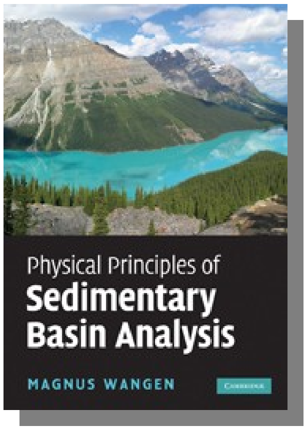

Physical principles of sedimentary basin analysis, by Magnus Wangen, 2010.
Cambridge University Press (www.cambridge.org). Hardback, xiv + 527 pages; price US$ 140.00; GB£ 80.00; ISBN 978-0-521-76125-3. E-book: price US$ 112.00; ISBN 978-0-511-71745-1.

Sedimentary basins cannot be analyzed anymore by mere measuring and sampling sections, tracing sequence-stratigraphic boundaries, and drawing paleogeographic maps. Modern geology requires a complex reconstruction of basin dynamics on the basis of physical principles and mathematical modeling. Not only the shape of basins and the rate of sedimentation should 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 cannot 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 of lectures. 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, something better than a comprehensive synthesis is offered here.

The book covers a wide spectre of topics. It 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 finishes with wells. The 15 chapters are impressive by their in-depth treatment of the above-listed subjects. Some approaches should be considered as an attempt to find geology confirming physics, whereas others attempt to find physics confirming geology. Thus, the structure seems appropriate even if it is disorganized at a first glance. The chapters sound like a symphony, not cacophony for those who can listen well.

In this context I think it appropriate to pay attention 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 rocks above them hotter - and those below them colder - than average. 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 changes 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 at constant temperature for quartz cementation to reduce the porosity by a half. 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 how new horizons of sedimentary geology are opened as you read it, page-by-page.

A main 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 geomodeling 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, obviously, 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 includes numerous exercises and some examples for those readers who will decide to absorb the information for further practical application. Secondly, he provides his personal comments on the main literature sources recommended for further 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 minor mistakes (e.g., the term 'illite' refers to p. 361, whereas this mineral is actually discussed on p. 362). Such easily avoidable mistakes should be corrected in a new edition!

The book has, unfortunately, one serious failure. It is not the author, who 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 descriptions of rocks in Canada. This is a classical example of a design made by a good artist who was not properly informed about the contents of the book.

In summary, I 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, the work is a new significant contribution to the understanding of the complex Earth dynamics. Well done!

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