

THE STRUCTURE OF THE EARTH

- 1 The Earth is a *differentiated planet*—that is, its constituent materials are separated and segregated according to density. Heavy material is concentrated near the center, and lighter material near the surface.
- 5 The major structural units are illustrated in Figure 1.8. The classic units are as follows:
 1. A solid inner core, composed predominantly of iron and nickel.
 2. A liquid outer core, also composed of iron and nickel.
 3. A thick, surrounding mantle, composed of silicate minerals rich in iron and magnesium.
 4. The crust, composed of rocks exposed at the surface.
- 15 In terms of the Earth's dynamics and plate tectonics, additional units are recognized.
 1. The lithosphere, which is the rigid outer layer approximately 100 km thick, includes both the continental and oceanic crust and part of the upper mantle.
 2. The asthenosphere is a soft, plastic zone in the upper mantle at depths between 100 and 200 km.

The asthenosphere is also known as the "low-velocity zone" because it transmits seismic waves at a much lower velocity than the adjacent layers.

- 25 3. The outermost layers of the Earth are the hydrosphere and atmosphere.

30 The *core* of the Earth is a central mass about 7000 km in diameter. Its density increases with depth but averages about 10.78 g/cm^3 . It is nearly twice as dense as the mantle, and though it constitutes only 16.2% of the Earth's volume, it accounts for 31.5% of the Earth's mass. Most scientists believe that it consists of two distinct parts—a solid inner core and a liquid outer core. The rotation of the Earth probably causes the liquid core to circulate, and its circulation generates the Earth's magnetic field.

35 The next major structural unit of the Earth, the *mantle*, surrounds or covers the core. This zone constitutes the great bulk of the Earth, 82.3% of its volume and 67.8% of its mass. The soft zone in the upper part of the mantle is called the *asthenosphere*. It is as much as 600 km thick, and its upper boundary is about 100 km below the earth's surface. The asthenosphere is distinctive because its temperature and pressure are in delicate balance, so that most of its material is near the melting point. It is therefore believed to be partly molten and structurally weak, and thus capable of flow. Movement within this layer is apparently responsible for volcanic activity and crustal deformation observed at the Earth's surface.

The *lithosphere* is the outermost shell of the Earth. It is a rigid, solid, strong layer about 100 km thick that rests on the weak, partly molten asthenosphere.

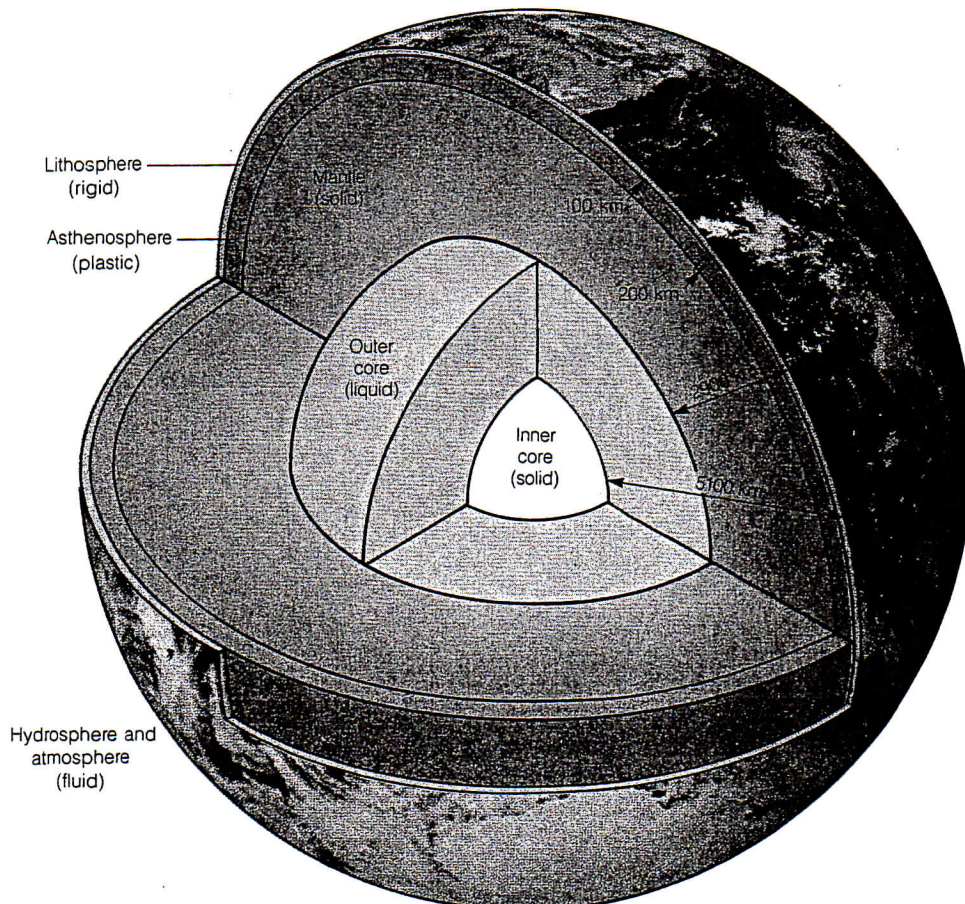


Figure 1.8

The internal structure of the Earth is known from studies of its density, its magnetic field, and the way in which it transmits seismic waves.

"THE EARTH'S DYNAMIC SYSTEM"