

# Dynamic Surface of the Earth

Lesson No.	Title	Activity
3	Dynamic Surface of the Earth	Make a list of five most destructive earthquakes occurred in India.

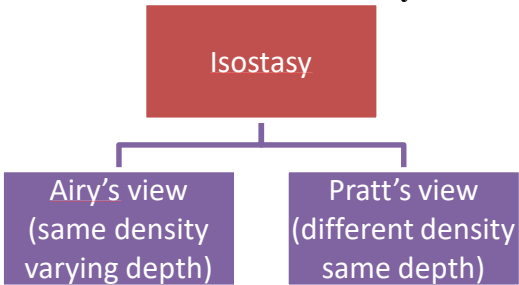
## Meaning

The type and density of rocks of the crust are variable. The surface features are dynamic in character. This dynamism is due to two forces — endogenetic and exogenetic. Endogenetic forces are those which are caused from below the surface. Due to this, an area may get elevated or gets submerged. These forces try to make the surface irregular while exogenetic forces are those which operate from above the surface. They try to eliminate the irregularities of the surface through the process of denudation.

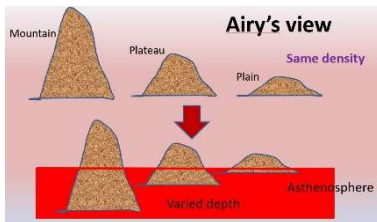
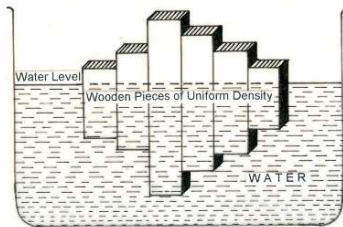
## Concept of Isostasy

- Derived from Greek word- **Isostasios** mean state of being in balance.
- There is great difference in height of earth's features.
- Earth's rotation keeps perfect balance among its features, therefore it is in isostatic equilibrium.

## Isostatic Balance: Views of Airy

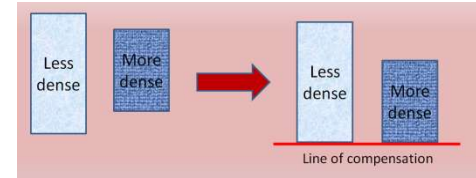


- As per Airy's view density of different columns are same.
- He proposed the idea of Uniform density with varying thickness.
- Assumed that Sialic crust is floating over Sima and land forms are with same density but varying depth.
- To prove his view, he used wooden blocks of same density with varying depth and immersed in water.
- They get immersed differently in proportion to their sizes.

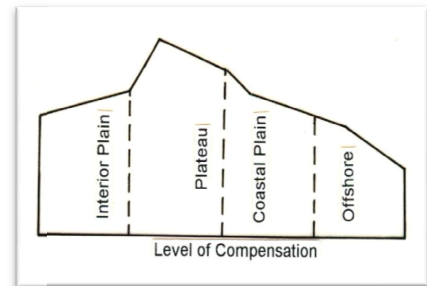


## Isostatic Balance: Views of Pratt

- Considered land blocks of various heights with different density.
- Taller landmass has lower density while shorter landmasses are denser.



- An inverse relationship between height & density.
- A line is being demarcated above which equal pressure with varying heights.

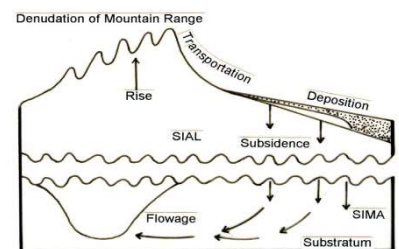


## Differences between the views of Airy and Pratt

Airy's views	Pratt's view
<ol style="list-style-type: none"> <li>1. Uniform density of crustal material</li> <li>2. Varying depth upto which root penetrates</li> <li>3. Deeper root below mountain and smaller beneath plain</li> </ol>	<ul style="list-style-type: none"> <li>• Varying density of crustal material</li> <li>• Uniform depth upto which crustal material reaches</li> <li>• No root formation but, a level of Compensation</li> </ul>

## Global Isostatic Adjustment

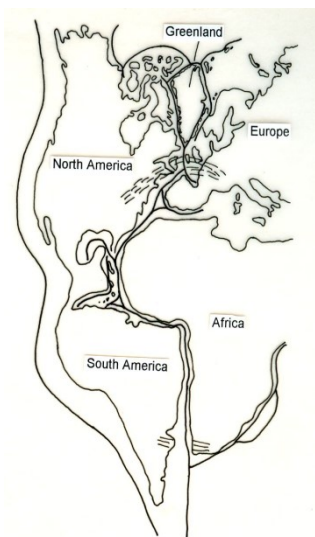
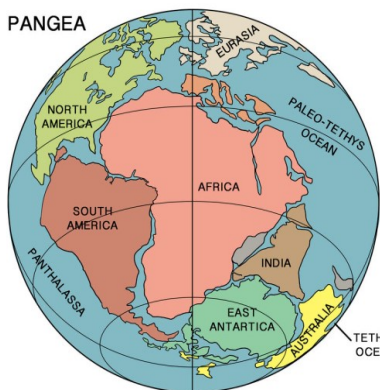
- No complete isostatic balance as Earth is unstable.
- Endogenetic forces often disturb crustal balance by regular earthquakes & volcanic eruptions.



- Nature always tries to make an isostatic adjustment.
- Exogenetic forces eliminate differences on earth's surface and in this way isostatic balance maintained.

### Continental Drift

- Alfred Wegener said that entire landmass of globe was together (280 million years ago) and called Pangea (a super continent) surrounded by huge water body - Panthalasa.
- Pangea broken latitudinally around 280-150 million years ago in Laurasia/Angaraland and Gondwanaland.



Both of them drifted away → shallow sea emerged in between (water from Panthalasa) → Tethys sea.

### Evidence of Drift

- Jig-saw-fit- Eastern coast of South America – identical - Western coast of Africa.
- **Geological similarities**- Mountain systems of Southern Atlantic coast S. America & Africa - similarity
- **Coal and Vegetation evidences**- Distribution of coal and

vegetation- S. America, Africa, India & Australia

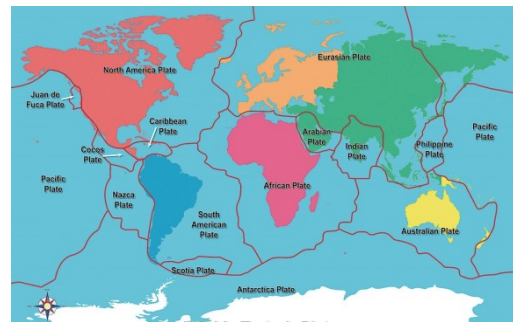
- **Evidences from paleomagnetism**- Paleomagnetism- study of direction of pole through ages
- **Sea floor spreading**- Along the mid Atlantic ridge- magma comes out at sea bed → solidified → New zone is formed

### Plate Tectonics

- Lithosphere is broken into several blocks called Plates.
- There are seven major plates moving over asthenosphere.

### Major Plates

- Eurasian
- African
- Indo-Australian
- Pacific
- North American
- South American
- Antarctic

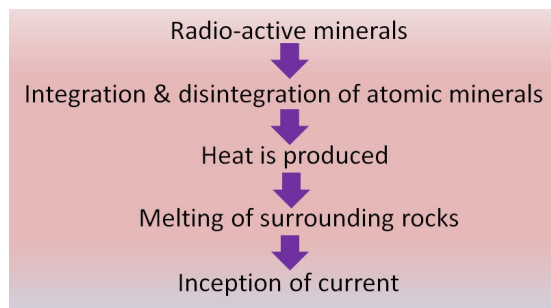


### Minor plates (20)

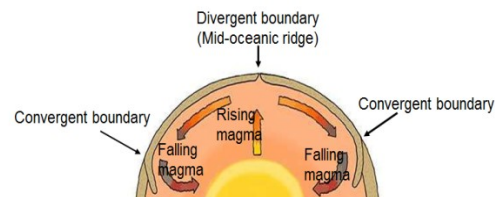
Arabian plate, Philippine plate, Cocos plate, Nazca plate, Caribbean plate, Scotia plate etc.

### Mechanism of Plate Tectonics

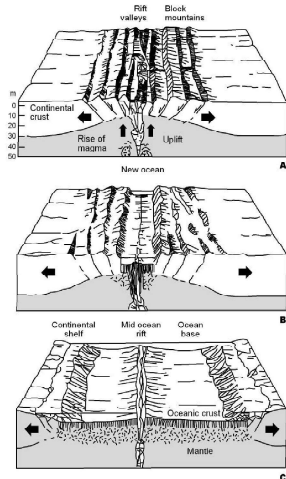
- British geologist Arthur Holmes proposed that Convictional currents exist underneath lithosphere in average depth of 100 - 250 km.



- Two types of currents- Rising (divergence activities) and Falling (convergence activities)

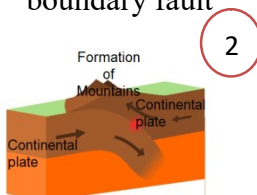
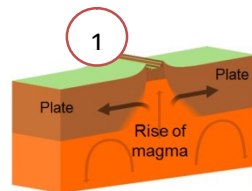


- Rising convectional current → transport of hot & viscous matter – upwardly → till about 100 kms below the surface Current gets diverged → split into upper part → molten material penetrates into split creating new surface
- 2 plates come together- convergent boundary where subduction takes place

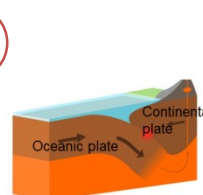


### Plate Boundaries

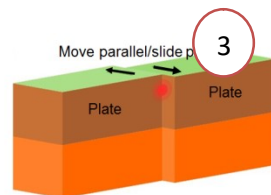
- Divergent Boundaries
- Convergent boundary
- Fracture or transform boundary fault



2 Continental plates



1 Continental plate, 1 Oceanic plate

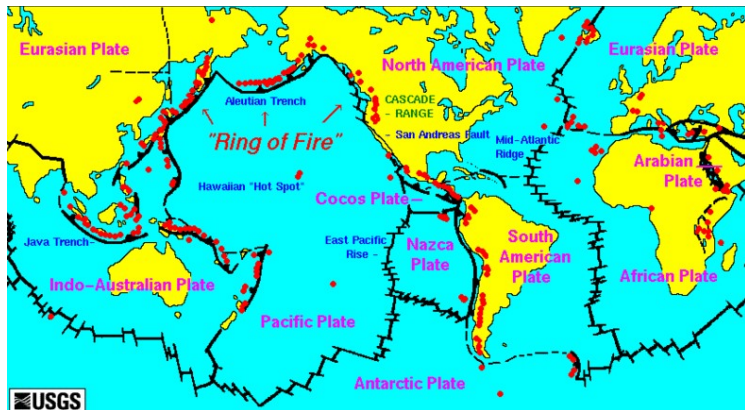


### Important Points for Plate Tectonics

- Plates- not a permanent features and vary in size and shape
- Plates can split/get welded with adjoining plate
- Almost all tectonic activities occur along plate boundaries
- Continental drift theory (Wegener) was criticized
- Later with more researches on material of sea floor and paleomagnetism supported the theory
- Plate tectonic theory (1960's)- solved problem of mechanism of movement

### Plate Tectonics Vs Earthquake and Volcanoes

- Distribution of earthquakes & volcanoes strongly associated with boundaries of plates
- All tectonic activities occurs at Plate boundaries/zones
- Movement of plates releases the energy in the form of earthquakes & volcanic eruption



### Do You Know?

#### Ring of Fire

Major concentration of volcanoes are found in Pacific Ocean in the shape of ring. It's called 'Ring of Fire'.

### Evaluate Yourself

1. Describe the views of Airy and Pratt on Isostasy. Find the similarities and differences in both views.
2. Do you think that global isostatic adjustment is possible in earth? Support your views with appropriate reasons.
3. With the help of diagram explain the movements of pangea over a period of time.
4. Evidence of drift was given by Wegner in the support of his theory. Give your views whether these evidence were appropriate or not.
5. How plate boundaries are closely associated with earthquake and volcanoes? Explain with suitable examples.