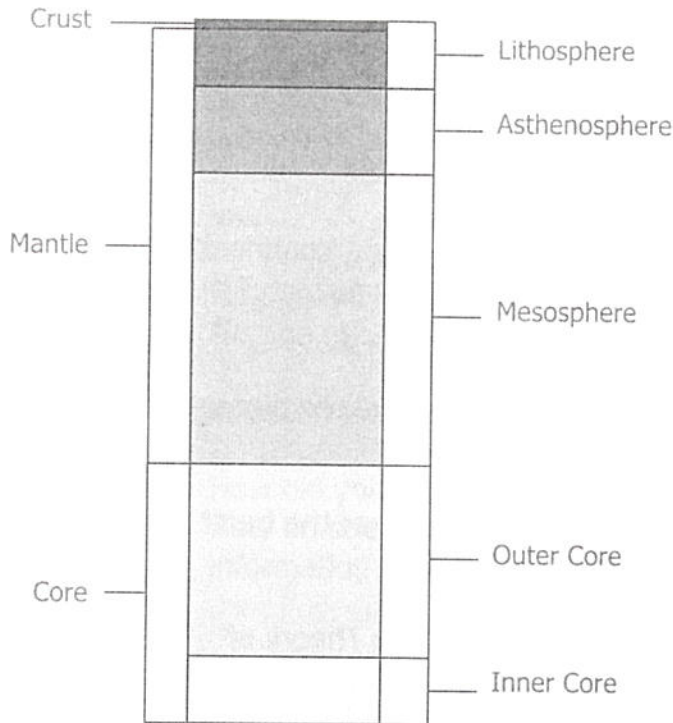


## The Theory of Plate Tectonics

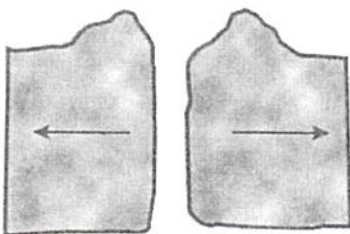
In the 1960s, geologists developed an exciting new theory called plate tectonics. The theory proposes that the Earth's lithosphere, which is made of the crust and the uppermost part of the mantle, is



not a continuous sheet of solid rock material. Instead, the lithosphere is divided into about twelve sections called plates. The plates float on the part of the mantle called the asthenosphere, which has the property called plasticity. This allows the plates to move across the top of it, carrying the continents and ocean basins with them as they drift about. For example, North America and a good part of the Atlantic Ocean are on the North American Plate.

Tectonics comes from the Greek word meaning "to build."

The Theory of Plate Tectonics revolutionized geology because it finally provided an explanation for how many geological events occur. Geologists could see that most mountain building, earthquakes, and volcanic activity take place along boundaries between the plates. They also found that in some areas new crust is always forming, while in other areas old crust is being destroyed. They identified three different types of plate boundaries: divergent, convergent, and transform boundaries.



Divergent plates move apart

New oceanic crust forms at rift valleys, where two plates diverge or pull away from each other. Hot, molten rock from deep within the Earth called magma oozes out from cracks along these rifts and hardens to form new crust. When magma reaches the surface of the Earth, it is called lava. Over time, the lava builds up and forms huge underwater mountain ranges along the ocean's floor. The mountain ranges are called mid-ocean ridges. When the mid-ocean ridge actually builds up enough height to extend above the water's surface, it forms an island. Iceland is an example of

## Understanding Earth and Space Systems, Part 2

such an island. Located at a diverging plate boundary between the North American and Eurasian plates, Iceland is a part of the Mid-Atlantic Ridge, which is part of the longest mountain chain on Earth. New crust oozes out daily at the Mid-Atlantic Ridge. For the last 250 million years, Europe has slowly pushed away from North America causing the Atlantic Ocean to grow wider as new crust has been added to each plate. This type of boundary is called constructive since it actually builds new material onto the edges of the plates.

Just as some plates are diverging or moving away from each other, other plates are converging or moving toward each other. The types of crust at their leading edge determine the result of the converging motion. There are three types of convergent plate boundaries:

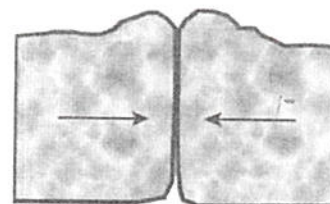
- continental/continental,
- oceanic/continental, and
- oceanic/oceanic.

When two plates carrying continents run into each other, the collision usually crumples the leading edge of both plates and creates lofty folded mountain ranges. The Himalayas formed when the plate carrying India collided with the plate carrying Eurasia. The Himalayas are a great mountain range in Asia extending from Tibet to Pakistan. The highest peak in the Himalayas is Mount Everest, the tallest mountain on Earth.

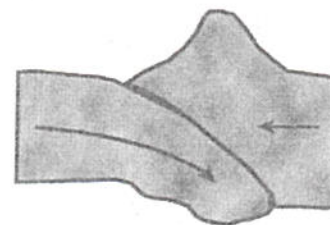
If two plates collide and one is made of oceanic crust and the other is made of continental crust, a deep trench forms in the ocean floor. The denser oceanic plate bends down and slides under the edge of the less dense continental plate. This process is called subduction. As the lower plate is pushed under, it eventually begins to melt. The melted rock, or magma, from the subducted plate is less dense than the mantle rock and begins to move upward, often fueling volcanoes, which form volcanic mountain ranges on the upper plate. The Andes Mountains along the western coast of South America are the result of the process called subduction. Areas of subduction are called destruction boundaries because old plate material is destroyed.

Collisions can also occur between two oceanic plates. The Aleutian Islands that form the tail off the coast of Alaska are formed in such a way. One oceanic plate is subducted beneath the other oceanic plate along a trench on the ocean floor. As a

Ocean-floor spreading is sometimes called sea-floor spreading. The two terms refer to the same geologic process.



Convergent plates move together



Subduction occurs when one plate slides beneath another plate

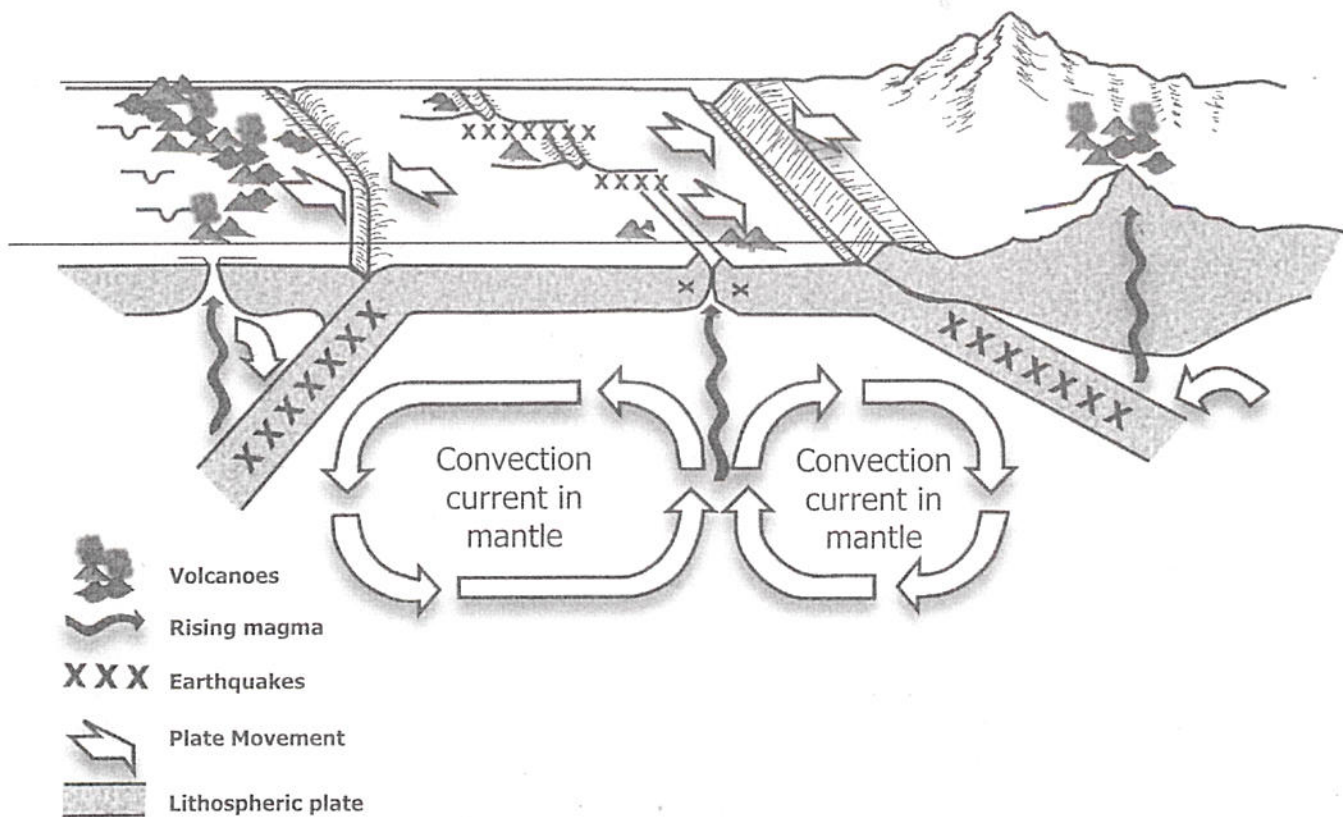
## Understanding Earth and Space Systems, Part 2

result, a string of volcanic mountains erupt. Once the mountains extend above the edge of the ocean water, they form a curved pattern of islands called an island arc.

Sometimes two plates slide past each other, as the Pacific and North American Plates are doing along California's San Andreas Fault. These types of plate boundaries are called transform boundaries. A fault is a break in the Earth's crust and is caused by stresses related to plate movements. This shearing motion at a transform fault often causes earthquakes, but neither plate is destroyed in the sideways motion.

In some locations, a narrow plume of hot material rises up through the mantle creating a hotspot under the plate. The extra heat melts some of the mantle rock, which makes its way up through the plate to form a volcano. As the plate slowly moves over a stationary hotspot, a line of volcanoes forms. It is important to remember that the plate moves across the hotspot, but the hotspot does not move. Once a volcano drifts past a hotspot, it becomes inactive, but a new, active volcano forms over the hotspot. A hotspot under the Pacific Plate formed the Hawaiian Islands in this way.

### Plate Tectonics Changes the Earth's Surface



## Understanding Earth and Space Systems, Part 2

### Individual Assessment

*Let's  
Evaluate*

#### Plate Boundaries and Earth's Land Features

Complete the table provided by your teacher to organize the main ideas about plate tectonics and the land features it forms. There are five diagrams in the table. Each one represents a type of plate boundary. Complete the table by filling in the blank boxes with choices from below. All choices must be used at least once. Some boxes require more than one answer.

#### Choices for **Type of Boundary**:

- convergent
- divergent
- transform

#### Choices for **Motion at Boundary**:

- collision of continental/continental
- collision of oceanic/oceanic
- collision of continental/oceanic
- ocean-floor spreading
- shearing
- subduction

#### Choices for **Land Feature formed**:

- island arc
- folded mountains
- midocean ridge
- rift valley
- transform fault
- trench
- volcanic mountains

#### Choices for **Actual Example(s)**:

- Andes Mountains
- Aleutian Islands
- Himalaya Mountains
- Iceland
- Mid-Atlantic Ridge
- San Andreas Fault