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Plate Tectonic Theory

The theory of Plate Tectonics was proposed by Morgan in 1967 by taking some attributes from some previous theories of Continental Displacement, thermal convection currents, & sea floor spreading. The theory is regarded as the most pragmatic & highly accomplished theory of geomorphology that able to substantiate the mechanism of endogenic forces & formation of several relief features over the surface of Earth. It is also a reformatory theory, able to overcome the limitations of its predecessor theory & based on 4 general geomorphological assumptions:-

- 1) The layer of lithosphere is segregated into some vertical plates slabs called as Plates, horizontally propagating over semi-molten asthenes or asthenosphere or magma. Their propagation is regarded as Tectonics. There are total 8 major & (20-22) smaller plates doing tectonics over semi-molten

astratosphere.

- 2) The movement of these plates over semi-molten magma depends on the direction & impulsive action of thermal convection current. Subsequently either plates are converging or diverging with respect to each other.
- 3) By the regular convergence or divergence of plates, the formation of new crust takes place over the surface of earth & at the same time the crust also get disintegrated. The rate of formation & disintegration of crust has acquired a profile of equilibrium by which the surface area of earth remain constant.
- 4) According to this theory, the continental plate is also ^{extended} extending over semi molten - asthenosphere. It means there is no complete segregation between the continental & the oceanic lithospheric blocks.
In this regard, the Plate tectonic theory

rejects the basic argument of continental drift theory that Continent SIAL & Oceanic SIMA are two different blocks.

Mechanism of Plate Tectonic Theory →

The theory of Plate Tectonic accepts the basic notion of continental drift theory that during Carboniferous period (200 ml. years ago) all the continental blocks were united together as a Super-continent of PANGEA surrounded by the watermass of PANthalasa. The disruption in PANGEA & evolution of 1st order relief features had taken place by the impulsive action of Thermal convection current. Basically, the mechanism of Plate Tectonic Theory depends on the phenomenon of Divergence & convergence.

Divergence of Plates →

Convection current originating from the boundary of mantle & core & diverging along the boundary of mantle & crust creates a long-fault

line in the slab of lithosphere. The fault becomes much more wider by divergence of plates & propagation of thermal convection current in different direction. Subsequently, the magma of asthenosphere move ~~up~~ along the fault line & erupt over the fault line as silent volcano to develop some physical features like new crust, sea mount, ridges, islands, low magnitude earthquake over the surface of earth.

This particular phenomenon of divergence is taking place in the central basins of Pacific & Atlantic Ocean. Subsequently, a long fault line in North-South direction also prevails in oceanic lithosphere along with which silent type of volcanic eruption regularly takes place with the occurrence of low magnitude earthquakes. By this resultant phenomenon the formation of mid-Pacific & mid-Atlantic ridges has also taken place over the fault line in the central basins of respective

Oceans in which the two plates diverges. It should be noted that by this resultant phenomenon of divergence the lithosphere of pacific ocean also gets segregated into the major plate of Pacific ocean & minor plates like Juan De Fuca, Cocos & Nazca plates. All these major & minor plates are diverging along the fault line in opposite direction.

The theory also provides evidences that during carboniferous period the plate of Africa was linked with the continental block of South America & the block of Eurasia was connected with the plate of North America. It should be noted that the physical locations of hotspots between the 2 plates & divergence of thermal convection currents along the boundary of mantle & crust able to segregate these plates into smaller continental columns. Subsequently, a long fault line develops, along which the semi molten magma upwells. Silen type of volcanic eruption starts & formation of new crust & several

Relief features like mid-Atlantic ridge had taken place in North-South direction. In the course of time, by the divergence of seafloor spreading plates, an intervening space was created between them which was filled by the water mass of Panthalassa. As a result the evolution of S shaped Atlantic Ocean had taken place between the diverging blocks of Pangea.

Convergence of Plates →

• Convergence of Continental-Oceanic Plate →

According to the theory of Plate Tectonic, when two plates of contrasting nature, density & different base level converges with each other under the impulsive action of thermal convection currents, then the subduction of much more denser oceanic plate would take place within continental lithosphere. The zone of convergence & subduction is characterised by

the presence of a depression between the adjoining plates below the sea level called as TRENCH. At the same time, in the zone of convergence where the 2 plates are colliding, the composition of rocks become weaker to create some fault lines & bring high magnitude earthquakes over the surface.

It should be noted that within the zone of subduction there could be a region where the frequency of earthquakes remains very high, that region is regarded as

Zone of BENI OFF.

Regular convergence of respective plates would lead to the increase in intensity of compressional force along the boundaries of contrasting plates, By regular convergence & compression, more bending of continental crust takes place along the margin to uplift the surface as young Fold mountains. It means the formation & upliftment of fold mountains having anticlines & synclines would take place at the margins of non-subducting continental plates. ☺

By regular compression & convergence, when the subducting oceanic plate enters

in the zone of asthenosphere below continental lithosphere, then the melting of oceanic rocks would take place to increase the volume of magma below continental plates. Now this semi-molten magma containing fragments of different size & trapped gases upwell against gravity to produce tremendous amount of hydraulic pressure over the non-subducting continental plate. In the course of time, it breaks & blow down the thinner crust of continent & erupts over the surface of earth with explosion to develop some volcanic relief features like mountain & plateaus over the surface of continental plate. It should be noted that the upliftment & formation of both fold & volcanic mountains, takes place over the surface of continental plate & the physical location of volcanic mountains remain behind the young fold mountains.

This particular type of convergence between the contrasting plates is taking place between the minor oceanic plates of Juan de Fuca, Cocos & Nazca & continental North & South American plates. By this ~~mean~~ resultant phenomenon, the upliftment of young fold mountains like Rockies & Andes, had taken place at the margins of continental plates & the formation of several trenches like Peru, Chile, Alaska etc. had taken place in the zone of subduction.

Apart from these, explosive type of volcanic eruption is also very much acknowledged over the surface of non-subducting continental plate by which there is a presence of approx. 30 active volcanoes along the margin of Pacific Ocean.

Volcanic mountains like Mount Rainier, Shasta, Hood, Albert, Nareda, Cotopaxi, Chimborazo, Aconcagua, etc. are located behind the young fold mountains of Rockies & Andes. At the same time, high magnitude earthquakes are also observed in the zone of Benioff located

at the boundary of converging plates.

• Continental-Continental Plate Convergence :
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According to this theory, when 2 plates of same nature, level of density converges with each other there would be no possibility of subduction, trench formation & volcanic eruption. However, if an oceanic plate lies ^{physically} between continental blocks then every tectonic & geomorphological activity could take place between the respective plates. It should be noted that this particular type of convergence is taking place between propagating blocks ^A of Gondwana land i.e.

the plates of Africa, Arabia, India, Australia & huge continental block of Angara land i.e. the plate of Eurasia. The subsequent phenomenon of plate tectonics uplifted the landmasses along the margin of respective plates to evolve the young

fold mountains like Atlas, Alps, Carpathian
Tauras, Hindu Kush, Himalayans, Elburz.
Elburz in west-east direction.