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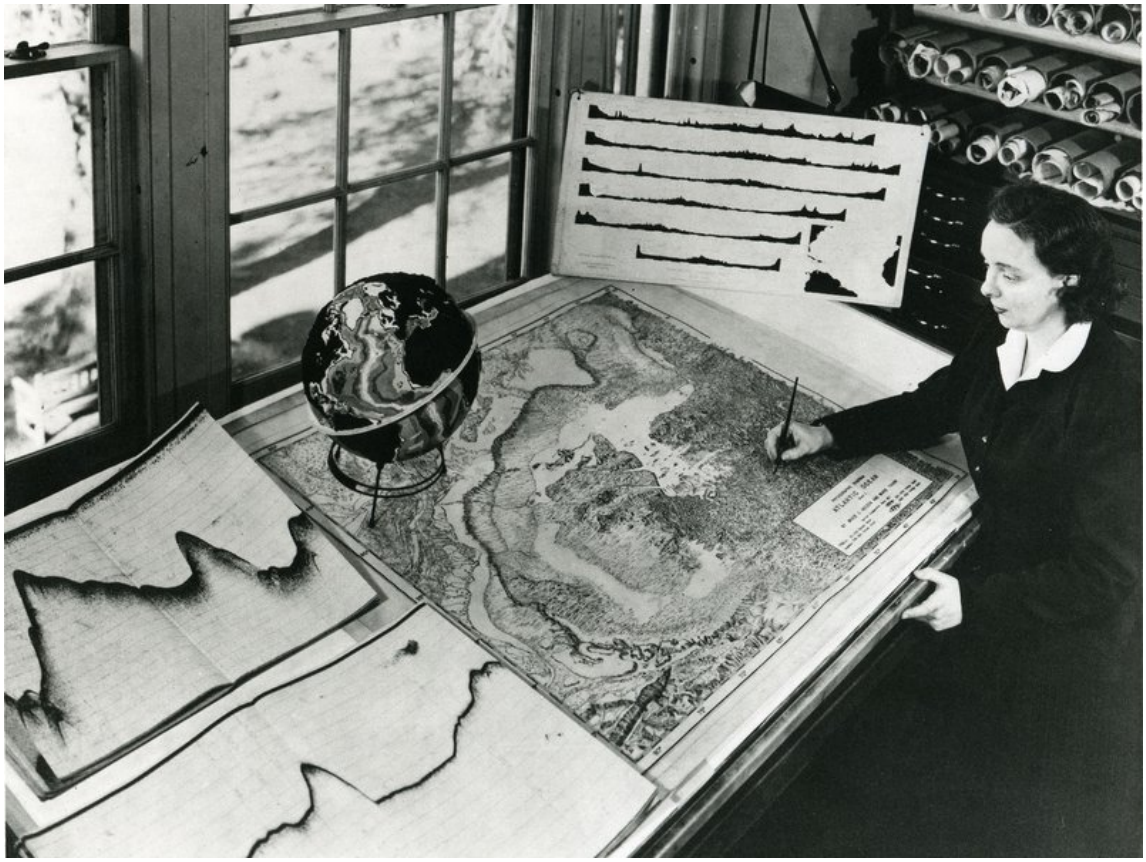
Seeing Is Believing: How Marie Tharp Changed Geology Forever

Marie Tharp's maps helped prove continental drift was real. But her work was initially dismissed as "girl talk"



Marie Tharp's map helped vindicate plate tectonics, but her work was initially dismissed as "girl talk." (Lamont-Doherty Earth Observatory and the estate of Marie Tharp)

By Erin Blakemore
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There's no denying that maps can change the way we think about the world. But what about the way we think about what's underneath? That was the case in 1953, when a young geologist named Marie Tharp made a map that vindicated the controversial theory of plate tectonics. But Tharp's discovery of the 10,000-mile-long Mid-Atlantic Ridge*—a find that showed that the sea floor was spreading—was initially dismissed as "girl talk."

Tharp, who was born in 1920, came of age during a time that was suspicious of women who chose to make science their life's work. In retrospect, it makes plenty of sense that the daughter of a soil surveyor for the U.S. Department of Agriculture would inherit a taste for both geology and cartography. But given the scant number of women in geology at the time—women obtained fewer than 4 percent of all earth sciences doctorates between 1920 and 1970—it's surprising that Tharp was able to pursue her passion.

Like many other women scientists of her day, Tharp found an unexpected opportunity in the form of a world war. During the 1940s, Tharp was able to pursue an accelerated master's degree in geology due to the dearth of young men in the earth sciences department at the University of Michigan.

Tharp knew that geology was a long shot. Women were not recognized by some professional societies and had long been discouraged from working in the field. But field studies are at the core, as it were, of much geology research. Tharp's mentors knew it would be an uphill battle; one encouraged her to work on her drafting

skills to increase her chances of getting any kind of job in the earth sciences after the war ended. At the time, it was good advice—women who refused to perform the deskbound of analyzing and drawing out results collected by men rarely found work in the sciences. Luckily for Tharp, the seemingly low-level drafting skills she honed would later lead to the biggest discovery of her career.

Armed with those skills and another master's degree in mathematics, Tharp began working at Columbia University's Lamont Geological Laboratory after a brief stint in the petroleum industry. Called the Lamont-Doherty Earth Observatory today, the lab was ground zero for cutting-edge earth sciences research.

It was a heady time for the field, in large part because it was so untapped. Meteorologist Alfred Wegener, fueled in part by observations of how South America and Africa had coastlines that looked like they went together and the existence of similar fossils in extremely different parts of the world, had proposed the concept of continental drift back in the nineteen-teens. But his theory was largely dismissed. At the time, there was no way to prove that a massive supercontinent had ever existed, and the idea that continents could move through the ocean floor seemed preposterous.

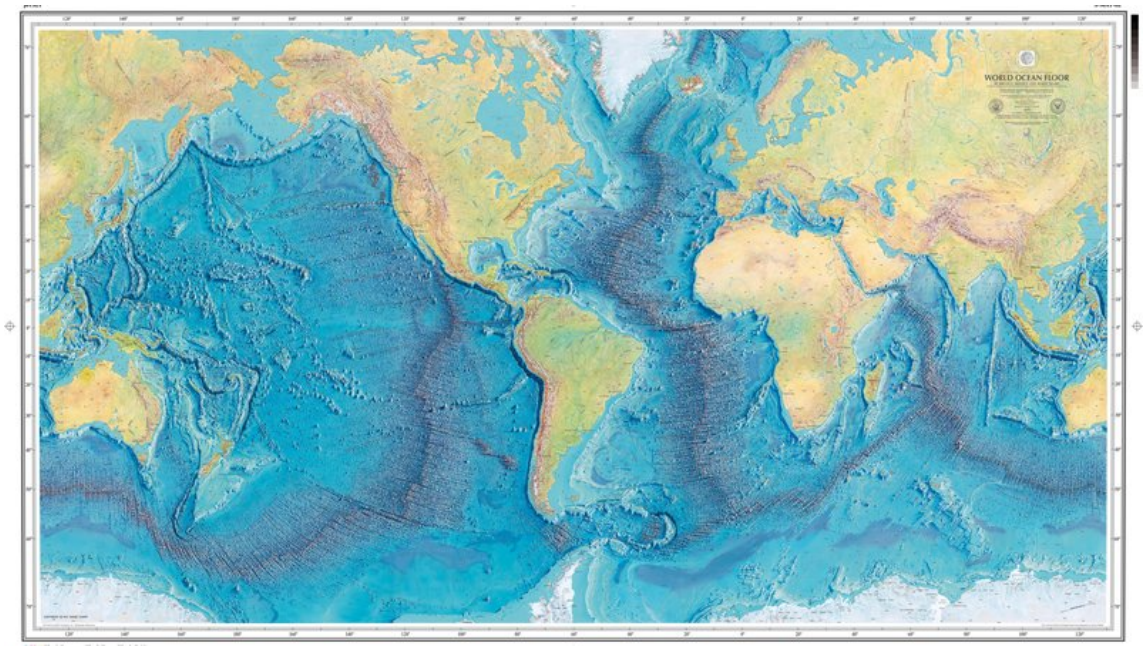
Besides, subsurface geology—the study of rock and soil beneath Earth's surface—didn't really exist yet. Nor did scientists have ways to map the ocean floor, which they assumed was drab and flat.

Lamont lab founder Maurice "Doc" Ewing was unwilling to tolerate that status quo—or to keep geology research trapped inside cluttered offices and museums. He pushed his lab mates toward the ocean, insisting on the use of physics and chemistry to study the phenomena at the bottom of the sea. Sonar had come into its own during the war, further advancing the nascent field.

Navy regulations meant Tharp couldn't go out on the research vessels that Ewing and her other colleagues chartered. Even if she had, they would not have been hospitable places for women (one of the deep sea cameras Ewing took on his journeys was affectionately dubbed "The Pyrex Penis" due to its phallic appearance). Instead, she stuck to her drafting table, collaborating with geologist Bruce Heezen on a map of the ocean floor.

For years, Heezen collected the data while Tharp crunched the numbers and charted them out. It was thankless work in a time before computers; Tharp had to comb through an enormous pile of sonar soundings and plot out her measurements by hand. Still, she found inspiration in the very mystery of the task. "The whole world was spread out before me," she recalled in a 1999 essay about the Lamont-Doherty Earth Observatory. "I had a blank canvas to fill with extraordinary possibilities ... It was a once-in-a-lifetime—a once-in-the-history-of-the-world—opportunity for anyone, but especially for a woman in the 1940s."

Then, something unexpected showed up on Tharp's canvas: a huge valley in the middle of the gigantic ocean ridge she was mapping. It was so deep that she kept re-checking her calculations. If it was what she thought it was, she would have evidence of a rift valley inside a ridge at the bottom of the North Atlantic Ocean. That, in turn, would be evidence that the huge chain of mountains she was mapping was a place where the oceanic crust was spreading apart.



The map created by Tharp and Heezen. (Lamont-Doherty Earth Observatory and the estate of Marie Tharp)

"When I showed what I found to Bruce," she recalled, "he groaned and said 'It cannot be. It looks too much like continental drift.' … Bruce initially dismissed my interpretation of the profiles as 'girl talk'." It took almost a year for Heezen to believe her, despite a growing amount of evidence and her meticulous checking and re-checking of her work. He only changed his mind when evidence of earthquakes beneath the rift valley she had found was discovered—and when it became clear that the rift extended up and down the entire Atlantic. Today, it is considered Earth's largest physical feature.

When Heezen—who published the work and took credit for it—announced his findings in 1956, it was no less than a seismic event in geology. But Tharp, like many other women scientists of her day, was shunted to the background.

"I think she was an extremely humble and modest person who seemed to genuinely not need external validation for her work," Hali Felt, whose book *Soundings: The Story of the Remarkable Woman Who Mapped the Ocean Floor* documents Tharp's thwarted dreams and undeniable achievements, tells Smithsonian.com. "At the same time, she was treated really poorly by Columbia University. Despite her incredible knowledge, she was never paid as well or never had a title or position that was adequate for what she was actually doing. It really was her discovery."

These days, the Mid-Atlantic Ridge Tharp mapped is seen as evidence for seafloor spreading and continental drift—a divergent tectonic plate boundary where magma boils up from inside Earth's mantle and through the crust and is cooled and pushed away. But at the time, her observation—and the complete map of the ocean floor that resulted from her collaboration with Heezen—was nothing short of provocative. "I think maybe a good analogy would be when astronauts first took those photographs of Earth from space," says Felt. "There was proof before that the Earth was a whole, but there wasn't a way to actually see it."

"There's truth to the old cliché that a picture is worth a thousand words and that seeing is believing," recalled Tharp in the 1999 essay. And there's a touch of irony to that observation. Thanks to Tharp's work, what we can't see at the bottom of the sea—and even further beneath Earth's crust—is no longer just a figment of the scientific imagination.

**Editor's Note, August 31, 2016: An earlier version of this article misstated the length of the Mid-Atlantic Ridge.*

About Erin Blakemore

Erin Blakemore is a Boulder, Colorado-based journalist. Her work has appeared in publications like *The Washington Post*, *TIME*, *mental_floss*, *Popular Science* and *JSTOR Daily*. Learn more at .

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