinct	No chance of eruption in future. Kohala in Hawaii Big Island.		



3. CAUSES

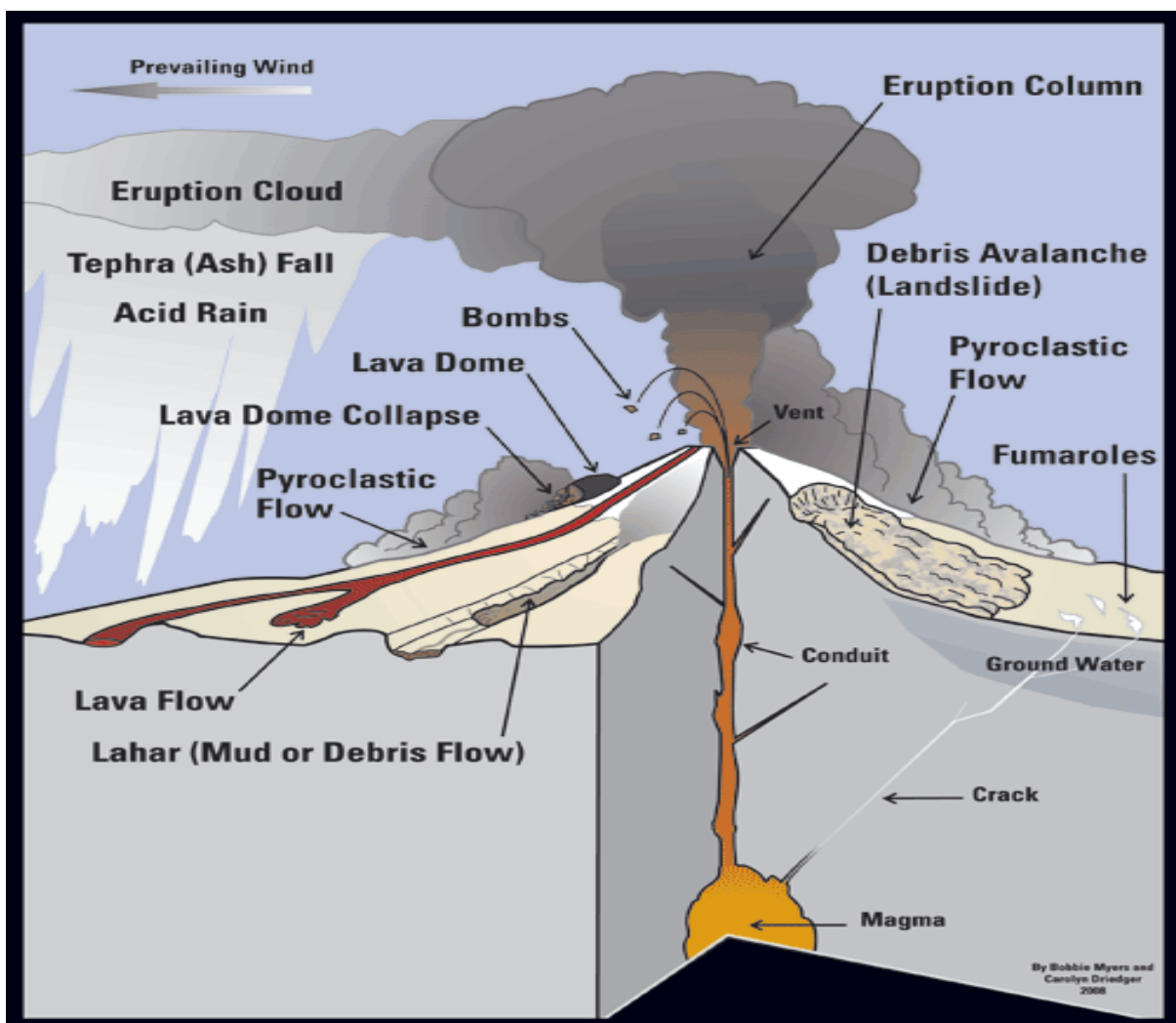
World seismological map shows that the volcanic activity do not occurs haphazardly .They are associated with the weaker zones of the earth

surface. Such as destructive, constructive plate margins, fracture zones, faults etc.

The mechanism of Volcanic eruptions are associated with ;

1. Gradual increase of temperature with increasing depth due to heat generated by radioactive disintegration.
- 2. Origin of magma because of lowering of melting point due to reduction of pressure of overlying load due to fracture.
- Origin of gases and vapor due to heating of under ground water.
- The ascent of magma forced by huge volume of gases and vapors.

4. Features of Volcanos





Fumarole : A fumarole (the word ultimately comes from the Latin fumus, "smoke") is an opening in the volcanic region which emits steam and gases such as CO₂, sulfur dioxide, hydrogen chloride, and hydrogen sulfide. The temperature of vapors is 645⁰ C .

These are often present on active volcanoes during periods of relative quiet between eruptions. These are closely related to hot springs and geysers. In areas where the water table rises near the surface, fumaroles can become hot springs. Periodic hot springs are called "Geysers". Siliceous deposits around the geyser is called "Gyserite".

Solfatars are the fumarole that emits sulfurous gases. "Mofets" are the fumarole that emits carbon dioxide. Native sulfur, realgar, orpiment are formed by fumaroles.

6. Volcanic Products

Lava : Molten rock material that has reached the surface. Basaltic lavas can be separated into three types:

- a. Pahoehoe(pronounced pa-hoy-hoy): Fluid, gas-rich lava having a ropy surface.
- b. Aa(pronounced ah-ah): Viscous, gas-poor lava having a broken surface.

Pillow Lava: Lava, typical of submarine mid-ocean ridge basalts (MORBs), extruded into water and quickly chilled

Volatiles: Dissolved gaseous materials in magma produces explosive volcanic activity when magma is near the Earth's surface and pressure is released. The typical volcanic gases include;

Water, CO₂, nitrogen and sulfur oxides, CO, hydrogen chloride (HCl), halogen gases (fluorine, chlorine) .

Pyroclasts: Such material are hot volcanic fragments blown out of a vent with explosive force and are subdivided on the basis of fragment size:

Dust: Very small particles less than 0.25mm.

Ash: Fine (0.25 mm to 4.00 mm) particles that may settle at considerable distance around the vent.

Lapilli/cinder: 4 to 32 mm pieces of lava; basaltic fragments are called cinder.

Volcanic blocks: >64 mm angular pieces that were solid when ejected.

Volcanic Bombs:>64 mm rounded masses that were molten when ejected; the term pumice describes frothy pieces of rhyolite glass that can float on water. Consolidated ash and dust is called “

volcanic Tuff". Consolidated bomb and blocks are called "Agglomerates" and "volcanic breccia". Accumulations of these fragmental materials form several types of deposits that include:

Tephra: A general term for pyroclastic debris that accumulates through vertical air fall.

Pyroclastic flows: These are the avalanches of incandescent ash and gas produced by the collapse of lava domes.

Lahars: Hot mudflows formed when water mixes with hot pyroclastic debris.

7. VOLCANIC LAND FORMS

Volcanic Landforms are divided into two broad categories

1. Negative relief features
2. Positive relief features

Negative relief features: Crater, Calderas, volcanic-tectonic depressions.

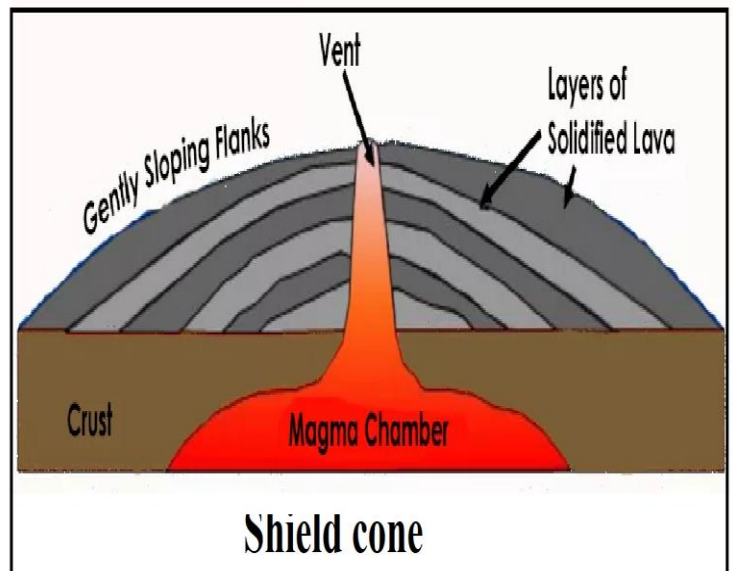
Positive relief features: Hornitos: Hills, Dribble cones, volcanic cones, volcanic mountains, Lava plateaus.

Crater: These are Bowl shape depression at the top of the volcanic cone. Funnel-shaped hollow that marks the top of the volcanic Vent. The Pyroclastic material forms the crater ring

Caldera: These are large crater with steep inner wall and flat floor. Size 1.6 km to 75 km. crater lake Varigona 8-10km diameter, 1100m deep, formed 6700 years ago.

Explosion Calderas; volcanic explosion entire central portion of volcano destroyed. Bandai san in Japan.

Collapse Calderas: The Top of the volcano collapse/subsides due to empty magma chamber beneath the volcano. The Various types are Explosion craters, pit craters, eruption craters, nested crater, Krakatau in Indonesia.



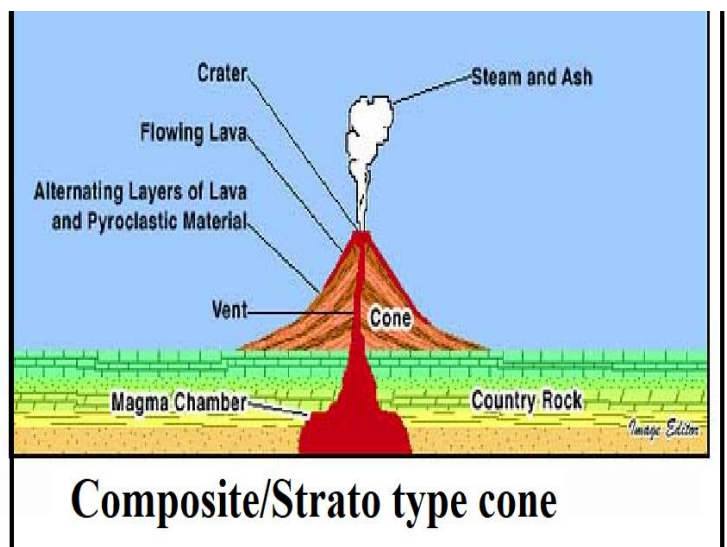
Volcanic-tectonic

depressions: These Depressions formed on the slope of the volcanic cones.

Negative Land features:

Hornitos: These are the terms applied to very small lava flows.

Dribble cones: These are small conelets produced by the most acid and viscous lava.



Volcanic plateau: are built by extensive extrusions of lavas, commonly basalts, and are associated with the fissure eruptions. There is piling of lava flows and each layer ranges in thickness between 15 to 100 metres and hundreds of square kilometres in extent. The Deccan plateau of the Peninsular India represents the best example.

Volcanic cones: are formed based upon the nature and size of the fragments ejected during the eruption. These are shield cone, cinder cone, composite cones, lava cone.

Shield cone: These are the dome shape with gentle slope.

These are mostly made up of less viscous lava (basalt). They are characterized by low-explosivity. Example: Mouna Loa in Hawaiian type.

Composite cone: These are most explosive cooler and more viscous lavas comes out through vent. Pyroclastic material and ashes comes out to the ground along with lava. Layers are formed of lava and pyroclastic material. Example: Mayon Volcano in the Philippines, Mount Fuji in Japan.

Cinder Cone: These are a steep conical hill of loose pyroclastic fragments, such as either volcanic clinkers, volcanic ash, or cinder that

has been built around volcanic vent. 30-60 degree slope. The lava is blown violently into the air, and the pieces rain down around the vent.

Lava cone: These are small cones and are formed when the lava is too viscous to do not flow to a great distance. As the lava dome slowly grows, the outer surface cools and hardens as the lava continues to pile.

8. IMPACT OF VOLCANISM

1. Steam jets and geysers provide suitable sites for generation of geothermal power.
2. Volcanoes depict the dynamic nature of our hot, turbulent planet, and profoundly impacts the Earth in many ways.
3. Volcanic rocks gets weathered and form fertile soils which support agriculture.
4. Volcanic mountains/highlands attract high rainfall on the windward side which is a source of rivers and also support agriculture, forest and settlement.
5. Some volcanic rocks are important source of building and construction materials. e.g. phonolites.
6. Volcanic eruption form valuable minerals deposits. Such as native sulfur, Volcanic massive sulfides, Cu deposits, base metal deposits etc.

SUGGESTED READINGS

1. <https://pubs.usgs.gov/gip/volc/reading.html>
2. <https://www.springer.com/gp/book/9783642651526>
3. <https://freebooksinfo.net/docs/volcanic-landforms-and-surface-features.html>
4. <https://www.pmfias.com/volcanic-landforms-extrusive-intrusive...>
5. <https://study.com/academy/lesson/volcanic-landforms-types-formation.html>.
6. https://geo.libretexts.org/Courses/Lumen_Learning/Book:_Earth_Science

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