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The Moving Story of Plate Tectonics

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Smoke and ash from Italy's Mount Etna volcano last week

FAITH LAPIDUS: This is SCIENCE IN THE NEWS in VOA Special English. I'm Faith Lapidus.

BOB DOUGHTY: And I'm Bob Doughty. Scientists who study the Earth tell us the continents and ocean floors are always moving. This movement sometimes can be violent, causing death and destruction. Today, we examine what causes earthquakes and volcanic activity.

(MUSIC)

FAITH LAPIDUS: The first pictures of Earth taken from space showed a solid ball covered by brown and green landmasses and blue-green oceans. It appeared as if the Earth had always looked that way -- and always would.

Yet the surface of the Earth is not as solid or as permanent as had been thought. Scientists found that the surface of our planet is always in motion. Continents move about the Earth like huge ships at sea, floating on pieces of the Earth's outer skin, or crust. New crust is created as melted rock pushes up from inside the planet. Old crust is destroyed as it moves toward the hot rock and melts.

BOB DOUGHTY: In the twentieth century, scientists began to understand that the Earth is a great, living -- and moving -- structure. Some experts say this understanding is one of the most important revolutions in scientific thought.

The knowledge of the Earth's constant motion is based on the work of scientists who study the movement of the continents. This process is called plate tectonics.

Earthquakes and volcanic activity are a result of that process. Plate tectonics is the area of science that explains why the Earth's surface moves, and how those changes cause earthquakes and volcanic activity.

FAITH LAPIDUS: Scientists say the surface of the Earth is cracked like a huge eggshell. They call these pieces tectonic plates. As many as twenty of them cover the Earth. The plates sometimes hit each other, and sometimes move away from each other. Because some continents are above two plates, the continents move when the plates do.

(MUSIC)

BOB DOUGHTY: The movement of tectonic plates can cause earthquakes and volcanoes. Modern instruments show that about ninety percent of all earthquakes happen along a few lines in several places around the Earth. These lines follow underwater mountains, where hot liquid rock flows up from deep inside the Earth. Sometimes, the melted rock comes out with a great burst of pressure. This forces apart pieces of the Earth's surface in a violent earthquake.

Some earthquakes take place at the edges of continents. Pressure increases as two plates move against each other. When this happens, one plate moves past the other, suddenly causing the Earth's surface to split open.

FAITH LAPIDUS: One example of this pressure is found on the west coast of the United States. One part of California is on what is known as the Pacific plate. The other part of the state is on what is known as the North American plate.

Scientists say the Pacific plate is moving toward the northwest, while the North American plate is moving toward the southeast. These two huge plates come together at what is called a fault line. This line between the plates in California is called the San Andreas Fault. It is along or near this fault line that most of California's earthquakes take place, as the two tectonic plates move in different directions.

The city of Los Angeles is about fifty kilometers from the San Andreas Fault. Many smaller fault lines can be found throughout the area around Los Angeles. A

major earthquake in nineteen ninety-four happened along one of these smaller fault lines.

(MUSIC)

BOB DOUGHTY: As we noted earlier, scientists began making major discoveries about plate tectonics in the twentieth century. One of those scientists was Alfred Wegener from Germany. One hundred years ago, he proposed that the continents had moved and were still moving.

Wegener said the idea came to him when he saw that the coasts of South America and Africa fit together like two pieces of a puzzle. He suspected that the two continents might have once been one, and then split apart.

Wegener believed the continents had once been part of a huge area of land that he called Pangaea. He said the huge continent had split more than two hundred million years ago. And, he said the pieces were still floating apart.

FAITH LAPIDUS: Alfred Wegener investigated the idea that continents move. He noted that a line of mountains that appears from east to west in South Africa looks almost exactly the same as a line of mountains in Argentina … on the other side of the Atlantic Ocean. He found fossil remains of the same kind of an early plant in parts of Africa, South America, India, Australia and even Antarctica.

Wegener said the mountains and fossils were evidence that all the land on Earth was united at some time in the distant past.

BOB DOUGHTY: Wegener also noted differences between the continents and the ocean floor. He said the oceans were more than just low places that had filled with water. Even if the water was removed, he said, a person would still see differences between the continents and the ocean floor.

Also, the continents and the ocean floor are not made of the same kind of rock. The continents are made of a granite-like rock. Granite is made when hot, liquid rock cools and hardens under the Earth’s surface. The ocean floor is basalt rock, a mixture of silicon and magnesium. The German scientist said the lighter continental rock floated up through the heavier basalt rock of the ocean floor.

FAITH LAPIDUS: Support for Alfred Wegener’s ideas did not come until the early nineteen-fifties. Two American scientists found that the continents moved as new sea floor was created under the Atlantic Ocean. Harry Hess and Robert Dietz said a thin valley in the Atlantic was a place where the ocean floor splits. They said hot melted material flows up from deep inside the Earth through the split. As the

hot material reaches the ocean floor, it spreads out, cools and hardens. It becomes new ocean floor.

The two Americans proposed that the floor of the Atlantic Ocean is moving away from each side of the split. The movement is very slow -- a few centimeters a year. In time, they said, the moving ocean floor is blocked when it comes up against the edge of a continent. Then it is forced down under the continent, deep into the Earth, where it is melted again.

Harry Hess and Robert Dietz said this spreading does not make the Earth bigger. As new ocean floor is created, an equal amount is destroyed.

BOB DOUGHTY: The two scientists said Alfred Wegener was correct. The continents do move as new material from the center of the Earth rises, hardens and pushes older pieces of the Earth away from each other. The continents are moving all the time, although we cannot feel it.

They called their theory "sea floor spreading." The theory explains that as the sea floor spreads, the tectonic plates are pushed and pulled in different directions.

FAITH LAPIDUS: Diamonds produced deep within the Earth have helped scientists learn when the continents first started moving. A report on the diamonds was published last July in the journal Science.

American and South African researchers studied more than four thousand four hundred diamonds from five continents. The researchers say mineral grains trapped inside the diamonds provided information about the Earth's mantle. They say changes in the chemical structure of the grains suggest that the process called plate tectonics began between three and three point two billion years ago.

(MUSIC)

FAITH LAPIDUS:The idea of plate tectonics explains volcanoes as well as earthquakes. Many of the world's volcanoes are found at the edges of plates, where geologic activity is intense. The large number of volcanoes around the Pacific plate has earned this area the name "Ring of Fire."

Volcanoes are also found in the middle of plates, where there is a well of melted rock. Scientists call these wells "hot spots." A hot spot does not move. However, as the plate moves over it, a line of volcanoes is formed.

The Hawaiian Islands were created in the middle of the Pacific Ocean as the plate moved slowly over a hot spot. This process is continuing, as the plate continues to move.

Volcanoes and earthquakes are among the most frightening events that nature can produce. They cause us to remember that the Earth is not as solid and unchanging as we might like to think.

BOB DOUGHTY: This SCIENCE IN THE NEWS program was written by Christopher Cruise. Our producer was June Simms. I'm Bob Doughty.

FAITH LAPIDUS: And I'm Faith Lapidus. Join us again next week for more news about science in Special English on the Voice of America.