

BOOK REVIEWS

SNYDER, D. & HOBBS, R. 1999. *The BIRPS Atlas II. A Second Decade of Deep Seismic Reflection Profiling*. (3 CD-ROM pack: CD1 for Windows, Unix and Macintosh; CD2 and CD3 for Windows and Unix only). London, Bath: Geological Society of London. Price £99.00, US \$165.00 (members' price £39.00, US \$65.00).

The BIRPS Atlas II is a volumetrically slim affair compared with its previous incarnation, which came in a large box. This version consists of a mere three compact disks in an attractively designed folder. The new slimline design has all the expected advantages and disadvantages. The crucial issue concerns ease of perusal: is it possible to access the CDs speedily and efficiently? Ignoring the brief instructions on the folder, I popped CD1 into my laptop and found that I could easily browse through the written material and accompanying figures. Printing out hard copy was also trivial. The seismic reflection data are stored on CD2 and CD3 and they have to be downloaded if you want to be able to play with them. Since seismic reflection profiles are long and thin, computer screens are pretty useless for browsing. No, they are maddening. I tried out the Lynx Seismic Viewer which can run directly from the compact disk drive. The images are a bit grainy and in black-and-white only. My laptop made lots of tedious whirring noises during a painstaking scroll across profiles. By the time you have reached the southwest end of a line you have completely forgotten when the northeast looked like. If you zoom out to avoid scrolling, you cannot see much. This Viewer was also just that: look but don't print. I then tried out WinPICS which has interpretational and printing capabilities. Although there was some struggling, it was well worth loading this stuff. WinPICS allows you to scroll more easily and the default red–blue colour display is excellent. The anticipated nightmare printing scenario never materialized: I was able to print off screen captures with ease and in colour. The disadvantage is that unless one has a whopping A0 printer, one is restricted to small pieces or impossible scales. WinPICS can also be used to interpret the data. So, in summary, accessibility is straightforward although my first action would be to make a complete set of hard copies for day-to-day perusal.

What about content? *Atlas II* gives you everything that the original *BIRPS Atlas* contained together with all subsequent surveys. CD1 contains the text which is divided into ten chapters. Chapter 1 is a useful historical introduction which explains how the British Institutions Reflection Profiling Syndicate was set up and run from 1981 until 1997 when NERC, in its wisdom, closed it down. The key features of later BIRPS surveys, which were shot between 1989 and 1997, are summarized in Chapter 2. This chapter has useful links with the remaining chapters which follow different themes. The reader cannot fail to be impressed by the list of spectacular deep surveys. Most of these surveys collected coincident deep seismic reflection and wide-angle data of breathtaking quality. For me, the most exciting is CHICXULUB which imaged the deep structure of the crater formed by the impact of an asteroid with a diameter of 10 km at the end of the Cretaceous. Chapters 3 to 7 depart from the practice of the original *BIRPS Atlas* by

discussing the geological implications of the entire suite of deep data collected by BIRPS. This approach works reasonably well although at times I felt that one particular view was being promoted at the expense of a broader perspective. New technology and improvements in the application and modelling of controlled-source targets are outlined in Chapters 8 and 9. The final chapter summarizes the background to the CHICXULUB experiment and concludes with a general discussion about asteroid impacts. CD1 also has a bibliography.

The stacked seismic reflection profiles are stored on CD2 and CD3 in industry-standard SEG-Y format. These data can be displayed and interpreted on Unix and PC platforms, using the included software. The surveys can be downloaded onto other platforms for more serious interpretation and post-stack processing. This ability is of great value and makes purchase of *Atlas II* a must, even for those who already have the original version. Of course, there is a great deal of extra data as well. Some of these additional surveys are from the British Isles but the majority are overseas.

Drum Matthews, one of the founders of BIRPS, said that 'politicians more and more regard science as an adjunct of technology and demand short-term economic gains. If this goes on, science, international and published, will not be the cornerstone of the twenty-first century as it has been of the twentieth'. As I browse this rich supply of data, it is sad to conclude that the BIRPS Programme was probably the apotheosis of thematic funding. For nearly 20 years, a relatively modest sum of money was used to acquire, process, and interpret over 20 000 km of high quality data. More than a handful of BIRPS surveys (e.g. DRUM, CHICXULUB, ARAD) have gained iconographic status. This wonderful achievement was accomplished with minimal financial overheads and with the lightest of administrative touches. Twenty years later, it is difficult to conceive of a thematic programme which could be run along similarly efficient lines.

The BIRPS Atlas in both of its manifestations is an essential bargain for all geologists and geophysicists. I particularly recommend the compact disk version to undergraduate and postgraduate students as an excellent and economical means for becoming acquainted with the deep structure of the British Isles. These compact disks are the fruits of the BIRPS Programme and I suspect that there are still many cherries waiting to be picked out.

N. White

BEAUMONT, E. A. & FOSTER, N. H. (eds) 2000. *Exploring for Oil and Gas Traps*. AAPG Treatise of Petroleum Geology; Handbook Series. xiv+1146 pp. Tulsa: American Association of Petroleum Geologists. Price US \$49.00 (hard covers). ISBN 0 89181 602 X.

This ten-pound tome is one of four books of the Handbook of Petroleum Geology, itself one of three sets forming the Treatise of Petroleum Geology which commemorates AAPG's 75th anniversary in 1991. It is not intended to be an advanced text and is aimed as a working reference for young

professionals who are just getting started but know something of the basics.

Content begins with a multi-contributor discussion of the philosophy required of a successful explorationist. This is followed by twenty chapters organized into four parts. The first, two chapters, deals with the concept of a trap and its context within a petroleum system. The second, five chapters, discusses sedimentary basin analysis, fluid pressures and the migration of petroleum. The third, three chapters, focuses on critical elements of the trap: reservoir quality, seal integrity and conditions governing preservation or destruction. The fourth, ten chapters, introduces techniques for predicting trap occurrence and ends with specific discussion of structural and stratigraphic traps.

It is almost inevitable in such encyclopedic and multi-author treatment that most of the topics are done better elsewhere. Seismic is particularly poorly served and even omits mention of offset-dependency as a basis for rock property calibration. No distinction is made between undercompaction and inflation overpressures. Migration through moving pore water is not treated. Basin modelling as an integrated discipline is barely mentioned. All magnetic basement is apparently Precambrian. Against this, source rock evaluation and oil–oil/oil–source rock correlation are particularly well done, as is the application of palaeontology. The chapter on the value of geological fieldwork should be mandatory reading for management and staff alike. The focus on pore-throat geometry as a key to reservoir quality is a welcome aspect that will be increasingly critical as ‘brownfield’ exploration increasingly supplants ‘greenfield’ and explorationists work more closely with petrophysicists. The inclusion of many minor topics such as bore-hole gravimetry, seepage sampling and magneto-tellurics add to completeness. References are fairly up-to-date.

The book is formatted in a technical writing style known as information mapping, which is certainly clear albeit very wasteful of space. In some sections this works well and the checklists for action are useful, the more so as they seldom figure in academic texts. In other sections basic definitions needed for understanding are omitted, for instance pseudo-reduced temperature and pressure which figure in nomograms presented for dealing with non-ideal behaviour of gases. Too many diagrams are taken from the literature rather than being drawn specially, in some cases to the detriment of clarity. The text is long on examples and short on basic principles and pitfalls: it cannot be recommended as a sole source of information. Like most cookbooks, it is best sampled selectively. It could and should have been much more compactly presented and will not appeal to those who turn up their noses at any suggestion of ‘exploration by numbers’. The incredibly low sponsored price makes it very good value for libraries. It is available electronically but not yet on CD-ROM.

David James

KRINSLEY, D. H., PYE, K., BOGGS, S., JR & TOVEY, N. K. 1998. *Backscattered Scanning Electron Microscopy and Image Analysis of Sediments and Sedimentary Rocks*. ix+193 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £50.00, US \$80.00 (hard covers). ISBN 0 521 45346 1.

The abstract for this book suggests that it is a comprehensive guide to the use of backscattered electron microscopy in examining minerals, textures and fabrics. The authors

quickly establish that such an all-encompassing guide is simply impossible to provide within a slim volume, and they set out instead to document a very broad range of applications in sedimentary geology. Their aim seems to demonstrate the remarkable potential of the technique, and thereby to encourage the reader to use BSE (despite the acronym’s sinister *alter ego*), and help us think of still more innovative applications. They succeed.

Following a brief history of the technique, the book gives a fairly simple explanation of the physical processes involved in the creation of a BSE image, with a comparison to secondary electron imagery. The tabulated data show the promise of BSE in distinction of minerals within images, and the drawbacks of poorly prepared materials are explained. Although mention is made of problems in distinguishing minerals that have different chemical composition but overlapping backscatter coefficients, there is no critical discussion of the necessity for frequent use of energy dispersive (EDS) X-ray emission mapping and analysis until much later in the book (the final chapter). I found the implicit assertion that BSE alone can differentiate most of the minerals of interest, even after initial calibration against EDS, was too optimistic. There is little treatment of imagery of rough surfaces, especially with regard to differing detector configurations, and no mention of stereo BSE as a tool in the examination of surface textures. The section on specimen preparation mentions all of the normal procedures, but perhaps does not emphasize the frequency with which non-aqueous media are necessary for prudent grinding, lapping and polishing. Backscattering diffraction (EBSD) studies are not covered.

Then we come to the main bulk (over half of the book), dealing with textures in many different specimen types. I found this to be the best part of the book. There are numerous illustrated examples of BSE from sedimentary materials that are commonly encountered by geologists, such as sandstones, shales and limestones. In each case, Krinsley *et al.* give a brief explanation of what can be inferred and list appropriate references to read. I saw much that was new and thought-provoking. I was a little disappointed that there was no discussion of the need for integrated scanning cathodoluminescence imagery, especially to reveal the extent of silica grain cementation in sandstones. Likewise, the complex substitution of magnesium, calcium, manganese and iron on a micrometer scale in zoned carbonate minerals really necessitates regular use of X-ray mapping. BSE shows some of the texture, but leaves the mineral composition largely unresolved.

The majority of the illustrations are very good, although a few are little too dark, and only a few show obtrusive instrument artefacts or sample preparation problems. Perhaps these should be explained in the captions, since they are so frequently encountered in everyday electron microscopy! The section on weathering and early diagenesis is particularly interesting, with clear potential for further applications in the geotechnic industries. Some striking images of stromatolitic textures complement a chapter on desert varnishes, and there is extensive treatment of textures revealing growth histories in glauconite.

The final chapter deals with image acquisition, processing and analysis, and will be familiar to anyone who has attempted such an approach. It does, however, lack the illustrations that would help a novice to understand the way in which image processing may aid or hinder the interpretation of texture and fabric, especially the modification of shapes that is implicit in use of erosion and dilation techniques.

One or two illustration captions contain errors (for example figures 3.26 and 3.12), and there are a few typographic errors, of which one on page 16 is startling: surely a resolution of better than 0.01 mm (*sic*) is routinely available? In fact every BSE in the book is substantially better than this! The reference list is a very welcome resource, and it comes as no great surprise that the quoted papers from the authors alone exceed three pages, a true reflection of their contribution to the wide application of BSE.

I felt that I had learnt a lot from the examples presented in this book, and that they had provoked a number of new ideas. Throughout, I gained the impression that the intention was not to simply present a review of previous applications, but instead to show how many new things could be done. Many of the commentaries conclude that a particular application is still in early stages or that few papers have been published on this rock type. The authors' message is clear: now you've seen what BSE can do, why not have a go yourself?

I think that the book will be a useful source for ideas for academic and professional geologists, and geotechnical companies and researchers. Worth having.

Anton Kearsley

ALDRIDGE, R. J., SIVETER, DAVID J., SIVETER, DEREK J., LANE, P. D., PALMER, D. & WOODCOCK, N. H. 2000. *British Silurian Stratigraphy*. Geological Conservation Review Series no. 19. xviii+542 pp. Peterborough: Joint Nature Conservation Committee. Price £76.00 (hard covers). ISBN 1 86107 478 6.

This is a lavish and mightily impressive publication. The question is: who or what is it for? Unlike most geological publications a lot of money has been available. The Silurian volume is one of the Geological Conservation Review Series being prepared by the G.C.R. Unit of the Joint Nature Conservation Committee. The idea as I understand it is to assess and document key Earth Science sites to provide a firm basis on which site conservation can be founded in the future. This sounds very laudable, but I only have to hear mention of such projects as conservation of geological sites and alarm bells ring in my mind (see Rickards, 2000). Even so, that tells us what the volume is for; and presumably it is to be used by conservationists and planners, as well as by geologists.

The preface by Palmer is an interesting read, not least because it does not seem to have much structure to it: there is mention of, on the one hand, Wordsworth and Ruskin, and, on the other the importance of quarrying (the opposite ends of an aesthetic spectrum, one supposes). And then he says 'Active conservation measures are needed to protect the most important geological sites'. Well, I wonder. The sites assessed in this volume are supposed to be the most important, so I had to look at the ones with which I am most familiar.

The River Rawthey (Wenlock) section (pp. 292–5) is covered in some detail by Woodcock, not only in terms of its litho- and biostratigraphy, and the nature of the outcrop itself, but also in terms of its value in contributing to palaeoenvironmental debate. What he doesn't say is what 'active conservation measures' are needed. In truth, none at all. This is one of those sections of the kind I have described elsewhere (Rickards, 2000) where the best form of conversation is inaction. No amount of collecting or hammering could damage this River Rawthey site, so if any official body tries to restrict hammering or collecting then they will not

only be wasting time and money, but holding back scientific enquiry. I suppose some grand engineering scheme or other could put it under threat – pipeline or reservoir, for example, so in that sense it is valuable that special sites are assessed or at least listed and described, in this fashion.

In this volume there are many sections where inaction would be the best action, apart from raising the awareness of non-geologists. Yet there are others such as the Hughley Brook section (pp. 234–8) where some form of serious conservation could be needed. But all the report says is 'It demands the highest priority for conversation'. Like what, for example? And the Skelghyll Beck section (pp. 140–4) is itself a section at risk not because of lack of 'active conservation measures' but because of them (see Rickards, 2000). So will the listing of sites in this volume put some sections at risk because of over-enthusiastic official response? Will others which need help not get it? Possibly some form of categorization of sections could be attempted, a priority list which summarized the basic conservation needs. This volume certainly puts between two covers all the crucial Silurian sections, even though much of that information is available in other, earlier, publications, but what it doesn't do is recommend how to conserve them for future appreciation and use.

R. B. Rickards

Reference

RICKARDS, R. B. 2000. Conservation of important geological sites. *The Geological Curator* 7, 109–10.

BRADLEY, R. S. 1999. *Paleoclimatology. Reconstructing Climates of the Quaternary*, 2nd ed. International Geophysics Series, Volume 64. xv+613 pp. San Diego, London, Boston, New York, Sydney, Tokyo, Toronto: Academic Press. Price £44.95 (hard covers). ISBN 0 12 124010 X.

The growth of palaeoclimatological research has been phenomenal over the last few decades, especially the study of Quaternary climates. Raymond Bradley wrote the first edition of his now well known and acclaimed text in the early 1980s. Back then the significance of Heinrich events had not been fully recognized, AMS radiocarbon dating was in its infancy, the first carbon dioxide measurements were being made on ice cores, general circulation models were crude, and so on.

Growing recognition of the subject has resulted in an academic boom which is only appropriate to its global importance for a number of obvious reasons. However, this makes it very difficult for a single author to keep his head above the rising tide of data. Nevertheless, for a text-book type publication like this, it makes sense to have a single author who has a good grasp of the material rather than a convoy of authors which can be very hard to control. To accommodate as much as possible of the new material Bradley has had to refer to an extra 1100 or so papers and add them to the bibliography along with another 200 figures and a short list of web-based palaeoclimatology resources. There is barely a page which does not have some sort of graphic. The innumerable high-quality illustrations range from graphs and maps to black-and-white photos which have reproduced very well. Whilst the bulk of the references are pre-1997, there is a scattering of 1998 ones which is pretty good considering this edition was published in 1999.

In one sense the title of Bradley's *Paleoclimatology* is

misleading, and any would-be reader unfamiliar with the first edition needs to pay attention to the subtitle – *Reconstructing Climates of the Quaternary* – because you are not going to find out about any older palaeoclimates than those of the Quaternary. Since the book already runs to over 600 pages it is perhaps unreasonable to expect any extensive coverage of the study of older climates. The 12 chapters are thematically based and range from palaeoclimatic reconstruction and climate variation, through dating methods, ice cores, marine and non-marine evidence to documentary evidence and palaeoclimate models. No doubt some individual specialists might feel that their ‘patches’ have not been given enough attention but overall this synthesis is a remarkable achievement.

Paleoclimatology is an invaluable text, reference and starting point for both undergraduate and graduate students who have to grapple with the complexities of this important subject which is currently growing like the proverbial ‘Topsy’. I hope Bradley continues to keep abreast of developments and produces another update in due course.

Douglas Palmer

SMITH, B. J., WHALLEY, W. B. & WARKE, P. A. (eds) 1999. *Uplift, Erosion and Stability: Perspectives on Long-Term Landscape Development*. Geological Society Special Publication no. 162. x+278 pp. London, Bath: Geological Society of London. Price £65.00, US \$108.00; members’ price £30.00, US \$50.00 (hard covers). ISBN 1 86239 047 9.

In recent years the study of landscape geomorphology, geology and history has involved an increasing diversity of Earth scientists, involving geochemists, geophysicists, and oceanographers as well as the more classical morphologists and physical geologists. In large part this evolution reflects the overriding influence of plate tectonics and the interconnected effects of tectonics, uplift, and denudation on local, regional and global scales. New techniques (e.g. apatite fission track analysis) have increased our ability to quantify better such processes as uplift, and long cores in the ocean have provided new proxies by which uplift and erosion have been better documented. One only has to consider the literature of the Himalayan uplift, its effect on the monsoon climate (as well as resulting geochemical signals in the ocean) to understand the eclectic nature of the current landscape studies.

The editors have reflected this eclectic field by compiling a wide range of 20 papers, arranged (somewhat routinely, I think) by geography: four papers dealing with the British Isles, five with Mainland Europe and Scandinavia, three on Africa and the Middle East, three on Asia, three on the Americas, and one on Antarctica. Interestingly, none of the three editors is an author or co-author on any of the papers.

One problem in landscape studies is that the diversity of specialists involved (e.g. tectonophysicists, geomorphologists, geochemists, etc.) can lead to misconceptions and misuse of terms and concepts. Conrad & Saunderson, for instance, confuse ‘sediment yield’ as used by geomorphologists to quantify the rate of landscape denudation with its use by fluvial scientists to quantify the amount sediment delivery per unit area of drainage basin. Because some of the eroded sediment is stored along its way to the ocean, sediment yield of a large river basin almost always is less than the sum of the tributary rivers, a point that apparently escaped Conrad & Saunderson as well as the editors.

But a greater problem is that by grouping the papers geographically, the diversity of techniques and traditions remains non-integrated. Why not combine, for instance, the papers by Basili *et al.*, Baird & Russell, Butler & Spencer and Eriksson, all of which deal with the tectonic control of landscapes? By grouping the papers geographically, they remain a collection rather than an integrated treatment of the subject. This problem is compounded by the lack of a synthesis chapter that tells the reader what it all means. The Introduction and Background serve as an appetizer, but there is no wrap-up at the end of the 20 chapters.

For someone who wants a selection of papers discussing various landscapes around the world, using a variety of techniques, this book should be a welcome addition to the library. But for someone looking for a more comprehensive and integrative treatment of landscape development, the answer may lie elsewhere.

John D. Milliman

WHYBROW, P. J. (ed.) 2000. *Travels with the Fossil Hunters*. xvii+212 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £19.95, US \$39.95 (hard covers). ISBN 0 521 66301 6.

The varied adventures, trials and tribulations of palaeontological fieldwork, conducted largely under the auspices of the Natural History Museum, form the core of this publication, which consists of 12 individual chapters written by 10 authors. David Attenborough furnishes the reader with their first impression of the tome, with his eloquent foreword lucidly conveying the thrill and excitement of ‘first contact’, the adrenalin rush that accompanies the unearthing of a specimen new to science. Attenborough assures us that the remainder of the book will ‘take us on expeditions all over the world to find some of the most exciting and surprising fossils that anyone could wish for’ and that it will ‘conjure up that excitement, that quickening of the pulse, that the person who found ... [the fossil] ... will have felt’ (p. xi).

However, reading through this collection of recounted tales of field experiences in all manner of exotic locations, I must confess to have been left somewhat unexcited and unsurprised by many of the accounts, given this distinguished build-up. On the other hand, there are many illuminating and even enthralling passages within the text – whose pulse would not quicken whilst heroically pursuing collecting passions in the throes of civil unrest in Sierra Leone with bullets ricocheting about their heads, being whisked rapidly out of Latvia on the last train before the fall of the Soviet Union, or whilst being buzzed by Apache helicopters during the Gulf War? However, for the majority of the diaries, as raised most pointedly in the Afterword by an anonymous reviewer of the unpublished manuscript, there is a tendency for some of the accounts to read rather like antique transcripts of an eighteenth century English Cook’s Tour of the ‘dirty countries’ (as a non-PC friend of mine would call them); there is perhaps too much of the days of the Raj in the overplayed tribulations associated with the accounts of performing one’s daily ablutions.

There are, I believe, several reasons why it took me a while to warm to the text. Whilst the sections are rightly written as personal recollections of often difficult field experiences as seen through the eyes of one individual, the book appears to lack clarity as to the nature of its target audience. It has been argued that many scientists do find it difficult to write engaging prose; certainly there is little of the Bill Bryson in many of the chapters presented here, perhaps apart from the

thought-provoking rendition of Latvian fieldwork by Per Ahlberg. Was the book devised as an Indiana Jones-style travelogue of adventures to foreign lands with an incidental palaeontological content that was designed to be easily digested by Joe Public, or perhaps it was envisaged as a coffee-table recruitment tool, to further stimulate those with a passing interest in palaeontology with tales of overseas adventure and high jinks? This lack of focus arises from the dramatically different subject coverage in many of the renditions. Some chapters are indeed simple travelogues which treat the trials and tribulations of fieldwork as *A Great British Adventure*, and provide only the barest bones (pun intended) of the scientific motivation or palaeontological benefit arising from the expedition. Others, such as Chris Stringer's rendition of collecting hominid remains on The Rock, or most notably Peter Andrews' account of his Turkish excavations, are constructed along much more scientific grounds, offering much in the way of digestible science whilst still maintaining a spicing of local colour. Whilst one cannot deny that most of the chapters provide an interesting account of fieldwork in many parts of the world, the book is unwieldy due to the predominant theme of the 'Caucasian Experience' of travel in African and Asian destinations. Whilst in many lands the protagonists found themselves in life-threatening situations or caught between the horns of a cultural dilemma (do you risk an international incident if you don't eat the sheep brains?), the brevity of page constraints appear to have robbed the reader of the exhaustive, heart-pounding descriptive reality and incongruity of many of the situations.

In all, this book provides an interesting insight into some of the customs and local colour of several of the countries visited by the authors, and the often difficult logistical situations that can transpire (when you've been stopped by overbearing customs officials carrying bags of suspicious 'white powder' which were nothing more than biogenic oozes, or informed by threatening armed police that you have been responsible for cultural pillage, you can relate to some of these!). However, in the main this book fails to illuminate scientifically. Perhaps this was not the goal of the work, but without maps, a geological timescale or even many quality photographs, one is left wondering quite where this laudable tome is being pitched.

Ian Harding

MACNIOCAILL, C. & RYAN, P. D. (eds) 1999. *Continental Tectonics*. Geological Society Special Publication no. 164. x+341 pp. London, Bath: Geological Society of London. Price £75.00, US \$125.00; members' price £35.00, US \$58.00; AAPG/SEPM/GSA price £45.00, US \$75.00; hard covers. ISBN 1 86239 051 7.

With a title so broad, encompassing the activity of a huge number of Earth Scientists, some explanation is necessary. This book is a collection of 13 papers arising from a meeting at Oxford in 1997, convened to mark Professor John Dewey's 60th birthday. The participants, and the contributors to this volume, were invited friends, colleagues, and past and present graduate students of Professor Dewey, and the title *Continental Tectonics* reasonably reflects an interest they all share. The contributions are varied in both their geographical and temporal focus, with at least three papers on the Caledonides, four on metamorphic core complexes of the Mediterranean and western USA, two on extensional continental margins in Greenland and Australia, and single

contributions on the Dead Sea Fault, the Kenya Rift, the Zaskar Himalaya and the island arcs of the southwest Pacific. With such a broad range, singling out any particular papers seems invidious, and would only reflect the narrower compass of the reviewer. There are several substantial and useful contributors here, with more colour figures than is usual. The editors make a brave attempt to impose a coherent framework on these papers, grouping them into arc, collisional and extensional processes. But, in truth, the papers are linked by more than their topics. All of them show a respect and attention to geological observations, and especially to field observations, that has rather gone out of fashion. This aspect varies, from the virtuoso assimilation and synthesis of astonishing amounts of regional stratigraphic and structural information (an enterprise at which Professor Dewey excels) to arguments based on detailed interpretations of seismic reflection data. In all of them, the emphasis is on seeing patterns or identifying processes. We live in an era when, in my opinion, these more traditional geological talents have been undervalued in favour of numerical modelling and simulations. It is worth being reminded that, without people who can see things, there is nothing for anyone else to do. I found this heartening.

James Jackson

MONTANARI, A. & KOEBERL, C. 2000. *Impact Stratigraphy. The Italian Record*. Lecture Notes in Earth Sciences Series no. 93. xiii+364 pp. Berlin, Heidelberg, New York, London, Paris, Tokyo, Hong Kong: Springer-Verlag. Price DM 198.00, Ös 1446.00, SFr 171.00, £68.50, US \$110.00 (paperback). ISBN 3 540 66368 1.

With the relatively recent realization that we were hit by a large impact 65 million years ago, there has been a significant increase of interest in impacts, and a wealth of data collection. The discovery, by Alvarez and co-workers, led to much debate on the signature that impacts leave within the geological record, and many diametrically opposed views on the evidence for impact were presented. The authors have been involved in this debate from the onset, and are perfectly positioned to render a fascinating review of the historical development of the arguments. A consequence of these debates has been the rapid progress in our understanding of impact stratigraphy. I can strongly recommend this book for any new entrant into the world of impact cratering; this book provides a great introduction. The book contains useful definitions of impact terminology, which I myself would have really appreciated a few years ago. This is also an important book for all geological and university libraries. We now realise that impacts have geological, evolutionary, and economical importance, but there are still far too few impact-related texts available. I congratulate the authors on their excellent job.

The first half of the book offers a general introduction to impact cratering, and discussion of the observational evidence for impacts (for example shocked minerals, diaplectic glasses, elemental and isotope anomalies within the stratigraphic record). Several well-known events are described in detail, including the infamous Chicxulub impact. In this event, both the meteorite and target rocks were vapourized and ejected all around the world to form the K-T boundary clay. The authors describe several ejecta layers that are associated with known impact craters, for example Chesapeake Bay (USA), Popigai (Siberia), Manson (USA) and Morokweng (Africa). The authors also

discuss a few famous distal ejecta fields for which the source crater is unknown, for example the North American and Australasian strewn fields.

The second half of the book describes in detail the Umbria–Marche sequence in Central Italy where there is an almost complete stratigraphic record of the last 20 million years. A number of impact events have been identified within this sequence and are described here, including the K–T boundary layer at Gubbio where the iridium anomaly was first discovered. Through the ESF-funded IMPACT program, Koeberl has been involved in organizing an annual short course to the Umbria–Marche region. Montanari has many years' experience in this area. The result is a book that would serve as an excellent field guide to researchers, students and amateurs interested in learning how to identify impact layers within the field.

J. Morgan

ANDERSON, J. B. 1999. *Antarctic Marine Geology*. vii+298 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £70.00, US \$115.00 (hard covers). ISBN 0 521 59317 4.

I generally approach single-author books with titles like 'Geology of ...' with some suspicion, especially if the ellipsis represents a significant proportion of the Earth's surface; the chances of being treated to a display of eminence seem depressingly high. When scientists get older, there is a tendency for them to synthesize on a larger and larger scale as (it is assumed) their experience gets broader and broader. The results of such descents into generality are not always happy. For instance, J. W. Gregory's early work on the East African Rift is much better than the later series of slim papers he wrote with titles like *Geology of the Pacific Ocean*. John Anderson is the doyen of Antarctic marine geologists, a man who has traversed more of the Southern Ocean than the average wandering albatross. In the thirty-five years since his first visit, he has steadfastly stuck with his first love, produced innumerable papers and guided two rugby teams (plus reserves) of graduate students to independent careers of their own. So, how does this ambitious book measure up to the eminence test?

First impressions are good. The book is organized into six chapters, taking the reader in a logical progression from the present-day environment, through the geological history, sedimentological and geomorphological processes on the continental shelf and rise, evolution of the continental margin to a final chapter on the glacial history of the continent. Chapter 1 is a good account of the present-day glaciology, atmospheric circulation and oceanography. My main criticism of this part is that, despite the title of the first section of this chapter (Antarctica's role in the global environment), the discussion centres on the continent, with global aspects restricted to the meteorology and oceanography of the Southern Ocean. The uninformed will not be aware that Antarctica's influence spreads north of the 45th parallel and will not get a feel for the 'why?' of Antarctic science. In this, I think that Anderson falls into the trap common among Antarctic workers of regarding Antarctica as an end in itself, separate from the rest of the planet. I am sure that this is not the way that John Anderson thinks, but I was left with the feeling that this was a missed opportunity to place Antarctica firmly into a global context.

Chapter 2 is a brief account of the main structural elements of the continent and an overview of the geological

history of Antarctica from the Archaean to the Neogene. This is necessarily brief, given the area and age range covered, but it is cheering for those of us who conduct our geology onshore, gazing forlornly across the pack ice, to hear from a marine scientist who acknowledges the existence of the continent (other marine geologists, take note). Many of the references cited in this chapter are from the late 1970s to mid 1980s, and are now superseded, but this is a small criticism of a good chapter.

In the third and fourth chapters, Anderson gives a competent account of the glacial and sedimentary processes which shape the continental margin, addressing such topics as the depth of the shelf, its erosional features and progradation of the margin. These strands are drawn together in Chapter 5 (Continental margin evolution) which describes the evolution of the margin in seven regional segments, describing the geological history, tectonic setting and stratigraphy (litho, bio-, seismic and sequence) for each segment. Special topics such as ridge crest–trench collision and basin evolution are dealt with as appropriate.

The last chapter covers Antarctica's glacial history. It is the best chapter in the book, and the one that will be of the greatest interest to a general audience. Indeed, it should be compulsory reading for undergraduates, many of whom still manage to latch on to the Eurocentric Quaternary geomorphological view of four glaciations in a cold snap which has existed for only a few tens or hundreds of thousands of years. (There is a case for book burning when it comes to old textbooks in university libraries.) Anderson tells the story of the Eocene beginnings of East Antarctic glaciation, and its development into a continent-wide ice sheet very well. He gives an even-handed view of the vituperative debate on the extent of Pliocene deglaciation, and manages to convey some of the flavour of that hot (if only intermittently illuminated) argument. In short, he succeeds in doing in the last chapter what he did not do in the first – capture the excitement of the science of this unique continent. For that alone, you should buy this book. Anyone interested in Antarctic earth science should have this book, as should anyone interested in global climate changes.

Despite my small criticisms above, it is clear that Anderson passes the test I set at the start of this review. This is a work of confident maturity, rather than eminent dotage.

David Macdonald

NICHOLAS, C. J. 2000. *Exploring Geology on the Isle of Arran*. xiii+234 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £9.95, US \$17.95 (paperback). ISBN 0 521 63555 1.

Over the years countless school and college students have visited the Isle of Arran very early in their geological careers. It is not, of course, that Arran is the only place to learn field geology, but it does expose a useful range of sediments, representing many different environments, and a variety of intrusive and extrusive igneous rocks as well as metamorphosed rocks. It also plays host to a number of geological 'oddities' including fulgurites and giant myriapod trails.

Chris Nicholas has used his wealth of experience of Arran geology to compile a useful guide to the island. An opening section introduces the user to the philosophy behind the book and offers advice on equipment and safety matters of which prospective visitors should take good heed. The bulk of the book describes ten field exercises, the logistics of which are given in sufficient detail for the lone visitor to plan

and carry them out without an experienced geologist. The first five exercises introduce basic field skills, such as an examination of modern sedimentological processes whilst dabbling about in the Sannox Burn, measuring dip and strike in sedimentary units, and investigation of intrusions, metamorphic deformation and the economics of mining barytes. The later five exercises are more advanced. These are rather ingeniously presented. Although there is nothing desperately original about the basics of the exercises, they are well-dressed, with an historical twist. For example, an examination of terrestrial and marine rocks from the Carboniferous is used as a vehicle to test Cuvier's hypothesis that the apparently abrupt environmental changes seen in the sedimentary record can be explained by a series of catastrophic events, and that of Lyell which interprets the same changes as due to processes seen operating at the present day. Similarly another uses the story of Hutton's discovery of the intrusive nature of granites to examine the well-known granite/Dalradian contact in North Glen Sannox. The final section of the book provides a summary of basic field skills, such as taking compass bearings, field descriptions of each of the major rock types, structures and fossils and constructing field sketches and cross-sections, as well as a short glossary. This final section will again be particularly useful for the lone worker.

All the instructions are well thought out and accurate; for each exercise there are clear details of start and finish points (including details of bus stop locations), any special requirements and a sensible estimate of its likely duration. The objectives of each exercise are clearly stated. The basic field skills sections are again such that they can be grasped without help. Some of the information may be oversimplified; the section on fossils is rather misleading in perhaps suggesting that brachiopods are euryhaline and that bivalves are solely freshwater organisms.

The one thing that does annoy about the book is its covert intention to become a field notebook. Despite extolling the vital skills of keeping a field notebook, nowhere is such an item mentioned (not even in the lists of necessary equipment). At first thought you would expect the list of essential equipment to span from sturdy footwear, warm water-proof clothing to the merits of a tough, pocket-size field notebook, complete with hard covers, perhaps for the more affluent containing rain-resistant paper. But no such advice is available – clearly this book, small and soft-covered though it is, should serve that purpose. Indeed to that end, around 50 of the book's 234 pages are effectively blank. It seems rather astounding that having paid nearly ten pounds for a book that over 20% of it should be devoid of fact. These pages are clearly supposed to allow the reader to make their own field observations. Indeed each is neatly separated into three columns for the recording of locality details, observations and data, but few students have handwriting of a suitable size to make these much use and diligent observers will surely want more space, particularly if trying to follow the advice on the importance of field sketches. I have not tried it out in the field, but I seriously doubt the book's tolerance of even moderately testing weather conditions, and its flimsy cover's ability to be wrenched in and out of pockets or rucksacks.

All in all this is a helpful contribution to the available literature on Arran geology. This statement must, perhaps, be qualified. The geological ground of Arran has been well trodden, and most institutions have well-established routines and exercises. There are two previously published well-known and well-used excursion guides: McKerrow & Atkins

(The Geologists' Association) and MacDonald & Herriot (Geological Society of Glasgow). It will doubtless irk some experience field leaders that the exercises outlined in this book are ones which are used widely already. But what is different and novel about this book is its presentation and its user friendliness. It is quite conceivable that the book can be successfully used by the amateur or a student working alone or in small groups without the benefit of an experienced field leader. It will also be invaluable for any institutions wishing to explore Arran for the first time.

Liz Harper

HARDY, P. 1999. *The Geology of Somerset*. 223 pp. Bradford-on-Avon: Ex Libris Press. Price £9.95 (paperback). ISBN 0 948578 42 4.

The Geology of Somerset is an excellent and very well illustrated introduction to the geology of the county for amateurs and students alike. Peter Hardy's considerable expertise at explaining the geology in an interesting way without jargon has clearly been honed over his years of extramural experience at Bristol University teaching adults about geology. Teaching adults is a particularly good way of learning how to explain complex matters effectively or you do not survive in the business.

Somerset does have a wonderfully diverse geology ranging from Silurian times upwards, even if most of the rocks are Upper Palaeozoic and Mesozoic in age. As Hardy shows, it is an ideal region for learning about many aspects of the subject from agnathans, andesite and anhydrite to unconformities, uniformitarianism, the Variscan Orogeny and zinc. Historically, Somerset also has a great deal of interest with mining (minerals and coal), quarrying, peat digging, early human occupation and the work of early geologists such as William Smith.

The numerous black-and-white geological maps, derived from survey maps (with permission), are generally excellent and must have been a real labour of love on Peter Hardy's part. Leaders of field trips to the region will find them particularly useful. And there are lots of black-and-white photos of remarkably good quality (again Peter Hardy is mostly responsible) for a publication as reasonably priced as this.

My only quibble is that Peter Hardy does not mention the Geological Conservation Review or the networks of localities selected as Sites of Special Scientific Interest (SSSIs), of which there are many in the county. Hopefully his book will run to a second edition, in which he could rectify this omission.

Douglas Palmer

BHATTACHARYYA, A. & CHAKRABORTY, C. 2000. *Analysis of Sedimentary Successions. A Field Manual*. xi+408 pp. Rotterdam, Brookfield: A. A. Balkema. Price EUR 70.00, US \$70.00, £47.00 (hard covers); EUR 38.50, US \$38.50, £26.00 (paperback). ISBN 90 5809 209 7; 90 5809 227 5 (pb).

The title of this book captured my imagination and I was looking forward to a good read; I was very disappointed. Following a preamble the book is divided into four main sections. By far the largest is 'Sedimentary Succession: Its Components'. The number of pages devoted to each subset is very puzzling. For example limestones occupy 12 pages yet

paleosols occupy 65 pages. In the limestone section there are 8 pages on stromatolites and 6 on diagenetic bedding only. There is nothing here (or anywhere else) on coal or evaporites, for example. As far as these authors are concerned the main elements of a sedimentary succession are conglomerate (15 pages), sandstone (53 pages), shale (28 pages), limestone (12 pages), trace fossils (24 pages), paleosol and paleokarst (65 pages – histosols are not mentioned), event beds (26 pages) and discontinuity surface (9 pages). The chapter is illustrated with diagrams and figures of varying quality.

The third chapter (14 pages) is on paleogeographic settings. This is a thin superficial chapter mainly comprising diagrams and tables. There is nothing here on different types of basins or climate. There is no room here for lakes (which does not even appear in the index). The fourth chapter (31 pages) is on sequence stratigraphy. This is poorly written, incomplete and of little use; there are many much more useful summaries of the technique.

The final chapter is on tectonic signatures in the basin fill (12 pages). It is not clear how this poorly illustrated chapter fits in. Surely this is a place to put those superb field photos of basin fills which can be found in most publications. The appendix of 85 pages reproduces the North American Stratigraphic code. There is an incomplete index, an author index and references at the end of the main part of the book.

A book on field sedimentology is potentially to be welcomed but I cannot recommend this one.

Andrew C. Scott

HARRIS, P. M., SALLER, A. H. & SIMO, J. A. T. (eds) 1999. *Advances in Carbonate Sequence Stratigraphy: Application to Reservoirs, Outcrops, and Models*. SEPM Special Publication no. 63. v+421 pp. Tulsa: SEPM (Society for Sedimentary Geology). Price US \$105.50 (SEPM members), US \$148.00 (non-members) plus shipping and handling; hard covers. ISBN 1 56576 060 3.

Leonid Brezhnev, the former Soviet president, is attributed with having once said that 'Nothing is more practical than a good theory'. As this book clearly shows sequence stratigraphic theory, despite all its detractors, continues to be a very powerful tool.

This book arose from an SEPM research symposium held in Dallas in 1997, and maintains the high reputation of the 'red book' series. The book is a compilation of 17 papers and an index. There is an introduction by the editors which consists of a very useful historical review of the topic, as well as a concise summary of each of the following papers.

This is an attractive and well produced compilation with a large number of important and useful contributions. The book contains five sections covering platform–basin correlations (four papers), high-resolution sequence stratigraphy (four papers), cyclostratigraphy (two papers), slope and basin facies (four papers) and three papers devoted to palaeo-oceanographic factors. There is not enough space here to review each chapter but specific topics covered include a synthesis of source and reservoir prone intervals in the Paradox and Permian basins, the proposal of a new type of sequence boundary for carbonate systems, the effects of differential compaction on stratal patterns, papers on glacio-eustatic cyclostratigraphy, a synthesis of carbonate para-sequence stacking patterns through time, Bahamian slope evolution, European chalk successions, to name just some. Familiar outcrops are once again used such as the Capitan system and the Canning Basin but outcrop correlation-

and-architecture studies cover material from Ordovician to Miocene age, with additional subsurface studies of Plio-Quaternary sediments. The applied sedimentologist will find many useful papers, several addressing both important exploration and reservoir scale issues.

The standard of the papers is very high and the authors of these papers are highly respected researchers. I am sure there will be many papers in this volume which will be regularly cited and the editors are to be congratulated on delivering an important book.

A book review should try to be balanced and so far I have been very positive. What I do not get from the book is any overall sense of critical assessment. I am left with the view that the desire to reduce the stratigraphic record to fit a narrow theory is still prevalent. Leonid Brezhnev would approve. Sequence stratigraphy is a powerful tool and I am impressed that such elegant and convincing, large-scale interpretations can be made when our knowledge of carbonate process sedimentology is dependant on a very narrow range of often unsophisticated depositional models. Depositional systems, especially carbonate ones, are in fact highly complex. Perhaps the sedimentological record is so filtered that what is left can be reduced to simple models? There are not many pixels in a sequence stratigraphic image. Enough of my prejudices.

Who will need to access a copy? This book is a must for anyone involved with carbonates whether as an academic or in the oil industry. It is an essential purchase for any university library. Would I have bought a copy (and it is expensive even for SEPM members like me) if I had not had a review copy? Yes, and I will make sure copies are available in the libraries of the university and oil and gas company where I work.

Paul Wright

YOUNG, G. C. & LAURIE, J. R. (eds) 1997. *An Australian Phanerozoic Timescale*. vii + 279 pp. plus twelve biostratigraphic charts. Oxford, New York: Oxford University Press. Price £110.00 (hard cover book plus charts in box). ISBN 0 19 553951 6.

This work comprises a 279-page authoritative text accompanying a robust boxfile containing 12 biostratigraphic charts (Cambrian to Cainozoic; two on the Jurassic, and two on the Cretaceous, otherwise one on each system or time period). As I work extensively on Australian rocks, on the biostratigraphy of (mainly) Ordovician and Silurian strata, I have had many occasions during the past two years to use this volume in the course of my research, and I have to say that I have found it the very best of the genre. All biostratigraphers find themselves using other people's compilations, at least at the initial stages of a research project, and what you look for is reasonable detail, sufficient geographical coverage (enough sections in different palaeobiogeographic regions), and clarity. These charts meet the highest standards on all counts. Each chart has a thorough global correlation with the chronostratigraphy to the left, including the magnetic polarity record and Ma scale. The last column of the chronostratigraphic portion comprises the Australian Stages, and against these are plotted the biostratigraphic columns. In the case of, for example, the Ordovician table, it begins with the Victorian graptolite (bio) zones, and then effects a correlation of these with the more important zonal schemes on other continents; and follows up the graptolite biozone with the main conodont biozones. Columns 11–18 then sum-

marize trilobite occurrences (as assemblages through time), palynofloral data, corals and stromatoporoids, brachiopods, nautiloids, bivalves and rostroconchs. The final column on the Ordovician chart depicts the eustatic sea level changes (and the Australian stagnation on the left of the chart is repeated, for convenience, at the right of the chart). All the charts are to a similar format, perhaps becoming a little more detailed and comprehensive up the geological column.

If the charts are impressive and useful then so is the text. Fifty-nine pages are spent on 'Overview' dealing with many matters of principle – magnetic polarity, uses of fossils, and so on – and it is an extremely valuable read. Following this is a chapter-by-chapter account of each System, each presented by different authors, taking the form of explanatory notes to the charts. Of necessity with a concept of such breadth the bibliography (Section three) is 76 pages long. The index seems exhaustive. I return to where I began: this is the most valuable of all such compilations I have ever used and the editors are to be congratulated.

R. B. Rickards

MACLEOD, N. (ed.) 2000. *PaleoBase. Macrofossils Part 1.0. Arthropods (including Trilobites). Brachiopods, Bryozoa, Trace Fossils and Graptolites*. CD-ROM. Minimum configuration: Mac: OS 7.6, 9 Mb RAM, 640×480 pixels, ×6 CD Drive; PC: Windows 95, 98 or NT, 12 Mb RAM, 800×600 pixels, ×6 CD Drive. Copublished by Blackwell Science, The Natural History Museum and CompuStrat. Price £25.00, ISBN 0632 05641 X.

Paleobase represents what was probably an inevitable union: the old world of specimen-based fossil studies, and the new world of computers and digital information. And an impressive union it is! In a nutshell, *Paleobase* provides an easy-to-use interface (outlined in a simple but effective tutorial), well-organized and easily accessed information, and good quality photographic images.

The first instalment in the series, *Macrofossils Part 1.0*, deals with the Arthropods (including trilobites), Brachiopods, Bryozoa, Trace Fossils and Graptolites. Representative taxa are selected from each of these groups and described through both visual means, by way of pictures and labelled drawings, and with text. This accompanying text generally includes such features as short descriptions with remarks, ecological preferences, biogeographic and stratigraphic ranges, taxonomic classifications, and information on key references. Glossaries are also provided for each group, allowing for quick and easy reference to unfamiliar terminology.

Moving between different animal groups (or from one time period to another) is easily accomplished through a series of well-organized pull-down menus plus a detailed search engine, which allow the perusing pre-defined or customized lists. Pop-up windows are commonly used, which allow easy movement between and comparison of different parts of the database at the same time.

To my initial regret, none of the five taxonomic groups included in version 1.0 are dealt with in a comprehensive fashion. I was quick to learn that this is almost certainly not the point of *Paleobase*, however – that role is already filled by a myriad of other publications, such as the *Treatise of Invertebrate Paleontology*. *Paleobase* is more about providing informative working examples than exhaustive lists. Thus, I feel it will prove to be an invaluable tool for any university that teaches undergraduate-level palaeontology, especially if actual fossil specimens are few. The inclusion of 'lab

unknowns', 30 sets of photographs of unidentified taxa, will provide another impetus for palaeontology lecturers to start using *Paleobase*.

Being a Macintosh person, I was delighted to see that *Paleobase* is compatible with both Macs and Windows-based PCs. It even ran on an ancient 75 MHz Macintosh Performa, albeit rather slowly. One perhaps picky complaint I do have, however, is of a technical nature. *Paleobase* will only work with QuickTime version 2.1 (which is included on the disk), but most PC users will be running at least version 4.0. This seems to me an unfortunate oversight on someone's part – it's already difficult enough to keep up to date with software, without having to deliberately install older versions of software you are likely already running. This, however, does not take much from what is otherwise a well-put-together, highly user-friendly, informative program.

All in all, I feel that Norm MacLeod, Blackwell Science, The Natural History Museum and CompuStrat have done a delightful job on this program. Students genuinely interested in palaeontology will love it, and professors who use it in their classes and labs will no doubt consider it a welcome addition to their syllabus. It may dip only briefly into the pool of taxa known for each of the groups it covers, but it does so in an informative and educative fashion. That said, I do hope that more thorough taxonomic treatments will be made available for the groups covered in this initial version (future versions will presumably deal with different animal groups), perhaps by means of downloadable database add-ons.

Rod Taylor

SCOTT, A. C. & FREEDBERG, D. 2000. *Fossil Woods and Other Geological Specimens. The Paper Museum of Cassiano dal Pozzo*. Series B: Natural History, Part III. 424 pp. Turnhout: Brepols Publishers. Price Euros 232.00 (hard covers). ISBN 1 872501 91 5.

We view the world through the dark glasses of our prejudices and perception; observation and interpretation must be meticulously teased apart if we are to allow nature to inform us about her objective reality. Scott & Freedberg's book is an important one because it provides us with a rare pictorial glimpse of how early seventeenth century scientists perceived their world. It publishes for the first time the oldest known examples of geological field sketches and drawings of fossil wood specimens commissioned by Prince Federico Cesi (1585–1630) of Aquasparta in present-day Italy. Cesi was the founder of the Accademia dei Lincei, Europe's first truly scientific society, which boasted Galileo amongst its membership. Most of the drawings relate to the unusual discoveries Cesi made on his father's estate of gigantic fossil tree-trunks composed, not of wood, but of stone and metal. One specimen was so large that eight pairs of oxen were needed to unearth it. Cesi and his fellow Linceans proudly invented a plethora of new terms such as *petrilignum* and *metallophyta* to describe these confusing 'middle' substances that were apparently both mineral and plant but, tragically, before ideas about their origin and significance could be fleshed out in a planned series of books, in quick succession Cesi suddenly died, Galileo was put on trial for heresy, and the Academy began to dissolve. Francesco Stelluti, another Lincean, posthumously published a pale semblance of Cesi's intended work in 1637, arguing that the fossil woods had transmuted from stone through the action of the underground lignite fires that burned on Cesi's estate. The original

drawings then passed into the Paper Museum of Cassiano Dal Pozzo, an Italian patron, and were forgotten. Their true significance was only recently realized following detailed field studies in Aquasparta by Andrew Scott (Royal Holloway), which confirmed the high quality and precision of Cesi's observations, and showed that the metallophytes represented the permineralized remains of giant sub-tropical conifer forests that covered southern Europe in Pliocene times. Although quite wrong in their interpretation of the metallophytes, the Linceans' clear unbiased observations of geological phenomena remain today as valuable scientific data. It is noteworthy that the Accademia dei Lincei was one of the earliest groups to begin experimenting with new ways of seeing the world through microscopes and telescopes. Today scientists 'indwell' even more complex instruments such as particle accelerators to apprehend reality, and possessing the observational clarity of the Linceans is even more pressing. Scott & Freedberg's book will prove to be an important resource for all those interested in the history of geology, and is a must for all university libraries.

Howard J. Falcon-Lang

VERMA, P. K. (ed.) 1999. *Geological Studies in the Eastern Himalayas*. xxiii+264 pp. Published by The Editor; distributed by Pilgrim Books Pvt. Ltd. (461 Express Tower, Azadpur Commercial Complex, Delhi 110033 India). Price RS 600.00, US \$22.00, £16.00 (paperback). ISBN 81 7624 076 1.

Geological Studies in the Eastern Himalayas is a collection of 13 contributions, edited by Dr P. K. Verma of Delhi University. Authors are drawn largely from the Geological Survey of India and from geological departments of universities in eastern India.

Technically the eastern Himalaya covers that part of the orogen lying east of Nepal as far as Namche Barwa south of the Tsangpo valley which forms the eastern bastion of the range. This should include the Darjeeling area of West Bengal, Sikkim, Bhutan and Arunachal Pradesh, as well as a small part of southeast Tibet. In fact, the contributions overwhelmingly concentrate on the geology of the 500 km wide sector of the Himalaya that traverses northern Arunachal Pradesh. There are few recent publications in international journals on the geology of the Himalayas east

of Everest, and none at all, that I know of, on the geology of Arunachal Pradesh, making it by far the least studied stretch of the entire chain. This is largely a result of Indian government policy that discourages foreigners from working in the region, due both to its proximity to a sensitive border with China and to the continuing unrest in Nagaland. Thus the geographical focus of the volume provides it with particular significance for international geologists, but I do find it odd that a book on the geology of the eastern Himalaya should have only one reference to Namche Barwa (in southeast Tibet), given that the associated syntaxis is probably the most significant tectonic feature east of Everest.

The emphasis of the contributions is mostly on bedrock geology (stratigraphy, palaeontology, structures, metamorphism and petrology) although two studies of geomorphology are included. The papers vary widely in scope and style. Some read like survey reports, documenting lithologies and mineral occurrences. Others, of more interest to the international audience, are regional syntheses. Of these, I found two to be of particular significance. The first, by V. C. Thakur, is a comparison between the lithostratigraphy and structures of Eastern Nepal and those of the Himalaya further east. This makes essential reading since Eastern Nepal is the most eastern well-documented region of the Himalaya and so correlations yet further east are of particular value. The second, by M. M. Saikin, is an overview of the plate tectonic evolution of the Indo-Burman orogenic belt. This fills a gap in the knowledge of Western geologists, covering a critical region where the convergent arc of the Himalaya is terminated by major transcurrent structures that feed into the Sunda arc of the Indian Ocean. I found the information and the interpretation from both these papers to be of high quality, and likely to be of interest to a wide audience.

The book is published by Pilgrims of Kathmandu, who run the finest bookshop in the Himalaya. However, the illustrations suffer from somewhat uncritical editing. Although most line drawings are clear, a few have been reduced beyond the limits of legibility. Black-and-white photographs are poorly reproduced and the few colour plates (photomicrographs of metamorphic rocks from the Magi Hill serpentinites) have poor definition. But overall I recommend this volume to all those interested in the regional evolution of the Himalaya. It provides a compendium of virtually all that is known about the geology of the Arunachal Pradesh sector.

N. B. W. Harris