represented (i.e. two dimensions). Bayly's Mohr diagram for flow behaviour must be of the second kind, and yet his introductory words talk of states of stress, and planes, which are more suggestive of the former.

Five appendices conclude the book. A–C concern abbreviations, precision, and weights as units of force. D discusses experimental work on rock deformation in a philosophical way. Appendix E, Books on Related Material, lists nine textbooks which deal with relevant topics at a general level. I was surprised that Biot's *Mechanics of Incremental Deformations* (1965) was not among them (my own personal bible).

The general question of whether textbooks should contain references, either to source material or to further reading, is clearly open to debate. In the case of this book, I think that the lack of references is a shortcoming which will prevent many readers from going much further than the ideas and applications presented. Parts of the book are innovative, and seem to contain ideas not presented in the research literature: or at least not in that way. However, there are other places where Bayly is presenting well-examined topics, or rederiving principles developed by others, and there is no easy way that a student could know which were which. Thus, Bayly's original approach has the downside that he is ploughing his own furrow, in parallel with considerable bodies of research in structural geology, and with no crossties. There are examples, as noted above, where idiosyncratic terms have been used instead of those in common parlance. But perhaps the greatest problem arising from the combination of his original approach and the lack of reference to relevant research papers is that readers are left with nowhere further to go. It would, of course, be an enormous task to include references to the many relevant papers in structure and tectonics which are based on the principles of mechanics outlined in the book. Nevertheless, I believe such an addition would add enormously to the book's educational value.

In conclusion, I found Brian Bayly's book well written and nicely produced, with a commendable absence of typographic errors. The illustrations are good, though descriptions of the figures in the main text, rather than in figure captions, could lead to a few difficulties. In any text as comprehensive as this, there are bound to be differences in emphasis that some teachers would give to particular topics. However, one of the charms of this book is that it *is* different from both structural geology text books and mechanics texts. Bayly has brought these two fields together admirably, with great intelligence, imagination and originality. For this reason alone, I think all active structural geologists, whether in research or teaching, and particularly those concerned with theory, should read this book. They may not agree with everything in it, but it will certainly make them think about the principles behind geological structures and tectonics.

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Fluids and subduction

Tarney, J., Pickering, K. T., Knipe, R. J. and Dewey, J. F. (editors) 1991. *The Behaviour and Influence of Fluids in Subduction Zones*. The Royal Society, London. 192 pp. Price £37.50 ($69.95).

Fluids are becoming recognized as having a major influence on geological processes at all levels within the Earth. Whether studying deformation history, metamorphic processes, mineralization phenomena or magmatic evolution, the influence of fluids is ubiquitous. Perhaps nowhere are fluids more intimately involved in geological processes than in subduction zones where wet sediments and hydrated ocean crust are either accreted to the overriding plate or dragged deep into the mantle. They represent places where water is recycled back into the mantle and hence fluid behaviour is significant not only for the workings of a subduction zone but also for the geochemical balances within the Earth as a whole. The present book is therefore a timely contribution to a subject of increasing geological interest.

The book is a collection of papers first presented at a discussion meeting of the Royal Society held on 8th and 9th of November 1990. The papers were originally published in the *Transactions of the Royal Society, Series A*, Volume 335, and have now been re-issued in book form. In fact, the page numbers of the original journal have been retained so that it was with some consternation that on reaching the end of the first article, I found myself on p. 242! Consecutive book pages have been added in parentheses, however. In the words of the editors, the collection is intended to serve as both a review or synthesis of what recent research has achieved, and a stimulus to further research by highlighting a number of directions requiring more attention.

The book contains 13 separate articles covering accretion of unconsolidated sediment to the geochemical evolution of the mantle. The articles nevertheless fall broadly into two distinct groups. The first group, of seven papers, is concerned with the fluid flux through the accretionary prism as observed in modern forearcs. The second group of six papers is largely concerned with the release of volatiles from the subducted slab within the mantle and the production of magmas. There is really very little in common between these two groups, although Peacock's interesting paper on the numerical simulation of subduction zone pressure–temperature–time paths acts as something of a bridge between the shallow and the deep processes.

Within the first group of papers, some are written essentially as reviews whereas others are largely vehicles for presenting specific data. Westbrook gives a clear synthesis of geophysical evidence for fluid flow in accretionary prisms, while Kastner *et al.* provide a thorough review of the geochemistry of fluids in modern prisms, stressing the problems of identifying the various sources of fluids. Le Pichon *et al.* present calculations of predicted fluid fluxes from compaction of wet sediments and dehydration of hydrous minerals at depth, and compare these with measurements of fluid fluxes on the Barbados, Central Oregon, Northern Cascadia and Nankai subduction zones.

All three papers conclude that measured fluid fluxes are much greater than predicted from compaction and dehydration. In the case of the Nankai zone, Le Pichon *et al.* suggest shallow level sea-water convection is important, but in other zones, large fluxes of low Cl^- fluids require a deeper and prolific source of water. It seems clear that much still needs to be done before fluid budgets of accretionary prisms are understood.

Moore *et al.* present a thought-provoking paper on the influence of variable porosity and permeability on fluid flow, comparing the muddy Barbados Ridge complex with the sandy Oregon prism, and Knipe *et al.* provide a thoughtful review of the microstructure of DSDP samples from accretionary wedges, posing some provocative questions regarding deformation processes in these environments. Finally in the first group of papers, Taira and Pickering give a relatively detailed comparison of fluid flow and structure of the Nankai, Izu-Bonin and Japan Trench subduction complexes. Overall I thought the chapters had been well chosen by the editors to give a thorough review of the present understanding of fluid expulsion during early accretion of sediments in subduction zones.

The second part of the book I thought perhaps less satisfactory, maybe because so much has been written on arc volcanism or perhaps because I am not an igneous petrologist. Peacock's paper, as mentioned earlier, explores the effect of a wide range of parameters on the thermal structure of subduction zones while Davies and Bickle present a one-dimensional model of a melt generation column. The remaining four papers attempt to address the origins of the distinctive geochemistry of arc volcanics. Hawkesworth *et al.* present a well-written and lucid review of the trace element and isotope characteristics of subduction-related magmas, addressing the question of how much influence the slab has on the chemistry of the melt; and Saunders *et al.* discuss the problem of LIL/HFS element anomalies of arc volcanics and present a model for their production. Both these papers conclude that induced convection in the mantle wedge above the slab is necessary for magma generation.

Ayers presents experimental data on the solubility of apatite, rutile, monazite and zircon in water of various composition at different pressures and temperatures, and finally McDonough argues for a 10% partial melting on the top 2 km of hydrated ocean crust, leaving a Nb and Ti enriched eclogite to accumulate in a deep mantle reservoir, thus changing the long-term geochemistry of the mantle.

The book is well produced with very few typographic errors. Some of the diagrams are rather small, requiring a handlens to read the lettering, probably due to the reduction in page size from A4 to B5. In these days of word processors and spelling checkers, it is interesting that errors are of a different type than in the past. Whole words get omitted, and rather than misspelt nonsense words, inappropriate words get through. "Drilling sights" and "isotopic radios" were two that brought a little light relief, no doubt both passing through the spelling checker with flying colours!

The final question is: who is going to buy this book? At £37.50 for 190 pages of reprinted articles, it isn't cheap. As a collection of papers,

I think it is one of the more successful efforts, but nevertheless few researchers are working on both sedimentary fluids and magma geochemistry. For researchers interested in subduction zones and wanting an up-to-date review and who do not have access to the original journal, the book would be a valuable aquisition. Several of the papers could be useful for graduate courses. Institutions that do not subscribe to the *Transactions of the Royal Society* should buy it. In these days of shrinking library budgets, however, I do not see many libraries purchasing it in addition to the original journal.

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Continental margins: a commemoration to M. T. Halbouty

Watkins, J. S., Feng Zhiqiang and McMillen, K. J. (editors) 1992. *Geology and Geophysics of Continental Margins*. American Association of Petroleum Geologists Memoir 53. The American Association of Petroleum Geologists, Tulsa, Oklahoma, U.S.A. 419 + xii pp. Price $82 (hardback; ISBN 0-89181-332-2); AAPG members $59.

This Memoir presents 22 papers from presentations at a conference on continental margins held at Galveston, Texas, in February 1989, to commemorate Michel T. Halbouty, the distinguished petroleum geologist. Holbouty has worked or supervised exploration in many regions, including the Gulf Coast, Alaska, southeast Asia, and the southwest Pacific, which are covered by papers in this book. His early investigations of the importance of stratigraphic traps led to the development of sequence stratigraphy, the subject of many papers in this book.

The wide-ranging title suggests a synthesis of principles governing the formation of continental margins. However, most papers in this book are instead a diverse collection of regional reviews and detailed studies of localities. There are five sections, each covering a theme that is either a geographical region or a general method. The first section, on the Chinese margin, comprises four papers. "Geological Characteristics and Petroleum Potential of Sedimentary Basins of the China Continental Shelf" by Wang Shansu and others, reviews 13 localities that are a mixture of extensional, backarc and foreland basins. It presents many figures on sediment volumes and thicknesses, and lists names of formations and traps, with information about hydrocarbon content. Many maps and cross-sections based on seismic reflection profiling are presented, but no original seismic sections. Both references are to publications by the first author. The second paper, "Geotectonic Framework of the East China Sea", by Yang Qi Lun, describes in more detail both of the basins, considered by Wang *et al.*, that are beneath this sea. Stratigraphy is reviewed, including hydrocarbon prospects, and formations are described and correlated between basins and are illustrated using original seismic sections. Changes in the evolution of these basins are related to changes in motion of Eurasia relative to the Pacific and Indian plates. The third paper, "Structure and Hydrocarbon Potential of the Para-Passive Continental Margin of the Northern South China Sea" by Feng Zhiqiang and others, does a similar job for this passive margin, including the Pearl River Mouth of Zhujiangkou basin with its large hydrocarbon reserves. Like in the previous article, formations are listed and delineated on seismic sections, stratigraphy is correlated, and tectonic evolution and hydrocarbon prospects are discussed. "Structural Evolution of the Western Pearl River Mouth Basin" by P. Edwards provides an independent summary of the stratigraphy and tectonic evolution of the same basin. It includes some high-quality seismic sections showing planar normal faults cutting basement, as well as detailed maps of the complexity of en échelon normal faulting. However, the bibliography contains only five references on the study area. The small numbers of references in some of these articles give the impression that little is published on basins offshore of China, which is not the case. A study of the Pearl River Mouth Basin by Su Daquan and others (*Basin Res.* **2**, 205–222, 1989) contains over 30 local references. There are dramatic discrepancies between different interpretations of this basin. For example, Su *et al.* concluded that most of its extension occurred during 60–35 Ma, with minor extension during 25–11 Ma. In this book, Wang *et al.* state that its extension covered 70–63 and 32–17 Ma, Edwards concludes 36–26 Ma, and Feng *et al.* prefer Mid Oligocene to Early Miocene or ~30–20 Ma. These discrepancies cannot have escaped the attention of the editors of this book. It is unfortunate that no attempt has been made to reconcile them, or to require authors to comment on them or justify their own interpretations.

The second section includes six papers on Southwest Pacific and Eastern Indian Ocean Margins. In "Tectonic History, Sedimentation, and Changes in Relative Sea Level: Chatham Rise, New Zealand", R.H. Herzer and R. A. Wood investigate this ~500 m deep continental submarine plateau that is east of the South Island of New Zealand, using seismic reflection and drilling. Before Cretaceous time, this region formed part of a landmass between the South Island and West Antarctica. Cretaceous rifting south of the Chatham Rise aborted, and the breakup of New Zealand from Antarctica occurred farther south. This paper discusses the subsequent evolution of this region, which is now part of the Pacific plate, including sedimentation as it has gradually subsided, and volcanism. B.W. Davy addresses "The Influence of Subducting Plate Buoyancy on Subduction of the Hikurangi–Chatham Plateau beneath the North Island, New Zealand". This study region is north of the Chatham Rise. Although called a plateau, its bathymetry is up to 4000 m. Gravity and seismic information constrain crustal thickness to ~10 km, suggesting that it probably comprises unusually thick oceanic crust formed at an anomalously hot spreading centre. P. R. King and G. P. Thrasher, cover "Post-Eocene Development of the Taranaki Basin, New Zealand". This Cretaceous passive margin has been affected by Tertiary shortening. M. S. Marlow, N. F. Exon and S. V. Dadisman investigate "Hydrocarbon Potential and Gold Mineralization in the New Ireland Basin". They use seismic reflection and other methods to constrain the structure and evolution of this basin, which at present is situated in the extreme southwestern part of the Pacific plate. They suggest a new interpretation of the Tertiary evolution of this remote and complex region. D. W. Scholl and R. H. Herzer investigate the "Geology and Resource of the Southern Tonga Platform". Although natural oil seeps exist in Tonga, the source beds have not been identified, and the hydrocarbon potential is unlikely to be significant. Finally, R. G. Matson and G. F. Moore discuss "Structural Influences on Neogene Subsidence in the Central Sumatra Fore-arc Basin". Oblique convergence of the Indian and Eurasian plates is locally accommodated in part by subduction of the Indian plate and in part by right-lateral faults onshore on Sumatra, which strike subparallel to the surface trace of the Benioff zone. The Tertiary evolution of the fore-arc basin, between Sumatra and the surface trace of this Benioff zone, is extremely complex.

The third section, on African and Mediterranean margins, is a real mixture. A. Bosellini examines "The Continental Margins of Somalia". He presents a great deal of well log and other information concerning the parts of these margins that are exposed onshore, which I believe is not published elsewhere, along with a new fit of the initial positions of Africa, Madagascar, India and Arabia. M. F. Coffin and P. D. Rabinowicz present a great deal of seismic and other information concerning "The Mesozoic East African and Madagascan Conjugate Continental Margins". M. Sarti and others discuss the "Basin Geometry and Architecture of a Tethyan Passive Margin, Southern Alps, Italy". Extensional basins formed in northern Italy in Mesozoic time at the southern passive margin of the Tethys ocean. These authors present a lot of interpretation of these basins, based on what appears to be little solid information. Finally, J. S. Holik and P. D. Rabinowicz discuss the "Structural and Tectonic Evolution of Oceanic Lithosphere Within the Jurassic Quiet Zone, Offshore of Morocco". This locality has been affected in Tertiary time by the Canary Islands upwelling mantle plume.

The fourth section covers sea level and seismic stratigraphic studies. K. J. McMillen and P. O'Sullivan discuss "Tectonic and Eustatic Controls on Paleogene Sequence Stratigraphy: Beaufort Sea, Alaska and Canada". This major petroleum province comprises a Mesozoic passive margin that has been affected by Tertiary shortening. Its interpretation is complicated by the fact that stratigraphy has been defined independently in its Alaskan and Canadian parts. M. Ito and F. Masuda discuss "The Evolution of Mesozoic–Cenozoic Sedimentary Basins Along the Japanese Continental Margin". They attempt to isolate effects of eustatic sea-level variations from tectonic effects. "Upper-Cretaceous Stratigraphy and Relative Sea-level Changes, Gulf Coastal Plain of Eastern and Central Alabama", by D. T. King and M. C. Skotnicki, a synthesis of many years of work, is an excellent introduction to the stratigraphy of this region, with numerous references to detailed studies in regional journals. A. H. Bouma and others