Lesson 13: Under the Sea – Part 1

Vocabulary 12.1

submersible, ***n.*** a small vehicle that can travel deep under water for research (**submersibles**) (**82**)

Rugged

Hydrothermal Vent

Seamount

Underlie

Firsthand

School

Word(s) from the Chapter	Pronunciation	Page
anemones	/ə*nem*o*nees/	88
Jacques Piccard	/jok/ /pee*kar/	89
Trieste	/treest/	89

Chapter 9: Earth's Undersea World

THE BIG QUESTION

How does the movement of tectonic plates shape and change the seafloor?

Chapter 9

Earth's Undersea World

THE BIG QUESTION
How does the movement of tectonic plates shape and change the seafloor?

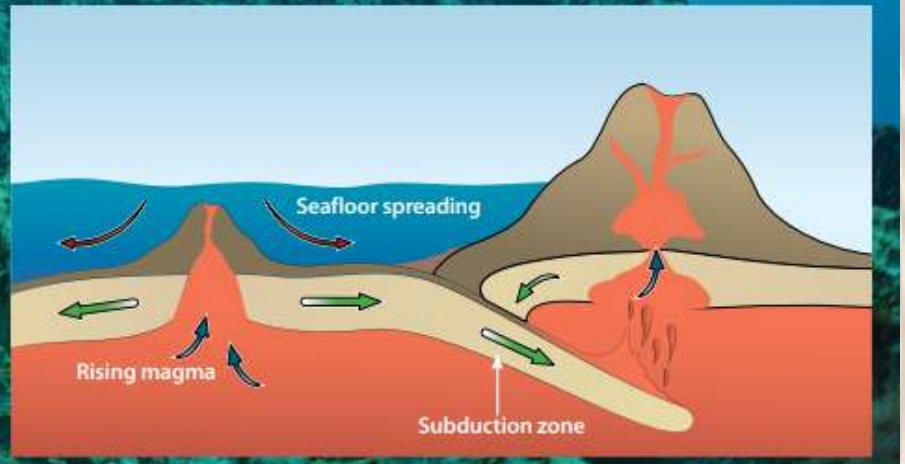
Imagine that you are dropping down, down, down into the middle of the Atlantic Ocean. The seawater outside the **submersible** gets darker and darker. Soon the light fades completely. Outside is a watery world as black as night. Finally, the sub's lights pick up shapes below as the ocean bottom comes into view. You see lumpy hills and looming peaks of dark volcanic rock. Welcome to the Mid-Atlantic Ridge. The ridge marks the boundary between several enormous tectonic plates. Portions of these plates form the bottom of the Atlantic Ocean.

Mountains and Moving Plates

In Chapter 8, you learned some of the ways Earth's slowly moving tectonic plates build mountains. Over millions of years, their movements have created many mountains and mountain ranges on land. Moving plates also build mountains underwater. In fact, there are more mountains on the seafloor than on all of Earth's continents and islands combined.

The Mid-Atlantic Ridge is a long, **rugged** underwater mountain range. It runs for thousands of miles along the boundary between tectonic plates that meet in the center of the Atlantic Ocean. The plates are very slowly moving apart at this boundary.

Remember Alfred Wegener? Wegener proposed the idea of continental drift in the early 1900s. At the time, though, no one knew of any force powerful enough to move continents around on Earth's surface. The theory of seafloor spreading was a big clue to solving the mystery.

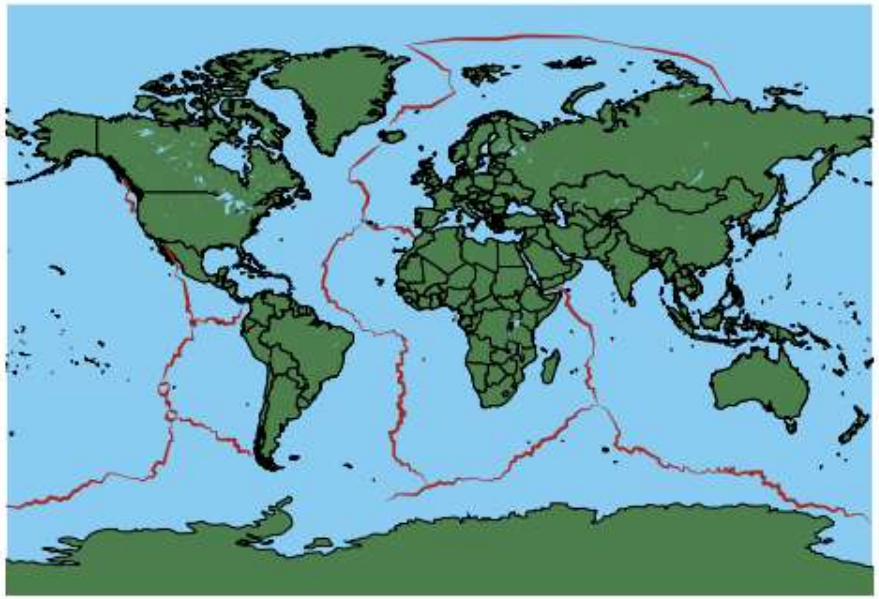


Seafloor spreading was one of several key pieces of geological evidence that led to the theory of plate tectonics. Think of the continents as riding on top of the plates. As the plates move, so do the continents.

It was the study of the Mid-Atlantic Ridge that first made scientists consider the possibility of seafloor spreading. They concluded that, as the seafloor spreads, the continents on either side of the Atlantic are pushed farther apart.

Scientists soon discovered that the Mid-Atlantic Ridge is just one of many mid-ocean ridges. These ridges are found in all the world's oceans, wherever tectonic plates are slowly moving apart. Altogether, mid-ocean ridges form a near-continuous chain of mountains that wraps around the earth like the stitching on a baseball. Spanning 40,389 miles, the chain of mid-ocean ridges is by far the world's longest mountain range. It is also the most volcanically active.

The Mid-Atlantic Ridge is just a part of this gigantic underwater mountain chain. Erupting lava has built up high walls of basalt on either side of the rift. The rift itself is nearly as deep as the Grand Canyon! If you travel along the ridge, you'll soon see more than just high walls of dark rock.



Mid-ocean ridges form a near-continuous chain of underwater mountains.

Hydrothermal Vents

At first glance, it looks like a fire. Black smoke is billowing up from a spot in the ridge. It's not smoke, though. It's searing hot, dark water gushing out of cracks in the rock. It's a **hydrothermal vent**.

Hydrothermal vents are a bit like geysers in Yellowstone National Park. These deep-sea geysers are much, much hotter than anything on land. Hydrothermal vents form as seawater sinks down through cracks in the oceanic crust. As it nears the magma lying below the crust, the water is heated to incredibly high temperatures. It can reach an astonishing 750°F! The water is so hot that it dissolves minerals from the surrounding basalt. The minerals become part of the hot liquid, like salt does when it's stirred into a glass of water.

At a hydrothermal vent, the super-heated, mineral-rich water comes roaring back up through cracks in the crust. It shoots out of the rock with the force of water blasting out of a fire hydrant. When hot vent water meets cold seawater, the dissolved minerals in vent water become solid again. They form tiny particles. The particles make the vent water look like dark smoke.

Hunting for Hydrothermal Vents

Hydrothermal vents

How do scientists find hydrothermal vents? They hunt for them from ships at sea. Hot, mineral-rich vent water moves slowly away from hydrothermal vents. It forms a plume, or cloud, of mineral particles that drifts away from the vent, like smoke from a chimney. If the scientists locate a plume, they send down a robot vehicle. When it locates the vent, the robot sends pictures back to the scientists.

There is more to hydrothermal vents than clouds of hot, black water. Communities of amazing and unusual animals live around many of these deep-sea geysers. Red-topped giant tube worms are the largest animals near vents. Some types of giant tube worms can grow as tall as a person. The vents are also home to ghostly white crabs, football-sized clams, and pale, blind shrimp.

Scientists believe there are tens of thousands of hydrothermal vents along the world's mid-ocean ridges. Scientists, however, have explored only a handful of them. Finding a new one is always exciting. Scientists often discover new types of animals as well.

Giant tube worms near a hydrothermal vent in the Pacific Ocean

Seamounts and Subduction Zones

Seamounts are another type of underwater mountain. Seamounts are underwater volcanoes that come in many shapes and sizes. Some are just a few hundred feet high. Others tower thousands of feet above the seafloor, although their tops are still far beneath the ocean's surface. If a seamount grows high enough to rise above the ocean's surface, it becomes an island.

Seamounts can form wherever magma is erupting through the oceanic crust. Many seamounts form alongside mid-ocean ridges or along subduction zones.

Finally, seamounts can also form over hotspots far from plate boundaries. The islands that make up the Hawaiian Island chain began as seamounts. As you read in Chapter 4, each island formed over a hotspot that **underlies** the center of the Pacific Plate. As a result of repeated volcanic eruptions, each island began as a small seamount that grew over time. Eventually, its top broke the water's surface, making it an island.

Seamount that grew into an island

Scientists estimate that there are at least 100,000 seamounts over 3,000 feet tall in the world's oceans. Since most seamounts are far below the ocean's surface, studying them is a challenge. Scientists have explored a few **firsthand**, traveling down in submersibles. More often, they send robot vehicles down to do the investigating.

No two seamounts are exactly alike. Many are teeming with life, even those that are very deep. Water flowing around these deep-sea volcanoes brings up nutrients from the ocean bottom. Nutrients fuel the growth of tiny, single-celled organisms in the water. These, in turn, become food for larger organisms, including animals that live on and around seamounts. Seamounts are often home to deep-sea corals, sponges, brittle stars, crabs, and anemones. Great **schools** of fish live around seamounts, too.

Deep-sea coral

Brittle star

Into the Trenches

Seamounts aren't the only undersea features that form along subduction zones. Where one plate slides under another, the seafloor dips down to create narrow, extremely deep valleys. These ocean trenches are the deepest places on the planet.

The Mariana Trench in the Pacific Ocean is the deepest ocean trench. It lies just off the Mariana Islands, east of the Philippines. The Mariana Trench is hundreds of miles long, but just 43 miles wide. It is like a deep slash in the ocean bottom. The trench's deepest known point is an area called the Challenger Deep. It is 36,070 feet beneath the ocean's surface, which is almost 7 miles down. By comparison, the average depth of the ocean is about 14,000 feet.

What is it like in the ocean's deepest spot? It is pitch black. The temperature of the water is only a few degrees above freezing. The water pressure is very high—equivalent to having three big SUVs pressing down on every inch of your body!

Only three people have traveled to the bottom of the Mariana Trench. (More people have landed on the moon!) Several robot vehicles have also made the trip. These visits have provided only brief glimpses of this remote and extreme environment.

The Lucky Three

As of 2014, people have traveled to the bottom of the Mariana Trench only twice. The first expedition took place in 1960. The explorers were U.S. Navy Lieutenant Don Walsh and Swiss scientist Jacques Piccard. Their underwater vehicle was *Trieste*. It took *Trieste* almost five hours to descend from the ocean's surface to the bottom of Challenger Deep. Piccard and Walsh peered out a small window onto a part of the planet that humans had not seen before.

Piccard and Walsh in *Trieste*

In 2012, Canadian filmmaker and ocean explorer James Cameron also made the trip. His vessel, *Deepsea Challenger*, was a slim, one-person, underwater vehicle. Cameron's descent took just over two and a half hours. He did something Walsh and Piccard weren't able to do. He filmed the descent and the view he had of the ocean floor at 35,756 feet.

Activity Page 13.2

1. What clues tell you that you are close to a vent?

2. How would you get close enough to observe the vent?

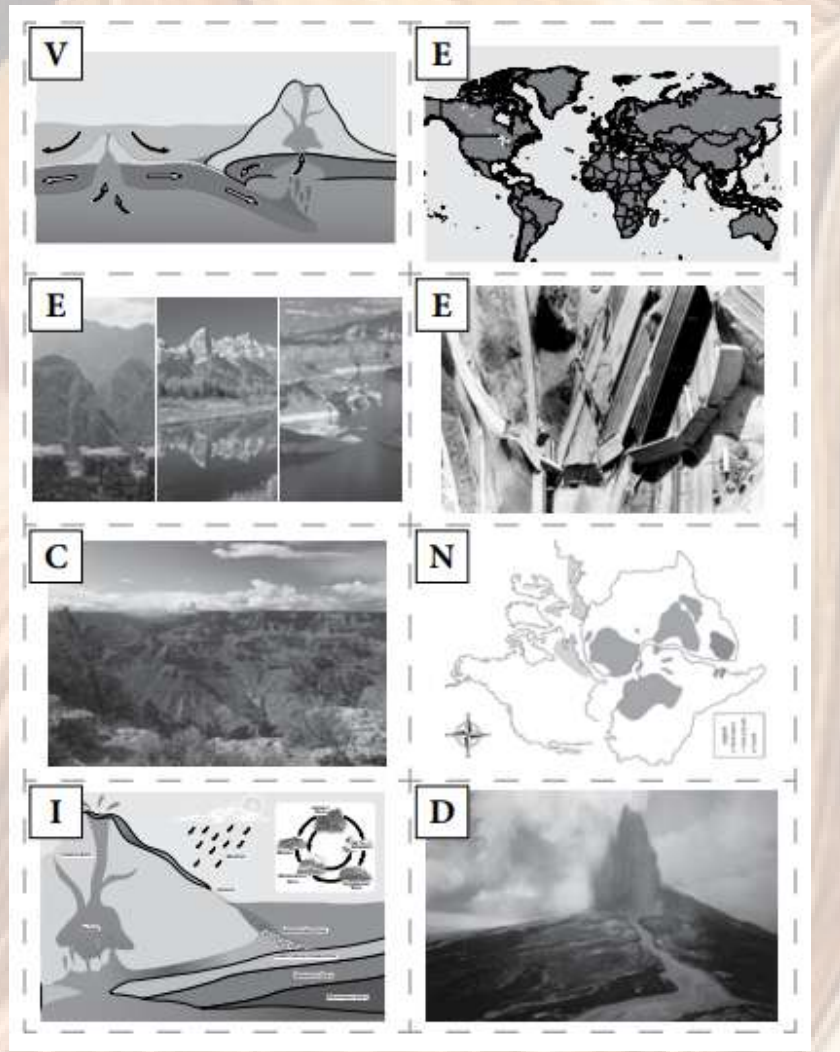
3. What would you discover on the seafloor near the vent?

4. Why is it important to conduct your underwater mission?

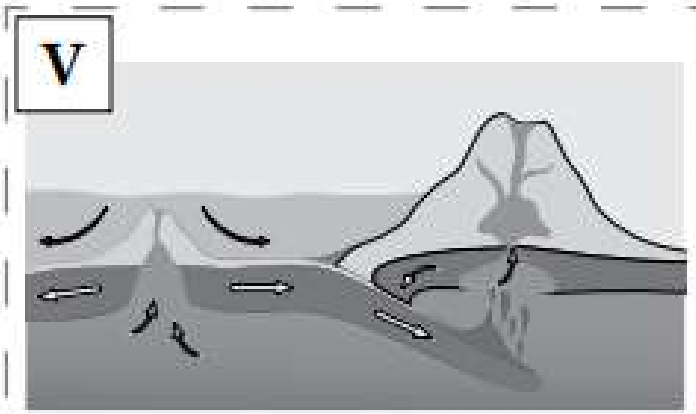
Activity Page 1.3 and 1.4

	Tectonic plates interact to create seafloor spreading and underwater subduction zones.		

Activity Page 1.3 and 1.4



Activity Page 1.3 and 1.4

	Tectonic plates interact to create seafloor spreading and underwater subduction zones.	V 		

Activity Page 1.3 Riddle

This word is the most important tool,
Difficult to find, challenging to rule.
It comes in many shapes and sizes
And is often full of surprises.
It’s the one thing scientists need to uncover.
It’s the key to what they hope to discover.

Now unscramble the letters! What is the answer to the riddle?

Word Work: Expedition

- The first expedition took place in 1960.
- Definition
- Only three people have ever made an expedition to the Mariana Trench.
- Examples
- Part of speech
- Synonyms

Writing: Descriptive Paragraph

*Focus – type of rock or item in the rock cycle

*Paragraph Format - Topic Sentence, Detail Sentences, Concluding Sentence

*Literary Devices – Alliteration, Similes, Personification, Strong Verbs

Writing: Descriptive Paragraph Sample

What is the paragraph focus? (What type of rock is Leah Lava?

My name is Leah Lava, and I feel as hot as the sun! That's probably because I'm lava shooting down the side of an active volcano. I hear a deep rumble behind me as rocks and debris spew out of the mountain, and I wonder if the plume is still reaching toward the blackening sky like an opening umbrella. As soon as I feel the air touch me, I begin to cool down. Thank goodness! It was getting awfully hot. As I cool, I harden, forming igneous rock. After all that hot activity, I like feeling wind blow across me and rain rinse my body. Sometimes I get uncomfortable in the scorching sun or the freezing cold, but I feel calm listening to the birds chirping around me and tasting the water that trickles over me.

Writing: Descriptive Paragraph Sample

Parts of a Paragraph

Find:
*Topic sentence
*Detail sentences
*Concluding sentence

My name is Leah Lava, and I feel as hot as the sun! That's probably because I'm lava shooting down the side of an active volcano. I hear a deep rumble behind me as rocks and debris spew out of the mountain, and I wonder if the plume is still reaching toward the blackening sky like an opening umbrella. As soon as I feel the air touch me, I begin to cool down. Thank goodness! It was getting awfully hot. As I cool, I harden, forming igneous rock. After all that hot activity, I like feeling wind blow across me and rain rinse my body. Sometimes I get uncomfortable in the scorching sun or the freezing cold, but I feel calm listening to the birds chirping around me and tasting the water that trickles over me.

Writing: Descriptive Paragraph Sample

Figurative Language

Find:
*Alliteration
*Similes
*Personification

My name is Leah Lava, and I feel as hot as the sun! That's probably because I'm lava shooting down the side of an active volcano. I hear a deep rumble behind me as rocks and debris spew out of the mountain, and I wonder if the plume is still reaching toward the blackening sky like an opening umbrella. As soon as I feel the air touch me, I begin to cool down. Thank goodness! It was getting awfully hot. As I cool, I harden, forming igneous rock. After all that hot activity, I like feeling wind blow across me and rain rinse my body. Sometimes I get uncomfortable in the scorching sun or the freezing cold, but I feel calm listening to the birds chirping around me and tasting the water that trickles over me.

Drafting a Descriptive Paragraph

*In Word, type your paragraph using 12.3.

Things to Remember:

*Indent the first line only!
*Start with a topic sentence (My name is…)
*Use complete sentences to give details.
*End with a concluding sentence that summarizes the main idea.

Did you include:

*Alliteration?
*1-2 Similes?
*Personification?
*Strong Verbs?