

Class Notes for B.A.-1 (Geography Hons.)

Paper-1: Physical Geography, Unit-1:

Topic- "Concept of Airy and Pratt on Isostasy"

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## ISOSTASY

### CONCEPT

The word isostasy is derived from a German word "isostasis" meaning in equal balance.

American geologist "Dutton" was the first who has propounded this term. He has explained the term isostasy in the following words.

"The state of balance must exist between large upstanding areas of the earth's surface (mountains, ranges and plateaus and contiguous low lands".

He was of the opinion that the upstanding parts of the (mountains, plateaus, plains and Ocean Basins) must be compensated by lighter rock material from beneath so that the crustal bulges should remain in the mechanical stability.

## DEFINITION

"Isostasy simply means a mechanical stability between the upstanding parts and lowlying basins on a rotating earth"  
Savinder Singh.

"This doctrine states that, wherever equilibrium exists on the earth's surface, equal mass must underlie equal surface areas."  
J.A. Steers.

## Airy's Concept on Isostasy

According to Airy the inner parts of the mountains can not be hollow, rather the excess weight of the mountains is compensated (balanced) by the lighter materials below. Hence the crust of relatively lighter material is floating in the substratum of denser material. In other words "SIAL" is floating in "SIMA". Thus the Himalayas are floating in denser granitic magma.

This concept of Airy is based on Law of Floatation

In other words, the Himalayas are floating in the denser magma with their maximum portion sunk in the magma, as the boat floats in water.

So, Argy postulated that "if the land column is thicker than the crust above the substratum is larger, its greater part would be submerged in the substratum and if the land column is lower, its smaller part would be submerged in the substratum."

According to Argy the density of different columns of the land (mountain, plateaus, plains) remain the same. In other words density does not change with the depth.

"Uniform density with varying thickness"

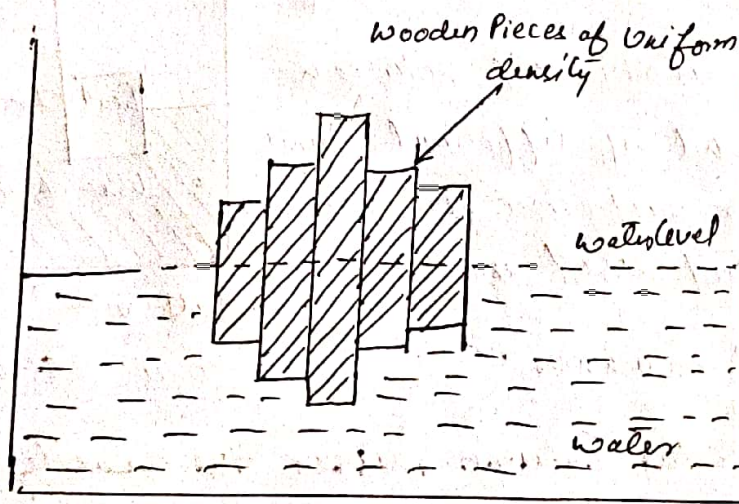


Fig. 1: Argy's view on Isostasy (Source: - Geomorphology, S. Singh)

### Criticism

If we accept the Argy's views on isostasy then every upstanding part must have a root below in accordance with its height. Thus Himalay might have root of almost 80,000m, which is quite impossible as at this depth everything melts.

## Concept of Pratt on Isostasy.

According to Pratt there is a level of compensation above which there is variation in the density of the different columns of the land but there is no change in the density below this level. Density does not change within one column but it changes from one column to other column above the level of compensation.

Thus the central theme of the concept of Pratt on isostasy may be expressed as "Uniform depth with varying density". According to Pratt equal surface areas must underlie equal mass along the line of compensation.

Thus the Pratt's concept of inverse relationship between the height of different columns and their respective densities may be expressed in the following manner.

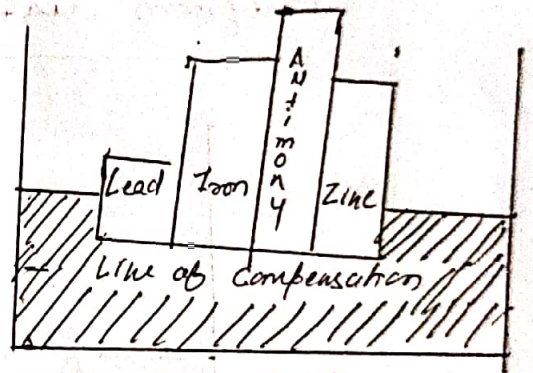


Fig. Pratt's view on isostasy.

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'Bigger the column, lesser the density and smaller the column greater the density.'

According to the Pratt density varies only in lithosphere and not in hydrosphere and barysphere. Thus, Pratt's concept of isostasy was related to the law of compensation and not to the law of floatation. Hence different relief features are standing as their mass is equal along the line of compensation because of their varying densities.