

## What Is Geology?

Geology, the scientific study of Earth, benefits you and everyone else on this planet. You might have survived an earthquake, flood, or other natural disaster thanks to action taken based on what scientists have learned about these hazards.

## What Is Physical Geology?

Physical geology is the study of the solid Earth and the processes that change the physical landscape of the planet.

## What Is Earth system?

The Earth system is a small part of the larger solar system, but it is, of course, very important to us. The Earth system has its components, which can be thought of as its subsystems. These systems, or "spheres," are the atmosphere, the hydrosphere, the biosphere, and the geosphere. You, of course, are familiar with the atmosphere, the gases that envelop Earth. The hydrosphere is the water on or near Earth's surface. The hydrosphere includes the oceans, rivers, lakes, and glaciers of the world. Earth is unique among the planets in that two-thirds of its surface is covered by oceans. The biosphere is all of the living or once-living material on Earth. The geosphere, or solid Earth system, is the rock and other inorganic earth material that make up the bulk of the planet.

## The Big Bang theory

The theory states that about 14 billion years ago all the matter in the Universe was concentrated into a single incredibly tiny point. This began to enlarge rapidly in a hot explosion, and it is still expanding today. Evidence for the Big Bang includes: all the galaxies are moving away from us. Prior to that moment there was nothing; during and after that moment there was something: our universe. The big bang theory is an effort to explain what happened during and after that moment. The Solar System and the Earth formed about 4.5 billion years ago and life on Earth began about 3.5 billion years ago.

## Earth's Interior

The earth can be divided into three concentric zones (See Fig1-1):-

### 1- The crust

The crust is the outermost and thinnest layer. Because the crust is relatively cool, it consists of hard, strong rock. There are two different types of crust: Oceanic crust and continental crust.

Oceanic crust is 5 to 10 kilometers thick and is composed mostly of a dark, dense rock called basalt.

Continental crust is about 20 to 40 kilometers, although under mountain ranges it can be as much as 70 kilometers thick and is composed mostly of a light rock called granite.

### 2- The mantle

The mantle lies directly below the crust. It is almost 2900 kilometers thick and makes up 80 percent of the Earth's volume. Although the chemical composition may be similar throughout the mantle, Earth temperature and pressure increase with depth. These changes cause the strength of mantle rock to vary with depth, and thus they create layering within the mantle. The upper part of the mantle consists of two layers.

The geothermal gradient is responsible for different rock behaviors and the different rock behaviors are used to divide the mantle into two different zones. Rocks in the upper mantle are cool and brittle, while rocks in the lower mantle are hot and soft (but not molten). Rocks in the upper mantle are brittle enough to break under stress and produce earthquakes. However, rocks in the lower mantle are soft and flow when subjected to forces instead of breaking.

### 3- The Core

The core is the innermost of the Earth's layers. It is a sphere with a radius of about 3470 kilometers and is composed largely of iron and nickel.

The inner is a solid, spherical mass of iron. The next zone, called the outer core, is believed to be a layer of molten liquid rich in nickel and iron.

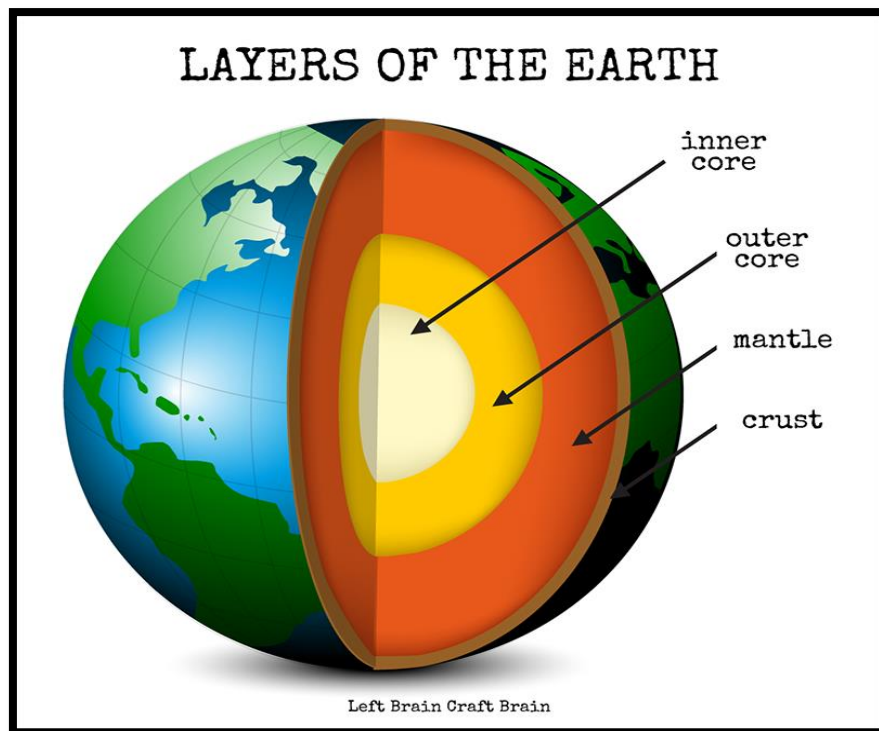


Figure (1.1) Earth's interior

## The Theory of Plate Tectonics

The plate tectonics theory provides a unifying framework for much of modern geology. It is the concept that the lithosphere, the outer, 75 to 125-kilometer-thick layer of the Earth, floats on the asthenosphere. The lithosphere is segmented into seven major plates, which move relative to one another by gliding over the asthenosphere.

Most of the Earth's major geological activity occurs at plate boundaries. Three types of plate boundaries exist:

1. New lithosphere forms and spreads outward at a divergent boundary, or spreading center;
2. Two lithospheric plates move toward each other at a convergent boundary, which develops into a subduction zone if at least one plate carries oceanic crust; and
3. Two plates slide horizontally past each other at a transform plate boundary.

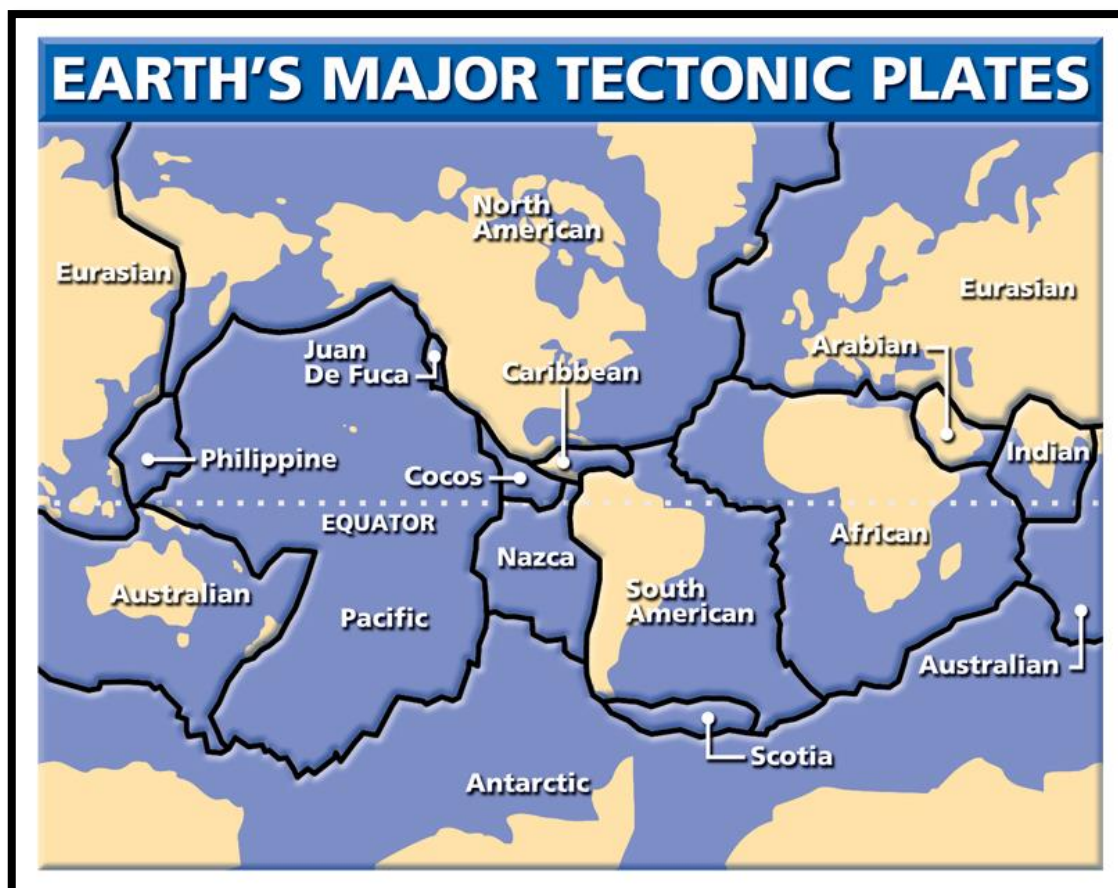


Figure (2-1) Plates of the world and the three types of plate boundaries.