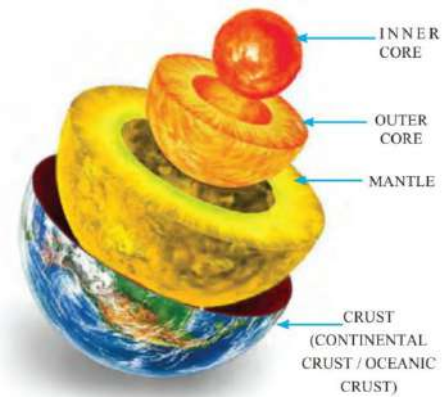
INTERIOR OF THE EARTH

The Earth’s interior is a layered structure consisting of the solid outer Crust, the Mantle and a dense metallic Core. Now, the ways in which information is collected about the Earth's interior and how much has been learned about the state of the interior with the help of the collected information are discussed below.

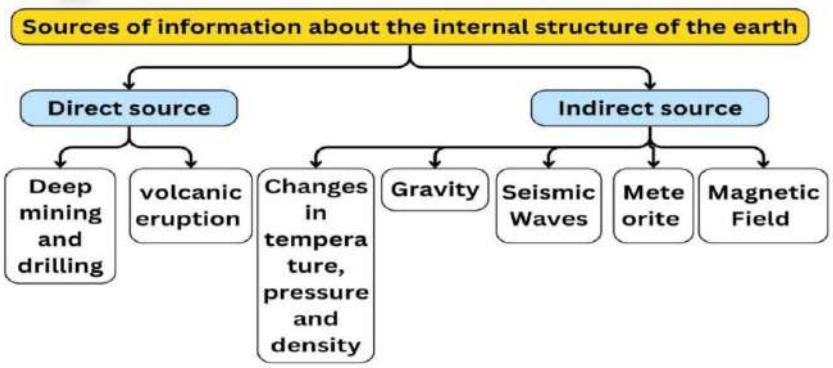


❖ Sources of data related to Interior of the Earth:

The radius of the Earth is 6370 km. Therefore, it is not possible for humans to directly observe and collect information from the center of the Earth. In fact, the sources through which information about the Earth's interior is collected can be mainly divided into two categories.

1. Direct Sources

2. Indirect Sources

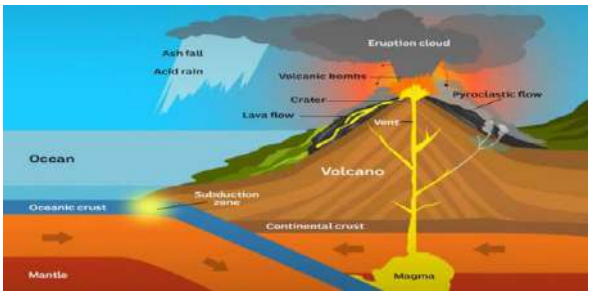


1. Direct sources: The information we obtain through direct observation is included in direct sources. For example:

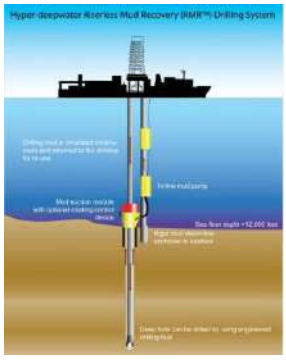
i. Mines: Mines are a major source of knowledge about the interior of the Earth. The deepest mine in the world (gold mine) is located in South Africa, which is about 3-4 km deep. But this depth below the surface is very insignificant for knowing the interior of the Earth.

ii. Volcanic Eruption: Through eruptions, we can learn various information about the interior of the earth. Molten rocks are formed through eruptions. When magma comes out, it is

examined and observed. However, it is very difficult to know at what depth and what type of magma originates.



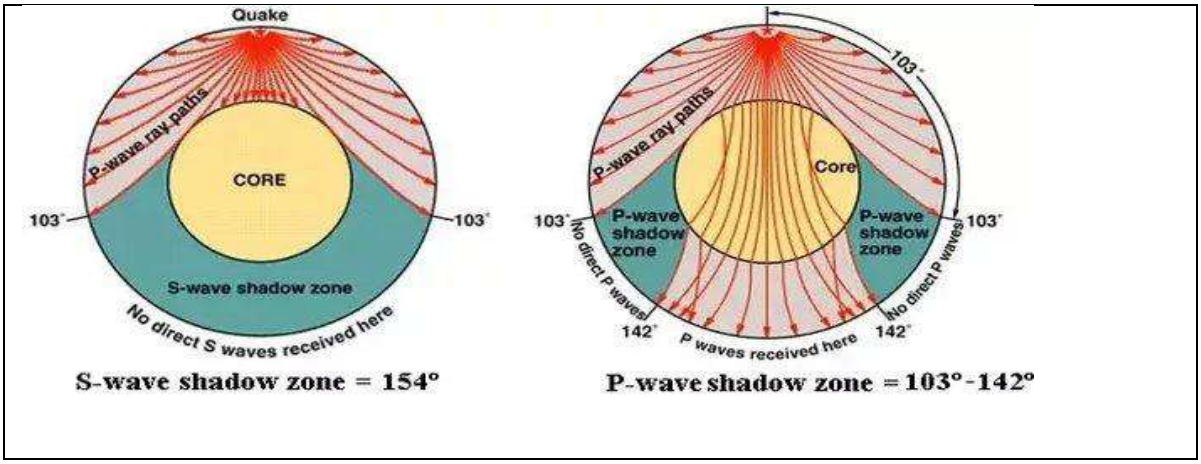
iii. Drilling under the sea: In addition to mines of various depths, scientists have tried to collect information about the interior of the earth by drilling into the seabed. Two such projects are- Deep Ocean Drilling Project and Integrated Ocean Drilling Project. Of these, the deepest (about 12 km) hole has been drilled in the Arctic Ocean trench adjacent to the Kola Peninsula.



2. Indirect Source: Indirect source such as-

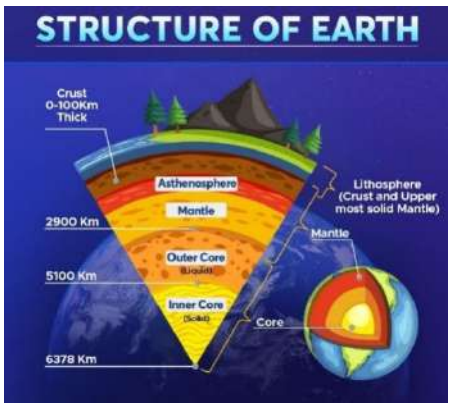
i. Seismic waves: When an earthquake occurs somewhere, information is collected about the internal structure and various features of the Earth by considering the nature of the motion of the earthquake waves, their characteristics (at what speed the vibration waves are flowing through the interior of the Earth, whether the speed is high or low at a corner, how the waves are reflected, etc.).

- **Seismic Shadow Zone:**A seismic shadow zone is the region on Earth's surface where earthquake waves are not detected by seismographs. It occurs due to variations in Earth's internal structure and composition.
- There are two main types of seismic waves: P-waves and S-waves. P-waves travel through solids, liquids, and gases, while S-waves travel only through solids.
- S-waves form a shadow zone beyond 103° from the earthquake focus because they cannot pass through the liquid outer core, indicating its fluid nature.
- P-waves are refracted when they enter the outer core due to a sudden change in density, creating a shadow zone between 103° and 142° where they are not observed directly.
- These shadow zones provide strong evidence about Earth's layered structure, confirming that the outer core is liquid and helping scientists understand the planet's internal composition.



❖ LAYERS OF THE EARTH:

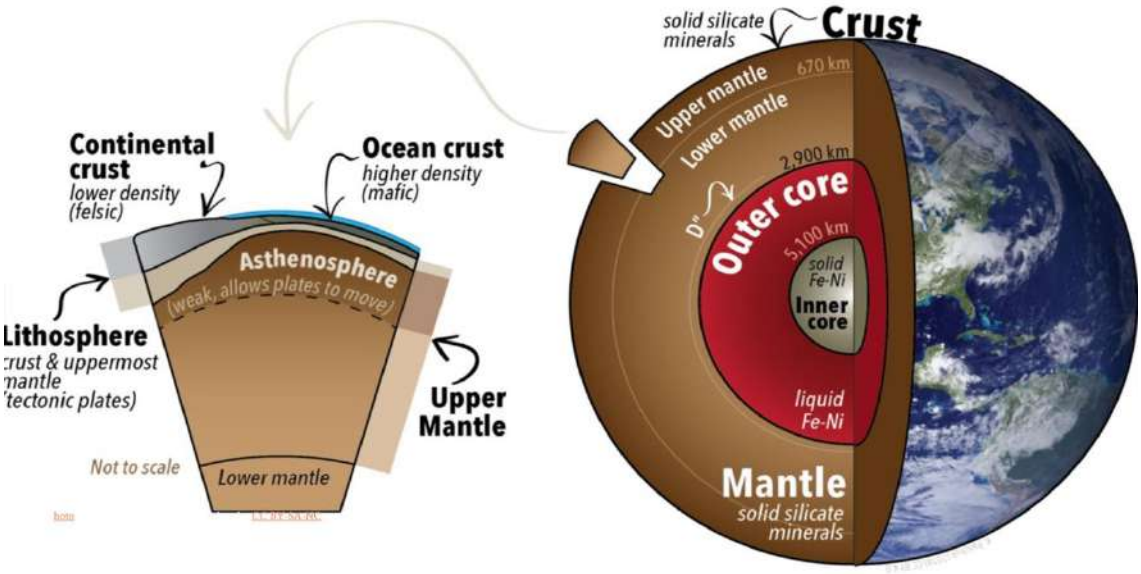
Three layers are identified separately by the behavior or movement of seismic waves, density of rocks, high pressure inside the Earth etc. These three layers are- **(A)The Crust (B) The Mantle (C) The Core**



A. The Crust: It is the outermost solid part of the earth. It is brittle in nature. The thickness of the crust varies under the oceanic and continental areas. Oceanic crust is thinner as compared to the continental crust.

i. Continental Crust: The Continental Crust is primarily composed of Silica and Aluminium, hence termed as **Sial**. Thickness of Continental Crust varies in between 30-50 km and can reach up to 70 km under mountain ranges like the Himalayas.

ii. Oceanic Crust: The Oceanic Crust is primarily composed of Silica and Magnesium, hence termed as **Sima**. The mean thickness of oceanic crust is about 5 km.



B. The Mantle: The portion of the interior beyond the crust is called the mantle. The mantle extends from Moho's discontinuity (crust-upper mantle boundary) to a depth of 2,900 km. The upper portion of the mantle is called asthenosphere. The word 'astheno' means weak. It is considered to be extending upto 400 km. It is the main source of magma that finds its way to the surface during volcanic eruptions. The crust and the uppermost part of the mantle are called lithosphere. Its thickness ranges from 10-200 km. The lower mantle extends beyond the asthenosphere. It is in solid state.

C. The Core: As indicated earlier, the earthquake wave velocities helped in understanding the existence of the core of the earth. The Core is extended from 2900 km to the centre of the Earth (6371 km). The outer core (2900 km to 5100 km) is in liquid state while the inner core (5100 km to 6371 km) is in solid state. The core is made up of very heavy material mostly constituted by nickel and iron. It is sometimes referred to as the **NiFe** layer.