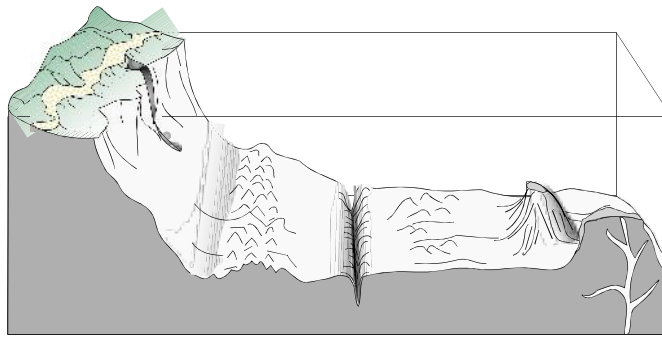


Introduction: The Ocean Floor—Features Underwater

Using sonar, seismic profiling, satellites, and underwater research vehicles, oceanographers have discovered that the **topography**, or shape of the ocean floor is quite similar to many of the dramatic sights we see on the landforms on Earth's continents. The ocean floor has raised masses of land similar to the Rocky Mountains and large areas of smooth and level

surfaces similar to the Great Plains. Underneath the ocean's surface, however, we would find canyons that are deeper, mountain ranges that are higher and longer, and plains that are wider and flatter than any landforms on the continents.

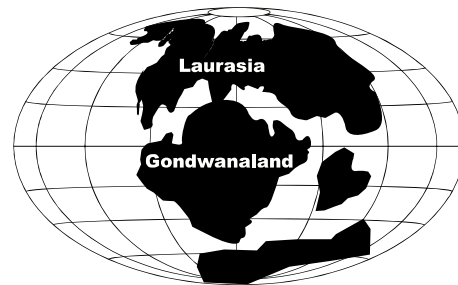


topography of the ocean floor

Crustal Plate Movement: The Pieces of Earth's Giant Puzzle

Scientists have collected evidence to show that Earth's continents were once one large landmass known as *Pangaea* (pan-JEE-uh). According to German scientist Alfred Wegener's 1915 hypothesis of continental drift, the continents separated over time and, like pieces of a giant puzzle, *drifted* to their present locations.

A theory known as *plate tectonics* suggests that the Earth's outermost layer, or *crust*, is separated into 12 or more large pieces or plates. These plates include the five-mile thick oceanic crust, which lies beneath the oceans. These plates are still moving, and this movement, or friction, between the plates helps explain why volcanoes and earthquakes occur along the plate boundaries.



German scientist Alfred Wegener suggested that at one time all of the continents were one large landmass called Pangaea. This landmass then split apart and broke into two large landmasses called Laurasia and Gondwanaland. These eventually broke apart and over time drifted across the ocean floor until they reached their present positions.

Continental Shelf: Continents under Water

Shorelines do not mark where the continents end; some continents actually extend into the ocean as much as 50 to 65 kilometers. From the shorelines, land begins to slope gently downhill and under water. The edge of the continent that is under water is called the **continental shelf**. Continental shelves were formed as rivers carried tons of particles of sand and soil from the land out to sea. This sand and soil then settled as layers of sediments, or layers of particles of rock and animal remains.

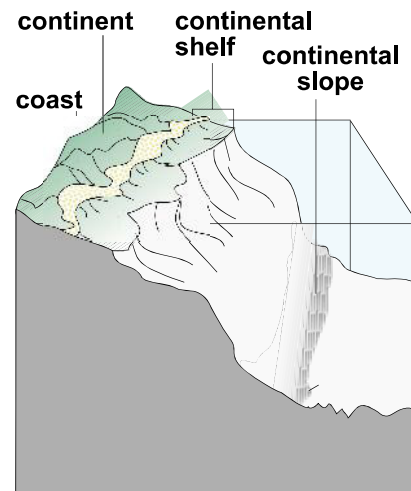
Although continental shelves are usually flat, they differ in their width, or the distance they extend into seawater. The steepness of the land along the coast affects the width of the continental shelf. For example, a mountainous coast will have a continental shelf that is narrow. A low-lying coast will have a long and wide continental shelf.

Layers of sediment and mineral deposits on the continental shelf provide pockets of oil and natural gas—natural resources that are valuable sources of energy. The waters over the continental shelf also provide productive fishing areas.

Continental Slope: The Underwater Cliff

At the edge of the continental shelf is a slope that may vary from steep to gradual known as the **continental slope**. The continental slope separates the continental shelf from the ocean floor.

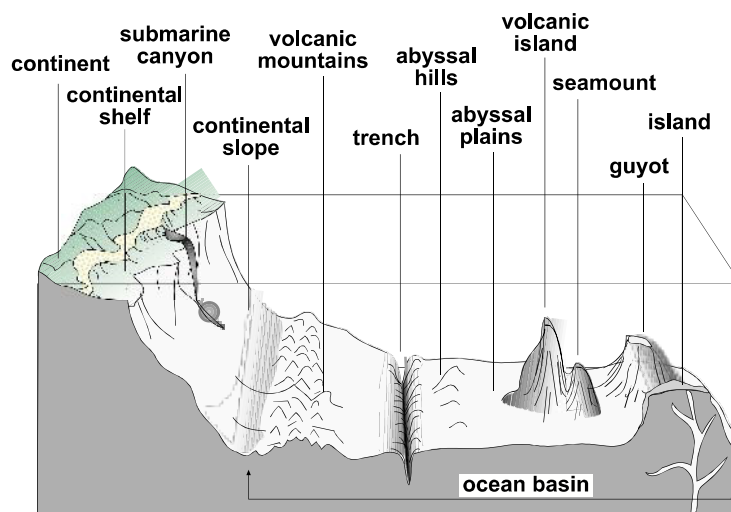
Continental slopes have many gullies and small valleys. **Submarine canyons**, or deep, ditch-like valleys that have been cut in hard rock, also appear along the slopes. The upper part of submarine canyons, scientists believe, were formed by rivers, and the deeper parts by undersea currents of sand and silt such as *turbidity currents* (see Unit 6). The sediment slows at the bottom of the slope and forms a gentle slope known as the *continental rise*. At the end of the rise is the *ocean basin*, which is more than 4,000 meters deep.



The part of the continent that is under water is called the continental shelf.

Abyssal Plains: Earth's Largest Plains

The *ocean basin*, or floor, begins at the bottom of the continental slope. Many plains on the ocean basin are larger and flatter than any found on the Earth's surface. They are called **abyssal plains**. Abyssal plains are formed by sediments deposited by turbidity currents and sediments continually falling from the seawater above. The deepest parts of the ocean floor are long, narrow cracks called **trenches**, which have been caused by shifts in the crustal plates. At some points, these trenches slice into the ocean floor more than 10,000 meters deep, and some run as long as 4,500 kilometers. The Marianas Trench in the Pacific Ocean is the deepest spot in the ocean—over 10,911 meters (6.78 miles) deep.



Like the surface of the continents, the landscape of the ocean floor displays a variety of physical features, including mountains, hills, trenches, and plains.

Seamounts and Guyots: Underwater Mountains

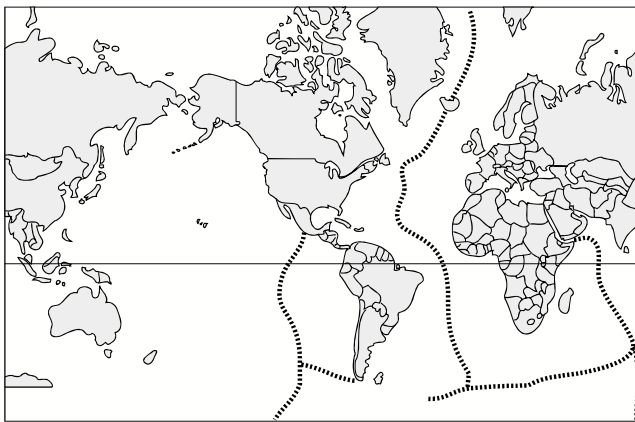
Along the ocean floor, often near crustal *plate boundaries*, are underwater mountains called **seamounts**. Seamounts are actually cone-shaped volcanic mountains with steep sides and a narrow summit, or top. Some seamounts rise through the ocean's surface and appear as volcanic islands. Seamounts are most abundant in the Pacific Ocean, possibly because of the activity of plates in the Pacific area.

Many seamounts do not rise to a peak but have a flat top. Flat-topped seamounts are called **guyots (GEE-oze or GEE-oots)**. Scientists hypothesize that the seamount tops were above sea level at one time and have been

removed by wave action. The flattened seamounts later sunk below the ocean surface. Scientists believe the sinking of the guyots was caused by the movement of crustal plates.

Mid-Ocean Ridges: Underwater Mountain Ranges

The most prominent feature of the ocean basin is the **mid-ocean ridges**. Mid-ocean ridges are underwater mountain ranges. The ridges form a continuous mountain chain from the Arctic Ocean, down through the middle of the Atlantic Ocean, around the tip of Africa and into the Indian Ocean. The chain then continues across to the Pacific Ocean and north to North America. In some areas, the highest peaks of the mid-ocean ranges reach above sea level, forming island chains.



outline of the worlds mid-ocean ridges

Mid-ocean ridges do not form in the same way as mountain ranges on land. Mid-ocean ridges form when molten magma from the mantle flows up to the seafloor. When the lava hits the seafloor, it cools and forms layers, making new crust. This expansion of the Earth's crust is called *seafloor spreading*. The mountain belt located in the Atlantic Ocean is called the *Mid-Atlantic*

Ridge. The mountain belt located in the Pacific Ocean is called the *East Pacific Rise* or *East Pacific Ridge*.

Summary

Continents extend into the ocean as much as 30 to 40 miles. These extensions are called *continental shelves* and are usually flat. They were formed by rivers carrying tons of particles from land to the sea. *Continental slopes* separate these shelves from the *ocean floor*, or basin. The ocean basin has a similar *topography* to that of Earth's land. In fact, many plains on the ocean floor are larger and flatter than any found on Earth's surface. And underwater mountains and mountain ranges can be found throughout the ocean.