

GEOGRAPHICAL REVIEWS


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SOUNDINGS: The Story of the Remarkable Woman Who Mapped the Ocean Floor. By HALI FELT. 340 pp.: maps, ills., notes, index. New York: Henry Holt and Company, 2012. \$30.00 (cloth), ISBN 9780805092158.

In the early 20th century, the German polar meteorologist Alfred Wegener used fossil and glacial deposits to postulate the prior existence of a large super-continent (Pangea), which then proceeded to split into pieces over geological time. His theory of continental drift was extremely controversial and rejected by most geologists, primarily because he was not able to provide a physical mechanism for his theory; he could not explain what was happening beneath the Earth's surface to cause these huge land masses to move about. That mechanism was found in the latter half of the century, ironically in the oceans. By this time, the technology behind SONAR, marine gravity and marine magnetics had advanced to the point that the complexities of the ocean floor and beneath could be unraveled in unprecedented detail. And it took a young woman with a background and training unusual for the time in both geology and mathematics, coupled with art, to have the courage of her convictions and her intellect to posit one of the most fundamental proofs of continental drift: a rift valley caused by the faulting of seafloor spreading. But because she was a woman, her contributions were belittled or outright ignored.

The biographies of Rosalind Franklin and Mileva Maric Einstein may come to mind. Franklin was the chemist whose research was instrumental in Watson and Crick's discovery of the structure of DNA, but she was largely unheralded and forgotten. Einstein was little more than a footnote in her husband's biographical story until a 1987 release of his private letters revealed that she was a brilliant and ambitious physicist in her own right. *Soundings*, by Hali Felt, is yet another account of an amazing female scientist, initially not allowed to function as a scientist, and then once finally allowed to do so, was not given proper recognition for her accomplishments until decades later. The account is extremely well written, well researched, and thus compelling, engaging, celebratory, and, most importantly, instructive.

Interestingly enough, at the beginning of the book Felt interweaves her own story alongside the narrative of Tharp's. This could have been quite distracting, but for this reviewer lent a level of personalism and authenticity that was attractive, drawing me even further into the Tharp narrative. Indeed, it is remarkable that Felt had never met Tharp, and did not start her work on this book in earnest until after Tharp's death in 2006. Tharp had no immediate family left when she passed, only her faithful research assistants, affectionately

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1 dubbed “Tharpophiles.” Yet Felt recreated scenes from her life as if there as a
2 witness, often describing in great and intimate detail what Tharp might have
3 been thinking at many critical junctures. I normally do not pay much attention
4 to the notes section of a book. But this is a work where I would highly recom-
5 mend a close study of the notes available for each chapter. It is within these
6 pages that Felt very carefully documents her sources, including how and why
7 she felt justified in “interpolating” Tharp’s life and thoughts. As a seagoing
8 mapper of the ocean floor who started working professionally just as Tharp
9 was finally being recognized for her great scientific accomplishments, the pages
10 of *Soundings* rang very true for this reviewer.

11 Part one consists of seven chapters chronicling Tharp’s early years, noting
12 that “on one level, for most of the first twenty years of her life, Marie did not
13 publicly display much interest in science. But on another level, it seems that
14 she was, throughout her childhood and adolescence, quietly gathering bits of
15 scientific knowledge like gossip, trying to deduce whether her private crush
16 might be worthy of pursuit (p. 27).” Inspired by many treks into the field with
17 her father, who was a professional soil surveyor for the government, and nour-
18 ished by very close relationships with both parents, Tharp went on from Ohio
19 University to an accelerated master degree program at the University of Michi-
20 gan (encouragingly open to women at the time with, so many men off to war
21 in the early 1940s). Those who could complete the degree, male or female, were
22 guaranteed a job in the petroleum industry. Tharp followed suit, gaining a
23 position as a geology assistant with Stanolind Oil in Oklahoma, while simulta-
24 neously earning a second bachelor degree in mathematics at the University of
25 Tulsa. Dissatisfaction with her life and station in Oklahoma caused her to
26 move to New York in search of a true research position at Columbia Univer-
27 sity, where she secured a post in the lab of the iconic Maurice “Doc” Ewing,
28 founder of the Lamont Geological Observatory.

29 Part two extends through chapter thirteen, covering Tharp’s original days
30 as a drafter for Doc Ewing to her pairing with Bruce Heezen, the most impor-
31 tant association of her professional and personal life, and how the two of them
32 began the first systematic, comprehensive attempt to map the entire ocean
33 floor. Heezen collected the data at sea, which he brought back for Tharp to
34 map. Tharp developed a truly unique process for translating millions of ocean-
35 sounding records into a single drawing. During this process she discovered the
36 rift valley of the Mid-Atlantic Ridge, which Heezen at first discounted, holding
37 incorrectly to his expanding Earth theory. In the early 1950s, it was the overlay
38 and correlations with earthquake data via a light-table-enabled process—herald-
39 ing the world of GIS that was to come—that finally persuaded Heezen to
40 believe in the rift valley. Tharp’s name was absent from the 1956 scientific paper
41 that released this discovery to the world. However, her name was allowed to
42 appear on the landmark 1959 Geological Society of America special paper, *The*
43 *Floors of the Oceans: 1. The North Atlantic*. And in 1961, M. N. Hill, writing for
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1 *The Geographical Review*, “recognized it as a ‘brilliant compilation of much of
2 the information from the North Atlantic’ and said that the authors ‘presented
3 a farsighted interpretation of its meaning (p. 124).”

4 Chapters fourteen to twenty-four of part three detail the expansion of
5 Tharp’s work with Heezen to the Atlantic and Indian oceans. While their pro-
6 fessional collaboration became closer, more fine tuned, and inclusive of oppor-
7 tunities for Tharp to travel abroad with Heezen to scientific meetings, a
8 dangerous professional rift between Heezen and Ewing began to fester in 1965.
9 “The Harassment,” as Heezen and Tharp dubbed it, was a most unfortunate
10 and regrettable circumstance, lasting far too long, and resulting in the eventual
11 dismissal of Tharp from Lamont in 1968. However, Heezen immediately
12 secured funding for her via the Naval Oceanographic Office. It was during this
13 year that she finally had the opportunity to go to sea, and to perform the first
14 ever shipboard processing and plotting of bathymetric data. During this time,
15 Tharp and Heezen also formed a successful partnership with Austrian land-
16 scape painter Heinrich Berann to produce several panoramas of the ocean
17 floors, leading to the now famous World Ocean Panorama of 1977.

18 Part four (chapters twenty-five to twenty-seven) describes the circumstances
19 surrounding the untimely death of Heezen in 1977 while in a submersible on
20 the deep floor of the Atlantic, with Tharp directly above aboard a research ves-
21 sel. This was just months after the printers had sent the final proofs of their
22 World Ocean Panorama. Part five (chapter twenty-eight to the final chapter
23 thirty-three) chronicles the untiring efforts of Tharp to continue their work
24 and preserve Heezen’s legacy, as well as her own. Tharp was a great storyteller
25 with her words, data, and of course with her maps. So the book ends appropri-
26 ately with the “story” of the development of the Heezen-Tharp collection in
27 the Library of Congress.

28 In addition to Tharp’s personal story, *Soundings* provides such a good over-
29 view of the 20th-century history of oceanography that I would recommend it
30 as required reading for all oceanography students, particularly those in marine
31 geology. There are very important insights to be had for students of cartogra-
32 phy as well. As her first, long-time employer, Doc Ewing, invented the field of
33 marine geophysics, Tharp invented the field of marine cartography. However,
34 unlike marine geophysics, marine cartography is not formally taught as part of
35 either an oceanography or geography degree. In fact, the UNESCO Interna-
36 tional Oceanographic Data Exchange (IODE) rightly points out that there isn’t
37 even a formal, accredited academic degree or curricula in oceanographic data
38 management. Hopefully these circumstances will quickly change given the ubiq-
39 uity of mapping technologies and data, the emergence of neocartography and
40 crowdsourcing, and the need for cartographers of both land and ocean to inte-
41 grate sound theory and intuitive design with ever-evolving technology.
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