Geography: Earth's Interior and Its Material: Objectives, Earth's Interior, Structure of the Earth's Interior

- The earth is the only known planet with developed life in the whole universe. The earth is spherical in shape, like most of the celestial bodies. Hot water and molten lava eject out from the earth's interior. It indicates that the temperature below the earth's surface is extremely high. The world's deepest mining is limited only to the depth of less than 5 kilometres.
- These activities can be explained by getting a better understanding of the interior of the earth. The group of exogenetic forces weaken and disintegrate the rocks at their original location. The second group consists of indogenetic forces which remove the disintegrated rocks from the high lands and deposit them in the lowlands. These two processes have been responsible for disintegration of rocks and shaping new landforms. They are also responsible for the formation of soil.

Objectives

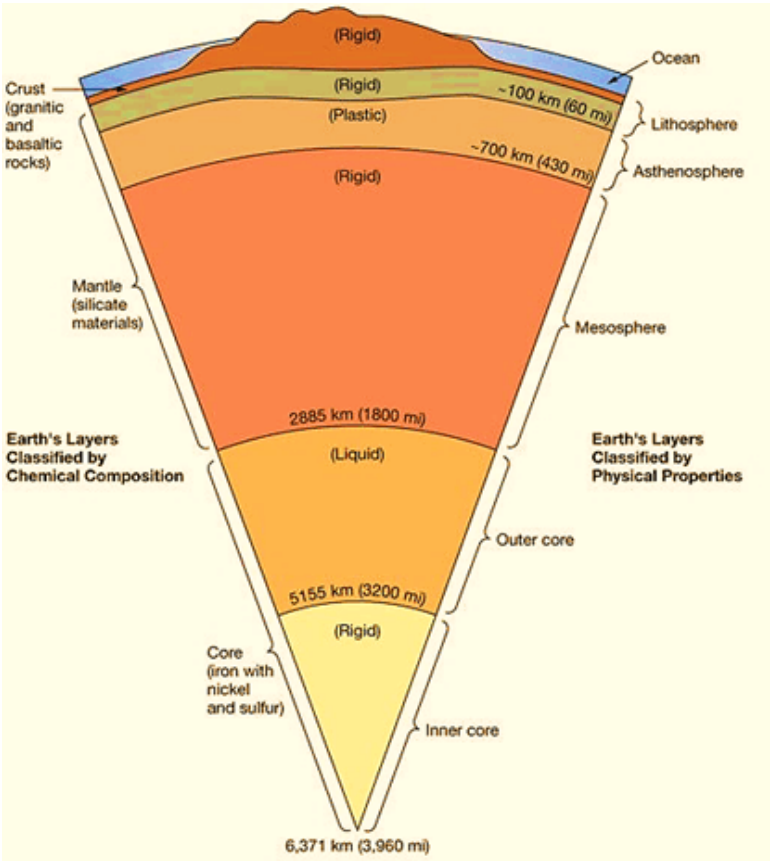
The major objectives of this chapter are:

- To explain the limitations of the direct observations of the earth's interior
- To compare the different layers of the earth's interior with reference to the parameters of thickness, temperature, density and pressure
- To distinguish between rocks and minerals
- To classify rocks according to their mode of formation
- To describe the economic significance of rocks
- To explain the term weathering and its different types with suitable examples
- To relate weathering with soil formation
- To explain the various gradational processes changing the face of the land
- To differentiate between degradation and aggradation
- To explain the various factors contributing to soil formation
- To explain the various types of soil erosion
- To explain the various methods of soil conservation

Earth's Interior

The huge size of the earth and rapid increase in the temperature below the surface of the earth are mainly responsible for setting the limit to direct observation inside the earth. Through mining and

drilling operations, we have been able to observe the earth's interior directly, but up to a depth of few kilometres only. The temperature in the earth's interior is very high that it can even melt the tools used for drilling. This restricts the operations of deep drilling. Thus, this causing hindrance to the direct observation of the materials of the earth's interior.



Structure of the Earth's Interior

The innermost layer surrounding the earth's centre is called core which is having a radius of about 3500 kms. Core is the densest layer of the earth with its density range from 9.5 to 14.5. It is mainly composed of the iron and nickel thus, commonly known as Knife (Nickel + Ferrum) . Core consists of two sub-layers. The inner one is solid and the outer one is semi-liquid. The layer surrounding the core is known as mantle.

It is about 2900 kms thick and composed of basic silicates. Major constituent elements of mantle are magnesium and silicon; hence, this layer is termed as Sima (Silica + Magnesium) . The density of this layer varies from 3.3 to 5.7. Mantle is surrounded by the outermost layer of the earth, known as the lithosphere. Its density varies from 2.70 to 2.95. Major constituent elements of the lithosphere are silica (Si) and aluminium (Al) , thus this layer is termed as Sial (Silica + Aluminium) . The outermost part of the lithosphere in known as crust. It is about 8 to 40 kms thick.

Temperature, Pressure and Density of the Earth's Interior

- **Temperature-** The rise in temperature with increase in depth is observed in mines and deep wells. These evidences along with molten lava erupted from the earth's interior, supported the fact that the temperature increases towards the centre of the earth. This increase is at an average rate of 1°C for every 32 metres increase in depth. At such a constant rate of increase in temperature, the temperature will be approximately 300°C at the depth of 10 km, and it will be 1200°C at 40 km depth. A basaltic lava rock which melts at 1250°C at the surface will melt at 1400°C at 32 km depth. The extra heat required for melting is produced by radioactivity, as a result of the breakdown of atomic nuclei of minerals emitting radiant energy in the form of heat from the rocks.

The behaviour of the earthquake waves further confirm that the composition of different layers is as variable as is the rate of change of temperature. While in the upper 100 km, the increase in temperature is at the rate of 12°C per km, in the next 300 km it is 20°C per km but is only 10°C per km below it. The temperature at the centre is estimated to lie somewhere between 3000°C and 5000°C. This high temperature inside the earth may be due to the chemical reactions under high pressure conditions and disintegration of radioactive elements.

- **Pressure-** The pressure increases from the surface towards the centre of the earth due to enormous weight of the overlying rocks. The pressure near the centre is considered to be 3 to 4 million times the pressure of atmosphere at the sea level.
- **Density-** Due to the increase in pressure and presence of heavier materials towards the earth's centres, the density of the earth's layers also goes on increasing.

Materials of the Earth's Crust

- The outermost part of the lithosphere is called crust. This is the most significant part because it is occupied by humans and is mainly made up of rocks. The rocks are of different types. They may be hard like granite, soft like clay and loose like gravel. Rocks have a variety of colour, weight, and hardness.
- Rocks are aggregates or the physical mixture of one or more minerals. On the other hand, minerals are made up of two or more elements in a definite ratio having definite chemical composition. Crust is made up of more than 2000 minerals. Out of these, 6 are the most abundant and contribute the maximum to this uppermost part of the earth. These are feldspar, quartz, pyroxenes, amphiboles, mica, and olivine.

- The constituent minerals of a granite rock are quartz, feldspar and mica which make it a hard rock. The change in the ratio of these minerals give rise to granites of different colours and hardness. The minerals containing metals are called metallic minerals. Haematite, a major iron ore is a metallic mineral. Ores are metallic minerals which can be profitably mined.