Bellringer

List the four layers of Earth, starting with the innermost and moving outward.

Earth's Interior

Notes

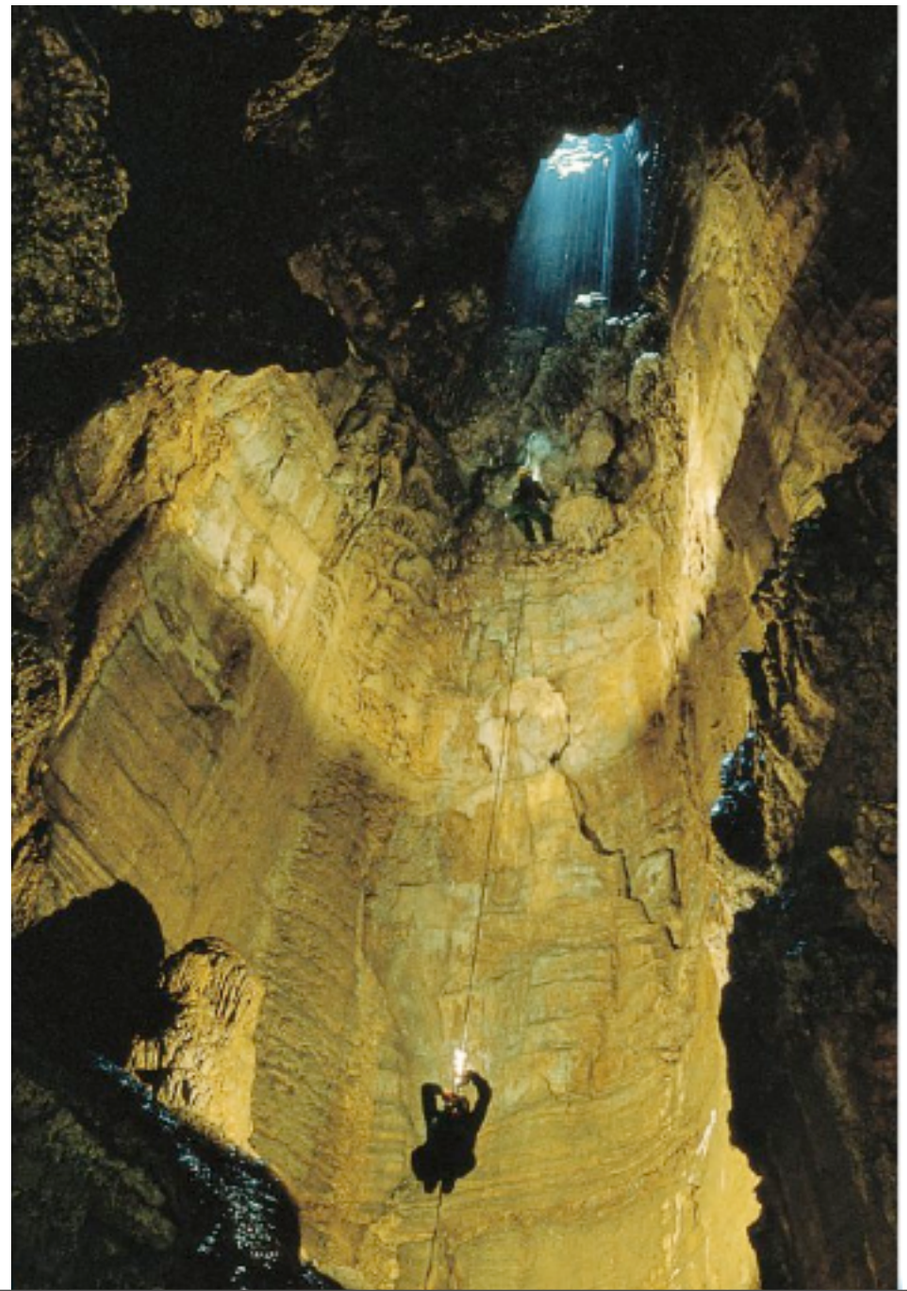
Exploring Inside Earth

- Geologists have used two main types of evidence to learn about Earth's interior: direct evidence from rock samples and indirect evidence from seismic waves.

Exploring Inside Earth

- Scientists cannot travel inside Earth to explore it. So scientists must learn about Earth's interior, or inside, in other ways.

Volcanic eruptions make people wonder what's inside Earth.



The deepest mine in the world reaches a depth of 3.8 kilometers. But to get to the center of the planet, you'd have to dig to 6,000 km!

Exploring Inside Earth

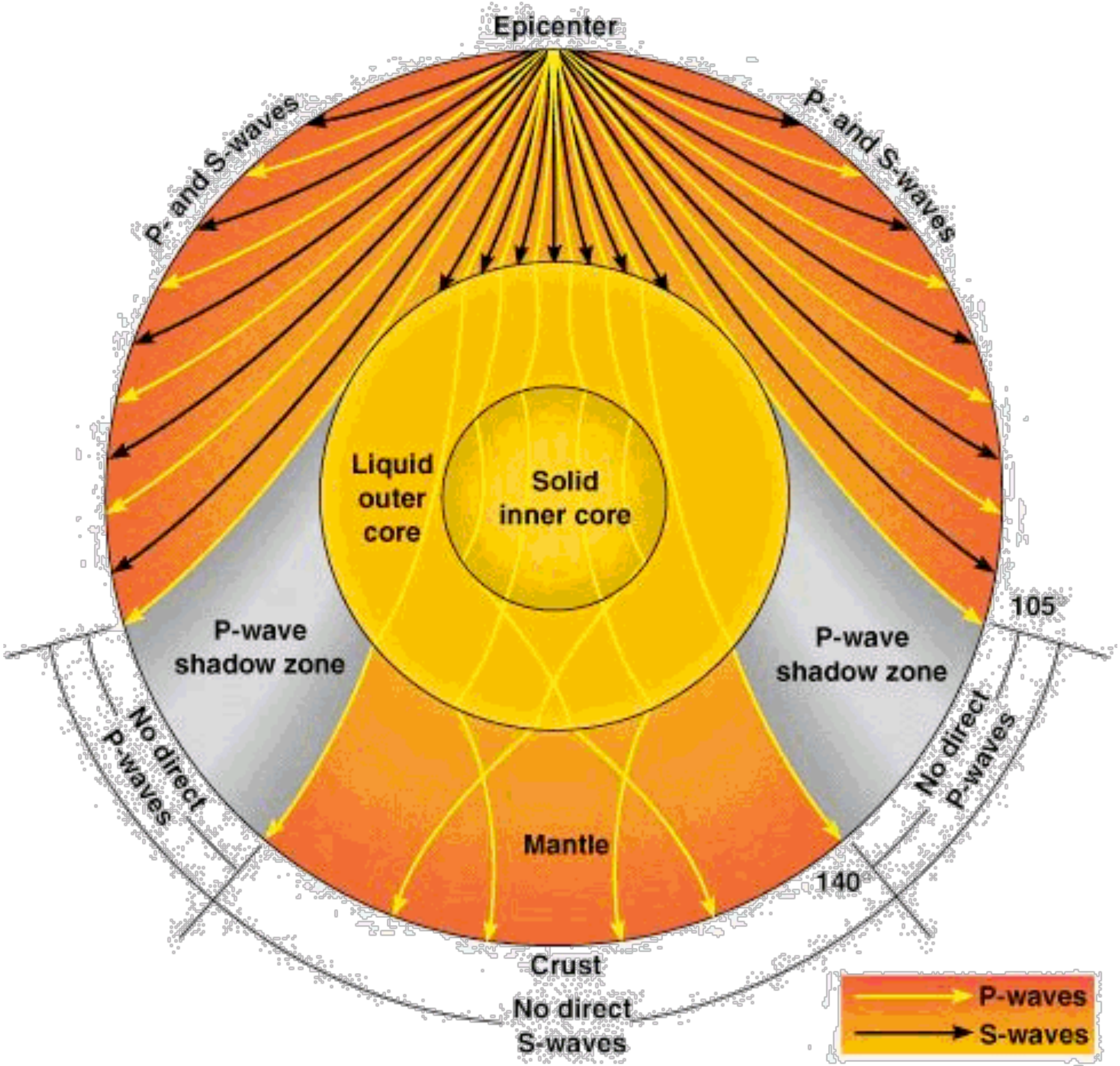
- Geologists have been able to drill 12 km into Earth's crust. These rock samples give insight into the conditions present at those depths.
- In addition to this, forces inside Earth can sometimes force rock up from depths of over 100 km.

Deep drilling of Earth's crust usually occurs at ocean drilling sites, where scientists can get a 5-8 km start at the ocean floor.

Exploring Inside Earth

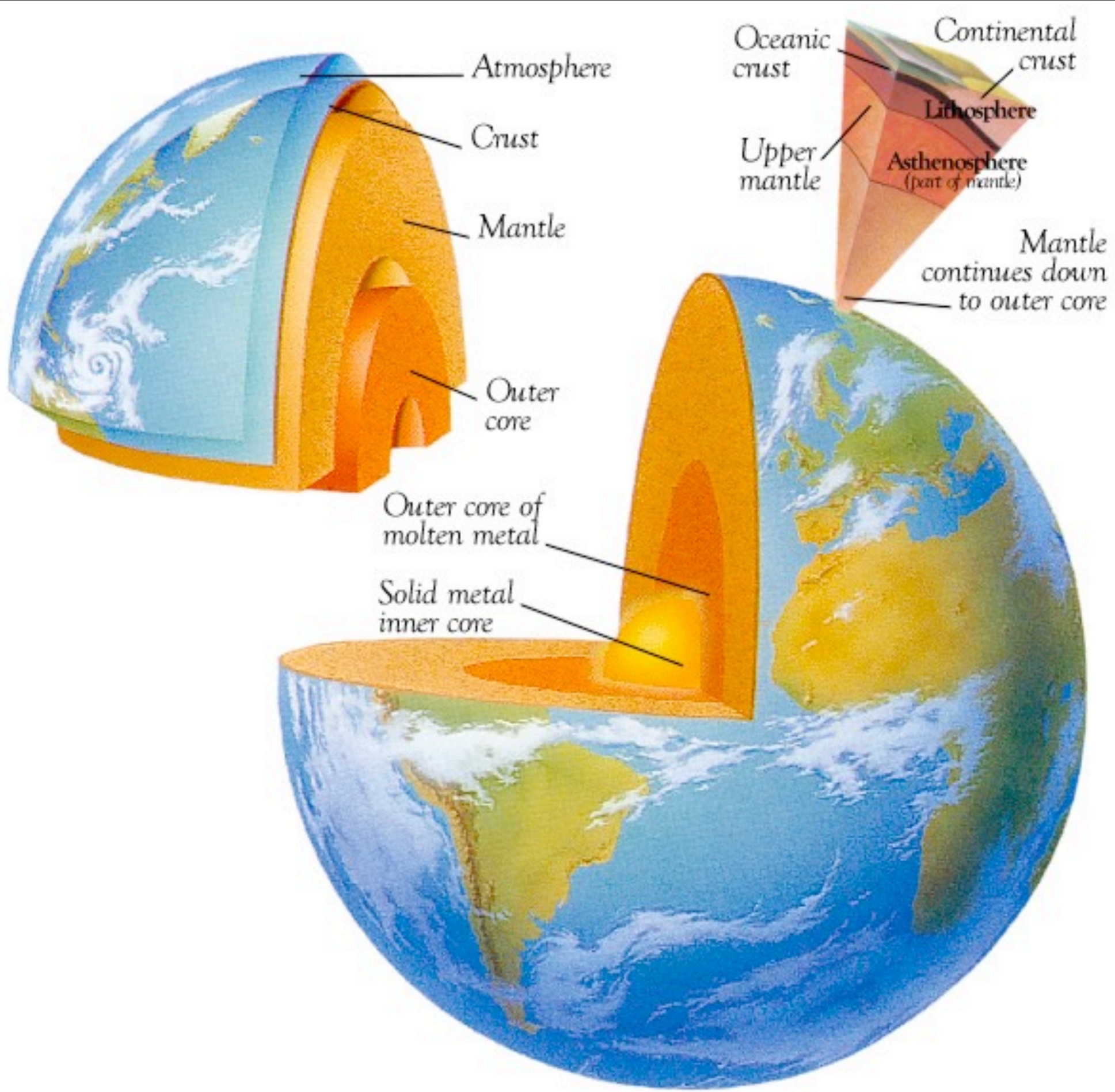
- Scientists study how seismic waves travel through Earth. **Seismic waves** are waves made by earthquakes. Seismic waves show that Earth is made up of layers like an onion.

- Remember that whereas P-waves can travel though all states of matter, S-waves are blocked by liquids such as that of the outer core.


Epicenter
P- and S-waves
P- and S-waves
Liquid outer core
Solid inner core
P-wave shadow zone
P-wave shadow zone
Mantle
105
140
No direct P-waves
No direct P-waves
Crust
No direct S-waves
P-waves
S-waves

A Journey to the Center of Earth

- Earth has four main layers. The crust is the outside layer. The mantle is beneath that. The outer core is below the mantle, and the inner core is the inner-most layer.


Atmosphere
Crust
Mantle
Outer core
Outer core of molten metal
Solid metal inner core
Oceanic crust
Continental crust
Lithosphere
Upper mantle
Asthenosphere (part of mantle)
Mantle continues down to outer core

A Journey to the Center of Earth

- Temperature increases from the crust to the inner core. It is ver hot inside Earth. One reason it is so hot is that some substances inside Earth give off energy.
- The primary sources of heat come from radioactive decay (80%) and residual heat from planetary formation (20%).
- With this heat, the temperature of Earth increases 22.1°C for every kilometer of depth, making the core about 7,000K or 12,000°F.

A Journey to the Center of Earth

- Pressure also increases from the crust to the inner core. **Pressure** is caused by the force pressing on an area. There is great pressure inside Earth because of all the rock pressing down from above.
- The core pressure can be 360 GPa (Giga-Pascals) or about 52,213,590 psi.

The Crust

- The **crust** is a layer of rock that Forms Earth's outer skin. The crust is Earth's thinnest layer. It is only 5 (on the ocean floor) to 70 (Mt. Everest) kilometers thick.

Exosphere
Thermosphere
Mesosphere
Stratosphere
Troposphere

Not to scale

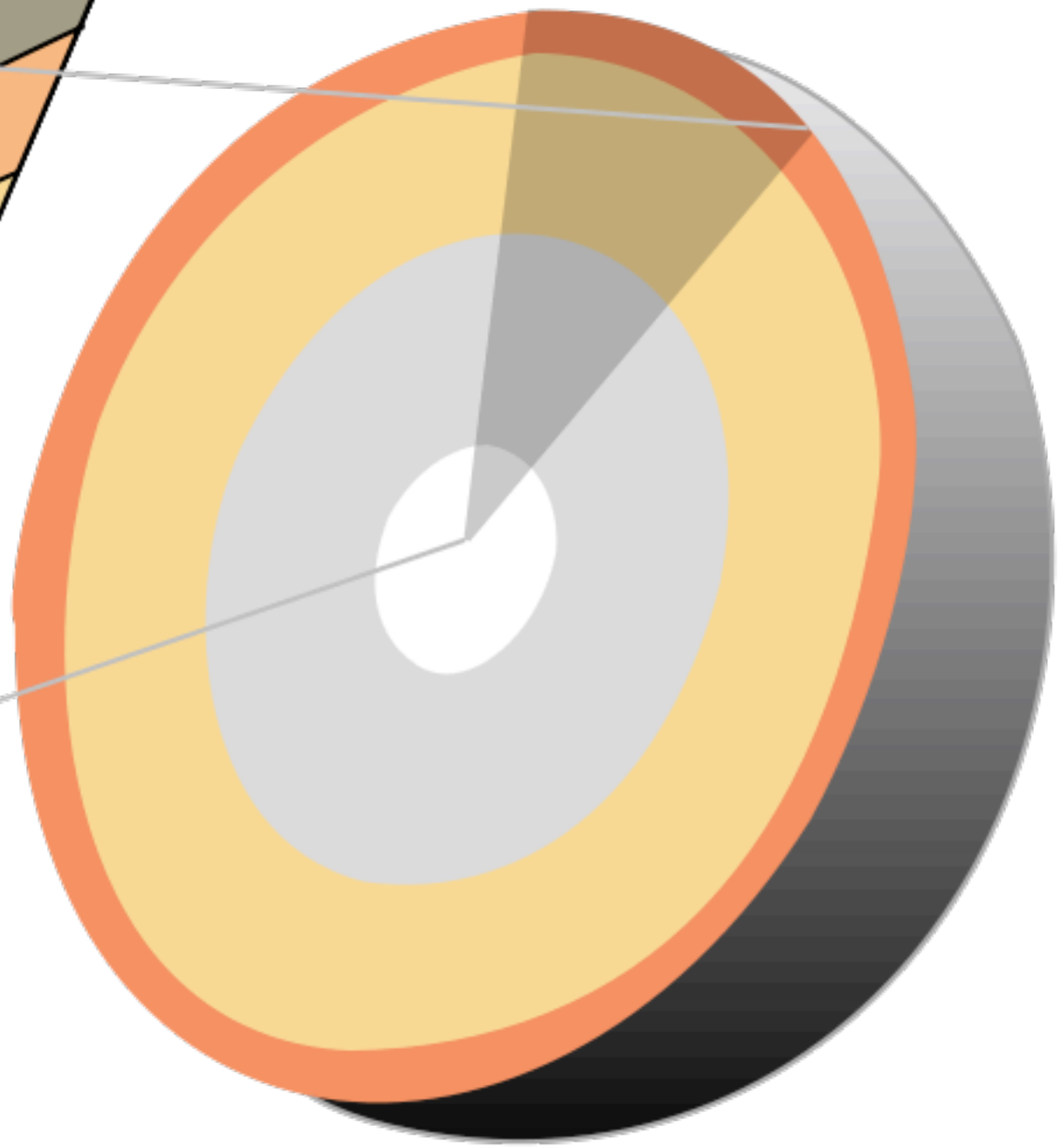
Crust

Upper Mantle

Mantle

Outer Core

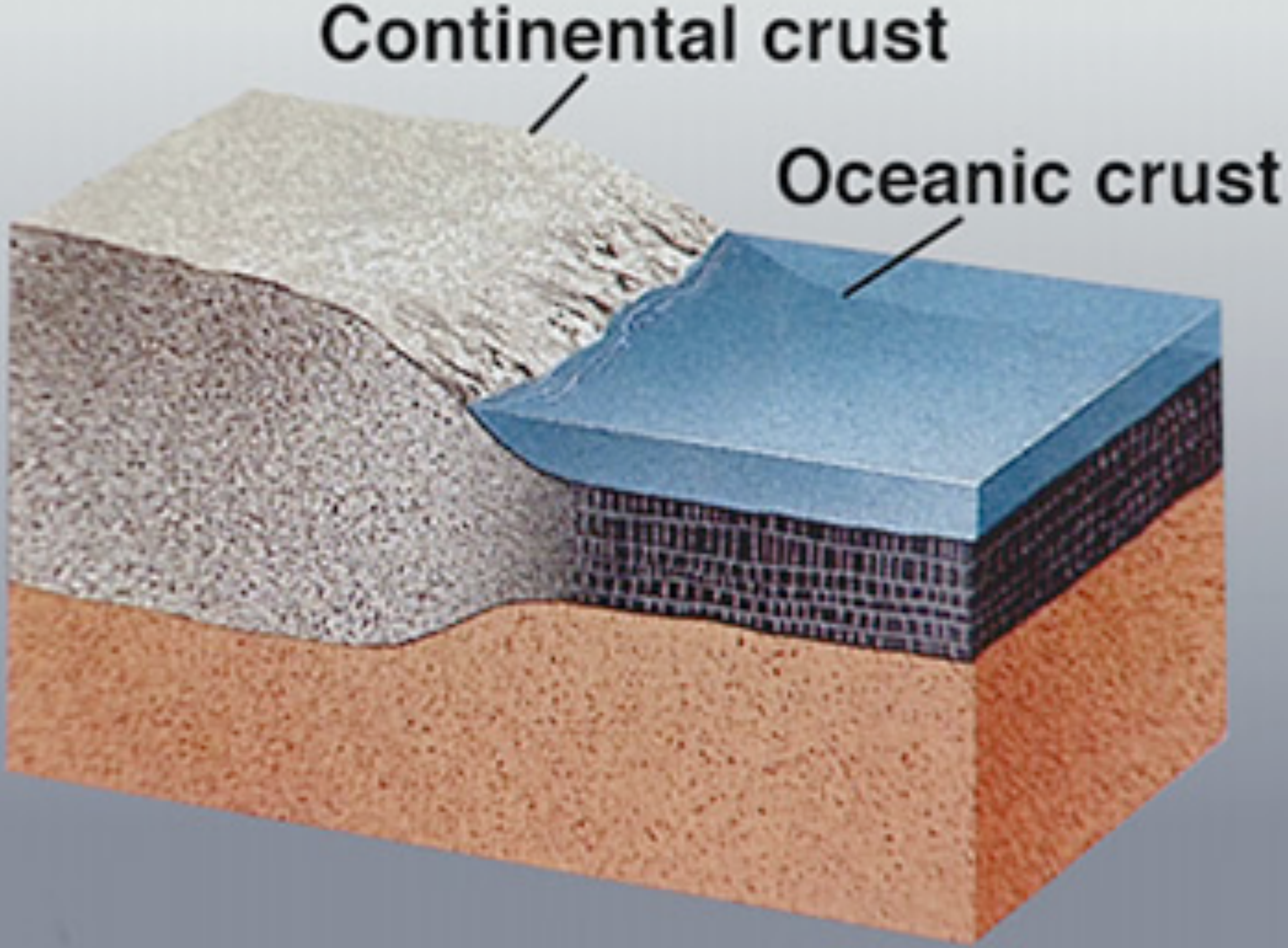
Inner Core



To scale

The Crust

- The curst that makes up the ocean floors is called oceanic crust. Oceanic crust is made mostly of a rock called **basalt**. Basalt is usually dark colored with a fine texture.
- The crust that makes up the continents is called the continental crust. Continental crust is made mostly of a rock called **granite**. Granite is usually light colored with a course texture.
- Continental crust is thicker than oceanic crust.


Continental crust
Oceanic crust

The Mantle

- The **mantle** is the layer below the crust. The mantle is Earth's thickest layer and is usually divided into three sections.

- The top layer of the mantle, along with the crust is the **lithosphere**. The the upper mantle is hard rock.
- The middle layer of the mantle is the **asthenosphere**. The middle layer is soft rock, like hot road tar, also sometimes referred to as plastic.

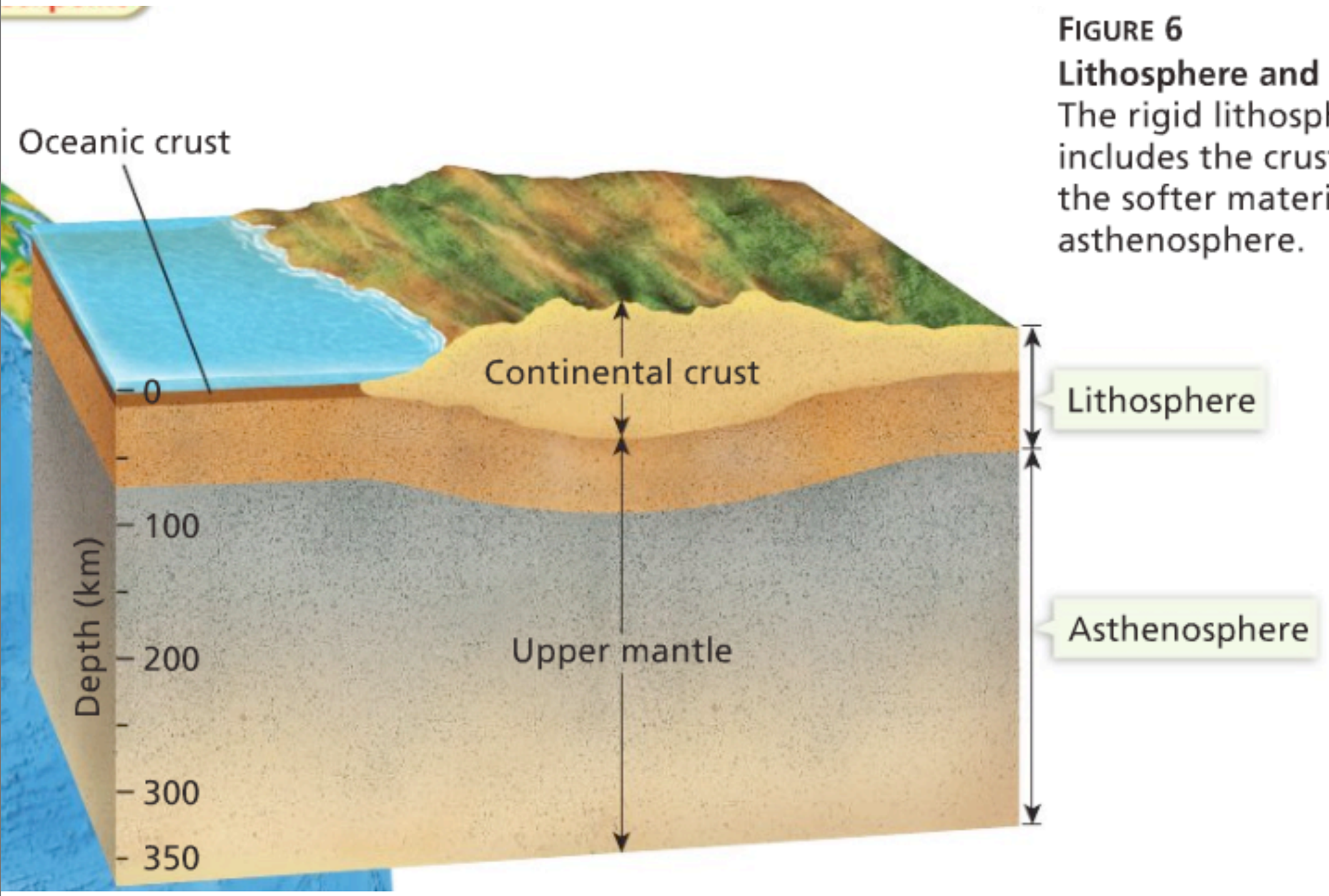


FIGURE 6
Lithosphere and Asthenosphere
The rigid lithosphere, which includes the crust, rests on the softer material of the asthenosphere.

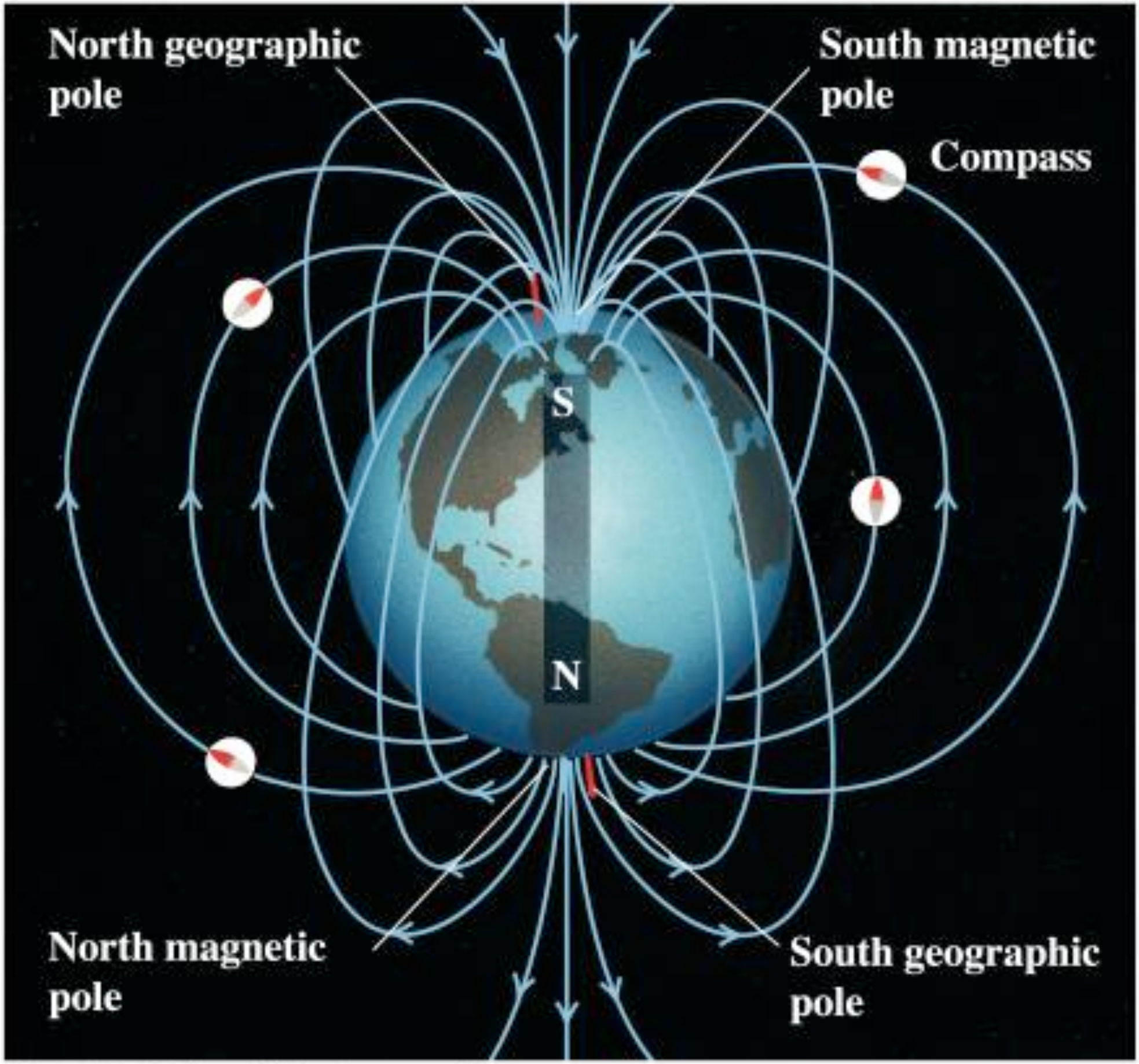
The Mantle

- The lower mantle is composed of hard rock and extends downward until it reaches the outer core.
- Overall, the mantle is nearly 3,000 km thick.
- The primary rock composing the mantle is peridotite.

The Core

- Both layers of the core are composed of nickel and iron.
- The outer core is made of liquid metal. The liquid metal flows in currents, convects, and is electrically conductive. These currents make Earth act like a giant magnet (Dynamo Theory), with north and south poles that attract iron.


MANTLE
OUTER CORE
INNER CORE



The Core

- The **inner core** is made of solid metal. The inner core is solid because it is under so much pressure.
- Keep in mind that it is over 12,000°F in the core, which is hot enough to melt most materials on Earth, but the pressure is so great that the atoms in the core are forced together into a solid state of matter.

Reading Checkpoint What is the main type of rock in oceanic crust?