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Interior of the Earth [https://www.youtube.com/watch?v=eJ5e7fhRP1M]

Sources for the study of Earth's Interior:

1. Artificial Sources -
 - a. Density
 - b. Pressure
 - c. Temperature
 - d. Meteorites
2. Tectonics is concerned with the form, pattern and evolution of the globe's major features such as mountain ranges, plateaus, fold belts and island arcs.
3. Structural Geology: It concerns smaller structures such as anticlines, faults and joints.
4. Tectogenesis: It means the study of deformation.
5. Tectostasy and Tectodynamic: J Tricart divided tectonics into two categories: tectostatic and tectodynamic types. Tectostasy refers to the actual disposition of existing strata and tectodynamism refers to the deformations that the rocks underwent at the given time period.

Important Notes

1. Average Density of Earth: 5.52 g/cm . Average Density of Earth's crust: 2.6 to 3.3 g/cm
This indicates higher density below the crust and because the acceleration due to gravity is quite uniform everywhere therefore mass is distributed uniformly in the form of concentric layers.
2. Pressure in itself is not responsible for the increase in density, rather the core is composed of intrinsically heavy metallic materials of high density.
3. Temperature increases at the rate of 2° to 3°C on every 100 m temperature
 - a. 100 km 1100°C
 - b. 400 - 700km 1500-2000°C

- c. 2900 km 3700°C
- d. 5100 km 4300°C
- 4. Meteorites (hitting earth) allow us to determine the density, mineralogy and chemistry of the nickel iron core of bodies having a similar composition to that of the earth.
- 5. Natural sources
 - a. Vulcanicity
 - b. Evidences from Seismology
- 6. Theories related to the origin of earth -Planetesimal, Tidal and Nebular Hypothesis
- 7. Seismology - Study of seismic waves generated during earthquakes.

Seismic Waves

Seismic waves are of three types:

1. Primary (Longitudinal or Compressional or 'P') waves-to and fro motion of particles in line of the propagation of the ray. These waves can pass through both the solid and the liquid medium
2. Secondary (transverse or distortional or S) waves-particles move at right angles to the rays. These waves cannot pass through the liquid.
3. Surface (Long-Period or 'L') waves.
4. Affect only the surface of the earth and covers the longest distance of all seismic waves.
5. It has lower speed than P and S waves but is of most violent and destructive nature. These waves get reflected and refracted while passing through a body having heterogeneous composition and varying density zones at the discontinuities.

Discontinuities

Many such discontinuities are expressed as follows -

1. 1. Gutenberg discontinuity -Between outer liquid core and the solid mantle
2. Mohorovicic discontinuity-Between crust and mantle.
3. Conrad discontinuity- Between oceanic (Basaltic or SIMA layer) and continental (Granites or SIAL layer) Crust- Up to 30 - 40 km beneath the continents (greater depth in mountainous regions) . 10 km deep beneath the oceans

Regions

- Mantle - Below the crust and up to 2900 km. It is a solid layer.
- Core - Outer core is liquid in state where as inner core is solid.
- Chemically the earth can be divided into following layers:

SiAl

- Just below outer sedimentary cover.

- Composed mainly of granites
- Density - 2.9
- 50 to 300km thick.
- Rich in silica and aluminium
- It forms the continental layer.
- Acidic in nature
- Silicates mainly present are those of sodium, potassium and aluminum.

SiMa

- Below SiAl
- Composed mainly of basalt
- Source of magma and lava
- Rich in silica and magnesium
- Density-2.9 to 4.7
- Thickness - 1000 to 2000 km
- Basic in nature
- Silicate mainly present are those of magnesium, calcium and Iron.

NiFe

- Below Sima
- Rich in nickel and iron
- Very high density
- Diameter of this layer - 6880 km
- Indicates magnetic property of the earth's interior

Mechanical Divisions of Earth

Mechanically the earth can be divided into following layers

Lithosphere

- The crust and the upper mantle (40 to 80 km) move as a unit known as Lithosphere
- Divided into several large fragments called plates.
- Moves over Asthenosphere

Asthenosphere

- Beneath Lithosphere and up to 300km of depth
- Low velocity zone (that is slow speed of seismic waves in this zone) .
- Plastic or less viscous (softer, more pliable) .

Mesosphere

- Below Asthenosphere
- Whole mantle apart from the portion lying in Asthenosphere and Lithosphere.

Barysphere

- It comprises core.
- Outer layer is liquid in state where as the inner core is solid.

Structural Geomorphology

- **Uniclinal or Homoclinal Structure:** It represents inclined rock strata at uniform dip angle caused by general regional tilt.
- They are subjected to differential erosion wherein resistant rocks are less eroded than soft rocks.
- The differential erosion of dipping strata of varying resistance gives birth to trellis drainage pattern and a few typical topographic features such as scarp and vale topography, cuesta and hogback ridges, etc.
- **Cuesta:** also called Homoclinal Ridge, physical feature that has a steep cliff or escarpment on one side and a gentle dip or back slope on the other. This landform occurs in areas of tilted strata and is caused by the differential weathering and erosion of the hard capping layer and the soft underlying cliff maker, which erodes more rapidly. Cuestas with dip slopes of 40° - 45° are usually called hogback ridges. Cuesta escarpments tend to be cut into rough, hilly country with numerous ravines and steep valleys, because the short streams flowing down the steep scarp face rapid erosion. The back slopes commonly are smooth.
- Cuestas are common in the United States, notably in Arizona and New Mexico and along the Atlantic and Gulf coasts.
- **Buttes:** The progressive dissection of twin cuestas results in the formation of isolated flat-topped.
- **Hogback:** The escarpments or ridges having symmetrical slopes on both sides are called hogback ridges.
- **Strike vales:** Rivers form their valleys along soft rock beds due to comparatively more erosion than the resistant rock beds giving birth to the formation of strike vales