

Lesson Outline for Teaching

Lesson 2: Landforms at Plate Boundaries

A. Landforms Created by Plate Motion

1. Massive, slow-moving tectonic plates have so much force that they can form tall mountains and deep valleys.
2. Three types of stresses—tension, compression, and shear—each produce a different type of landform.

B. Landforms Created by Compression

1. The largest landforms on Earth are produced by compression at convergent plate boundaries.
2. If two continental plates collide, tall mountains, like the Himalayas, can form.
 - a. The resulting mountain ranges form in stages, slowly, over millions of years.
 - b. Although plates move horizontally, the collision causes the crust to move vertically as well.
3. When two plates collide, one can go under the other and be forced into the mantle in a process called subduction.
 - a. A deep trench forms where the two plates meet.
 - b. Ocean trenches are deep, underwater troughs created by one plate subducting under another plate at a convergent plate boundary.
4. Volcanic mountains can form in the ocean where plates converge and one plate subducts under another one.
 - a. The volcanoes form islands about 100 kilometers in distance from where the two plates meet.
 - b. A(n) volcanic arc is the curved line of volcanic islands that forms parallel to a plate boundary.

C. Landforms Created by Tension

1. Where plates move apart, tension stresses stretch Earth's crust.
2. At divergent boundaries, oceanic plates move apart, and there are tension stresses that cause crust to spread apart.
 - a. As tension stresses cause oceanic crust to spread apart, hot rock from the mantle rises.
 - b. The hot mantle rises and pushes the seafloor upward, making a long, tall ridge on the bottom of the ocean, called a(n) mid-ocean ridge.
3. When divergent boundaries occur within a(n) continent, they can form continental rifts, or enormous splits in Earth's crust.
 - a. Tension stresses in the cold upper part of the crust create faults.

Lesson Outline continued

- b. At these faults, large blocks of crust move downward, creating a rift valley between two ridges.

D. Landforms Created by Shear Stresses

1. Shear stresses at transform boundaries produce faults where plates slide past one another horizontally.
2. Faults that form where tectonic plates slide horizontally past each other are called transform faults.
 - a. Segments of mid-ocean ridges are sometimes separated by transform faults.
 - b. The transform faults are perpendicular to the mid-ocean ridges, and they get longer as the plates move.
 - c. As old(er) transform faults move farther away from the mid-ocean ridge, new transform faults form.
3. A(n) transform fault that can be seen at Earth's surface is the San Andreas Fault in California.
 - a. Many transform faults that are part of this fault system cannot be seen on the surface of Earth, but instead are underground.
 - b. A(n) fault zone is an area of many fractured pieces of crust that lie along a large fault.

Discussion Question

Name some high mountain ranges in the United States and other places. Describe how you think they formed. What kinds of stresses contributed to their formation?

High mountains in the United States include the Rocky Mountains (and smaller mountain ranges within the Rocky Mountains); the Sierra Nevada mountains are another high mountain range in the United States. Students might also be familiar with other high mountains around the world, including the Himalayas, the Andes, the Alps, the Urals, and the Caucasus. Many of these mountain ranges have formed due to collisions of continental plates and, therefore, have been created by compression forces.