

Continental Drift Theory

[UPSC Notes]

Continental Drift Theory deals with the distribution of the oceans and the continents. For millions of years, all the land of Earth was joined together in a supercontinent, which is known as Pangaea. But about 200 million years ago, the land started to drift apart and broke into two pieces. These large two pieces continued to break apart into smaller continents that are seen today, and scientists called it movement 'continental drift'.

Continental Drift Theory UPSC Notes would cover all the related facts and information related to the Continental Drift Theory. It would surely help the candidates to cover this topic in the Geography section and make their preparation rock-solid.

Objective of Continental Drift Theory

- Alfred Wegener a German meteorologist propounded his concept of continental drift in 1912. In 1922 he elaborated his concept in a book entitled 'Die Entstehung de Kontinente and Ozeane' which was translated into English in 1924.
- The prime objective of Wegener for postulating his drift theory was to explain major climatic changes which have occurred in the past geological history of the earth, such as Carboniferous glaciation
- There could be two possible explanations for the climatic changes that happened (1) If the continents stayed fixed in their locations and the climatic zones changed from one region to another (2) If the climatic zones remained stationary, and the continents drifted. Wegener agreed with the second alternative

Basic Premise of the Continental Drift Theory

- Alfred Wegener followed the idea of three layers system of the earth -.the outer layer of 'sial', an intermediate layer of 'sima', and the lower layer of nife. According to Wegener sial was restricted to the continental masses only while the ocean crust was represented by the upper part of sima. Continents or sialic masses were floating on sima without any resistance offered by sima.
- Wegener argued that all the landmasses were united together in the form of one landmass, which he named **Pangaea**. Pangea was surrounded by a huge water body, which was named '**Panthalassa**'.
- Around 200 million years ago Pangaea started splitting and broke down into two large continental masses **Laurasia and Gondwanaland** forming the northern and southern components respectively.
- Later, **Gondwanaland and Laurasia** continued to break into several smaller landmasses and broken landmasses drifted away from each other and the present position of the continents and ocean basins became possible.

Evidence in Support of The Continental Drift Theory

The Matching of Continents (Jig-Saw-Fit)

- The opposing coastlines of the Atlantic can be fitted together in the same manner that two cut off pieces of wood can be refitted
- The coastlines of South America and Africa show a remarkable and unique match.
- In 1964, Bullard created a map using a computer program to find the right fit of the Atlantic margin and it proved to be quiet.

Rocks of the Same Age across the Oceans

- The radiometric dating methods have helped in correlating the formation of rocks present in different continents across the ocean.
- Geological evidence shows that mountain systems of the western and eastern coastal areas of the Atlantic are similar and identical
- The Appalachians of North America are compatible with the mountain systems of Ireland, Wales, and north-western Europe.
- The ancient rock belts on the coast of Brazil match with those found in Western Africa.
- The old marine deposits found on the coasts of South America and Africa belong to the Jurassic Age. This implies that the ocean never existed before that time.

Tillite

- It is a sedimentary rock made from glacier deposits.
- The Gondwana system of sediments from India is recognized as having its counterparts in 6 different landmasses in the Southern Hemisphere.
- Generally, the similarity of the Gondwana-type sediments shows that these landmasses had exceptionally similar origins.
- The glacial tillite gives clear evidence for palaeoclimates and the drifting of continents.

Placer Deposits

- The presence of abundant placer deposits of gold along the Ghana coast and the complete lack of its source rocks in the area is a phenomenal fact.
- The gold-bearing veins are present in Brazil and it is evident that the gold deposits of Ghana in Africa are obtained from the Brazil plateau from the time when the two continents were beside each other.

Distribution of Fossils

- The interpretations that Lemurs occur in India, Africa, and Madagascar led to the theory of a landmass named "Lemuria" connecting these 3 landmasses.
- Glossopteris flora distribution in India, South Africa, Australia, Antarctica, Falkland Islands, etc shows fact that all the landmasses were once connected and continuous in the form of Pangaea.
- The fossils and vegetative remains discovered on the eastern coast of South America and the western coast of Africa are strikingly similar.
- Mesosaurus was a tiny reptile adapted to shallow brackish water. The skeletons of these creatures are found in the Traver formations of Brazil and the Southern Cape Province of South Africa.

Force for Drifting

- According to Wegener the continents after breaking away from the **Panagaea** drifted in two directions (1) equatorward and (2) westward
- The equatorward movement of continental blocks was due to gravitational differential force and force of buoyancy.

- The westward movement of the continents was caused by the tidal force of the sun and the moon. The attractional force of the sun and the moon dragged the continental blocks over the interior of the earth, towards the west

Evaluation of the Continental Drift Theory

Criticism faced by Continental Drift Theory:

- Forces given by Wegener (differential gravitational force and the force of buoyancy and tidal force of the sun and the moon) are insufficient to drift the continents so apart.
- Modern theories (Plate Tectonics) reject the concept of sialic masses (continents) freely floating over sima.
- The concept 'jig-saw fit' cannot be validated as both the coasts of the Atlantic Ocean cannot be completely refitted.
- Wegner has not described the situations of pre-Carboniferous times.
- Similar vegetation is also found in unrelated parts of the world and thus they need not be linked in the past.

Despite the fact that most points of Wegener's continental drift theory were disapproved its central theme of horizontal displacement remained retained. In fact, Wegener's continental drift theory resulted in the postulation of plate tectonic theory after 1960.