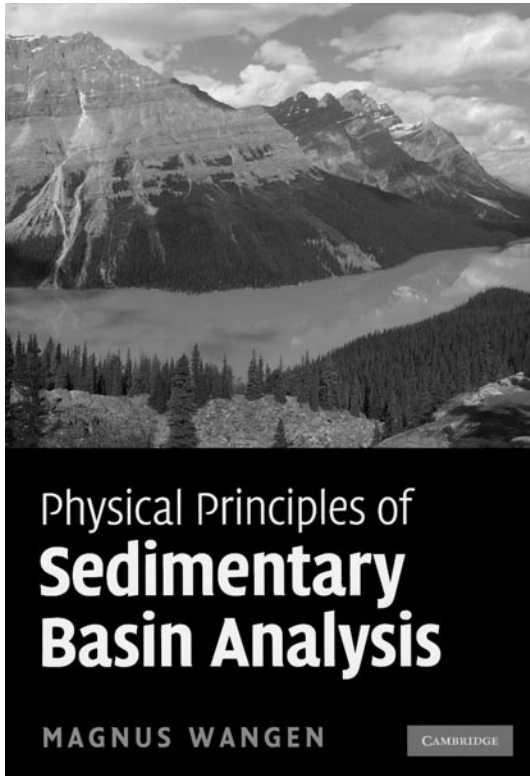


Book reviews

Physical principles of sedimentary basin analysis, by Magnus Wangen, 2010. Cambridge University Press (www.cambridge.org). Hardback, xiv + 527 pages; price GBP 80.00; USD 140.00; ISBN 978-0-521-76125-3. E-book: price USD 112.00; ISBN 978-0-511-71745-1.



Analysis of sedimentary basins is not only measuring and sampling sections, tracing sequence-stratigraphic boundaries, and drawing palaeogeographic maps. Modern geology allows, if not requires, a complex reconstruction of basin dynamics on the basis of physical principles and mathematical modelling. Not only the shape of basins and the rate of sedimentation can be reconstructed, but also heat flow, diagenesis, fluid flow, etc. The new book by Wangen shows a way for such 'high-tech' reconstructions. It is based on lecture notes for a seminar. Each chapter deals with a particular subject (see below), and all chapters together form a collection of case histories. The book is not comprehensive, and it treats only some basic topics. Consequently, it can not be criticized

for the absence of discussions on relevant topics, for example, the concept of dynamic topography. Yet, this volume is a structured book, rather than a haphazard collection. It does what it promises, i.e., establishing a framework that shows how physics and math can be used for the purposes of sedimentary geology. In other words, Wangen offers something better than a comprehensive synthesis.

The content of the book covers a wide spectrum of topics. The author starts with porosity, elasticity, and compressibility, then goes to burial histories, heat flow, and subsidence, subsequently focuses on subsidence, rheology, lithosphere flexure, and gravity, to follow with quartz cementation, overpressure, and fluid flows, and he finishes with wells. The 15 chapters are impressive by their in-depth treatment of the above-listed subjects. And don't think something bad about the structure of this book seeing that chapters treat either very general or very particular topics. The structure is logical, indeed, as some subjects need a general approach, whereas other topics require much detail. Some approaches should be considered as an attempt to find geology confirming physics, whereas others attempt to find physics confirming geology. But all together, the chapters sound like a symphony, not cacophony.

I think it appropriate in this context to pay attention here to three particular topics dealt with in the book, in order to demonstrate its unconventional approach and unprecedented wide scale of topics. Section 6.10 is devoted to salt domes. Wangen explains that diapirs change heat flows in the Earth's crust and make the space above them hotter and below them colder than normal. Section 7.14 deals with backstripping and tectonic subsidence. Here, the author makes a clear distinction between two kinds of

subsidence and between global (eustatic) sea-level changes and water-depth changes. A bit earlier (Section 7.3), he demonstrates with simple equations that sea-level changes can alter subsidence in sedimentary basins, even if such alterations are minimal. Very exciting! Section 11.4 discusses isothermal quartz cementation. Do many people know about this? In this section, one can learn how much time it takes for quartz cementation to reduce the porosity by a half at constant temperature. This is a very specific analysis, but the outcomes are important for a correct understanding of the rates of diagenetic processes. It is just one more proof that Wangen's work may not be a book which impresses immediately when you take it into your hands, but that it will charm you when you find, page-by-page, how new horizons of sedimentary geology are opened.

Characteristic of the book is the huge quantity of math (hundreds of equations, matrices, and graphs). But this is the purpose! The book is oriented by definition on well-prepared readers, who have a solid background in mathematics. In my opinion, a specialist in geophysics or geomodelling will have no problem at all to digest the information. The reader should also be well aware of physics (but no very special knowledge is required) and, of course, geology. Surprisingly, the text is not difficult to read, even if you are not good in mathematics and physics (but you should be good in geology!), because the writing style is easy. Further, I would like to point out two other technical aspects. In the first place, Wangen included numerous exercises and some examples for those readers who will decide to absorb the information for further practical application. Secondly, he provided his personal comments on the main literature sources recommended for fur-

ther reading. The book bears enough illustrations, which are chiefly graphs, diagrams, and model images. They may look very similar for an unprepared reader, but this is misleading: all are informative and useful. The subject index of the book is well thought over but contains few mistakes (e.g., the term 'illite' refers to p. 361, whereas this mineral is actually discussed on p. 362).

Unfortunately, the book has one serious failure, but the author should not be blamed, as it does not concern any scientific deficiency or bad style. It is the book's cover (and, thus, the criticism should be addressed to the publisher)! Sure, the cover looks really nice. It has, however, no relation to the book's content at all. I guess that many readers will be disappointed if they see the book cover with rocks along a beautiful Canadian lake, just to find out that the book is full of math and physical theory without any descriptions of rocks in Canada. This is consequently an example of very poor design!

I tend to recommend this book to all specialists in sedimentary geology (and, particularly, basin analysis), geophysics, tectonics, and, possibly, geomorphology. In addition to professionals in these disciplines, some graduate and postgraduate students with good skills in mathematics may find this book useful as a source of some advanced knowledge. Generally, this well-done work is an unconventional and precious contribution to the understanding of the complex Earth dynamics.

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