Module 3, Investigation 2: Sea Floor Spreading

Introduction

Welcome!

You have learned about Wegener's theory of continental drift. You also heard that the theory was never accepted. Over time, more and more evidence has been discovered. It became clear that Earth had been very different in the past.

Now you will look at evidence from the sea floor that was not known in Wegener's time. This information has helped scientists understand how the continents could move over long periods of time.

Folder 1: Sea Floor Features

Sea Floor Features

When you look at the satellite imagery in Google Earth, you can see a lot of detail in the sea floor. Look at the Atlantic Ocean between South America and Africa. Do you see smooth plains extending away from the continents? Do you see what looks like a jagged scar running north-south in the middle?

Folder 2: Undersea Volcanoes

Thar She Blows!

You just mapped what is called the mid-ocean ridge system. The mid-ocean ridges are the most extensive mountain ranges on Earth. Most of them are far below the ocean surface. But in a few spots, such as Iceland, they reach the surface. You visited Iceland earlier in this course. What do you remember about the geology of Iceland? You can refer to your field notebook to refresh your memory.

Next, watch the video below showing volcanic eruptions in the deep sea.

[Undersea volcanoes video]

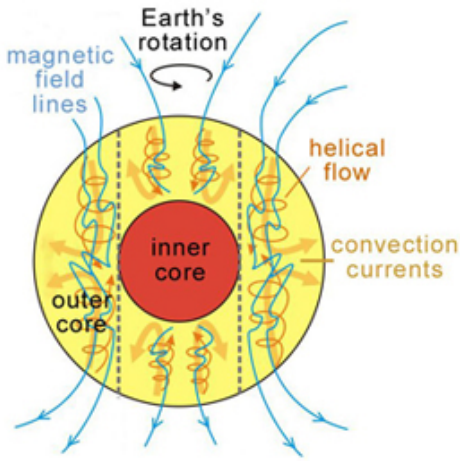
Folder 3: The Hypothesis

The Sea Floor Spreading Hypothesis

Scientists reason that as new rock forms along the mid-ocean ridge, the sea floor will spread and the continents will be pushed apart. If this were really happening, where would the sea floor be youngest? Where would it be oldest? How can we determine the age of the sea floor so that we can test our ideas? The answer has to do with Earth's magnetic field.

If you have ever used a compass, you know that Earth has a magnetic field with a specific polarity. That is why the compass arrow always points toward the magnetic North Pole rather than toward the South Pole.

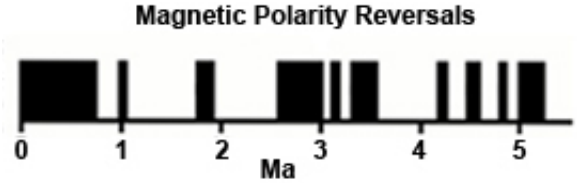
Scientists are still not sure what actually creates Earth's magnetic field. It has something to do with how Earth's solid metallic inner core and rotation around its axis influence the flow of electrically conducting fluid within the outer core. This is called the "dynamo theory".



Earth as a "Geodynamo".

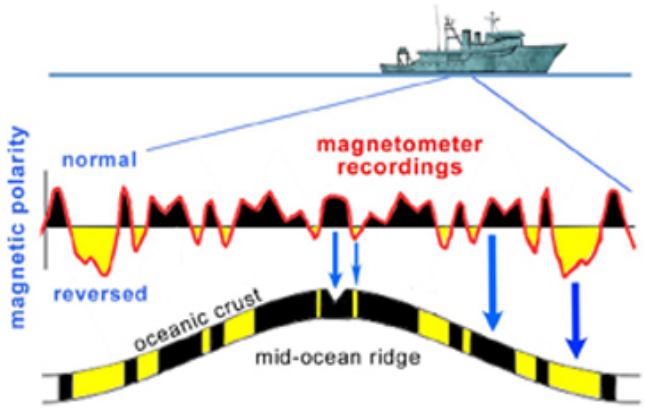
The polarity of Earth's magnetic field is recorded in rocks. This is because when magma cools, the metallic minerals in it act like tiny compass needles and align toward the North Pole._ However, in the 1920?s scientists discovered that in some rocks the minerals point south!_ How could this be?

Scientists later learned that the polarity of Earth's magnetic field sometimes suddenly reverses. They know when in Earth's history these flips have occurred, but they still are not sure why they happen.



Earth's magnetic polarity has reversed many times.

During the 1950's and 1960's research ships used special instruments called "magnetometers" to measure the polarity of rocks making up the sea floor. The data showed continuous stripes of rock with alternating polarity. These magnetic stripes seemed to be mirrored on each side of the mid-ocean ridges.



Stripes of oceanic crust with opposite polarity are mirrored on each side of the mid-ocean ridges.

By knowing when each magnetic reversal occurred, scientists could figure out the age of each section of the sea floor. They could also calculate the rate of sea floor spreading in each ocean.

Summary

Let's Reflect!

You've now learned how scientists can determine the age of the sea floor and that the age pattern shows that the sea floor is expanding. Sea floor spreading can explain why the continents appear to have "drifted" apart over time. But what causes the sea floor spreading?