

## BOOK REVIEWS

BEST, M. G. & CHRISTIANSEN, E. H. 2001. *Igneous Petrology*. xvi+458 pp. Oxford: Blackwell Science. Price £29.50 (paperback). ISBN 0 86542 541 8.  
*Geol. Mag.* 139, 2002, DOI: 10.1017/S0016756802216507

For lecturers and students of igneous petrology, the end of the last century was marked by a void of appropriate course textbooks. I was therefore delighted to discover that Myron Best and Eric Christiansen had compiled *Igneous Petrology*.

The text is written at the level appropriate for second or third year undergraduate students. It is an up-to-date and comprehensive compilation of all aspects of igneous petrology, ranging from the nucleation and growth of crystals to magma genesis. It is well illustrated with line drawings and numerous photomicrographs and field photographs. The book is divided into 13 chapters based on igneous processes. At the end of each chapter there are 'Critical thinking questions' and throughout the text there are occasional special interest boxes that provide the reader with detailed insights into topics such as 'Experimental petrology of the deep interior' and 'The controversial origin of layering in the Skaergaard intrusion'.

The first chapter of *Igneous Petrology* is a broad overview of fundamental concepts. The second chapter examines the composition and the classification of rocks and discusses the use of major and trace elements together with radiogenic, cosmogenic and stable isotope ratios in igneous processes. Chapter 3 focuses on the principles of thermodynamics and kinetics and their significance to our understanding of the behaviour of rock forming systems. Chapter 4 examines the role of silicate melts and volatile fluids in magma systems. Subsections on explosive volcanism and hydrothermal solutions highlight the importance of volatiles in igneous processes. In Chapter 5, phase diagrams and photomicrographs of rock textures are used to portray the effects of changing intensive variables on melting and fractionation. Chapter 6 examines the chemical dynamics of melts and crystals and how these relate to igneous textures, and Chapter 7 discusses the relationship between fabrics and crystallization processes.

The physical and thermal dynamics of magma bodies are described in Chapter 8. This chapter includes sections on magma rheology and density, conductive and advective heat transfer and magma convection. Chapter 9 examines magma ascent and emplacement; theoretical models are illustrated with numerous field examples. The varying styles of emplacement and eruption of volcanic rocks are discussed in Chapter 10. Chapter 11 is concerned with the generation of magma. It discusses the physical aspects of melt generation in the mantle and crust and also the effects of source composition. The differentiation of magmas is examined in Chapter 12. Magma chamber processes are highlighted by descriptions of 'classic' igneous intrusions (e.g. Skaergaard and the Palisades sill) and the bulk-rock compositions of magmas from Tonga and New Zealand are used to illustrate chemical differentiation of basaltic magmas. The final chapter of *Igneous Petrology* examines tectono-magmatic relationships, including the generation of MORB, ocean-island basalts, continental flood basalts, island arcs, granites and alkaline igneous rocks.

The book has an appendix of chemical analyses of common igneous rock-forming minerals and an appendix that illustrates how normative compositions are calculated. An extensive list is given of references cited in the text. Keywords, highlighted in the text, are defined in a comprehensive glossary at the end of the text. A paperback copy of *Igneous Petrology* should just be affordable to undergraduate students and I shall certainly recommend this as a second year textbook.

Sally A. Gibson

AHLBERG, P. E. (ed.) 2001. *Major Events in Early Vertebrate Evolution. Palaeontology, Phylogeny, Genetics and Development*. xiv+418 pp. London, New York: Taylor & Francis for The Systematics Association. Price £55.00 (hard covers). ISBN 0 415 23370 4.

*Geol. Mag.* 139, 2002, DOI: 10.1017/S0016756802226503

*Major Events in Early Vertebrate Evolution* is a timely volume of recent discoveries, ideas and debates central to the origin and evolution of early vertebrates. The contributions to this volume bring together the fields of palaeontology, developmental biology and molecular phylogenetics, once seen as exclusive disciplines that are currently being effectively integrated to further elucidate our understanding of the evolution of vertebrate morphology.

This book is based on papers that were presented from a joint Systematics Association/Natural History Museum conference held in April 1999, organized by Per Ahlberg. Twenty-three chapters are presented sequentially from basal chordates and vertebrate origins through to tetrapods. This volume provides an excellent fusion of techniques from phylogenetic inference (e.g. Zardoya & Meyer) to gene expression patterns (e.g. Holland & Holland) and data, from cephalochordates to amphibians, drawing on both palaeontological and extant taxa.

Palaeontology remains central to our understanding of early vertebrate evolution, as it provides a temporal aspect as well as the only direct documentation of morphology and diversity. Inclusion of new fossil forms may overturn existing phylogenies (Coates & Sequeira) or provide links between major clades (Zin Min & Schultze). Robust phylogenies are therefore essential prerequisites for research addressing major evolutionary episodes. This is exemplified by the inclusion of Stethacanthids, strange, primitive shark-like fishes from the Early Carboniferous, in order to reinvestigate early chondrichthyan and primitive gnathostome interrelationships (Coates & Sequeira).

However, fossils may not always be giving the true story of vertebrate relationships and molecular phylogenetics is having its greatest impact on the problematic relationships of some of the major splits in vertebrate evolution. Using molecular phylogenetics, contentious issues such as the hagfish–lamprey–gnathostome interrelationships are beginning to be re-addressed. Molecular data (Mallat *et al.*; Hedges; Zardoya & Meyer) support a hagfish–lamprey sister group relationship, rather than the lamprey–gnathostome relationship corroborated from morphological and physiological datasets. Further work utilizing further datasets is

required in order fully to resolve this conflict. Likewise, molecular data are strongly influencing our ideas on basal chordate evolution and have had a significant impact on current views of the phylogenetic position of problematic groups such as the calichordates (Gee; Jeffries).

Expression patterns of developmental genes in the amphioxus is providing evidence for homologies between vertebrates and non-vertebrate chordates (Holland & Holland; Holland *et al.*), and changing our views about the common ancestor to these groups. Several authors integrate both fossil and developmental data to interpret changes in morphological systems such as evolution and patterning in the head of cartilaginous, bony fish and tetrapods (e.g. Goujet; Smith & Coates; Bemis & Forey; Maisey), paired fins of lungfish (Joss & Longhurst) and tetrapods (Hinchliffe *et al.*), and the actinopterygian caudal fin (Metscher & Ahlberg).

This book would greatly benefit both students and professional academics alike, as it not only gives an excellent insight into some of the major events in the evolution of vertebrates, but serves to demonstrate how effectively different disciplines can be integrated to provide advancement of our understandings of evolution.

Julia J. Day

SCHUBERT, G., TURCOTTE, D. L. & OLSON, P. 2001. *Mantle Convection in the Earth and Planets*. xv+940 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £140.00, US \$200.00 (hard covers), £49.95, US \$74.95 (paperback). ISBN 0 521 35367 X; 0 521 79836 1 (paperback). *Geol. Mag.* 139, 2002, DOI: 10.1017/S001675680223650X

The continuing advances in computing should allow further advances in understanding mantle convection. This is therefore a timely treatise of 940 pages on mantle convection, written in a clear, scholarly manner with a high information density. It is thus not an easy book to read cover to cover, but is more a reference book suited to readers who will pick out the chapters and sections that are of interest to them. If your research interest touches on mantle convection, and you want to find out more on any aspect, then this book will always be an excellent starting point. It will probably cover the point of interest directly, but if not it will probably point you into the literature. It has a huge, up to date, reference list of 76 pages. This book is likely to become the backstop reference book for the field, since it is so comprehensive and balanced. While the authoritative authors do give their opinions, they also mention other possibilities, and usually caution where things are uncertain. Personally I felt that their judgement regarding our current understanding was spot on.

This book is not intended as a gentle introduction to the field of mantle convection, but is for readers who either know what they want to learn, or are motivated. It is therefore not targeted as an undergraduate textbook. It is, though, a must for the library of any research establishment whose research is impinged upon by mantle convection. I would also recommend it for the personal shelves of research workers in mantle convection.

The book has 15 chapters: Historical Background; Plate Tectonics; Structure and Composition of the Mantle; Mantle Temperatures and Thermodynamic Properties; Viscosity of the Mantle; Basic Equations; Linear Stability; Approximate Solutions; Calculation of Convection in Two Dimensions;

Numerical Models of Three-dimensional Convection; Hot Spots and Mantle Plumes; Chemical Geodynamics; Thermal History of the Earth; Convection in the Interiors of Solid Planets and Moons; Nature of Convection in the Mantle. As you can see it is comprehensive.

The book is well illustrated, with many graphs, diagrams and figures. Where the original figures are in colour, they are in black-and-white in the text, but then a colour version can be found in sections with colour plates. The book by and large has been well edited with very few errors until the last few chapters where they become more common – though all the errors I noticed were trivial and obvious. The book is broad in scope, bringing in such aspects as the constraints of seismic topography, and mantle convection in other planetary bodies. The book has questions sprinkled throughout; these are numbered and set aside from the flow of the text. The final chapter is a review, which largely comments on the questions. This chapter would be of interest to the researcher wanting to get a feel for the frontiers of the field and its successes. This is an exciting field, and the future challenge for a truly comprehensive theory of mantle convection is obvious given the significant differences it must explain between the planetary bodies. This book will be the foundation for many workers as they broach the challenge ahead.

J. Huw Davies

ISAACS, C. M. & RULLKÖTTER, J. (eds) 2001. *The Monterey Formation. From Rocks to Molecules*. xxv+553 pp. New York: Columbia University Press. Price US \$50.00 (paperback). ISBN 0 231 10585 1. *Geol. Mag.* 139, 2002, DOI: 10.1017/S0016756802246506

The Miocene Monterey Formation of California is one of the world's classic petroleum source rocks. Because it represents an unusually clear ancient example of deposition within the oxygen minimum zone (OMZ) of an upwelling-influenced continental margin, it has also become one of the main 'compass points' used by organic geochemists in their characterization of marine sediments. It is this perspective that dominates the volume: there is considerably more of the molecules than the rocks – good news for organic geochemists, perhaps a little disappointing for the rest of us. Only five of the main chapters are 'geological', while ten deal with molecular organic geochemistry. Four chapters focus on Monterey-derived oils, four deal with maturation-related geochemistry, and two with isotopic chemistry. There is only one chapter on inorganic (trace and major element) geochemistry.

The introductory chapter by Caroline Isaacs provides an excellent overview, and deserves to be widely read, though it contains no major surprises for anyone familiar with her earlier works. She has long argued that lower diatom silica dilution results in the highest organic contents occurring in the most slowly deposited intervals, deposited when productivity was lowest. Her conclusion that dissolved oxygen had little effect on the organic content is primarily because it hardly varied (suboxic); at the low sedimentation rates observed, the formation would not have been as organic-rich had fully oxic conditions prevailed. Isaacs also argues that the modern Californian Continental Borderland intra-OMZ basins are actually a poor modern analogue for Monterey deposition, which was deposited much more widely, in less steep basins, with topography-related upwelling that generally resulted only in moderate palaeoproductivity.

The indisputable strength of this volume is the diversity of

analytical data and supporting information it contains. It is based on the Cooperative Monterey Organic Geochemical Study (CMOGS) which ran from 1989 to 1993, distributing well characterized replicated samples around 30 laboratories. Most of the chapters use only the original 23 CMOGS rock samples (chosen from two outcrops, one immature and one mature) and 11 CMOGS oils (nine from onshore fields and two offshore). For the immature (Naples Beach) section, this usually equates to only nine samples from the 375-m-thick Monterey Formation. Deliberate sampling of the lithological variants presumably explains why the data suggest a greater geochemical heterogeneity than was often previously inferred. The great duplication of analytical effort during CMOGS has permitted an interesting inter-laboratory statistical comparison of 11 whole rock, 11 molecular and 5 extract parameters.

To judge from the references cited, this volume has had a rather long gestation period. There are only 32 post-1994 citations included (only four post-1996). The volume is well produced but the cover of the paperback edition is rather flimsy, and I am not optimistic that it (or the binding) will stand up well to handling.

Who should own this book? Anyone interested in the Monterey Formation of course, but also those interested in the organic geochemistry of ancient or modern OMZ and upwelling-related sediments. The paperback price is reasonable for a specialist volume and no great deterrent to personal ownership. The libraries of all institutions engaged in marine organic geochemical research should also purchase a copy.

Richard Tyson

KHAN, M. A., TRELOAR, P. J., SEARLE, M. P. & JAN, M. Q. (eds) 2000. *Tectonics of the Nanga Parbat Syntaxis and the Western Himalaya*. Geological Society Special Publication no. 170. vii+485 pp. London, Bath: Geological Society of London. Price £90.00, US \$150.00; members' price £39.00, US \$65.00; AAPG/SEPM/GSA price £54.00, US \$90.00 (hard covers). ISBN 1 86239 061 4.  
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The Himalaya is widely considered as the best suited natural setting to investigate orogenic processes during an on-going continental collision. Yet, although our understanding of the Himalayan orogen has greatly improved during the past few decades, numerous key areas remain poorly known, mainly because of rugged topography and restricted access to sensitive border regions. A new book reporting on the geology of such areas is therefore bound to raise interest, especially if it claims to address 'one of the most exciting frontiers for continental tectonic studies'.

*Tectonics of the Nanga Parbat Syntaxis and the Western Himalaya* is a collection of 24 research papers arising from the thirteenth Himalaya–Karakoram–Tibet workshop held in 1998 at the University of Peshawar in Pakistan. These contributions deal with various aspects of the Himalayan tectonic evolution in northern Pakistan and adjoining areas of India. This region, characterized by extreme topographic gradients reaching above 8000 m, provides a unique opportunity to investigate complete transects across the deformed margins of the Indian and Asian plates, as well as across the exceptional Kohistan island arc caught in-between. This region also represents the western limit of the Himalayan range, where the remarkable arc-parallel structural continuity observed for more than 2000 km along the belt abruptly

terminates at the level of a sharp orogenic bend. In the core of the antiformal half-window formed by this Nanga Parbat syntaxis, crystalline rocks of the Indian plate are tectonically exhumed from beneath the Kohistan island arc sequence, that has been previously overthrust onto the Indian margin along the Main Mantle Thrust. Recent geological investigations revealed that the rocks of the Nanga Parbat massif record some of the highest uplift, exhumation, and erosion rates measured on Earth. The Nanga Parbat syntaxis appears therefore as a key area to decipher the interactions between tectonic and superficial processes during exhumation of deep crustal rocks, and it is not surprising that such a spectacularly active orogenic context is attracting an increasing number of geoscientists.

*Tectonics of the Nanga Parbat Syntaxis and the Western Himalaya* is not intended as a thorough geological synthesis, and the relevant results of previous investigations in these regions are only briefly summarized in the introductory chapter. The wide range of topics covered by the papers gathered in this volume provide, however, a fairly extensive overview of the present-day state of knowledge of this complex orogenic setting. A large part of these contributions is focused on the tectonic and metamorphic history of the Indian plate and Kohistan arc units of northern Pakistan. These studies yield a rich supply of new constraints, particularly about the structural evolution of the Nanga Parbat syntaxis and Main Mantle Thrust, the pressure–temperature–time evolution of the polymetamorphic, eclogite-bearing crystalline rocks of the Indian plate, and the unexpected correlation of these latter rocks with the Lesser Himalayan units exposed farther to the southeast. These results are complemented by an extensive survey of the gravity field of the Karakoram range and surrounding areas, field-based and remote-sensing quantitative assessments of the vigorous unroofing and erosion dynamics in the Nanga Parbat massif, and a thought-provoking numerical modelling suggesting that the Himalayan syntaxes could reflect buckling at the scale of the lithosphere. Additional papers address notably the crustal shortening accommodated across the Indian continental margin, and the protracted tectono-stratigraphic history recorded in the ophiolitic mélanges of the Indus Suture zone, in the Himalaya of northwest India. Of particular interest are two reports on the still poorly documented geology of the Asian plate units exposed in the Karakoram and Hindu Kush ranges of the northernmost part of Pakistan. These contributions provide much-sought-after information about the Mesozoic accretion of the Karakoram terrane and Kohistan arc along the southern Asian margin, as well as about the tectonic evolution of this margin during its Tertiary collision with the indenting Indian plate.

Some years ago, a renowned Himalayan geologist remarked that the facts versus theories ratio in the Himalayan geological literature tends to decrease. It is consequently worth emphasizing that this book is chiefly about geological facts, as exemplified by several original geological maps contributing to complete the survey of regions that were largely unknown until a few decades ago. Most of the papers give account of field-based studies and they collectively present an impressive set of new structural, geochemical, geochronological, petrological, stratigraphic, geomorphological, and geophysical data. These results are richly illustrated by clear graphics and pictures, the carefully edited text contains few errors, and the overall presentation is representative of the high-quality standards of this series of publications. Like the previous Geological Society Special Publication no. 74 dedi-



cated to Himalayan tectonics, the present volume represents a major contribution to our understanding of the tectono-thermal evolution during the India–Asia continental collision, as well as the pre-Tertiary geodynamic history of the various terranes involved in the Himalayan orogen. It is not, however, a comprehensive textbook on Himalayan geology, and readers not necessarily familiar with the subject may regret the lack of a more detailed introduction to the broader Himalayan geological context. Moreover, the sum of new information contained in this book would surely have benefited from a concluding synthesis, providing a critical assessment of the progress made and highlighting the remaining unresolved issues. In any case, the present volume is an essential reference for future Himalayan research and it illustrates that there still are, indeed, exciting frontier areas for geologists to explore. I highly recommend it to all those interested in the geology of the Himalaya in particular, and in continental tectonics in general.

Jean-Claude Vannay

PASSCHIER, C. W. & TROUW, R. A. J. 2000. *Microtectonics*. Minimum configuration: PC 486, 8 MB RAM, hicolor SVGA graphic adapter, 1 MB free space on hard disk, MS Windows 3.11, double speed CD-ROM drive, mouse. Recommended configuration: Pentium 1 PC or faster, 32 MB RAM or more, true-color X VGA graphic adapter, 1 MB free space on hard disk, Windows 95 or 98, fast CD-ROM drive, mouse. The CD-ROM can be used on Macintosh computers if a PC simulator and Windows are installed. Berlin, Heidelberg, New York, London, Paris, Tokyo, Hong Kong: Springer-Verlag. Price DM 148.48; Ös 935.00, SFr 116.50, £55.49, US \$89.00. ISBN 3 540 14679 2.  
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This CD-ROM is basically an interactive and enhanced version of the materials from the textbook *Microtectonics* by the same authors. The CD-ROM basically follows the same structure as the 289-page book and is split into eleven chapters with appendices of videos and photos. Installation is relatively straightforward (I installed it on Windows 2000 and Windows 98 without problem), but users of newer operating systems will be bemused by the request to install Intel Indeo video drivers (these came out with Windows 3.1). The installation software does not seem to be aware of Windows Media Player. The Indeo video drivers work without problem, however. Accessing the CD-ROM materials is achieved via the Navigator and Text links on the opening splash screen. These are negotiated using something that resembles the old Windows 3.1 help interface, which takes a little bit of getting used to if you are expecting a web browser (one with panes would suit the format best). Within the text, references, figures and key topics are hyperlinked, and links are also provided to other relevant chapters. A glossary is provided which includes underlined words in the text, although these are not hyperlinked.

The subject matter is comprehensive, and working through the CD-ROM will give you a good grounding in recent developments in microstructural geology. A strongly technical approach is balanced by many real-world examples, with illustrative materials that are lavish and clear. The CD-ROM can be worked through systematically, or individual topics can be accessed at random via the Navigator. Chapter 1 presents a framework of microtectonic studies, and is followed by chapters that introduce the principles of

deformation, deformation mechanisms, foliations, shear zones, dilatation, porphyroclasts, microgauges, and special techniques (such as cathodoluminescence, electron microscopy, lattice-preferred orientation analysis, and modelling). The CD-ROM finishes with a chapter on the steps involved in going from hand sample to thin-section, and the main text is followed by a chapter of useful and instructive problem thin-section examples. It is hard to do justice to the breadth of material covered with a brief review like this, but I found the chapters on porphyroblasts and shear zones particularly comprehensive. The focus is more qualitative than quantitative, which may not satisfy everybody, although there is a large bibliography, allowing a specific topic to be followed up in more detail. Overall, the colour figures, simple animations, and videos give the CD-ROM version of *Microtectonics* a huge advantage over the static, monochrome illustrations of the printed version, and I can highly recommend it to anyone seeking a good undergraduate text covering the nature of microstructural analysis with abundant examples, or seeking to update their general microstructural knowledge.

Alan Vaughan

MCCALL, J. 2001. *Tektites in the Geological Record: Showers of Glass from the Sky*. Earth in View Series. viii+256 pp. London, Bath: Geological Society of London. Price £65.00 (paperback). ISBN 1 86239 085 1.  
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Outside of scientific journals, there are few complete accounts of tektites in the modern literature. Four previous compilations, two academic (Barnes and Barnes, 1973, *Benchmark Papers in Geology*, Dowden, Hutchinson and Ross; and O'Keefe, 1976, *Tektites and their Origin*, Elsevier, New York), both now outdated, and two popular (Heinen, 1998, *Witnesses of Cosmic Catastrophes*; McNamara & Bevan, *Tektites*, 3rd ed., 2001, Western Australia Museum), have so far served researchers, students and the wider public. This new work by McCall brings the subject into the 21st Century by providing an extensive and detailed academic review of tektites, their nature, occurrence and origin.

The elucidation of the origin of tektites as the distal terrestrial glass ejecta from meteorite impact events in the geological past is one of the great scientific detective stories of the last century. However, McCall does not treat the subject from this perspective; rather, he provides solid, detailed information on their form, composition, geological occurrence and interpretation. Many aspects of the formation of tektites remain to be solved, not least of which is the identification of the elusive source of the Australasian tektite and microtektite strewn field. The author rightly does not view this as an easy prospect.

The book comprises nine chapters and an appendix dealing with all aspects of the study of tektites from historical, geological, morphological and analytical perspectives. Chapter one deals with the history of the recognition of tektites, early discussions of their origin, and the crucial link with the emergence of the study of impact craters on Earth as an important geological process. Chapter two is a catalogue of information (discovery, distribution, physical characteristics, composition, age and numbers) for each of the four known (Australasian, Central European, North American, and Ivory Coast) tektite strewn fields. Chapter three is devoted to microtektites (strewn field specific), their relationship to the larger tektites with which they are associated, and their important role in defining tektite strewn fields

and ages. Chapter four concentrates on the Muong Nong tektites, large bodies of layered glass thought to lie close to the source of the Australasian tektite strewn field. There is also a discussion of layered 'Muong Nong-like' glasses from other strewn fields, and the importance of these partially homogenized tektites in understanding the original target materials from which they were produced. Chapter five explores the suggested, but now discounted, 'age paradox' between the stratigraphic occurrence of some tektites, notably australites, and their radiometric ages. Chapter six covers the sources of tektites emphasizing their terrestrial origin, and provides the evidence linking the tektite strewn fields to particular impact structures.

In chapters seven and eight there is a departure from the main tektite theme to discuss occurrences of other natural glasses in relation to impacts, such as Libyan Desert Glass in Egypt, Darwin Glass in Tasmania, and glasses associated with the Zhamanshin crater in Kazakhstan. The discussion is extended to cover tektite-like glass from the K/T boundary in Haiti and Mexico; more enigmatic glass occurrences such as microtektite-like spherules in Upper Devonian rocks of Belgium and China; and spherules (microcrystites) from the Archaean of Western Australia and South Africa. Surprisingly, the urengoite tektites and other recent discoveries of tektite-like glass in Russia with much better tektite credentials (low water content) are overlooked. Nevertheless, these two chapters serve to make the important distinction between proximal impact glass (impactites) and distal (tektites and microtektites) glass ejecta.

In chapter nine McCall brings the evidence together in a discussion of the origin of tektites. Here, and in other parts of the book, the author occasionally lends unnecessary credence to outlandish and scientifically unsupported explanations of tektites that have long since been discredited. But I suspect that the author is sometimes playing 'devil's advocate' by taking an opposing view. However, the author always returns to the orthodox view of the origin of tektites that is strongly supported by evidence, eventually overcoming any prejudices that the reader may harbour. Overall there is a slight bias towards the Australasian tektite strewn field. This is forgivable since it is the largest yet described, and one in which many additional questions remain to be answered. This includes a better understanding of the special circumstances and physics of tektite-generating impacts producing abundant glass and launching it as tektites to considerable distances (more than 4000 km) from the source crater.

The book is well illustrated (b/w) and, like every good review, contains rich and useful compilations of data gleaned from a wide range of publications, many of which are either difficult to obtain, or no longer generally available. This aspect of the book, combined with its extensive reference list, is its real strength. Many researchers will find it a useful addition to their libraries as an easy reference source for many aspects of tektite research. The book is also a good introduction for students entering the subject for the first time, but the level of presentation may be beyond the wider public. The glossary and an appendix on isotopic studies will, however, aid many readers without a geological background.

One matter of real concern is the price-tag (£65). An enquiry with my local Australian distributors gave a current retail price for the book of \$AUD 220 (+10% tax)! This is an inordinate amount of money for a soft-covered publication of this size lacking colour illustrations, and it will undoubtedly affect its distribution. I will certainly treasure my review copy!

Alex Bevan

DILEK, Y., MOORES, E., ELTHON, D. & NICOLAS, A. (eds) 2000. *Ophiolites and Oceanic Crust: New Insights from Field Studies and the Ocean Drilling Program*. Proceedings of the Penrose Conference held in Marshall, California, 13–17 September 1998. Geological Society of America Special Paper no. 349. viii+552 pp. Boulder: Geological Society of America. Price US \$104.00 (members), US \$130.00 (non-members); paperback. ISBN 0 8137 2349 3.

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Thirty years ago, at the first Penrose conference on ophiolites in 1972, ophiolite complexes were first compared to sections of the oceanic crust and upper mantle. It is astonishing to think of the progress made since then. Particularly impressive is the interaction between field structural geologists and igneous petrologists studying ophiolites in the field, with marine geologists and geophysicists. The recent deep drilling of the lower oceanic crust and upper mantle at the Hess Deep, the Mid-Atlantic Ridge and the Southwest Indian Ridge has allowed a much closer comparison to the plutonic complexes of ophiolites. Ocean drilling, however, will never allow the very detailed three-dimensional view of the oceanic crust and upper mantle provided by on-land ophiolites. It is only in these well exposed and complete ophiolites, such as the Oman, where some tectonic processes will be deduced. Detailed 3D mapping of mantle fabrics makes it possible to determine palaeo-mantle flow patterns, mantle melting processes and melt pathways up into the lower crust. Detailed mapping of the gabbros and sheeted dyke complex can be used to determine the shape and size of magma chambers and how melts are channelled to the volcanic edifice above. Detailed sampling and structural analysis of the high-temperature metamorphic sole, combined with thermobarometry and microstructural studies, can resolve the obduction history.

This book is a collection of 39 papers resulting from the Penrose conference convened in September 1998 in Marshall, California. The book covers just about all aspects of ophiolite petrogenesis and includes field-related studies and results from the Ocean Drilling Program. It is divided into six sections. The first section covers the ophiolite–oceanic lithosphere analogue, the second section covers the oceanic lower crust and upper mantle, the third section the structure and physical properties of the upper oceanic crust, and the fourth section covers hydrothermal processes. The final two sections cover regional ophiolites from around the world.

The two most important 'ophiolite conundrums' are their tectonic setting origins and their emplacement mechanisms. The conflict between a mid-ocean ridge setting, a supra-subduction zone setting (fore-arc, immature island arc or back-arc) or a transform fault environment still goes on, as does the conflict between detachment at the ridge axis and subduction zone processes during obduction. Geochemistry and isotopic composition of lavas, sheeted dykes and gabbros have classically been used to interpret tectonic settings. However, it is becoming increasingly more obvious that the metamorphic sole, and even the sedimentary and volcanic rocks in the thrust sheets immediately beneath the ophiolite, hold the key to resolving tectonic setting. Detailed geochronology of most metamorphic soles and ophiolite complexes has yet to be conducted.

Because of the very limited sampling of the lower oceanic crust from drilling, inferences about processes at the base of the crust and magma chamber models have largely relied on the study of ophiolites. The structural and petrological

complexity shown in ophiolites makes one realise just how much can be missing from a single core! The astonishing 3D structures of the layered cumulate series above the Moho, the shape of gabbroic magma chambers, tracing magma pathways from gabbros up through the sheeted dykes to pillow lavas, revealed from a gentle stroll up any one of the numerous wadis in the Oman mountains which cut through the ophiolite, really brings home the fact that the answer ultimately lies in the field!

Recent detailed geophysical, petrological and geological investigations of active spreading centres has enabled more accurate observation and sampling of lava flows and hydrothermal systems. These new data have resulted in models which incorporate melt production, migration and injection with seafloor observations including seismic data, bathymetry and gravity. Ongoing geophysical studies in the oceans such as the Mantle Electromagnetic and Tomography experiment will provide crucial new data for interpreting the deep structure of the mantle. This book contains a wealth of new data and new thinking on the whole problem of ophiolites and oceanic crust and upper mantle. It is crucial reading for anyone involved in ophiolite research, and indeed for anyone interested in processes operating in the oceans which cover two thirds of our planet.

Mike Searle

VERNON, R. 2000. *Beneath Our Feet. The Rocks of Planet Earth*. viii+216 pp. Cambridge, New York, Melbourne: Cambridge University Press. Price £18.95, US \$29.95 (hard covers). ISBN 0 521 79030 1.  
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It is always slightly shocking to discover just how little even the brightest young recruits to university science courses know about the most common earth materials, rocks, and their most abundant mineral components the silicate minerals. In *Beneath Our Feet*, Ron Vernon aims to overcome this problem by providing an accessible and well illustrated introduction to 'the Rocks of Planet Earth', as he subtitles his book. Vernon is a well known Australian geologist, specializing in metamorphic rocks, author of a classic textbook *Metamorphic Processes* and an editor for the *Journal of Metamorphic Geology*, so he knows his stuff.

His pitch is fairly basic and so mainly directed at introductory geology courses and perhaps a more general readership. After a brief introduction to plate tectonics, the structure and composition of the Earth, the book is divided into thematic chapters from the evidence for flow in rocks, through mantle derived materials, igneous rocks and an all-too-brief section on sedimentary rocks, metamorphic rocks to meteorites. Vernon has had the good idea of portraying rocks at all scales from the field context through the hand specimen to the thin section – although I do wonder just how much the untutored eye will be able to read from the thin

sections without some direction. In my experience, it can take some explaining for students to be able see what is actually before their eyes, otherwise they just seem to see pretty patterns of polarization colours that might just as well be hangovers from the days of acid-rock LP covers or some of the linoleum patterns that used to be in fashion but are probably collectors' items now.

However, with some 170 colour photographs, this book should certainly be pointed out to first year students and available in departmental libraries. There is an accompanying glossary, index and disappointingly brief recommended reading list and no mention of relevant websites which surely are *de rigueur* these days. My only other gripe is that the colour values of many of the photos are slightly odd with a pervasive and curious pink-grey hue, but I suspect that will only be noticeable to the experienced eye.

Douglas Palmer

CRAWLEY, M. 2001. *Angiosperm Woods from British Lower Cretaceous and Palaeogene Deposits*. Special Papers in Palaeontology no. 66. 100 pp. London: The Palaeontological Association. Price £44.00 (paperback). ISBN 0 901702 76 5; ISSN 0038-6804.  
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This is a highly specialized book (really an extended scientific paper) whose 100 pages are almost entirely devoted to a very detailed, quantitative description of a large collection of fossil angiosperm woods from Britain. The title is slightly misleading in that only one specimen is given a Cretaceous age, and even this assignment seems highly questionable; the wood fragment was collected as an erratic one hundred years ago, no locality details were recorded, and certain 'advanced' anatomical features may imply a Tertiary age! In general the specimens described in this volume are well illustrated and the text is well organized, but frustratingly there is little attempt made to discuss this potentially interesting material in its broader (and more exciting) palaeoenvironmental context. For example, tree-rings in the woods are briefly analysed but their significance is not fully synthesized with earlier studies of global and regional palaeoclimate and palaeogeography. Maps giving the palaeoenvironmental setting would have been invaluable here. Similarly, aspects of wood anatomy are variously described as being primitive or advanced, yet the reader is never introduced to the interesting story of the functional evolution of angiosperm wood anatomy.

In summary, this book will surely serve as a useful reference volume for those concerned with the anatomy and evolution of Cretaceous and Early Tertiary angiosperm woods but, given that this community numbers no more than forty or so worldwide, I doubt this contribution will have enormous appeal.

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