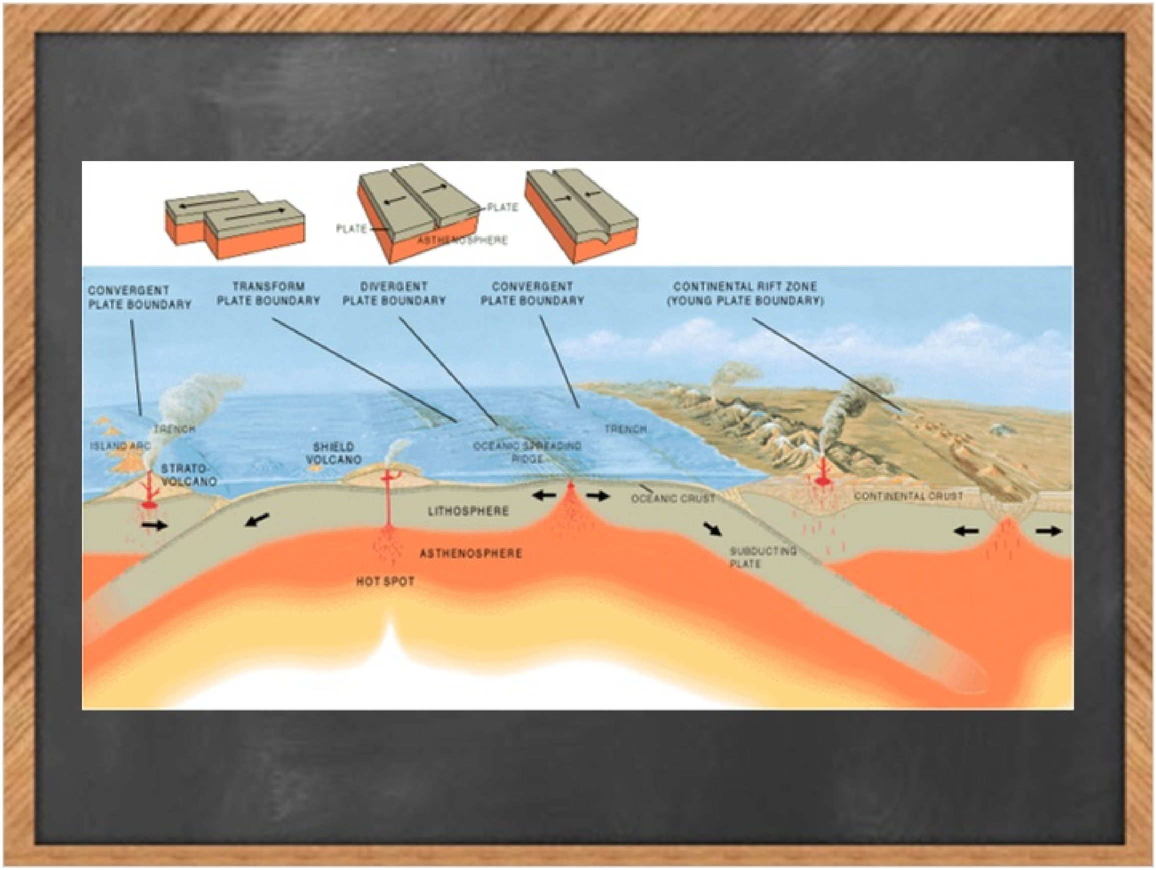
Module 3: Geology
Topic 4 Content: Plate Tectonics Notes

In 1965, a scientist named John Wilson built on the previous theories of continental drift and seafloor spreading to form a new theory he called plate tectonics. Wilson's theory provided a more accurate and conclusive explanation than previous theories on how the seafloor spreads and how the continents move, with emphasis on the role of isostatic equilibrium. In his plate tectonics theory, Wilson divided the lithosphere into fifteen major sections, or plates, which float along like giant jigsaw puzzle pieces on the asthenosphere. The points at which plates meet are plate boundaries.

Image credit: USGS: Public Domain



Remember that there are two types of crust: oceanic and continental. Plates comprised of either type of crust create different features as they interact at their plate boundaries. These interactions produce earthquakes, volcanoes, and mountains. Scientists study three types of plate boundaries: convergent boundaries, divergent boundaries, and transform boundaries. At these boundaries, plates collide, separate, or slide past each other. Let’s examine these boundaries in greater detail.

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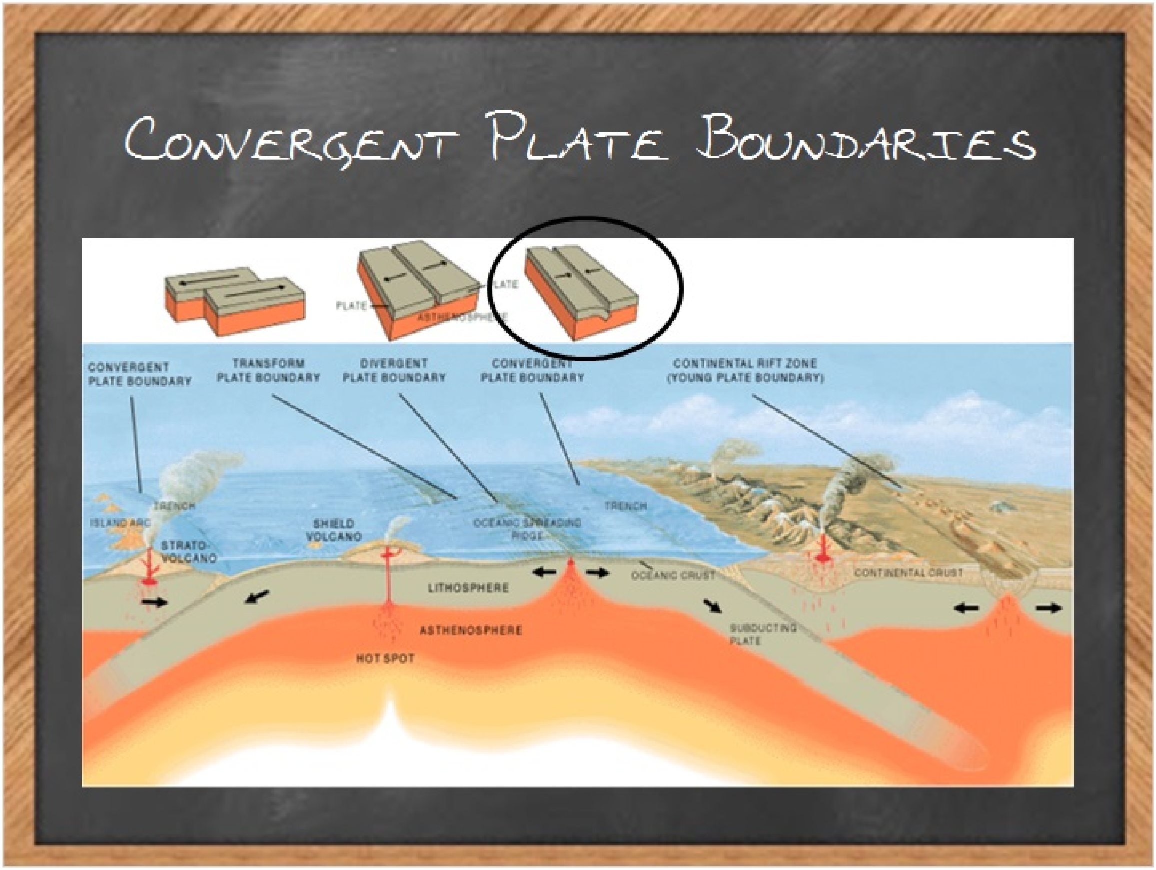
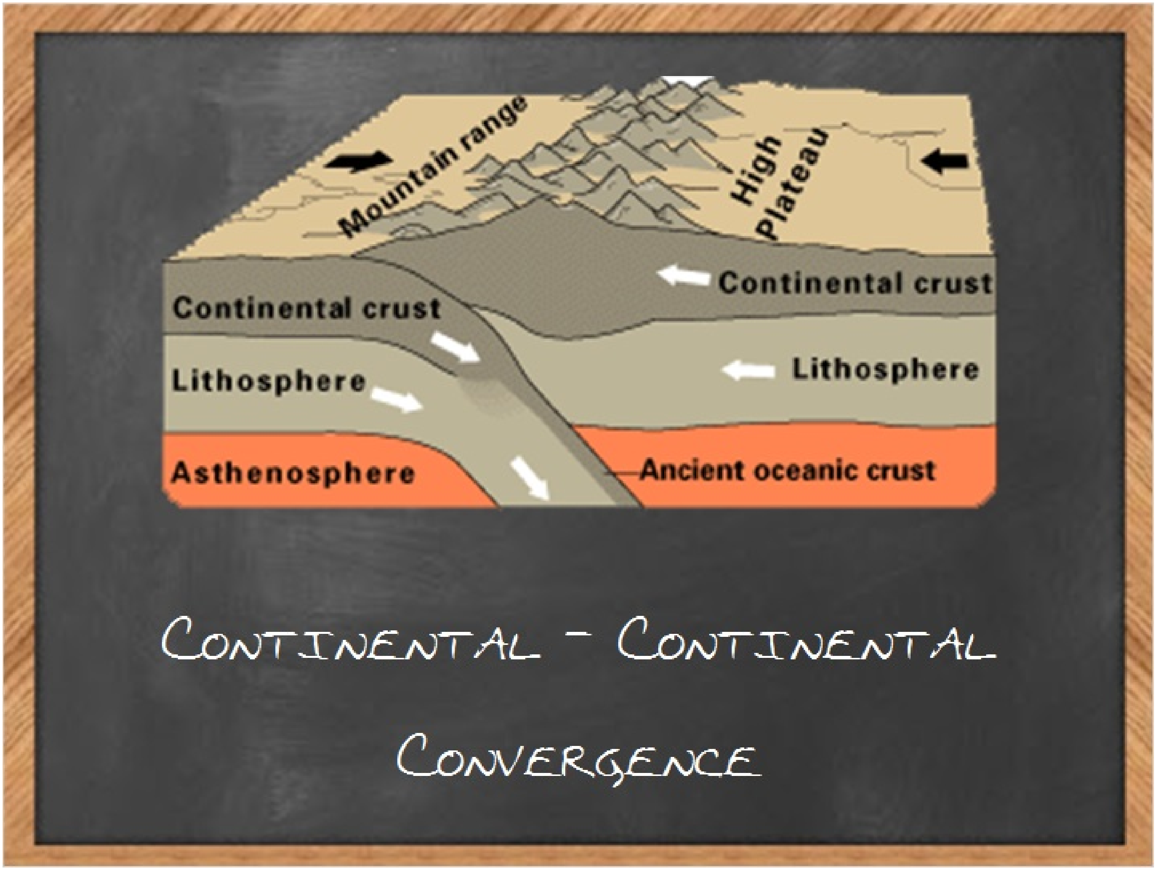
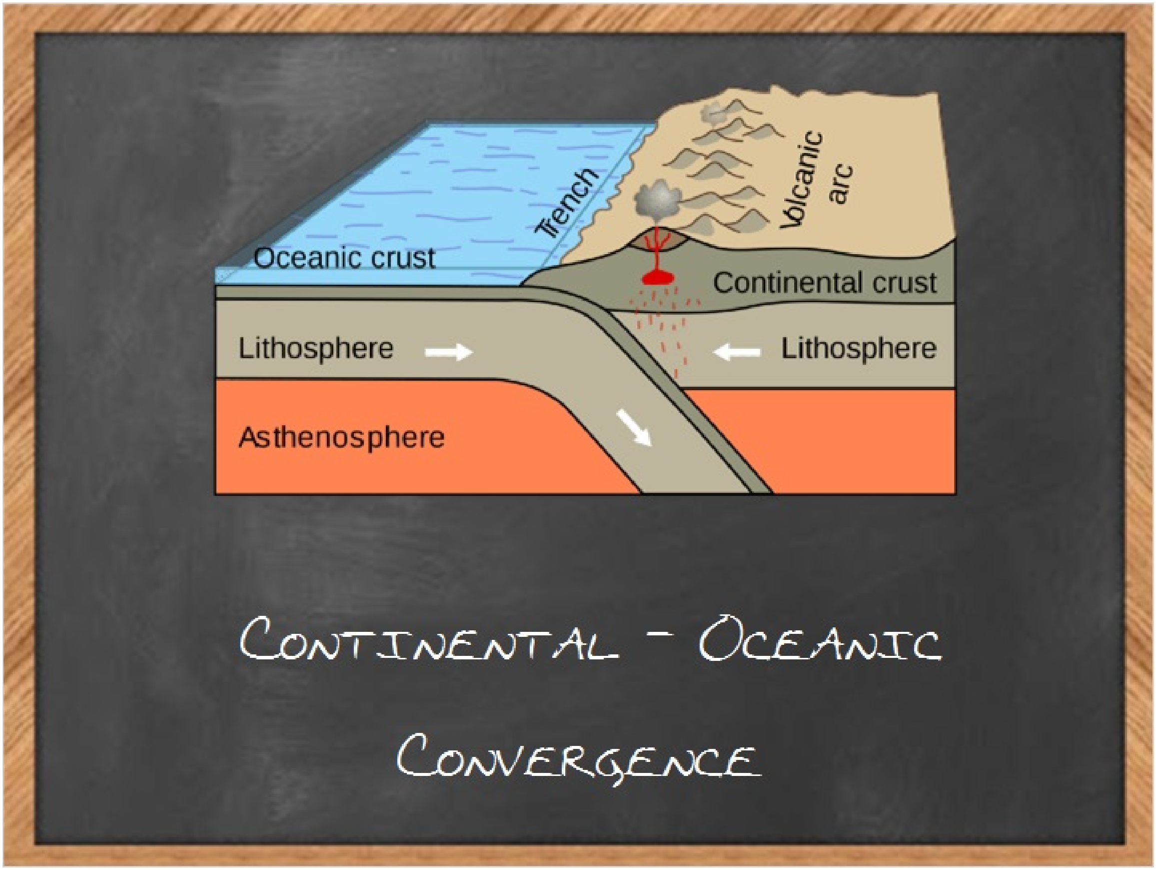


Two plates collide at a convergent boundary, resulting in compression or squeezing of the plates. Imagine the tremendous forces present when plates three to eighteen miles thick slam into each other. Three different interactions occur at convergent boundaries. Let's take a closer look at each type.



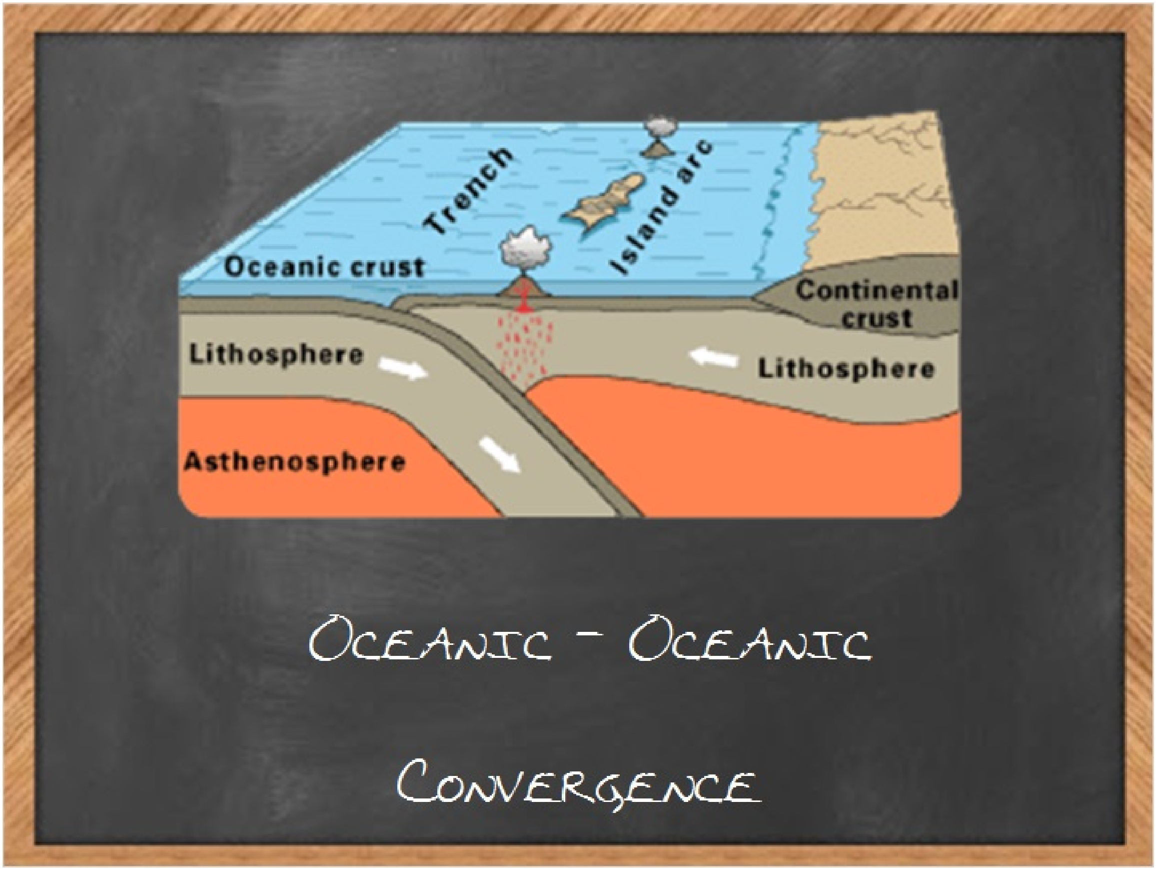
Continental – Continental

In this case, two continental plates collide producing tectonic uplift and mountain ranges. An example of a continental – continental interaction is the Himalayan Mountain range where the Indo-Austrian Plate collides with the Eurasian Plate.



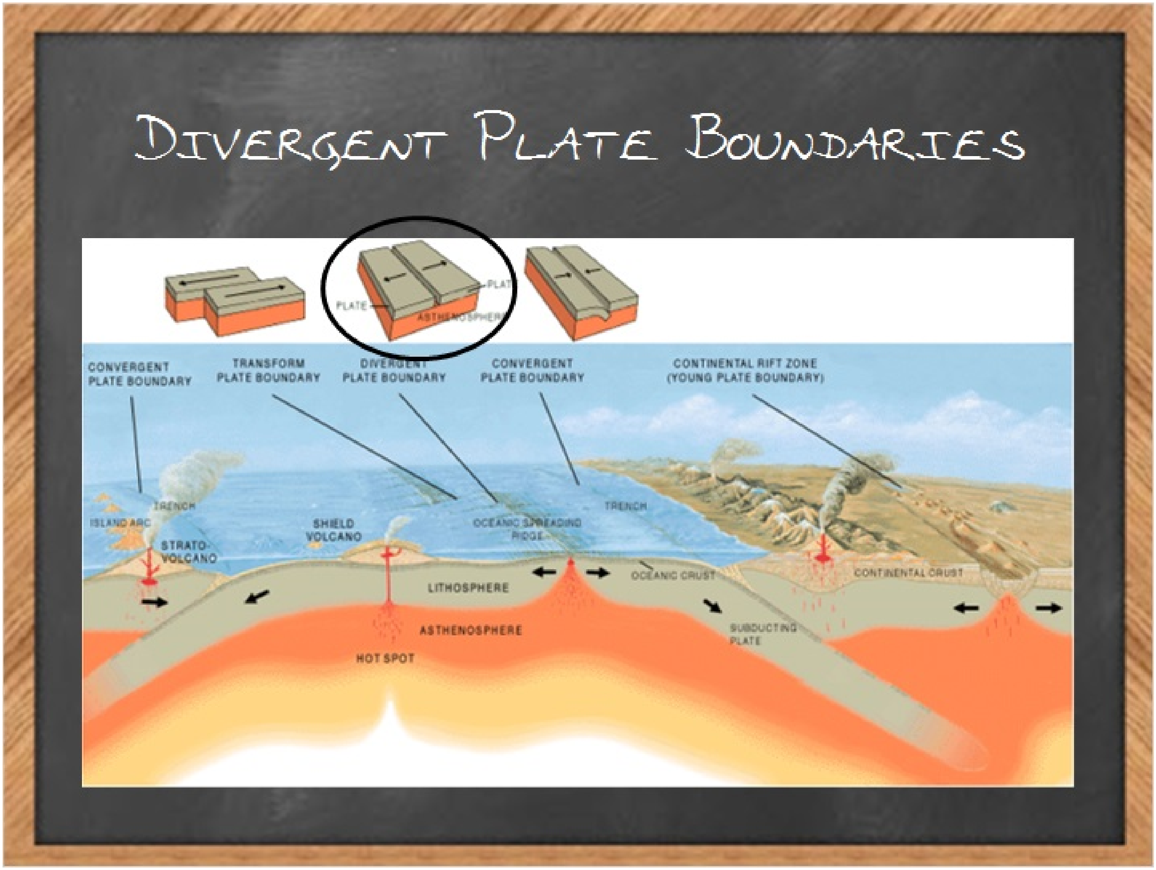
Continental - Oceanic

The collision of a continental plate and an oceanic plate produces a volcanic mountain range. A great example of a continental – oceanic interaction is the plate boundary between the Nazca Plate and South American Plate. The collision here produces the Andes Mountain range. As well as volcanoes along the western edge of South American

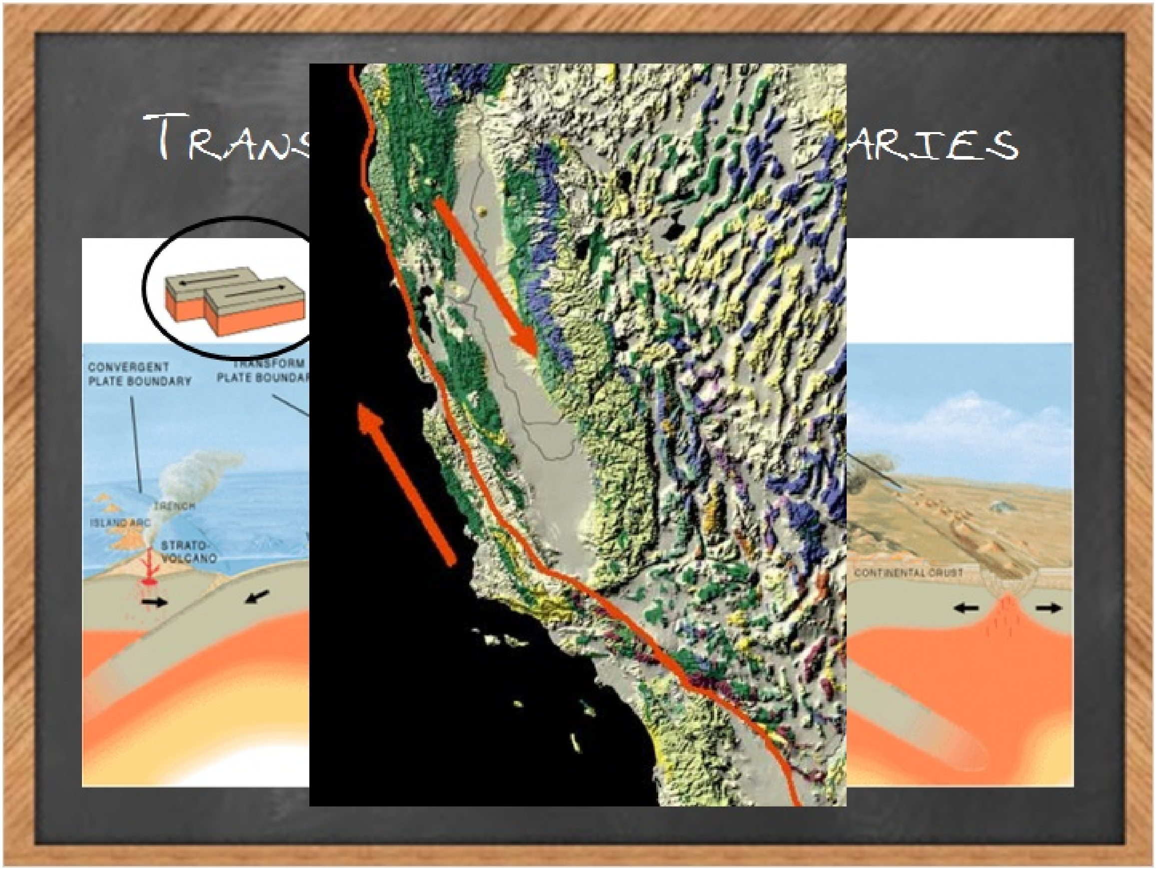


Oceanic – Oceanic

Here, two oceanic plates collide producing a subduction zone, trench, or island arc. An example of an oceanic – oceanic interaction is the subduction zone where the North American Plate and Caribbean Plate meet.



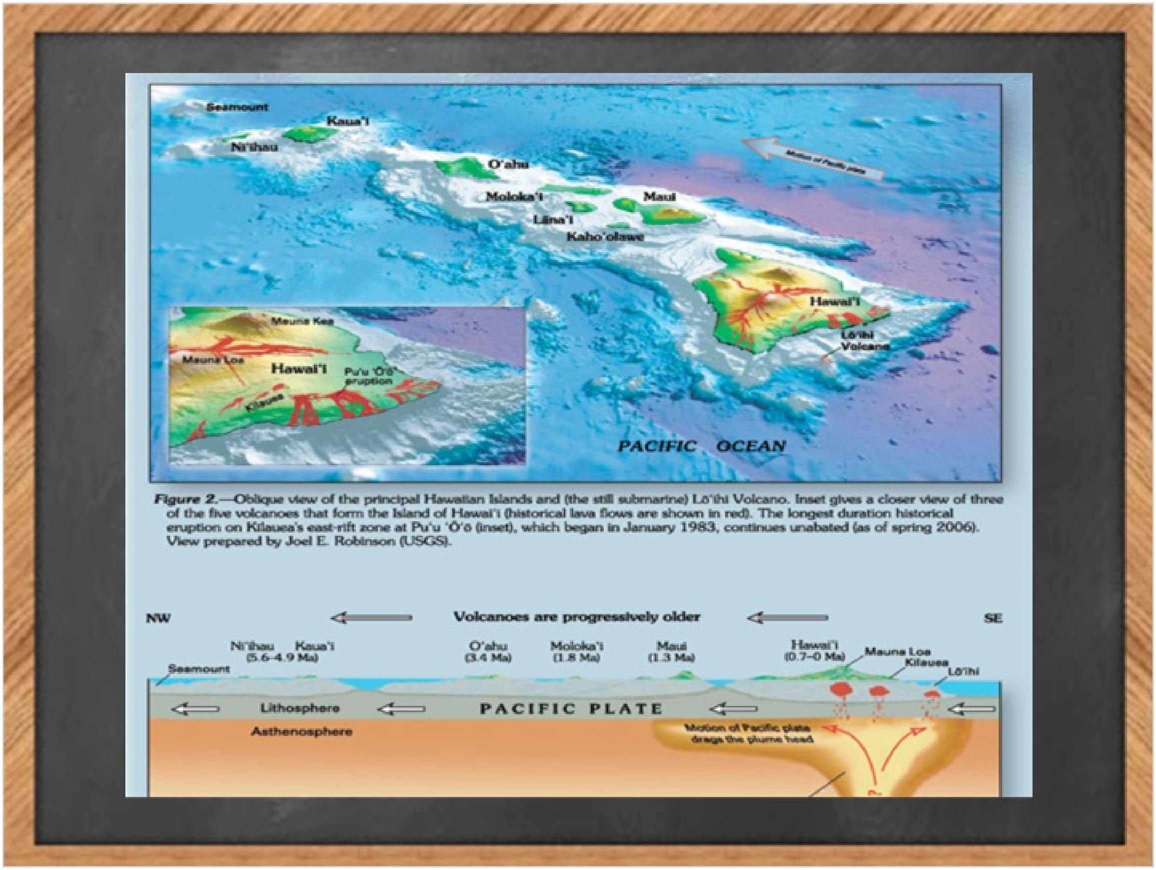
Two plates divide or separate at a divergent boundary. Here, three to eighteen miles of rock slowly pull apart, resulting in a huge tension force. As the plates move apart, magma from the asthenosphere rises and solidifies, creating new seafloor. A divergent boundary exists between the North American Plate and Eurasian Plate.



At a transform boundary, two plates scrape and slide past each other with no vertical movement. Scientists call the tremendous force produced at transform boundaries, shearing. Through shearing, the two plates break into many cracks called faults.

Although a major transform boundary doesn't exist in the oceans, an excellent example of a transform boundary on land is the San Andreas Fault in California. As shown in this image of the Sand Andreas Fault, the Pacific Plate on the left slides past the North American Plate on the right.

Unfortunately, the shearing of two plates is anything but smooth. Instead, the plates bind and stick together along their edges until enough tension builds up to snap them apart. We experience this as an earthquake.



John Wilson continued expanding and refining his ideas on plate tectonics as other scientists produced new research. For example, in 1963, Wilson suggested that the Hawaiian Islands formed from magma melting upward through the lithosphere and breaking through to the crust. He called these uprisings, hot spots.

Importantly, Wilson observed that the Hawaiian hot spot didn't move with the Pacific plate and that it was far from any mid-ocean ridge where magma typically emerges. Instead, the hot spot seemed relatively stationary. Wilson concluded that tectonic plates must move over these hot spots.

In this image from the U.S. Geological Survey, you see a trail of underwater mountains – the Hawaiian Islands. These mountains resulted from tectonic plate movement across the Hawaii hotspot over millions of years. In fact, the hot spot that created the Hawaiian Islands and the Emperor Seamount chain is around 35 million years old!

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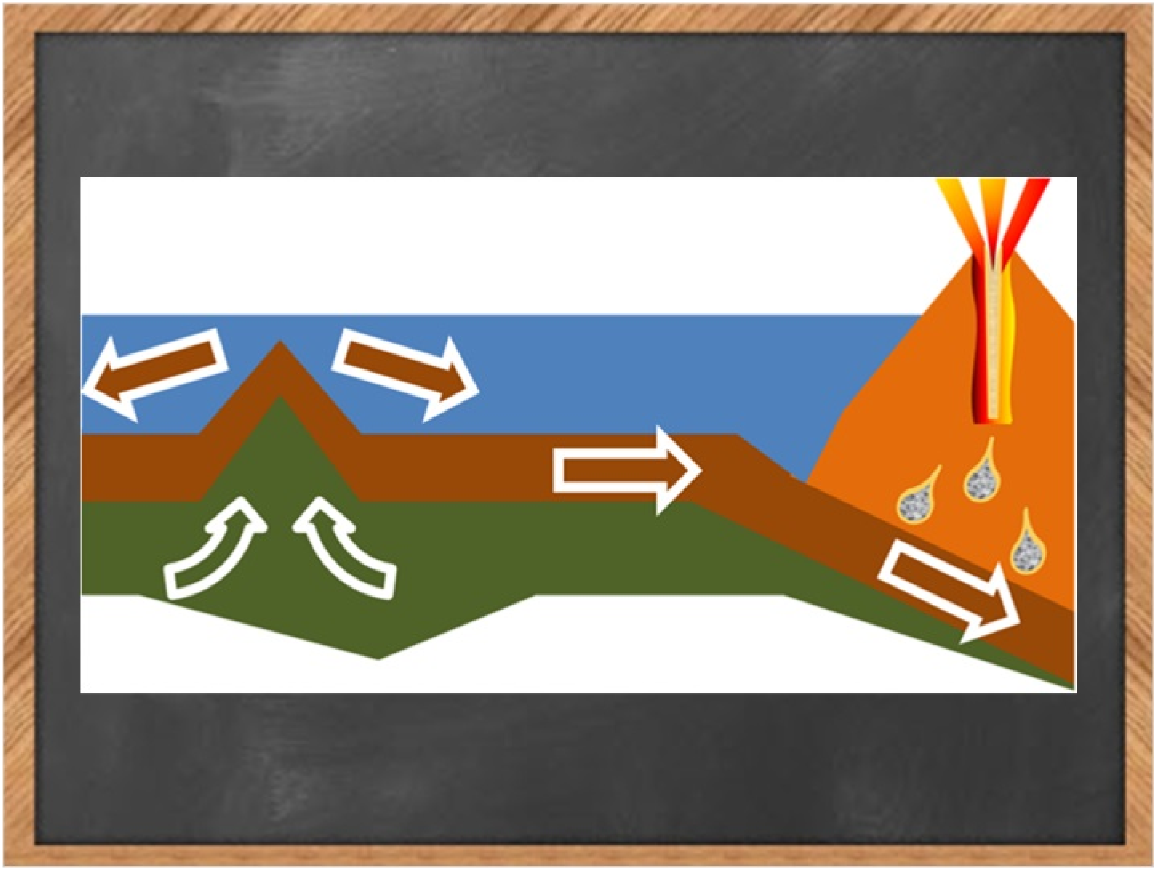

You learned earlier in this module that scientists didn't at first accept Alfred Wegener's Theory of Continental Drift because he failed to explain how the continents moved to their current locations. However, thanks to John Wilson's work, the Theory of Plate Tectonics finally explained the entire picture of how the continents moved.

Deep within the asthenosphere heated materials slowly rise, then cool and sink in a process called thermal convection. This continuous circular motion of material gradually pushes the plates. The movement of plates creates the different interactions you learned about in this lesson.

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