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Colin P. North and Kitty L. Milliken, Editors

A.J. (Tom) van Loon, Associate Editor for Book Reviews

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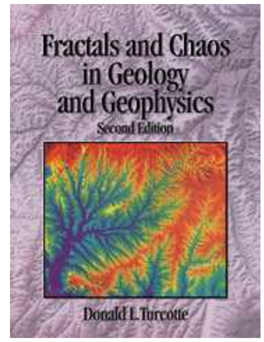
Fractals and Chaos in Geology and Geophysics *(2nd ed.),* by Donald L. Turcotte, 1997 (digitally printed 2007). Cambridge University Press, The Edinburgh Building, Cambridge, CB2 2RU, United Kingdom. Paperback, 398 pages. Price GBP 43.00; USD 80.00. Hardback) (no longer available according to CUP website), 398 pp. Price GBP 70.00; USD 100.00. ISBN 978-0-521-56164-8.



How long is the coast of Britain was the first of three fractals described by Mandelbrot in his classical work *The fractal geometry of Nature* thereby illustrating the close involvement of earth sciences in the development of the concept of fractals. *Fractals and chaos in geology and geophysics* covers the basic principles of fractals and chaos, amply illustrated by models and observations from the earth sciences. By doing so, it provides the reader with a clear and very accessible mathematical background of fractals and chaos, as well as a very wide spectrum of their applications. The mathematical derivations and explanations are thorough, yet not very fundamental, thus making the book easily accessible for both students as well as practicing earth scientists. Questions are asked at the end of each chapter; brief answers are given at the end of the book.

After an introductory chapter on scale invariance, the first two chapters are dedicated to the foundations of fractals and fragmentation. Statistical distributions are treated in conjunction with their fractal parallels. At the end of the second chapter, the first geological examples are given, related to fragmentation.

In the following two chapters, both spatial and temporal distributions of seismicity and ore-grade distributions are amply discussed. Application to petroleum data—size of hydrocarbon accumulations—is briefly mentioned at the end of this chapter.

Chapters 6 and 7 are dedicated to the relationship between fractal clustering and probability theory, and to the definition of self-affine fractals. The use and typing of Fourier spectra is dealt with in the last part of Chapter 7. As an industry geophysicist, I think the field of application is potentially much wider than described here.

Chapter 8, a new addition in this edition, deals with topics from geomorphology, starting with the description of drainage networks with fractal trees—the cover showing an impressive example of this phenomenon. In the ensuing discussion of various models, Fourier Transforms are mentioned again, now in conjunction with wavelet transforms.

Chapters 9-14 deal with low- order dynamic systems, exhibiting chaotic behaviour, the second main theme of the book. The Lorenz equations—a rather confusing name in physics—are succinctly discussed, clearly showing the ability of the author to convey complex topics in an accessible manner. The rather classical problems of mantle convection and the Rikitake Dynamo are discussed in separate chapters.

Chapters 14 and 15 are essentially new in this edition, treating renormalisation group methods and self organised criticality. Renormalisation is brought into context with fault rupture, both in space as well as in time. This last aspect is linked to log-periodic behaviour of earthquakes and their aftershocks. In particular the topic of Chapter 15 is of relevance for sedimentologists. This chapter starts with discussing the classic question of slope instability—in a model, sand is being randomly dropped on a pile and the observation is made that its slope never reaches criticality before it collapses. Several models are discussed, also in the context of their fractal behaviour. It is quite obvious that this approach is applicable in many depositional environments. The second part of this chapter is dedicated to the behaviour of sliding blocks, thus referring to earthquakes again.

At various places in the book the author states clearly states that fractal parameters such as fractal dimension, constitute an excellent means of describing observed phenomena, without pretence of being capable to provide a causal explanation. The qualities for inter- and extrapolation are widely spelt out, and—in the question of earthquake prediction—prudently qualified.

The last chapter just comprises a two-page reflection of the author, pondering on the present state of knowledge with respect to fractals, chaos and self-criticality, and wondering what the future will hold. The reader may be inclined to think that, after having seen proved the worth of the fractal methodology in describing processes and use in inter-and extrapolation, inversion from data may constitute the next major step.

An impressive number of fairly recent references is listed at the end of the book, covering a very wide range of topics in geology and geophysics, thus offering a rich source of information for the pursuant researcher. Both a “Glossary of Terms” and a list of units and symbols are supplied as well.

The book has been digitally printed in 2007, with all graphs and illustrations in black and white. For most graphs this is suitable, however a dozen or so illustrations would benefit greatly if printed in colour. The book mentions the possibility of downloading those from the Cambridge University Press website, but even when printed on a high-quality printer, these illustrations do not come out as well as deserved.

In conclusion, this 1997 book, digitally printed in 2007, is still a good textbook for students in an advanced stage of their study in view of the rich spectrum of examples and models. As well the book comprises a good point of entry for those practicing earth scientists who wish to acquaint themselves with fractals and chaos prior to reading more specialised literature. In other words, the book can serve as a textbook as well as a reference book. As mentioned above, this second edition was issued 10 years ago, which may raise the question whether a next edition is in the offing.

G. Diephuis
Geophysical Education & Advice
11 Delfland
9405 NJ ASSEN
The Netherlands
e-mail: gdiephuis@xs4all.nl

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