

Earth is the planet of the solar system where life exists. The Earth was in a hot gaseous form at the time of its origin. Its matter condensed with time and distinct layers were formed in its interior and outer parts. Initially the Earth's surface cooled, condensed and took the form of a solid layer. This solid outer layer of the Earth's surface is known as '**crust**'. Just as the Earth's origin, man has still not completely understood mystery of the Earth's interior. It is not possible for us to directly get knowledge about the structure of the Earth's interior, because it is very hot. The Earth's interior is in which state ? Why seismic vibrations occur all of a sudden ? Why does a volcano eject very hot matter and earth materials ? Why does tsunami occur ? Are all these phenomena related to the structure of the Earth's interior ? So come, let us know the mysteries of the interior.

## Sources of Information about the Interior

The Earth's centre is located at a depth of about 6370 km. from its surface. It is not possible to go upto the Earth's centre and view its interior form. Also, we don't have an X-ray like instrument to know about the Earth's interior form. It is also not possible to obtain specimens from the Earth's central portion. Since the Earth's interior is not visible, our knowledge about the interior is very limited. Whatever we know about the Earth's interior is based on indirect sources and imagination. Still, a part of this information is based on direct observations and analysis of material from the interior.

**(1) Direct Sources :** There are two sources to have direct information about the interior : (1) Deep mines and oil wells (2) Material ejected from the interior at the time of volcanism. The world's deepest mine is the Robinson mine of South Africa. This gold mine is about 4 km deep. Depth of oil well drilled in search of oil is not more than 8 km. Drilling could be done upto 12 km in Kola area of Arctic Ocean. As the Earth has an average radius of 6370 km, man's attempts to know about the interior become futile.

Another source to have direct information about the interior is volcanic eruption. The magma that comes out during eruption, becomes available for research work in laboratory. Still we cannot determine the depth from which the magma comes out.

**(2) Indirect Sources :** It is possible to get indirect information about the Earth's interior by analysing characteristics of materials obtained from the interior. Important indirect sources and their evidences are based on density, pressure, temperature, meteorites, gravitation, magnetic surveys, seismic activities etc.

**(1) Density :** The Earth's average density is 5.5gram/cubic cm. Density of rocks of outer surface of the Earth is 2.7gram/cubic cm. Density of igneous rocks below the lithosphere is 3.0 to 3.5gram/cubic cm. This proves that density of Earth's interior part must be more than the parts above. Density of the Earth's inner most parts is estimated to be about 11 to 12 gram/cubic cm. The Earth's density was first measured in 1774. Measurement of density is based on Newton's law of gravitation.

**(2) Pressure :** The Earth's upper layers exert pressure on the layers below it. Hence as we go towards the Earth's centre, density increases due to increase in pressure.

**(3) Temperature :** Normally, temperature increases by 1 degree Celsius for every increase in depth of 32 metres. At this rate, temperature of the Earth's central part is estimated to be more than 6000 degree Celsius. Hot gases and magma, hot water springs and geysers, water vapour ejected during a volcanic eruption suggest that the material in the Earth's interior is likely to be in liquid and gaseous state.

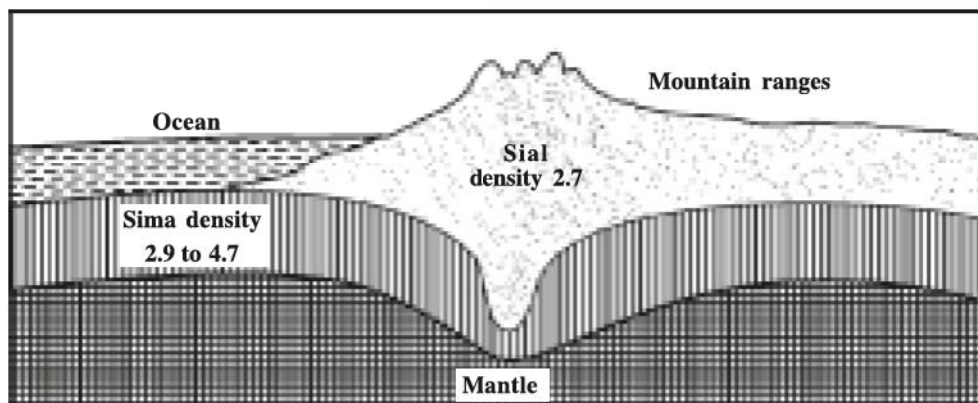
**(4) Meteors :** Shower of meteors from space on Earth helps to know about the Earth's interior. Meteors are known to contain heavy metals like iron and nickel. It's an evidence of presence of heavy metals in the Earth's central part. Just like meteors, our Earth is also a member of the solar system.

**(5) Gravitation :** Different parts of the Earth's surface experience gravitational force differently. As the Earth's centre is closer to the poles, the gravitational force is more at the poles compared to that at the equator. As the Earth's centre is relatively far from the equator, here the gravitational force is lesser compared to that at the poles. Due to uneven distribution of geo-materials in the interior also variations occur in gravitational force. Thus, we can know about the Earth's interior.

**(6) Magnetic Surveys :** Magnetic surveys have proved that distribution of geo-materials is uneven in the Earth's interior.

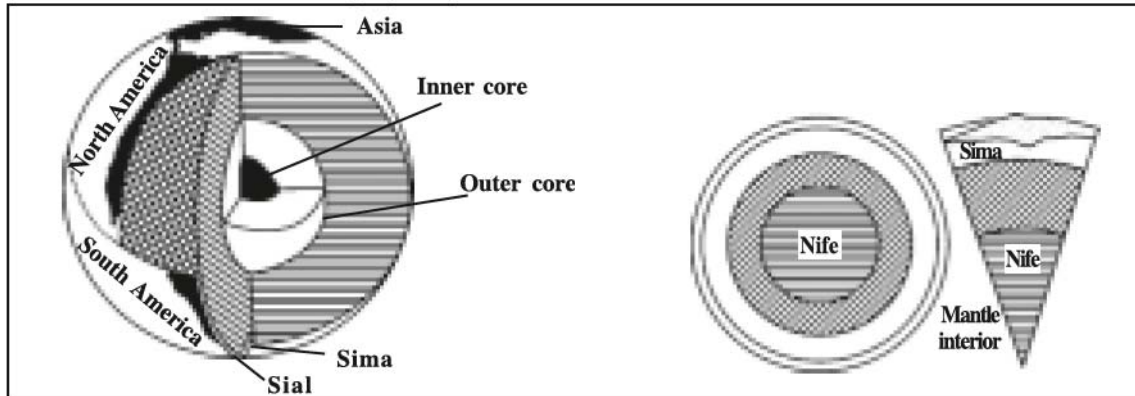
**(7) Seismic waves :** Seismograph records three types of seismic waves. (1) P-Waves (2) S-Waves (3) L-Waves. On the basis of study of waves recorded, scientists have obtained some information about the Earth's interior. On the basis of this information, three divisions have been recognized from surface to the centre : **(1) Lithosphere (2) Mantle (3) Core** . Core has been subdivided into (1) outer core and (2) inner core.

**(1) Lithosphere :** This is the outer layer of the Earth's surface, composed of layers of soil or rocks. It is known as lithosphere or crust. Thickness of the Earth's crust is 33 km on an average. It is upto 30 km thick below the continents and 5 km below the oceans. Its thickness is more in the major mountainous regions. Its thickness is about 70 km below the Himalayas. There is a thin layer of sedimentary rocks near the Earth's surface. Its lower part is again sub-divided into : (1) Sial and (2) Sima. Sial is composed of granite rocks. It has more of silica and aluminium ( $\text{Si} + \text{Al} = \text{Sial}$ ). The mean density of this layer is 2.75 to 2.90 gram/cubic cm. Continents are composed of **Sial**.



### 3.1 Earth's interior structure

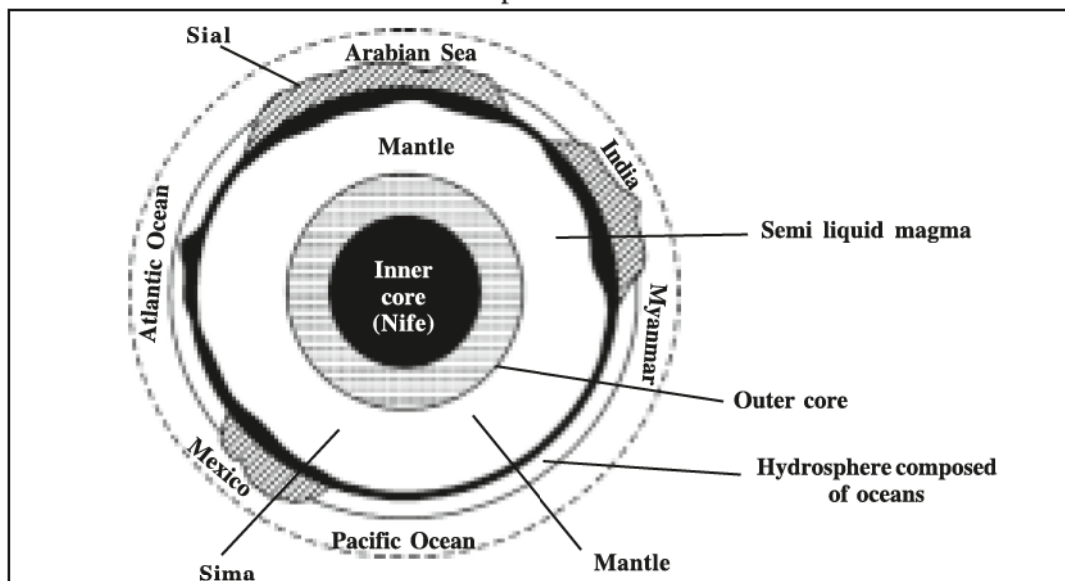
The layer below the Sial has an abundance of silicon and magnesium. Hence this layer is known as **Sima**, from the first two letters of these elements. It is composed of basalt rocks. Here, density of rocks is about 2.9 to 4.7 gram/cubic cm. Its depth is about 1000 km. Sial and sima layers are within scope of man and nature, and highly important to life.



### 3.2 Earth's interior structure

There is a distinct Sial layer above sima over continents, but in the deeper portions of seas and oceans, the bottom is composed of sima. In Maharashtra, layers of lava can be seen in Matheran near Mumbai. These layers have been formed from spreading of lava ejected during a volcanic eruption. Many rocks of basalt and granite are seen over granite.

**(2) Mantle :** This layer is below the lithosphere and about 2900 km in thickness. It is composed of mixed mineral content. The upper layer of mantle is known as the Asthenosphere. Its thickness is about 700 km. It has more of basaltic rocks with density of about 3.5. Here matter is in the form of magma. The crust floats over this Asthenosphere.



### 3.3 Earth's interior structure

**(3) Core :** The layer from the mantle upto the centre is known as the Core. The Core extends from a depth of about 2900 km to the Earth's centre (6370 km). This layer has an abundance of nickel and ferrous mineral matter. It can be sub divided into : (1) inner core and (2) outer core. Outer core is mainly in liquid and semi liquid state. Its density is about 5. The inner core is known as **Nife**. Here density is about 13 gm/cubic cm, which indicates intense pressure. This metallic core is responsible for the Earth's gravitational force, magnetic force and rigidity.



## EXERCISE

### 1. Answer the following questions in detail :

- (1) Describe structure of the Earth's interior, its divisions and explain the lithosphere.
- (2) Describe the indirect sources to know about the Earth's interior.
- (3) Which are the types of sources to know about the Earth's interior ? Give information about the direct sources.

### 2. Write to-the-point answer of the following questions :

- (1) What is Sial ?
- (2) Write a short note on Mantle.
- (3) Write a short note on Core.

### 3. Answer the following questions in brief :

- (1) How many divisions are there according to the Earth's interior structure ?
- (2) Which minerals are present in Sial layer ?

### 4. Answer the following questions in one-two sentences :

- (1) Lithosphere of the Earth's surface is also known as ?
- (2) What is the depth of the Earth's centre in km from its surface ?
- (3) Which is the deepest mine in the world ? In which continent is it located ?
- (4) Who gave the law of gravitation ?
- (5) What is the average thickness of the lithosphere ?

### 5. Select the correct option from the options given and write the answer :

- (1) The Earth's core is also known as ?  
(a) Sial                                      (b) Sial                                      (c) Nife                                      (d) Mantle
- (2) Which are the major mineral elements in the core ?  
(a) Nickel and Iron                                      (b) Silica and Iron  
(c) Silica and Magnesium                                      (d) Aluminium and Iron
- (3) What kind of rocks are there in Sial ?  
(a) Basalt                                      (b) Granite                                      (c) Lava rocks                                      (d) Sedimentary
- (4) Where is the Robinson gold mine ?  
(a) U.S.A.                                      (b) Russia                                      (c) South Africa                                      (d) South Korea

