

# The Geology Companion

Essentials for  
Understanding the Earth



Gary Prost and Benjamin Prost



CRC Press  
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# The Geology Companion

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—*Keenan Lee, Colorado School of Mines, USA*



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G. Prost  
B. Prost

# The Geometry of Complex Manifolds



# The Geology Companion

## Essentials for Understanding the Earth

Gary L. Prost  
Benjamin P. Prost



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# The Geology Companion

## Essentials for Understanding the Earth



*To our colleagues, who inspire us; to Nancy, for your love and support;*

*to Max and Nate: you are our future.*



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## Preface

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When Taylor & Francis reached out four or five years ago, their thought was to compile a comprehensive handbook of geology with contributions from world-renowned experts in various aspects of earth science. I countered that there are already lots of handbooks; what is needed is a book on earth science written for the general public, the “man-or-woman-on-the-street.” In any case, I was still working full-time and didn’t have the occasion to put together something that would require a large investment of time and effort.

About two years ago, I retired, and like so many retirees, I decided to write a book. The first advice you get about writing is to write what you know, so I cobbled together an outline of the book I had in mind, a book that would answer questions that have been directed at me over my career by family and friends: Do crystals have special powers? Why are you skeptical about man-made global warming? How did you know that that movie was filmed in the Canadian Rockies? How do you know that the rocks on either side of that valley were once continuous across the gap? How did you know that that fossil was from Morocco? What is “dirty oil?”

Lots of excellent geology texts exist for college students, and there are many children’s books about geology, but there was nothing comprehensive *and* basic enough for the general public. This book is written at an average 11th-grade reading level. It is written at this level because we wanted it to be easily understood.

We feel strongly that science literacy is fundamental to a free society and a thriving economy. Politicians and school boards do students a disservice when they argue, as was done in Missouri in 2013, that the theory of evolution should be taught on an equal footing with the “theory” of intelligent design. It serves no useful purpose when a news anchor shows white “smoke” coming from a smokestack and calls it pollution (it’s not; it’s just water vapor), or when a documentary shows glaciers calving while an omniscient narrator calls it the result of global warming (it’s not; all glaciers calve whether the climate is warming or not). Many consumers don’t want to know that their food comes from slain livestock; similarly, they often don’t want to acknowledge that the plastic in their computers, the rare earth minerals in their cell phones, and the metal in their cars come from digging in the earth. But the simple fact is that we are not living in huts and driving oxcarts *because* we have learned how to exploit the earth. *Exploit* isn’t always a bad word.

So we wrote this book for the beginning student in earth science, the recreational rock collector, the incurably curious amateur scientist. I was joined in this effort by my son, who writes and edits K-12 educational books and software. Together, we set out to write in an easy style, keeping jargon to a minimum and defining uncommon or technical terms when necessary. We used everyday examples with photos and charts to illustrate concepts. With 487 figures, 24 charts, and 21 tables, this is basically a picture book with some text.

We did not shrink from tackling complex (and controversial) topics such as evolution, nuclear waste, oil sands, frac’ing, and global warming. In our experience, students and the curious want to be challenged, and they are usually eager to engage tough topics. The demanding subjects round out and complete the book.

We hope you enjoy the book, and that it answers all the questions you have.



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## *Acknowledgments*

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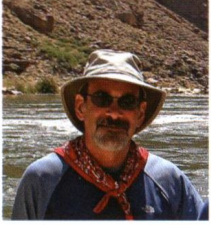
We would like to thank the many reviewers who took time to help make this book better, more accurate, and more complete. They include Dr. Seyi Fatoke (evolution), Don Hladiuk (climate change), Melissa Newton (climate change and Earth history), Dr. David Haddad (deep time, the changing face of the earth, evolution, paleontology and fossils, Earth history, natural hazards, hydrocarbons, and climate change), and Dr. Walter Sheets (all sections). Finally, thanks to Adelle and Rick Palmer for providing photos of Mount Vesuvius and Mount Etna, to Monika Falkenberg for the photo of oil-stained feet, and to Adam Prost for photos from the Grand Canyon, Sierra Nevada, and Canadian Rockies.



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## Authors

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**Gary L. Prost** (primary author) obtained a BSc in geology from Northern Arizona University in 1973 and an MSc (1975) and PhD (1986) in geology at Colorado School of Mines. Over the past 40 years, Dr. Prost has worked for Norandex (mineral exploration), Shell U.S.A. (petroleum exploration worldwide), the US Geological Survey (geologic mapping, coal), the Superior Oil Company (mineral and oil exploration), Amoco Production Company (worldwide oil exploration, remote sensing, and structural geology), Gulf Canada (international new ventures), and ConocoPhillips Canada (Canadian Arctic exploration, field development, oil sands modeling, and reservoir characterization). Dr. Prost spent more than 20 years working as an image analyst/photointerpreter in the search for oil and minerals in more than 30 countries. During this time, he applied structural geology and remote sensing to mineral and oil exploration and development projects, and to environmental monitoring. His most recent work has been in petroleum exploration and field development, in leading field classes, and in public outreach.

Dr. Prost is the principal geologist in G.L. Prost GeoConsulting, which leads field trips, teaches classes, and assists companies with exploration and development projects applying the most recent technologies.

Prost has published two books, *Remote Sensing for Geoscientists: Image Analysis and Integration* (3rd edition, Taylor & Francis 2013) and *English–Spanish and Spanish–English Glossary of Geoscience Terms* (Taylor & Francis, 1997). He is a registered professional geologist in Wyoming (USA).



**Benjamin P. Prost** (coauthor) has had an interest in geology since he tried to eat a sample of native sulfur in his parents' backyard. He was 3 years old, and the yellow crystals were appetizingly orthorhombic. The son of a geologist, he could identify pyrite, galena, gypsum, and several other minerals before he knew the alphabet.

A bit later, he graduated from Occidental College with a degree in something other than geology (a decision he regrets). For the past 11 years, he has been a writer, editor, grammar maven, and style-guide aficionado in Los Angeles and New York. He currently writes and edits online children's books. He is valued for his ability to limn scientific topics in language that any first grader can understand—which is much harder than it sounds. He is routinely called upon by coworkers to explain the difference between *weathering* and *erosion*.



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