Marie Tharp translated sonar data into a detailed map of the Atlantic Ocean floor.

GEOSCIENCE

Depth charge

Cecily Wolfe welcomes a life of cartographer Marie Tharp, revealing her part in the plate-tectonics revolution.

Generations of geoscientists are familiar with the iconic 1977 World Ocean Floor Map by Bruce Heezen and Marie Tharp: a spectacular image of what the sea floor would look like if the water were drained away. Yet the eccentric Tharp, who converted sonar data into maps, remained in the background for decades. Only since the 1990s has she begun to receive due credit for her pioneering work.

Soundings, by Hali Felt, tells the story of this figure whose accomplishments are all the more remarkable because her career began in the 1940s, when women were relegated to supporting roles.

The author takes the view that understanding Tharp as a woman is integral to understanding her as a scientist. Felt, who teaches writing at the University of Pittsburgh in Pennsylvania, interweaves her own story of creating the book into the narrative, which diverts attention from the main subject, and renders some events in a quasi-fictional style. Yet she captures well Tharp's quirky and determined personality. We learn, for example, how she refashioned and wore the clothes of her deceased loved ones: her father, brother and Heezen.

Tharp had a nomadic childhood as the daughter of a soil surveyor. After earning a master's degree in geology, she worked

at an oil company and obtained another degree in mathematics. She moved to New York in 1948, where she sought out Maurice 'Doc' Ewing — the formidable oceanographer who founded Columbia University's Lamont Geological Observatory — and secured an assistant's job in his group.

In 1952, after she rebelled against her role as a "frazzled factotum" at Lamont, Tharp was moved to Heezen's exclusive supervision. She worked with profiles of sea-floor topography. Splicing together data to form just six transoceanic ship tracks, Tharp had before her a big-picture view of the Atlantic sea floor. She noticed a consistent deep notch near the ridge crest, which she asserted was a rift valley on the ocean floor.

Heezen initially dismissed her discovery, saying it looked "too much like continental drift" — a controversial 1915 theory by Alfred Wegener. However, Heezen and Tharp subsequently found that the location

**Soundings:
The Story of the
Remarkable
Woman Who
Mapped the Ocean
Floor**

HALI FELT
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of earthquake epicentres correlated with the rift position, helping them to extrapolate how a continuous rift system encircled the globe. In 1960, Heezen incorrectly attributed the rift to an expanding Earth.

After a 1957 lecture on the continuous rift valley, given by Heezen at Princeton University in New Jersey, Harry Hess, who later became a founder of plate tectonics, said, "You have shaken the foundations of geology." It was not until 1959 that Tharp received credit for her contribution, when she was a co-author on *The Floors of the Oceans* (Geological Society of America), which included their physiographic diagram of the North Atlantic. Marie's rift was crucial to Hess's landmark 1962 paper introducing the concept of sea-floor spreading, which sparked the plate-tectonics revolution.

Tharp and Heezen went on to map all of the world's oceans, and their work reached millions through panoramas of ocean-floor topography created with the painter Heinrich Berann. Yet Tharp eventually became a pawn in Ewing's attack against Heezen, during a period, beginning in 1965, termed "The Harassment", when she set up what became a permanent home office. One issue of contention was funding Tharp's travel to a discussion meeting at the International Geological Conference to present their Indian Ocean map, because this did not conform to the idea of a typical 'significant' presentation. But although Tharp did not give scientific presentations or frequently go on research cruises, as Heezen could, she was key to organizing and interpreting data into a meaningful form.

The book presents glimmers of Heezen and Tharp's relationship; his will left half the estate to her. They were an unconventional couple, but to what extent remains a mystery. Heezen died in 1977 on a submarine at the Reykjanes Ridge while Tharp was also at sea studying the ridge from a ship. She preserved their legacy, publishing articles about their work and establishing archives at the Smithsonian Institution and the Library of Congress. Yet without Heezen, Tharp lacked the scientific clout to maintain funding for her mapping, and Lamont eventually pushed her into early retirement. Some two decades later, the observatory honoured her with an award.

Sadly, *Soundings* lacks illustrations, so the reader can see none of Tharp's work. It also gives short shrift to some of the scientific history. But it provides a memorable account of the golden years of oceanography during the 1940s to 1960s: a thrilling time when so much was being discovered. And it celebrates the extraordinary life of Tharp as a woman and a scientist. ■

Cecily Wolfe is a Professor in the School of Ocean and Earth Science and Technology at the University of Hawaii at Manoa.
e-mail: cecily@soest.hawaii.edu