

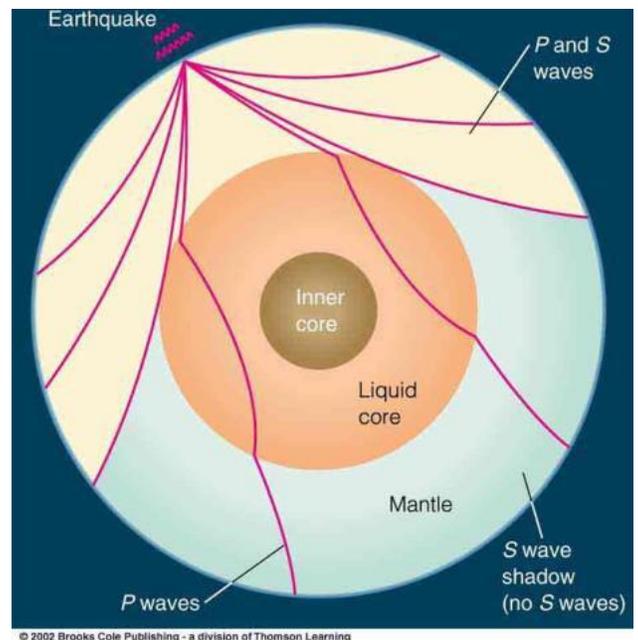
A Journey to the Center of Earth

Earth's Four Layers

Some of the deepest places that man has dug into Earth are in South Africa. Mining companies trying to extract gold have dug into the Earth about 3.5 kilometers. But we can't go too much further, because the heat and pressure at these depths prevent humans from going deeper. So if we can't go very deep into Earth, and we can't see the inside, then how do we know what's below the surface?

Isaac Newton (the same scientist who discovered gravity) was one of the first scientists to develop theories about the structure of Earth's interior. Based on his studies of gravity, Newton calculated the density of Earth and found that it had to be more than twice the density of rocks on the surface. Newton realized that the Earth had to be made of something besides rock.

Most of our knowledge about the structure of Earth comes from studying earthquakes. Every earthquake sends out waves in all directions - including through the Earth. These earthquake waves are called **seismic waves**. Observing seismic waves as they travel through Earth gives scientists an idea of the different materials that the waves move through. Seismic waves behave differently when they travel through different types of materials. Sometimes they change speed, and sometimes they bend or curve. By calculating these seismic waves as they move through Earth, scientists have concluded that there are four major layers that make up the Earth. Three of these layers are solid, and one of these layers is a liquid. All four layers have different characteristics.



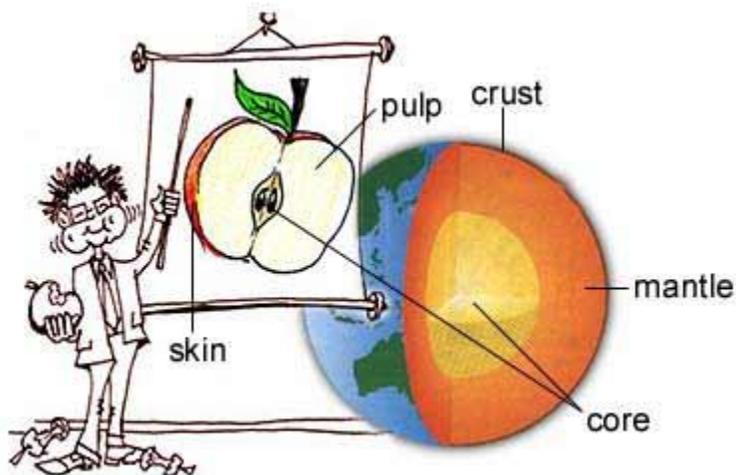
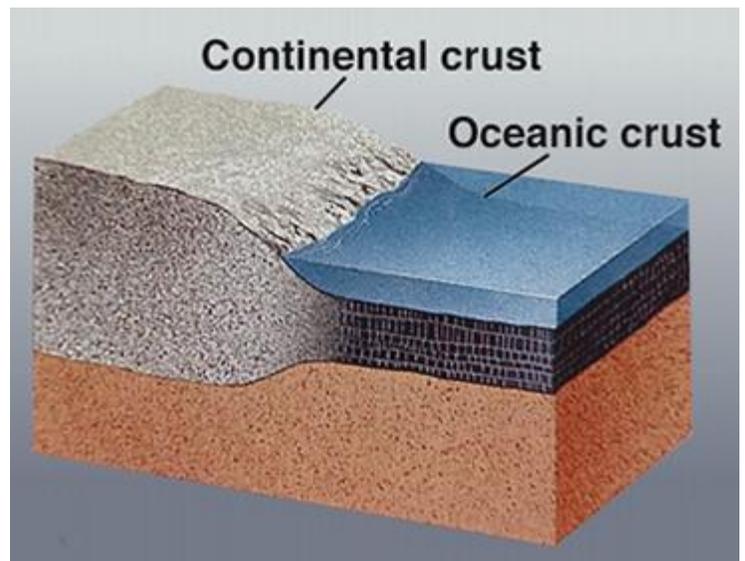
CRUST

The crust lies above the mantle, and is the Earth's hard outer shell. The crust is the surface on which we are living! The crust is 1–32 km thick. Compared to the other layers, the crust is the **thinnest** and the **least dense** layer. It floats on top of the softer, denser mantle. The crust is made up of **solid rock**, but these rocks are not the same all over the world.

There are two major types of crust: crust that makes up the ocean floors, and crust that makes up the continents. **Oceanic crust** is a thin layer found under the oceans. Even though it is thin, it is very heavy. Oceanic crust is made up of a metamorphic rock called basalt. Most oceanic crust is only **7–10 kilometers thick**.

Continental crust makes up the continents. It is lighter than oceanic crust, and is made up of less heavy rock such as granite. The continental crust is much thicker than the oceanic crust, which is why the continents rise above the oceans. Continental crust thickness ranges between **35 and 40 kilometers thick**.

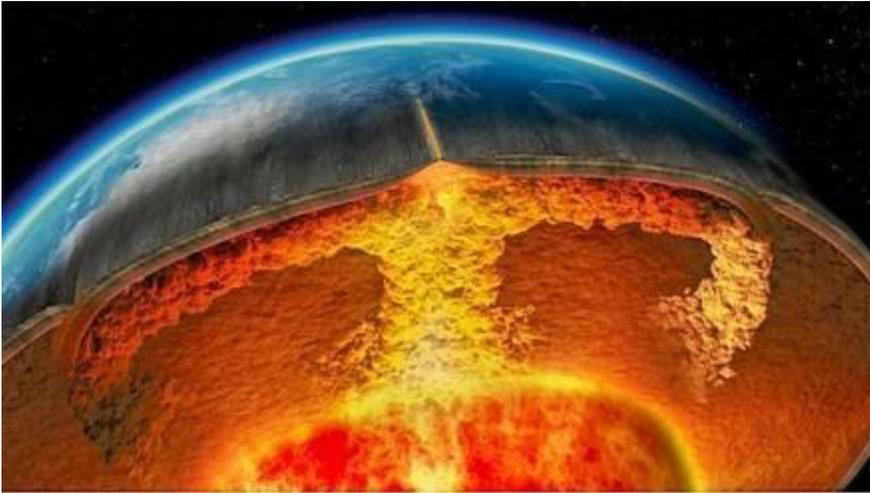
Earth is very hot inside. But it gets cooler as you move to the outside. The crust is the **coolest of Earth's layers**. Its temperature ranges from the **normal surface temperatures** that we feel, to as much as **870 degrees Celsius** at the bottom.



If the Earth were compared to an apple, the crust would be the thin skin of the apple.

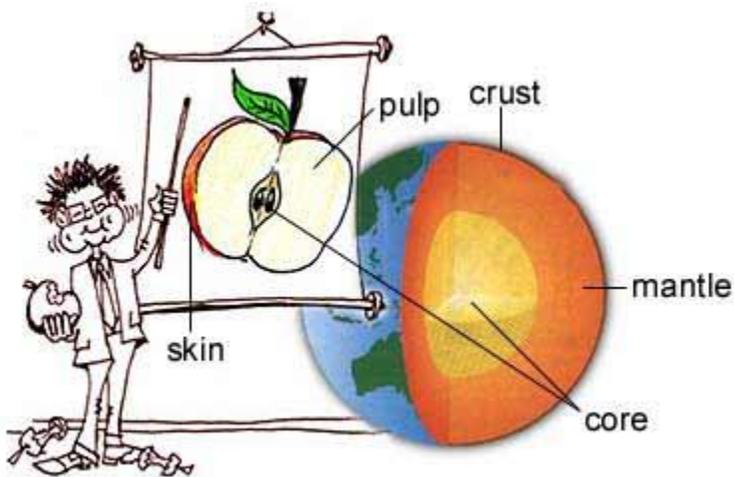
MANTLE

The layer beneath the crust is the mantle. It is **2,868 kilometers thick** – Earth's **thickest layer**. In fact, the mantle makes up nearly 80 percent of the Earth's total volume. The mantle is **made of rock** that is mostly solid, but in some places it is so hot that it softens and can move. As heat moves up through the mantle, **convection currents** form. This movement of the mantle moves Earth's crust, causing earthquakes, volcanoes, and mountain building.



Heat from Earth's core moves up through the mantle, forming convection currents. These convection currents move Earth's crust and create earthquakes and volcanoes.

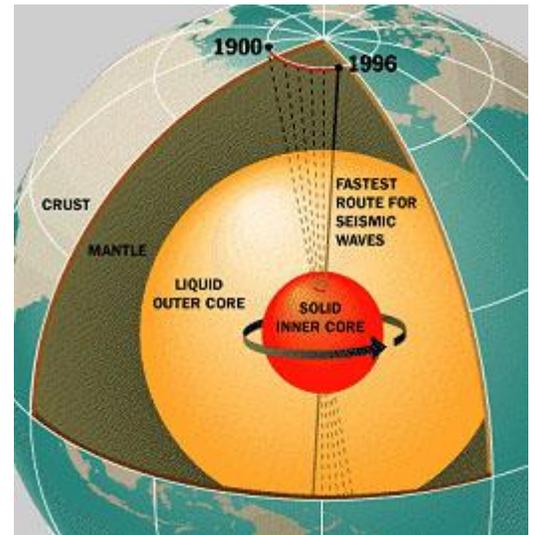
The temperature of the mantle **increases as it gets deeper**. At the top of the mantle, near the crust, the temperature is **870 degrees Celsius**. At the bottom of the mantle, near the core, the temperature is **2,200 degrees Celsius**.



If the Earth were compared to an apple, the mantle would be the white pulp, or fruit, of the apple.

CORE

The inner part of Earth is the core. The core is different from the mantle and crust, because it is not made of rock. Instead, the core is a very heavy and hot ball made of two **metals**: **iron** and **nickel**. After observing the speeds of seismic waves from earthquakes, scientists have concluded that the center of Earth is divided into two layers - the outer core and the inner core.

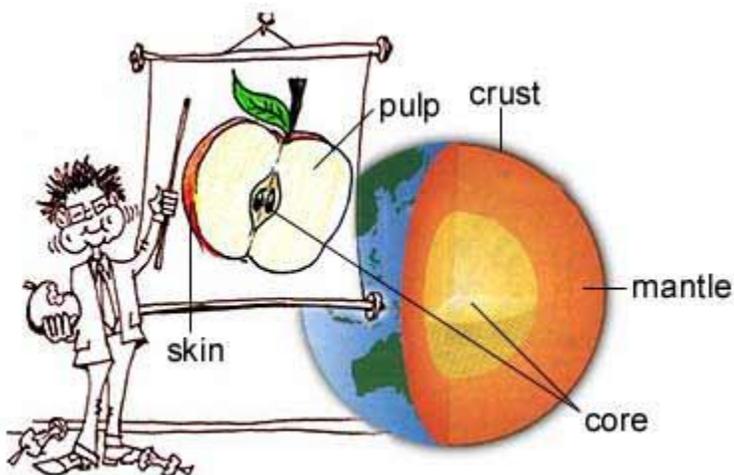


THE OUTER CORE

The outer core is so hot (between **2,200 and 5,000 degrees Celsius**) that the iron and nickel metals are **molten**. Molten means melted, which means that this layer is liquid - the **only liquid layer**. The outer core begins about 2,900 kilometers below the surface, and it is about **2,300 kilometers thick**. As Earth rotates, the outer core spins around the inner core. This causes Earth's **magnetism**!

INNER CORE

The inner core is 5,150 kilometers below the surface of Earth. You would have to travel about **1,300 hundred kilometers** to reach the very center of the core. The inner core is the **hottest layer** of all - about **5,000 - 6,000 degrees Celsius**. This temperature is hot enough to melt the iron and nickel metals in the core. However, the inner core is also under tremendous amounts of **pressure**, from the weight of all of the layers on top. This pressure squeezes so hard that the inner core is actually **solid**. It is the **most dense** of all of Earth's layers.



If the Earth were compared to an apple, the core would be the seeds.

