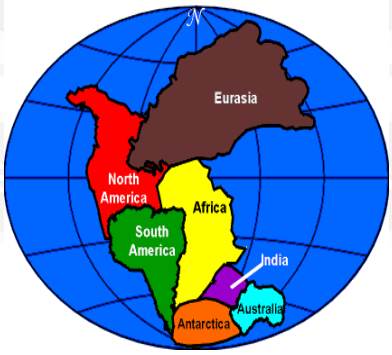
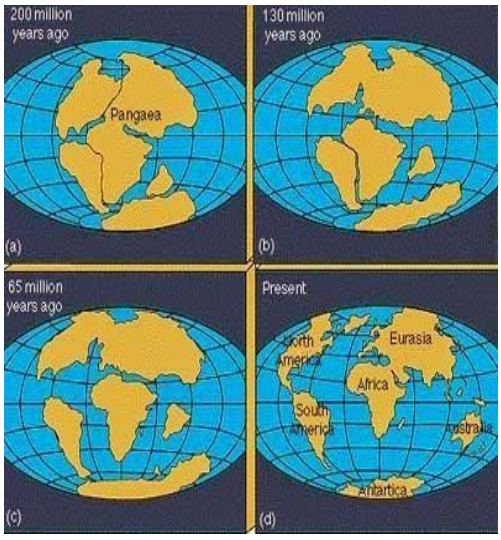
1.7 PLATE TECTONICS

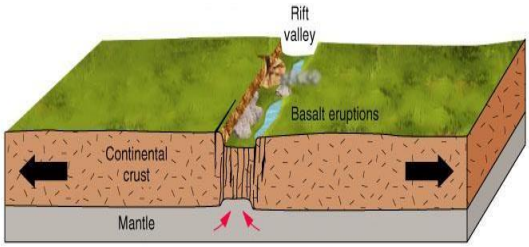
According to this theory, the earth's outer strong layer called lithosphere extending to a depth of 150-200km is divided into several rigid plates. These plates have been in gradual shifting W.R.to each other are called tectonic plates.

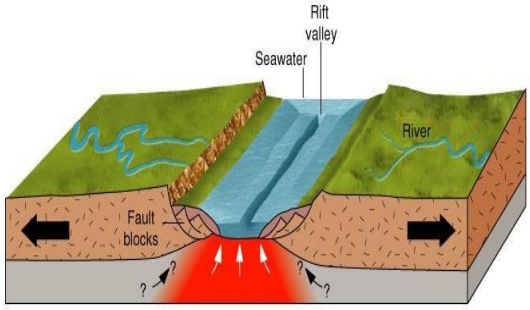
The theory of plate tectonics provides explanations for the past and present day tectonic behaviours of the Earth, particularly the global distribution of mountains seismicity, and volcanism in a series of linear bells, seafloor spreading, polar wandering and continental drift. From several lines of thought and evidences it is learnt that all of the natural phenomena of the earth might be the result of a single basic mechanism, i.e., convection in the mantle.

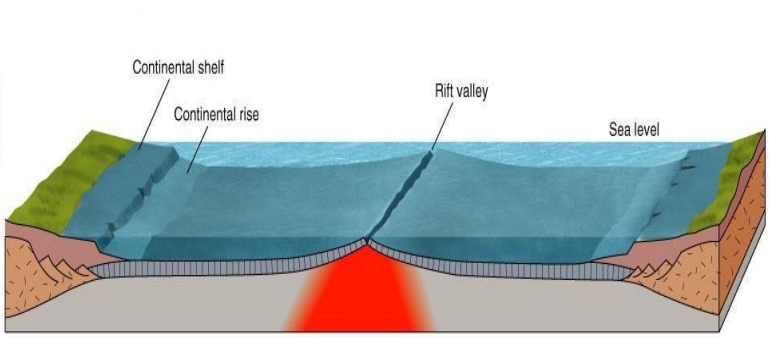
- The theory of plate tectonics supposes that the sphere of the earth is made up of 7 major and several minor plates which are in constant motion relative to each other.
- The motion of the plates refer to the rigid slabs of the continental and oceanic crust that slides over the plastic zone of asthenosphere of the upper mantle
- A fractures egg shell forms a good analogy to the spherical plates of the earth. These plates are bounded by active linear zones causing volcanism and earthquakes.











Elements of Tectonism

- Seismology permitted an insight into the Earth. As per the seismic data the Earth is composed of a few layers of different composition, density and physical nature.
- The earth consists of three Principal layers, namely crust, mantel and Core.
- Crust is divisible into oceanic and continental crust. The earth's movements involve the upper mantle also in the upper mantle is a layer called low velocity zone which behaves like a fluid. Thus it possesses a plastic flow. The layer is also known as asthenosphere.
- Continental Crust, Oceanic crust and a part of upper mantle constitute a plate which a rigid part of the lithosphere.

- Plates overlie the asthenosphere. Any movement in the underlying asthenosphere affects the plates.

Characteristics of Plates

- A Plate consists of crust and a part of upper mantle.
- Size and Shape of the plates are not constant.
- One large plate may be fragmented into many small plates, many unit to form a large one.
- Plates are spherical of curved and are independent.
- Thickness of plates varies. It is 70 km beneath oceans and 150 km beneath continents.
- Plates are bounded by different boundaries distinguished by the relative motion of the adjacent plates.
- Plates are enclosed by Features like mid-oceanic ridges, oceanic trenches great faults and fold mountain belts.
- The length of the boundary is variable.
- Plates move with respect to each other and to the axis of rotation.
- Plates move with different velocity and in different directions. Even different parts of the same plate move at different velocities.
- Plate margins are subject to deformation .but interior of the plate is free from deformation.
- Plates bearing continental crust will not be consumed at the boundaries.
- Plates and boundaries are not permanent features.

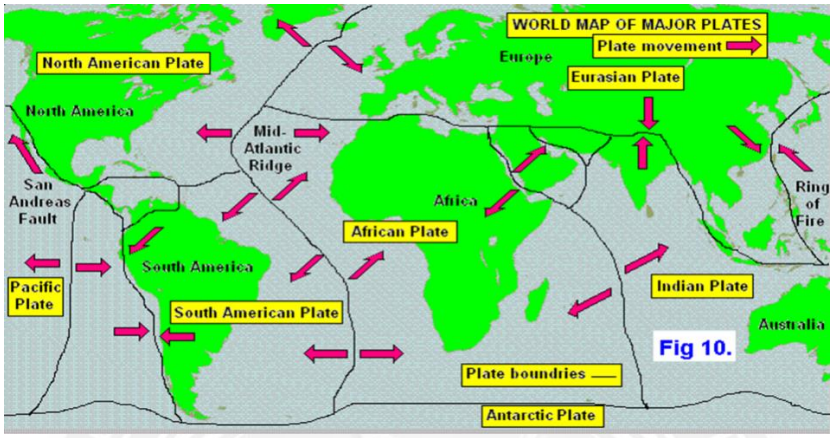
World Plates

Geographical plates of the Earth are recognized as follows. Seven plates are larger and many others are smaller.

Major plates:-

1. The Pacific Plate
2. The North American Plate
3. The South American Plate

4. The African Plate
5. The Antarctic Plate
6. The Indian (Australians) Plate
7. The European/Eurasian Plate



Minor plates:-

1. China Plate
2. Philippine Plate
3. Arabian Plate
4. Iran Plate
5. Nazca Plate
6. Cocos Plate
7. Caribbean Plate
8. Scotia Plate

The collusion may occur in following

1. Two Oceanic Plates
2. One Oceanic & One Continental Plate
3. Two Continental Plate

Plate Boundaries

The surficial trace of the zone of motion is known as plate boundary. The end of the plate is called plate margin. Figure 20.2 shows the boundary and the margin. There are three types of plate boundaries. These are recognized on the basis of the movement associated with the plate junctions.

Theory of Tectonic plate boundary

1. The Diverging plate boundaries
2. The converging plate boundaries
3. The transform fault boundaries

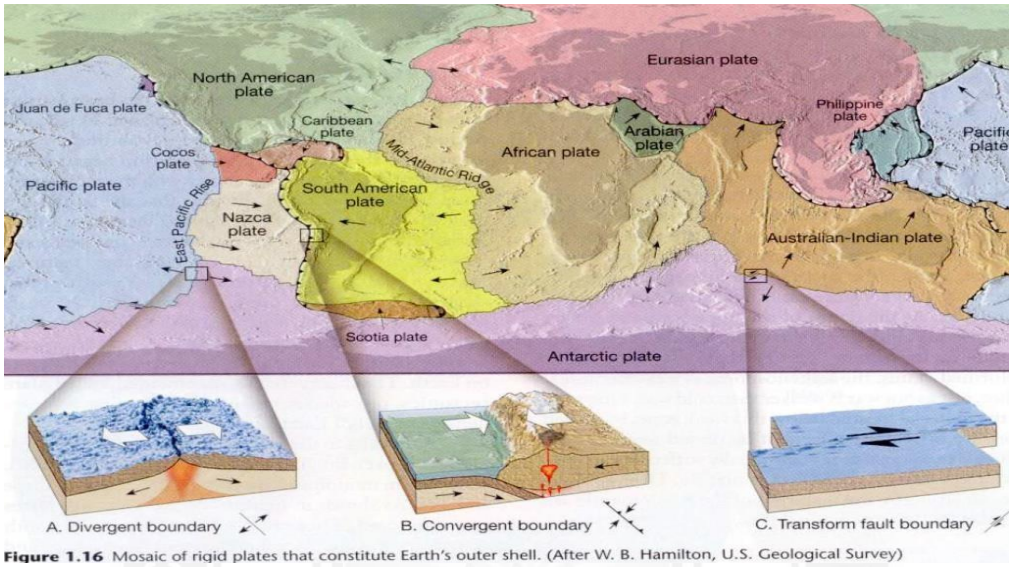


Figure 1.16 Mosaic of rigid plates that constitute Earth's outer shell. (After W. B. Hamilton, U.S. Geological Survey)

The Diverging Plate boundaries

Long the middle of the ocean floor their rises a ridge with a central 'V' shaped valley. The boundary line that separates the two plates runs along the valley bottom. Materials of the two flanks of these mid oceanic ridges move away from each other. This boundary is known as divergent boundary as the plates diverge with reference to the boundary line. But they are never separated. Because new material is poured out continuously and is accreted to the moving plate margins material is symmetrically divided into two halves and mobilised. The symmetry may be produced in this way: A new ribbon of material is added to the margins of separating plates. The rigidity of the material is lower and lower as the centre of the ribbon is approached. Splitting may occur along the line of weak zone. Thus when the ribbon is subjected to tensional forces (because of the mobile plates) it is broken symmetrically as the plane of weakness occupies the central part of the ribbon.

Eg:-

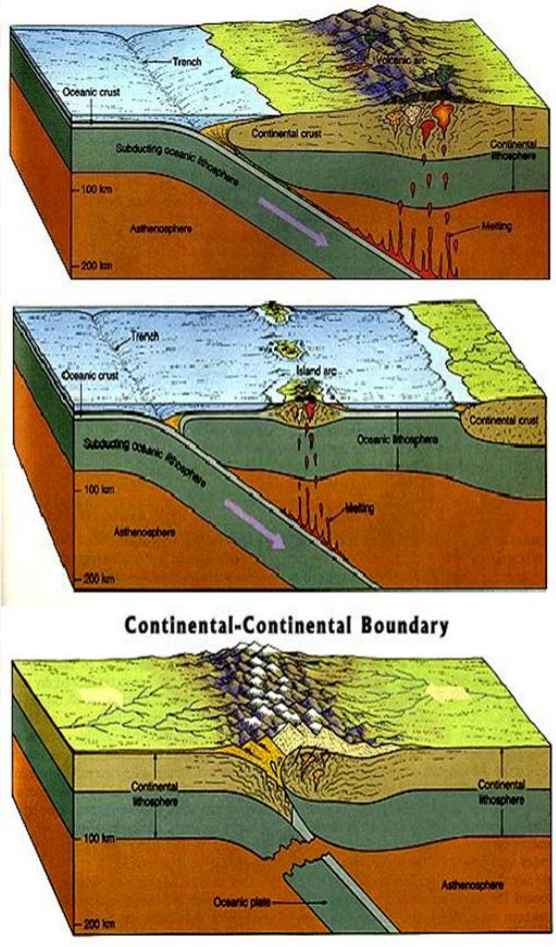
- NA plate VI Eurasian plate.
- Formation of mid Atlantic ridge encircling the globe Arctic Ocean to South Africa.

- Two plates are pulling away from each other.

The Convergent plate boundaries

This boundary is developed as two plates converge towards each other and thus it is known as Convergent boundary. Since land area is lost along this type of boundary, it is known as destructive boundary. For the reason that the material is being sunken at these boundaries they are also known as sinks. Convergent Boundaries are marked by deep sea trenches and fold mountain belts. They may be located along the northern and western border of the Pacific forming Aleutian trench, Japan Trench and Tonga trench and Tonga trench, Western continent slope of the South America forming Eru-Chile trench, Himalayas f India, Mediterranean trench and java trench.

Formation of Himalayas due to convergent movement of plates.

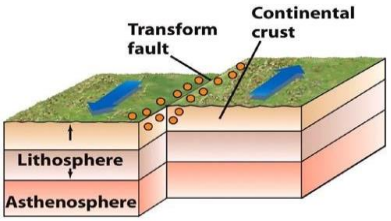


The Transform boundaries

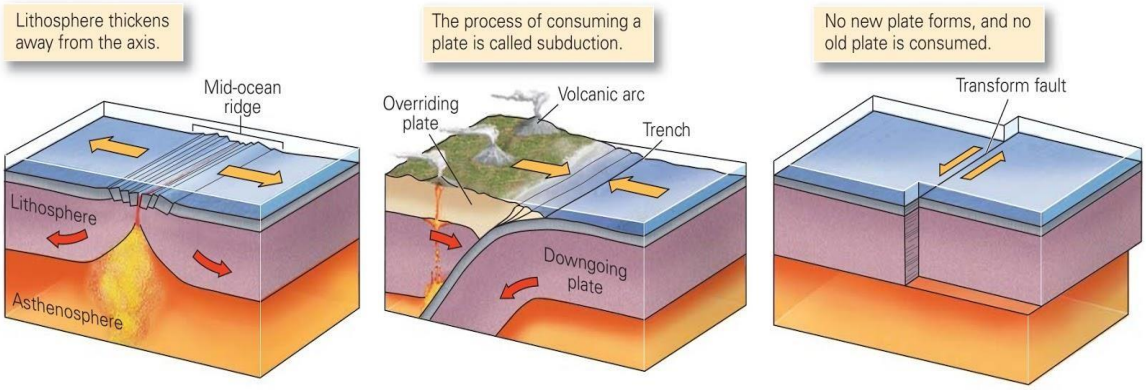
1. Sliding motion of plate, along transform fault boundary.
2. The zones where adjoining plates slide apart each other in a horizontal direction.

Eg:-

California-Transform fault.



TRANSFORM FAULT BOUNDARY



(a) At a divergent boundary, two plates move away from the axis of a mid-ocean ridge. New oceanic lithosphere forms.

(b) At a convergent boundary, two plates move toward each other; the downgoing plate sinks beneath the overriding plate.

(c) At a transform boundary, two plates slide past each other on a vertical fault surface.