Physics and Chemistry of the Earth 35 (2010) 881–886

Contents lists available at ScienceDirect

Physics and Chemistry of the Earth

journal homepage: www.elsevier.com/locate/pce

Marie Tharp: The lady who showed us the ocean floors

Gary W. North *

North Arrow, Ltd., US Geological Survey 43685, Augusta National Terrace, Leesburg, VA 20176-3979, United States

ARTICLE INFO

Article history:
Received 11 January 2010
Received in revised form 24 May 2010
Accepted 31 May 2010
Available online 8 June 2010

Keywords:
Ocean floors
Marie Tharp
Bruce Heezen
William E. Tharp
Heinrich Berann
Mapping

ABSTRACT

Marie Tharp and Bruce Heezen of the Lamont-Doherty Earth Observatory of Columbia University are best known for creating the first maps of the ocean floors. Bruce sailed the oceans collecting the data and overseeing the projects, but the person who turned the precision depth recordings and other geoscience data into the two-dimensional views of the bottoms was Marie. Meticulously, she sketched the features that comprise the ocean floors, aligned the data according to the orientations of the fracture zones, and identified volcanoes, earthquake epicenters, faults and sea mounts. Marie's discovery of a deep valley centered along the axis of the Mid-Atlantic Ridge and her linkage of the major crustal plates for over 64,000 km (40,000 miles) around the Earth, showed us, and thus confirmed, the concept of plate tectonics and crustal movement. How Marie came to her place in history, what she was like, and how her life unfolded are the subjects of this paper.

1. Introduction

In the Earth sciences there has always been a historical connection between soils and geology. In Marie Tharp's case, the unique connection is that of father and daughter. Her father, William E. Tharp, was a soil surveyor and Marie was a geologist. Throughout her youth, she traveled with "Papa Tharp", as she called him, from the northern states in the summer to the southern states in the winter, as he made Soils maps for the Bureau of soils of the US. Department of Agriculture (see paper by Landa, *this volume*, focused on W.E. Tharp).

In 1995, Ralph Eherenberg and James Flatness of the Geography and Map Division of the (US) Library of Congress were contacted by Marie Tharp of Nyack, New York. Marie was looking for a home for the cartographic materials that she and her working partner, Dr. Bruce C. Heezen, had developed as part of their 30 years effort to map the ocean floors. The two of them had worked at the Lamont-Doherty Earth Observatory of Columbia University and had produced the first maps of the world's ocean floors. Dr. Heezen died in 1977 and Marie had, in her possession, thousands of items resulting from their work. Thanks to Ralph, Jim, and later Ron Grim, Steve Cuculo, and the current chief of the division, John Hébert, those materials now reside with the Geography and Map Division for use by students, scholars, and the general public.

In 1995, I retired from the US Geological Survey and formed North Arrow, Ltd. a spatial data consulting company. On a visit to the library, I met with Ralph Ehrenberg and he showed me boxes and tubes of Tharp materials that were in need of being organized and indexed. Having spent my career in the Earth sciences and retiring as Assistant Chief of the National Mapping Division, I submitted a successful proposal to the library to unpack and organize the materials. To assist me, I hired Robert G. Rhodes, a geographer and retired Army Colonel. It was estimated that there were 5000–7000 items, and that the effort would take about a year to complete. The initial number of items turned out to be over 40,000; and new items acquired before and after Marie's death continue to flow in. Working with Marie for 9 years, and then serving as an executor of her estate for three more years, has provided me with an insight into her life and work that few biographers get to have.

2. Marie Tharp

Who was Marie Tharp? During my research I came across a quote, generally attributed to Ralph Waldo Emerson, which states: "Do not follow where the path may lead, go, instead, where there is no path and leave a trail."[1] That describes Marie and the trail that she left changed the way we view a significant part of our planet (Fig. 1).

To most people, Marie appeared to be a shy and quiet person, although colleagues speak about her temper, her swearing and her arguments with Bruce. They tell of ink bottles and erasers

* Tel.: +1 703 669 5840.
E-mail address: northarrow@aol.com

[1] The framed copy of this quote from Marie's home was distributed in 1973 by Continental Publications.

1474-7065/$ - see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.pce.2010.05.007

Fig. 1. Marie Tharp, taken in April 2000 (from the author's collection).

being thrown around the room, and maps being torn up. I first met her in 1997. I was asking her why a certain set of data look different from other similar information and she said: "It was just bad data from the profiler." I asked what was wrong with the profiler and she replied: "The f...ing thing just would not work." That from a 77-year old lady who wore long dresses and field boots. She always suffered foot problems, and from the time she first started working at Columbia, she went to Macy's where they took casts of her feet and made custom field boots. The long dresses covered them up to some degree, but everyone noticed them. After working with her for a few years, we got her to try on some Nike's; she made the switch to modern footwear and was deeply thankful for her increased ability to move around.

Born in 1920, Marie grew up when there were few women in the sciences, and due to her upbringing and nature, she always gave Dr. Heezen all the credit for their work. She always sold herself short, and said she could not write or speak. When she answered the phone she often sounded quiet, lost and lonely until I would say: "Get your bathing suit and flippers on, we're going water skiing on the Hudson today." She would laugh and perk up immediately.

In the fall of 1997, the Library of Congress honored her as one of the four outstanding cartographers of the 20th century. During the preparation for a taped interview, I asked her who she was. She replied, "I am an American. We moved so often during my early years that I have no alliances. Even so, there were special places like the Piney Woods down south, the big dam at Muscle Shoals, Serpent Mound, the likes of which I had never seen before or since. There were also weekends of sightseeing in the winter season in Washington, D.C. every 4 years which happily, for me, coincided with the inaugural parades of Coolidge and Hoover." She went on by saying: "And on the eastern coast, the fabulous fall colors which are draped over the hills like a heavenly tapestry are fairly unique as the land gets flatter and the trees fewer as one approaches the midwest, wheat fields, and grazing lands up to the Rockies. But then, as I say, every place had something special and yet we belonged nowhere."[2] This, I believe, is a fitting example of her feel for the land and of how her nomadic childhood helped to shape her life.

3. Background and education

Marie Tharp was born in Yipsilanti, Michigan in 1920. Her mother, Bertha Newton (1880–1936), was a German and Latin teacher, and her father, William Edgar Tharp (1870–1959) became a soil surveyor in 1905. Marie went to schools in Alabama, the District of Columbia, Indiana, Iowa, Michigan, Mississippi, Louisiana, New York, and Ohio. She attended Ohio University in 1938 where she majored in english. She said she did not know what she wanted to do, and that there were only three things a girl could do. You could become a teacher, but her mother had already done that. You could become a secretary, but she thought that would be boring. Or you could become a nurse, but the sight of blood made her sick. So it was english, although she did take art and music as well as a couple of geology courses which she really enjoyed.

In December of her senior year, she was walking by a bulletin board and saw a notice that the University of Michigan was offering a masters degree in geology for women only. Not only did you get a degree but you were guaranteed a job in the oil business. She headed to the registrar's office and they discovered that, because of her summer school courses, she had enough credits to graduate. So in January 1943 she graduated and headed to Ann Arbor to become a member of what became known as "The Petroleum Girls." It was war time and geologists were badly needed, as most men were being drafted into the Army. After 2 years at Michigan, which included half a year in field camp in Jackson Hole, Wyoming, she got her Master of Arts degree in geology. After graduation, she headed to Tulsa, Oklahoma with the Stanolind Oil and Gas Company. They were not sure what to do with a woman because she certainly could not go to the field with the men, so they put her to work in the office. She transferred data from well logs and did some drafting, but she was bored. To fill her time, she enrolled in night school at the University of Tulsa, and received a bachelor of science degree in mathematics in 1948.

Ms. Tharp next appears at Columbia University in New York looking for a job. For many years I asked her why she came to Columbia? She would pause and quietly tell me that Columbia was the center of geologic research and she came because of its reputation. One day I was working with some of her early map sheets and I came across one that had been signed, in her handwriting, as Marie Flanagan. I called her and asked, "Who was Marie Flanagan?" There was silence and she asked: "Oh Gary, how did you find out?"[2]. I told her about the map, and she later erased the name during a visit to the Library of Congress. While at Ohio University, she had fallen in love with a violinist named David Flanagan and returned to Ohio from Tulsa to marry him in 1946. He had been drafted when they were in college, was released on a medical discharge, and later was accepted for course work at the Julliard School of Music in New York. He had suffered battle fatigue and a nervous breakdown, and even though they were married, they spent little time living together. He had an apartment in New York near Julliard, and that is how Marie came to Columbia. She said she was ashamed of this period in her life, and always wanted to keep it quiet. To a friend, she said the marriage had been annulled, but divorce papers were found in her safety deposit box following her death.

On the day she showed up at Columbia, she was directed to Dr. Maurice Ewing, the head of the geology department; but since he was at sea, she had to wait a couple of weeks for an interview. When she finally met him, his first question was: "Can you draft?" She drew a perspective view of a profiling instrument and that drawing is part of the library's collection. Her first assignment was to operate a Monroe calculator for Frank Press who was a Ph.D. graduate student. Dr. Press completed his degree at Columbia in 1949, and after taking a faculty position at the California Institute of Technology, later became President Carter's Science Advisor (1977–1980) and the president of the National Academy of Sciences (1981–1993). During Marie's first year at Columbia she met a graduate student named Bruce C. Heezen, who would become her life-long working partner.

[2] These quotes came from conversations, notes, letters, papers, video tapes, tape transcriptions and personal recollections all of which are unpublished. They came from working with Marie for 9 years and serving as an executor of her estate for 3 years. Most of these quotes and/or references are from documents that are part of the Heezen–Tharp Collection at the library of congress. Currently, they have not been indexed or catalogued.