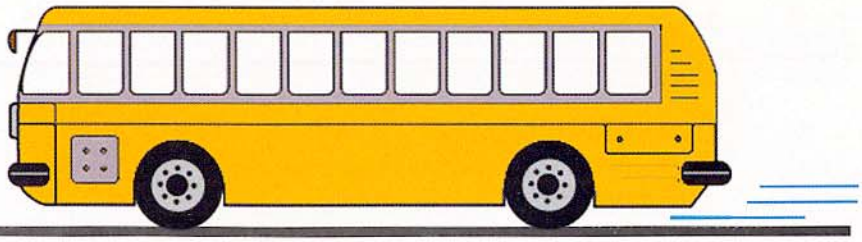
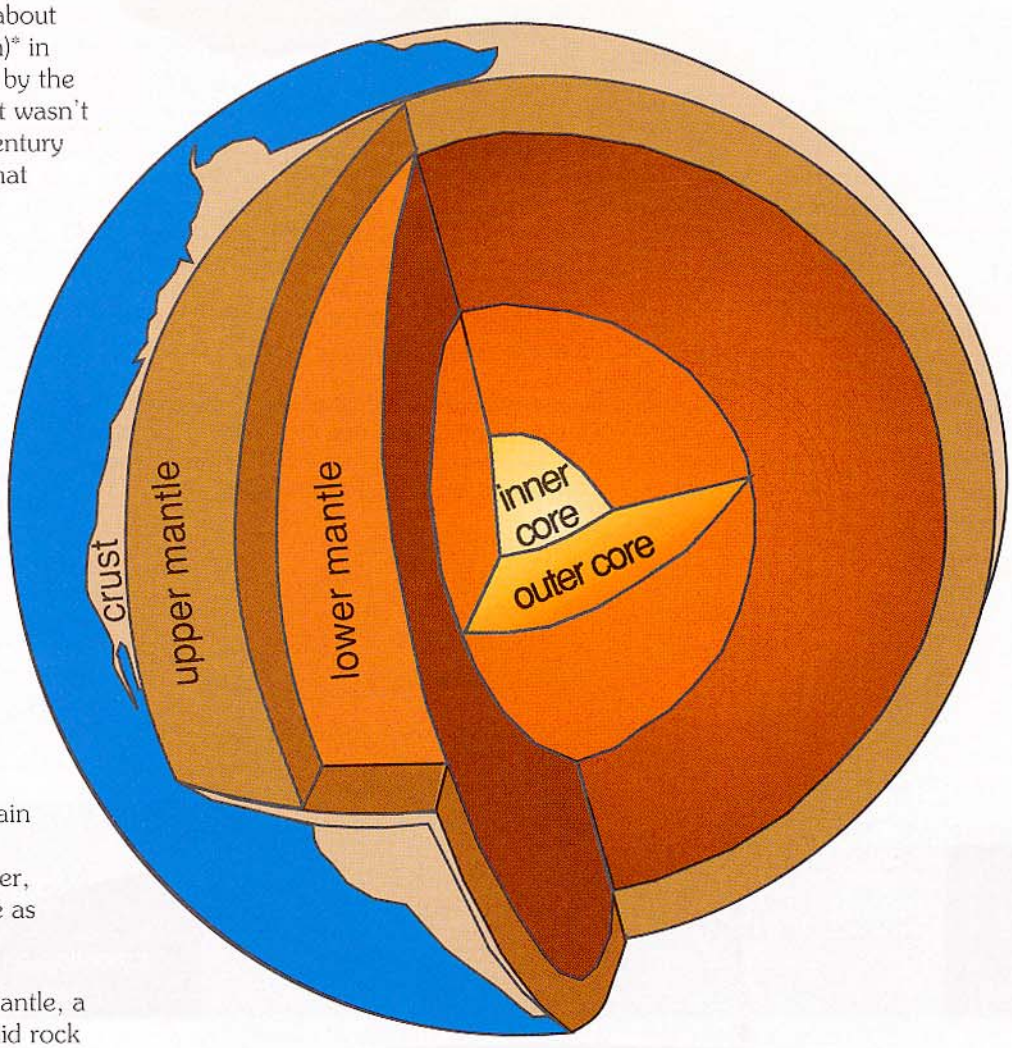
Teacher Feature



INSIDE THE EARTH

The size of the earth—about 12,750 kilometers (km)* in diameter—was known by the ancient Greeks. However, it wasn't until the turn of the 20th century that scientists determined that our planet is made of three main layers: *crust*, *mantle* and *core*. This layered structure can be compared to a boiled egg. The crust, the outermost layer, is rigid and very thin compared with the other two. And like an egg's shell, the earth's crust is brittle and can break. Beneath the oceans, the crust varies little in thickness, generally extending only to about 5 km. The thickness of the crust beneath continents is much more variable; it averages about 30 km. Under large mountain ranges, such as the Sierra Nevada or the Alps, however, the base of the crust can be as deep as 100 km.



Although the core and mantle are about equal in thickness, the core forms only 15 percent of the earth's volume, whereas the mantle occupies 84 percent. The crust makes up the remaining 1 percent.

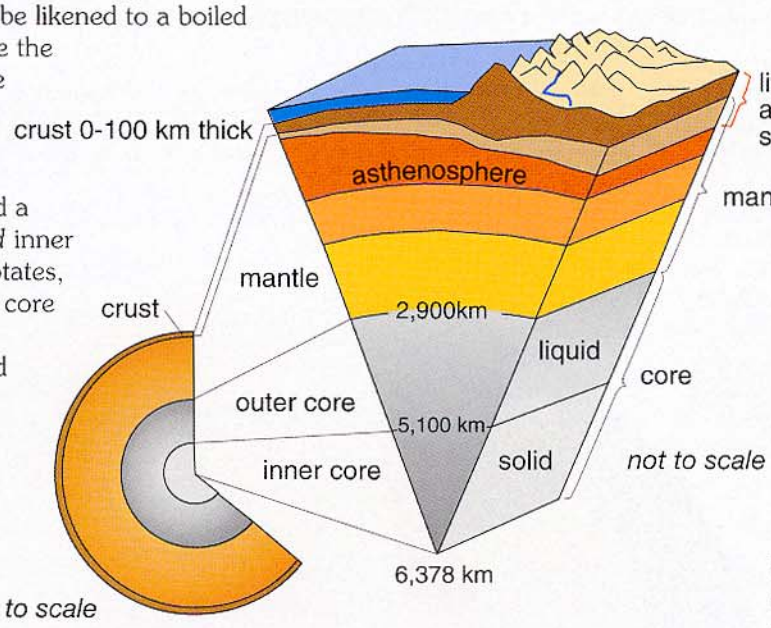
Below the crust is the mantle, a dense, hot layer of semi-solid rock approximately 2,900 km thick. This mantle, which contains more iron, magnesium, and calcium than the crust, is hotter and denser because temperature and pressure inside the earth increase with depth. As a

*1 kilometer (km) = 0.6214 mile

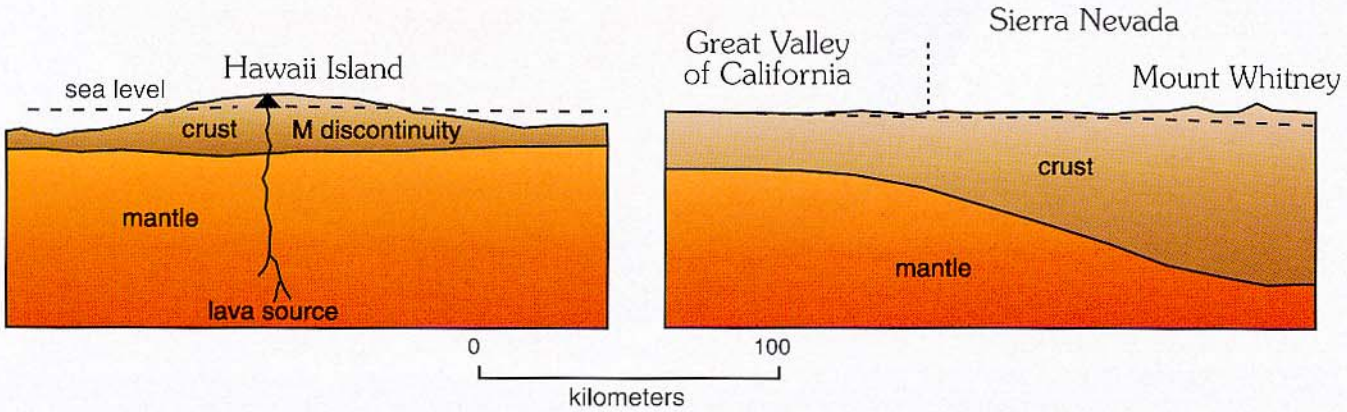
comparison, the mantle might be thought of as the white of a boiled egg.

At the center of the earth lies the core, which is nearly twice as dense as the mantle because its composition is metallic (iron-nickel alloy) rather than stony. The core can be likened to a boiled egg's yolk. But unlike the yolk, the earth's core is made of two distinct parts: a 2,200 km-thick *liquid* outer core and a 1,278 km-thick *solid* inner core. As the earth rotates, the liquid part of the core spins, creating the earth's magnetic field which in turn spins the moon-size inner core slightly faster than the planet rotates.

Not surprisingly, the earth's internal structure influences plate tectonics. The upper part of the mantle is cooler and more rigid than the deep mantle; in many ways, it behaves like the overlying crust. Together they form a rigid layer of rock called the *lithosphere* (from *lithos*, Greek for stone). The lithosphere tends to be thinnest under the oceans and in volcanically active continental areas, such as the western U.S. Averaging at least 80 km thick over much of the earth, the lithosphere has broken into the moving plates that contain the world's continents and oceans. Scientists believe that below the lithosphere is a relatively narrow, mobile zone in the mantle called the *asthenosphere* (from *asthenes*, Greek for weak). This zone is composed of hot, semi-solid material, which can soften and flow after being subjected to high temperature and pressure over geologic time. The rigid lithosphere is thought to "float" or move around on the slowly flowing asthenosphere.



Cutaway views showing the internal structure of the earth. The view at left (drawn to scale) shows that the earth's crust literally is only skin deep. The view at right (not drawn to scale) shows earth's three main layers (crust, mantle and core).



The oceanic crust at Hawaii Island is about 5 kilometers thick. The thickness of the continental crust under eastern California ranges from a normal 25 kilometers under the Great Valley to 60 kilometers under the Sierra Nevada.

Information taken from the U.S. Geological Survey's website: www.usgs.gov/