

BOOK REVIEW

Structural Geology



Haakon Fossen

Cambridge University Press; 2010; 480 pp.; ISBN 978-0-521-51664-8; \$70.

Structural geology and continental tectonics were ushered in to the modern quantitative age of geosciences with the arrival of the global plate tectonics paradigm (circa 1968), derived using new data from the oceans' depths, and John Ramsay's 1967 seminal work, *Folding and Fracturing of Rocks*. Fossen is to be applauded for crafting a unique, high-caliber, and accessible undergraduate textbook on structural geology that faithfully reflects this advance and the subsequent evolution of the discipline. This well-written text draws on Fossen's wealth of professional experience, including his broad and diverse academic research and experience in the petroleum industry. This book is beautifully illustrated, with excellent original color diagrams and with impressive color field photographs that are all keyed to locations and placed into geologic context.

In addition to being a great textbook option for undergraduates, this book will serve as an excellent refresher for professional geologists. Fossen's extensive use of citations throughout the text, in figure captions, and at the end of each chapter provides an excellent window into many of the most important papers in the primary literature of both modern and

classical structural geology. Readers will also find Fossen's references to free and commercial structural geology software and other resources helpful.

In addition to the modern approach to structural geology and tectonics that the book reflects, it has several other important strengths. First, it deliberately balances painstakingly accurate detail with "big picture" ideas and broad thinking. Students and instructors who use this book will also benefit from the balance it provides among observational, theoretical, and numerical and analogue modeling perspectives. Second, the book nicely balances the traditional academic approach to structural geology with important industry applications (e.g., chapter 19, Salt Tectonics; chapter 8, Faults; and many additional interpreted seismic sections) that tend to receive only cursory treatment in other structural geology textbooks. A third strength is its clear and rigorous yet accessible physics and math coverage of strain and stress theory (e.g., chapters 2–6 and Appendix A); the strain analysis spreadsheets and other ancillary material such as textbook figures, problem sets, and field photographs available on the

textbook Web site (<http://www.cambridge.org/features/fossen/>) should also prove to be great learning and problem-solving tools.

The book provides thorough and insightful coverage of the tectonic context of the contractional (chapter 16), extensional (chapter 17), and strike-slip (chapter 18) regional structural assemblages in which geologists often work. To complete the picture, the strike-slip chapter nicely covers transtension and transpression, subjects of significant focus in Fossen's own research.

The few minor weaknesses of this book need to be mentioned. The order in which the chapters are laid out, if strictly followed, might prove difficult for some undergraduates; the book provides a heavy dose of theoretical material prior to offering concrete, real-world examples and applications. However, the flexible style of the text easily allows the order of chapters to be arranged to meet the needs of instructors and students. A few of the equations (e.g., 7.12 and 7.13) contain minor typos; however, these should easily be cleaned up in the second edition, and many are already noted on the author's personal Web site (<http://folk.uib.no/nglhf/StructuralGeoBook.html>).

The book also lacks some richness in the chapter on deformation mechanisms (chapter 10), in its coverage of strain significance of cleavage and foliation (in chapter 12), and in "old-fashioned" descriptive structural geology (chapters 7, 8, and 11–15). A separate chapter or an appendix on geologic maps and structural cross-section construction would also have been a useful addition. Practical material on field-based techniques is typically included in a structural

geology course, and such an addition would have benefited students who use structure textbooks as reference books at field camp and while pursuing their own field studies. More extensive coverage of the analysis of active structures (e.g., treatment of modern geodetic and geomorphic records of deformation), and some mention of meteorite impact structures and early-Earth structural assemblages (e.g., Archean greenstone belts), would have provided a more complete "whole Earth" picture of deformation. These are all, however, minor shortcomings. This is an excellent book that will surely benefit many students, instructors, and professionals.

This book will likely get a lot of use; it is well written and priced right. The many long-term users it will surely have would have benefited if the publisher had used a stronger, sturdier binding. After only several uses, pages in our examination copies began to fall out. However, the author indicated in a recent correspondence that this problem has been resolved.

In summary, this is an excellent, accessible introductory structural geology text that is admirably well illustrated and well written. It should prove to be a valuable resource for students and instructors alike.

This review benefited from discussions we had with several colleagues who looked this book over carefully while considering it for use in their classes and who generously shared their impressions and comments.

—JOHN WEBER, Grand Valley State University, Allendale, Mich.; E-mail: weberj@gvsu.edu; and
KURT L. FRANKEL, Georgia Institute of Technology, Atlanta