BOOK REVIEWS

Volcanoes at their best

FRANCIS, P. *Volcanoes, a planetary perspective*. 1993. Oxford University Press. £25 softback. 443pp, 414 figures and photographs. ISBN 0 19 854033 7.

Probably the most readable geology book ever produced was Peter Francis' first, 1976, edition of *Volcanoes*. The little Penguin paperback offered exciting and attractive reading and at the same time was sound, authoritative, scientific material. It was a gem of a book, soon out of print, and then longingly sought in the second-hand shops. A hard act to follow.

But Peter Francis has done it again. He did not want to compete in the popular market with other small volumes that he admired, and he also felt that the book should evolve with his own considerable volcano experience. So his new book is bigger, more encyclopaedic, even more carefully researched; and there are literature references — intentionally added in as unobtrusive superscripts so that they do not interrupt a good read. As a consequence, it must now rank as the number one book on volcanoes.

Even with all this added authority, the book survives as an enthralling read. His style of writing is brilliant — oh that more of us could emulate his mastery of prose. His descriptions are so lucid: "known as shelly pahoehoe, to walk over the surface is to invite sudden crashing descents or wrenching stumbles when the thin shell breaks abruptly. Amusing the first time, exasperating the twentieth time, and unprintable after that". Hardly formal scientific writing — and all the better for it; now we really know what a fragile lava crust is like. And to describe mantle plumes, he makes the analogy with those old "lava lamps", ending with "Some volcanologists tolerated these lamps in their homes long after their unspeakable garishness had made them kitsch to more refined taste . . .". Such style, and so refreshing in a "science book".

As for contents, everything on volcanoes is included, except, perhaps surprisingly, any extensive treatment of volcanic monitoring and eruption prediction; other than in this area, the author's place at the sharp end of volcano research means that the book is bang up to date. Plate boundary subduction goes with progressive thinking on the role of gravity, and dehydration of the descending oceanic slab is emphasized in the role of triggering volcanism in island arcs. His chapter of classic eruptions has Mt St Helens 1980, added to Vesuvius 79, Mt Pelee 1902 and Krakatau 1883 — all with excellent and perceptive descriptions.

Lavas are, of course, thoroughly covered. The pahoehoe to aa contrast in basalts is ascribed more to flow rate than to shearing, though the author freely admits that there is plenty unknown about this particular subject. The obsidian to pumice relationship is clearly explained; but the author avoids any concise explanation of why obsidians and rhyolites are so similar and yet intermediate materials are so uncommon. Perhaps there is more to learn here.

Particularly welcome are the chapters on pyroclastic flows. These phenomena have only been properly understood in recent years, and this is the first really accessible textbook coverage. Fluidized flows, turbulent surges, nuées and ignimbrites are all neatly defined in terms of flow density and particle density; they are variants within a spectrum of pyroclastic flows in the broader sense. Then each has its own chapter. Notably the author describes nuées ardentes as hot avalanches, and draws the reader away from the misconception of the glowing cloud. This is just the sort of clarification that a book should provide.

A whole chapter is given over to debris flows — those huge landslides formed when an inflating and over-steepening volcano superficially collapses. Since the concept was first really appreciated with the famous 1980 event at Mt St Helens, over 100 prehistoric cases, many much larger, have been re-interpreted in the true style of scientific progress. And the lethal tsunami of the Krakatau eruption in 1883 is now explained by a huge collapse and debris flow, instead of by some ill-defined sort of blast.

Topical as ever, there is a chapter on the role of both volcanic aerosol acid and volcanic dust in climatic change. The debate, backed with some useful data, is honest enough to remain inconclusive; but there is an interesting comparison of the effects on Europe of the Laki 1783 eruption in Iceland, with the probable influence at the Cretaceous-Tertiary boundary of the production of the Deccan flood basalts in India.

As in every book, there are trivial editorial errors, but their details would detract from the real values of *Volcanoes*. This is an excellent book — very good science, very well written, very well illustrated. Every professional geologist and every enthusiastic amateur alike will want to have, should have, and will enjoy reading their own copy.

Tony Waltham

How to become famous

OLIVER, J. E. *The incomplete guide to the art of discovery*. 1991. Columbia University Press, New York. $52 cloth, $21 paperback, xiv + 208pp. ISBN 0 231 07620 5.

This is an interesting, and often quietly amusing book about scientific discovery and how to achieve it; its stated motto is "to discover, act like a discoverer". Jack Oliver is an influential US geophysicist who was originally based at Columbia University — working in the hothouse of Lamont-Doherty Geological Observatory — and is now at Cornell. In the 1960s he was instrumental, along with Bryan Isacks and Lynn Sykes, in the development of plate tectonic theory, especially the role of subduction zones. The book is very much a personal view, and thus strongly orientated towards geology, and in particular marine geophysics. This is no bad thing as it makes a refreshing change from books of this type that usually plod through the 'standard' discoveries of biology, physics and chemistry such as penicillin, vaccines, pulsars and the like.

The book comprises seven main chapters, the titles of which reveal their contents: About Discovery; Strategy for Discovery; Tactics for Discovery; Personal

Traits and Attitudes for Discoverers; A Few Views and Comments on Science; and The Inside Story of One Discovery. I particularly liked the chapters on Strategy and Tactics, because they contain some useful advice. Some tactics are fairly obvious, such as avoiding the crowd and developing your own field, avoiding scientific eddies, or avoiding jargon to present your ideas clearly to others. Some are less obvious: for example, skimming through the other parts of a scientific volume when you have taken it from the shelf for one specific article. This could lead to new discoveries, or new ways to understand old data.

The chapter on Personal Traits and Attitudes for Discoverers holds up a mirror to scientists, and will be revealing to the non-scientist who still labours under the impression that science is an undemanding career. Basically, it's as cut-throat as any other. The scene is set for this chapter in the Preface: "success in science . . . comes not to the most gifted, nor the most skilful, nor the most knowledgeable, nor the most affluent of scientists, but rather to the superior strategist and tactician." Taken at face value, this is an overly cynical viewpoint, although there is more than a grain of truth in it. Furthermore, the author almost contradicts the statement later in the book by stating that "discovery is commonly the product of inspiration and insight on the part of *a gifted individual* placed in a favourable situation." (my italics). I agree with this view; successful discovery depends on a complex and unpredictable mixture of talent, hard work and serendipity.

The book is not without its flaws and omissions. It can be self-contradictory, and I am surprised that there is not more on the mentor-student relationship and the role of altruism in science. But these are not serious drawbacks. This book should be on the reading list of all undergraduates of geology, and indeed of other subjects as well. It should also be read by non-scientists, who will enjoy its approachable format. And it should certainly be read by government administrators; the proposed changes in higher education, especially the concentration of research in a small number of "centres of excellence", will do little for the chances of gifted individuals being placed in favourable situations where they may develop and discover.

Andrew D. Saunders

What rocks are for

DEITRICH, R. V. and SKINNER, B. J. *Gems, Granites and Gravels: knowing and using rocks and minerals*. Cambridge University Press. £15.00, 173pp. ISBN 0 521 34444 1.

Mineralogy books are usually of one of two types. The first contains lots of data on minerals with some explanations of physical, chemical or optical properties, and is really a reference book. The second is of the "coffee table" variety, with lots of colour photographs of mineral specimens, the like of which most amateur (and professional!) geologists never find in the field. This book is different. Some of the basic concepts and background information about minerals, such as crystallography, chemistry and mineral stability fields are introduced in an elementary and understandable way. The authors then introduce the various types of rocks, including soils, weathering and meteorites, and finish with ores and industrial rocks and minerals, including construction materials. Artificial rocks, like concrete, bricks and glass are also briefly discussed. The uses of minerals and rocks are emphasised at every available opportunity. The last chapter, rather than discussing issues relevant to the protection of our environment, as one expects from every new book today, is entitled "Rocks and minerals in diverse environments". This introduces plate tectonics, and very briefly discusses the distribution of rocks and the rock cycle. It leaves a message of the Earth as a dynamic system in which the interrelationship between rocks, water, the atmosphere and life is not yet fully understood.

This is not a book to refer to in order to find information about specific minerals and rocks, as useful tabulated data is restricted to two very short appendices. However, there is a lot of factual information presented, and the reader will find for example, Moh's hardness scale, some data on ionic radii, coordination number data and basic silicate structures, a list of principal non-metallic ore minerals (industrial minerals) and even descriptions of coal macerals. Discussion of subject matter often begins with historical comments which put the topic in context. The treatment is exclusively at an elementary level, but this does not mean that advanced aspects (eg. crystal structure and X-ray diffraction) are ignored. Some topics that fascinate students, and are usually ignored in textbooks are also covered; for example, there is a section on the origin of mineral names. The 51 coloured plates include gemstones, mineral and rock specimens, field photographs of rock structures and landforms, and a few of the uses of building stone and other construction materials. Most have informative captions, and not simply the name and address.

Having worked with minerals and taught mineralogy and mineral deposit geology for many years, it is difficult to put myself in the position of someone with no mineralogical knowledge and assess the benefits that would be received from reading this introductory text. Perhaps I should have given the book to a student to review! Certainly the information in the book is not difficult to assimilate. The authors have an easy style, along the lines of the Open University Course Books, and explain geological terms as they arise. For those with some, even basic, knowledge and experience of minerals and rocks, reading this book would provide an expansion of knowledge in an interesting way without the feeling that one was struggling through a textbook. The only word of caution is to remember that the book is principally for an American audience. For a while I was completely confused on p22 by the statement, "But suppose, as Huygens had suggested two hundred years earlier, that the tiny particles at the nodes of an array were not spheres, but instead were shaped, say, like a football". The authors were explaining the relationship between external crystal symmetry and the 230 space groups that describe all of the ways that atoms can fill space. Think about it!

Peter W. Scott

Understanding geological maps

POWELL, D. *Interpretation of geological structures through maps*. 1992. Longman Group UK Ltd, £13.99 softback, 176pp. ISBN 0 582 08783 X.

It would appear to me that the teaching of a practical course in geological mapping and structures to first year undergraduates represents one of the most difficult (or should I say stimulating) challenges for a lecturer. There are several reasons for this. Firstly, we accept students with such a wide range of academic backgrounds, some wholly quantitative, others more qualitative; a substantial proportion may have no prior knowledge of the principles of geology. Secondly, mastering this type of course demands an ability to think laterally, in order to extend the two-dimensional map representation of the geology into not only the third dimension (by means of the cross-section or block diagram) but also the fourth (time and the geological history). Thirdly, negotiating a transition from simplified, stylised artificial "problem maps" (which have their place in introducing principles and techniques) to the real thing is no easy matter. Real stratigraphic units do not have constant thicknesses and infinite lateral extent; structure contours of real boundaries are never straight, parallel or equally spaced, and so on. In relation to this last point, too many texts have, in the past, relied too much on such "problem maps".

It must follow, therefore, that the writing of a course manual which will succeed in achieving its aims represents a challenge equal to that of the teaching. This impressive manual broadly succeeds, although I suspect it will demand a significant degree of application on behalf of the student in order to achieve its potential. It will be worth it.

The overall structure of the manual does not depart radically from other texts in this field, with chapters on planar (including curvi-planar) geological surfaces, outcrop shape, drill hole data, isopachytes, faults and folds. It has no separate chapter on unconformities, but instead treats these important features as integral components of sedimentary sequences from the outset. A chapter devoted to linear structures, particularly intersections between planes, is useful. I found Chapter 2 innovative and stimulating; the entire spectrum of map-scale structures is introduced in a series of block diagrams illustrating stages in the geological history of an idealised portion of crust. It includes a deformed basement/cover succession, emplacement of plutons and sheet intrusions, an overstepping and onlapping sedimentary sequence, three unconformities, a compressional event involving synchronous thrusting and folding, and finally an extensional event involving listric normal faulting and dyke intrusion. This chapter may run the risk of overwhelming or alienating those students new to geology so that it may be an idea to encourage such students to work through chapters 3-10 first, in which case chapter 2 would constitute a useful retrospective overview of the inter-relationships between different classes of structure.

Illustrations are of high quality and all appear to convey their intended purpose successfully, although some are rather on the small side, in relation to the amount of information they contain. Students should be encouraged to attempt as many of the exercises as possible; they are refreshingly near-realistic in content and generally excellent in quality; the effort will pay dividends.

All in all, the author is to be congratulated for the quality and clarity of his text; in most respects this must be, to date, the best of a large batch.

Stephen Temperley

The Ice Age in pictures

EHLERS, J., GIBBARD, P. L. and ROSE, J. (Eds). *Glacial deposits in Great Britain and Ireland*. 1991. A. A. Balkema, Rotterdam and Brookfield. £58.00 hardback, ix + 580pp. ISBN 90 6191 875 8.

The book is organised in three main sections: glacial events (11 chapters), critical regions (23 chapters), and critical topics (10 chapters). There is a foreword by Richard West, a compendium of references, a list of the 48 authors and a comprehensive index (although referencing certain topics and areas is sometimes difficult). The book is hardback, just less than A4 in size and lavishly illustrated throughout with high quality line drawings, black and white and colour photographs. In a short review and with a book of this size it is impossible to provide detail on every chapter without degenerating into a mere listing of authors and chapters. Therefore the following comments are of a general nature in order to give an overview of the book.

The division of the book into three sections is a good idea and on the whole the papers fit nicely in each section. Essentially, separation into "Glacial Events", "Critical Regions" and "Critical Topics" partitions the book into temporal, spatial and methodological sections. Within these, chapters are neatly organised into chronological order in terms of "Glacial Events" and geographically in terms of the "Critical Regions". These contain a real mix of both traditional views and more recent (novel) interpretations. The juxtaposition of many of these ideas could have generated considerably more debate and discussion than is evident (e.g. the interpretations of the Irish and Isle of Man sequences). This is perhaps a criticism of the book — there is not enough discussion. At the very least this could have been achieved via a summary chapter at the end of each section or in the form of appendices attached to individual chapters. Having said this, Bowen's opening chapter (pp3-11) does provide a good overview, and highlights many of the important issues.

The idea of identifying "Critical Regions and Topics" is important, although there is little justification for the choice of these. Probably the areas most neglected in the coverage of Great Britain and Ireland are in the uplands e.g. North Wales, Northern Scotland, Lake District, etc. This deficiency could easily have been remedied if the editors had provided a concluding chapter highlighting regions and topics which need future attention.

This book has been a long time in production and may well have lost impact because much has been published since the contributions were written. The notion that "this book provides an excellent textbook"

cannot be really justified because the majority of papers are written with a clear research emphasis and the coverage of "Critical Topics" is far from comprehensive. Nevertheless it will remain an important reference book for Quaternary scientists working in Britain and as a desirable book (with a £58 price tag) it will probably find its way onto the coffee tables of the more affluent Quaternary scientists.

Jeff Warburton

The end of an era

SWEET, W. C., YANG ZUNYI, DICKENS, J. M. and YIN HONGFU (Eds). *Permo-Triassic events in the eastern Tethys. International Geological Correlation Programme Project 203: Permo-Triassic events of East Tethys region and their intercontinental correlation.* 1992. Cambridge University Press. £45.00 hardback, xiv + 181pp. ISBN 0 521 38214 9.

The Permo-Triassic is familiar to all Mercian geologists as the thick and distinctive suite of rocks which underlies and occasionally surfaces over much of the Midland counties. However, the rocks of the Germanic Province, of which Britain forms a part, have always posed special problems for the biostratigrapher, since they are mostly developed in continental or, at best, restricted marine or lacustrine facies. To the misfortune of a later generation of geologists, it was in the Germanic Province that the divisions of much of the Permo-Trias were first defined. Since then, the recognition of rock units equivalent to divisions of the "Bunter" and "Keuper" has severely exercised generations of stratigraphers.

It was gradually realised that the best prospects for a meaningful fossil-based Permian and Triassic stratigraphy lay in the long marine sequences of the Tethyan Realm in the southern hemisphere. Alpine sequences were the first to be studied in detail and are now well-known, but farther east the facts were hidden in a maze of frequently obscure and difficult-to-find literature. This book is therefore to be welcomed, since it presents an easily accessible up-to-date summary of eastern Tethyan biostratigraphy and correlative potential. Chapter 1 can be recommended as an excellent overview that will be of interest to the general reader. Those expecting a British component will, however, be disappointed.

There are 16 chapters in the form of self-contained papers which offer an excellent coverage of eastern Tethys; areas studied include Mediterranean Europe, southern parts of the old USSR, Israel, India, Pakistan, Iran, Australia, New Zealand and, notably, China. Seven of the chapters are wholly or jointly authored by Chinese geologists and this represents an important step forward in the dissemination, in English, of data from that vast country. Not surprisingly, the accounts concentrate on the more biostratigraphically useful fossil groups, particularly conodonts, but the applications of a wide range of fossils are discussed. Although the book is dominated by palaeontologically based studies, there are two challenging chapters by Chinese geologists who discuss the effects of volcanism on Permo-Triassic mass extinctions, introducing some much-needed balance into the asteroid/volcanism debate.

The book is produced in a clear A4 format, and the text is supported by many useful figures which are generally good, but which occasionally show poor (computer-based?) draughtsmanship. Some are also over-reduced, and are consequently very difficult to decipher. A skilled cartographer is still a valuable commodity! There are a few plates, but it is my guess that authors were not encouraged to submit them in order to keep costs down.

This is not a book for the general geologist and at £45 is not particularly cheap, but if you are stimulated by the challenges inherent in the study of Permo-Triassic rocks, you will find much of interest here.

Andrew Swift

NOTES FOR CONTRIBUTORS

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