



# E Prime Layer

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## Why in News?

According to a research conducted at the Advanced Photon Source of Argonne National Lab and PETRA III of Deutsches Elektronen-Synchrotron in Germany, a new mysterious layer called the **E prime layer** has formed on the outer part of the [Earth's core](#).

- This happened because **surface water penetrated deep into the planet**, changing the composition of the outer region of the **liquid metal core**.

## How Did E Prime Layer Develop Over Time?

- **Tectonic Plates Transporting Water to Earth's Core:**
  - New research reveals a fascinating process where [tectonic plates](#), carrying surface water, have been transporting it deep into the Earth's interior over billions of years.
  - As this water reaches the core-mantle boundary, located approximately 1,800 miles beneath the Earth's surface, **it instigates significant chemical changes that directly influence the structure of the Earth's core.**
- **Chemical Reactions and Structural Impact on Earth's Core:**
  - Observations by scientists highlight the chemical reactions occurring **when subducted water interacts with core materials** under high pressure.
  - This interaction results in the creation of a distinct layer in the outer core **characterized by high hydrogen content and low silicon levels**, forming a film-like structure.
  - Additionally, **the process generates silica crystals that ascend into the mantle**, causing compositional changes.
    - These alterations in the liquid metallic layer have potential implications, including reduced density and modified seismic characteristics.
- **Significance of E Prime Layer in Understanding Earth More:**
  - This finding suggests a more **intricate global water cycle than previously recognized**. The altered core layer carries significant implications, **shedding light on the interconnected geochemical processes** that link surface water cycles with the deep metallic core.

# INTERIOR OF THE EARTH

## 1 THE CRUST

- Thin, outermost layer
- Oceanic crust – thinner
  - Mean thickness -5 km
  - Made up of Silica and Magnesium (SiMa)
- Continental crust – thicker
  - Mean thickness - 30 km
  - Made up of Silica and Aluminum (SiAl)
  - Thicker in the areas of major mountain systems.
    - Around 70 km thick in the Himalayan region.
- Temperature increases with depth (rises by up to 30° C for every km)

### Lithosphere

- Rigid outer layer, thickness: 100 km
- Consists of the crust and the upper mantle
- Divided into tectonic plates responsible for large-scale changes in the earth's geological structure (folding, faulting)

## 3 THE CORE

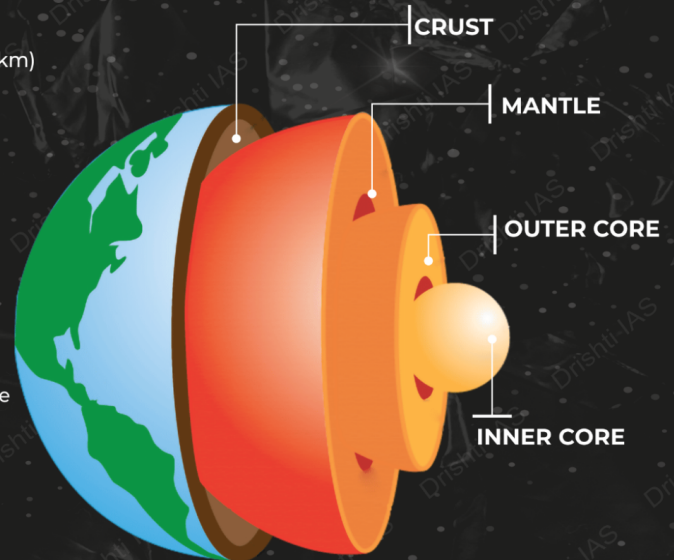
- Lies between 2900-6370 km below the earth's surface
- Made up of heavy materials, primarily nickel (Ni) and iron (Fe) - NiFe
- Outer core –
  - Between 2900-5100 kms
  - Liquid because of not enough pressure to solidify
- Inner core –
  - Between 5100-6370 kms
  - Solid – it can transmit secondary waves (earthquake) which outer core can't
- Denser than Mantle

### Boundaries/discontinuities between Earth's layers

- Conorod Discontinuity- between upper and lower crust
- Mohorovicic Discontinuity (Moho) – separates the crust from the mantle, its average depth being about 35 km.
- Repiti Discontinuity – between the upper and lower mantle
- Gutenberg Discontinuity – lies between the mantle and the outer core.
- Lehman Discontinuity- between inner and outer core

## 2 THE MANTLE

- Extends from Moho's discontinuity to a depth of 2,900 km
- Upper portion is called **asthenosphere**
  - Zone of weak rocks; in semi molten or jelly like state
  - Extends upto 400 kms
  - Main source of magma that comes out of volcanic eruptions



## UPSC Civil Services Examination, Previous Year Question (PYQ)

### Prelims

**Q 1.** In the structure of planet Earth, below the mantle, the core is mainly made up of which one of the following? (2009)

(a) Aluminium

- (b) Chromium
- (c) Iron
- (d) Silicon

**Ans: (c)**

### **Mains**

**Q.** Define mantle plume and explain its role in plate tectonics. **(2018)**

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