# **TECTONIC PLATES**

### **Plate Tectonic Theory**

• Earthquakes are caused along



#### **Conservative Plate Boundaries**

- Boundaries where the two plates slide past each other
- A plate is neither created nor destroyed in this case.
- A large amount of stress is released as the plates move against each other.
- Release of stress leads to shallow-focus intense earthquake.
- Example: San Andreas Fault in California

#### **Divergent Plate Boundaries**

- Boundaries where the two plates move away from each other.
- This is prominent along the oceanic ridges.
- All the plates move along the pole of rotation.
- Rate of movement of the plates is more at the equator and less at the poles.
- Thus rate of divergence of the plates is more at the equator.
- Rate of divergence of the plates is relatively less at the poles.
- These two different rates of movement divide a single plate into many plates.
- Each part of the divided plates will have a relative motion of its own.
- The parts of the plates will have a mutual relative motion.
- This relative motion will be along the conservative plate boundaries.
- Shallow-focus intense earthquakes are caused.

CONSERVATIVE PLATE BOUNDAR









• Conservative plate boundaries come into existence due to plate divergence.

### **Convergent Plate Boundaries**

- Boundaries where the two plates move towards each other.
- Convergence leads to the sinking of the heavier tectonic plate
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- Benioff zone refers to a dipping planar zone of the earthquake that is produced by the interaction of a down-going oceanic crustal plate with a continental plate.
- At the point of subduction the rocks get broken due to compression.
- Reverse Fault refers to the breaking of the rocks due to compression under subduction.
- Shallow-focus earthquakes are caused due to reverse fault.
- The plates slide inside under its own weight due to subduction.
- Normal Fault refers to the fault in which the hanging wall has moved downward relative to the footwall.
- Normal fault results in Intermediate-focus earthquake.
- Upon further subduction compression caused due to the pushing of the plate by the magma results in the breaking of the rocks i.e. Reverse Fault.
- Deep-focus earthquake take place in this case.
- Thus all three types of earthquakes occur along the convergent plate boundaries.
- Plate tectonic theory also explains the distribution of the earthquakes since most of the earthquakes occur along the plate boundaries.
- Example:
  - a) Earthquake occurring along the circum-pacific belt is due to subduction.

b) Earthquake occurring along the mid-Atlantic ridge is due to plate divergence











c) Earthquake occurring along the mid-continental belt is again due to divergence



## Volcanicity

- Refers to the process through which the gases and the molten rocks are either extruded on the earth's surface or intruded into the earth's crust.
- At times the magma solidifies beneath the earth's surface before emerging on to the surface.
- Based on the solidification of magma, it can be of two types:
  - a) one that solidifies on the earth's surface
  - b) one that solidifies beneath the earth's surface
  - Due to the two types of solidifcation of the magma two types of solidifcation are produced

extrusive topography (magma solidifying on the earth's surface)

 intrusive topography (magma solidifying beneath the earth's surface)

## Extrusive Topography

• Can be of two types:

a) Magma may emerge in the form of a fissure flow.b) Magma may emerge from a volcanic pipe.

- Magma emerging in the form of fissure flow mostly occurs along the divergent plate boundaries.
- In this case magma gets derived from the mantle which in turn is made up of the peridotite rocks.
- Peridotite rocks contain relatively less amount of silica and hence the magma containing these rocks are less viscous.



- When the fissure flow occurs along the divergent plate boundaries oceanic ridges and plateaus are formed. Example: Columbia Plateau
- Again if the amount of silica present in the fissure flow is too less it leads to the formation of the planes.
- Magma emerging from a volcanic pipe and forming a volcanic cone is typically found in the case where the plates get subducted.
- Plates are made up of basaltic rocks which are rich in silica.
- Magma which rises after melting these plates are viscous because of the rich amount of silica present
- This magma solidifies and forms a conical shape upon • reaching the earth's surface
- Central cone type volcanoes get formed when the magma rises from the subducted plates and form volcanic arc
- Volcanic arcs can be classified based upon:
  - a) Intensity of eruption
  - b) Activity
  - c) Composition
    - Classification based on the intensity refers to how violent the explosion is.
    - Intensity of eruption depends upon the amount of silica present.
    - Classification based on the activity refers to the frequency of eruption
- Based on the activity, the volcanoes can be classified into:
  - a) Active volcanoes
  - b) Dormant volcanoes
  - c) Extinct volcanoes
    - Active Volcanoes refer to the volcanoes that keep erupting after a period of time. Example: Etna, Strombolian
    - Dormant Volcanoes refer to the volcanoes that erupt after a relatively lengthier period of time. Example: Krakatoa, Fujiyama
    - Extinct Volcanoes refer to the volcanoes that show no sign of eruption in future. 0 Example: Koh-i-Sultan
- Based on the composition:
  - a) Cinder and Ash cone: Cone made up of pyroclastic rocks, dust and ash and devoid of lava.





Increasing intensity

- Vulcanian type

2) Strombolian type

1) Hawaiian type

- 4) Vesuvius type
  - 5) Pelean type



- These cones have a small height. Hence also called Ant's Mount
- They are thoroughly permeable
- b) Basic Lava cone: Cones made up of the magma that contains very less amount of silica.
  - Due to less amount of silica the lava flows and forms plateau.
  - These cones are of smaller height and have gentle slope.
  - These cones are also known as shield cones.
  - Example: Hawaiian Volcano
- c) Acid Lava cone: Cones formed from the magma having a relatively higher amount of silica.
  - Because of a higher amount of silica the magma solidifies and form cones with steep slope.
- d) Composite cones: Cones having alternate layers of lava and pyroclastic material.
  - These cones have the highest height.
  - They are also called Strato cones.
- e) Parasitic cones: Refers to the one-shaped accumulation of volcanic material that is not part of the central vent of a volcano.
  - It gets formed by the eruptions from fractures on the flank of the volcano.



### **Intrusive Topography**

- Refers to the magma solidifying beneath the earth's surface
- The shape of the solidified magma will be the same as the shape of the void in which the magma gets solidified.
- Intrusive topography may be of two type:
  - a) Plutonic
  - b) Hypabyssal
    - Plutonic topography is one in which the magma gets solidified at a greater depth beneath the earth's surface.
    - Hypabyssal topography is one which the magma gets solidified just beneath the earth's surface.

- Hypabyssal topography are more significant since they are exposed on to the surface once the surface material gets weathered away.
- Based on the shape of hypabassal topography:
  a) Sills: Deposition of the Magma is in the form of flat table.

Example: Siberian Plateau

b) Laccolith: Deposition of Magma is in the form of Mushroom.

Example: Bushveld of South Africa





c) Lopolith: Refers to the solidification of the magma in the form of a bowl shaped cavity.



d) Phacolith: Deposition of Magma in the form of anticlines and synclines.



e) Batholith: Deposition of Magma in huge dome shaped style.



f) Dikes: Deposition of the Magma in the form of a wall.

