Title

Internal Structure of Earth

Introduction

As we all know that earth is planets where human being can survive, due to the existence of earth atmosphere, which is most suitable for the sustenance of life. In order to understand plate tectonics, it is essential to know about Earth's interior.

Earth is composed of several layers. By various studies it has come to notice that the Earth's structure is like a fruit with a large pit inside like in a peach or plum. If we cut a fruit into half we will see it is composed of 3 parts.

- A very thing crust on the outside.
- Most of the mass of the earth contained in mantle.
- A core of significant size in the center.

1. The Earth's Crust (Lithosphere)

This is the outermost parts of the earth. It consist of silica and aluminum. If forms the upper layer of the continent and is mostly composed of granite rock. The crust divided into two parts.

The Continental crust & Oceanic crust.

- **The Continental Crust**

Its thickness is 25 to 60 km under continents. The crust is quite complex in structure and made from many different types of rocks like granite.

- **The oceanic Crust**

The oceanic Crust that underlies the ocean basins which various in thickness from 4to 6 km under the ocean. This layers consist of primarily of basalt.

2. Earth's Mantle (Mesosphere)

This is the layers below the crust. It is composed of Iron and Manganese. It lies between the crust and the core. The mantle is made up of very dense and hot igneous rocks, found in semi liquid states. It extends downwards2900km and the temperature ranges between 5000°C to 7000°C. Temperature of s mantle varies at different depths. The temperature is lowest immediately beneath the crust and increase with depths. This steady increase in temperature with depth is known as **Geothermal Gradient.**

- **Geothermal Gradient**

Geothermal gradient is responsible for different rocks behavior's are used to divide the mantle into two different zones.

Rocks in upper layer is cool & brittle and rocks in inner layer are hot and soft.

3. Earth's Core (Barysphere)

This is the innermost layer of the earth. It is composed of nickel (alloy) and iron. Its diameter is approximately 2500-2700 km and it temperature is around 5500°C.

The earth's core contains radioactive materials, and is the earth's core is divided into two zones.

- **Outer core**

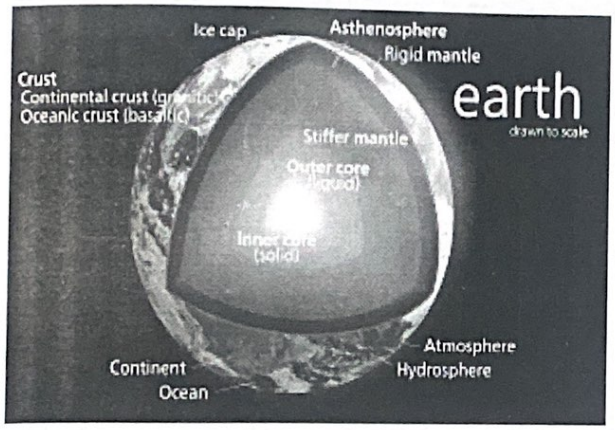
The outer core is liquid owing to high temperature which are adequate enough to melt iron nickel alloy.

- **Inner core**

The inner core is solid even though its temperature is higher than the outer core. The reason being that the pressure caused by the weight of the overlaying rocks is strong enough to bind the atoms tightly together, preventing a liquid state.

Internal structure of earth

The interior structure of the Earth is layered in spherical shells: an outer silicate solid crust, a highly viscous mantle, a liquid outer core that is much less viscous than the mantle, and a solid inner core.



Scientific understanding of the internal structure of the Earth is based on observations of topography and bathymetry, observations.

Layers of earth

- Crust
- Mantle
- Core

Mass

The force exerted by Earth's gravity can be used to calculate its mass. Astronomers can also calculate Earth's mass by observing the motion of orbiting satellites. Earth's average density can be determined through gravitometric experiments, which have historically involved pendulums.

The mass of Earth is about 6×1024 kg.

Structure

The structure of Earth can be defined in two ways: by mechanical properties such as rheology, or chemically. Mechanically, it can be divided into lithosphere, asthenosphere, mesospheric mantle, outer core, and the inner core. Chemically, Earth can be divided into the crust, upper mantle, lower mantle, outer core, and inner core.

Crust

The crust ranges from 5–70 kilometres (3.1–43.5 mi) in depth and is the outermost layer. The thin parts are the oceanic crust, which underlie the ocean basins (5–10 km) and are composed of dense (mafic) iron magnesium silicate igneous rocks, like basalt. The thicker crust is continental crust, which is less dense and composed of (felsic) sodium potassium aluminium silicate rocks, like granite. The rocks of the crust fall into two major categories – sial and sima (Suess,1831–1914). It is estimated that sima starts about 11 km below the Conrad discontinuityThe uppermost mantle together with the crust constitutes the lithosphere

Many rocks now making up Earth's crust formed less than 100 million (1×108) years ago; however, the oldest known mineral grains are about 4.4 billion (4.4×109) years old, indicating that Earth has had a solid crust for at least 4.4 billion years.

Types of crust

- Oceanic crust
- Continental crust

a) Oceanic crust

The topmost layer, about 500 metres (1,650 feet) thick includes lavas made of basalt that is, rock material consisting largely of plagioclase feldspar and pyroxene.

Oceanic crust differs from continental crust in several ways: it is thinner, denser, younger, and of different chemical composition. This layer is called as sima

b) Continental crust

The continental crust is the layer of igneous, sedimentary, and metamorphic rocks that forms the continents and the areas of shallow seabed close to their shores, known as continental shelves. This layer is sometimes called sial

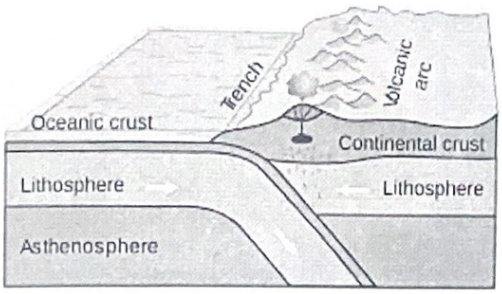
The average density of continental crust is about 2.7 g/cm3

- **Importance of continental crust**

Because the surface of continental crust mainly lies above sea level, its existence allowed land life to evolve from marine life. Its existence also provides broad expanses of shallow water known as epeiric seas and continental shelves where complex metazoan life could become established during early Paleozoic time, in what is now called the Cambrian explosion.

- **Difference in continental crust and oceanic crust**

Both oceanic crust and continental crust are less dense than the mantle, but oceanic crust is denser than continental crust. This is partly why the continents are at a higher elevation than the ocean floor.



MANTLE

Earth mantle extends to a depth of 2,890 km, making it the thickest layer of Earth. The mantle is divided into upper and lower mantle. The upper and lower mantle are separated by the transition zone. The lowest part of the mantle next to the core-mantle boundary is known as the D″ (pronounced dee-double-prime[5]) layer. The pressure at the bottom of the mantle is ≈140 GPa (1.4 Matm). The mantle is composed of silicate rocks that are rich in iron and magnesium relative to the overlying crust. Although solid, the high temperatures within the mantle cause the silicate material to be sufficiently ductile that it can flow on very long timescales

Types of mantle

- lower mantle
- upper mantle

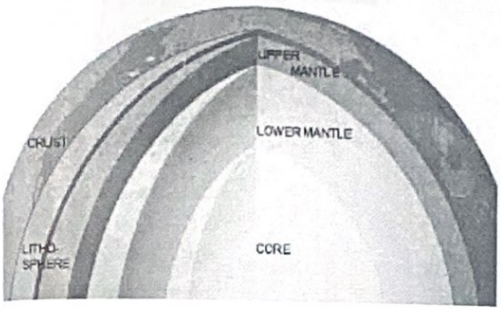
lower mantle

Below the crust is the lower mantle, and below the lower mantle is the core. There is the outer core, which is still liquid, and the inner core, which is made of solid metal. The lower mantle is in between the upper mantle and outer core of the earth

Upper mantle

Below the lithosphere is a layer of upper mantle called the asthenosphere. This is made up rock that is fluid and can move. It is this fluidity that powers the movement of the tectonic plates of the Earth's crust.

The temperature of upper mental range between 500 to 900 °C (932 to 1,652 °F) at the upper boundary with the crust; to over 4,000 °C (7,230 °F) at the boundary with the core.



Core

The Earth's core is the part of Earth in the middle of our planet. It has a solid inner core and a liquid outer core

Inner core

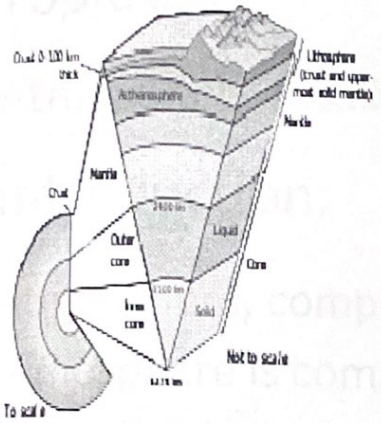
The inner core of the Earth, as detected by seismology, is a solid sphere about 1,216 km (760 mi) in radius, or about 70% that of the Moon. It is believed to be an iron–nickel alloy, and may have a temperature similar to the Sun's surface, approximately 5778 K (5505 °C).The seismic wave data suggests that crystals in the "inner inner core" are in an east-to-west direction. Those in the "outer inner core" are lined up north to south

Outercore

The outer core of the Earth is a liquid layer about 2,260 kilometers thick. It is made of iron and nickel. This is above the Earth's solid inner core and below the mantle. Its outer boundary is 2,890 km (1,800 mi) beneath the Earth's surface. The transition between the inner core and outer core is approximately 5,000 km (3,100 mi) beneath the Earth's surface.

The temperature of the outer core ranges from 4400 °C in the outer regions to 6100 °C near the inner core. Eddy currents in the nickel iron fluid of the outer core are believed to influence the Earth's magnetic field.

The average magnetic field strength in the Earth's outer core was measured to be 25 Gauss,



Without the outer core, life on Earth would be very different. Convection of liquid metals in the outer core creates the Earth's magnetic field.[2][3] This magnetic field extends outward from the Earth for several thousand kilometers, and creates a protective bubble around the Earth that deflects the Sun's solar wind. Without this field, the solar wind would directly strike the Earth's atmosphere. This might have removed the Earth's atmosphere, making the planet nearly lifeless. It may have happened to Mars.

DYNAMO THEORY

It suggests that convection in the outer core, combined with the Coriolis Effect, gives rise to Earth's magnetic field. The solid inner core is too hot to hold a permanent magnetic field (see Curie temperature) but probably acts to stabilize the magnetic field generated by the liquid outer core. The average magnetic field strength in Earth's outer core is estimated to be 25 Gauss (2.5 mT), 50 times stronger than the magnetic field at the surface