



Content :

- Volcanism and Volcano
- Magma and its Types
- volcanism Process Include Four activities
- Volcanic Eruption Include: Solid , liquid and Gas materials
- Volcano caused by Two Plate Movements
- Volcano Explained by Plate tectonic theory
- Classification of Volcano : Frequency, Mode and Characteristics
- Volcanic Landforms : Intrusive and Extrusive .
- Two Types of Volcanoes
- Concept of Cratons and Continental Shields
- Concept of Hotspots, Mantle Plumes
- List of Volcanoes
- Distribution of Volcanoes in the World : Three Main Areas
- Island and Festoons and Trench
- Ring of Fire in Detail
- Volcanoes in India
- Positive and Negative effects of Volcanic Eruptions
- Key Facts of Volcanoes
- Hawaii Island and Their Formation
- Hotspots and Geysers :
- India Map of Hotspots
- Volcanic Explosivity Index
- Cold Lava

Define:

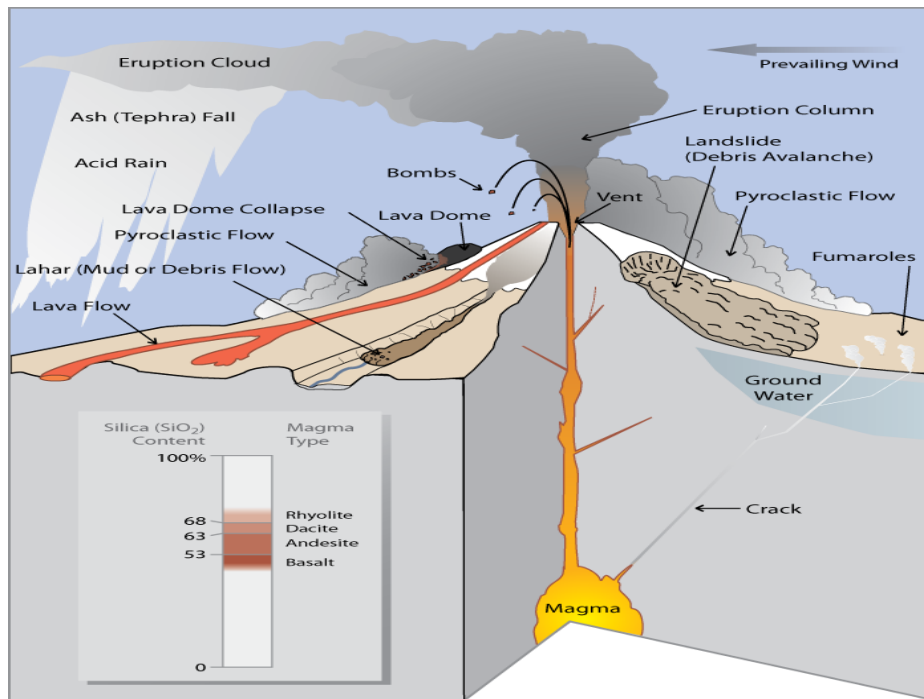
- The process by which solid, liquid and gaseous material or (molten material) escape from the earth's interior to the surface of the earth is called as Volcanism
- Volcano is Geological Event or geological feature
- There are about 1500 potentially active volcanoes worldwide

Magma

- is the term used to denote the molten rocks and related materials seen inside earth.
- magma = molten silicate material ; Silica and water are the main constituents
- Asthenosphere, usually is the source of magma.
- Lava is nothing but the magma on earth surface.

So, volcanism can be defined as an igneous activity or processes which includes the following :

1. Formation of Magma
2. Upward movement of Magma
3. Ejection on the surface
4. Cooling and Solidification.



Magma = includes Solid+ liquid+ Gas materials

Volcanic Gases:

- are water vapor 60 % of total emission (H₂O),
- carbon dioxide (CO₂),
- sulfur either as sulfur dioxide (SO₂) (high-temperature volcanic gases)
- or hydrogen sulfide (H₂S) (low-temperature volcanic gases),
- nitrogen, argon, helium, neon, methane,
- carbon monoxide and hydrogen and oxygen
- hydrogen chloride, hydrogen fluoride, hydrogen bromide,
- nitrogen oxide (NO_x),
- sulfur hexafluoride,
- carbonyl sulfide, and organic compounds.
- Exotic trace compounds include mercury, halocarbons (including CFCs), and halogen oxide radicals.

- ❖ Solid or Pyroclast: Cinders(smaller than ash particles), volcanic dust, ash, volcanic bomb ie mass of molten rock (tephra) larger than 64 mm(2.5 inches) in diameter
- ❖ Liquid Magma - two types .

Acid and Basic Magma : They Differ: Ex composition influences the properties and behaviour of magma

Parameters	Acid Magma	Basic Magma
Composition	Rich in Silica (60 % +)	Less in Silica
Viscosity	High and Less Floating	Less and more fluid
Gas content	Higher and lead to explosive volcanic eruptions	Contain fewer gases resulting in less explosive
Colour	Lighter due to high quartz content (granite; rhyolite)	Darker rocks -Basalt, gabbro due to iron and magnesium content
Eruption style	Explosive type	Effusive type- long distance without significant explosive activity
Mineral content	Rich in Feldspar and Quartz And less in ferromagnesian minerals like Olivine and pryojene	higher proportion of these ferromagnesian minerals

Associated with	Convergent Plate (O-C and O-O)	Divergent Plate and Hotspots
Crystallization pattern	Crystallise slowly due to high viscosity leading to large crystal sizes	Cools quickly due to less viscosity result in small crystal sizes
Geological Features and Slope	Volcanic mountains, Island Arc, Steep Slope	Volcanic plateau or Shield volcano and gentle slope

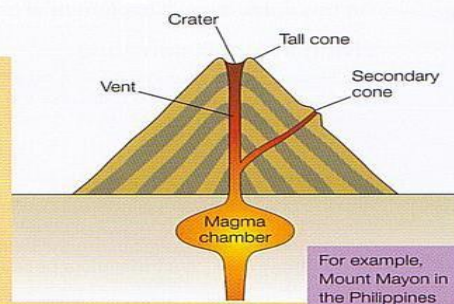


Volcanoes

There are two main types of volcano.

Composite volcanoes

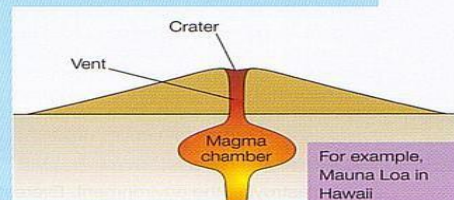
- ◆ They're found at destructive plate margins. When the oceanic plate sinks into the mantle and melts, it forms magma. Magma mixed with sea water then rises up through cracks in the Earth's crust and erupts at the surface – forming volcanoes (page 11).
- ◆ Composite volcanoes have steep sides, and are made up of alternate layers of ash and lava.
- ◆ The lava is sticky, so it doesn't flow far. It's also acidic.
- ◆ Eruptions can be violent – expelling steam, ash, lava and rock – but they don't happen very often.



For example, Mount Mayon in the Philippines

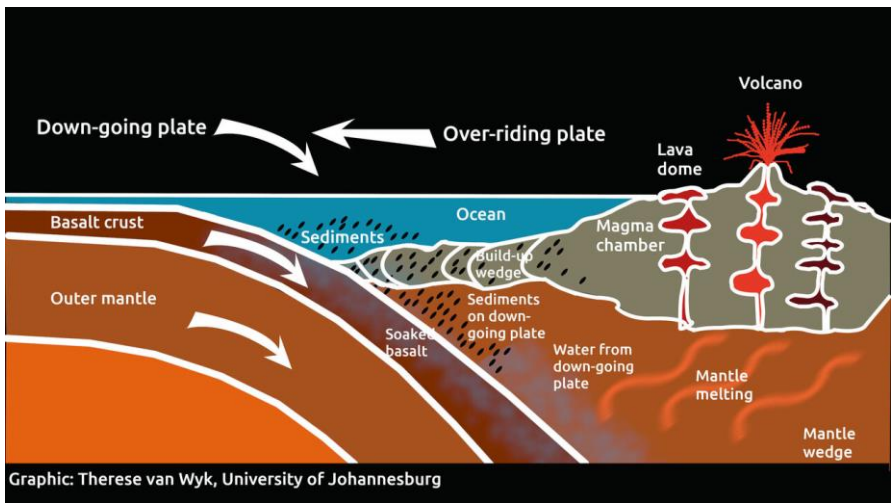
Shield volcanoes

- ◆ They're found at constructive plate margins. As the two plates move apart, magma rises up from the mantle. Some magma is forced to the surface through a vent – forming a volcano.
- ◆ Shield volcanoes have a wide base and gently sloping sides.
- ◆ The lava is runny and flows a long way. It's also basic (that's the opposite of acidic).
- ◆ There can be frequent eruptions, but they're not violent.



For example, Mauna Loa in Hawaii

Composite or Stratovolcano	Shield Volcano
Andesitic Magma	Basaltic magma
Andesitic Lava	Basaltic lava
Felsic in composition	Mafic in composition
Acidic in Nature	Basic in nature
More in Silica Percentage	Less Silica
Viscosity High, Light colour Low density	Less Viscous, Dark colour, High density
Less Widespread (flow slowly)	More widespread (flow fast)
Volcanic Mountains	V. Plateaus
Steep Slopes and Narrow Base	Gentle slope and wide base
Mt Fujiyama	Deccan Plateau
Found on Convergent Boundaries	Found in Divergent plates and Hotspots
Found at O-O and O-C convergence	



Graphic: Therese van Wyk, University of Johannesburg

Mountains of Accumulation or Composite Volcano names

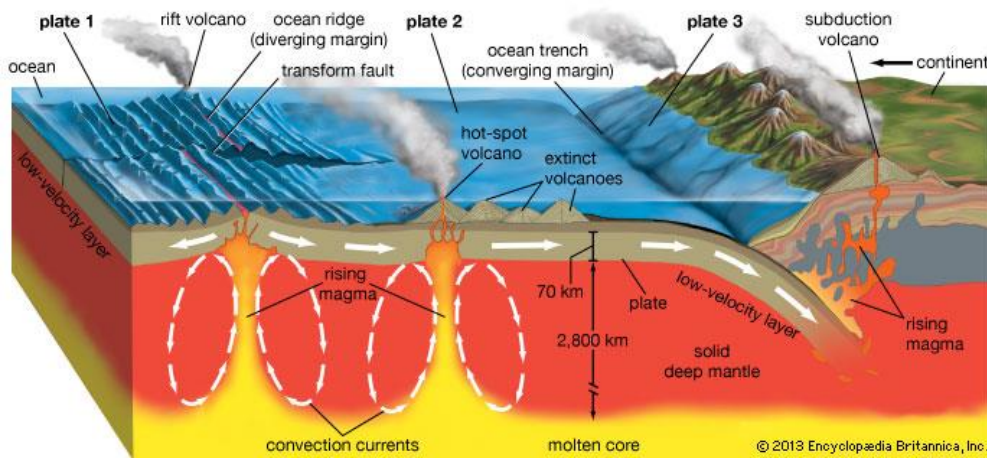
- Mt Fuji Japan
- Mount Saint Helens , Cascade Range, near Washington . not Washington DC
- Mt Vesuvius , Italy
- Mt Stromboli , lighthouse of Mediterranean sea
- Mt Etna, Sicily , Mediterranean sea.
- Mt Shasta, California
- Mt Merapi, Sumatra
- Mt Agung, Bali
- Mt Cotapaxi, Ecuador
- Mt Mayon, Philippines
- Mt Chimborazo, Chimborazo is the highest mountain in Ecuador.
- Mt Karakotoa, Between Java and Sumatra

Shield Volcano:

- is mafic lava ie basalt.
- not very viscous and hold little gas
- long distance to spread out in thin layers.
- Deccan Plateau and Hawaii Volcano, Columbia Plateau
- Mauna Loa, Hawaii
- Galapagos island
- Iceland
- Canadian Shield
- Snake basin USA

Note :

- At sites of advective gas loss, precipitation of sulfur and rare minerals forms sulfur deposits and small sulfur chimneys, called fumaroles.
- Fumaroles create pathways for rising heat, volcanic gas, and magma.

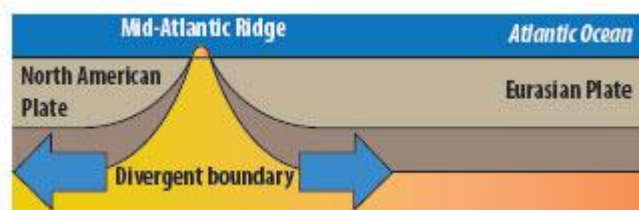


Note: Volcanic eruptions are associated with Weaker zones of Earth Surface : the convection currents in the mantle creates convergent and divergent boundaries (weak zones)

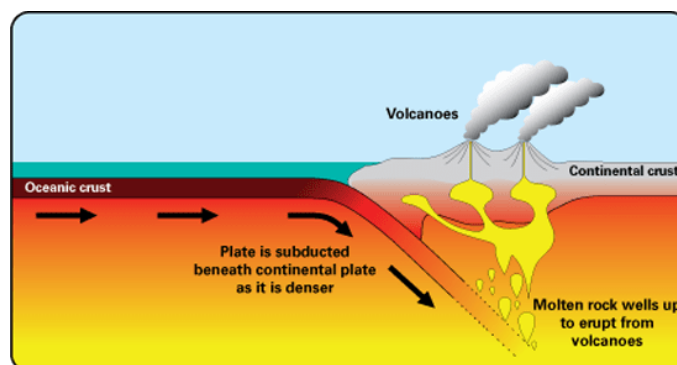
VOLCANOES ARE CAUSED by Three Factors :

1 .Constructive Plate Margin or Divergent Plate Boundary

- Iceland lies on the Mid Atlantic Ridge, a constructive plate boundary-divergent boundaries. Hot magma rises from the mantle at mid-ocean ridges, pushing the plates apart



- This spreading sites zone creates Shield or fissure volcanoes at mid oceanic ridges, these basaltic outflows are less violent but more fluid (widespread)



2 Destructive, or convergent, plate boundaries

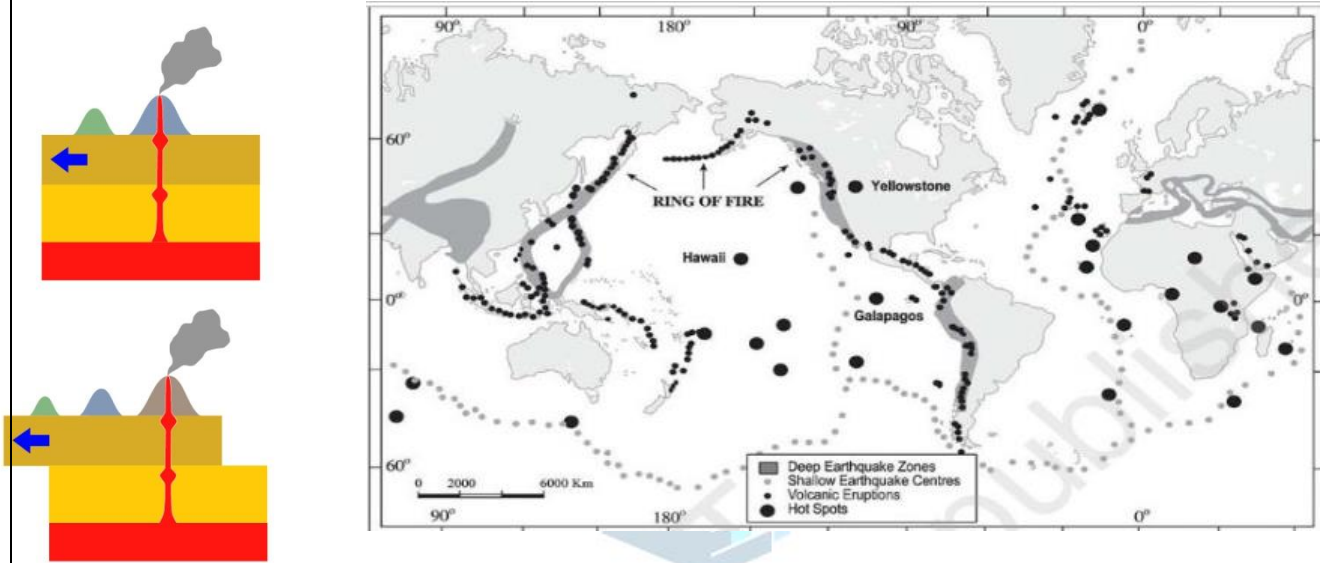
- are where the tectonic plates are moving towards each other.
- This process is called subduction and creates distinctive types of volcanoes depending on the setting:

Ex:

- This creates composite or stratovolcano- andesitic and very explosive.
- ocean-ocean subduction produces an island-arc volcano
- ocean-continent subduction produces Andean-type volcanoes
- C-C - Convergence not related with volcano (Reason - Continent crust thickness more)
- Volcanoes do not typically occur at transform boundaries. (Reason - there is little or no magma available at the plate boundary)

3. Hot-spot volcanism

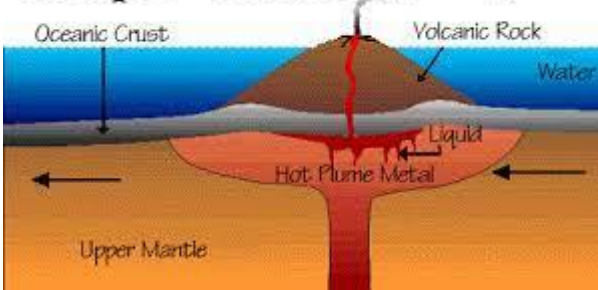
- Volcanoes can also form above a column of superheated magma called a mantle plume.
- It is also referred to as hot spot or intraplate volcanism.
- Ex The Hawai'ian Islands are a chain of volcanoes in the middle of the Pacific Plate



IN GEOLOGY, HOTSPOTS ARE

- an Upwelling plume of Magma
- are localised volcanoes fed by underlying mantle that is anomalously hot compared with the surrounding mantle..
- They are stationary and located in the weak zones of the Earth Crust
- Rising Magma associated from the deeper mantles called Mantle Plumes
- Hotspots activity are stationary, they themselves do not move
- When Plates are moving along the Hotspot region, then creates long linear chain of Islands , Seamounts etc

"Hotspot" Volcano (e.g., Hawaii)



HOW HOTSPOTS FORMED ?

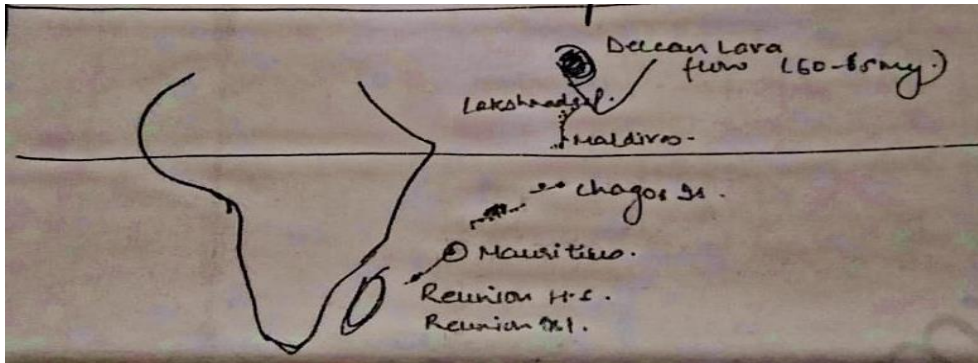
- Originate at Core - Mantle Boundary (still debated)
- Process related to Earth Heat Flow and Convection Currents .
- Hotter and Lesser denser materials rises upwards towards the Surface in the Weaker Zone of Crust.

KEY LOCATIONS OF MAJOR HOTSPOTS

- Hawaiian Hotspot, in Pacific Ocean

- the Yellowstone Hotspot in North America
- Iceland hot spot under the island of Iceland in the North Atlantic
- Afar hot spot, located under northeastern Ethiopia
- Réunion hot spot under the island of Réunion in the Indian Ocean

Example Reunion Hotspot have traced long linear chain of Islands and Volcanic Features associated with basaltic lava . But this is possible when the Plates above the Hotspot moves and creating this pattern

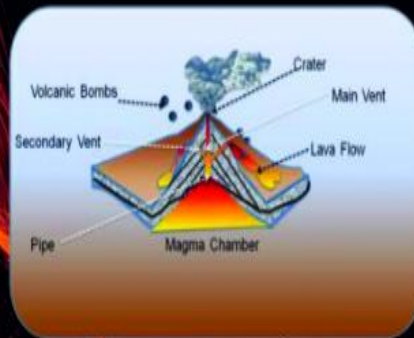


Reunion Hotspot create long linear chain of Islands in Indian Ocean. This Hotspot is responsible for Deccan Lava Eruptions about 60 to 65 mya. Indian Plateau was over Reunion Hotspot.

POSITIVE EFFECTS	NEGATIVE EFFECTS
Weathering of volcanic rocks leads to formation of fertile soil	Impacts Environment and Air Pollution Leads to Natural disaster and high destructive potential to life and property
Volcanic ash acts as fertiliser for soils	V. eruptions may leads to earthquakes
Landforms creations- Island arc, plateau , mountains , and intrusive and extrusive landforms	Can cause tsunami in coastal region
Rising magma brings key minerals provide mining opportunities	Impact climate change .Increase co2 and so2 and other gases increase global warming and global cooling effects
Release SO2 lowers earth temperatures	Long term Socio - economic Impacts
Diamond -kimberlite rocks of South Africa are actually the part of an ancient volcano.	Volcanic gases responsible for acid rain
Provides Geothermal Energy from springs and geysers exx Puga valley of ladakh and manikaran region shimla	Cause secondary events- floods, landslides , mudslides , wildfires etc
Tourism Potential - Yellowstone National Park of USA	Cold lava is also dangerous than hot lava

VOLCANOES

A volcano is a vent or a fissure in the crust from which lava (molten rock), ash, gases, rock fragments erupt from a magma chamber below the surface



Types: On basis of -

Periodicity of Eruption:

- Active volcano: Recently Erupted
- Dormant Volcano: Potential for eruption, no imminent signs
- Extinct: No recent eruptions, low possibility in future

Nature of Eruption:

- Hawaiian: Calmest types (low gaseous content)
- Strombolian: Formation of large gas bubbles in magma
- Vulcanian: More explosive
- Plinian eruptions: Magma's volatile gases rise via a narrow conduit
- Icelandic: Often build lava plateaus

Shape of Volcanoes:

- Shield volcanoes: Composed of basaltic lava, low slope
- Cone volcanoes (Cinder Cones): Most abundant
- Composite cones (stratovolcanoes): Formed by layers of diverse materials.

Volcanic Features:

Extrusive :

- Crater: Cone-shaped vent for magma
- Caldera: Large, crater-like depression
- Volcanic Plateaus: Levelled areas from fissure eruptions

Intrusive:

- Batholiths: Central core of a volcanic mountain.
- Dyke: Vertical intrusion cutting across country rock bedding.
- Sills: Tabular intrusions along sedimentary bedding.
- Laccoliths: Magma injection along horizontal sedimentary bedding.

Minor:

- Geysers: Underground water above 100°C, powered by magma, results in powerful eruptions with steam and diluted minerals.
- Hot Springs: Heated water flows quietly along fault zones.

Distribution of Volcanoes:

- Subduction zones (Circum Pacific Belt)
- Divergence zones (Mid Atlantic Ridge)
- Intra-plate oceanic volcanism (Hawaiian chain)
- Mid-continental belt and volcanoes in Mediterranean region

Volcanoes in India:

- No volcanoes in Himalayans
- Barren Island (Only active volcano)

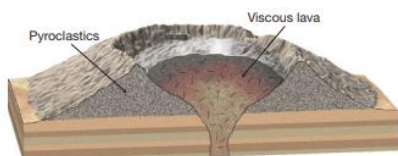
Products of Volcanic Eruption:

- Gases: H, C, O, S, N, CH₄, NH₃
- Solid: Pyroclastic materials
- Liquid: Lava

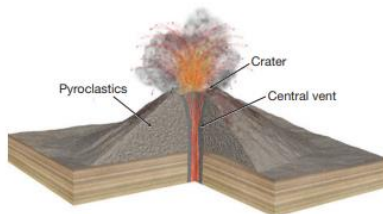


TABLE 14-1 Principal Types of Volcanoes

Volcano Type	Shape and Size	Structure	Magma and Eruption Style	Examples
Shield	Broad, gently sloping mountain; much broader than high; size varies greatly.	Layers of solidified lava flows.	Magma usually basaltic; characterized by quiet eruptions of fluid lava.	Hawaiian Islands; Tahiti
Composite (Stratovolcano)	Steep-sided symmetrical cone; heights to over 3700 m (12,000 ft.).	Layers of lava flows, pyroclastics, and hardened mudflow deposits.	Magma usually intermediate in chemistry, often andesitic; long life span; characterized by both explosive eruptions of pyroclastics and quiet eruptions of lava.	Mt. Fuji, Japan; Mt. Rainier, Washington; Mt. Shasta, California; Mt. Vesuvius, Italy; Mt. St. Helens, Washington
Lava Dome (Plug Dome)	Usually small, typically less than 600 m (2000 ft.) high; sometimes irregular shape.	Solidified lava that was thick and viscous when molten; plug of lava often covered by pyroclastics; frequently occur within the crater of composite volcano.	Magma usually high in silica, often rhyolitic; dome grows by expansion of viscous lava from within; explosive eruptions common.	Lassen Peak, California; Mono Craters, California
Cinder Cone	Small, steep-sided cone; maximum height 500 m (1500 ft.).	Loose pyroclastic material; may be composed of ash or cinder-size pieces.	Chemistry of magma varies, often basaltic; short life span; pyroclastics ejected from central vent; occasionally produce lava flows.	Paricutin, Mexico; Sunset Crater, Arizona



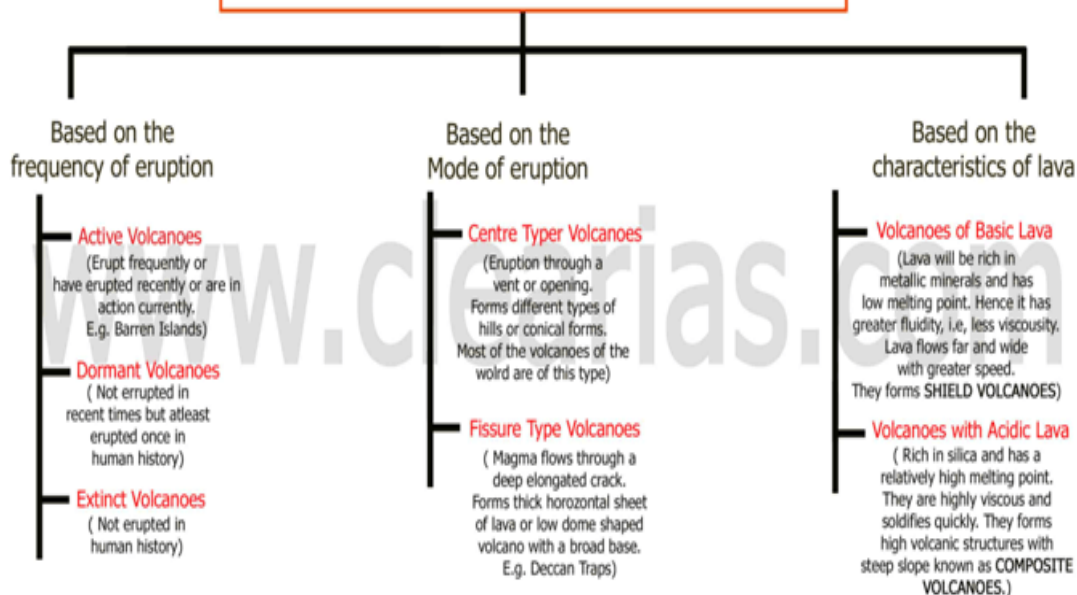
▲ **Figure 14-37** Lava domes (plug domes) develop when viscous lava (commonly rhyolite or dacite) is "squeezed" up into a volcanic vent. The plug of lava may be mantled or surrounded by explosively ejected pyroclastic material.



▲ **Figure 14-39** Cinder cones are small volcanoes consisting of pyroclastic material.

Cinder Cones: Cinder cones are the smallest of the volcanic peaks

Classification of Volcanoes



Types of Volcanic Eruptions
Volcanic eruptions can be **effusive**, with smooth basaltic magma flow, or **explosive**, characterised by viscous magma causing explosive releases. **Six primary types** include:

- **Icelandic** with flowing basaltic lava.
- **Hawaiian** forming shield volcanoes.
- **Strombolian** with frequent bursts of glowing lava.
- **Vulcanian** featuring moderate gas and ash explosions.
- **Pelean** being explosive with destructive pyroclastic flows.
- **Plinian**, the most violent, produces high-speed jet blasts reaching the stratosphere.

Volcanic landforms types: Intrusive and Extrusive:

- When Magma solidifies below Earth surface, it produces plutonic igneous rock.
- Rocks formed by the cooling of magma within the crust are called Plutonic rocks.
- Rocks formed by the cooling of lava above the surface are called Igneous rocks(volcanic rocks).

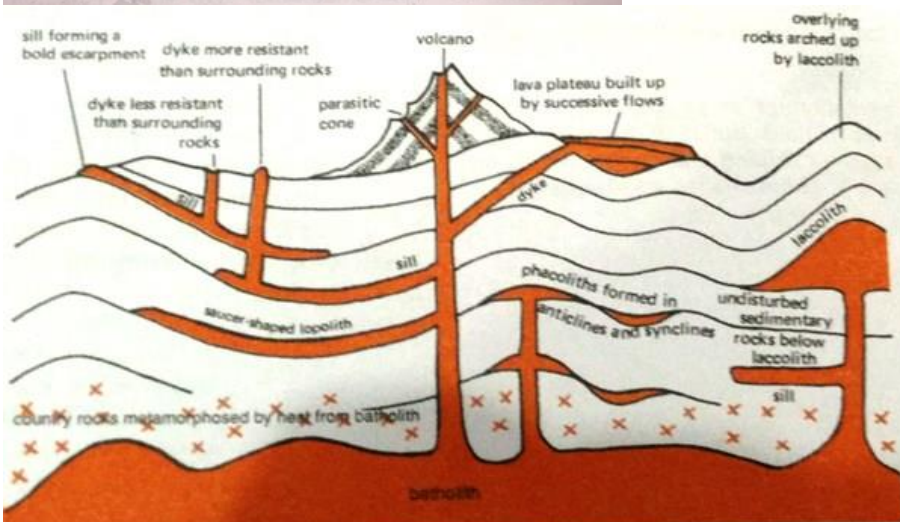
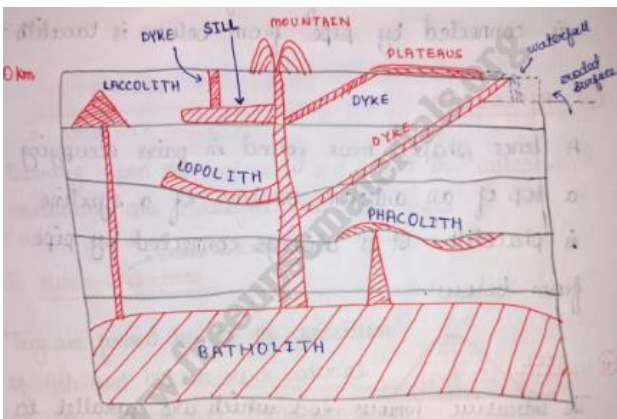
Intrusive :

1. Sills & Dikes (Common intrusive landforms)

- When an intrusion of molten magma is made horizontally along the bedding planes of sedimentary rocks, the resultant intrusion is called a Sill.
- Thinner one called Sheet and Thick Horizontal deposit called Sill.
- Similar intrusion when injected vertically as narrow walls of igneous rocks within the sedimentary layers are termed as Dikes.
 - Dykes : When the lava makes its channel through cracks and the fissures, it solidifies almost perpendicular to the ground.



Igneous intrusions on a larger scale are various types of Liths viz. Laccoliths, Lopoliths, Phacoliths & Batholiths



Laccoliths An igneous mound with a dome shaped upper surface & a level base, fed by a pipe like conduit from below, example Karnataka plateau

Lopolith/Lapolith As and when the lava moves upwards, a portion of the same may tend to move in a horizontal direction wherever it finds a weak plane. It may get rested in different forms

An igneous intrusion with a saucer shape, concave shape

Phacolith

A lens shaped mass of igneous rock occupying the crest of an anticline or the bottom of a syncline & being fed by a conduit from beneath

Batholith

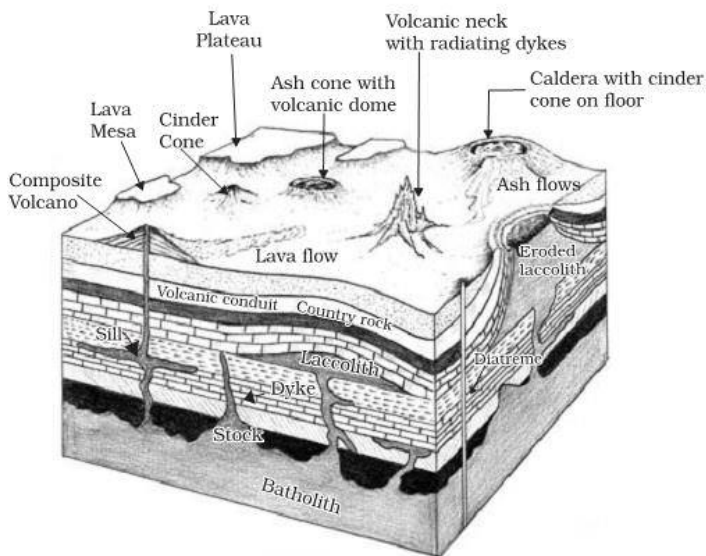
• These are large granitic rock bodies formed due to solidification of hot magma inside the earth.
A huge mass of igneous intrusive rock, mainly granite, that forms from cooled magma deep in the Earth's crust

Batholith :

- granite magma and All Fold mountains have batholith core
- Magmatic material cools deep within the crust to form large domes known as batholiths (granite bodies), i.e., they are the cooled remnants of magma chambers
- Batholith form the core of huge mountain and may be exposed on the surface after erosion process and forms cratons and shields thereafter .

Stock: is discordant igneous intrusion have surface exposure of less than 100km.

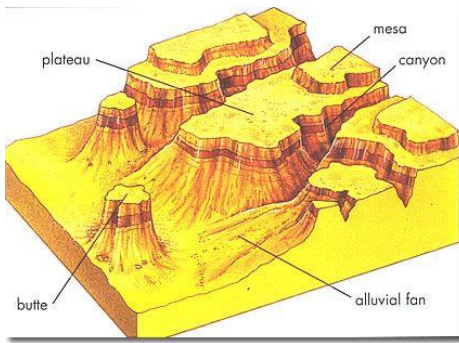
Diatreme: volcanic vent or pipe formed by magma , energized by gas.



Mesa and Butte Topography

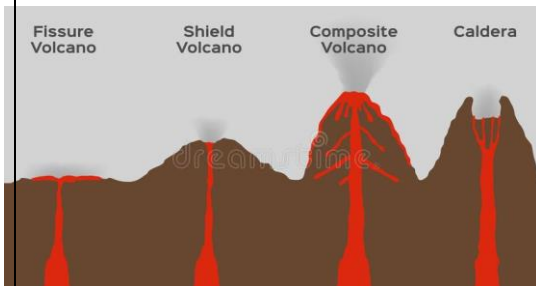
- Mesa is a spanish word meaning table
- Size: Butte - Mesa- Plateau
- this topography found in Arid, Semi arid, desert feature.
- Butte: Small isolated Flat topped hill with steep side
- Mesa: due to igneous formation, mesa have much larger top, flat top like table
- a very resistant horizontal top layer and very steep sides
- Mesa may be formed in canyon regions or on fault blocks
- Grant mesa in Colombia

Mesa locally called Pats: Patland in Chota nagpur Plateau of jharkhand in Maharastra, mahabaleshwar plateau, Panchgani-Satara. : basaltic Mesa example.



Extrusive Landforms

▪ Vent and its Types



Lava or molten magma ejects at a very high pressure through a pipe known as Volcano's neck or vent

Top portion of volcano is known as crater and a crater lake is formed when rain water gets accumulated in

Some volcanos may have greatly enlarged depressions like cauldron known as Calderas

- Volcanic dust or ash (finer particles) that emerges out of volcano travels round the world & falls as black snow, which can bury house & people.
- The coarser fragmental rocks are collectively called as Pyroclasts which include cinders, pumice & volcanic bombs.



Types of Vent :



1. Conical vent

- A conical vent is a narrow cylindrical vent through which magma flows out violently.
- Conical vents are common in andesitic volcanism (composite or stratovolcano).
- Mount Stromboli (the Lighthouse of the Mediterranean), Mount Vesuvius, Mount Fuji are examples.

2. Fissure vent or lava Plateau

- A fissure vent (volcanic fissure) is a narrow, linear volcanic vent through which lava erupts, usually without any explosive activity.
- The vent is often a few meters wide and may be many kilometres long.
- Fissure vents are common in basaltic volcanism (shield type volcanoes).
- Example: Siberian Traps, Deccan Traps, Snake Basin, Icelandic Shield, Canadian Shield.

EXTRUSIVE LANDFORMS :

- vents
- craters and caldera
- shields
- volcanic plateaus

- Mesa and Butte Topography
- Crater: A crater is an inverted cone-shaped vent through which the magma flows out. When the volcano is not active the crater appears as a bowl-shaped depression. When water from rain or melted snow gets accumulated in the crater, it becomes a crater lake.
- Craters are formed by the outward explosion of rocks and other materials from a volcano. Calderas are formed by the inward collapse of a volcano. Craters are usually more circular than calderas. (Calderas may have parts of their sides missing because land collapses unevenly.)
- Lonar Lake, also known as Lonar crater (Lonar, Buldhana district, Maharashtra) was created by a meteor impact
- Lake Toba (Indonesia) It is the largest crater lake in the world.

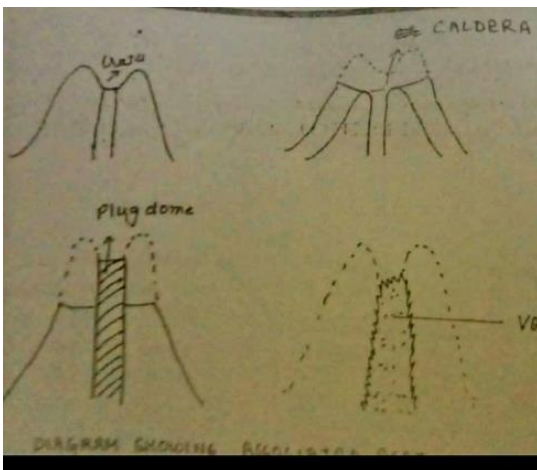
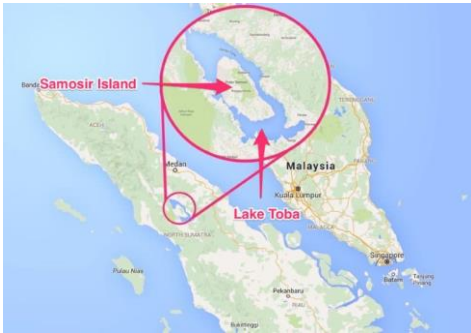


Diagram Showing volcanic neck evolution : crater, caldera, plug dome and then formed volcanic neck (extrusive landforms)

Cratons are Hard resistant igneous rocks which exposed to weathering to form shields on continents

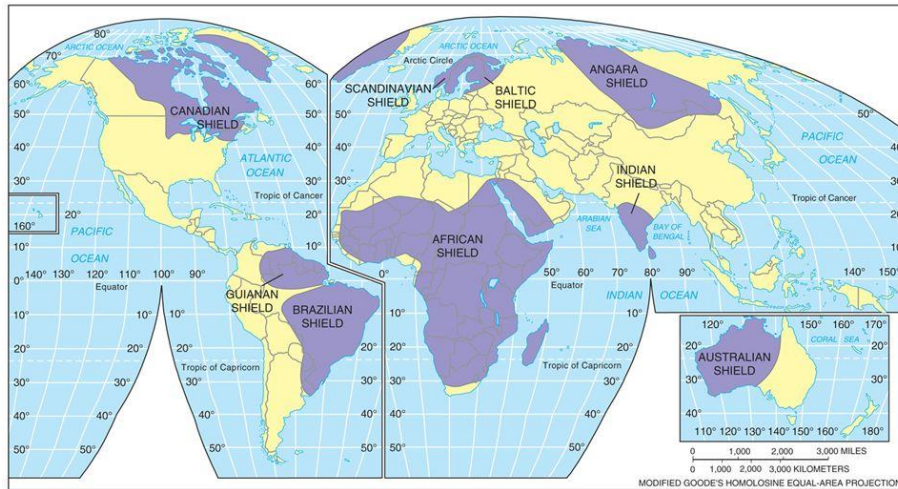
Shield :

- is generally a large area of exposed Precambrian crystalline igneous and high-grade metamorphic rocks that form tectonically stable areas.
- A shield is that part of the continental crust in which these usually Precambrian basement rocks crop out extensively at the surface,
- Shields occur on all continents.
- rich in metalliferous minerals

- due to presence of hard rocks beds these regions are stable regions



Continental Shields



(a)

Copyright © 2006 Pearson Prentice Hall, Inc.

Figure 12.4

Volcanic Plateaus of World

These are very large and extensive plateaus formed due to basaltic lava. After Weathering these areas give rise to Black Soil.

Famous Regions :

- Columbia Snake Plateau : USA
- Patagonia Plateau : Argentina
- Parana Plateau : South America
- Drakensberg Plateau : South Africa
- Siberian Plateau: Russia
- Deccan Plateau India
- Kimberley Plateau Australia
- Katanga Plateau Congo



New Vision IAS Academy
Aspirations to aspirations

Islands

Oceanic Islands

- Volcanic Islands
- Coral Islands

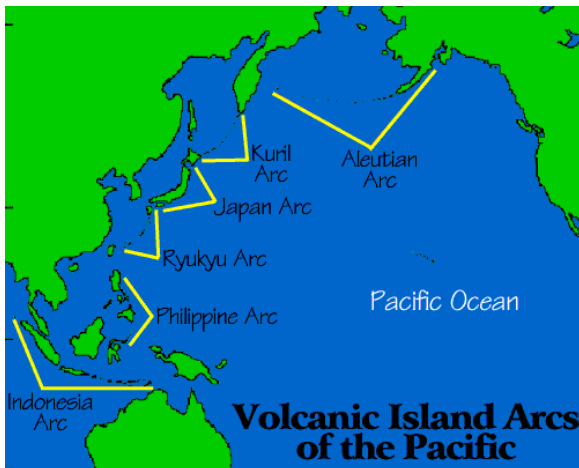
Continental Islands

- Individual Islands
- Archipelago or Island groups
- Festoons

- Greenland is continental individual island other madagascar
- Archipelago: Group of Island of varying size and shape .Indonesia, Philippines , chagos archipelago (Leased to USA, administration by UK, claimed by Mauritius but now Both states had agreed to ensure the continued operation of the joint UK/US military base on Diego Garcia)
- Volcanic island : Hawaii islands
- Coral Island : Lakshadweep and maldives

Festoons or Island Arcs

- Formed due to ocean ocean convergence
- Island arcs are long chains of active volcanoes with intense seismic activity found along convergent tectonic plate boundaries.
- Most island arcs originate on oceanic crust and have resulted from the descent of the lithosphere into the mantle along the subduction zone.
- Island arcs can either be active or inactive based on their seismicity and presence of volcanoes.
- the East Indies, the Aleutian Islands, Ryukyu Islands, Islands of Japan, Kurile Islands, Andaman and Nicobar islands, Philippine Islands, Sunda Arc

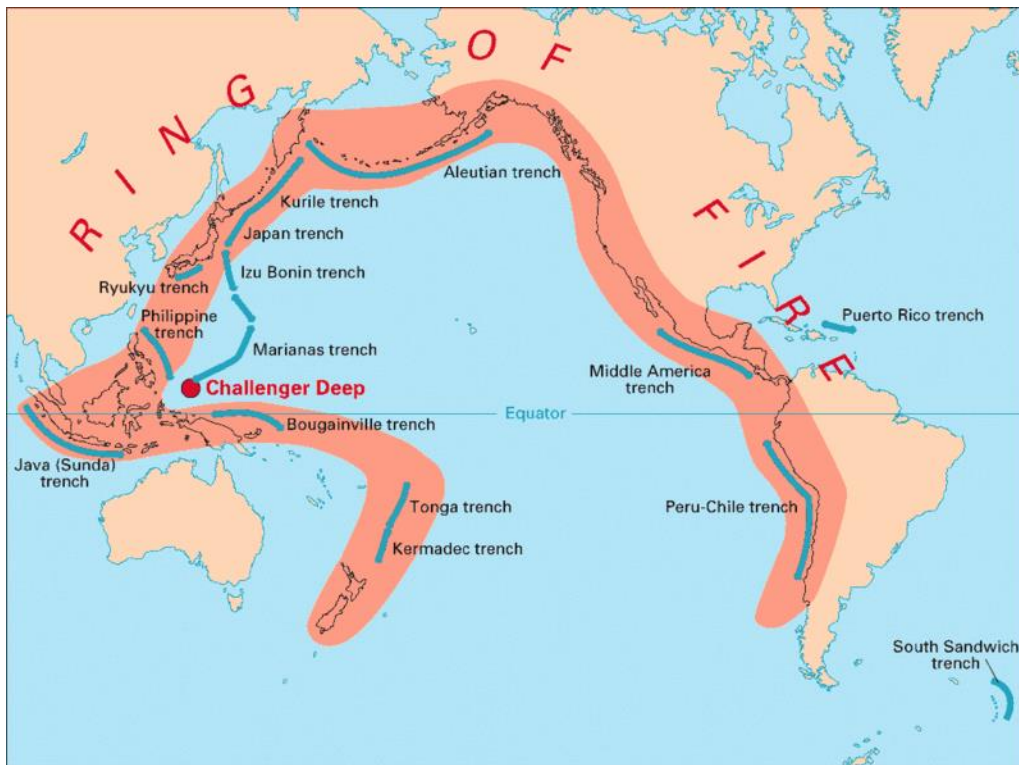


Example Japan Island Arc : formed due to collision of Eurasian Plate , Pacific Plate and minor philippines Plate. Pacific Plate subducts forming a trench Ryuku Trench and Kuril Trench and Formation of Islands like Kuril and Ryuku Islands .

Phillppines Island formed due to collision of Pacific Plate with Philppines Plate and due to subduction zone formed mariana trench and Mindano Trench

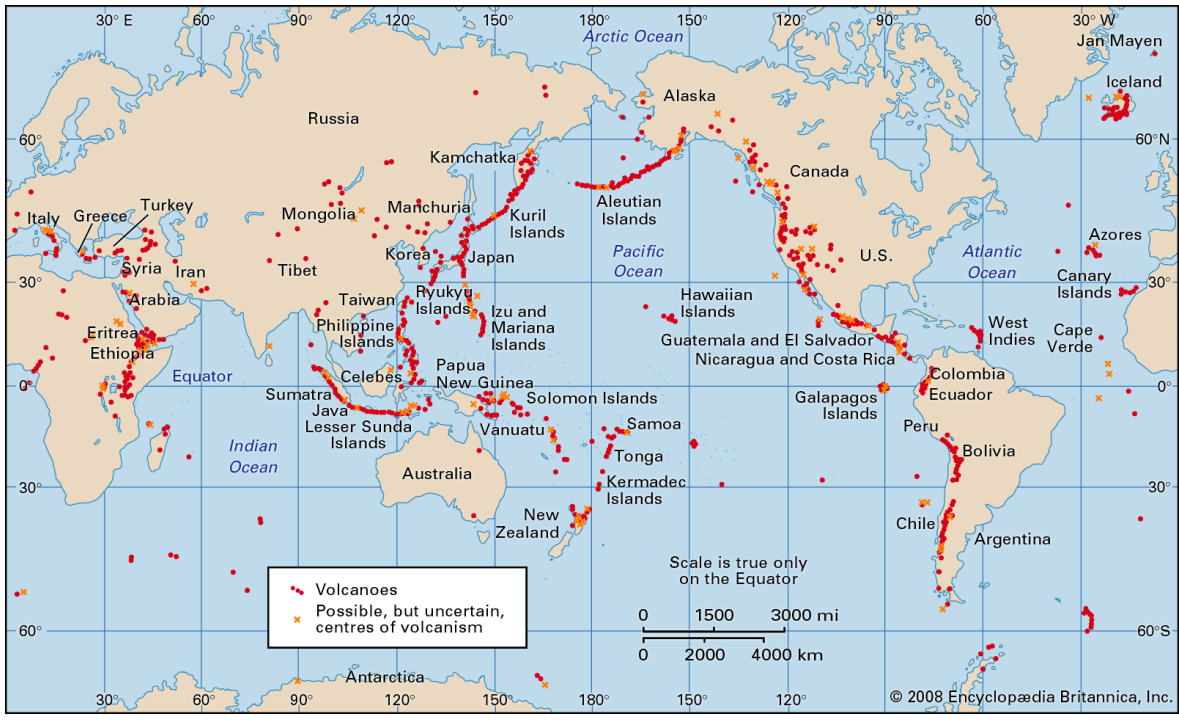
Trench :

- a minor Ocean Relief Features
- a long, V shaped , deep depression in the ocean floor.
- Trenches are located (formed due to) in subduction zones at or near a convergent boundary, continental crust, and/ or volcanic islands
- The Mariana Trench is the deepest known trench globally,



About Pacific Ring of Fire :

- Created by Convergent Tectonic plates
- Ring of fire concept by Hugo Benioff , a seismologist, in 1940. this plotted locations help in development of new concept of Seafloor Spreading and Plate tectonics.
- is the collection of volcanoes and earthquake zones bordering the Pacific Ocean. This zone is infact a ring of subduction zones so it has many active volcanoes and Trenches
- In a 40,000 km horseshoe shape,
- It has 452 volcanoes (more than 75% of the world's active and dormant volcanoes).
- The Ring of Fire is sometimes called the circum-Pacific belt.
- The Aleutian islands of Kamchatka, Japan, the areas of Philippines, Indonesia, Islands of Solomon, Tonga and North Island, New Zealand, the Andes to Central America and up to Alaska are the part of Pacific rim of fire.
- Mount St. Helens in the USA, Mount Fuji in Japan and Mount Pinatubo in the Philippines. It is also sometimes called the circum-Pacific belt.



DISTRIBUTION OF VOLCANOES IN THE WORLD

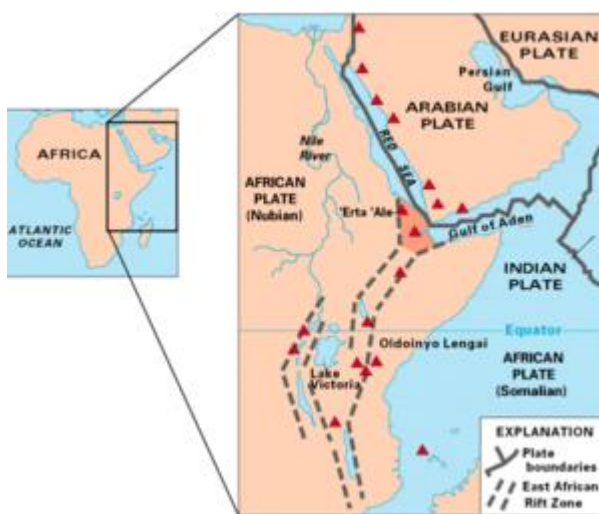
- Formation of central vents (Andesitic lava)
- Along the Trenches (Andesitic lava)
- Along MOR (Basaltic Lava)
- Hot Spots and Triple Junctions regions (Basaltic Lava)
- Fracture Zones

Most of the volcanoes in the world are found in three well defined belts:

1. The Circum-Pacific Belt (The Pacific Ring of Fire).
2. The Mid- Continental Mountain Belt.
3. The African Rift Valley Belt.
 - Mid-Continental belt → due to convergent continental plate margins This belt has various volcanoes of the Alpine mountain chain, Mediterranean Sea (Stromboli, Vesuvius, Etna etc., fault zone of eastern africa)
 - Mid-Atlantic belt → This belt includes the volcanoes of the Mid-Atlantic Ridge, having fissure eruption type example Iceland, Canary Island, Cape Verde, Azores island in Atlantic Ocean

The African Rift Valley Belt

- The Great Rift Valley (Length about 7,000 km Length from Lebanon in Asia to Mozambique in Southeast Africa.
- formed due to divergent plate boundary and having two part and eastern and western rift
- The Afar Depression, located on Afar plate tectonic triple junction, basaltic lava outpours .
- The Afar Region located in northeastern Ethiopia and the homeland of the Afar people. It's bordered by Eritrea to the north and Djibouti to the northeast, and shares regional borders with the Tigray, Amhara, Oromo and Somali regions.



Volcanoes in the great rift region: Mount Kilimanjaro and Mount Kenya of the East African Rift Valley have some extinct volcanoes. Mount Cameroon is the only volcano active in West Africa.

volcanoes along the Atlantic coast: The Atlantic coast has a comparatively fewer number of active volcanoes. But it has many dormant volcanoes such as Saint Helena, Cape Verde islands etc. The volcanoes of Iceland and Azores along the Atlantic coast are active volcanoes.

Volcanoes in the Mediterranean region : The Alpine folds, such as Vesuvius, Stromboli (also known as the Lighthouse of Mediterranean) and the Aegean Islands are the areas of the Mediterranean region where active volcanoes are found.

VOLCANOES IN INDIA

- Narcondam which is in the north-east of Barren Island is another volcanic Island in India.
- Narcondam volcano has not been active in the recent past. Other parts of
- Narcondam Island is a dormant volcano in the area by the Geological Survey of India (Kolkata, 1851). (Under Ministry of mines)
- India do not have an active volcano.
- Baratang Island in Andaman Section is India's Only Mud Volcano
- Deccan Traps, Maharashtra Barren Island : A volcanic Island
 - Part of Andaman Islands
 - located north east of Port Blair about 140 km
 - it is the only confirmed active volcano in the Indian subcontinent,
 - it is an island located in the Andaman Sea
 - the only active volcano in South Asia, along a chain of volcanoes from Sumatra to Myanmar.

- After the first recorded eruption in 1787, further eruptions were recorded in 1789, 1795, 1803–04, and 1852. After nearly one and a half century of dormancy, the island had another eruption in 1991 that lasted six months and caused considerable damage
- There were eruptions in 1994–95 and 2005–07, the latter considered to be linked to the 2004 Indian Ocean earthquake.
- with the most recent one being in 2020
- The island is uninhabited

• Recent timeline of volcanic eruptions in Barren island:

- 1787: First recorded eruption 1789, 1795, 1803, 1852: Further eruptions were recorded.
- 1991: The eruption occurred after about 150 years of dormancy. It lasted for about 6 months and caused considerable damage, particularly to the island’s fauna.
- 1995: Eruption reported
- 2004-05: Eruption recorded and linked to 2004 Indian Ocean earthquake.
- 2017: Volcano was spotted. They were a continuation of eruption in 2005, as per a study by Indian Space Research Organisation (ISRO).
- 2018: Volcanic eruptions reported and linked to 28 September 2018 earthquakes in Sulawesi, Indonesia.
- 2024 March

Que : Consider the following statements:

1. The Barren Island volcano is an active volcano located in the Indian Territory.
2. Barren Island lies about 140 km east of Great Nicobar
3. The last time the Barren Island volcano erupted was in 1991 and it has remained inactive since then.

Which of the statements given above is/are correct? UPSC 2018 Ans ()



some regions in India that contain volcanic features or remnants of ancient volcanic activity.

- Deccan Traps : Shield or Fissure Volcanoes ; Gentle Slope
- Barren Island : Stratovolcano or Composite ; Steep Slope
- Tosham Hills, Haryana: ancient volcano activity
- Dhosil Hill, Haryana : ancient volcano activity
- Dhinodhar Hills , Gujarat: ancient volcano activity

Key Facts :

- Countries have most volcanoes : USA, Japan, Indonesia , Russia, Chile
- World Highest Volcano : Ojos Del Salado , Chile- Argentina
- The largest active volcano on Earth is the Mauna Loa in Hawaii, United States active shield volcano (in terms of area and volume)
- Mauna Kea- dormant volcano, still classified as active volcano due to its recent geological activity (is considered the tallest mountain on Earth when measured from its base on the ocean floor to its summit)

About Hawaii Volcanic Island : Presently, there are six active volcanoes in Hawaii, located in North Pacific Ocean. As shield volcanoes, they are built by accumulated lava flows having broad base and gentle slope



See Linear pattern:

How they Created : The Hawaiian Islands were formed by a volcanic hot spot, an upwelling plume of magma, that creates new islands as the Pacific Plate moves over it.

- Kīlauea, the youngest and most active volcano on the Island of Hawai'i, erupted almost continuously from 1983 to 2018
- Hawaii's Mauna Loa is the largest active volcano on our planet. Mauna Loa, the largest volcano on Earth, has erupted 34 times since 1843
- Hualālai, the third most active volcano on the Island of Hawai'i,
- Mauna Kea, the highest volcano on the Island of Hawai'i

Another Example:

Zubair Group, Al Zubair Group s a group of 10 major volcanic islands, on top of an underlying shield volcano in the Red Sea, which reach a height of 191 m (627 ft) above sea level. The volcano has continued to erupt in historic times. The islands belong to Yemen



- Mount Ruang : Indonesia
- Mount Semeru : Indonesia
- Mount Sinabung: Indonesia
- Mount Merapi : Indonesia
- Mount Bromo: Indonesia

FOR EXAM : Other famous active volcanoes

- Tonga : southern Pacific Island which triggered Tsunami waves around the Pacific is undersea v. eruption
- Mt Sangay Volcano : Ecuador
- Taal Volcano : Philippines
- Nyiragongo in DR Congo
- La-Palma Canary Island , Spain
- Klyuchevskoy volcano and Raikoke : Russia's far eastern Kamchatka peninsula.
- Fournaise volcano Reunion Island France Indian Ocean
- Erebus on Antarctica
- Mount Etna, Vesuvius and Mt Stromboli Italy
- Cotapaxi Ecuador
- Aira Japan

2023 Volcanic Eruptions

- Mount Etna, Sicily
- Villarrica Volcano, Chile
- Kilauea Volcano, Hawaii
- Merapi Volcano, Indonesia
- Fagradalsfjall Volcano, Iceland

- Klyuchevskoy Volcano, Russia

2024 Key Examples :

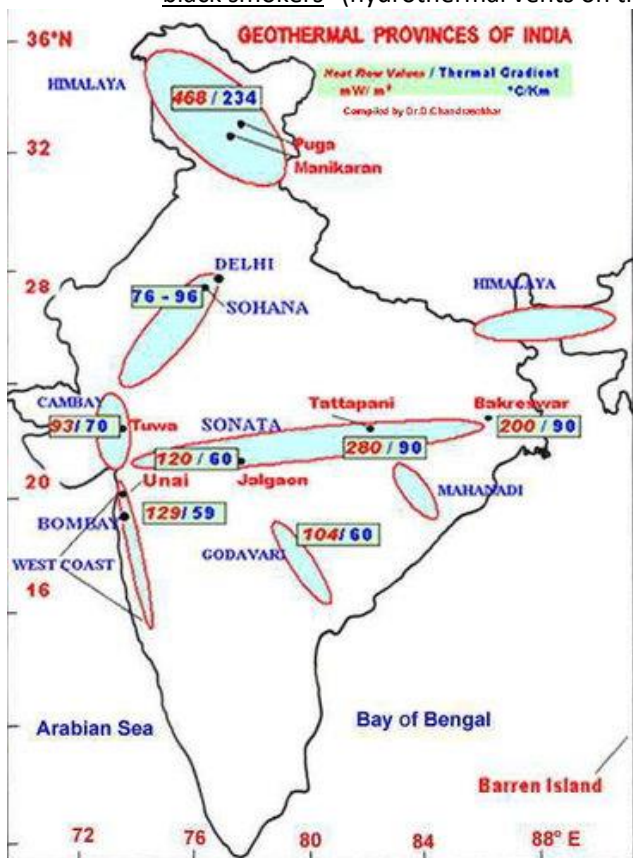
- Kilauea - Hawaii USA
- Shiveluch Volcano, Russia
- Sundhnúkur Eruptions, Iceland
- Kikai and Aira - Japan
- Mayon and Taal - Philippines

HOTSPRINGS AND GEYSER DIFFERENCE :

- Hot Springs Are Continuously Flowing Sources Of Geothermally Heated Water, While Geysers Are Rare Features Characterized By Intermittent Explosive Eruptions Caused By Steam Pressure Buildup

Hotsprings or Geothermal springs :

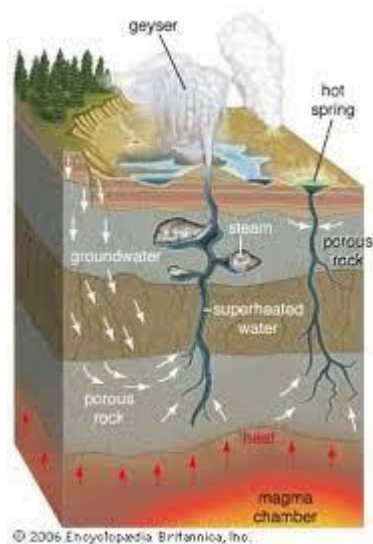
- Groundwater, coming in contact with the magma, gets heated beyond 37 degree C and when comes to surface is known as hot spring. ex ladakh and Manali, shimla areas.
- A Hot Spring, also known as a geothermal spring is a naturally occurring spring of water that emerges due to heated groundwater.
- The heat produced is either through the magma within the Earth’s crust or through the movement of fault in the crust.
- "black smokers" (hydrothermal vents on the ocean floor)



Hot Springs are present in various parts of the country. Given below are a few of the springs in India:

State/UT	Name/ Location
Ladakh	Panamik, Nubra Valley (largest in India) Chumathang

Himachal Pradesh	Kheerganga Kasol, Parvati Valley Manikaran Sahib Shrine on banks of River Parvati Vashisht Tattapani
Uttarakhand	Gaurikund Rishikund Suryakund Tapovan Sahastradhara
Sikkim	Yumthang Reshi Hot Springs
Orissa	Taptapani Atri
Maharashtra	Aravali Hot Water Springs Akoli
Madhya Pradesh	Dhuni Pani
Meghalaya	Jakrem



Benefits of Hotsprings:

- are used to generate electricity called " Geothermal Energy".
- rich source of sulfur and its healing benefits include treating skin irritations and infections
- to help treat dry scalp, arthritic pain and internal problems such as menopausal symptoms and digestive disorders.
- Heal Skin Problems: Combats dry skin: The high silica content in hot spring water can soften rough and dry skin.
- Boost Blood Circulation because hotsprings water include a variety of different minerals, Our bodies soak up these minerals when we are in a hot spring, which increases circulation and overall oxygen flow.
- Reduce Stress and Promote Sleep

Geysers:

- when the heated water at high pressure comes out of the surface and bursts into steam, it is known as Geysers.
- Geysers are found in very few regions, while the hot water springs are found all over the world.
- In most of the cases, a crater like structure is formed at its mouth.
- A jet of steam and hot water that immediately spouts out of the ground is known as Geyser.
- It results from the heating of groundwater by shallow bodies of magma.

- As water is ejected from geysers and is cooled, dissolved silica is precipitated in mounds on the surface. This material is known as sinter.
- Most of the world's geysers are found in the areas of Iceland, New Zealand and the Yellowstone National Park of USA. The hot springs and geysers of Japan and Hawaii are great tourist attractions.

Volcanic Explosivity Index (VEI)

- is a relative measure of the explosiveness of volcanic eruptions.
- devised by Christopher G. Newhall of the United States Geological Survey and Stephen Self in 1982
- The scale is logarithmic, with 0 to 8 : with each interval on the scale representing a tenfold increase

Consider the statements with respect to " Cold Lava":

1. Cold Lava or lahar is a Phenomenon that occurs when rain mixes with volcanic materials like ash, sand, and pebbles.
2. It is considered more destructive and deadlier compared to regular lava flows.
3. Cold lava remains hot internally due to chemical reactions within the volcanic material, but its external appearance and behaviour are more akin to wet concrete

Select the correct code:

- a) 1 and 2
- b) 2 only
- c) 2 and 3
- d) 1,2 and 3

Ans D



NEWS :

- Mt. Kanlaon Natural Park on Negros Island, Philippines, witnessed rivers of cold lava following an explosive eruption recently.
- Earlier Cold lava from Mount Marapi (the most active volcano in Sumatra, Indonesia) resulted in the death of more than 40 people, and many went missing.
- Both Mount Kanlaon and Mount Marapi are strato volcanoes situated in the Pacific Ring of Fire.

Formation

- Lahars can occur without volcanic eruptions, often triggered by heavy rainfall or landslides on volcano slopes covered in loose volcanic material.
- Eruptions can also generate lahars by melting snow and ice or through pyroclastic flows.
- Additionally, lake breakout floods caused by volcanic landslides can transform into lahars as they erode and incorporate more debris and water, significantly increasing their volume and destructive power.

About Cold Lava:

- Called "lahar" in Indonesian, cold lava is a phenomenon that occurs when rain mixes with volcanic materials like ash, sand, and pebbles.
- The mixture forms a concrete-like substance that destroys everything in its path.
- Rain can carry cold lava down the slopes of a volcano during an eruption and into the paths of nearby towns or villages.
- Unlike traditional lava flows, which move slowly and give residents time to evacuate, cold lava can advance rapidly, at a speed of hundreds of kilometres per hour, and spread as far away as 60 km from the volcano.
- One of the defining characteristics of cold lava is its ability to pick up additional debris and sediment as it travels downhill.
- This mixture can rapidly increase in volume and destructive potential, transforming from a relatively innocuous flow into a powerful force.

- It is considered more destructive and deadlier compared to regular lava flows.
- Its high density and abrasive nature mean that it can cause significant damage to buildings, bridges, and roads, posing a serious threat to human life and property.
- Cold lava remains hot internally due to chemical reactions within the volcanic material, but its external appearance and behaviour are more akin to wet concrete.
- While it is commonly associated with volcanic eruptions, lahars can also occur when no eruption takes place.

Cold Lava :

- Geological Phenomenon
- called lahar
- Combination of Volcanic debris and water
- flows down the slopes
- Can Flow Rapidly and Having more destructive potential than regular lava
- can form both with and without explosive volcanic activity
- Heavy rains or melting snow can erode loose volcanic sediment, creating a slurry (wet concrete)that flows downhill.
- Cold lava remains hot internally due to chemical reactions within the volcanic material, but its external appearance and behaviour are more akin to wet concrete
- While it is commonly associated with volcanic eruptions, lahars can also occur when no eruption takes place.
- A mud volcano or mud dome is a landform created by the eruption of mud or slurries, water and gases



New Vision IAS Academy
 ...wings to aspirations