

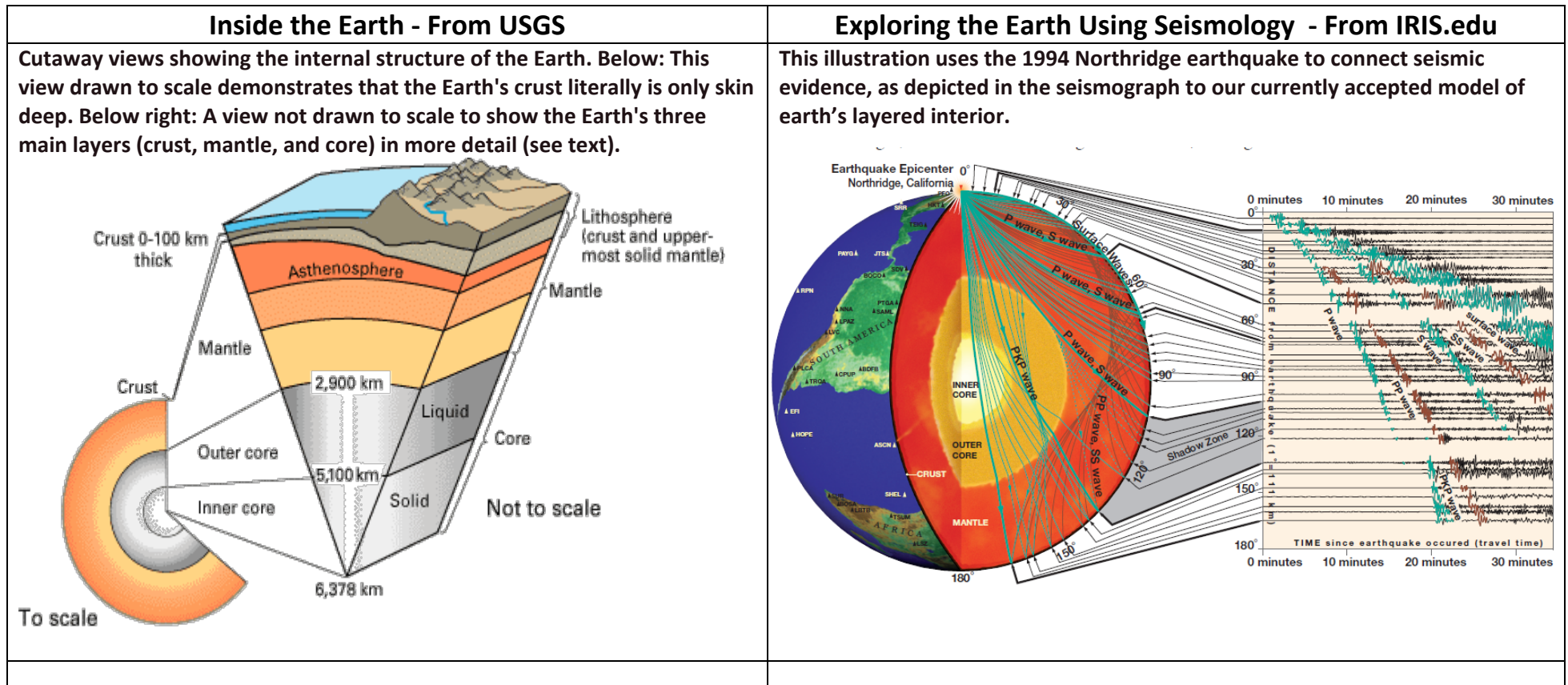
## Comparing Two Descriptions of Earth Interior Structure

Your Task: Carefully read these two descriptions of Earth's interior structure and summarize what you notice about similarities and differences.

### Starting Questions

Use this to get you started in your comparison, but document other similarities and differences you notice.

1. What is the main idea of the article?
2. What role does scientific evidence play in supporting claims?
3. What does the article convey about the nature of science?
4. What words or phrases convey the level of certainty conveyed by the author?



## Inside the Earth - From USGS

The size of the Earth -- about 12,750 kilometers (km) in diameter--was known by the ancient Greeks, but it was not until the turn of the 20th century that scientists determined that our planet is made up of three main layers: crust, mantle, and core. This layered structure can be compared to that of a boiled egg. The crust, the outermost layer, is rigid and very thin compared with the other two. 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 but averages about 30 km; under large mountain ranges, such as the Alps or the Sierra Nevada, however, the base of the crust can be as deep as 100 km. Like the shell of an egg, the Earth's crust is brittle and can break.

Below the crust is the mantle, a dense, hot layer of semi-solid rock approximately 2,900 km thick. The 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 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. Unlike the yolk of an egg, however, the Earth's core is actually made up of two distinct parts: a 2,200 km-thick liquid outer core and a 1,250 km-thick solid inner core. As the Earth rotates, the liquid outer core spins, creating the Earth's magnetic field.

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 United States. Averaging at least 80 km in thickness over much of the Earth, the lithosphere has been broken up 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 about on the slowly flowing asthenosphere.

## Exploring the Earth Using Seismology - From IRIS.edu

Earthquakes create seismic waves that travel through the Earth. By analyzing these seismic waves, seismologists can explore the Earth's deep interior. On January 17, 1994 a magnitude 6.9 earthquake near Northridge, California released energy equivalent to almost 2 billion kilograms of high explosive. The earthquake killed 51 people, caused over \$20 billion in damage, and raised the Santa Susana Mountains north of Los Angeles by 70 centimeters. It also created seismic waves that ricocheted throughout the Earth's interior and were recorded at geophysical observatories around the world.

The paths of some of those seismic waves and the ground motion that they caused are shown below. On the right, the horizontal traces of ground motion (seismograms recorded at various locations around the world) show the arrival of the different seismic waves. Although the seismic waves are generated together, they travel at different speeds. Shear waves (S waves), for example, travel through the Earth at approximately one-half the speed of compressional waves (P waves). Stations close to the earthquake record strong P, S and Surface waves in quick succession just after the earthquake occurred. Stations farther away record the arrival of these waves after a few minutes, and the times between the arrivals are greater. At about 100 degrees distance from the earthquake, the travel paths of the P and S waves start to touch the edge of the Earth's outer core. Beyond this distance, the first arriving wave — the P wave — decreases in size and then disappears. P waves that travel through the outer core are called the PKP waves. They start to appear beyond 140 degrees. The distance between 100 and 140 degrees is often referred to as the "shadow zone". We do not see shear (S) waves passing through the outer core. Because liquids cannot be sheared, we infer that the outer core is molten. We do, however, see waves that travel through the outer core as P waves, and then transform into S waves as they go through the inner core. Because the inner core does transmit shear energy, we assume it is solid.

