



BOOK REVIEW

Plate Tectonics and Basin Classification

Busby, C. J. and Ingersoll, R. V. (editors) 1995. *Tectonics of Sedimentary Basins*. Blackwell Science, Cambridge, MA. ISBN 0-86542-245-1. Price: hardback \$69.95.

This book has been designed to meet the needs of university courses in sedimentation and tectonics, which in recent years have proliferated not only in the U.S.A. but throughout the world. There are, of course, numerous texts covering sedimentation and tectonics as separate disciplines, but relatively few in combination and, to my knowledge, none in the way attempted in this volume. The basic scientific rationale behind the book is that sedimentary basins are formed in specific plate-tectonic settings, and that it is possible to define depositional models in relation to each of these settings. In the case of many ancient sedimentary basins, it is not always possible to determine unambiguously their relationships to particular plate boundaries, so that the approach adopted in the book has been to develop for each distinct plate-tectonic scenario an *actualistic* model, i.e. a model based on a recent sedimentary basin for which the plate-tectonic regime is well understood and for which depositional systems can be clearly observed. By establishing diagnostic features for each of the *actualistic* models and by recognising these in ancient basins, the controlling tectonics hopefully can be established. This has resulted in a bewildering array of twenty-six basin types, based on the classification of Ingersoll (1988), which, for those old enough to recall, is somewhat reminiscent of Marshall Kay's (1951) classification of North American Geosynclines.

The book is divided into 13 chapters, each written by separate experts in the analysis of particular basin types. The devotion to the task of writing these chapters clearly has been exemplary, with one author expressing his gratitude to a collaborator who 'showed selfless devotion to the geology of our beloved planet', and another thanking 'Elf Aquitaine Production for abruptly terminating his contract, thus providing him time to complete the manuscript'. The initial chapter, written by the editors, outlines the approach taken for the book as a whole and describes the classification of basin types and the essential features of each type. This chapter sets the scene for the whole book. At the outset I was highly sceptical that all basins could be fitted neatly into any scheme based on modern plate-tectonic settings. However, the introductory chapter skilfully persuades the reader of the validity of the approach to such an extent that I was reasonably satisfied that the majority of fossil basins could be legitimately classified using the book's guiding principles.

The remaining chapters cover individual, or groups of, basin types, subdivided by tectonic setting. Thus there are two chapters covering divergent setting, including continental and proto-oceanic rifts; one chapter covering a range of basins in an intra-plate setting; six chapters covering convergent settings, including one chapter each on ocean trenches, forearc basins, intra-arc basins, interarc/backarc basins, retroarc foreland basins and collisional-related foreland basins; one chapter on strike-slip basins; and a final chapter on intracratonic basins in hybrid settings. The contents of each chapter clearly have been dictated by the guiding principles set out by the editors in the first chapter, so that the reader experiences a continuity of approach throughout the book. Nevertheless, each chapter has its individual flavour brought out by the particular interests and styles of the author(s). The one possible exception to this is Chapter Two dealing with sedimentation and tectonics of fossil rifts, in which all nature of rift-related basins are described, including those associated with wrench settings as well as those in divergent settings.

Each chapter includes a section on tectonics and mechanisms of basin formation, which in some instances is rudimentary and scarcely more than that given in the introductory chapter. However, in others, tectonics is covered in some detail with good discussions of basin-

controlling structural features, burial history and subsidence mechanisms and related heat-flow and igneous activity. In every case, basin architecture and basin fill are described and discussed in some detail, often in relation to tectonic controls of deposition. There is a particularly useful discussion of structures connected with isolated and linked normal faults in relation to sedimentary architecture within the associated rift basin. In most chapters there is relatively little discussion of subsequent tectonic history of the basin fill, so that characteristics of metamorphism and deformational style are either not treated, or given only a very general coverage. This is a pity, as many ancient basins, particularly peripheral foreland basins can be characterised by the style of subsequent deformation. The deformation and tectonic history of a basin also has important implications for basin preservation, and it is clear from some of the chapters on basins in convergent settings that it is most unlikely that ancient examples will survive and/or be recognised. This is particularly the case for intra- and inter-arc basins, and the case studies of these basin types from Baja, California, the Central American Arc, and the lesser Antilles are very informative. Where relevant, a section on the economic potential of a basin type is included.

Perhaps one of the most valuable aspects of each chapter is the documentation of examples of recent and ancient examples of particular basin types. Discussion of these examples leads to a fuller understanding of both the validity of the approach, and to the variety of geology associated with each type. It is probably true that no two basins are identical and the reality is an infinite variety which can only be captured crudely in the pigeon-holes of a classification. Because many of the authors, as well as the editors, are based in North American institutes, it is perhaps not surprising that many of the *actualistic* and ancient basin examples have been taken from North America. It is also true that plate tectonic processes in North America are some of the best documented in the world. The book, however, also includes examples from across the globe, ranging from such well known cases as the East African rift, the Red Sea proto-ocean rift, the Dead Sea strike-slip pull-apart, the Amadeus intracratonic basin, and the Alpine and Himalayan foreland basins, to many lesser-known examples.

I found it a somewhat daunting task to read the entire 579 pages of tightly-written scientific text. This is a book that the reader will want to dip into to find out more about a particular basin type rather than attempt a frontal attack. However, the book is well cross-referenced and has an excellent index. There are also useful suggestions for further reading at the end of each chapter. The full bibliography at the end of the book is very valuable, but I found it particularly difficult to find references because of the lack of author highlighting; later editions, which I am sure will be forthcoming, will want to correct both this and the relatively few typos. I also found the frequent splitting of figures between two pages, so that it is necessary to turn the page to find the rest of the diagram, very frustrating.

As suggested above, I am confident that this book will be adopted as a course text for many undergraduate courses. It has very few shortcomings and fills an obvious gap in the market. It will also be useful for postgraduate students and course teachers, as well as for informed professional geologists, particularly in the hydrocarbon industry.

REFERENCES

- Ingersoll, R. V. 1988. Tectonics of sedimentary basins. *Bull. geol. Soc. Am.* **100**, 1704-1719.
Kay, M. 1951. North American geosynclines. *Mem. geol. Soc. Am.* **48**, 243 pp.

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