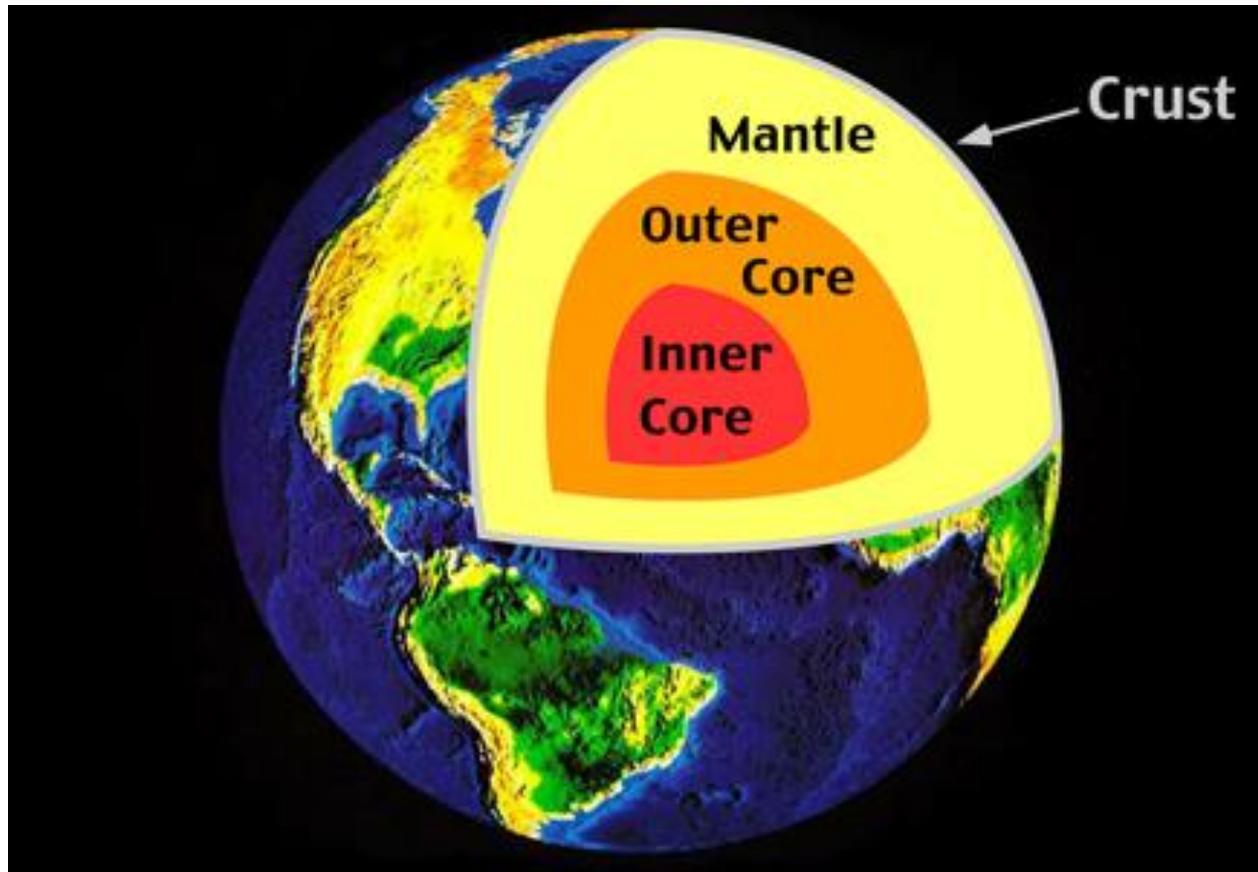


Earth Structure and Composition

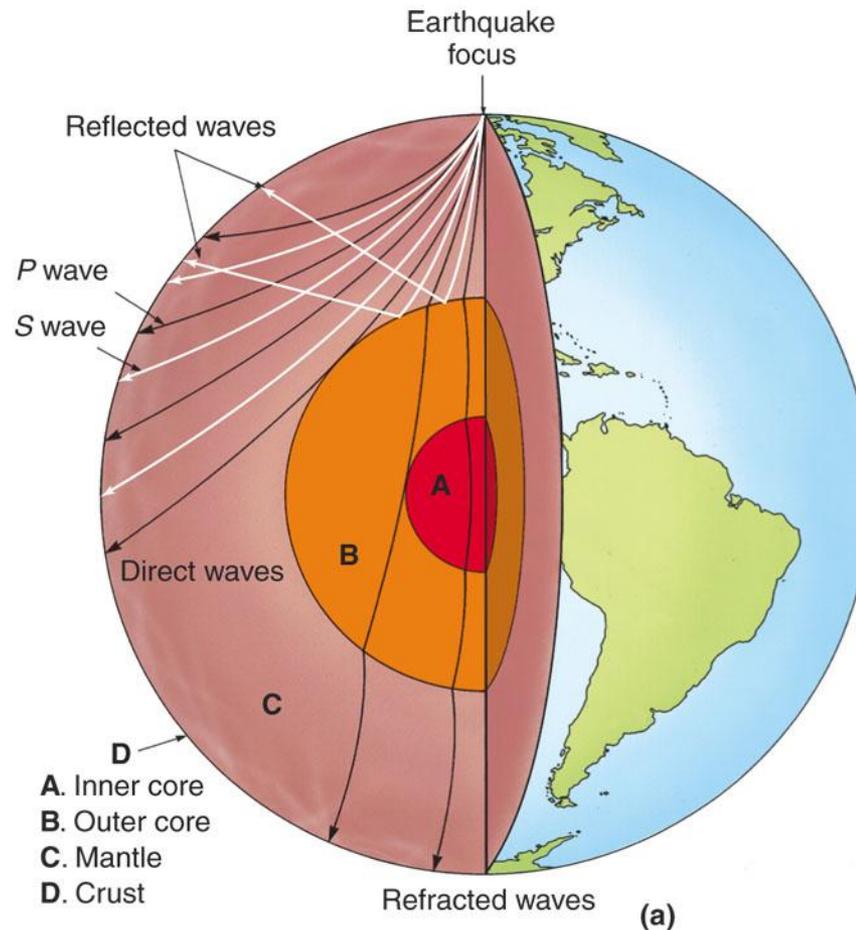
Layers, Rocks, Minerals and the Rock Cycle



The Layers of the Earth

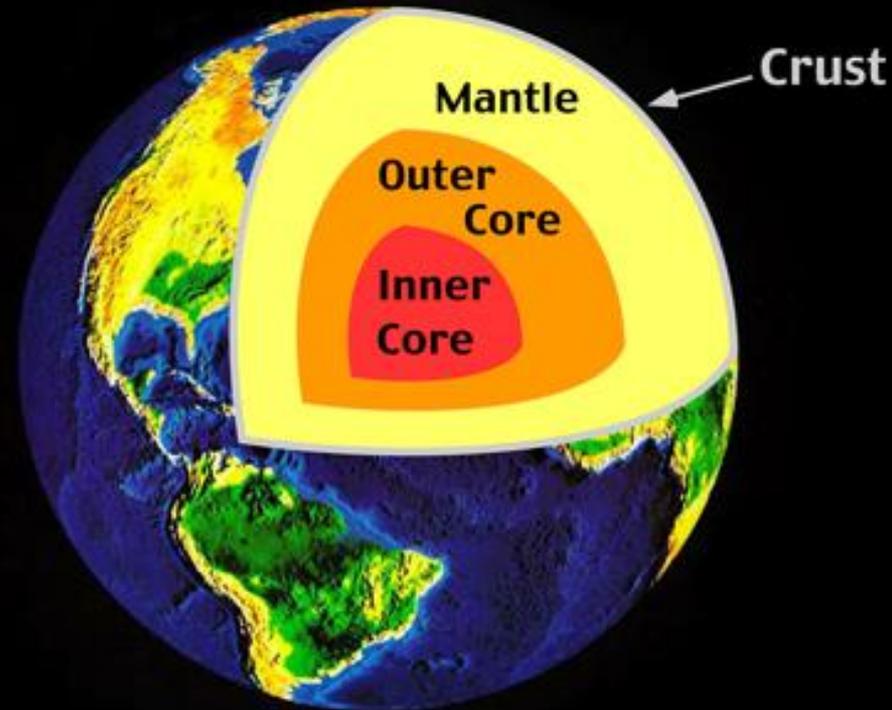
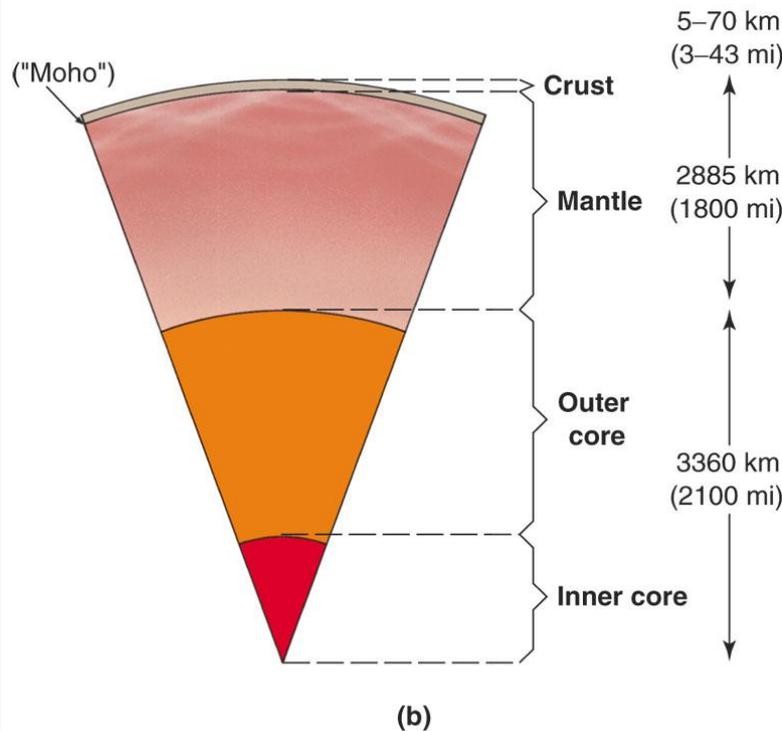
The Earth is an oblate spheroid – the Solid Earth.

It is composed of a number of **different layers** as determined by deep drilling and seismic evidence.

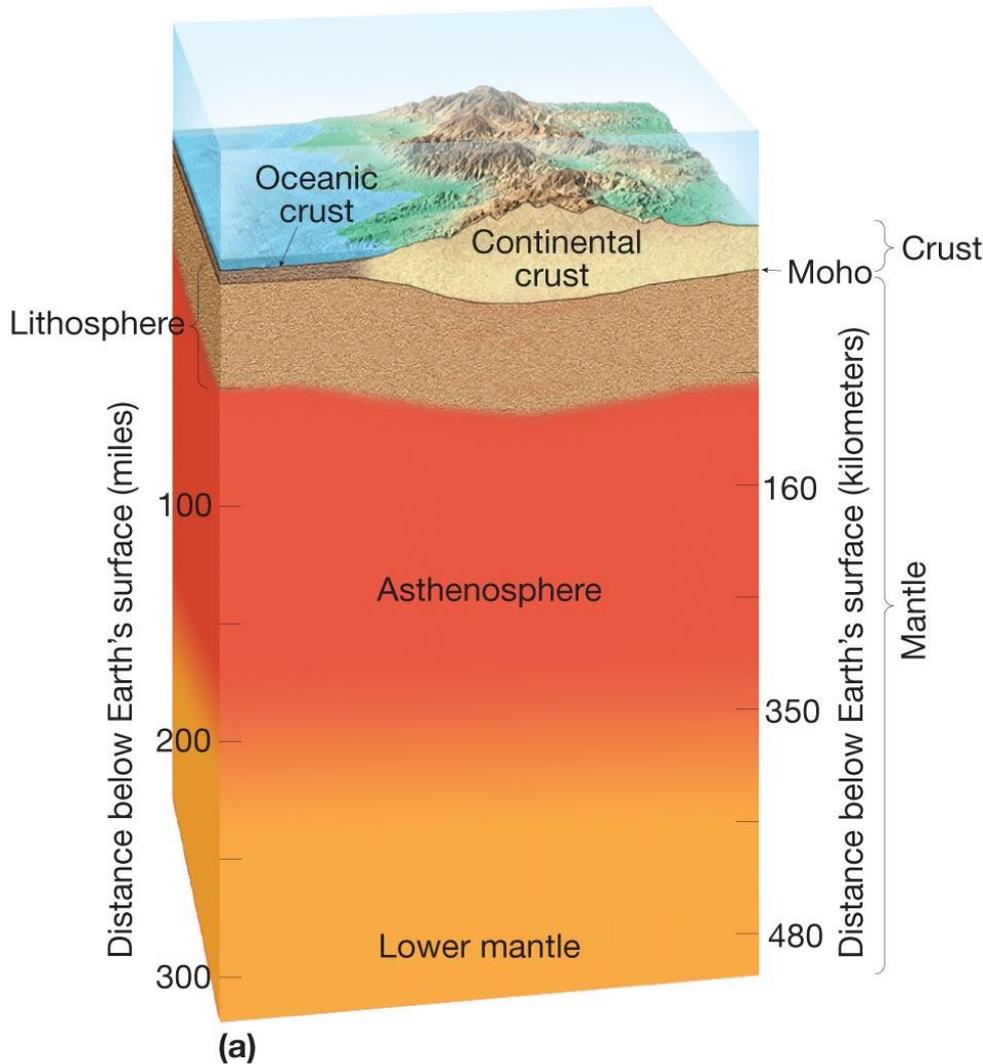


The Four Basic Layers

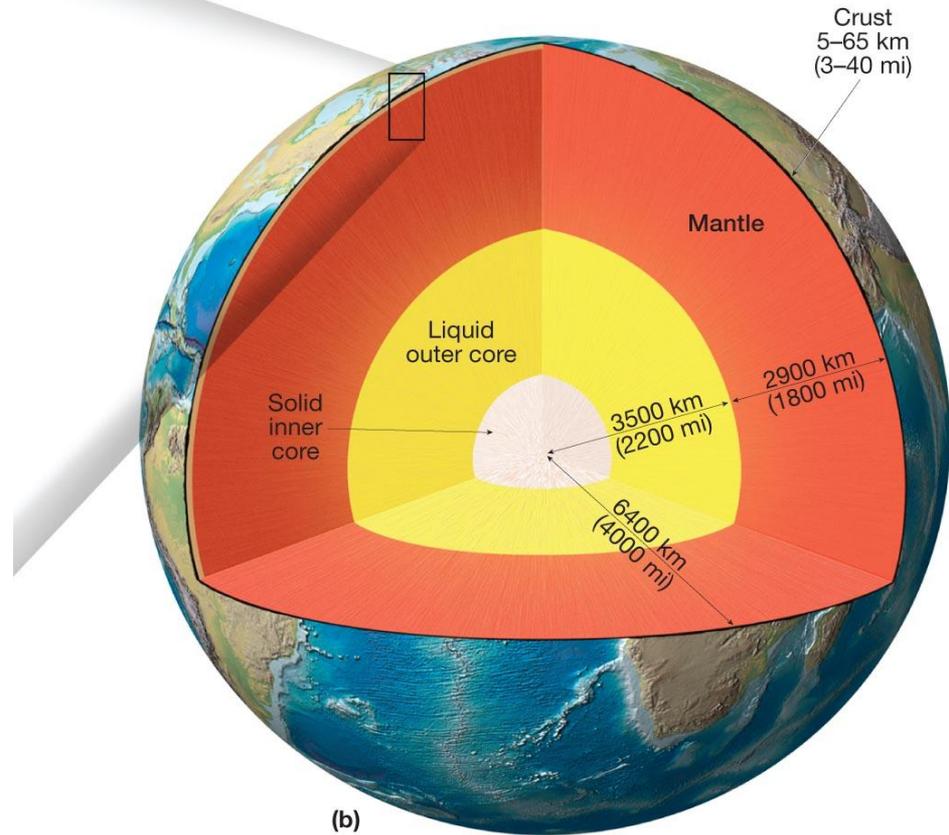
- ❑ The **crust** is the layer that you live on, and it is the most widely studied and understood.
- ❑ The **mantle** is much hotter, has the largest mass, and several layers (uppermost/rigid mantle, asthenosphere, lower mantle).
- ❑ The **outer core and inner core** are even hotter with pressures so great you would be squeezed into a ball smaller than a marble if you were able to go to the center of the Earth!



A More Detailed View of Earth's Structure



(a)

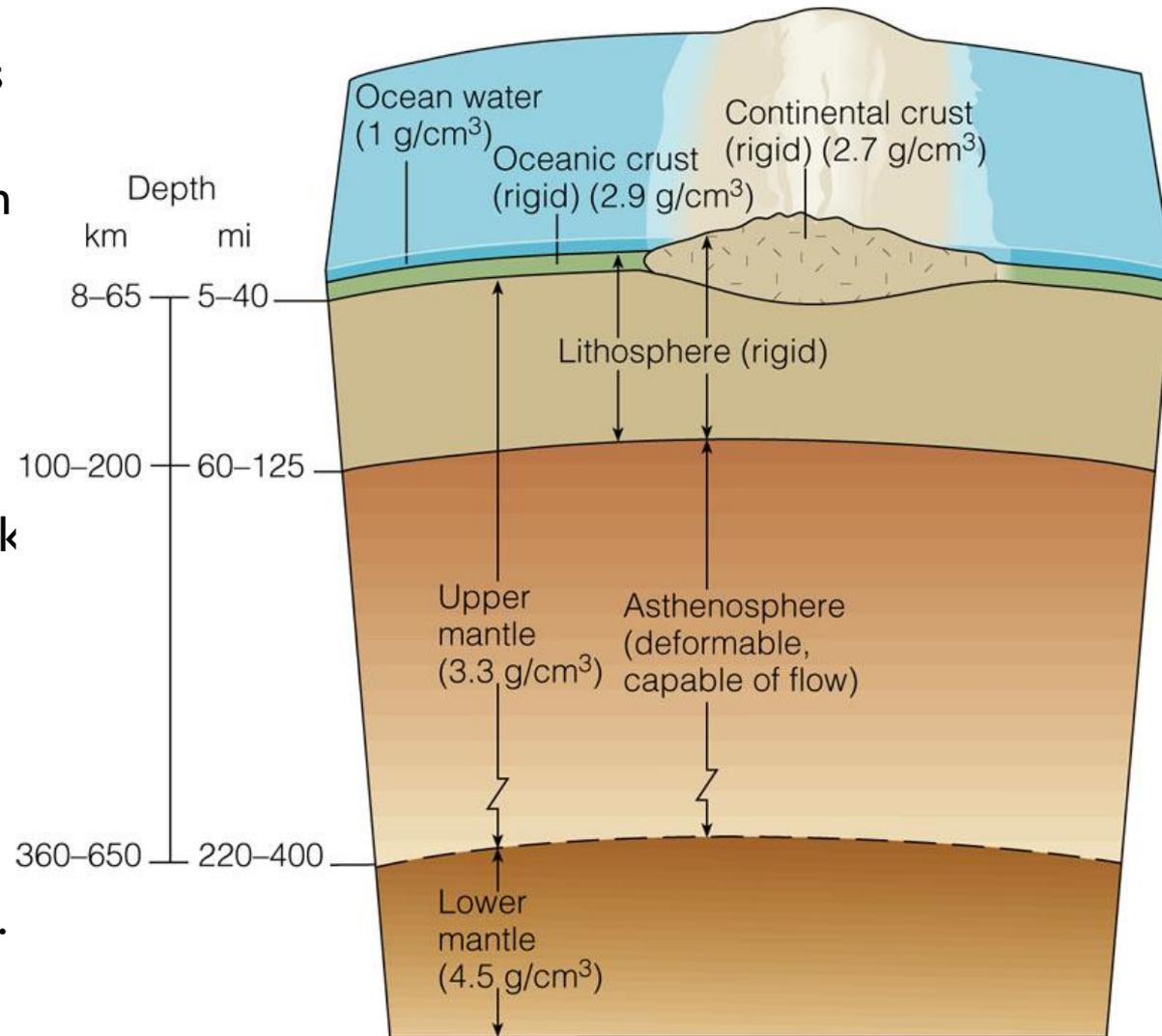


(b)

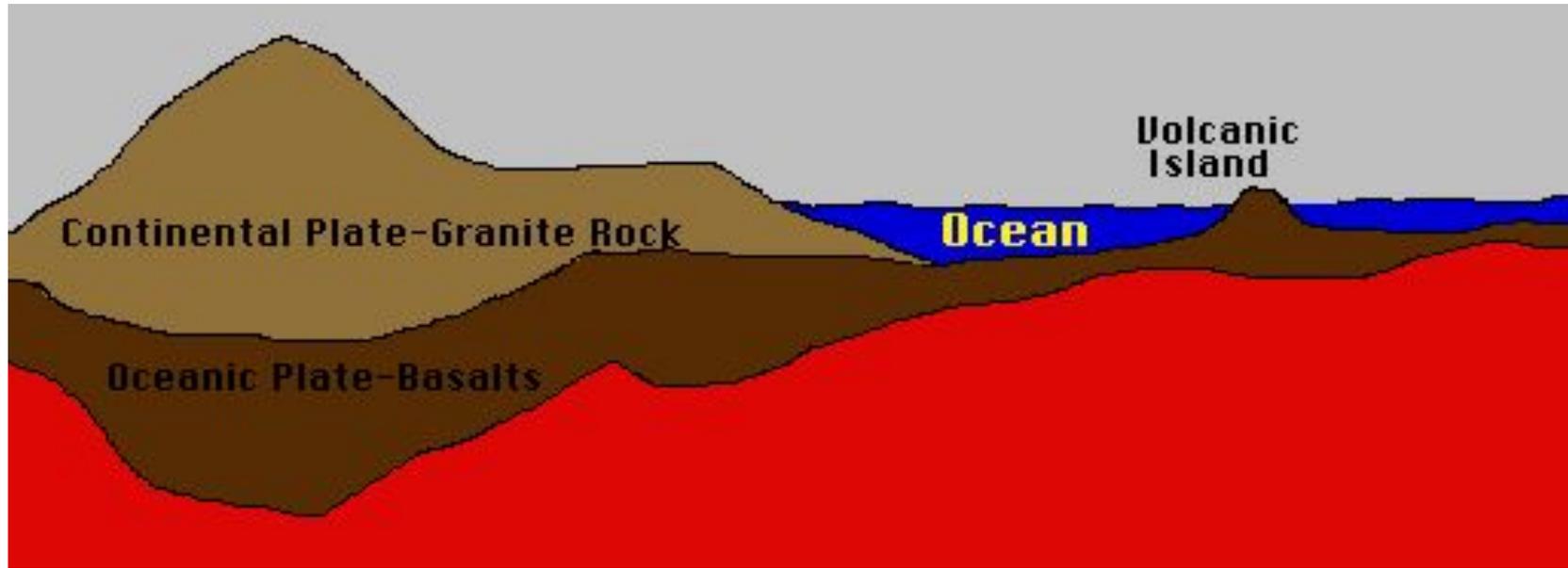
The Crust

The Earth's **Crust** is like the skin of an apple. It is very thin in comparison to the other three layers.

The crust is only about 3 - 5 miles thick under the oceans (**oceanic crust**) and about 25 miles thick under the continents (**continental crust**).



The Crust



The **crust** is composed of two different rocks.
The **continental crust** is mostly **granite**.
The **oceanic crust** is **basalt**.

Basalt is much denser than granite. Because of this the less dense continents ride on the denser oceanic plates.

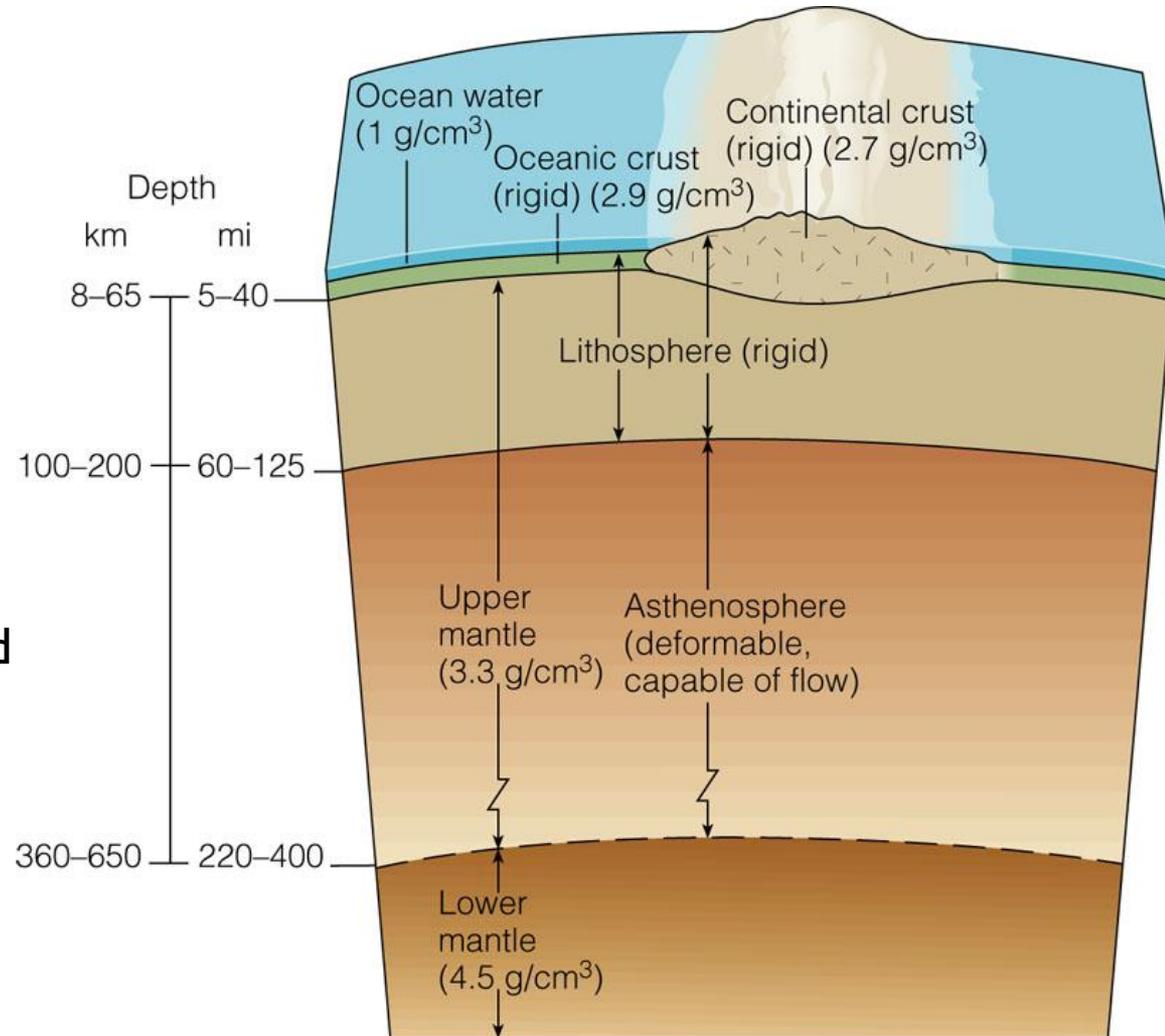
The Mantle

The **Mantle** is the largest layer of the Earth (1800 miles thick – 2/3 of earth's mass), it is hot (5100 - 3300° F), and the source of most **magma** → **(lava)**

The uppermost part of the mantle is rigid, and together with the crust, forms the **Lithosphere**

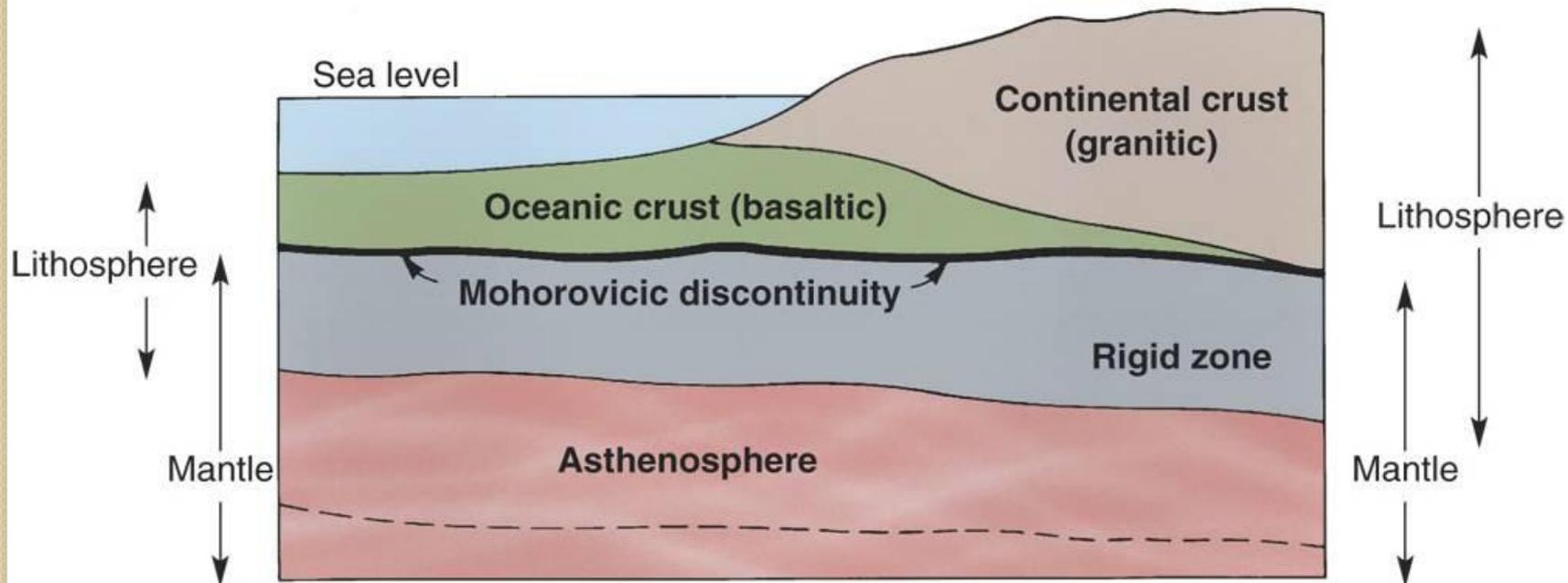
The middle part of the **upper mantle** is composed of very hot dense rock that flows like asphalt, and it is called – **asthenosphere**

The lower mantle is hot and dense.

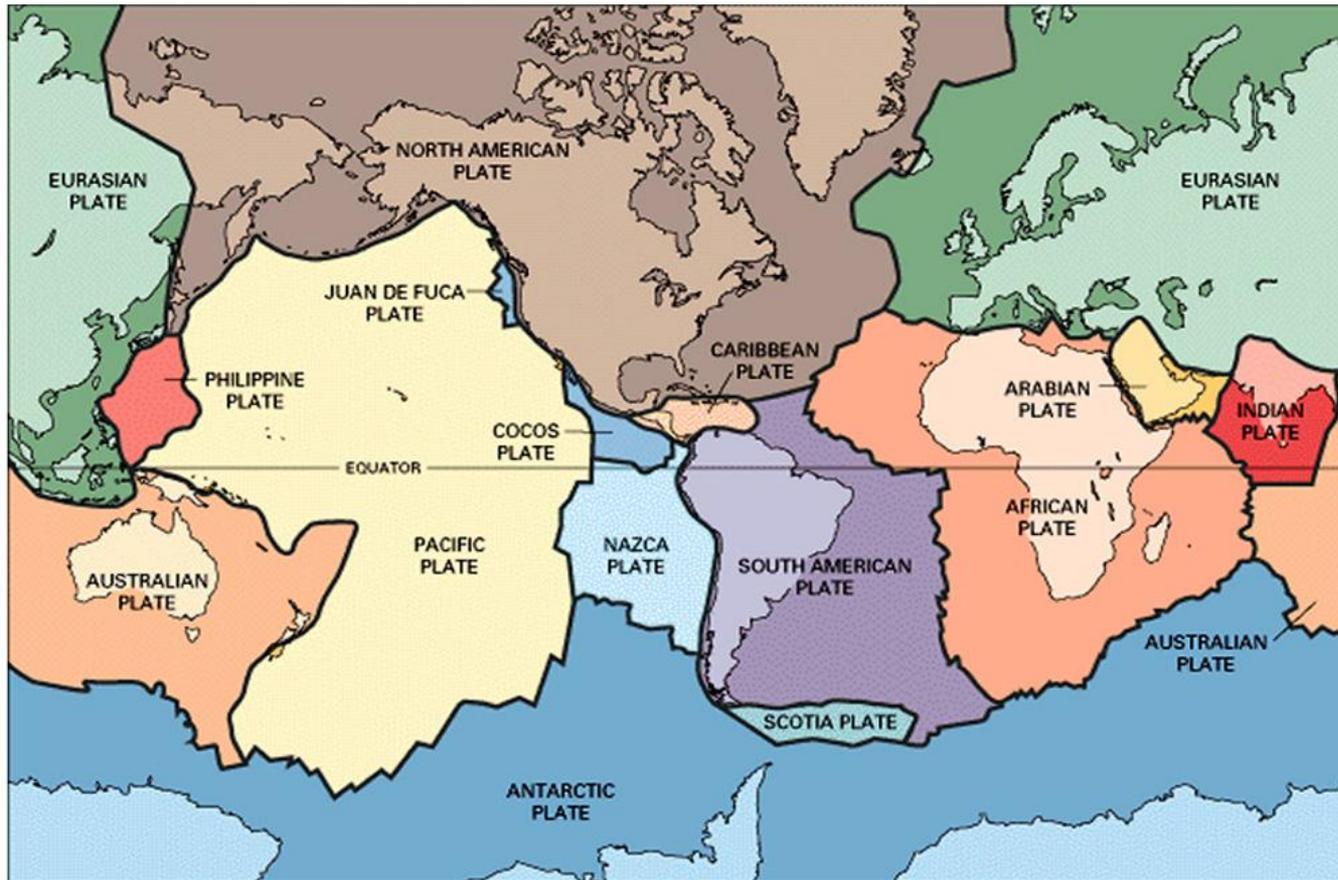


The Lithosphere

The **crust** and the **uppermost layer of the mantle** together make up a zone of **rigid, brittle** rock called the **Lithosphere**.



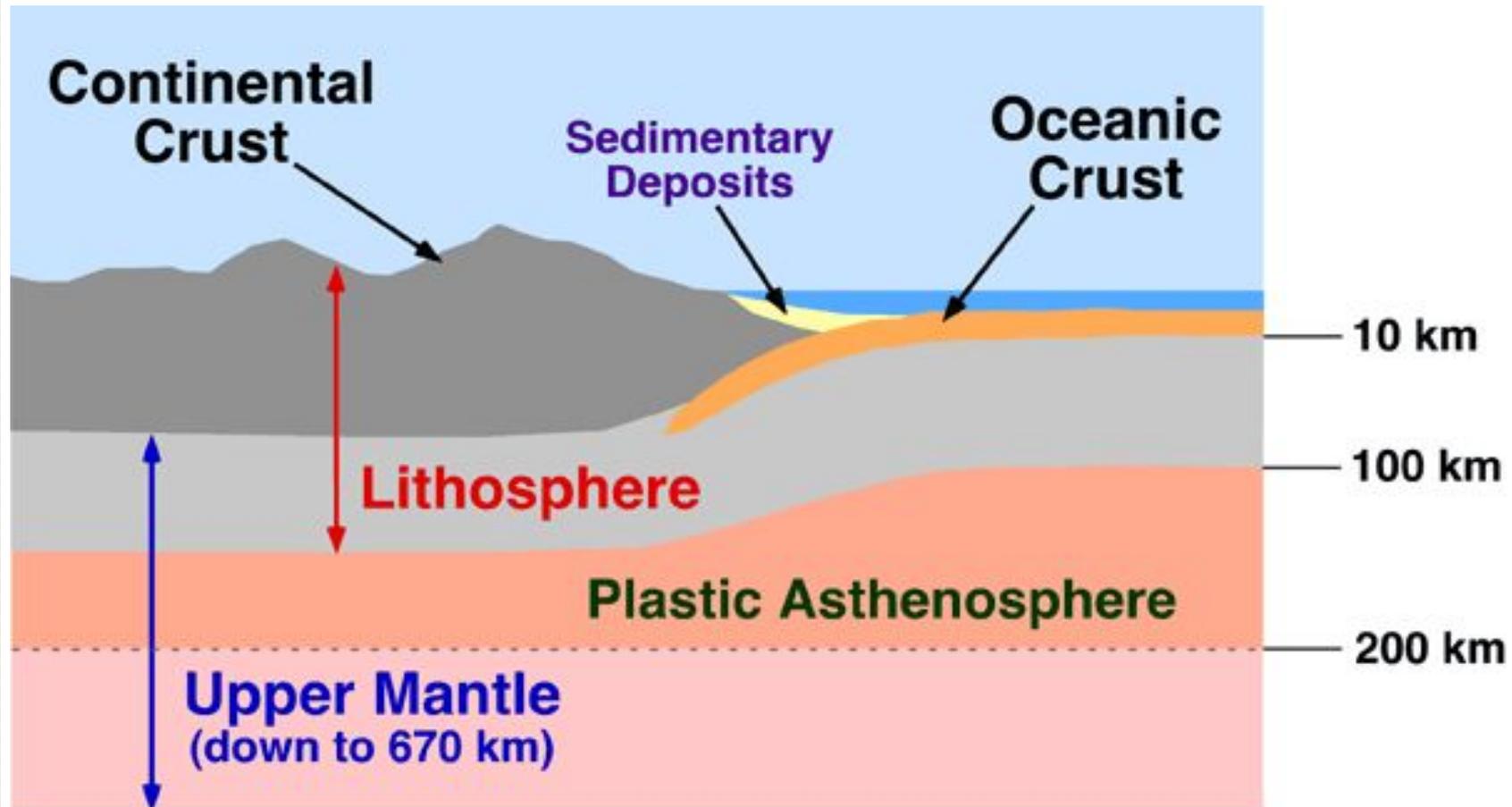
The Lithospheric Plates



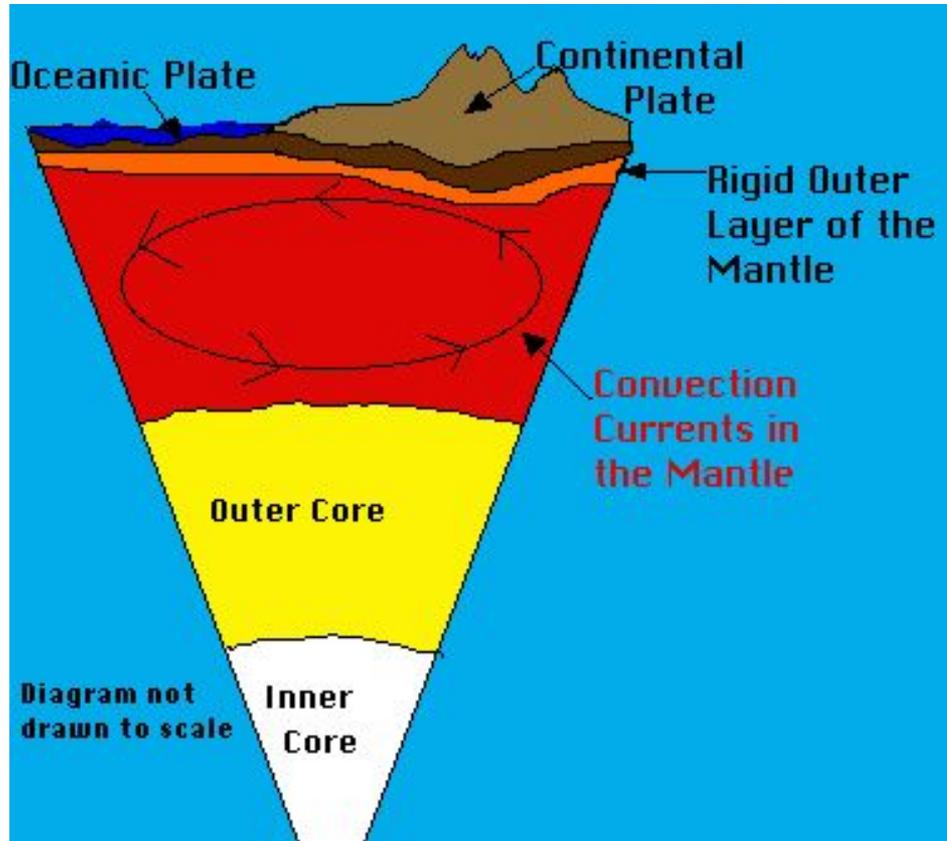
The **crust** of the Earth (which is part of the lithosphere) is broken into many pieces called **lithospheric/crustal plates**. The plates "float" on the soft, semi-rigid or plastic **asthenosphere**.

The Asthenosphere

The **asthenosphere** is the semi-rigid part of the **upper mantle** that flows like hot asphalt under a heavy weight.



Convection Currents



The asthenosphere "flows" because of convection currents.

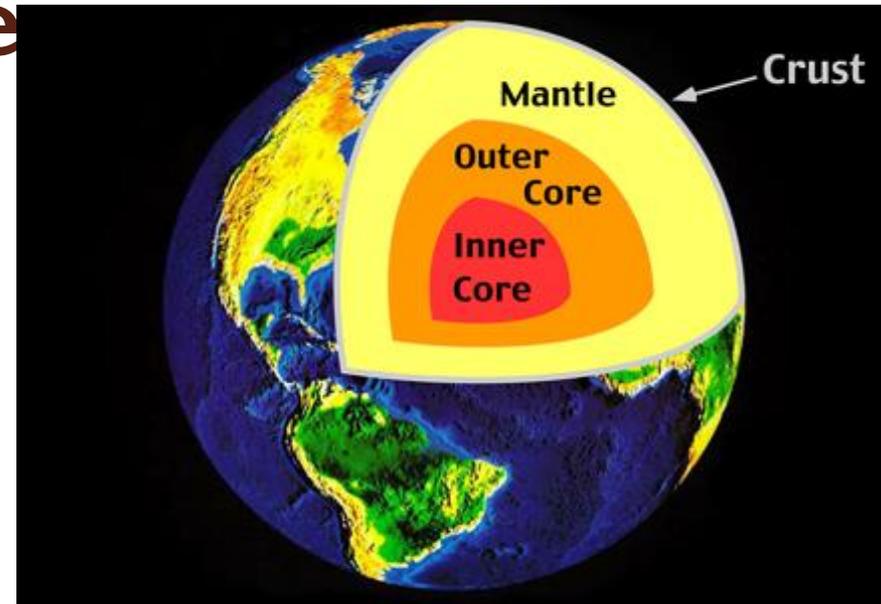
Convection currents are caused by the very hot material at the deepest part of the mantle rising, then cooling and sinking again – repeating this cycle over and over.

When the convection currents flow in the **asthenosphere** they also move the lithospheric/crustal plates.

- ❑ **The core** of the Earth has a radius of 2100 miles and contains 1/3 of Earth's mass.
- ❑ It is like a ball of very hot metals, with estimated temperatures of 12,400°F at the center, and 8,600°F at the outer limits.

The Outer Core

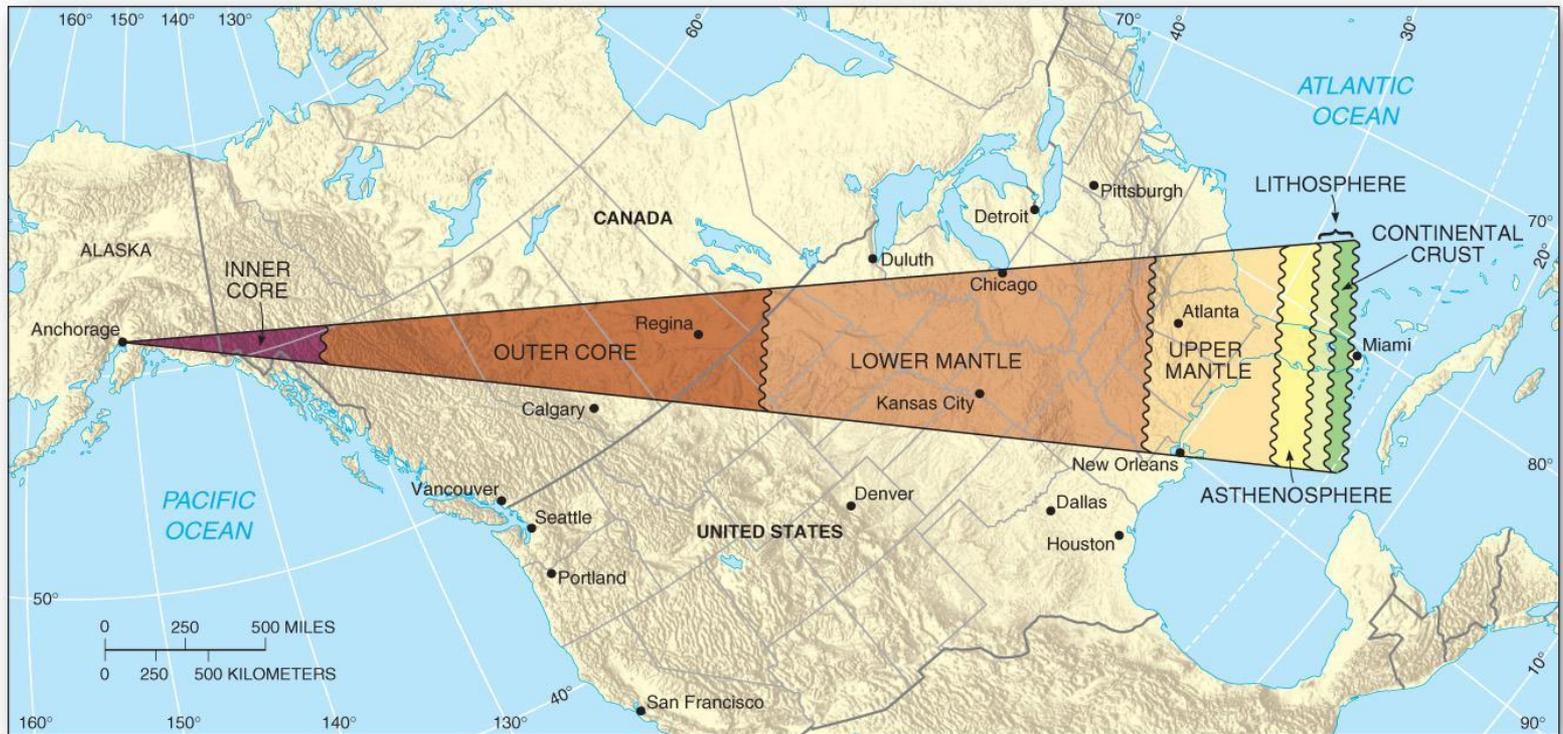
The **outer core** (1400 miles thick) is so hot that metals in it are in liquid state. It is composed of mainly melted **nickel and iron** → Earth's **magnetic sphere** is largely related to this outer core



The Inner Core

The **inner core** of the Earth, about 700 miles thick, has temperatures and pressures so great that the metals are squeezed together and are not able to move about like a liquid, but are forced to vibrate in place like a **solid**.

Core to Crust

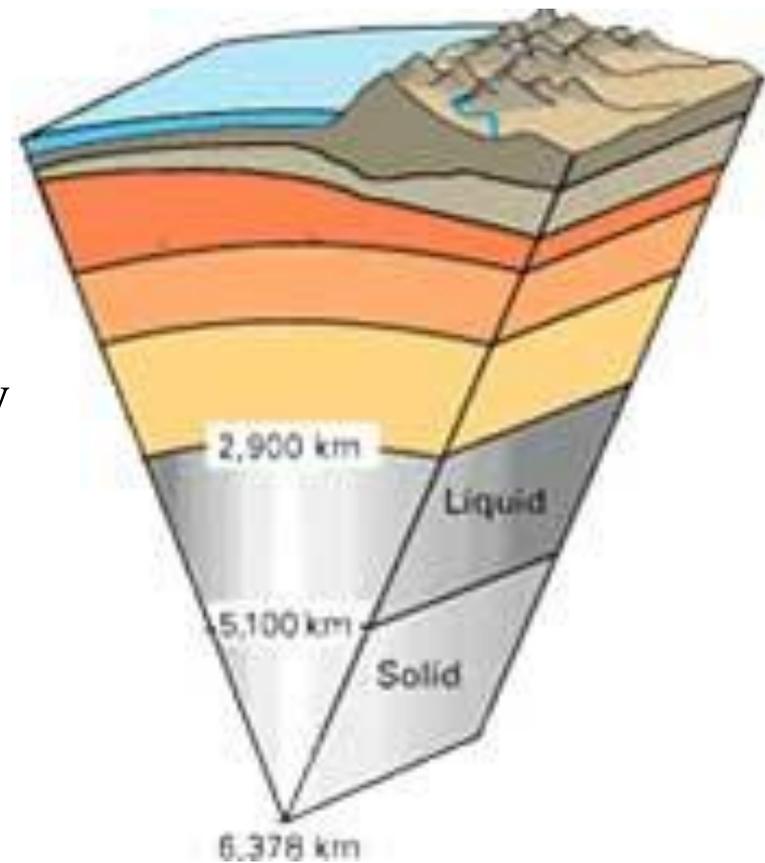


Earth Structure: Established Relationships

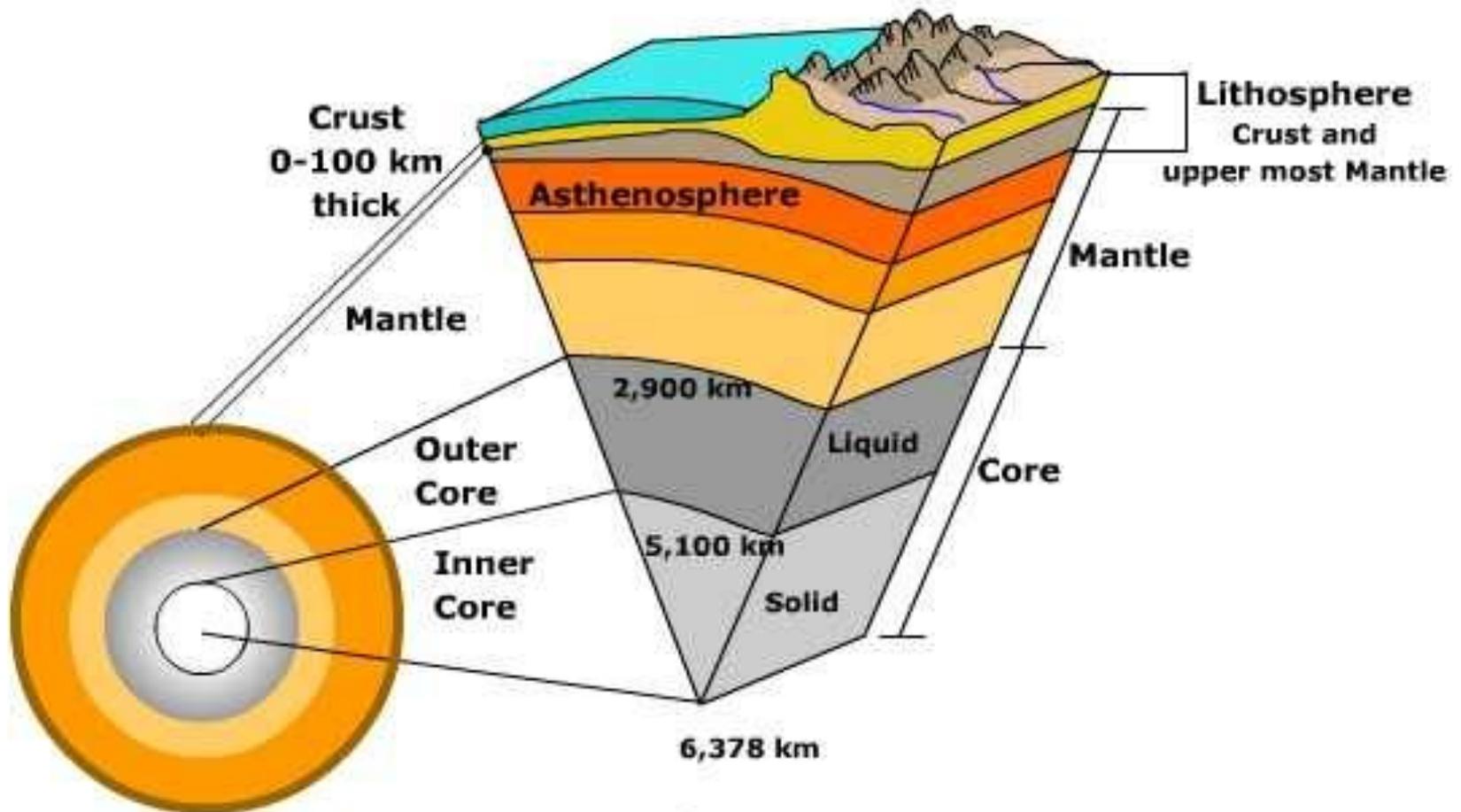
- ❑ **Density of materials** (rocks, minerals) greatest in the center (core), and decreases towards the surface
- ❑ **Gravitational force** strongest at the center, decreasing towards the surface
- ❑ **Temperature** also decreases from center to the periphery
- ❑ **Pressure** decreases from center to periphery as well
- ❑ **Layers** in earth's internal structure are differentiated by composition, density, temperature and other characteristics
- ❑ Earth's interior is an immense **reservoir** of **minerals** and **geothermal energy**

Questions

1. What are the different layers in Earth's Structure that are indicated on this diagram?
2. Which layers together constitute the Lithosphere?
3. Which layer is characterized by convection currents?
4. What layers are solid? Which ones are liquid and/or plastic?
5. **Have we ever seen part of the Mantle? Explain.**



Detailed View of Earth's Structure



Earth Structure
(Not to Scale)