Smithsonian

OCEAN TRENCHES AND DEEP-SEA LIFE

Lisa Perlman Greathouse

TCM Teacher Created Materials

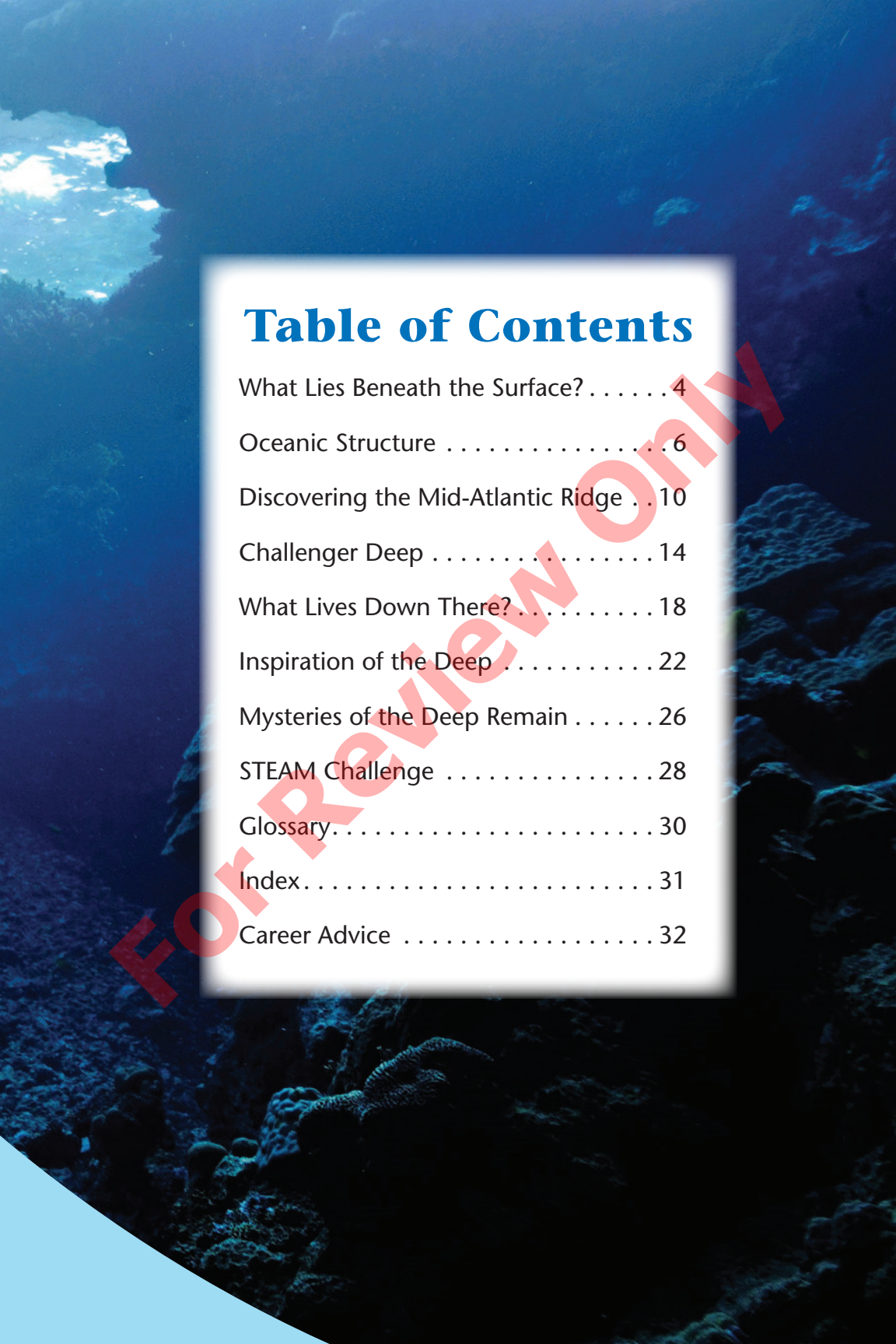


Table of Contents

What Lies Beneath the Surface?

For centuries, people have wondered what lurks below the surface of Earth's oceans. Beneath the glistening water, oceans are complex, mysterious, **dynamic**, and deep. And because Earth's surface is about 70 percent water, that means most of the surface of our planet is under the oceans. Movies and books have explored the subject, sometimes playing off our fears of the unknown. What strange creatures might lurk deep in the darkness below?

Scientists have been studying the very bottom of Earth's oceans for decades. They have discovered the ocean floor holds answers to questions about our planet's formation. Scientists once thought the ocean floor was a flat, still, and boring place. Now, we know the seafloor is always changing. Frequent earthquakes and volcanic eruptions can shake things up. And creatures unlike anything on Earth's surface live in the depths. The deep sea is the largest **biome** on Earth.

Think of the ocean floor the same way you think about land on Earth. There are multiple levels: flat plains, gentle hills, towering mountain peaks, and deep **trenches**. There's a lot to learn about the world under the water's surface, so let's dive in!

FUN FACT

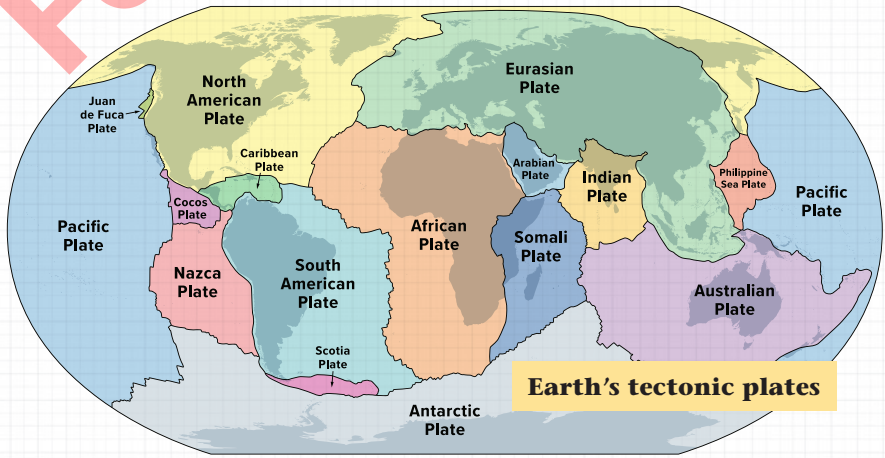
This 1972 photo of Earth from outer space is called *The Blue Marble*. In the image, you can see how much water makes up the planet's surface.

Oceanic Structure

If you're seeking the deepest valley on Earth, you won't find it on land. It's deep in the ocean! The deepest ocean trench reaches roughly 10,935 meters (35,876 feet) below the water's surface. The way ocean trenches form is tied to the structure of Earth's crust. The crust is a thin layer of rock that makes up Earth's surface. Continental crust exists on land, and **oceanic crust** exists at the bottom of oceans.

All of Earth's land—both above and below water—sits on tectonic plates. These are like huge puzzle pieces of Earth's crust. They are made of solid rock. Under each plate is a weaker layer of partially melted rock. For hundreds of millions of years, these plates have been shifting around and bumping into each other. As the plates move, the continents on them move, too. The theory of plate tectonics explains how plates move and interact with one another.

The structure of the oceans is caused by the way tectonic plates move over time. The shallowest parts of oceans are along the edges of continents. They are called *continental shelves*. They are extensions of what's found on the land around them. For example, shelves along the coastline of plains are flat or gently sloping. Shelves along mountainous coasts are steep. Shelves **descend** toward the deep ocean floor in what is called the *continental slope.*



Earth's tectonic plates

Ocean Depths

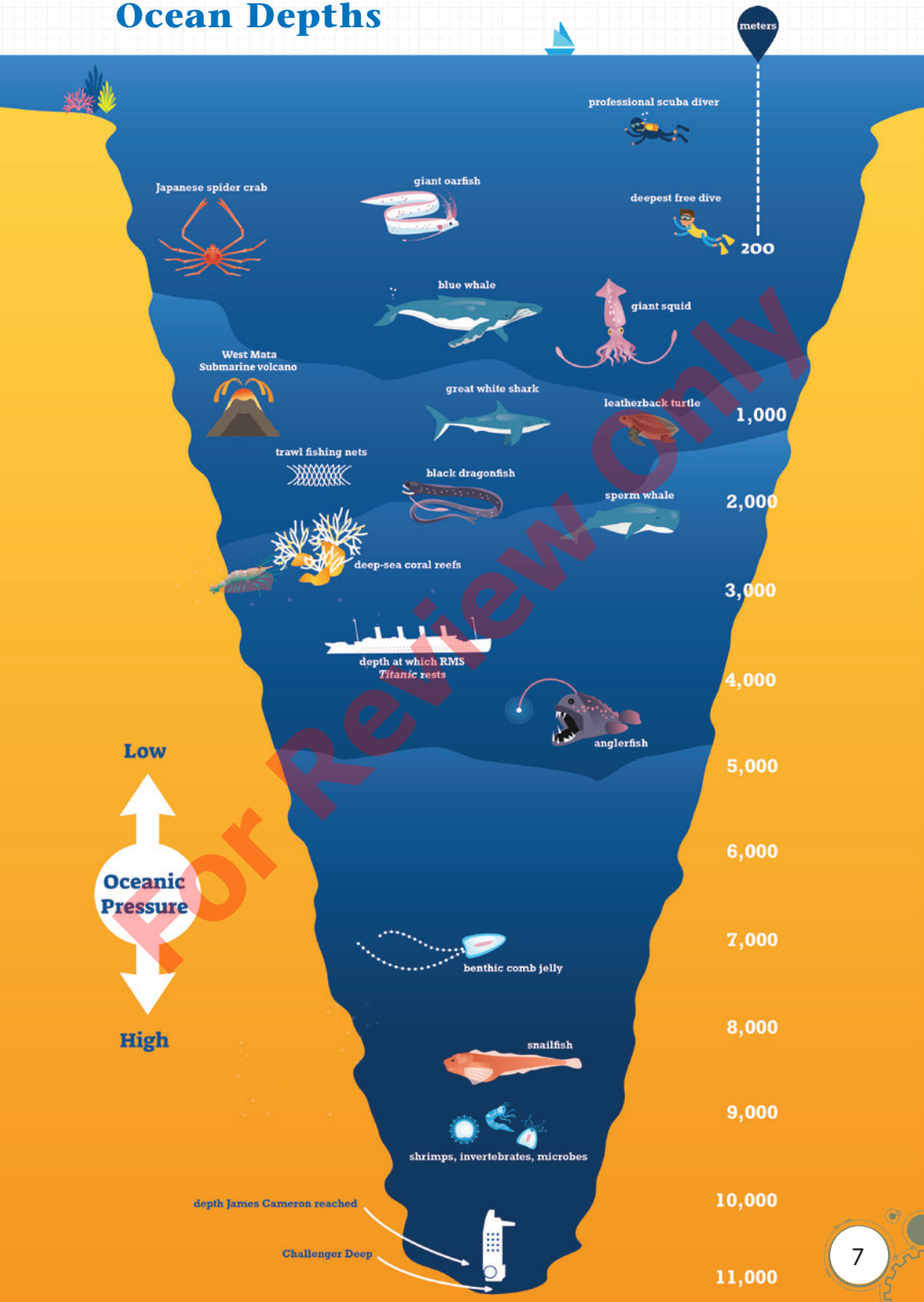
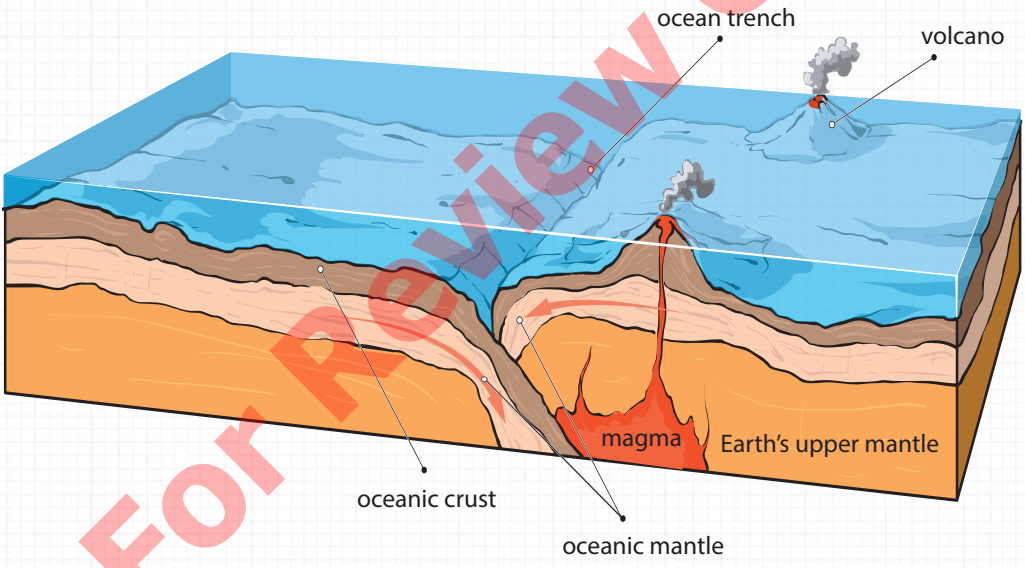


Plate Movement

The collisions of tectonic plates can cause earthquakes and volcanic eruptions, both on land and in the water. Underwater earthquakes can sometimes result in tsunamis. These are giant walls of water. When they crash ashore, they can cause widespread destruction.

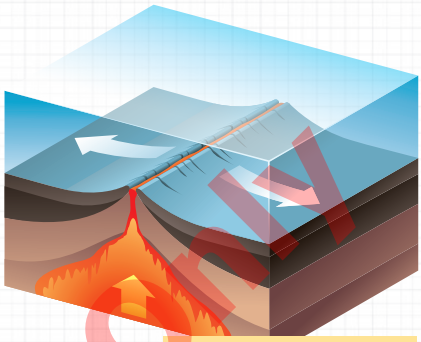
Sometimes, when the edges of tectonic plates rise up, underwater mountain ranges are formed. Other times, one plate may slide under another plate. Areas where this occurs are **subduction** zones. When two plates meet at a subduction zone, a deep ocean trench can form.



Seafloor Spreading

With tectonic plates sliding under each other, you might wonder why Earth isn't shrinking. That's because the plates sometimes pull apart instead. When that happens, it's called *seafloor spreading*. It may only be a few inches a year—but it adds up!

Seafloor spreading creates a new seafloor. You might expect valleys or trenches to form where plates pull apart. But instead, **magma** fills in the gaps. When seafloor spreading happens slowly, it can result in steep cliffs and mountains on the ocean floor. When it happens quickly, it can cause gentle slopes and result in new geographic features. For example, the Red Sea was created when the African plate and the Arabian plate split apart.

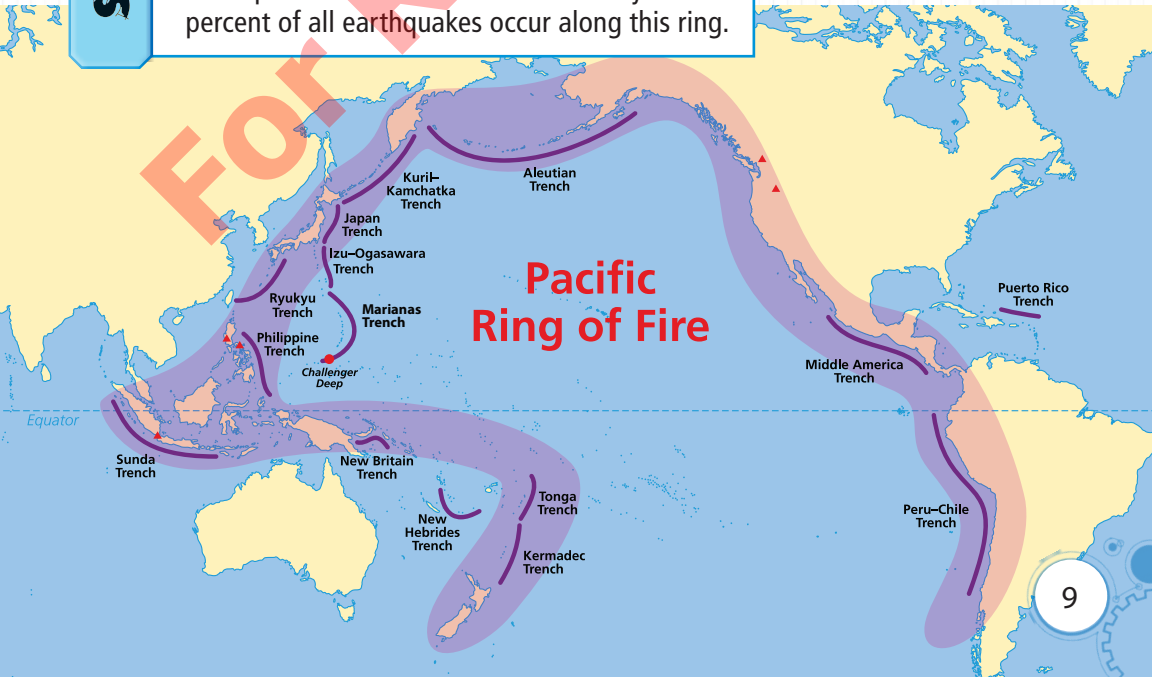


Seafloor spreading occurs when magma rises up to the boundaries of two tectonic plates.

SCIENCE

Ring of Fire

Deep trenches can be found in all oceans, but most are found in the Ring of Fire. This is a ring-like area around the Pacific Ocean. Its name comes from its many volcanoes and earthquakes—and fire-hot lava! Nearly 90 percent of all earthquakes occur along this ring.



STEAM CHALLENGE

Define the Problem

Near the Ring of Fire, nearly 20 different ocean trenches exist. This means that for people living in the area, earthquakes and tsunamis are a constant threat. Architects are seeking new construction ideas for buildings that can withstand earthquakes and tsunamis. To help the architects, you will design and test a structure model against both catastrophic events.

Constraints: You may only use the materials provided to you.

Criteria: Your structure must fit onto a paper plate and must be at least 46 centimeters (18 inches) tall. It must remain standing without structural damage during both the mock earthquake and tsunami.

CAREER ADVICE
from Smithsonian

Do you want to study the oceans?

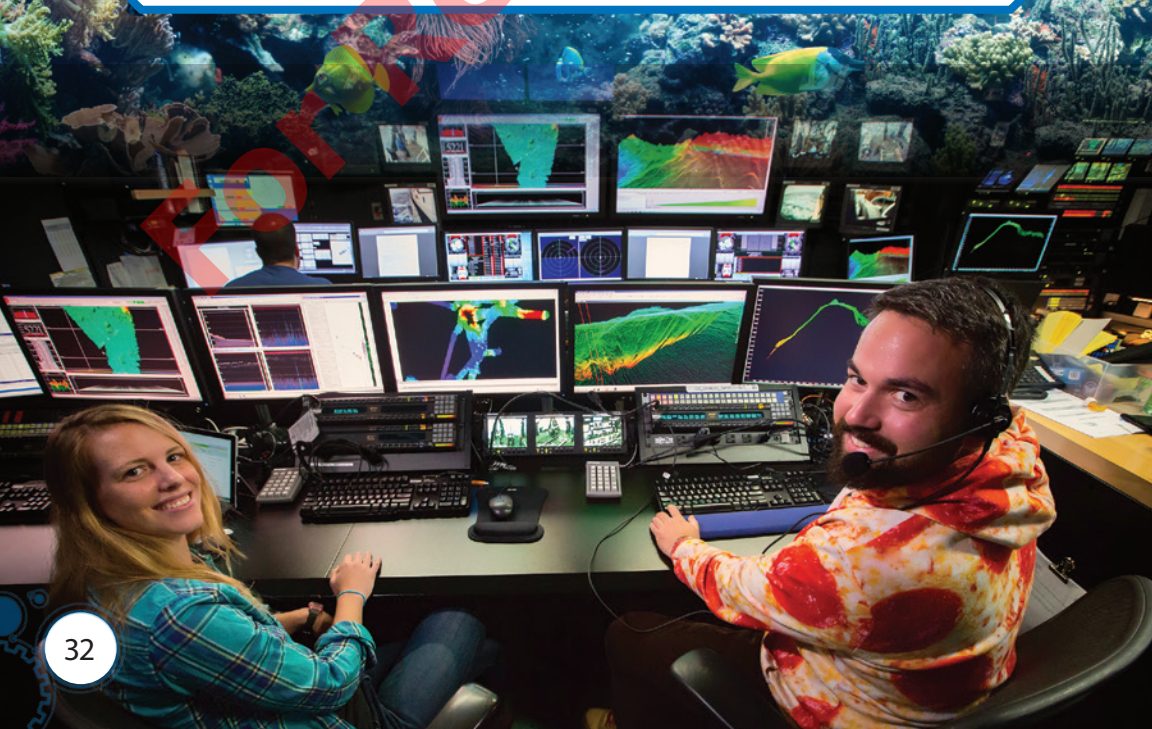
Here are some tips to keep in mind for the future.

"Build a model of an ocean trench using clay or sand. It's a fun way to visualize the incredible depths of our oceans."

– Dr. Erin Dillon, Postdoctoral Researcher, Smithsonian Tropical Research Institute

"Examining maps of the ocean floor is an amazing way to explore our planet's underwater landscapes and ocean trenches."

– Dr. Kimberly García-Méndez, Lab Manager, Smithsonian Tropical Research Institute



Read and Respond

1. How do ocean trenches form?
2. What is the theory of plate tectonics?
3. Why is it difficult for humans to explore the deepest parts of Earth's oceans?
4. Choose one deep-sea species and explain how it lives in its environment.
5. How did Marie Tharp's work change scientists' understanding of the seafloor?
6. Do you think scientists will ever fully explore our oceans? Explain your thinking.