Chapter 2: Earth’s Layers and Moving Plates

THE BIG QUESTION: How do tectonic plates and Earth’s layers interact to change the surface of the earth?

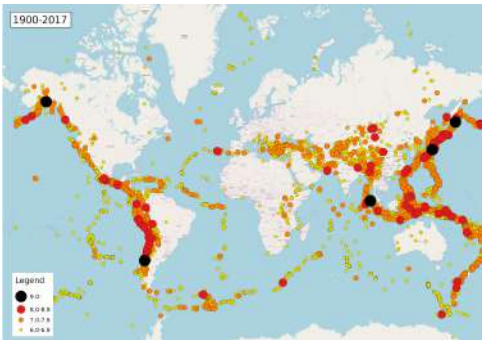
Alfred Wegener's Theory

Alfred Wegener had a very smart idea about how the Earth's land moves. He noticed that the edges of some continents fit together like puzzle pieces, and that continents far away from each other had the same kinds of rocks and fossils. But, he didn't know how something as big as a continent could move so far. Wegener's friends who study rocks didn't know of any force strong enough to move continents.

Earth's Moving Puzzle

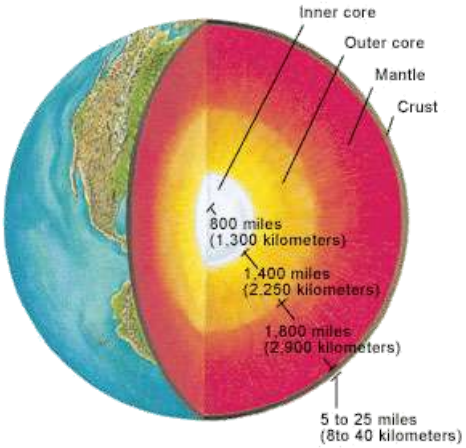
Most scientists didn't believe that Earth's continents could move. They didn't agree with this idea. A few scientists, though, thought it was possible. They asked, "How can we find out what's under Earth's surface?" Surprisingly, earthquakes gave them the answers they needed.

Earthquakes



Have you ever seen little waves when you toss a small rock into a pond? Waves travel through the water when the rock hits. Just like that, during an earthquake, the ground shakes. It's like the waves of energy from the earthquake travel through the earth. They're called seismic waves. These powerful waves can travel very far, through the Earth's crust and deep inside it.

Earth's Layers



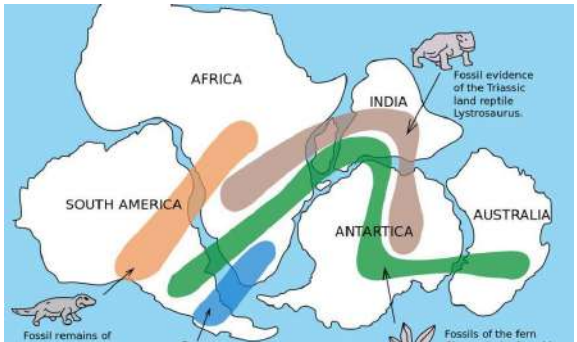
Some scientists studied Earth and found out it's made of four main layers. The deepest layer is a very hot, solid inner core. Above that, there's a layer of hot, liquid metal called the outer core. Then, there's the biggest and thickest layer called the mantle. The mantle is made of very hot, very heavy rock. In the middle of the mantle, the rock is neither solid nor liquid.

Earth's Crust

The Earth's crust is a thin, rocky layer. There are two types of crust: oceanic crust and continental crust. Oceanic crust is under the ocean water. Continental crust is mostly dry land, but some edges are covered by water. Oceanic crust is thinner but heavier than continental crust.

Continental Drift

For scientists who wanted to learn about how the Earth's land moves, they focused on the slow movement of the



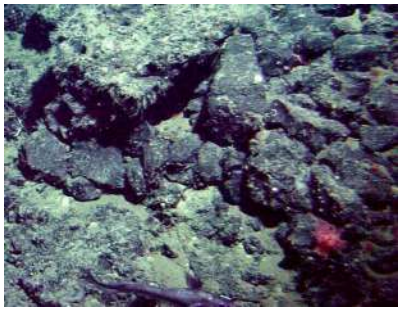
middle part of the Earth called the mantle. They wondered if the movement of material in the mantle made the land on Earth move too. They thought it might be one of the reasons why the big pieces of land, called continents, move. Some scientists believed this. But before they could be certain, they needed proof that the land on Earth was truly moving.

Exploring Underwater Mountains

During the olden days, new tools helped scientists make special maps of the bottom of the sea. The maps showed long lines of underwater mountains, known as mid-ocean ridges, in every one of Earth's oceans. There was a split, or rift, that went through the center of these ridges. The rift was like a seam in pants, where two pieces of cloth meet.

Ocean Ridges and Rocks

Once, scientists got some rocks from the bottom of the ocean. All the rocks were called basalt. They thought that the mid-ocean ridges looked like long, skinny strings of volcanoes under the water.



Scientists picked up rocks at different places along the mid-ocean ridge. They found out that the rocks near the middle had just formed. Rocks that were far away from the middle were older. The farther scientists went from the middle, on both sides, the older the rocks were.

Earth's Crust and Ocean Ridges

The experts found out that cracks in the Earth's crust make mid-ocean ridges. Magma under the crust comes out through these cracks as hot lava. The lava gets cold and turns into basalt, making new ocean floor on each side of the crack.

How the Ocean Floor Moves

As new rock is added, older rock gets pushed away from the crack in the ocean floor. Little by little, year after year, the ocean floor spreads out into the ocean. Scientists called this the spreading of the ocean floor. They thought that as the ocean floor moves, the land next to the ocean also moves. This is one way to explain how the land can move!

The Earth's Crust

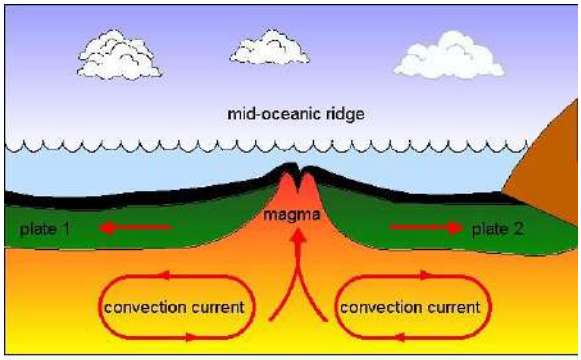


Plate 1 and plate 2 move apart. Magma rises, cools and solidifies forming new igneous rock. This is sea-floor spreading and is a constructive plate boundary.

Scientists knew the earth wasn't getting bigger. If new land forms under the ocean, then old land must go away somewhere else. Scientists thought that deep undersea canyons are where old land sinks into the earth. In the 1960s, scientists came up with a new idea about how the surface of our planet changes. They called it "plate tectonics."

Plate Tectonics

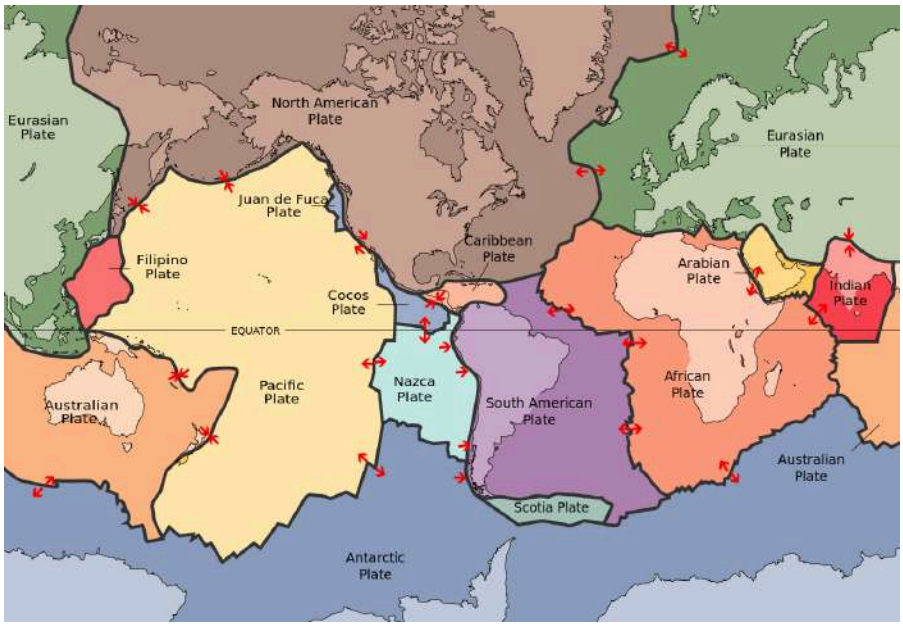
The Earth has big, rocky pieces called tectonic plates. These plates can move very slowly because of heat and pressure. The pressure makes the plates move bit by bit.

A Matter of Time

Some parts of the ground, called tectonic plates, move apart. When this happens, hot liquid rock comes up from the earth into the space between them, making new land. In the Atlantic Ocean, the plates are getting farther apart at a speed of about 0.8 to 2 inches every year. It doesn't sound like a lot, but over a long time, it is. Two hundred million years ago, parts of North America and Europe were connected, and the same goes for South America and Africa. But because of the moving plates, these continents are on different sides of a big ocean now.

In other places, the tectonic plates are crashing into each other. This can make the ground crumple up and form big mountains. Sometimes, one plate moves under another, creating deep parts in the sea and tall mountains on land. This has been happening all over the Earth for a very long time.

Lastly, some plates slide against each other. It’s not an easy process, and the edges press together really hard. They often get stuck, and the pressure keeps getting stronger. Eventually, the stuck edges break free, and the plates move past each other.



This is a map of Earth’s Plate Tectonics

Providing the Answers

The theory of plate tectonics has answered lots of questions about the Earth. It explains how the big landmass called Pangaea split apart. It also explains how the continents have been slowly shifting for millions of years. When the plates move, they cause mid-ocean ridges, deep ocean trenches, and patterns in the way mountains are placed on Earth. This theory is super important in geology. As the plates move, it can cause cool things to happen. Most of the time, it happens really slowly. But sometimes, the effects are sudden and exciting, like earthquakes and volcanoes!

Core Conclusions

Have you ever heard of the scientist Inge Lehmann? ? She did a lot of research and found out some really cool things! A long time ago, people thought the Earth only had three layers. But Lehmann studied earthquakes and discovered something new. She found out that the Earth has two parts in its core: a liquid outer part and a solid inner part. She changed the way people think about our planet!