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Book review

Analogue and Numerical Modelling of Crustal-Scale Processes, S.J.H. Buiter, G. Schreurs (Eds.), Geological Society Special Publication No. 253, London (2006), ISBN: 1-86239-191-2, 978-1-86239-191-8:

One of the greatest problems geologists face, compared to many other scientific disciplines, is the immense difficulty in replicating relevant natural processes in a laboratory due to obvious spatial and temporal limitations. So our understanding is partly based on conceptualization of the most likely processes involved, which is guided by what we can see and measure in the field. Hence, analogue and numerical experiments can greatly improve understanding of large-scale geological processes that are otherwise impossible to replicate. This special publication is a compilation of 23 papers, originating from the GEOMOD 2004 International meeting (held in Switzerland, June 2004), which examine and interpret both analogue and numerical experiments with respect to large-scale geological processes.

Following a brief introduction, two very interesting papers by the editors (Schreurs et al. and Buiter et al.) comprise the first section of the volume. These contributions firstly compare and benchmark analogue models from several experimental modelling laboratories, and then expand this concept by comparing them to numerical equivalents. This first section presents a strong foundation for comparisons between analogue and numerical experiments throughout the remainder of the book.

The second section examines both analogue and numerical models of large-scale orogenic processes such as subduction, thrusting and accretionary prism development. The results are shown to have a significant benefit for interpreting and determining the evolution of structural complexities at large orogenic scales. The next contribution presents a comparison of Proterozoic and Archaean continental lithosphere models with respect to the differences in buoyancy and thermal structure at these times and following this the last paper in this section presents some comparisons and simulations of decollements during the formation of accretionary prisms.

The third section examines deformation processes in sedimentary basins with examples from both analogue and numerical simulations, with examples from 4D modelling of sedimentary basin architecture and migration of hydrocarbons through time. The following contributions examine the effects of rifting and provide some insight into inheritance of crustal heterogeneities. This section is completed by contributions of basin inversion and extensional tectonic models.

Section four examines surficial processes, with an introduction to recent advances in this area. This is followed by studies on landscapes and their response to uplift and rainfall, and the section is completed with some erosion models of the Himalayas.

The final section of this publication concentrates on modelling of faults and fluid flow which covers sediment compaction processes and the importance of incorporating them in modelling studies. Other contributions include modelling fault displacement fields around conjugate structures and also dislocation modelling of earthquake ruptures.

Overall this book provides a very good account of current modelling techniques, ideas and analogue-numerical comparisons within a range of geological settings and scales. A slight weakness of the book is the lack of studies concerning coupled deformation-heat-fluid flow models, which would have made an important contribution to the text. This publication however is generally a well rounded, well presented, succinct and informative contribution which should belong in the library of all modellers and those with an interest in crustal scale geodynamic processes.

John G. McLellan*
Earth and Environmental Sciences, James Cook University, Angus Smith Drive, Douglas, Townsville, QLD 4811, Australia
* Tel.: +61 747816774.
E-mail address: john.mclellan@jcu.edu.au

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