

PLATE TECTONIC THEORY

Introduction: Plate tectonic theory was derived first by Professor Harry H. Hess of the Princeton University in 1960. After this, the Canadian geophysicist J. Tuzo Wilson, D. P. Mackenzie of Cambridge and Parker of America and W. J. Morgan of the Princeton University had also presented their own view on this theory in 1965, 1967 and 1968 respectively.

The theory of plate tectonics is the most significant because it solved several geological and geomorphical incidents like mountain buildings, volcanic eruption and earthquake etc.

Bases of Plate tectonic theory: This theory is based on the following bases:-

i. Concept of Plate: - The earth's crust is made of several rigid and solid masses are called plates. The width of these plates is 100 to 150 Km approx. There are numerous plates on the earth are identified. The earth's crust is divided into six major and twenty minor plates which named are following -

a. Major Plates

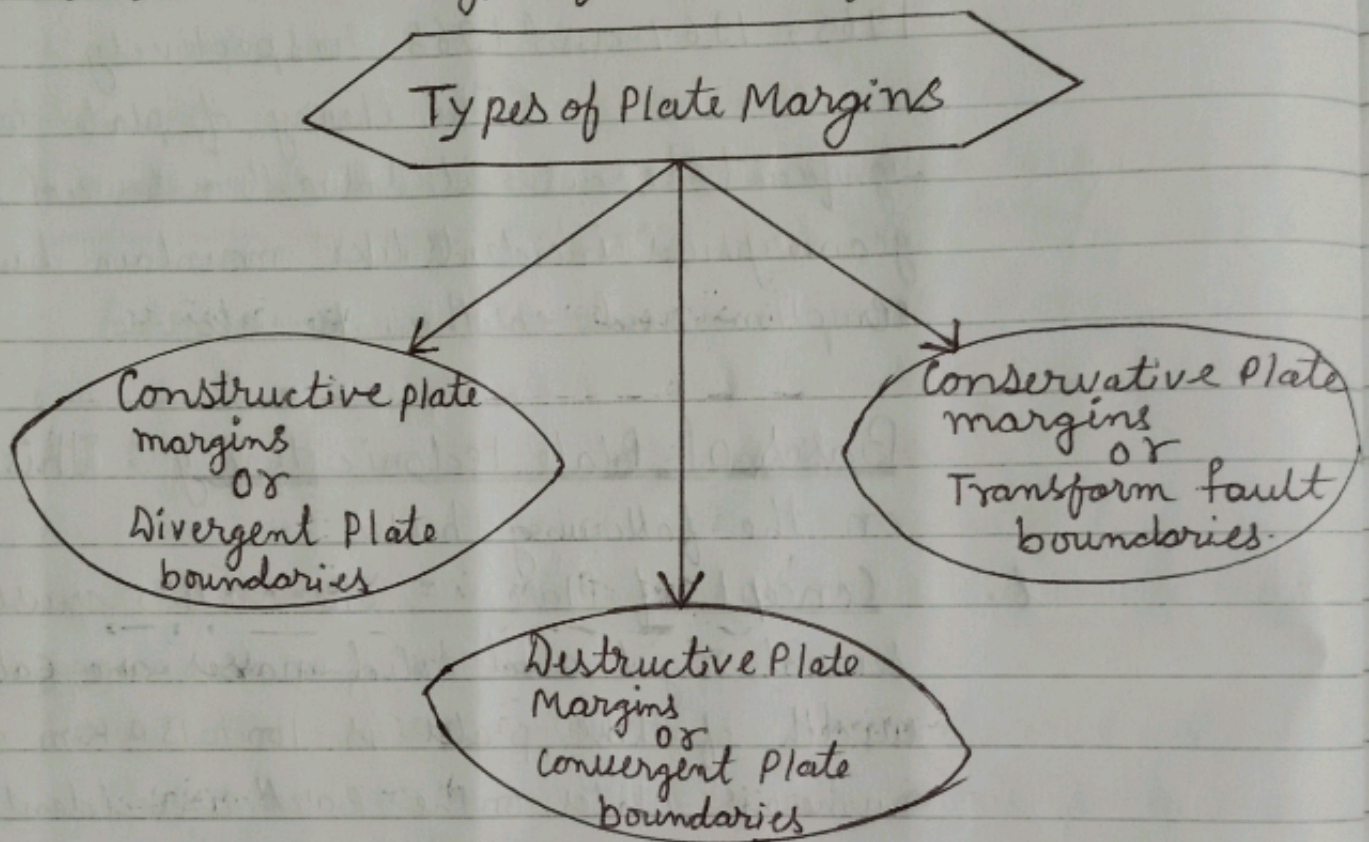
- (i) Indian Plate
- (ii) Pacific Plate
- (iii) American Plate
- (iv) African Plate
- (v) Eurasian Plate
- (vi) Antarctica Plate

b. Minor Plates

- (i) Arabian Plate
- (ii) Philippines Plate
- (iii) Cocos Plate
- (iv) Caribbean Plate
- (v) Nazca Plate
- (vi) Scotia Plate, etc.

ii. Concept related to the nature of Plates: - All plates have mobility. On a mobile plate, all its parts moves through a

Small circle path along the axis of ~~rotation~~ rotation.
 Sometimes it diverges to from each other and
 Sometimes it converges to each other due to mobility.
 So, all tectonics activities occur along the plate margins.
 Therefore, the discussion about plate margin is very important.
 There are three types of Plate margin.



1. Constructive Plate Margins :- When two plates move along a line in two opposite directions, then it is called constructive plate margins because divergent movement of plates results in volcanic activity of fissure flow of basaltic magma, which creates new oceanic crusts, submarine ridges and ridges, etc. The American and African plates come in this group.
2. Destructive Plate Margin :- When two plates move towards each other and collide, then the leading edge of the lighter plate over-rides the denser plate and as such the

denser plate is subducted into upper mantle where it is lost. Hence, this convergent plate boundaries are called destructive plate margin. The American and the Pacific plates come into this category.

3. Conservative Plate Margin :- When two plates slide past each other along transform faults, these are called conservative plate margin because crust is neither created nor destroyed. They create transform faults which move almost parallel to the direction of plate motion.

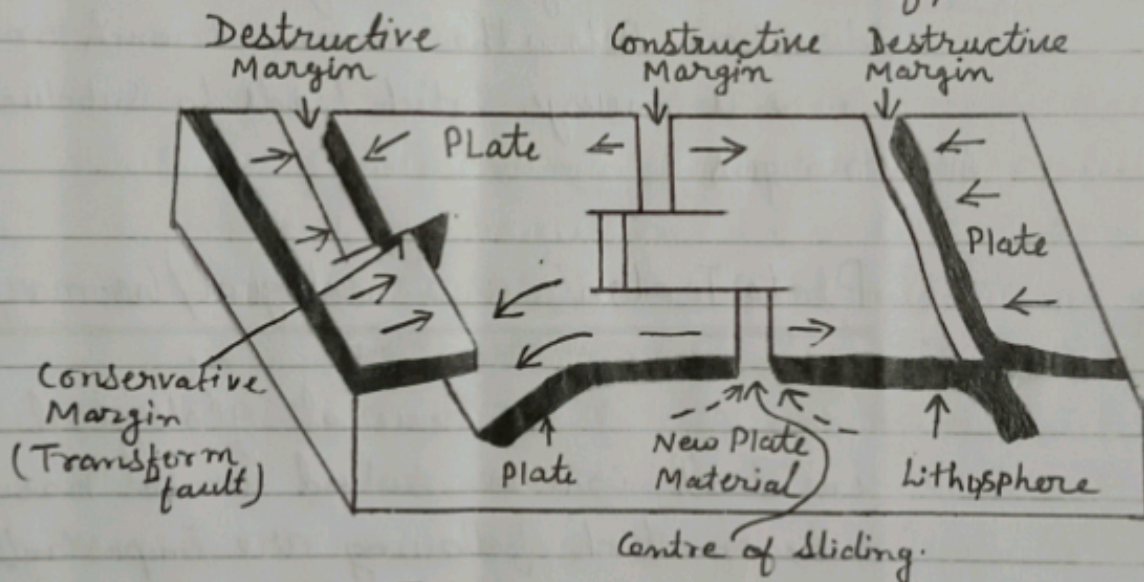
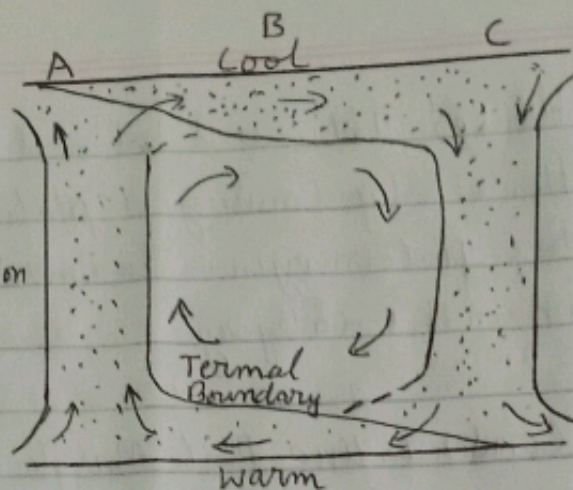


FIG. Types of plate margins

iii. Concept of Plate Motion :- The movement of plates is the most important characteristic of it. All plates are continuously mobile in relation to each other with varying rates. Although, there is no unanimity among scientists about the possible causes of plate motion, but Lord Rayleigh and I. G. Bragg like geologists has tried to explain the plate motion on the basis of A. Holmes' convection currents theory.

Fig:- Thermal convection
Process and formation
of plate.

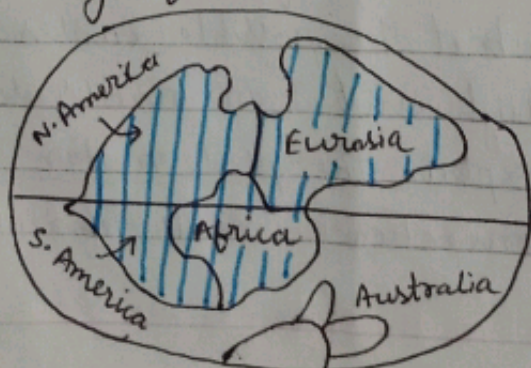


According to this concept, when the hot convectional currents reaches the upper surface, it tends to diverge laterally. The plate ^{then} move in opposite directions. Below the oceanic trench or canyon, horizontal currents converge which leads to subduction of plate margins.

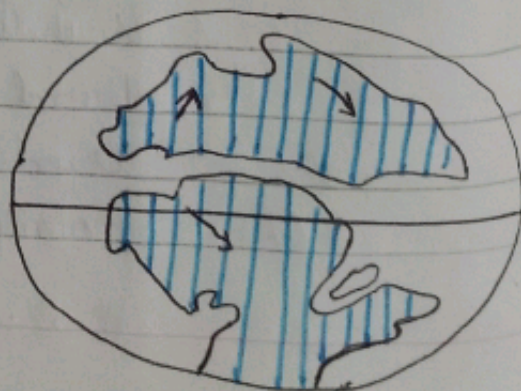
Plate Tectonic and Geological/geomorphic Process

Several geological and geomorphic incidents can be solved on the basis of plate tectonic, in which following are important:-

- A. Plate Tectonic and Continental Drift \Rightarrow Plate tectonic theory is very helpful to solve the complexity of continental drift. There are several evidences of opening and closing of seas and oceans.



1.



2.

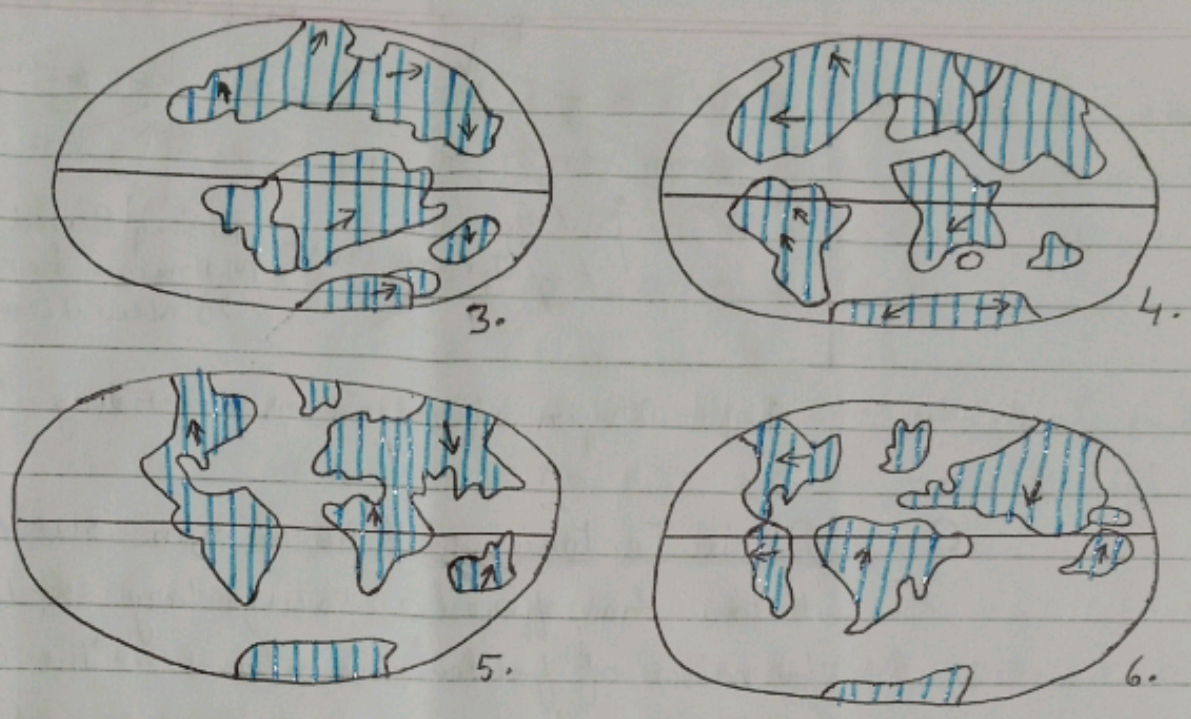


Fig: The evolution of the continents and ocean basins on the basis of plate tectonics since Triassic period and the probable future pattern of events upto 50 million years hence. 1. Triassic Period - 200 million years ago, 2. Late triassic period - 180 m.y. ago, 3. Late Jurassic period - 135 m.y. ago, 4. Late Cretaceous period - 65 m.y. ago. 5. Present position, 6. 50 m.y. hence.

In presently, the Pacific Ocean is continuously being contracted in its size due to westward drift of the American plate. On the other hand the Gulf of Aden is spreading at the rate of 1.8 to 2.2 cm per year.

B. Plate Tectonic and Volcanicity :- Mostly, the belts of earthquake and volcanoes in the world are situated along the plate margins. In fact, the delimitation of plates is based on earthquake's belts. Hence, plate tectonic theory is very useful to solve this types of problems.

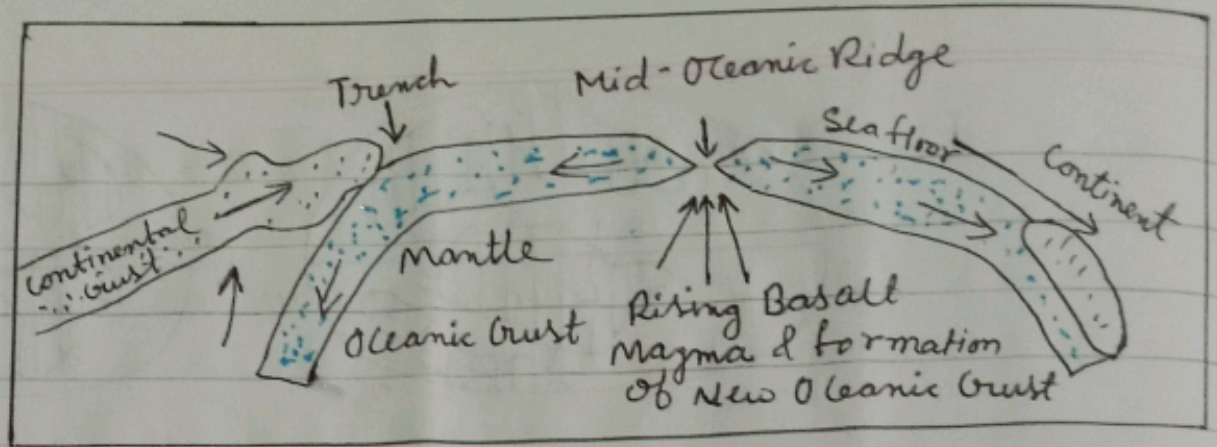


Fig: - Origin of volcanoes according to plate tectonics.

- C. Plate Tectonic and Mountain Building :- Plate tectonic has offered a satisfactory explanation of the formation of folded mountains. The convergence of plate boundaries occurs in three situations which are following -
- i. Convergence of two continental plate :- When two continental plates come closer to each other, then they are likely to collide. As a result, the denser plate is subducted below the lighter plate. The Alps and the Himalayas were formed in this manner.
 - ii. Convergence of continental & oceanic plate :- When the continental and oceanic plates mutually collide, a part of the denser oceanic plate subducts under the lighter continental plate. Mountains are then formed due to compression in the sediments deposited along the continental shelves. The Rockies & the Andes were formed in this manner.
 - iii. Convergence of Oceanic plates :- When two oceanic plates collide, one of them subducts below the other. The compressional force produced in this process causes the formation of mountains in the island festoons and

island arcs. The Japanese Alps, Phillipine Arc and Meriana Arc have been produced in this manner.

Criticism against plate tectonic theory.

- (i). Sometime, the evidence of movement of one plate in to two other direction at same time is found which is impossible.
- (ii). It can't say definitely that each plate works as a unit.
- (iii). Plate tectonic is not success to find the cause of formation of mountain building. like, Easter Highland of Australia, Dakenberg of South Africa and Siara Delmar of Brazil. These are not related to this theory.

In conclusion, instead of these criticism this is truth that this theory is very scientific and revolutionary because several unexplained geological incidents, can be solved on the basis of plate tectonics.

The end.