

A black and white photograph of Marie Tharp, a woman with short dark hair and glasses, resting her chin on her hand.

# Marie Maps the Sea

Young Marie Tharp thought her dad had the best job ever. He traveled around the country, making maps. His maps were special—they revealed hidden things. They showed where different kinds of soil were, and wet and dry places. That helped farmers know what to plant.

He taught Marie to draw maps too. They moved around a lot. Marie changed schools often. But she loved to see the country, and draw, and play her violin.

In college, Marie tried lots of different subjects. Her

father always told her, “When you find your life’s work, make sure it is something you can do, and most important, something you like to do.” She took classes in art, and music, and math, and teaching, and geology. She couldn’t quite make up her mind.

Then one day, her geology teacher pointed to a big map of the earth. Almost three-fourths of it was plain blue ocean. What was under all that water? Was it flat, like a beach? Or were there mountains and valleys, as on land? No one knew. That got Marie’s attention. All that blue blank space—waiting to be mapped.

A good map tells you where you are.

And where the treasure is!



## Exploring with Numbers

Marie became a geologist. She got a job with a group studying the oceans. But Marie wasn't allowed to go to sea. The Navy did not let women on ships. Marie's job was to stay in the office and do math and draw. But that didn't mean she couldn't explore.

Part of Marie's job was to keep track of all the data that the ships sent back. One number she often wrote down was the depth of the water. Ships measured this with sonar—sending out a sound ping and timing the echo. Often they made many measurements each day. In the old days, sailors lowered a weight on a string until it hit bottom, then measured the string.

The office had huge books listing how deep the ocean was along routes where ships sailed. Over the years, many sailors had noticed that the ocean got shallower down the middle of the Atlantic. Were there mountains under the sea?



Marie with some of her maps. She put together the black squiggly lines to make a 3-D view.



Boats measure the depth of the ocean with sonar, sending sound pings and listening for the echo.



It does seem a bit shallow here.

In the old days, sailors measured depth with a weight on a string.







This is the ocean map that Marie and Bruce made. Some areas had not been measured, so they had to guess. Scientists are still discovering new mountains and valleys under the sea.

All those books filled with depth measurements gave Marie an idea. Could she use them to make a new kind of map—of the whole sea floor?

She plotted the numbers on graphs. Each graph made a picture of the depth along a line east to west, like a slice of the sea floor.

She put the slices together to make a 3-D map. Where the soundings showed a deep bottom, that was a valley or canyon. Where it stayed the same for a long way, that meant a flat plain. The numbers revealed underwater mountains. And lots of blank places.

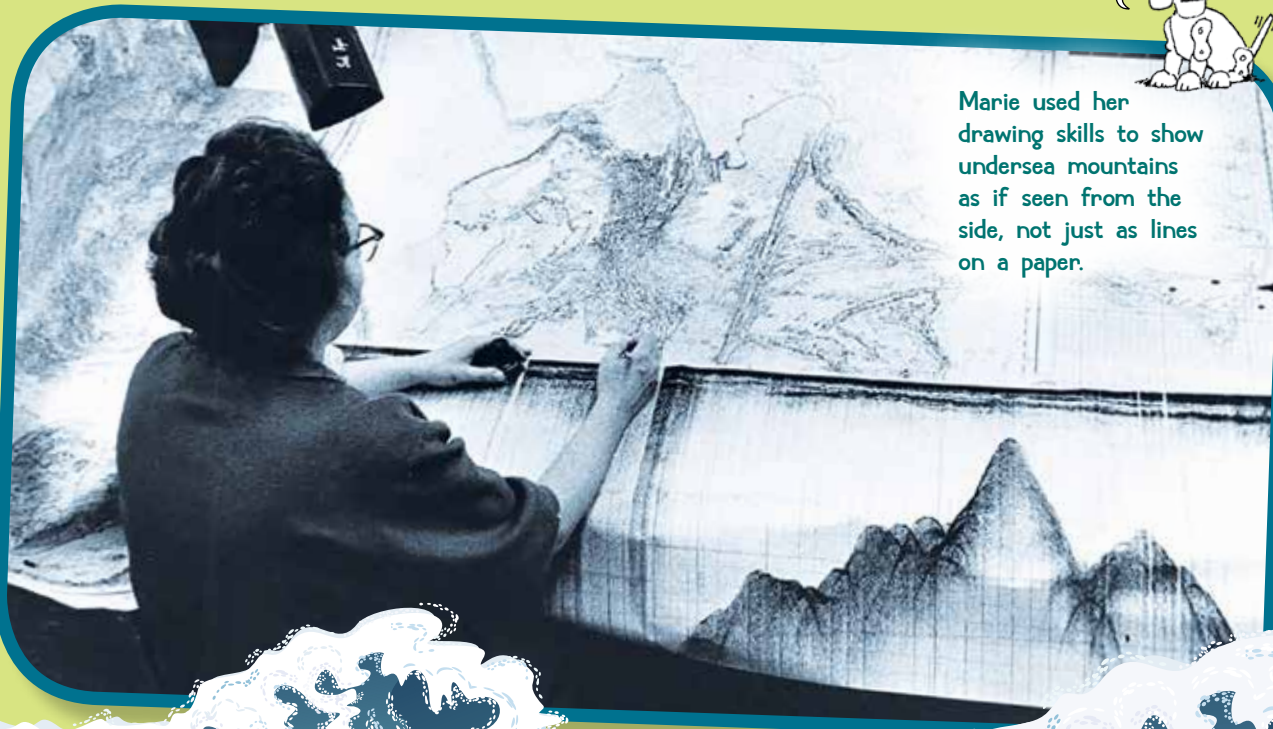
With the help of her fellow geologist Bruce Heezen, Marie set out to fill in the empty places.

Bruce went out on ships and collected data, and together they made the maps. Ocean scientists from other countries shared their measurements. It took many years. But eventually, all those thousands of depth readings fit together to make the very first map of the ocean floor.

Numbers reveal all.



Marie used her drawing skills to show undersea mountains as if seen from the side, not just as lines on a paper.





## Sea Floor Surprise

The new map showed that the bottom of the ocean is not flat at all. It is filled with mountains and valleys, just like the land. There is indeed a long line of mountains down the middle of the Atlantic Ocean. It continued on across the whole globe, like the seam on a baseball.

In the middle of these mountains was another surprise—a long crack or rift, right down the center. That rift helped solve an old puzzle.


In 1915, a German geologist called Alfred Wegener had come up with a truly wild idea. He suggested that the continents move. He said that the reason South America and Africa look like they should fit together is because they once did. The continents had drifted apart.

This idea seemed so preposterous that not many people believed him. After all, how could huge pieces of Earth's crust move? Geologists had been arguing about Wegener's idea ever since.

Scientists continue to add to Marie's maps. This map shows huge deep-sea currents that move warm and cool water around the world. These currents help keep Earth's temperature even.



But Marie's map proved Wegener right. Its undersea mountains traced the edges of big, rocky plates. Where two plates are pulling apart, magma bubbles out of the crack, making underwater mountains. At other edges, plates are crunching together. This makes deep trenches and triggers earthquakes and volcanoes.

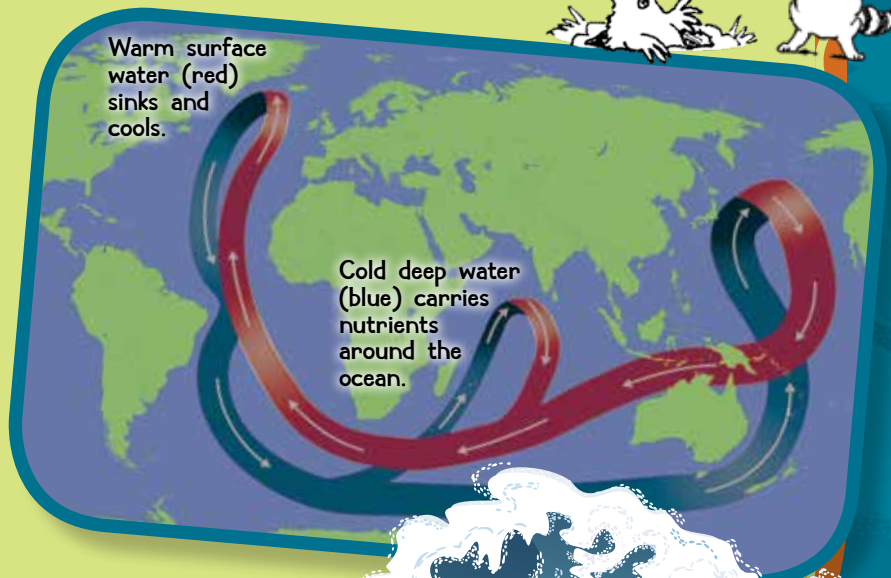
Modern satellites can now actually measure the continents moving—very slowly, a few centimeters a year. And Marie's map showed the way. 

Do continents move? Marie's map said, yes.



I think the Earth is trying to tell us something

Yeah! Never stand still!



Warm surface water (red) sinks and cools.

Cold deep water (blue) carries nutrients around the ocean.

I hope they don't find our secret hideout!

