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BOOK REVIEW

North Pole, South Pole: The Epic Quest to Solve the Great Mystery of Earth's Magnetism, by Gillian Turner. The Experiment, LLC, New York, NY, USA, 2011. 272 pp. ISBN 978-1-61519-031-7.

Gillian Turner's first book, *North Pole, South Pole: The Epic Quest to Solve the Great Mystery of Earth's Magnetism*, provides a thorough, historical accounting of scientific discovery of the earth's magnetism, magnetic field, and its resulting effects. Turner is a senior lecturer in physics and geophysics at Victoria University in Wellington, New Zealand, and her writing possesses the voice of both a teacher and storyteller. She meticulously traces the history of our scientific understanding of magnetism, the scientists who were intrigued by the phenomena, and the innumerable research efforts to solve the puzzle of earth's magnetism and its effects on the planet's geology. As she states in the introduction, "for millennia, magnetism has commanded a magical sort of curiosity" (p. 4).

Turner carefully leads the reader through 2500 years of scientific discovery. She starts with the ancient Greeks' early observations of the magnetic properties of lodestones and the earliest recorded development and use of the compass by the Chinese in the first century AD. The story ends with the breakthroughs of modern-day physicists and mathematicians modeling the geodynamo and the earth's polarity reversals. Turner takes great pains to set the historical stage for each chapter of the book, the milieu of the times, places, and key players, as generations of scientists undertake investigations to decipher the phenomenon of magnetism. As a means of transitioning from chapter to chapter, Turner iteratively reveals the gaps in research at a particular point in history and then follows the unknown by tracing new developments through time by emerging scientists.

The beginning of the story is dominated by an earth science focus, but Turner engages the reader more deeply in the key physical science concepts of magnetism and electricity as she explores issues such as development of the compass, measurement of magnetic declination, batteries, and electromagnets. Scattered throughout the text, the author introduces interesting humanistic information. These engaging insights into the personal and professional lives of the scientists repeatedly reveal the arduous work, frustrations, and successes involved in doing science. As the story progresses, Turner describes the discovery of the earth's core through the measurement earthquakes, the apparent wandering of the north pole, and the furious race to map the ocean floor and its magnetic anomalies. The magnetic anomalies supported the concept of geomagnetic polarity reversals concurrent with new crust formation at the spreading ridge capturing the orientation of the earth's magnetism in the rock. The discovery of alternating, invisible bands of normal and reversed polarities on both sides of oceanic divergent boundaries was key evidence for plate tectonics.

The historical accounting of the scientific investigations into the earth's magnetism does not include much, if any, real diversity in its characters. The nearly complete ab-

sence of women scientists and non-Western European perspectives in this story was perhaps predictable, but disappointing nonetheless. Only one woman scientist was mentioned, Inge Lehmann, a Danish seismologist, who in 1929 proposed that the earth has an additional, inner core. I was surprised not to read about Marie Tharp, whose work with Bruce Heezen was instrumental in mapping the ocean floor. Tharp, after convincing Heezen, proposed that the Mid-Atlantic Ridge and its strong association with seismic activity was evidence of continental drift, which was later identified as sea floor spreading, a key process in modern plate tectonic theory. This effort, in conjunction with magnetic anomalies, was the proverbial smoking gun that finally convinced the scientific community of the validity of the radical new theory. As the theory of evolution is to biology, the theory of plate tectonics is the unifying theory of geology, and it revolutionized the field by explaining the earth's internal forces. Until the final part of the book, there is an absence of non-Western European scientists other than a brief mention of the ancient Chinese compass. Overall, this portrayal of science reinforces old stereotype that science is the purview of Western culture and male dominated. It is regrettable that in her final analysis of the history of geomagnetism, Turner did not go further to emphasize the lack of diversity in these domains of science, and consequently, she misses an opportunity to appeal to a wider audience.

This book will be of interest to history of science buffs, science teachers, and faculty at secondary and tertiary levels as a resource for improving their own understanding of the history of magnetism and its ancillary effects. The plentiful illustrations that accompany the text are invaluable, providing visual relief and clarity to the dense scientific language and concepts. The language is straightforward, and the text is well written, but there is a high level of academic language. For example, some of the more complex scientific concepts, such as electricity, and the frequent interaction of multiple concepts may present difficulty to those without a strong background in the physical and earth and space sciences. However, with that said, excerpts could be provided by teachers and supported with inquiry-based instruction, for students to learn about geomagnetism as well as an exemplar of the nature of science. In fact, Turner has included, as supportive resources, a listing of the main scientists featured in the account, an extensive glossary, and a bibliography of selected references for further reading on the topic.

North Pole, South Pole: The Epic Quest to Solve the Great Mystery of Earth's Magnetism offers a compelling look into the science of earth's magnetism as well as the people who have contributed to this pursuit. Turner reminds us through her narrative that there is always more to be learned about the world around us, and that the puzzle of the earth's magnetic field is no less intriguing than our quest to refine our knowledge of human genetics or to unravel the complexities of the universe.

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