

BOOK REVIEWS

INESON, J. R. & SURLYK, F. (eds) 2003. *The Jurassic of Denmark and Greenland*. Geological Survey of Denmark and Greenland Bulletin no. 1, 948 pp. Basic price Dkr 500 + (VAT (Denmark) 25%; handling Dkr 50; postage: Europe 33% total order, North America 50% total order). Hard covers, Obtainable from: Danmarks og Grønlands Geologiske Undersøgelse (GEUS), Øster Voldgade 10, DK-1350 Copenhagen NV, Denmark. ISBN 87 7871 116 9. DOI: 10.1017/S0016756804210019

The Jurassic of Denmark and Greenland is rightly claimed by the publishers as a milestone publication from GEUS, the now combined Geological Surveys of Denmark and Greenland. It represents the first issue of the new serial publication, the *Geological Survey of Denmark and Greenland Bulletin*, which replaces the now discontinued *Geology of Denmark Survey Bulletin* and the *Geology of Greenland Survey Bulletin*. The volume is dedicated to the late Ole Winter Christensen who played a key role in uniting the Denmark and Greenland geological surveys.

This is a massive compilation, representing 15 years of research. As a book it was conceived in the early 1990s. It appears to have been geopolitically motivated to be published as a single 948-page volume, despite its rather disparate content. It weighs 3.7 kg – I have already seen a copy whose inadequate binding clearly shows signs of the overloading! This important volume is soon going to be looking very tatty on the shelves of those who will use it frequently. It would have been much better published as two separate volumes, one covering eastern Greenland and the other covering Denmark. It may also have made the editors' work easier by breaking it into more manageable chunks. This long-awaited volume has been in gestation since 1996 according to some of the original submission dates, which must have been very frustrating for authors. Clearly the editors had some headaches.

The title is a bit of a misnomer, because it implies coverage of the whole subject area. The book is really only a theme set of papers relating to the title and does not cover the subject in full. It also includes useful articles on the Jurassic of Sweden and the Netherlands. The Greenland part principally concerns East Greenland, mainly Jameson Land and Milne Land, and, apart from one strangely isolated paper on Kuhn Ø, excludes the North-East and other parts of Greenland. But perhaps it is good that the rest of Greenland was not included because it would have made the volume unliftable.

The volume is composed of an editorial review and 28 papers. It is divided into three principal sections, entitled firstly Stratigraphy, secondly Denmark, Sweden and the Netherlands, and thirdly East Greenland. Each paper has an abstract and is selectively key-worded.

'Stratigraphy' is subdivided mainly by ammonites into Early Jurassic by Page, Mid Jurassic by Callomon and Late Jurassic by Zeiss. Page's paper is very Europe-centred, and although an important biozonational summary does not involve Greenland faunas. Callomon, benefitting from much experience across the whole area of the book title, and Zeiss provide more balanced sections. Poulsen & Riding review the dinoflagellate cyst zonation of subBoreal

northwest Europe and include an appendix on oxygen isotope palaeotemperatures from the Jurassic of northwest Europe. Apart from ammonites and dinoflagellates, very little other stratigraphic data is discussed in detail. Future studies would benefit from a more integrated approach.

The Denmark, Sweden and the Netherlands section commences with an important updated and revised stratigraphic review of the onshore and offshore Danish Jurassic, by Michelsen *et al.*, and of the Netherlands by Hemgreen *et al.* The Danish Central Graben subsection is covered in papers by Japsen *et al.* on the structural framework and nomenclature of the Late Jurassic–Early Cretaceous; Møller & Rasmussen on Mid Jurassic–Early Cretaceous rifting; Andsbjerg & Dybkjæer on Jurassic sequence stratigraphy; Andsbjerg on the sedimentology and sequence stratigraphy of the Mid Jurassic Bryne and Lulu formations; Fabricius *et al.* on gamma-ray analysis of the Mid Jurassic of the Harad Field; Johannessen on sedimentology and sequence stratigraphy of Late Jurassic sandstones; and Ineson *et al.* on the Volgian–Ryazanian 'hot shales' of the Bo Member, Farsund Formation. The Danish Basin and Fennoscandian Border Zone subsection is covered by Mogensen & Korstgaard on Triassic and Jurassic transtension in the Sorgenfrei–Tornquist Zone; Nielson on Late Triassic–Jurassic development; Ahlberg *et al.* on the Jurassic of Skåne, southern Sweden; Frandsen & Surlyk on transgressive–regressive Sinemurian mudstones of Skåne; Donovan & Surlyk on the Lower Jurassic (Pliensbachian) ammonites of Bornholm, Baltic Sea; Nielsen *et al.* on the Early to Mid Jurassic of the Anholt borehole; Nielsen *et al.* on the burial depth and post-Early Cretaceous uplift of Early to Mid Jurassic based on organic maturity; and Petersen *et al.* on the depositional environments and vegetation of Early and Mid Jurassic mires.

The East Greenland section commences with Surlyk's extensive review of the Jurassic of 'East' Greenland, but extending geographically across much of North-East Greenland and stratigraphically up into the Early Cretaceous (Hauterivian). In revising the stratigraphy a large number of new lithostratigraphic names from group to member level are introduced, sadly only provisionally and will remain so until properly defined. Koppelhus & Dam examine the palynostratigraphy and palaeoenvironments of the lower part of the Neill Klint Group of Jameson Land, and Koppelhus & Hansen cover the upper part, the Sortehat Formation. Their important results indicate differences in comparison to the Boreal successions of Poulsen & Riding (above) and the BP Scheme from the North Sea, especially with regard to *Nannoceratopsis gracilis/senex* and *Luehndia spinosa*, which need further examination. Engkilde & Surlyk study the shallow-marine syn-rift sedimentation in the Mid Jurassic Pelion Formation of Jamesonland. Alsgaard *et al.* examine the Mid to Late Jurassic early syn-rift sedimentation of Kuhn Ø in North-East Greenland properly introducing several new lithostratigraphic units. Larsen *et al.* examine the stratigraphy and sedimentology of a Middle to Late Jurassic basement-onlapping shallow-marine sandstone, the Charcot Bugt Formation. Finally Larsen & Surlyk describe Late Callovian–Mid Oxfordian shelf edge delta and slope deposition in the Olympen Formation.

The presentation of the book is very clear and despite the very varied authorship it has been moulded successfully into a very uniform textural style. On the whole I find the volume generally well and precisely written and the editors are to be congratulated on achieving the results. There are many excellent colour photographs and diagrams. The colouring of the diagrams follows the style developed by the preceding bulletins, with pale to mid-range pastel colours, on which writing overlays are particularly easy to read. However, some of the field photograph descriptions would benefit from having more precise location information (e.g. on pages 696–7). There is a grating mixture of ‘Lower’ and ‘Early’ and ‘Upper’ and ‘Late’ chronostratigraphic divisions throughout the book, which would make the late Brian Harland twist in his ether. But perhaps others are at long last beginning to see his light (e.g. Zalasiewicz *et al.* 2004). Editors should also encourage the proper introduction of new formal lithostratigraphic terms and not encourage the use of unsupported new names (pp. 666–7). Another quibble is that I find it a little strange that the official subdivision of Greenland into specific areas, such as East Greenland and North-East Greenland, is frequently not followed, even by the editors of the present volume. This leads to considerable confusion. Sadly there is no index which would have been very useful in this large volume.

This book deserves to be on the bookshelf of every geologist concerned with the Jurassic of northwest Europe and Greenland and especially those concerned with the North Sea and the North Atlantic regions. It contains masses of well presented and useful information. Priced at DKr 500, it represents very good value. The GEUS advertisement at the end of the volume indicates that the forthcoming Jurassic of North-East Greenland volume is in preparation. I wonder how long we will have to wait for it? But I’m sure it will be worth the waiting.

Simon R. A. Kelly

Reference

ZALASIEWICZ, J., SMITH, A., BRENCHLEY, P., EVANS, J., KNOX, R., RILEY, N., GALE, A., GREGORY, F. J., RUSHTON, A., GIBBARD, P., HESSELBO, S., MARSHALL, J., OATES, M., RAWSON, P. & TREWIN, N. 2004. Simplifying the stratigraphy of time. *Geology* **32**, 1–4.

COLLIE, M. & DIEMER, J. (eds) 2004. *Murchison’s Wanderings in Russia. His Geological Exploration of Russia in Europe and the Ural Mountains, 1840 and 1841*. xv + 474 pp. + maps in folder. Keyworth: British Geological Survey. Price £40.00 (hard covers). ISBN 0 85272 467 5.

DOI: 10.1017/S0016756804220015

I did not think that any publisher still produced books like this, meticulously prepared with footnotes (over a thousand), appendices (with potted biographies of the extensive cast list from Czar Alexander to the Duke of Wellington), lots of illustrations (76) clearly reproduced, including half-tones and a magnificent colour reproduction of ‘Russia in Europe and the Ural Mountains Chiefly coloured from Geological Researches Conducted under the Auspices of The Emperor of All the Russias By His Imperial Majesty’s most devoted Servants Roderick Impey Murchison; M. E. de Verneuil

& Count A. V. Keyserling, assisted in the field by Lieut. Koksharof. 1845’, plus coloured sections – and all for £40.

Fortunately, the British Geological Survey has taken the plunge and done just this by publishing *Murchison’s Wanderings in Russia*. This is no vanity publishing exercise but a wonderful document which extends far beyond the underlying geological purpose and gives remarkable insight into an important aspect of the social history of earth sciences in the mid 19th century.

Whatever one might think of Murchison – politically, he was a high Tory and against reform; socially, he espoused the British and European caste system; personally, he was highly ambitious, a snob and social climber and networker *par excellence* – nevertheless he achieved great things. And some of his greatest achievements were his Russian expeditions of 1840 and 1841 recounted in his travel diaries collated as *Wanderings in Russia*.

Whilst travelling huge distances from St Petersburg to the White Sea and down the Urals to the Sea of Azov and back again, he kept a diary with a curious and wonderful mixture of facts and observations. The geological results of the work appeared as a series of papers from 1841 onwards and included the definition of a whole new system, the Permian.

Subsequently, the geological and economic information and its essential palaeontological ‘backup’ was published in the massive two-volume *Geology of Russia*, coauthored with two of his travelling companions Philippe Édouard Poulletier de Verneuil and Alexander Andreevich, Count von Keyserling and a lot of help from sundry others. Published in 1845, it is a remarkable work which is, I suspect, largely unknown and unappreciated by British geologists today. Part of the problem is that only 600 copies were printed of the English edition and, according to Michael Collie and John Diemer, over a hundred of these went to Russia. The work is probably better known by our European colleagues since the second palaeontological volume was in French and there was an abbreviated German edition published in 1848.

For Michael Collie and John Diemer, editing and preparing *Murchison’s Wanderings in Russia* must have been a considerable labour and presumably one driven, at some level, by admiration for the indefatigable Murchison. In their introduction and postscript, the editors make a strong case for a reappraisal of Murchison and his achievements. My own personal view was admittedly biased somewhat against him by what little understanding I have of the Murchison–Sedgwick Cambrian–Silurian controversy. But thanks to this book, I have had to modify my prejudices somewhat. Murchison certainly was capable of making many lifelong friends and could be surprisingly benevolent to those whom he thought deserving, presumably mediated by subtle pressures from his very capable wife Charlotte.

Still, there are some breath-taking asides ‘the peasants, I am told, would decidedly oppose their own liberation . . . and are sure of being fed by the nobility should a famine arise . . . murders are absolutely unknown.’ He has a great admiration for the toughness of the Russian horses ‘we went 100 versts in the day with the same pair of horses, paying only 30 roubles for the same, by very bad roads . . . what English horses will do that?’ And he has supreme confidence in himself: ‘I leave Russia with the desire of exploring the Eastern regions of the Empire, and of putting them into direct connection with those of the west. This is merely a work of detail. The great points are fixed, and if I could see the Ural, I should get them all in order’.

In August 1840 he finished the first round trip with a few days around St Petersburg and encounters reddish cornstones

with 'an absolute identity of structure with our Herefordshire cornstones' and full of fish scales, teeth and a kind of brachiopod (spiriferid). He concludes 'QED – The mixture of Devonian shells of Devonshire with fishes of the Highlands of Scotland demonstrates that Sedgwick and myself were right to identify the Scottish Old Red with the Devonian rocks, under the name of Devonian . . . the Devonian, based on Silurian, and overlain by Carboniferous limestone, is now completely established'.

Great stuff and a real eye opener to the personalities and working conditions during the formative decades of modern geology. The editors have done a brilliant job of placing Murchison's comments in an understandable context for the modern reader. You will learn as much social history as mid 19th century geology in *Murchison's Wanderings in Russia*.

Douglas Palmer

DILEK, Y. & ROBINSON, P. T. (eds) 2004. *Ophiolites in Earth History*. Geological Society Special Publication no. 218. vii + 717 pp. London, Bath: Geological Society of London. Price £95.00, US \$159.00; GSL/IGI members' price £47.50, US\$79.00; AAPG/SEPM/GSA/RAS members' price £57.00, US \$95.00 (hard covers). ISBN 1 86239 145 9.

DOI: 10.1017/S0016756804230011

Most oceanic crust that has been formed over the life of our planet has been subducted, removing it from direct study. This leaves us with little record of the processes operating in, and tectonic configurations of, two-thirds of the Earth's surface over most of geological time. Fortunately, some portions of oceanic crust are occasionally preserved as ophiolites. Although ophiolites probably form in a diverse range of geological settings they provide an important perspective on the chemical and tectonic evolution of the planet carrying information about features such as the timing and orientation of extension and the composition of the upper mantle beneath these past spreading ridges. However, we still have little idea how to interpret much of the information stored in them. For example, can lava geochemistry be used accurately to fingerprint the tectonic setting of formation? Or can past contamination of the mantle produce an indistinguishable geochemical signature? The main theme of this book is the use of ophiolites as aids to interpreting the history of the planet (mainly the Neoproterozoic and Phanerozoic history, so those interested in Earth's earlier history will need to look elsewhere).

The book is a series of 32 papers divided into five sections. Two deal with 'regional occurrences and geodynamics' – one focussed purely on Tethyan ophiolites and one on the rest of the world's ophiolites. These two sections between them contain well over half the papers in this book. At first sight there is a surprising paucity of papers on two of the best-known ophiolites (Troodos and Oman), but considering there have previously been many special issues dedicated simply to these two ophiolites this is not actually surprising (this issue also comes relatively soon after two Geological Society of America Special Papers concerning aspects of ophiolite genesis and history). The major advantage of this volume is that less-well-known ophiolites, from many locations around the globe, are described and interpreted. This in itself provides a useful reference point for anyone interested in global processes recorded in ophiolites and provides a broad

overview of global ophiolite occurrences, tectonic settings, field observations, geochemistry and petrology.

The other three sections of the book cover ophiolite genesis, hydrothermal and biological alteration and emplacement mechanisms. There is much similarity in the general style of papers in the 'ophiolite genesis' section to those in the 'regional occurrences and geodynamics' sections, broadening the regional coverage. Two of the four papers in the alteration section focus on the evidence from oxygen isotope studies against any secular variation in seawater oxygen isotope ratio. This section provides perhaps the best example in the book of the use of ophiolites to study Earth history in a global context – to my mind it is a shame that this section did not contain more papers along these lines. The short (3 papers) section on emplacement mechanisms is dominated by the continuation of the debate over the mechanism of obduction of the Oman ophiolite.

Unfortunately, the opportunity to compile all the data, and perhaps even the papers, presented in this volume electronically on a CD in the back cover has been missed, which is a shame – this would have provided a very useful resource. I suspect this a book that will be heavily thumbed over on library shelves by people with a wide range of interests. At a price of £95, this may not be a book people feel the need to add to their personal collections unless their specific area of interest requires a global overview of ophiolite geology.

Laurence Coogan

References

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- DILEK, Y. & NEWCOMB, S. (eds) 2003. *Ophiolite Concept and the Evolution of Geological Thought*. Geological Society of America Special Paper 373. xii + 504 pp. + map in folder. Boulder: Geological Society of America.
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- LOMAS, S. A. & JOSEPH, P. (eds) 2004. *Confined Turbidite Systems*. Geological Society Special Publication no. 222. vii + 328 pp. London, Bath: Geological Society of London. Price £85.00, US \$142.00; GSL/IGI members' price £42.50, US \$71.00; AAPG/SEPM/GSA/RAS members' price £51.00, US \$85.00 (hard covers). ISBN 1 86239 149 1.
- DOI:10.1017/S0016756804240018

The latest two special publications from the Geological Society both derive from an international workshop on Confined Turbidite Systems held in Nice (France) in September 2001. The particular focus of this workshop was the Grès d'Annot turbidite system: the subject of seminal early studies by Bouma and Stanley, and still a mecca

for turbidite sedimentologists. Faced with a total number of papers too great for a single volume, the editors have pragmatically confined those on the Grès d'Annot into one publication and allowed the residue to spill over into another.

The realization has grown over the past decade that most turbidite systems do not represent the unimpeded radial fans of earlier models. Many systems are deposited in basins with a pre-existing topography sufficient to steer density flows or confine their deposition to sub-basins within the system. Moreover, many turbidite systems are the product of contemporaneous crustal deformation, which not only uplifts sediment source areas but continually modifies the topography on which that sediment accumulates. The localization of sources, reservoirs and traps in confined basins make them optimal petroleum targets, and there is consequently a dual academic and commercial interest in the principles of confined basin formation and fill.

The Grès d'Annot volume is the more cohesive of the two, providing an up-to-date review of all aspects of the basin: structural evolution, synsedimentary tectonics, sequence stratigraphy, onlap architecture, geochemistry and seismic modelling. In most basins, some of the detail and inevitable repetition would be superfluous for many readers, but the importance of the Grès d'Annot system as an international analog makes this detail more justifiable. By contrast, the confined turbidite system volume has a more diverse collection of mostly field-based studies, some from classic basins such as Wales and Tabernas, others from less well-advertised examples such as Thrace and Adana (Turkey). This diversity might have been unsatisfactory were it not for a helpful review by the editors and for two overview papers by Arnold Bouma and Ru Smith.

Together, these volumes provide a helpful snapshot of confined basin studies, though not quite as fresh as might have been, two and a half years after the conference. Most readers interested in one volume will also want to read the other, but will be reluctant to pay £190 for the whole collection. The Geological Society's special publications already seem less good value than they once were. The Society will risk losing potential purchasers if more conferences are allowed to spawn two volumes. A solution is tighter editorial control on the lengths and submission deadlines of papers for special publications. We all gain from more concise, more timely and less costly books.

Nigel Woodcock

MIDDLETON, G. V. (ed.) 2003. *Encyclopedia of Sediments and Sedimentary Rocks*. Encyclopedia of Earth Sciences Series. xxx + 821 pp. Dordrecht, Boston, London: Kluwer. Price Euros 399, US \$390, £250 (hard covers). ISBN 1 4020 0872 4.
DOI: 10.1017/S0016756804250014

A book of this nature is always a challenge to a reviewer to find out just how comprehensive it really is. My first few hours of using this book were taken up with attempts to think of relatively obscure terms or concepts in sedimentary geology and then looking for them within the 821 pages of text. Overall I was reasonably satisfied that the subject area was well covered, although I was disappointed that neither 'jokhulhaup' nor 'sandur' seemed to have a mention when I reviewed the glacial sections, and when looking more broadly, the

terms 'palustrine', 'strandplain' and 'chenier ridge' also appeared to be absent. At first I thought that there were more omissions, as I could not find terms like 'dropstone' and 'adhesion ripple' in the index, but it transpired that the index was at fault here and mention of these topics was to be found buried in articles. It was perhaps a little unfair of me to be deliberately looking for faults from the outset, but this approach did give me an insight into the organisation of the encyclopedia and an indication of how useful it might be to the casual (or indeed, intensive) user. I was not wholly impressed with what I found.

The book is organized into approximately 250 topics about which an article has been contributed by a relevant expert. The length of each entry varies from a few paragraphs to several pages, each with references and most with cross-referencing. The references are up-to-date and well-chosen, providing the reader with a good starting point for further research. In general the articles are well written with an appropriate level of specialist terminology: there were only a couple of instances where I read an entry and felt none the wiser about the topic when I had finished it. Whilst there is a degree of uniformity of style and standard in the text, the same cannot be said of the use of diagrams, with some topics well illustrated, and others not at all. I found it disappointing to discover that there were no pictures or drawing of soft-sediment deformation structures, successions like the 'Bouma Sequence' or features such as alluvial fans. On the other hand, several spectra for bauxite were provided, which seemed to me an odd balance, but perhaps that is just my view. There is just one colour plate, used to illustrate cement fabrics.

The choice of topics for major articles is inevitably arbitrary, so there is not necessarily a logic in where information about an individual item might be found: 'Lacustrine Sedimentation' has an entry in its own right, but lagoonal sediments are to be found within the entry on 'Coastal Sedimentary Facies'. The logic of the topics for articles is not always obvious. For instance, having come across 'Neritic Carbonate Depositional Environments' I was expecting another on 'Pelagic Carbonate Depositional Environments', but in fact these are covered under two other headings 'Chalk' and 'Oceanic Sediments'. Some topics inevitably get more emphasis than others: the 'Deltas and Estuaries' section provides much more information about the first of these two important depositional environments than the second. In fact it seemed to me the spectrum of paralic (not in the index) is covered in a rather patchy way, with so little about lagoons and estuaries, although the discussion of processes and facies in 'Coastal Sedimentary Facies' is one of the better articles with some excellent illustration.

In addition to the gaps in the coverage, there is also overlap. For example, there is an article on 'Alluvial fans', followed later by one entitled 'Rivers and Alluvial Fans', and then there are separate entries for 'Meandering Channels', 'Braided Channels' and 'Anabranching Rivers'. This choice of entry titles has resulted in overlap and repetition of material. It also highlights a problem (common to encyclopedias) of partitioning of subject matter which makes it difficult to read about a general topic; unlike a reference text book, which might have a single chapter on, say, 'Glacial deposits', reading about this topic in this work involved starting with 'Glacial Sediments: Processes, Environments and Facies' and then moving on to 'Tills and Tillites' and so on using the cross-referencing system of keywords at the end of each article. This unwieldy approach generally works, though, except in the case of 'Desert Sedimentary Environments'

from which none of the obvious relevant articles are cross-referenced. For this book to work well as a source of information, the cross-referencing and the index both need to be comprehensive, and both are incomplete in their coverage.

Most of the information in this encyclopedia could be found in a series of good sedimentology text books which would provide the same ease of access to information if well-indexed. However, some of the articles are excellent summaries of a topic which might not be found in such a concise format elsewhere, for example, 'Biogenic Sedimentary Structures', and there are miscellaneous items which often only an encyclopedia can provide, such as 'Forensic Sedimentology'. It is difficult to think where else one might find a collection of short biographies of 20 famous sedimentologists, from Bagnold to Walther.

The format of this encyclopedia seems to be geared for web-based access to information. With a search engine, the order of articles and the quality of the index is largely irrelevant because keywords can provide all the links. This volume is in fact one of about a dozen similar encyclopedias from the same publisher which between them attempt to cover the whole of the Earth Sciences. All of these volumes are linked into an on-line encyclopedia of Earth Sciences, which would be a much more efficient way of accessing information than the individual hardback volumes. If the library of your institution has access on-line, then purchase of the paper version is superfluous, especially at a list price of £250. This price makes the book prohibitively expensive to most individuals, so it is likely to be only found on the bookshelves of the 200 article authors and those given copies to review. Even libraries are likely to balk at the price, especially if faced with the prospect of paying for a dozen companion volumes.

There are some good articles in this encyclopedia, and anyone who does have access to it will doubtless find it useful, but they may also be frustrated by the fact that it is not quite as comprehensive or as thorough as one might wish. Other users will probably find the on-line access a more satisfactory way of using this resource.

Gary Nichols

KLEIN, C. 2003. *The 22nd Edition of the Manual of Mineral Science*. xii + 644 pp. + CD-ROM. New York, Chichester: John Wiley & Sons. Price £38.95 (hard covers). ISBN 0 471 42767 5.
DOI: 10.1017/S0016756804260010

This is a new edition of Dana's *Manual of Mineralogy*. Cornelis Klein has extensively reorganized and revised the previous, 21st, edition published in 1993, and given the text a new name. The emphasis of the book is now very much on crystal chemistry and a crystal chemical treatment of the rock-forming minerals. The identification of rock-forming minerals by hand specimen study is also covered in considerable detail. Professor Klein comments in the preface that the revisions have been undertaken in an attempt to reflect recent changes in the emphasis of many undergraduate geology courses, where the mineralogy component tends to be a one-semester course that concentrates on the chemical and crystal chemical aspects of the subject.

The first part of the book, comprising seven chapters, is significantly reorganized compared to the previous edition.

The first chapter has a brief section that sets the subject of mineralogy in the broader context of geological science and gives a good, brief summary of the history of mineralogy. The second chapter deals with the physical properties of minerals in the hand specimen and covers hardness, fracture, cleavage density, etc. The elements of crystal chemistry are introduced in Chapter 3 and cover atomic structure, bonding, coordination and simple crystal structures. Topics such as solid solution and the graphical representation of compositional space are also introduced. Chapter 4 covers topics related to mineral reactions, stability and behaviour and includes a very good section on stability diagrams. In many ways this chapter is the heart of the book and covers topics such as polymorphism, polytypism, exsolution, defect structures, and the origin of colour in minerals. The basics of crystallography are now introduced in Chapter 5, and a more detailed discussion of point groups and space group symmetry is given in Chapter 6. These topics were dealt with in the second and third chapters of previous edition. Analytical methods in mineral sciences including a concise treatment of mineral optics are covered in Chapter 7. Other analytical methods introduced include X-ray diffraction and transmission electron microscopy, and a short section on atomic force microscopy has been included.

The second part of the book consists of a series of chapters containing descriptions of common non-silicate and silicate minerals. The minerals are grouped chemically and there are three non-silicate chapters, each including an extended introductory section reviewing the main points of the crystal chemistry of the group.

The volume comes with a CD-ROM containing four tutorial modules. These are easy to use, well constructed, and their content reflects the focus of the new edition on the crystal chemistry of rock-forming minerals. Overall this is a very good textbook that will serve students both as an introductory text and as a useful reference book in their future careers as geologists.

Allan Pring

BRUNSDEN, D. (ed.) 2003. *The Official Guide to the Jurassic Coast. Dorset and East Devon's World Heritage Coast. A Walk through Time*. 64 pp. + fold-out map. Wareham: Coastal Publishing. Obtainable by mail order from <<http://www.jurassiccoast.com/>> or direct from the World Heritage Team at Dorset County Council, County Hall, Dorchester, DT1 1XJ for £7.00. Price £4.95 (paper back). ISBN 0 9544845 0 9.
DOI: 10.1017/S0016756804270017

So now the East Devon and Dorset Coast ranks alongside the Grand Canyon, the Great Barrier Reef, the Taj Mahal and the Great Wall of China. This is an area not just of striking topography, but of very great historical interest because of the wealth of geological information which it has generated from the days of Mary Anning's discoveries right up to today. For these reasons this 155 km of coastline from Exmouth to Studland Bay was proposed to UNESCO as a World Heritage Site and culminated in the area being formally designated on 13 December 2001 as the Dorset and East Devon World Heritage Coast. Although popularly termed the 'Jurassic Coast', major contributions to the geology are made also by Triassic rocks which form the spectacular red

sandstone cliffs of the south Devon coast, and Cretaceous rocks, including the Chalk and Upper Greensand, which overlie a major unconformity across the whole area. All have suffered strong Tertiary deformation followed by erosion to give the spectacular present-day geomorphological features.

This booklet is an excellent visual introduction to the Jurassic Coast and is a high quality geo-tourist guide. It explains the concept of a World Heritage Site and why the South Devon and Dorset coasts are so important. It takes the reader from Triassic through Tertiary time explaining the geological events which have controlled the formation of the rocks, the fossils contained in them, the geological structures and the geomorphology now exposed. It then gives an account of sites from west to east, which broadly stratigraphically goes from the older Triassic rocks in the west through Jurassic to Cretaceous rocks in the east, including such classic sites such as Beer, Lyme Regis, Charmouth, Bridport, Portland, Lulworth Cove and Ballard Head. It is well illustrated throughout by full colour photographs, supplemented by diagrams of interesting features such as geological cross-sections and modern reconstructions with well written supporting text. The photographs are often very striking, particularly some of the aerial obliques taken in unusual lighting conditions. Historical studies include illustrations and notes on some of the important people who have contributed to the geological knowledge of the area. It is not just the natural features of the Jurassic Coast which are important, but also the historical and current commercial exploitation by quarrying, particularly in the isles Portland and Purbeck which have contributed much to geological knowledge. Remarkably, within the heritage site under east Purbeck is situated western Europe's largest onshore oilfield, the carefully managed Wytch Farm site, operated by BP. It is a great pity that the sprawling caravan sites which are an eyesore at many points along the Jurassic Coast are not as well camouflaged as this area of massive current industrial exploitation. The volume finishes with a useful list of Coastal Visitor Centres, Tourist Information Centres and appropriate museums, other attractions and useful contacts with telephone numbers and web addresses.

I have few quibbles with this generally well polished volume, but I would reverse the order of the key on page 12 so that the Cretaceous lies on top of the older rocks. The limestone found around Osmington Mills is the Corallian, not Cornbrash, and the rocks beneath the Lias/Mercia Mudstone Group are certainly not Bridport Sands (p. 53). Perhaps I would add a page of four simplified palaeogeographies of the British Isles showing the changing coastlines of the last 250 million years. It is a pity that the foldout map of the east Devon and Dorset coast is not very inspiring, being typical of the type handed out by tourist offices, showing main roads, railways and honey pots. A geological caricature map, but carrying the same general information, would have been much more interesting and could be sold separately too as a poster.

This booklet targets the informed member of the general public. It is just the sort which I would recommend to my non-geological friends to explain why I find the 'Jurassic Coast' such a fascinating area. It is an ideal lightweight addition for the rucksack when walking the coastal footpath. Clearly the designation as a World Heritage Site is going to bring the dubious advantage of a great influx of newly inspired visitors to tramp the coast. But well written volumes such as this will help bring better understanding to the general public of the geological events leading to the creation of this, the jewel in the geological crown of the English south coast.

Simon R. A. Kelly

LEE, W. H. K., KANAMORI, H., JENNINGS, P. C. & KISSLINGER, C. (eds) 2002. *International Handbook of Earthquake & Engineering Seismology, Part A*. International Geophysics Series Volume 81A. xliii + 933 pp. + CD-ROM. Amsterdam, Boston, London, New York: Academic Press (Elsevier Science) in conjunction with the International Association of Seismology and Physics of the Earth's Interior (IASPEI). Price £100.00 (hard covers). ISBN 0 12 440652 1. DOI: 10.1017/S0016756804280013

Putting 3.6 kg on the scales and with the stated ambition to 'summarise our present knowledge about earthquake and engineering seismology as whole [in conjunction with Part B]' the *International Handbook of Earthquake & Engineering Seismology, Part A* is a weighty tome indeed. The *Handbook* is the outcome of a project by IASPEI (International Association of Seismology and Physics of the Earth's Interior) and the International Association of Earthquake Engineering. The present volume concentrates on earthquake seismology, with forays into related topics such as controlled source seismology and plate tectonics; engineering issues are largely confined to Part B.

Each of the book's 56 sections, mostly 10–15 pages long, has been written by well-known experts in the various sub-disciplines of seismology. These sections are grouped into seven major chapters. The first chapter provides an historical overview and sets the context for much of seismological research by an extended introduction to plate tectonics. The second chapter introduces concepts of theoretical seismology. Topics span from the classic theories of elasticity and wave propagation over the physics of earthquakes to the more general issues of probabilistic inverse theory and complexity in earthquake distributions. The chapter on observational seismology begins with a discussion of seismic instrumentation. Sections on seismic signals and noise are interspersed with ones focusing on processing techniques. These techniques are put to use in a number of specific applications (volcano seismology, test ban monitoring, marine seismology) and a case study. Wider context is provided by the chapter on 'Earthquake Geology and Mechanics'. The articles in this chapter nicely demonstrate how the interaction between geology and seismology works in both ways, with geology providing answers to seismological questions in fields such as palaeoseismology, and with seismology helping to answer geological questions, for example in continental tectonics. Concepts of earthquake mechanics introduced in the theory chapter are explored in more detail and with reference to empirical observations. The penultimate chapter describes the 'Seismicity of the Earth' through both explanatory essays and extensive lists of earthquakes (reproduced partly within the book and partly available on the accompanying CD). The last chapter is concerned with the Earth's structure, with one section providing a general overview with a focus on mantle structure, and sections on the core, continental crust, and oceanic crust. Again, the articles present a mixture of technique-oriented (anisotropy and seismic tomography) and more descriptive essays (on gross Earth structure with a focus on the mantle, the core, and continental and oceanic crust).

Most articles were written specifically for this volume, some are adapted from previously published works, and in only a few cases have older articles, mostly of historical orientation, been reproduced more or less verbatim. Not surprisingly with 82 contributing authors, there is a large variability in style and expected level of prior knowledge. But unlike most collections of articles by many different

authors, this book really is more than the sum of its parts, and largely achieves its ambition of providing a comprehensive seismological reference. Most articles are written with great clarity, effectively introduce (seismologically literate) non-experts to the most important concepts within some sub-field, and point to the relevant literature if a more detailed treatment were needed. Clearly not designed for front-to-back reading, the usefulness as a reference work is greatly enhanced by cross-references between articles and the presence of an index, which unfortunately does not cover the second volume of the *Handbook*. Inevitably, there are some topics missing (e.g. intraplate and deep earthquakes, advances in earthquake location), as acknowledged in the preface by the editors; for others one would have wished for a little more detail; but these are minor shortcomings, and in any case the wish-list for more detailed treatment would probably look different for every potential user.

In conclusion, I can wholeheartedly recommend this volume, and in fact I already find myself frequently looking up one fact or technique or another in my daily work. Although the cost of the book is low for its size and content thanks to editors and contributors foregoing royalties, it is still high in absolute terms, and thus probably beyond the budget of many students and junior researchers. It is, however, a must for every Earth Science library and a worthwhile investment for every practitioner.

Frederik Tilmann

GUEST, J., COLE, P., DUNCAN, A. & CHESTER, D. 2003. *Volcanoes of Southern Italy*. Earth in View Series. ix + 284 pp. London, Bath: Geological Society of London. Price £65.00 (paperback). ISBN 1 86239 138 6. DOI:10.1017/S001675680429001X

Southern Italy is a wonderful place to study volcanic processes and volcanic environments. There are well-known active volcanoes such as Vesuvius, Stromboli, Vulcano and Etna, and other, perhaps less familiar, ones such as those of the Campanian Province, several of the Aeolian Islands and a few volcanic islands in the Strait of Sicily. The volcanoes of southern Italy are most notable for the long historical record of their activity, the AD 79 eruption of Vesuvius being the first volcanic eruption ever to be described in detail. Their presence has always had a direct effect on the cultural and social life of the region. Famous archaeological sites provide insight into the human history of those living around the volcanoes, which has been closely entwined with volcanic activity and, in many places, has been severely influenced by devastating eruptions. Because of their majestic beauty, varied geology and spectacular eruptions, the volcanoes of southern Italy are also major tourist attractions. With a wide range in the type of eruptive activity from one volcano to another, they provide a unique opportunity to observe most of the known volcanic phenomena within a rather small geographical area. As a result, southern Italy is a popular area for student field trips, and for many professional geologists, volcanologists and tourists, with a keen interest in geology and archaeology, who visit the region each year.

Prepared especially with those in mind visiting the volcanoes of the region, but of great interest to students, amateur and professional Earth scientists as well, *Volcanoes of Southern Italy* profiles seventeen volcanoes and volcanic islands in southern Italy, nine of which have been active in historical time. Categorized by volcanic regions, the book outlines the principal characteristics of each volcano, its

volcanic history, types of eruption, the materials erupted and volcanic hazards. *Volcanoes of Southern Italy* opens with an introductory chapter that presents the geography and geodynamic environment of southern Italy and an overview of the volcanoes and their type of activity, along with descriptions of some key scientists and their ideas developed from studies of these volcanoes, the history of civilization, and associated volcanic hazards. The rest of the book is divided into a series of chapters devoted to individual volcanic regions or islands. Every entry is accompanied by a geological map, photographs and diagrams illustrating chemical compositions of rocks erupted from each of the volcanoes. Informative sections list a few field locations to be visited in the area and provide background on research conducted by other volcanologists. In a final chapter, the authors undertake a view into the future, addressing topics such as future eruptive activity, eruption prediction, risk mitigation and monitoring of the Italian volcanoes. An appendix illustrates the diversity of rock compositions and a series of colour photoplates of the volcanoes covered in the book. Readers less familiar with the terminology used in the book will find it helpful to refer to the glossary of geological terms. For those who want to learn more about specific aspects of the volcanoes of southern Italy, the book offers a timely and comprehensive bibliography.

Written and illustrated by highly experienced volcanologists, the book's strength is the fascinating and informative geological summaries provided for each of the volcanoes. John Guest and his co-authors Paul Cole, Angus Duncan and David Chester have brought together a very readable and enjoyable account of the volcanoes of southern Italy and have successfully achieved the rather difficult goal of providing a wide background for non-specialists, students and professional geologists. Because of their hazard potential and eruptive activity, some volcanoes including Vesuvius, Stromboli and, perhaps not surprisingly, Etna are presented in slightly more detail than others, but on the whole due weight is given to each volcanic centre. Those familiar with the area will find dipping into this book a pleasant experience and may become easily engrossed in finding out more about the volcanoes they personally know and other volcanoes of the region. The book should appeal equally to those with a geological or an archaeological background. It would be quite suitable for preparing an undergraduate or graduate-level field excursion to the area, and is essential reading for everybody planning a trip to the volcanoes of southern Italy.

Ralf Gertisser

KOEBERL, C. & MARTÍNEZ-RUIZ, F. (eds) 2003. *Impact Markers in the Stratigraphic Record*. Impact Studies Series. xvi + 347 pp. Berlin, Heidelberg, New York: Springer-Verlag. Price Euros 89.95 (+ VAT at local rate), SFr 149.50, £69.00, US \$99.00 (hard covers). ISBN 3 540 00630 3.

DYPVIK, H., BURCHELL, M. & CLAEYS, P. (eds) 2003. *Cratering in Marine Environments and on Ice*. Impact Studies Series. xv + 340 pp. Berlin, Heidelberg, New York: Springer-Verlag. Price Euros 79.95 (+ VAT at local rate), SFr 133.00, £61.50, US \$109.00 (hard covers). ISBN 3 540 40668 9. DOI: 10.1017/S0016756804300014

Half a century ago, scientists argued vehemently as to whether or not certain circular structures on the Earth's surface

were, in fact, the result of asteroidal or cometary impact. Today, impact studies are an established, highly specialized branch of planetary science, and arguments have moved well beyond those of simple recognition. As our understanding of impact processes improves, subtle differences emerge that enable us to characterize impacts that took place on former continental shelves, where water played an important role, to impacts on other volatile-rich target materials, including ice. Recognizing impact ejecta (both distal and proximal) in the stratigraphic record provides important time markers. In some cases, impact events have been recognized from regionally extensive or globally distributed ejecta, even though, as in the case of the Australasian tektite strewnfield for example, no impact site has yet been recognized.

From the interdisciplinary scientific programme 'Response of the Earth System to Impact Processes' (IMPACT) supported by the European Science Foundation (ESF) come two more volumes: *Impact Markers in the Stratigraphic Record* and *Cratering in Marine Environments and on Ice*. The ESF IMPACT Programme was directed at understanding meteorite impact processes, and their effects on Earth.

The sixth ESF IMPACT workshop 'Impact markers in the stratigraphic record' was held in Granada (Spain) in May 2001. The resulting publication (edited by Christian Koeberl and Francisca Martínez-Ruiz) contains fourteen peer-reviewed papers. Introducing the volume, Koeberl & Martínez-Ruiz provide a broad overview of the stratigraphic record of impact events. In one of their two contributions, King & Petruny note, importantly, that both North American and International Commissions on Stratigraphic Classification (Nomenclature) do not consider impact-related horizons, and they make recommendations as to how this oversight can be remedied. This paper alone should be read by all geologists involved in stratigraphic nomenclature. The third review, by Muñoz-Espadas *et al.*, covers the main geochemical signatures related to meteorite impacts with an evaluation of their usage. Such signatures can be used to identify impact structures, and to infer impactor types.

The remainder of the volume is taken up with more specific contributions. Jones *et al.* tackle the controversial subject of a possible relationship between giant impact and the generation of volcanism. Shuvalov models impact cratering to understand the excavation flow and expansion of ejecta through the atmosphere. Masaitis describes the lithology and distribution of proximal ejecta formed during the last stages of the excavation of the Popigai (35 Ma) impact crater, Siberia. Two papers on the Boltysh crater in the Ukraine analyse the proximal ejecta (Valter & Plotnikova), and provide a detailed study (Gurov *et al.*) of the extensive (6500 km²) ejecta blanket. Dating gives an age of 65.17 ± 0.64 Ma placing the event coincident with, or just a few thousand years off, the K–T boundary, and raises the intriguing possibility that Chicxulub was just the largest of several coeval events. King & Petruny provide new data on the stratigraphy and sedimentology of proximal K–T deposits at Albion Island, Belize. Griscom *et al.* apply Electron-Spin-Resonance of Mn²⁺ and SO³⁺ to proximal and distal K–T boundary ejecta. Reimold & Koeberl analyse a drill core from the edge of the Morokweng impact structure, and suggest a maximum diameter of 70–80 km for this structure. The stratigraphy, palaeomagnetism and palynology of the Carlton Heights section of the Permian–Triassic boundary (~253 Ma) in South Africa are examined by Schwandt *et al.* A search for a meteoritic (iridium) component in the Alamo Breccia (Nevada) by Koeberl *et al.* provides ambiguous results. Although shocked quartz in the deposit is proof of

an impact origin, iridium levels do not clearly indicate an extraterrestrial component. Finally, Suuroja *et al.* describe the Ordovician (~475 Ma) Osmussaara Breccia covering an area of 5000 km² in Estonia. This breccia cannot be linked with any known impact structure, and the authors suggest it resulted from a palaeo-earthquake.

Another ESF workshop entitled 'Submarine craters and ejecta–crater correlation' with a special session on 'Icy impacts and icy targets' was held at Svalbard, Norway, in August/September, 2001. The resultant publication (edited by Henning Dypvik, Philippe Claeys and Mark Burchell) entitled *Cratering in Marine Environments and on Ice* contains sixteen contributions, including two (Vadja *et al.*, and Pesonen *et al.*) that were incorporated from the 9th ESF IMPACT meeting in October, 2002.

After the editors provide a short review of impact into marine or icy environments, papers are divided into three sections dealing with 'Marine impacts and ejecta', 'Icy impacts and icy impactors', and the application of 'Methods' to particular crater features. Two papers on the marine Mjøltnir impact crater in the Barents Sea, explore the proximal erosional features (Tsikalas & Faleide), and the biotic response to the event (Merethe *et al.*). Vadja *et al.* examine the global effects of the Chicxulub impact on vegetation, from the palynological record of the K–T boundary in New Zealand. Suuroja & Suuroja give a detailed account of the Neugrund marine impact structure in the Gulf of Finland. The structure-filling sediments in the Wetumpka structure, Alabama, are described by King *et al.*, and may be characteristic of resurge resulting from marine impacts. The enigmatic Krk breccia in the eastern Adriatic sea (Marjanac *et al.*) may be interpreted as an impact crater fill created by collapse and fallback, but the lack of shock metamorphic features means that this remains a hypothesis only. Pálffy considers whether the Puchezh–Katunki (80 km) impact triggered an extinction, while Mader *et al.* search for a possible signature of the mid-Miocene Ries impact in the marly limestones of the Cònero Riviera, Ancona, Italy.

In the 'Icy impacts and icy impactors' section, Lorenz speculates that Titan, one of the satellites of Saturn, may offer an unprecedented opportunity to study impact processes into ice and liquid-rich surfaces. Burchell *et al.* estimate crater sizes for impacts on small icy bodies, while Leliwa-Kopystynski & Burchell consider impact cratering of icy and rocky targets. As part of the current discussion on the possible existence of life elsewhere in the Solar System, Mann *et al.* study the survivability of bacteria in hypervelocity impacts on ice.

In the last section on 'Methods', Pesonen *et al.* measure the palaeomagnetism and the ⁴⁰Ar–³⁹Ar age of impactites from the Ilyinets structure in the Ukraine. Gucsik *et al.* compare experimentally shocked zircons with naturally shocked zircons from the Ries crater. Finally, Pierazzo & Collins provide a guide to the basic principles of hydrocode modelling of impacts.

All of the volumes from the ESF IMPACT Programme are never far from my reach, and they are a constant source of reference. As one would expect from science distilled from intense debate, these volumes are a rich source of information. Sadly, they lack indexes which makes finding details time consuming. A series index would be the ideal solution to the problem, but is now, with the end of the IMPACT Programme in late 2003, probably not feasible. Nevertheless, I can recommend both of these volumes as essential reading not only to impact researchers, but also to the wider geological community.

Alex Bevan

WILLIAMS, D. M. & FOREY, P. L. (eds) 2004. *Milestones in Systematics*. The Systematics Association Special Volume Series 67. xvii + 290 pp. Boca Raton, London, New York, Washington D.C.: CRC Press (Taylor & Francis) for the Systematics Association. Price £60.99 (hard covers). ISBN 0 415 28032 X. DOI: 10.1017/S0016756804310010

Biological systematics, a field of endeavour that was widely considered (following the rise of cladistics) either parochial or potentially seriously misleading a mere three decades ago, has become one of the mainstays of biological research. As a junior researcher who was witness to the vitriolic debates of the 1970s, the transformation in terms of the relevance and practice of systematics in my area of palaeobiology is genuinely dramatic.

Milestones represents a deliberate attempt by the systematics community to set time aside to review developments and progress in biological systematics. It arose from a symposium on this topic (organized by Williams and Forey) at which participants were specifically selected because they could be considered to have had first-hand experience in the changes in systematic practice during the last third of the twentieth century. Strictly personally, I consider this to be a timely publication and one that naturally attracted my eye. My only concern was to establish the degree to which such high-sounding aims might have been achieved. As we all know from experience multi-authored volumes, such as this, can be rather patchy or idiosyncratic in their content.

The essence of this volume is of necessity one that encourages historic and therefore philosophical perspectives throughout and the authors are to be congratulated on maintaining, at varying levels, this approach; equally the editors are to be congratulated for providing a reasonably logical flow in the ordering of the chapter contributions. Winsor sets up the volume nicely by examining the tension between influential individuals' perceptions of history and philosophy by effectively debunking the historical perspectives within the published work of both Sneath and Mayr – this was both amusing and a very refreshing kick up the 'a posteriori'. There is a very sound lesson to be learned here. This is followed by [Joe] Cain's reassessment of the historical events that led up to the formation and early development of the Society for Systematic Zoology. In all it is a far more closely argued historical account that focuses on political infighting and ultimately political influence; this was a bit too parochial for my taste, but perhaps not others'.

Walter Bock produced a short and neat encapsulation of the problems associated with generating a putative phylogeny and then trying to interpret that phylogeny as a series of historical events, and the philosophical pitfalls that abound when such 'historical narratives' are attempted (Popper looms!). Popper becomes heavily present in the overview provided by Olivier Rieppel who dissects, as rigorously as he can, the logic and inherent philosophy that underpins the use of systematics as a method for revealing the underlying truth behind our theories of relationship; this can be heavy going, but is a worthwhile read simply because it is an exercise that attempts to exorcise a number of logical and terminological demons that we all wrestle with both consciously and unconsciously while actually practising our own systematics. We then enter into more restrictive considerations of the application of Hennigian systematics to pattern construction and the question of evolutionary resolution through contributions from Wägele and Nelson.

Peter Forey provides a compact overview of the influence and perceived importance of fossils in systematics and phylogeny reconstruction: how the influence has waxed, waned and waxed again in new guises; and, how the approaches to systematics have played a major role in the reassessment of the role of fossils (dismissed so cursorily by Darwin, admittedly in the face of a fairly pathetic fossil record). There then follows a little historical anecdote by A. W. F. Edwards concerning the early development of statistical programs for use on laborious mainframes that preceded the rise of powerful personal computers and software.

The last three chapters provide overviews of conceptual issues (homology and analogy) by David Williams; key events in the development of a refined (but still deeply complex and contradictory) historical biogeography by Colin Humphries; and finally a short review of the way in which systematics and developmental biology emerged in a form of synergy, diverged radically only to re-merge in the latter decades of the last century (Peter Holland).

All in all this book, though perhaps not an absolute 'must have' to all practising systematists, is nevertheless an important and (generally) well-presented volume. There is a higher percentage of interesting contributions than is often the case with such volumes, and the book is undoubtedly fastidiously edited and both editors are to be congratulated. I would definitely buy it, and would recommend it to others; it is however (depressingly) expensive for what it is (basically a set of review articles) and is therefore something that will probably need to be 'recommended' onto library shelves rather than purchased individually. My copy has the text not centrally framed on each page, so the words always feel like they are slipping off the bottom (I hope that is the penalty I pay for having a review copy!).

David Norman

RUDWICK, M. J. S. 2004. *The New Science of Geology. Studies in the Earth Sciences in the Age of Revolution*. Variorum Collected Studies Series CS 789. xvii + 336 pp. Aldershot: Ashgate. Price £59.50 (hard covers). ISBN 0 86078 958 6. DOI: 10.1017/S0016756804320017

For any one interested in the history of science, Ashgate's Variorum Series is invaluable. For earth science history we have already had David Oldroyd's *Studies in the History of Mineralogy and Geology*, Hugh Torrens's *The Practices of British Geology, 1750–1850* and now Martin Rudwick's collected *Studies in the Earth Sciences in the Age of Revolution* under the general title of *The New Science of Geology*.

Professor Rudwick's career has taken him from palaeobiological studies of brachiopods and the question of Precambrian glaciation into a wide range of geological and palaeontological topics within the history of earth sciences, and this collection covers over 30 years of his publications. Historians of science seem to publish their work in a wide range of journals and books which can be very difficult for the general reader to access. So this collection will be especially useful for those who do not have access to a specialist history of science library taking journals such as *Minerva*, *Earth Science History* and *Archives of Natural History*, let alone numerous books from publishers all over the world.

Rudwick writes that his criteria in making this selection was threefold. Firstly, there is a focus on 'the age of

revolution' from the late 18th to early 19th centuries on what 'political historians often call "the age of revolution"'; secondly they deal with 'the area of natural knowledge that at just this time was being transformed into the science of "geology"' and thirdly they are articles which Martin Rudwick feels have 'stood the test of time, in that they continue to be cited by historians and geologists . . .'

The breadth of Rudwick's historical research is considerable, ranging across much of the subject matter of late 18th and early 19th century science from minerals and fossils, questions of geological time, glacial theory, the Devonian controversy to the contributions of major French naturalists, especially Cuvier. So there is something here for everybody. My own favourite is his 1976 paper 'The emergence of a visual language for geological science 1760–1840', which was a groundbreaking contribution. Fortunately, Ashgate have gone to considerable trouble to make sure that the illustrations have been properly reproduced. Apart from anything else Rudwick reminds us of the wealth of superb visual material that was produced in the period and which is now almost totally inaccessible except to historians of science. Rudwick went on to make another wonderful selection available through his book *Scenes from Deep Time: Early Pictorial Representations of the Prehistoric World* (Chicago, 1992).

Hopefully, the provision of readily accessible research papers such as these will encourage the ever increasing numbers of writers dabbling in the history of science to do their homework a bit more thoroughly in the future. My copy is already well thumbed.

Douglas Palmer

DRUITT, T. H. & KOKELAAR, B. P. (eds) 2002. *The Eruption of Soufrière Hills Volcano, Montserrat, from 1995 to 1999*. Geological Society Memoir no. 21. xv + 645 pp. London, Bath: Geological Society of London. Price £140.00, US \$234.00; members' price £70.00, US \$117.00; AAPG members' price £84.00, US \$141.00 (hard covers). ISBN 1 86239 098 3. DOI: 10.1017/S0016756804330013

Volcanology is still a young science, and each significant observed volcanic eruption tends to surprise us with unexpected phenomena that revolutionize understanding. In 1980 Mount St Helens taught us that sides of volcanoes collapse, generating debris avalanches and explosive lateral blasts. In 1991 Mount Pinatubo surprised us with pyroclastic density currents from remobilized hot deposits, and taught us much about the effects of aerosols on climate and how to manage protracted lahar hazards. Kilauea showed us that thick basalt lavas inflate from within rather than flood catastrophically across the landscape. Each eruption spawned a surge of multi-disciplinary research, and it has become a volcanological tradition to compile a thick volume of research papers in the aftermath. The resultant volumes are destined to become classics as they provide a superb archive of eruptive phenomena and their consequences. A high standard set by the volume on Mount St Helens (Lipman & Mullineaux, 1981) was exceeded by subsequent volumes (Newhall & Punongbayan, 1996; Heliker, Swanson & Takahashi, 2003). The latest volume in this tradition is *The Eruption of Soufrière Hills Volcano, from 1995 to 1999*. It is a magnificent volume of 30 cross-referenced research papers

that documents the first four years of an ongoing, protracted andesite eruption on a small Caribbean island.

Initial background and overviews of the eruption and the research effort are wonderfully illustrated with a gallery of dramatic 'before, during, and after' photographs. Twenty papers, several with a bewildering number of authors, variously describe and model andesite dome growth, block-and-ash flows, pumiceous pyroclastic density currents, Vulcanian explosions, sector collapse and tephra fallout, drawing on observations and deposit interpretation. These are followed by six papers on geophysical and gas studies. Amongst the highlights are insights into the interactions between magma conduit flow, degassing, dome pressurization, fragmentation and eruption dynamics, for example during sub-Plinian and Vulcanian explosions. As experience grew, the observatory volcanologists were able to predict activity on a daily basis. Fascinating eye-witness accounts provide perspectives from the community trying to live with an active volcano. The tiny island of Montserrat offered limited space to evacuate to, and this led to attention focussing upon ever-changing micro-zonation of the hazard maps. Important lessons were learned about interactions between volcanologists, civil authorities and the resident community.

The Soufrière Hills memoir is well presented in large format, with nicely crafted maps, logs, diagrams and numerous instructive, carefully chosen colour photos of eruptive phenomena and pristine deposits. The overall effect makes for fascinating browsing for anyone interested in volcanoes. However, the main value lies in the detailed documentation and interpretation of events, observations and measurements, by over 50 authors. This will have far-reaching international impact. Readers interested in petrological and geochemical aspects of the eruption should consult the August 2003 thematic issue on the eruption in *Journal of Petrology*, volume 44. I expect I shall see the memoir on the bookshelves of many volcanologists, but at £140 it will be too expensive for students and, sadly, many professional volcanologists in developing countries. All serious libraries should stock it, as it will be a valuable reference work for many years to come.

The eruption continues . . .

Mike Branney

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This revised edition of a popular textbook aims to provide a 'thorough introduction to the subject in its widest sense'

for first-year undergraduates and beyond. It is relatively slim at 296 pages, yet quietly conveys both the importance of chemistry to the understanding of looming environmental crises and the multidisciplinary basis of environmental science. The careful incorporation of organic chemistry and the recurrent emphasis on microbial mediation are significant strengths which highlight the latter. It remains one of the best environmental *science* textbooks available.

The book has a simple but logical structure, being divided into seven chapters, the four most substantive dealing with atmosphere, continental solids, continental waters and the oceans. These are preceded by a short introduction and an 'environmental chemist's toolbox', and followed by an integrative chapter on global change. The toolbox will be very useful for the many students who lack a strong chemical background and is supplemented by the use of text boxes that explain relevant chemical concepts without disrupting the flow for those who do not need them. Each chapter has recommended further reading, and very sensible internet search keywords (rather than websites which come and go). The resulting text is accessible to students with a range of ability and experience – just the job these days.

The Introduction (Chapter One) sets the scene and very briefly outlines element synthesis, planet accretion and early differentiation, the formation of the crust, atmosphere and hydrosphere and modern ideas for the origin of life. Human influence is introduced here, an important theme for later on. The toolbox (Chapter Two) is a nice idea, essentially collecting together fundamental concepts that chemists take for granted and explaining them for the non-specialist to use. Then come the central chapters on the outer reservoirs of the Earth. Chapter Three summarizes the composition and structure of the atmosphere, sources and sinks of the component gases, and discusses several contrasting styles of air pollution in an interesting historical context. The Chemistry of Continental Solids (Chapter Four) introduces some of the basic disciplines needed to investigate mineral–water interactions – mineralogy, solution chemistry and soil science, and concludes with a snapshot of the rapidly-developing interest in contaminated land. This is followed nicely by the Chemistry of Continental Waters (Chapter Five) which follows the same approach – basic science explained clearly, followed by application to contaminated waters drawing on several pertinent case studies. Chapter Six reviews estuaries and the oceans in a systematic way, emphasizing sources and sinks of the major ions, comparative behaviour of minor components and returns to anthropogenic influence to place it all in context. The organization of the book inevitably leads to some compartmentalization, but the final chapter, Global Change, brings things together by considering integrated carbon and sulphur cycles, our human influence on them and the reliability of our predictions of the future. The global influence of locally-produced persistent organic pollutants brings the book to a fitting close.

I would recommend this book very highly to all environmental science students – the chemistry it introduces is essential for anyone who hopes to make sense of environmental data, and leads directly into practical issues such as contaminated land and climate change.

Mike Fowler

ARTHUR, T. J., MACGREGOR, D. S. & CAMERON, N. R. (eds) 2003. *Petroleum Geology of Africa: New Themes and Developing Technologies*. Geological Society Special

Publication no. 207. vi + 289 pp. London, Bath: Geological Society of London. Price £75.00, US \$125.00; members' price £37.50, US \$63.00; AAPG members' price £45.00, US \$75.00 (hard covers). ISBN 1 86239 128 9.

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In May 2000 the Petroleum Group of the Geological Society of London and the Petroleum Exploration Society of Great Britain together held a three-day conference entitled 'Petroleum Systems and Evolving Technologies in African Exploration and Production'. This conference included 33 oral presentations and 21 posters. *Petroleum Geology of Africa: New Themes and Developing Technologies* is the long-term tangible result of this symposium. It is, if you like, the insoluble residue of the conference, consisting of only 14 papers. Sadly this volume lacks an editorial introduction that might have explained the background to its publication and how the resultant 14 papers were selected. One wonders if indeed they were self-selected, since there is no obvious rationale for their presentation in a single volume. It is tempting to speculate that the editors panicked and sent to the press such papers as had arrived on a given day.

The volume begins with three regional pan-African reviews, then follow four papers on North Africa, six on West Africa (that include excursions to Brazil and Australia), and one on South Africa. The three review papers flesh out the wealth of statistical data available on USGS Open File reports in recent years, and describe past petroleum exploration successes, and future prospects. Burke provides a magisterial review of African petroleum systems, setting those of Africa in their global context.

The papers in the rest of the volume are arranged without rhyme or reason, like clasts in a debris flow. Thus the lonely South African paper on source rocks is embedded between papers on North Africa. One of the North African papers describes the application of 3D seismic to petroleum production in the Berkine basin of Algeria, another reviews the tectonic development of the Sahara. Two papers deal with Saharan source rocks. The West African papers range geographically from Morocco, via the Gulf of Guinea and the Niger delta down to Angola and Gabon. They include a notable analysis of the tectonics of the salt basins from Morocco down to Angola.

Despite the uneven and scrambled geographic treatment of Africa, the volume 'does what it says on the label' in that it provides case histories that illustrate developing themes and technologies in African petroleum geology. These include ever more detailed 3D seismic, high resolution gravity maps, geochemical studies of source rocks and the application of fluid inclusion analysis to petroleum migration.

The book has been produced to the usual high standards of the Geological Society publishing house, with many colour illustrations funded by several oil companies. Some of the line figures reproduced from earlier publications lower the tone somewhat. A CD-Rom inside the back cover contains a suite of coloured maps that illustrate various aspects of Africa's geology.

Overall, however, *Petroleum Geology of Africa* is disappointing. It does indeed illustrate new themes and developing technologies. But a reader can learn about these from leafing through current issues of *Petroleum Geoscience*, or even the *Bulletin of the American Association of Petroleum Geologists*. There is no need to spend £75 on this book to learn of these themes and technologies. Readers will find the

geographic selection of papers in this volume eccentric, and will require a more catholic book to give them a detailed account of the petroleum geology of Africa.

R. C. Selley

BASSETT, M. G., KING, A. H., LARWOOD, J. G., PARKINSON, N. A. & DEISLER, V. K. (eds) 2001. *A Future for Fossils*. National Museums & Galleries of Wales, Geological Series no. 19. 156 pp. Cardiff: National Museums & Galleries of Wales. Price £14.50 plus postage and packing (paperback). ISBN 0 7200 0479 9
DOI: 10.1017/S0016756804360012

This volume represents the printed results of the international conference 'A Future for Fossils', which was promoted by English Nature with financial and logistical support of the National Museums and Galleries of Wales, Cardiff University, the Countryside Council for Wales and the Palaeontological Association. It was held in Cardiff on 14–15 October 1998. The rather vague title disguises an important volume which examines ethics and morals of palaeontological collecting. Its aim was to see if further legislature was necessary in an age of reduced access to small temporary exposures, of increased public interest, and increasing depth of pocket for those building collections. The volume contains 25 individually authored contributions, complete with abstracts and an index.

Section 1, 'National Perspectives and Policies', was introduced by Andy King. Euan Clarkson reviewed the palaeontological resource of Great Britain indicating the significant contributions which have been made in each period. Tony Weighell examined the role of the government agencies such as the Joint Nature Conservation Committee in managing the fossil resource. He recognized two types of sites used in UK classification: integrity sites which have finite collecting potential where collecting must be controlled or the palaeontological value will be lost, and exposure sites where there is replenishment as in active quarrying or coastal sections. In international terms such sites may be raised to UNESCO World Heritage Site or Geopark respectively. Andy King & Jonathan Larwood examined 'Operations Likely to Damage' in the most fragile of Sites of Special Scientific Interest of which there are 55 such sites in England. Informing those likely to have an interest was paramount, such as landowners, tenants, environmental agencies, planning authorities, and the Secretary of State for Environment, Transport and Regions. John Harvey discussed the policies of organizations including the National Trust. The National Trust has an actively restricted policy concerning fossil collection on their land, which includes about 60 Sites of Special Scientific Interest. Colin Macfadyen highlighted important Scottish sites which have contributed special palaeontological specimens, such as in the Devonian Rhynie Chert and Carboniferous vertebrate sites. However he pointed out the problems which have occurred at a number of sites where casual collecting or mindless hammering has destroyed dinosaur material and foreign commercial collecting has been a serious problem. Michael Wuttke showed how German nature conservation legislation concerning Geotope sites such as Messel could be put to advantage in the controlled but high profile site development. Lars Karis showed that in Sweden, although there is an almost unlimited right to roam in the

countryside, the collection of fossils is technically illegal, unless permission is granted. Serious problems have been caused by commercial exploitation of some sites.

Section 2, 'Policy into Practice: Local and Regional Case Studies' was introduced by Andy King. Richard Edmonds, in collaboration with members of the West Dorset Fossil Collecting Working Group, examined a new voluntary code of conduct for fossil collecting on the West Dorset coast where many key scientifically important specimens are collected each year. The scheme involves recording new significant finds which are graded into categories I (potential new species, rare specimens and exceptionally preserved material) and II (fossils of some scientific importance), the offering of new finds to appropriate depositories, requiring proper ownership of fossils, proper site management and coverage of health and safety issues. Provided that the code is followed, avoidance of restrictive control legislation can be achieved. Martin Munt examined fossil collecting on the Isle of Wight where there have been conflicting interests of collectors, museums, dealers, land owners and others despite there having been a published code of practice which has been readily available. There have been problems over ownership of certain dinosaur specimens and collectors may be perceived as agents of erosion on a small island. 'Pirates or Palaeontologists?' was an alternative viewpoint of Martin Simpson, also from the Isle of Wight. He discussed proper and improper removal of dinosaur specimens and offered a revised code of conduct for fossil collecting. Colin Reid & Jonathan Larwood examined the Wren's Nest, contrasting that site's peculiar situation, surrounded by dense housing estates with their attendant vandalism, and the recent geological vandalism, despite being permanently warded. Nevertheless this National Nature Reserve with a well way-marked geological trail remains an important educational site where collecting may still be done with permission from the warden. Alistair Bowden showed that as a result of unscrupulous foreign fossil collecting at the Salthill Quarry, Lancashire, new protective measures were now in place helped by increased local awareness by constructive media presentation and publication. Steve Thompson showed how professional collectors had come to an arrangement with the owners of Conesby Quarry in the Frodingham Ironstone, allowing them to collect and any special material being given free to the North Lincolnshire Museum, as well as allowing other collectors to use the site for non-commercial activity. Peter Austen demonstrated how organized rescue collecting at the Late Carboniferous Writhlington mine dump in Somerset had vastly increased the amount of fossil insect material known as well as providing other collections. Matthew Parkes looked at how the Devonian tetrapod trackway on Valentia Island, SW Ireland, was being left *in situ* and being used as a local cultural amenity, bringing geo-tourists to visit the area.

Section 3, 'Users of the Resource', was introduced by Jonathan Larwood. Eric Robinson defended the amateur collector's right to have as much freedom as possible, provided that a strict code geological fieldwork guide was followed. David Sole documented two case histories where the private collector has made important contributions towards the responsible and successful rescue collecting in the Early Jurassic of Conesby Quarry, Scunthorpe, and the Charmouth Bypass. Both temporary sites were being actively worked by heavy and potentially very dangerous moving vehicles which would in many cases have led to a ban on collecting. Neil Clark examined the use of the fossil resource from the point of view of a Scottish

Museum from the museum display to the type, figured and general collections kept in store. Increasing access to such collections through the internet is important, but many museums lack the resources to make the information that they have available to the public – but that is changing rapidly. Leslie Cherns took an academic perspective showing the division between palaeontological research and the use of specimens and geological sites for teaching. Phil Manning examined partnerships in palaeontology, looking at collectors and collections with particular respect to the Yorkshire coast.

Section 4, 'Valuing the Resource: the Sustainable Approach', was introduced by Jonathan King. Mike Forster reviewed the prices being fetched at auction recently for geological specimens, including a staggering US\$55,000 for a Solnhofen pterodactyl and the best British price, US\$1500, for a Lyme Regis ichthyosaur snout. Striking British ammonite specimens were fetching US\$350–600. Almost all the material is being sold to private collectors. Such prices influence the way people collect, particularly those with no scruples. David Williams showed what could be achieved using carefully prepared casts from high quality original specimens, thus providing large numbers of otherwise unique specimens for teaching, as well as preparing striking displays without the need for original specimens. Michelle Webber showed what happens when a Somerset foreshore ammonite bed is targeted by collectors. Such a site needs protection if it is to continue as a renewable resource. Dennis Parsons showed how the Banwell Bone Cave in Somerset has remained a sustainable resource despite two centuries' collecting! Larwood and King discussed applying the principles of sustained development in conserving palaeontological sites. The importance of sustainability was reinforced by the 1992 Earth Summit in Rio de Janeiro.

The volume concludes with an important debate under the chairmanship of Tim Palmer discussing the motion 'Are changes required to current legislation to protect our fossil resource?' Four introductory speakers opened the

discussion with their viewpoints. Colin Prosser (English Nature) commenced, asking with regard to SSSIs, whether the balance is right to protect the sites for the future, to allow scientific gain, to protect reasonable landowner rights and to keep palaeontology alive and relevant as a subject. He examined the sustainability of collecting at such sites. Paul Ensom (Natural History Museum, London) acknowledged the help of amateurs in contributing to national and regional collections, but wanted to ensure that the donors held legal possession of the material in the first place. He asked whether, as in archaeology, developers of sites should have a geologist to record the section and make basic collections and organize any rescue mission for anything special. Steve Etches (amateur collector, Dorset) asked for more funding to bridge the gap between professional and amateur collectors on one side, and to provide information for the general public. Dave Martill (University of Portsmouth) examined the problems of heavy legislation in Brazil prohibiting the collecting and export of fossils in that country. This has simply driven the problem underground and has even resulted in life-threatening serious gunpoint confrontations. The important points in the ensuing debate centred on the legal right to collect fossils at sites, and the sustainability of certain sites. It is important that since the meeting the new Countryside and Rights of Way Bill has been enacted by Parliament giving conservation agencies power in preventing third-party damage to fossil sites.

This volume has been well edited and the varied authorship articles have been successfully integrated to make a uniform and compact work. The collection of fossils within our increasingly bureaucratic world needs encouragement and also proper approaches. The problems and many of the answers are examined in this volume and it deserves to be read by all responsible (and irresponsible) fossil collectors. As a postscript it would have been useful to have had a summary of all the acronyms used, which are a nightmare to those browsing in the volume and not familiar with the jargon.

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