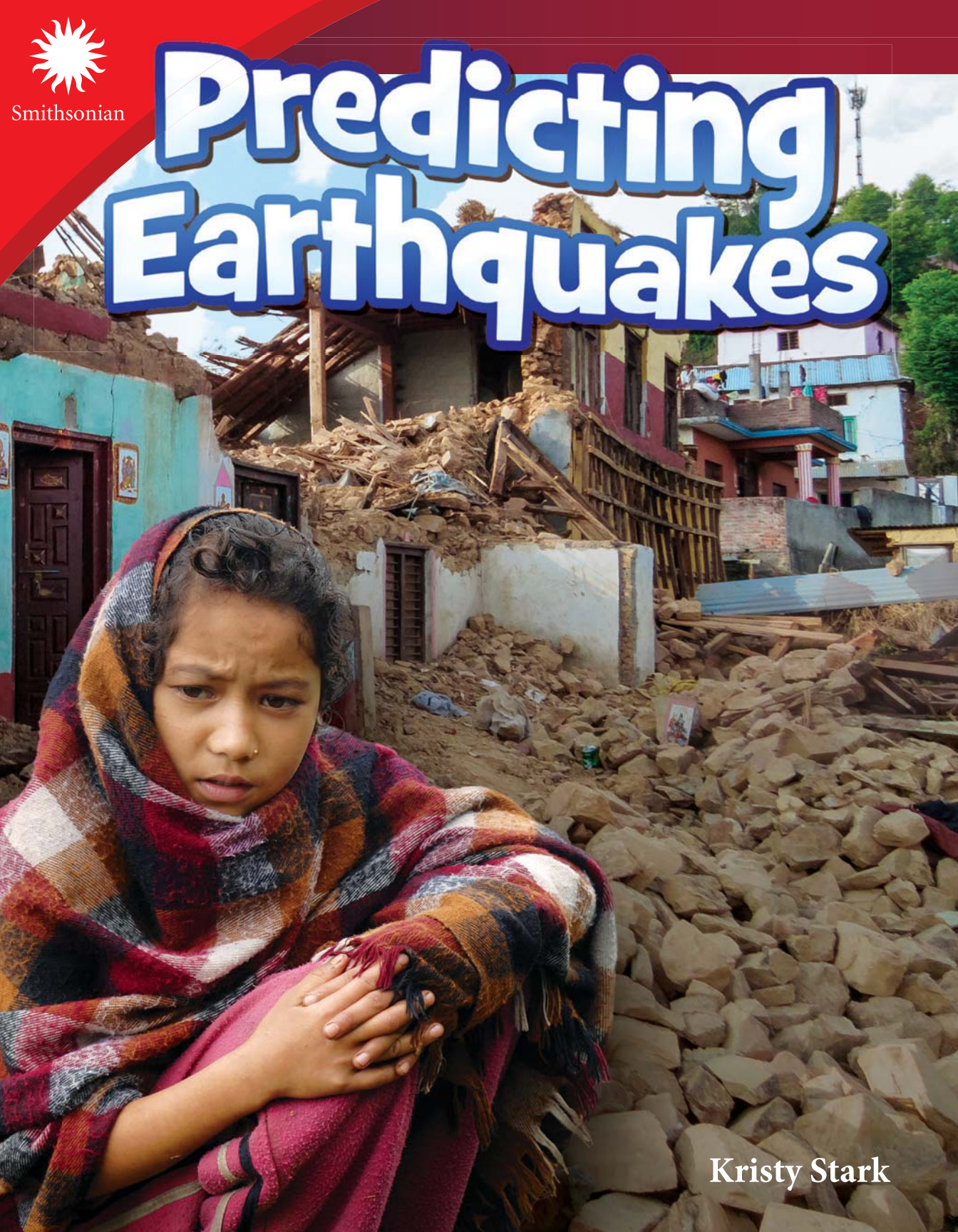
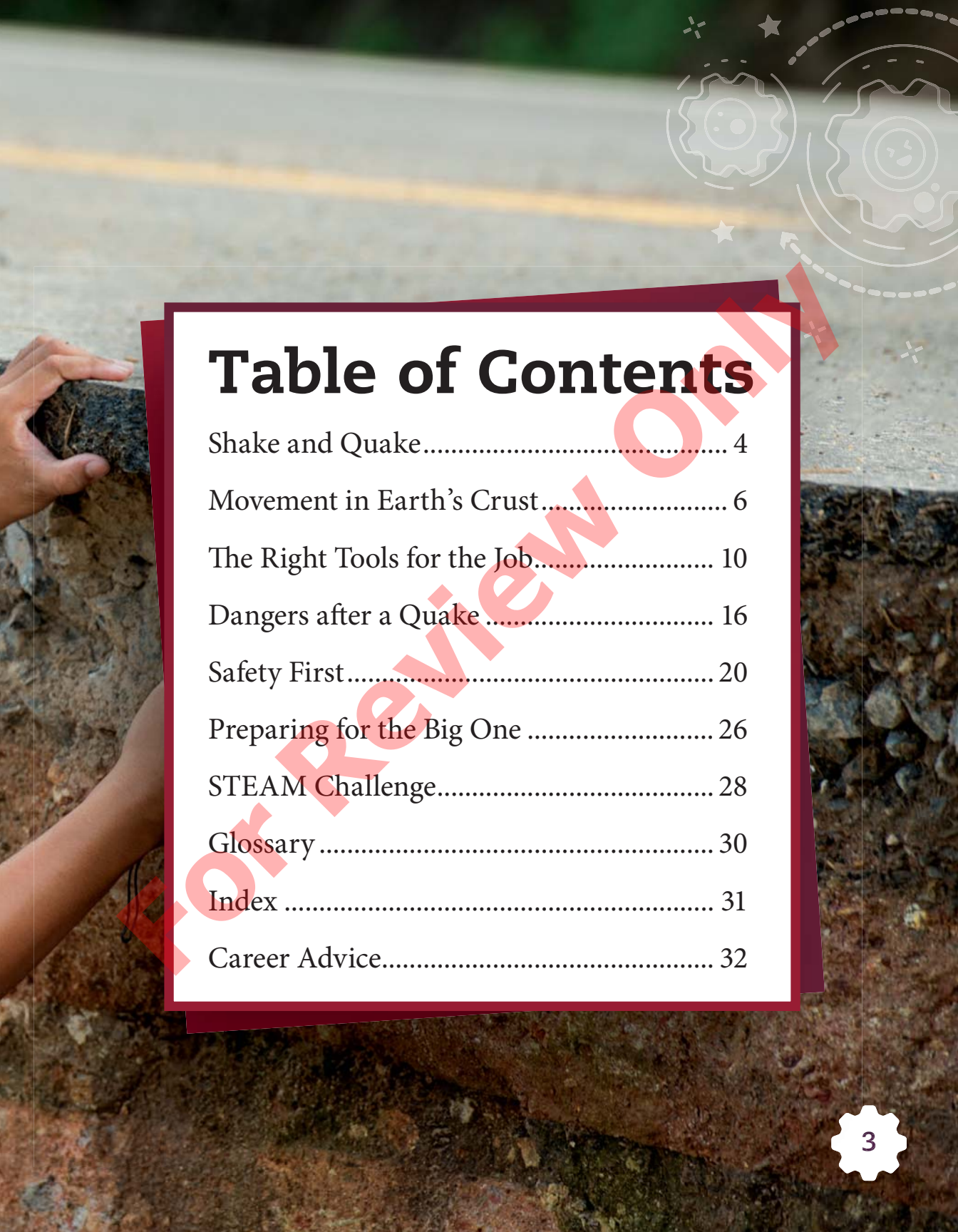
Smithsonian

Predicting Earthquakes



Kristy Stark



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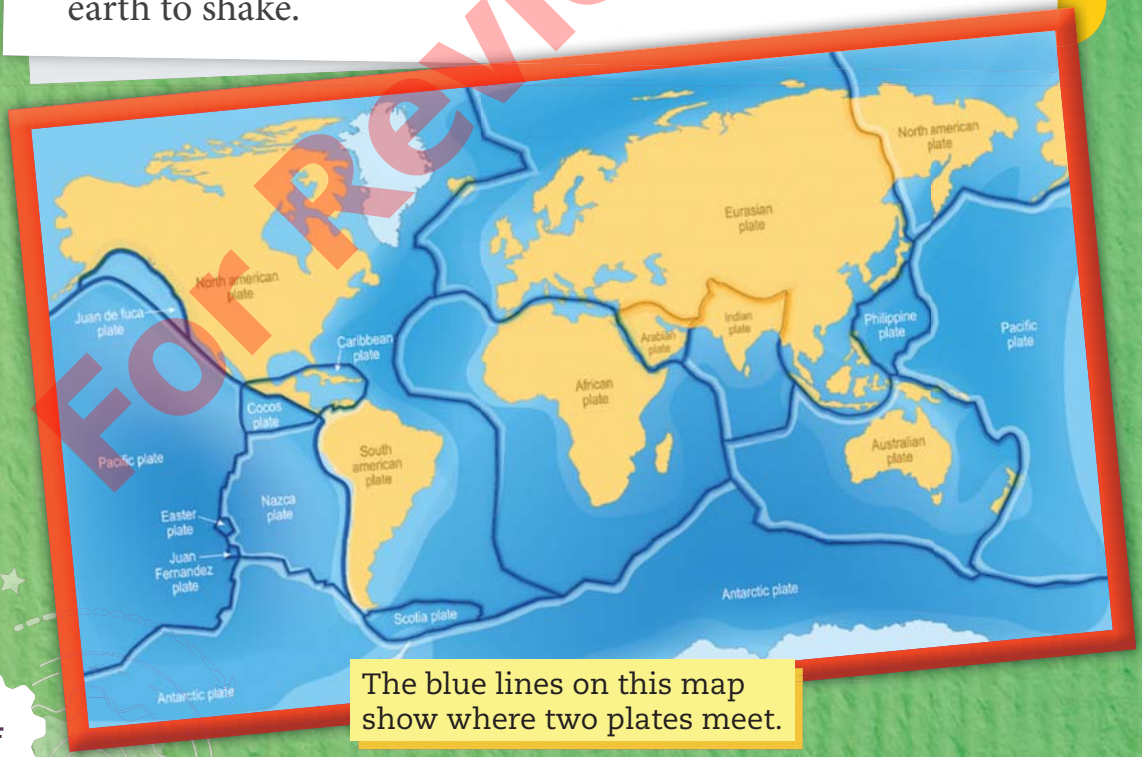
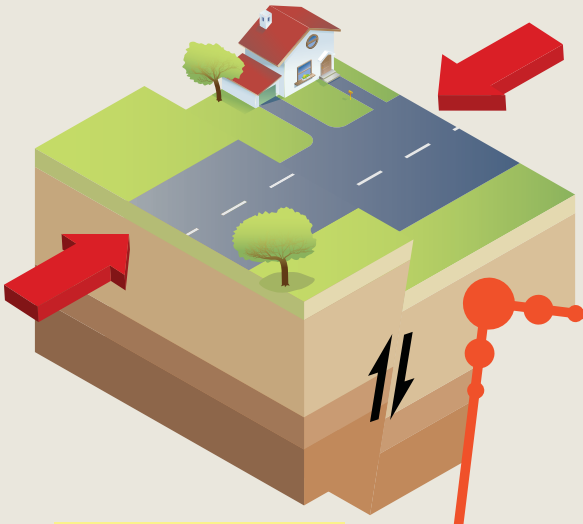
Shake and Quake

You are sound asleep in your bed. Then, the bed starts to shake. You look around to see if your dog has jumped on the bed. A few books fall off your bookshelf. You hear your windows rattle. You finally realize: it's an earthquake!

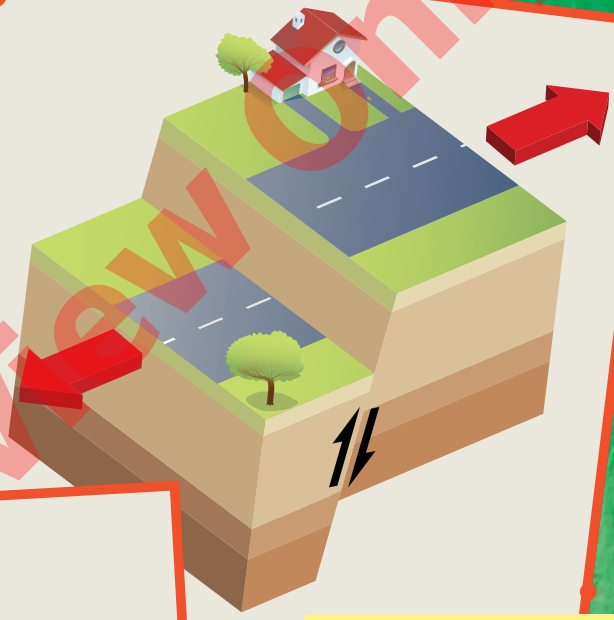
What causes earthquakes, or quakes? Most quakes occur along cracks, or faults, in Earth's crust. Molten lava under the crust allows enormous pieces of land, called **tectonic plates**, to move and shift. Some of these plates slide past one another. Some push against one another. Other plates move away from each other. When a plate collides into or slides over another plate, it builds up a lot of energy. When too much energy builds up, it needs to be released. The release of this energy is what causes the earth to shake.



The blue lines on this map show where two plates meet.



Some plates move toward each other.



Some plates move away from each other.

Some plates slide next to each other.

Movement in Earth's Crust

Scientists now know that most earthquakes are caused by tectonic plates. These plates are always moving. They bump into and move away from each other. But people didn't always know this to be true. For years, they would not believe that the land could be moving.

A Good Fit

Abraham Ortelius (ohr-TEE-lee-uhs) made the first atlas in the late sixteenth century. An atlas is a book of maps. In it, he pointed out that South America and Africa looked like they fit together like puzzle pieces.

Other people agreed. They looked for more clues that the two places were once connected. Some found rocks in both places that seemed to match up. Others found similar plants and animals.

These men did not know what might have caused the land to break apart. But they were the first to write about this **theory**. In science, a theory is based on evidence that tells why something happened. It took a long time before enough evidence was found to change people's minds.

South America and Africa look like they could fit together like puzzle pieces.

Abraham Ortelius

SCIENCE

Earth's Structure

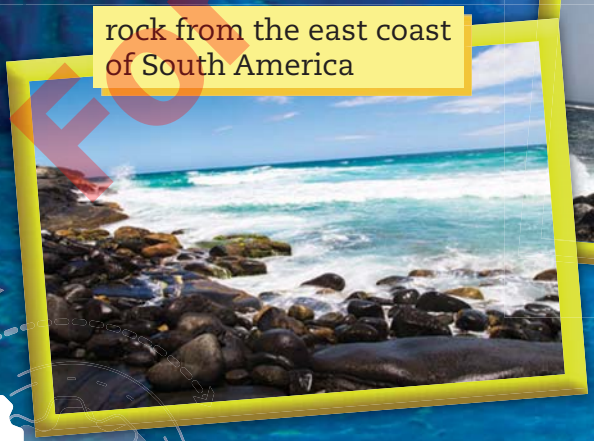
Earth has several layers. The *crust* is the outer layer. It includes land and oceans. The layer under the crust is the *mantle*. It is made of really hot rock. The top of this layer is partly molten. Next is the *outer core*. It is made of molten iron and nickel. The *inner core* is the deepest layer. It is made of solid iron and nickel.

Two hundred years passed. In 1799, Alexander von Humboldt went to South America. He found rocks on the east coast that looked like rocks on the west coast of Africa. He also thought the two landmasses had once been joined.

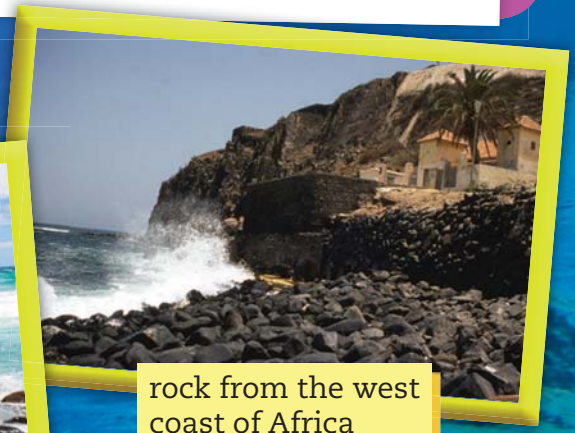
More explorers found clues that supported this idea. They found similar species of animals that lived in both South America and Africa. They found fossils of the species in both lands, too.

Below the Sea

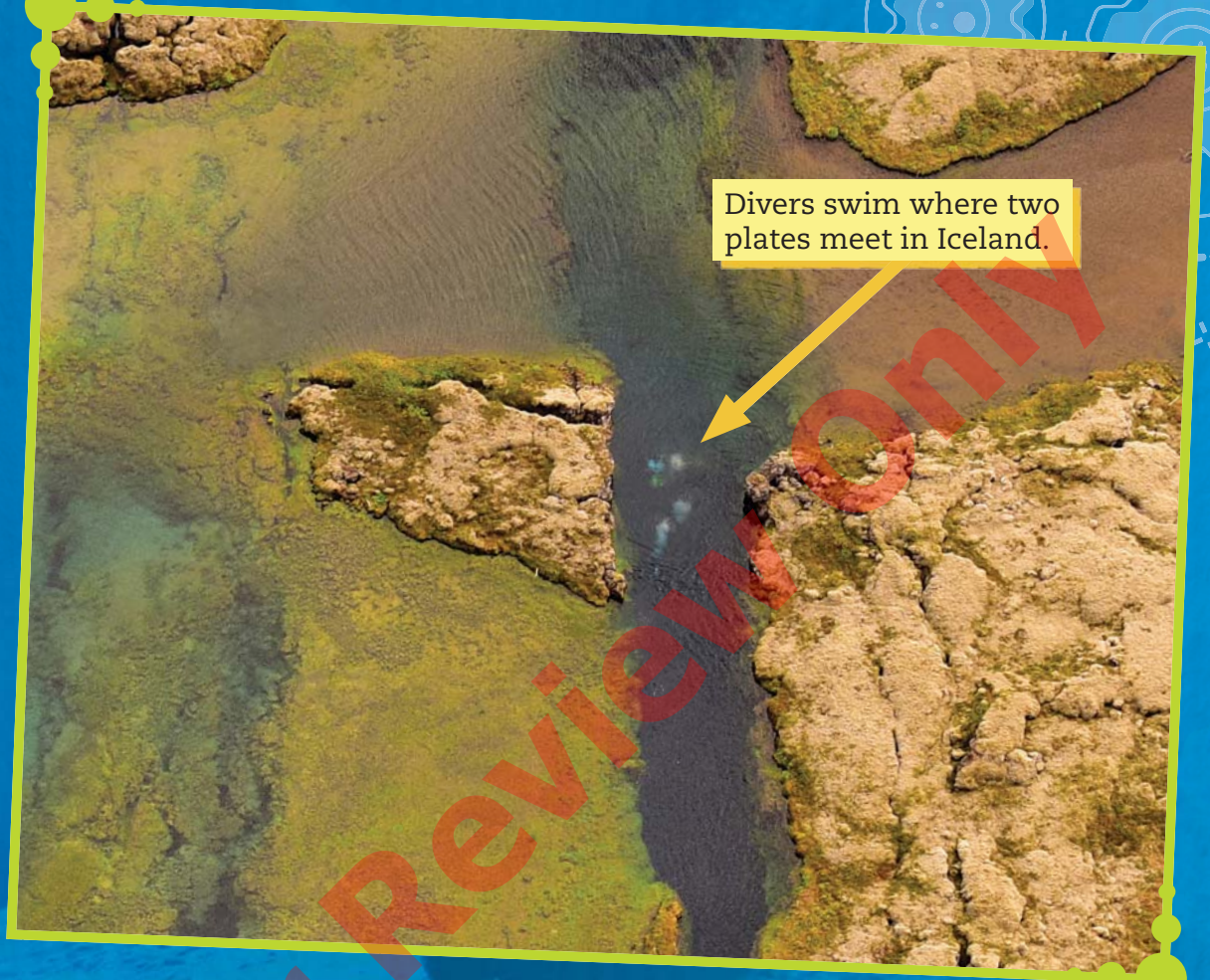
By the late 1960s, most experts thought that all Earth's land was once joined. But they were not sure how or why this changed. W. Jason Morgan and Dan McKenzie thought that Earth was covered with huge slabs of rock, or plates. They thought the slabs once fit like a puzzle. They thought the slabs moved in a lot of directions. Over time, the plates moved farther apart.



rock from the east coast of South America



rock from the west coast of Africa



Tectonic plates move from 2 to 5 centimeters (1 to 2 inches) per year. That is about the same speed that fingernails grow.

STEAM CHALLENGE

Define the Problem

How can a building protect people and property during an earthquake? Engineers think about this question when they design buildings near faults. Your task is to design and build a structure that can hold up during an "earthquake." In the process, you will discover how engineers approach this problem!

Constraints: Your structure must be at least two stories tall. It must be able to hold a small bag of sand at each story.

Criteria: Your model should survive a 30-second shake test.

Research and Brainstorm

How does the movement of Earth's plates lead to an earthquake? How do scientists know where earthquakes may occur? What types of materials are used for buildings near a fault?

Design and Build

Sketch your design. What purpose will each part of the structure serve? What materials will work best? Build the model.

Test and Improve

Test your model using a shake test. Did it work? How can you improve it? Modify your design, and try again.

Reflect and Share

Could you make a taller structure? What materials could make it stronger? What other types of natural events do engineers think about when they design a building?