NO PREP

Ocean Floor Features

Trenches, Ridges, and Plains

Includes: Student reading, case study, differentiated questions, teacher key

Name:	Period:	Date:

Ocean Floor Features: Trenches, Ridges, and Plains

The Landscape of the Ocean Floor

When we imagine Earth's surface, most people think of mountains, valleys, and plains on land. But beneath the oceans lies an even more dramatic landscape. The ocean floor covers more than 70% of Earth's surface and is filled with features just as varied as those found on land. These include mid-ocean ridges, deep trenches, volcanic seamounts, and flat abyssal plains. Unlike the surface we walk on, the seafloor is shaped by the constant motion of tectonic plates. At spreading centers, ridges rise where new crust is formed. At convergent boundaries, trenches sink where one plate dives beneath another. Between them are vast plains that seem empty but hold important clues about Earth's history. Modern sonar mapping has allowed scientists to "see" this hidden world, transforming our understanding of the ocean. Each of these features

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Mid-Ocean Ridges: Earth's Longest Mountain Chains

The mid-ocean ridges are underwater mountain ranges formed where tectonic plates pull apart. Magma rises through cracks, cools, and creates new crust. The Mid-Atlantic Ridge is a well-known example, stretching thousands of miles down the Atlantic Ocean. These ridges are not only the longest mountain chains on Earth but also the birthplace of new seafloor. Ridges often include a central valley called a rift, where volcanic activity is common. Heat from below fuels hydrothermal vents, releasing mineral-rich fluids that support unique ecosystems. Scientists study these ridges to understand both plate tectonics and the deep-sea life that thrives in extreme environments.

Abyssal Plains: The Hidden Flatlands

Between ridges and trenches lie the abyssal plains, which are among the flattest and smoothest regions on Earth. These plains are formed as sediments gradually cover the irregular ocean floor, smoothing it out over millions of years. Though they may appear empty, abyssal plains play an important role in Earth's carbon cycle, as sediments trap and store carbon. They also contain clues about climate history, preserved in the layers of sediment that settle there. Despite their remoteness, abyssal plains are increasingly important for human activity. Some areas are being studied for deep-sea mining, as they contain nodules rich in valuable metals like manganese, cobalt, and nickel. However, scientists caution that disturbing these plains could have lasting environmental impacts.

Key Information: Table: Key Features of the Ocean Floor

Feature	Description	Example
Mid-ocean ridge	Underwater mountain range at divergent boundary	Mid-Atlantic Ridge
Ocean trench	Deep valley formed at subduction zones	Mariana Trench
Abyssal plain	Flat, sediment-covered seafloor	Atlantic Abyssal Plain
Seamount	Underwater volcanic mountain	Hawaiian Seamount Chain
Rift valley	Central valley at ridge where plates pull apart	Iceland Rift Zone

Case Study: The Mariana Trench

The Mariana Trench, located in the western Pacific Ocean, is the deepest natural point on Earth's surface. At its lowest spot, the Challenger Deep, the trench reaches about 11,000 meters (36,000 feet) below sea level—deeper than Mount Everest is tall. The trench formed where the Pacific Plate subducts beneath the smaller Mariana Plate. This subduction zone not only creates great depths but also generates powerful earthquakes and volcanic activity in nearby island arcs. In 1960, Jacques Piccard and Don Walsh became the first humans to reach the bottom of Challenger Deep in the Trieste bathyscaphe. More recently, explorers such as James Cameron and scientific unmanned submersibles have returned, collecting samples and discovering new species. These expeditions reveal that life can survive under immense pressure, total darkness, and near-freezing temperatures. The Mariana Trench is a reminder of how much we still have to learn about Earth's most extreme environments.

1. How did the Mariana Trench form?

_____

_____

2. Why is the Challenger Deep scientifically important?

_____

_____

Multiple Choice

1. What forms at a divergent boundary under the ocean?

    a) Abyssal plain

    b) Mid-ocean ridge

    c) Subduction zone

    d) Ocean trench

2. Which trench is the deepest part of the ocean?

a) Mariana Trench

b) Puerto Rico Trench

c) Tonga Trench

d) Java Trench

3. What makes abyssal plains so flat and smooth?

a) Constant earthquakes and plate movements

b) Volcanic eruptions

c) Seafloor spreading

d) Sediment covering irregularities

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Mid-ocean ridge	A) Underwater volcanic mountain
2. ___ Mariana Trench	B) Formed at divergent boundary
3. ___ Abyssal plain	C) Found at center of spreading ridge
4. ___ Seamount	D) Flat, sediment-filled seafloor
5. ___ Rift valley	E) Deepest ocean location

Fill-in-the-Blank

1. The _____ Trench contains the Challenger Deep, the lowest point on Earth's surface.

2. Sediment builds up over time to create _____ plains.

3. Magma rising at divergent boundaries forms _____ ridges.

Short Answer

Answer each question in 2-4 complete sentences.

1. Why are mid-ocean ridges considered the longest mountain chains on Earth?

2. What scientific discoveries have been made in the Mariana Trench?

3. Why are abyssal plains both scientifically important and environmentally sensitive?