Barringer, Back to the Future: Airborne Geochemistry and Many Related Topics, by Peter M. D. Bradshaw, ISBN 978-0-09691014-5-1, 2015, Association of Applied Geochemists, 2015, 159 p., US$68.

Originally from England, Tony Barringer founded Barringer Research Limited (BRL) in Toronto, Canada, in 1961 (later moved to Golden, Colorado, in 1977). To geophysicists, his earliest and best-known invention was induced pulse transient (INPUT), an airborne electromagnetic method first introduced in the early 1960s, which has been credited with more than two dozen major mineral discoveries worth more than US$100 billion. Later geophysical developments included COTRAN, RADIOPHASE, and E-PHASE.

This book, however, concentrates on Barringer's groundbreaking contributions to airborne geochemical systems developed in the 1960s and 1970s, which were applied to both minerals and oil and gas exploration. The approach included collecting both atmospheric gases (e.g., mercury, sulphur dioxide, and hydrocarbons) and particulates, which could be analyzed for many elements. In addition to hardware development, Barringer directly or indirectly funded research into botany, microbiology, weak-leach geochemistry, laser ablation, and multielement analytical methods, statistical methods, and the marriage of these topics with geophysical techniques.

The opening chapters contain a brief summary of Barringer and BRL by Peter Bradshaw. The main content consists of 13 independent reviews of different systems, each authored by geochemists who actively worked with the equipment and acquired data with nine other contributors (mostly ex-BRL employees). A list of former BRL employees and people working for other organizations who assisted in the compilation of this volume is included in Acknowledgments.

Part One includes systems developed for minerals and oil and gas exploration, including AIRTRACE (airborne geochemistry for subcropping, blind and buried mineral deposits, and hydrocarbon exploration using particulates generated from microseeps with an emphasis on marine environments); SURTRACE (surface microlayer and vegetation sampling for mineral exploration); and FLUOROSCAN (identification of hydrocarbons on the water surface from an aircraft by laser fluorescence in hydrocarbon exploration and monitoring of oil spills). Part Two discusses systems including COSPEC (correlation spectrometer for remote sensing of SO_2 and NO_2 for environmental purposes, and monitoring SO_2 related to volcanic activity); GASPEC (remote detection of gases for exploration, environmental monitoring, and chemical warfare); and IONSCAN (ion mobility spectrometer for explosives and drug detection). Part Three contains descriptions of LASERTRACE (laser ablation analysis of geologic, plant, and related material); HHRR (portable/handheld ratioing radiometer); REFSPEC (reflectance spectrometer); sensitive mercury spectrometers for the detection of mineral deposits; airborne mercury pollution and underground nuclear tests; and an instrument to monitor the loss of heavy water (D_2O) in nuclear plants. In an acknowledgment to Barringer's most financially successful development, a brief summary of the INPUT system is included in an appendix.

The chapters vary in length, from two to 26 pages. The technical details are presented in a clear, concise style with numerous photos, diagrams, and schematics of the equipment and maps, profiles, and spreadsheets of survey data, as well as interesting anecdotes of particular applications and successes. Survey results for each system are presented in approximate chronological order and, as such, also represent the improvements with time of the instrumentation and in understanding the factors that affected operations and interpretation. A list of patents awarded to BRL in the United States is included at the end of the book.

The book extensively discusses Barringer's development of instrumentation and analysis techniques for environmental monitoring and security. In fact, these instruments have been the most commercially successful (apart from INPUT). This book provides an extremely useful service in documenting the technical details and successes of some of the most innovative technical developments in geosciences in the 20th century. Very little of the information appears to be available publicly (try searching the Internet), and I suspect that most of the original data will pass along with the various authors.

— Richard Irvine
Lakewood, Colorado, USA

Earthquake Time Bombs, by Robert Yeats, ISBN 978-1-10-708524-4, 2015, Cambridge University Press, 361 p., £19.99 (print), £18.99 (Kindle).

Robert Yeats is an experienced seismologist, and in *Earthquake Time Bombs*, he attempts to highlight the seismic risks in cities and regions and discusses the historic and modern context of those risks, along with what is and isn't being done to mitigate them.

The book has two parts. The first explains the tectonic forces that create earthquakes, the distinction between earthquake prediction and earthquake forecasting, and the urbanization of the last few centuries that can make the consequences of large earthquakes so catastrophic. These chapters are aimed at a general audience and present the relevant information well. Throughout the book, the author includes personal anecdotes — some of these work better than others, but they all provide a change of pace from what can, at times, be a fairly dry text.

Each chapter in the second part is devoted to a city or region that is threatened by earthquakes. The author provides some historic and social context and then describes what is known about the occurrence of historic earthquakes and what this means for the probability of another earthquake. These chapters conclude with a discussion of the earthquake awareness and preparedness

of the area, and what actions, in the author's opinion, should be taken to mitigate the risk of a catastrophe.

The author advises that the book is written to allow the reader to go straight to chapters that are of interest. I ignored that advice for this review and tried to read it straight through. Unfortunately, I found that as a consequence I was becoming inured to disaster (*only* 200 dead compared to 200,000?), depressed by the litany of corruption, and fatigued by the recital of historic earthquakes.

The author has a noble intention of trying to raise public awareness of the seriousness and immediacy of the threat of earthquakes and, like the champion of any cause, he focuses on his concerns. But I kept thinking that the health and resilience of society are much more multidimensional, and the issues he raises need to be kept in context. The author makes comments such as "decision makers … may choose to ignore the problem [of earthquake faults]," and implies that this choice is foolish, corrupt, or uninformed. Although earthquakes are, without a doubt, a major concern for the cities and regions, the author writes about decision makers who may often be foolish, corrupt, or uninformed; how earthquakes are not the only concern of these places; and that decision makers can be rational, honest, and informed and still choose not to act on the threat of earthquakes. Societies need people, like the author, to galvanize action, but choosing to spend billions of dollars on earthquake preparedness is probably seldom an easy choice. Should limited resources be spent on earthquake preparedness to possibly save thousands of lives in the next hundred years, or should it be spent on access to clean water or better health systems that will certainly save hundreds of lives next year? These questions are beyond the scope of the book but could have merited more acknowledgment.

Overall, the book is well written and accessible to an audience interested in science and public safety. The black-and-white maps and photographs are good and adequately illustrate the text. Some of the text would have benefited from editing to remove repetition, and one or two of the images could have been larger to make it easier to identify features mentioned in the text, but these are minor quibbles. You should read this book if you want to get a quick appreciation of the global extent of earthquake peril and the actions that are being taken, or should be taken, to minimize the consequences of future major earthquakes.

— Ray Wood
Wellington, New Zealand

Principles of Electromagnetic Methods in Surface Geophysics, by A. A. Kaufman, D. Alekseev, and M. Oristaglio, ISBN 978-0-444-53829-1, 2014, Elsevier, 794 p., US$205 (print), US$205 (eBook), US$246 (print plus eBook).

Electromagnetics (EM) has been one of the most essential parts of geophysics since its very beginning when geophysics matured to be an independent subdiscipline of physics. Physicists, such as James Clerk Maxwell, laid out the mathematical and physical fundamentals of EM; however, it is the geophysicists of several generations who extended and expanded the theory of EM to be vastly more practical in studying the EM field of the earth, fulfilling pure scientific curiosity, and exploring and exploiting the natural resources from the earth.

Principles of Electromagnetic Methods in Surface Geophysics is published by Elsevier as Volume 45 of a long series of publications (in the *Methods in Geochemistry and Geophysics* series). It focuses on the topics and issues of EM survey methods conducted on the surface of the earth, explicitly excluding the applications of EM methods in boreholes or other subsurface situations.

The major contents are divided into 15 chapters that can be combined in five parts. Part 1 opens by discussing the system of equations of the constant electric and magnetic fields as an introductory to set the fundamentals. Using a simple conductive medium as the host material, Part 2 discusses the behavior of the EM field in a wide frequency range. The authors emphasize that even in later time intervals or in low-frequency range, the EM field still has wavelike properties. This observation does not contradict the fact that the EM field can be accurately described by diffusion equation in time or in low frequency.

Part 3 treats the EM problems generated by dipole sources above a conductive, horizontally layered earth without considering the displacement current. The authors use this situation by introducing the concept of geophysical exploration by showing the relationship between the behavior of the EM field in both time and frequency domains and the geoelectric structure of the medium.

The first three parts serve to introduce the concept of EM sounding in Part 4 using magnetotelluric, frequency domain, and transient signals. Chapter 11 is devoted to the magnetotelluric method that uses natural sources and has a great depth penetration. Chapter 12 prepares the readers by discussing the major points for active-source EM sounding, and Chapter 13 provides the detailed discussion of the behavior of the quasistationary EM field generated by an electric dipole in a horizontally layered earth.

The authors devote Part 5 to the special problems associated with mining prospecting for highly conductive bodies in a layered earth. At the end of this part, the authors also briefly discuss the 2D and 3D effects of the highly conductive body and provide the interpretation for the sounding curve shapes in the presence of lateral heterogeneity. At the end, the authors provide a few useful appendices associated with real-world surveys.

The entire book is quite comprehensive on EM exploration methods of the earth's surface. It adopts vector notation in all mathematical formulas, and is easy to follow for anyone with modest mathematical knowledge. The figures in this book are very clear, straightforward, and easy to follow. There are no color illustrations, and the indexing is detailed. At the end of each chapter, the authors offer a list of papers for further reading.

This book is good for both graduate students and instructors in geophysics. It is also useful for scientists and engineers working in geophysical exploration. In my opinion, as a geophysicist who works with EM, this book is a valuable reference on my desk.

— Lanbo Liu
University of Connecticut

Reflexive Cartography: A new perspective on mapping, by Emanuela Casti, ISBN 978-0-12-803509-2, 2015, Elsevier, Modern Cartography Series, Vol. 6, 288 p., $US120.

For geoscientists, maps are such a fundamental tool that it's hard to imagine how geologic and geophysical studies could proceed without them. Maps have become ubiquitous in everyday life — frequently accompanying news events and stories, and used to display demographic trends, scientific discoveries, and a vast array of other information. The underlying assumptions, biases, and societal factors of using maps, which are usually overlooked, are the subject of this interesting but challenging book.

The main theme of the book is that cartography in the 21st century can be much more influential on society than in the past, as the computerization of recent decades allows almost anyone to generate new types of maps. The approach is to review a broad range of research in the social sciences by considering maps as a primary communication method, particularly in the context of computer- and web-based methods for preparing and distributing maps.

The historic context is covered first, with examples mostly drawn from the European colonization of Africa. Early maps were often individualistic efforts by explorers, but before long, maps became standardized and controlled by governments to fit strategic objectives, to agree with exerting political control, and/or to develop resources for colonizing interests. The personal viewpoint then shifted to drawing of landscapes rather than maps. The arrival of computerized cartography allowed control of maps to revert back to the individual, allowing the effective integration of landscapes and maps, as well as enabling innovative and interactive forms of display. In the book's final chapter, the author looks to the future where the transition of maps as "topos" (representation primarily of physical space) to "choras" (considering assets, values, and societal interests of a region) is complete.

It is important to note that this is an academic book written for other researchers working on the same problem. For someone not in the field, it can be heavy going, especially the first chapter that delves intensely into the philosophic approaches to studying cartography in the broad context of its impact on society. Jargon and specialized language are perhaps unavoidable in academic research, so the reader must be prepared to deal with terms such as "hermeneutic perspective" (a 12-page section), and passages such as this on page 21:

> "Maps are indeed the products of denomination, relying on the semiotic dynamics of linguistic codes. Yet the dynamic of semiosis is in itself a semiotic field, within which the use of various codes triggers yet another semiosis."

The other five chapters are considerably more readable, although I had to keep my 1700-page *Oxford Reference Dictionary* handy, and occasionally even it was at a loss (e.g., p. 215, "odeporic").

For a book about maps, it seems sparsely illustrated — 64 figures in all — but then the emphasis is not on the maps per se, but on the intellectual processes involved in their production and use. Many of the maps are rather murky gray-scale reproductions, so it was very useful to have the full-color versions available online.

In summary, this is an interesting book on an important topic, but its specialist viewpoint and presentation preclude a general recommendation for readers of *TLE*.

— William R. Green
North Vancouver, British Columbia, Canada

Cartography is the science (or art) of making maps. Maps are tools used in selecting what data is to be highlighted, sidelined, or concealed (not displayed). Cartography is evolving from the strict physical topographical map to "mapping" in every sense of the word, including a social sense of territory. Reflexive cartography is a developing concept that applies to the evolution of mapping in which the cartographer is involved with the construction of the map, combined with the effective solution of socially and culturally relevant issues. Essentially, the map has relevance to address beyond just the topographic or territorial data presented, but is interpreted by the user and how the user interprets the map. This is the communicative power of maps.

The six chapters in *Reflexive Cartography: A new perspective on mapping* follow cartography from the past of simple mapping through a potential future in which maps evolve past simple boundaries and symbolic information and allow users to utilize maps for their cultural and social sense. The first half of the book covers the past of mapping, and the second half develops the ideas behind reflexive cartography. This is a research book seeking to advance the science. Extensive footnotes with comments and a glossary — to better define these new concepts — are included.

So what is in the book for geophysicists? Unfortunately, nothing is directly related to the practice of geophysics. There are ideas of how to use maps, or any illustration, as a conveyer of a multitude of information. This allows cartographers to display more of a multidisciplinary pluralism in the information they convey. Online databases allow a user to interact with a map (or illustration) to change the information to make it more relevant to the user. This is more than just using animation or deciding what map layers to display, but the map is now responsive and relevant to the map's user. The book, originally written in Italian, is well written and is certainly an advance in the science of cartography. To geophysicists, however, it will be of very limited value.

— David Bartel
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