

BOOK REVIEWS

WILLIS, K. J. & MCELWAIN, J. C. 2002. *The Evolution of Plants*. x + 378 pp. Oxford, New York: Oxford University Press. Price £22.99 (paperback). ISBN 0 19 850085 3.

Geol. Mag. 140, 2003, DOI: 10.1017/S0016756803217568

This is the finest palaeobotanical textbook for decades, and one that captures extremely well the exciting renaissance the subject is currently experiencing. This dramatic transformation is largely a response to the recent surge in interest in past and future global change issues and the rise of Earth System Science. In their bold and ambitious synthesis Willis & McElwain emphasize the importance of plants in regulating the Earth's system throughout its later evolution and provide numerous examples of how fossil plants can actually provide the key to unlocking many aspects of past global change.

Following an opening chapter on palaeobotanical methods, the majority of the book is devoted to a whistle-stop tour through the most significant milestones in the 'greening of the Earth'. This grand narrative begins with a discussion of the probable marine precursors of terrestrial plants; it proceeds by explaining the many physiological innovations required to colonize the hostile land; it witnesses the development of the first forests; it considers the emergence of the seed, which finally liberated plants from waterlogged environments; it marvels at the colour and scent that flowering plant evolution brought to the world; and finally it examines the nature and origin of our modern flora. One particularly important and innovative aspect of this book is the way that each stage of plant evolution is illustrated with biome maps, indicating the general trends in changing global plant distribution through time. Whilst some biome reconstructions are speculative, they greatly help to conceptualize the ecophysiology of ancient plant communities, and will certainly provide an enormous stimulus for new research. The book concludes with two interesting chapters dealing with patterns of evolution and extinction within the plant kingdom through geological history, which seek to emphasize the rarely appreciated fact that the rate and timing of evolutionary change in plants is often very different from that of the animal world.

Overall Willis & McElwain's provocative book is both well written in lively and accessible language and well illustrated with a good selection of line drawings and black-and-white photographs, thus singling it out as the only palaeobotanical textbook currently available suitable for undergraduate students. I have no doubt that it will prove to be an important and popular resource for all those teaching History of Life courses, and survive as a last landmark to a scientific discipline that has newly come of age. I heartily recommend you buy this book.

H. J. Falcon-Lang

SCHOLZ, C. H. 2002. *The Mechanics of Earthquakes and Faulting*, 2nd ed. xxiv + 471 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £90.00, US \$130.00 (hard covers); £32.95, US \$48.00 (paperback). ISBN 0 521 65223 5; 0 521 65540 4 (pb).

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This is the second edition of a book first published in 1990. The aim of the first edition was to view faulting in

the Earth from perspectives that combined rock mechanics, geological observations and earthquake seismology, thereby bridging the gap between two famous books of the 1950s, Anderson's *The Dynamics of Faulting* and Richter's *Elementary Seismology*. The author was well qualified to do this, being a substantial contributor to the whole range of different disciplines and certainly one of the most profound thinkers on the interfaces between them. The book he produced was, in my opinion, the most important in this area for a generation, with no serious rivals. This revised edition is therefore very welcome, as quite a lot has changed in the last 12 years.

The most obvious changes are observational, with vastly improved seismological data from new digital broad-band networks combining with previously unavailable geodetic (GPS and InSAR) information to give ever more detailed pictures of the fault geometries and rupture distributions in individual earthquakes. Over the same time period, new geological observations of fault scaling relationships and population distributions have stimulated the entire subject of how faults develop with time, to a level which would have been unrecognizable 12 years ago. The observational advances have in turn spawned developments in theory and models of fault growth, development and interaction, to many of which the author was a major contributor. These subjects are all treated in the same concise, lucid, manner that characterized the first edition, this time with some extra plates in colour, which is the only clear way to present InSAR and Coulomb stress patterns.

The second major area of change that has been incorporated, dear to heart of the author but less so to that of the reviewer, is the modern experimental work on rate–state friction laws. The author is probably right in thinking that, while geodynamicists tend to be obsessed with notions like 'strength', most of the interesting characteristics of fault slip in earthquakes are probably related to the properties of friction. Certainly the modern experimental work has produced more and more intricate and complicated friction laws that are understood by a dwindling group of people. Outsiders tend to recoil in horror, wondering whether such complex models are really necessary. Perhaps they are, but modern Earth Sciences is more commonly a story of major insights being reproduced by physical models that are so simple they seem obvious in retrospect. Friction may yet prove the philosophical exception. Either way, one topic that remains as controversial today as it was 20 years ago is indeed the 'strength' of faults (meaning the shear stress necessary to get them to move) and its relation to the forces that drive plate motion. Scholz is firmly in the (relatively) high stress camp, limited by Byerlee friction and hydrofracture, but I suspect there may be more to it. This may be a subject that is one day resolved by a broader geodynamic perspective rather than increasingly focused experimental work.

The revisions have all been made without substantially changing either the length of the book or the bulk of its content. Its great virtues remain its clarity of exposition and argument, and the authority of the author, who knows what he is talking about. If he seems overbearing and one-sided in places, it is always because he has clearly thought out his position. Scholz has been such a key player in earthquake and fault mechanics for at least 30 years. This is his broad

perspective of the whole subject and is likely to remain the most important textbook in the area for some time: a worthy successor to Anderson and Richter.

James Jackson

SINCLAIR, A. J. & BLACKWELL, G. H. 2002. *Applied Mineral Inventory Estimation*. xviii + 381 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £75.00, US \$110.00 (hard covers). ISBN 0 521 79103 0. *Geol. Mag.* 140, 2003, DOI: 10.1017/S0016756803237560

With a proliferating world population, and the desire for improving standards of living, demand for the products of mining is increasing. At the same time the price that society is willing to pay for these products is generally static, if not decreasing in real terms. Much of the world has already been explored, and the more obvious and simpler-to-mine deposits have been exploited. Cost-effective production of current workings, and planning of future exploitation, require sensible and reproducible estimates of distribution, grade, and tonnage of ore in place. These estimates, which often have legal implications, have to be produced against a background of cost control (and cutting) in a market where the commodity price (and fluctuations) are usually beyond the influence of the producer.

In the last few decades statistical techniques have become increasingly used in mineral inventory estimation, and this book sets out to be a comprehensive text for senior undergraduate and graduate courses on mineral resource/reserve estimation. It assumes an understanding of mineral deposits and their formation, and also a basic understanding of statistics. As the title implies, it is about the application of statistical data to mineral inventory estimation, with plenty of examples drawn from the literature, and the authors' own experience.

The text ranges from the problems of adequate sampling, to the selection and use of appropriate statistical techniques for any given situation. The reader is left in no doubt that practitioners require a solid basis in both geology and statistics, as well as practical experience in a variety of geological settings. Each chapter contains a summary of practical concerns, and ends with a number of exercises (some depending on computer programs and data to be downloaded from the publisher's website). The book also contains a bibliography of over 500 articles and books, many of which were published in the last decade (the latest being 2001). I found the listing of any individual author from latest to earliest, rather than the usual earliest to latest, a little odd at first.

I wish that I could recommend this book. I found much in the text that would be useful background for potential workers in the field, and the cautionary tales would be salutary to anyone thinking of investing in a mining prospect. But it is all let down by the number of mistakes scattered throughout the text. Several of the equations contain errors, not all of them are numbered, and at times the wrong equation number is referred to in the text, or an equation number referred to in the text does not exist. Sometimes a symbol listed in an explanation of an equation does not exist in the equation. I noted a numerical error in an early worked example. There are also a number of standard typographical errors. Given these editorial problems I suppose that I should not have been surprised to be unable to find the promised programs and data on the publisher's website.

A textbook on statistical techniques where you cannot trust that the printed equations are correct seems a non-starter to me, particularly when you consider the price. It certainly

doesn't set a good example for professional work requiring accuracy and reproducibility.

Antony Wyatt

AITKENHEAD, N., BARCLAY, W. J., BRANDON, A., CHADWICK, R. A., CHISHOLM, J. I., COOPER, A. H. & JOHNSON, E. W. 2002. *The Pennines and Adjacent Areas*, 4th ed. British Regional Geology Series. x + 206 pp. + map in pocket. Keyworth: British Geological Survey. Price £18.00 (paperback). ISBN 0 85272 424 1. *Geol. Mag.* 140, 2003, DOI: 10.1017/S0016756803247567

To admit to a nostalgic affection for the British Regional Geology guides is to betray a reviewer's age. Although first published before the Second World War, revised editions kept the whole BRG series up to date at least into the 60s and early 70s. At that time the guides could still claim to be the first point of reference for the student, amateur or professional geologist wanting an introduction to one of the twenty component regions of Britain and Northern Ireland. However, revisions over recent years have been infrequent, except for the Scottish volumes. Despite a half-complete set on my shelves from the 70s, I have to confess that it is now at least a decade, possibly two, since I opened one of them. I am now reminded why. The third edition of *The Pennines and Adjacent Areas*, for instance, was published in 1954. I note that my copy is the fourth impression (1966) and cost me 6 shillings (6s. 7d. had it been posted to me). As the foreword to the new edition understates, 'The vast amount of work carried out in the last 40 years makes the publication of this fourth edition long overdue.'

The only similarity between the new edition and its forerunners is the list of contents. The chapter headings almost exactly parallel those of earlier editions: an Introduction, seven 'stratigraphical' chapters – with appropriate updates, for instance, of Carboniferous Limestone to Dinantian and of Coal Measures to Westphalian – one on Structure, and one on Geology and Man. Within this familiar shell, the book has been completely rewritten and newly illustrated. The text is fact-packed but not dull; probably just what most potential readers want. The information is as up-to-date as could reasonably be expected, presented in a traditional but informative way. There are 29 colour plates, 44 line drawings, all in at least two colours, 13 tables and a good bibliography. The relevant area of the 1:635 000 geological map forms an enclosure. The book is neatly designed in a format somewhat larger than the earlier editions, and now runs to 206 pages rather than the 86 of the third edition. The £18 price tag is probably just within the budget of the book's intended readership. (That both the price of the volume and the cost of posting it within Britain have risen by exactly sixty times since 1966 is as coincidental as it is parenthetic.)

The Pennines and Adjacent Areas is the first product of an advertised programme to update all the British Regional Geology guides. This is a project worth realizing as fast as the inevitable multi-authorship of each volume will allow. (If a single-author book takes a year to complete, Woodcock's Law states that, with n authors, it will take n years to finish rather than the $1/n$ years that logic would suggest.) A country with Britain's wealth of geology deserves a series such as the BRG guides to fill the gap between popular 'tourist geology' guides and more academic texts. Rapid revision of the series will help to keep alive the public service reputation of the British Geological Survey, continually under threat from the commercial pressures of the market economy.

Nigel Woodcock

GREELEY, R. & BATSON, R. 2001. *The Compact NASA Atlas of the Solar System*. 408 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £39.95, US \$64.95 (hard covers). ISBN 0 521 80633 X.

Geol. Mag. 140, 2003, DOI: 10.1017/S0016756803257563

Let me say straight away that this is a most handsome book and one that will be found both useful and stimulating by a wide range of readers. It is unencumbered by technical jargon and illustrated by the most beautiful images and clearly reproduced maps and mosaics. The excellence of the *Atlas* is almost guaranteed by the two names that appear on the dust jacket, for these two NASA-connected planetary scientists have been involved in the business for several decades, at the forefront of planetary research.

In their introduction they write: 'It is not intended to be a textbook on the Solar System; such an effort could easily expand to encyclopaedic proportions. Rather the text and illustrations are produced to give the reader sufficient background to place the maps in an overall context of the Solar System and gain some insight into the nature of the mapped planetary bodies.' In this quest they have acquitted themselves admirably; the result is a mine of information, well presented, that deserves to be found on the shelves of academic institutions, general libraries and anyone else with an interest in our planetary system.

The initial chapters introduce the subject of planetary mapping and its various styles, followed by the Solar System with each planet being described in turn and put in the context of Solar System evolution. This includes sections on geological processes. Then follows the main meat of the book, the chapters bringing to our eyes the magnificent images and maps that have been generated over the past few decades by the series of spacecraft and other missions that have been working away to improve our understanding of the Sun's family. The text is informative and lucid, while the illustrations speak for themselves.

I do have one or two observations to make that, to my mind, would enhance a further edition. For a book published in 2001, there is remarkably little within its pages concerning the Global Surveyor MOLA project – which certainly has produced some fascinating mapping data – and the orbiter's mapping camera which generated some magnificent polar imagery. Neither is there much imagery from the Mars Pathfinder missions which contributed mineralogical data. It would have been nice to have included that, but then, one never knows when the authors completed their manuscript.

The same observation can be made of the 'Additional Readings' appendix: this is not up to date, with several newer editions of books mentioned now being available. I feel that the editor should have picked this up. I also question the value of some of the very large two-page photographs, for instance the huge but largely featureless crescent of Neptune that fills pages 296–7, and the Venus image that fills page 55 and even then is cropped. There are several similar cases in the sizes of maps of the outer planet moons where I feel smaller versions of these would have released space for more informative maps or larger versions of some that appear rather small to my eye.

These are, however, minor criticisms and undoubtedly were beyond the control of either of the authors. I heartily recommend this lovely book and know that it will bring hours of enjoyment and a wealth of information to anyone who purchases it. The appendices alone hold a wealth of

information, in particular the gazetteer, which I have found particularly useful.

Peter Cattermole

MARTINI, I. P., BAKER, V. R. & GARZÓN, G. (eds) 2002. *Flood and Megaflood Deposits: Recent and Ancient Examples*. International Association of Sedimentologists Special Publication no. 32. vii + 312 pp. Oxford: Blackwell Science. Price £55.00 (paperback). ISBN 0 632 06404 8.

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The session of the International Association of Sedimentologists' meeting in 1998 that spawned this publication was one of the first devoted to catastrophism in sedimentary geology and as such it sparked quite a lot of interest. Even those of us familiar with the reports of jokulhlaups such as the 1996 event on Skeidararsandur, Iceland (various aspects of which are documented by three separate papers in this volume) were awed by the scale of Pleistocene events in North America and central Asia described by Vic Baker at the conference and summarized in the review paper which opens this volume. Giant gravel bars, 5 km long and 120 m high, deposited by a series of catastrophic floods triggered by ice-dammed lake bursts in southern Siberia, are documented by Carling *et al.* in this volume: the scale of these events is difficult to imagine but must be significant in the geological record. Given that they provide such a fascinating insight into the scale of surface processes, it is somewhat disappointing to find that only one other example of a megaflood, from the Holocene of north Iceland, is documented. I wanted to learn more about these catastrophic events.

The other 14 papers are concerned with flooding which, although catastrophic on a human scale, lacks the awesome power of the Quaternary megafloods. The only paper concerning the pre-Quaternary is on debris flow deposits on an Eocene alluvial fan in the southern Pyrenees – all other papers document Quaternary events. The modification of coastal geomorphology by flooding is nicely illustrated in South Island, New Zealand, and there are detailed analyses of alluvial fan deposits in California and the Italian Alps. A discussion of the processes of hyperconcentrated flows in terrestrial settings and the recognition of the flow products is presented by Benvenuti and Martini, using examples from Italy. Four further papers cover fairly familiar ground in documenting the morphology of river systems subject to flooding in Holland, Czech Republic, Canada and Spain.

The high standards of editing and production which are a familiar feature of IAS Special Publications have been maintained here and this is a worthy addition to the series. It does not, however, provide the focus on the very large scale catastrophic events which I had hoped for: perhaps that should be a topic for another book in this series. Anyone interested in editing a volume on catastrophism in sedimentology?

Gary Nichols

JOHNSEN, O. 2002. *Photographic Guide to Minerals of the World*. Oxford Natural History Series. First published in Danish in 2000 as *Mineralernes Verden*. 439 pp. Oxford, New York: Oxford University Press. Price £17.99 (hard covers). ISBN 0 19 851568 5.

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This book is a new volume in the Oxford University Press series of photographic guides and is aimed primarily at the

serious amateur geologist. It is a compact guide to mineral identification in hand specimen with the aid of a hand lens, so detailed optical properties and topics such as X-ray diffraction are not covered. The book starts with a short section explaining what is meant by a mineral and how they are named. This followed by an excellent introduction to crystallography (at the morphological level) and includes discussions of the symmetry characteristics of each of the point groups and the use of Miller indices. There are also introductory sections on the formation and growth of crystals, and their chemical, physical and basic optical properties. The bulk of the volume is however devoted to the description of some 220 minerals. The mineral descriptions are grouped into the standard chemical groups: native elements, sulphides, halides, oxides, etc. The individual mineral descriptions consist of a brief discussion of the crystallography, followed by physical properties, chemical properties, occurrence, and conclude with a sentence on diagnostic features.

The outstanding strength of the volume is the mineral photographs, over 600 in total, all showing minerals in hand specimen. The quality of the photographs is truly outstanding and the vast majority of the specimens figured are from the collections of the Geological Museum, Copenhagen. Thus many of the specimens come from localities in Greenland or Scandinavia, and many of the photographs have not been published before. While locality data are given for the minerals shown in photographs, the volume does not provide a guide to mineral localities.

Overall this is an excellent little book and I am sure that many amateur collectors will purchase a copy for the photographs. The overall production quality is outstanding and the binding appears to be very strong. The book was originally published in Danish, by Gads Forlag under the title *Mineralernes Verden*, and Oxford University Press is to be congratulated in bring out an English version. Although this is not really a volume for large academic geological libraries, I am sure it will be popular with the public and would make an ideal gift to encourage young budding geologists.

Allan Pring

SMITH, A. B. & BATTEN, D. J. (eds). 2002. *Fossils of the Chalk*, 2nd ed., revised and enlarged. Field Guides to Fossils Series no. 2. ix + 374 pp. London: The Palaeontological Association. Price £14.00 (paperback). ISBN 0 901702 78 1; ISSN 0962-5321.

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The first edition of this book was so popular that a translation into German was published. This new edition deserves even greater success. Only seven more plates and 68 more pages have been added, but it really has been revised. In particular, the introduction by Gale and Kennedy does tell us what it was like for an organism living in the Chalk sea, on the bottom or in the sediment and we are told how that sediment formed. Indeed, it is a more useful background to Chalk stratigraphy in 26 8vo pages than the much longer introduction to *British Upper Cretaceous Stratigraphy* in the Geological Conservation Review Series.

Illustrations are a vital part of any guide to fossils. The 66 plates are excellent. Magnified pictures, including scanning electron micrographs, have been used where advisable, e.g. for bryozoans. Drawings have been used where helpful, e.g. whorl sections of nautiloids and the descriptive terms used for sharks' teeth.

There are new chapters on corals, serpulid worms and nautiloids, three groups left out of the first edition. All groups of macro-body-fossils are now covered. A few remarks have been left in from the first edition which are now out of date. It is no longer true to say that 'Chalk belemnites have received scant attention in Britain' when there have been two major monographic papers by Christensen in 1991 and 1995. Instead of classifying references chapter by chapter, they are now in a consolidated list except for several pages of useful further reading for chapter one.

Although this book does not pretend to be a monograph on Chalk macro-fossils (micro- and nanno-fossils are not covered) there are several groups, e.g. corals, serpulids, gastropods and sponges, where it would be difficult to find a general account outside this book. There is one major omission in the systematic chapters: the trace-fossils. In many exposures of chalk the only obvious fossils are trace-fossils. There is a good general drawing in the introductory chapter, but it is not adequate for the average reader to recognise the normal appearance of traces such as *Zoophycos*.

This book is essential for anyone who has an interest in Chalk fossils, even if you have the first edition; and is a bargain at the price.

J. M. Hancock

CLEAL, C. J., THOMAS, B. A., BATTEN, D. J. & COLLINSON, M. E. 2001. *Mesozoic and Tertiary Palaeobotany of Great Britain*. Geological Conservation Review Series, Volume 22. xviii + 335 pp. Peterborough: Joint Nature Conservation Committee; purchasing address: NHBS, 2-3 Wills Road, Totnes, Devon TQ9 5XN, UK (www.nhbs.com). Price £58.00 (hard covers). ISBN 1 86107 489 1.

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This is yet another excellent contribution in the important Geological Conservation Review Series, whose twenty-two volumes have brought a rigorous scientific basis to geological conservation in Britain. The present volume, which considers Mesozoic and Tertiary fossil plant localities, not only contains clear descriptions of the key localities and the history of their research, but also provides detailed background information concerning the palaeoenvironment and vegetation biomes represented. In addition to its carefully chosen content, the volume is further strengthened by its clear organization, elegant writing style (the authors have succeeded in summarizing detailed geological data in simple straightforward language), and profuse illustrations (mostly line drawings with a good selection of black-and-white photographs). I particularly liked the numerous palaeogeographic maps that helped put the fossil plant localities in their global context.

One criticism is that sedimentological logs are not provided for all sites, and where they are, detail is usually insufficient to determine the precise horizon of origin of fossil assemblages and their facies context. That relatively minor quibble aside, I have no doubt that this book will prove to be an invaluable resource for all those engaged in Mesozoic-Tertiary palaeobotanical research in Britain. It will do much to stimulate the restudy of classic localities and also ensure that this important part of Britain's heritage is preserved for the future.

Howard Falcon-Lang