Book Reviews

Engineering Geology and the Environment (vols 1–3). P. G. Marinos, G. C. Koukis, G. C. Tsiambaos & G. C. Stournaras (eds). Balkema, Rotterdam, 1997. £185.00 hardback; c. 4000pp (5 volumes). ISBN 90-5410-877-0 (5 volumes).

The International Association of Engineering Geology has been providing a forum for geologists and engineers to interchange ideas and experience since 1971. The 22nd International Symposium, sponsored by the IAEG, took place in Athens in June 1997, with the topic ‘Engineering Geology and the Environment’.

The Symposium was divided into nine themes, with each theme being introduced by an invited presentation and followed by a series of short contributions. The publication of these short contributions, 568 in total, forms three thick volumes of over 3300 pages. Additional volumes covering the Invited Lectures and General Reports and Post-Symposium Proceedings are also available, but were not reviewed.

This substantial compilation provides a complex tapestry of information reflecting the increasing global concern with the environment. There are many interesting case histories and analytical papers, tackling the problems of man’s interaction with his environment.

A total of 53 countries is represented in the compilation, although most of the papers originated from the host country (Greece), Europe and the former Soviet Union. The great diversity of topics covered makes it possible to find a case study covering most aspects of adverse environmental geology and how the problems have been overcome. For example, there are several papers considering the problems of construction in karstic terrain and how they were resolved. There are several papers from the Indian subcontinent that reflect growing environmental concerns in this developing region. Some of these papers tackle the problem of environmental degradation, and highlight the need for planning and management. The paper on hazards and vulnerability of the capital of Bangladesh typifies this type of contribution.

The quality of most of the contributions is high, despite occasional translation and spelling quirks. The numerous figures and illustrations are clear and legible, with very few exceptions. However, the sheer number of papers makes the publication rather impenetrable to the causal reader, and a keyword index would have been helpful. A few papers reflect less mainstream ideas in engineering geology and appear out of place in this publication. Another minor shortcoming is that, with very few exceptions, the papers in the French language lack an English abstract, and none of the English papers have a French abstract.

The proceedings provide a useful compilation of the environmental issues that will continue to challenge engineers and geologists into the next millennium. They contain many valuable ‘nuggets’ of international experience and expertise covering many of the problem situations. As we increasingly occupy a global village, where information and ideas can be readily exchanged, the Athens Conference proceedings represent an important addition to the network of experience, and deserve a space in environmental geology reference collections.

Adrian V. J. Collings

Hard Rock Hydrosystems. T. Pointet (ed.). IAHS Publication No 241. IAHS, Wallingford, 1997. £28.00 softback; viii+168pp. ISBN 1-901502-10-4.

This book represents the proceedings of an international symposium held in Morocco concerned with the hydrogeology of hard rocks. The aim of the symposium was to discuss and promote the use of better techniques for the exploration, exploitation and management of groundwater supplies, especially those in arid areas, so that the emphasis of future work could become more deterministic and less empirical. The authors of the papers are predominantly from Europe and Africa and the papers are in both English and French. They cover a broad area of research from hydrogeological investigations and modelling in hard rock areas in Europe, India and Africa to research associated with the disposal of long-lived radioactive waste. It is work in the latter area over the last twenty years that has had such a profound effect on our understanding of groundwater flow in fractured rocks.

The papers in this book examine subjects from the hydrogeochemistry of fractured rock systems, through the use of tracers, to hydraulic conductivity distributions, scale effects and modelling of fractured rocks. Pollution of groundwater systems in fractured rocks is common in many countries and there are interesting papers on the natural denitrification of groundwater by pyrite-bearing schists and the anthropogenic effects on the hydrochemistry of groundwaters.

Many of the groundwater systems investigated consist of a fractured basement with a considerable thickness of overlying altered and weathered material. In both a temperate climate in Europe and in an arid climate in Africa, the hydraulic properties of the underlying basement were shown to have a controlling effect, in contrast to the classical assumption in groundwater studies that the crystalline basement is hydraulically inactive.
Groundwater supplies are being derived more and more frequently from fractured rock masses and these need to be protected from all forms of pollution. Modelling of such near-surface aquifers is reported for markedly different climate types in Europe and Africa and the potential difficulties associated with modelling such systems are discussed. These difficulties are invariably related to the large spatial heterogeneities that are inherent in fractured rocks. In arid areas the use of remote sensing techniques can be particularly helpful, especially when combined with GIS, and two papers discuss the use of such techniques. Another interesting paper discusses the problems of scale effects and spatial variability of fractured, hard rock aquifers in the central Africa in determining targets for groundwater supply boreholes.

The understanding of groundwater flow and solute transport in fractured rocks has progressed considerably over the last two decades. This short book reminds us that, although we have made notable progress in this area, we still have far to go in applying this understanding to practical solutions in groundwater supply and pollution studies. It provides a useful summary of how more sophisticated techniques are being applied in investigating groundwater resources and is recommended to practising hydrogeologists, in particular to those working on groundwater resources in more arid areas.

Tim McEwen

Introduction to Geomorphology. F. Ahnert (ed.). Arnold, London. £19.99 softback; viii+352 pp. ISBN 0-340-69259-6.

This book, first published in 1996 under the title Einführung in die Geomorphologie by Eugen Ulmer, was translated and co-published in the US, Central and South America by John Wiley. Frank Ahnert is Professor Emeritus of Physical Geography at RWTH (Technical University) Aachen, Germany. Geomorphological literature has now become so voluminous that it may seem impractical for an individual writer to encapsulate it all. However, in the last ten years several introductory texts have been written by academic authors. If the individual student is to be expected to clearly comprehend the scope of geomorphology it is only fair to expect that a sufficient overview must be within the grasp of the individual writer.

I believe that Professor Ahnert has made a good attempt at presenting, in a systematic manner, an up-to-date review of the fundamental aspects of geomorphology. The book stems from a course of lectures given to first-year undergraduates in the Department of Geography and builds on the foundations normally provided at school. A conscious effort has been made to shift the student's thinking from some of the more sterile aspects of school work in geomorphology towards a comprehensive understanding of the functional interdependence of form, material and process. It is an introductory survey from which the reader can progress smoothly to more advanced studies in future years.

As the readership is aimed at 1st and 2nd year undergraduates studying geomorphology, a conventional arrangement of the material has been adopted, each chapter providing the reader with sufficient exposure to the underlying ideas and the direction for further study. The full development of a number of more difficult topics is limited and only introduced in outline.

Some of the 24 short chapters are better written than others in terms of their depth of treatment of the subject matter. The chapter on Applied Geomorphology was disappointing in view of its increasing importance and considerable potential for helping to solve many environmental and engineering problems.

The layout is clear and logical and the type face very readable. The book adopts a double column format; items are easy to find and cross referenced. The text is comprehensive, precise and easy to understand. Keywords are emboldened and succinct definitions are provided. There is a comprehensive bibliography of over 600 references and a unique selection of material from Germany. They are appropriate and in the main accessible.

The book is illustrated with over 200 black and white photographs, maps and diagrams. However, some of the photographs are unclear and many of the figures are basic or of poor quality. Despite these minor limitations, the price would appear to be reasonable.

M. Cross

Landslide Risk Assessment. D. Cruden & R. Fell (eds). Balkema, Rotterdam, 1997. Hfl 160.00 hardback; xii+371pp. ISBN 90 5410 914 9.

This book contains the proceedings of an international workshop convened by the IUGS Working Group on Landslides, in Hawaii, 1997. A committee on the assessment of risk of landsliding was set up under the chairmanship of Professor Robin Fell in 1996 with the objectives of reviewing international definitions; reviewing standards of tolerable risk and methods of applying these to landslide risk; and reviewing methods of predicting vulnerability to life and property. To this end, the book begins with a overview paper setting the broad framework; this is followed by four invited theme papers and 21 subsequent papers submitted from various parts of the world. It necessarily contains a fair amount of probabilistic mathematics.

The first theme paper is the current state-of-the-art in landslide risk assessment and ends with four bullet points of activities suggested as priorities for developing
the practice further. The second theme covers the systematic assessment of landslide risk by mapping techniques and the use of decision analysis. As with all risk assessment approaches, the calculation of the risk is often difficult enough but the management of that risk may be even more difficult since it involves making decisions that concern other people's livelihoods. The third paper tackles the thorny issue of acceptable or tolerable risk, to individuals and to society as a whole, using case histories of risk assessment frameworks. One of the aims of the workshop was to look at other areas of similar risk, such as may arise from living in proximity to major industries, large dams or nuclear power plants, and to see if the same concepts could be adopted for landslide risk. The book provides a good synthesis with examples from organizations such as the UK Health and Safety Executive and the Canadian BC Hydro.

The final theme paper deals with the assessment of the consequences of landsliding and how to quantify the likelihood of occurrence of various consequence scenarios, drawing on the model that has been developed in Hong Kong.

This book succeeds in bringing together a wealth of current practice in what is a relatively new subject to many people. It will certainly provide a starting-off point for those wishing to develop risk assessment practice and I can see that the ideas presented could be transferable to other fields apart from landsliding. No doubt risk assessment techniques will evolve rapidly in the coming few years but I would commend this volume to anyone for whom the book is intended will have difficulty progressing beyond the first diagram in the geology section—a poorly reproduced 3D block diagram labelled ‘Conceptual flow models for NAPL Sites’ including a ‘detailed blow-up of a DNAPL unsaturated zone four phase system’ (in sharp contrast to the third chapter entitled simply ‘Hydrogeology’). The practising geoscientist or student for whom the book is intended will have difficulty progressing beyond the first diagram in the geology section—a poorly reproduced 3D block diagram labelled ‘Conceptual flow models for NAPL Sites’ including a ‘detailed blow-up of a DNAPL unsaturated zone four phase system’ (NAPL and concepts of porosity and saturation are not introduced for a further 30 pages). The figures are generally poor throughout the book.

These introductory chapters are followed by four more applied chapters on subsidence, sources of contamination, impacts on water resources and groundwater protection. These contain some useful data and examples. However, theoretical concepts such as solute transport are addressed in a patchy way throughout the book rather than in an introductory section so that it will be difficult to use this book as a handy reference. The final chapter contains case studies on the Nubian sandstone in Egypt, a landfill on limestone, catastrophic subsidence and the hydrogeology of Figeh Spring in Damascus. These largely reflect the personal interests and expertise of the authors rather than assist a general reader. In summary, this book falls a long way short of its stated target as a complete introduction to the subject.

M. J. Streetly

**Hydrogeologic Models of Sedimentary Aquifers.**

*G. S. Fraser & J. Matthew Davis (eds).* SEPM, Tulsa, 1998. £41.50 hardback; vi+188pp. ISBN 1-5676-052-2.

This excellent book is a ‘must’ for anyone interested in developing an understanding of how the spatial distribution of sediment types in fluvial and glacial formations can influence their groundwater flow properties. It considers several different approaches that address two of the principal uncertainties in groundwater flow and contaminant transport modelling: uncertainty related to the spatial heterogeneity of geological materials, and uncertainty associated with the flow and transport parameters associated with these materials. The approaches range from the purely mathematical and statistical techniques to those based on a geological understanding of depositional environments and processes.

Although the bulk of the book consists of ten papers that deal with different techniques and case studies, these
have been drawn together in an introduction by the editors. This provides a valuable and well written overview of the history, current state and future direction of research into the application of spatial geological simulation for groundwater modelling. It summarizes the different tools and approaches currently available, presents synopses of the included papers and provides a comprehensive reference list which should satisfy anyone who wants to delve deeper. The methodologies described include the use of classical field investigation and interpretive mapping, geophysical and tracer test techniques, and the simulation of heterogeneity between observations using geostatistics, fractal geometry, Markov chain models, Monte Carlo analysis and geological process models. The process models generate three-dimensional distributions of sediments from a quantified description of depositional processes. Groundwater flow models may then be parameterized if permeabilities can be associated with the sediment types. Many such models can be generated to produce a range of geological distributions which are consistent with observations, thus allowing the impacts of uncertainty in spatial heterogeneity on (for example) contaminant breakthrough times to be considered.

The approaches described are likely to be most relevant where groundwater modelling is being applied to contaminant transport problems in uncremented clastic sedimentary aquifers—all of the case studies are from fluvial or glacial aquifers in the USA. The UK hydrogeologist should find these accounts useful for studies of the Drift and also of sandstone aquifers, although in these, diagenesis, cementation and fracturing are also clearly important influences on hydraulic properties. Sedimentary geologists providing input to large-scale hydrogeological modelling investigations, such as those recently concerned with the Sherwood Sandstones at Sellafield in Cumbria, should also find much of interest in this book.

Helpful schematic illustrations, maps, charts and distributions accompany most of the papers and the quality of reproduction is high throughout.

Rob Soley

Aggregate resources: a global perspective. P Bobrowsky (ed.) Balkema, Rotterdam, 1998. £63 hardback; viii + 470pp. ISBN 90-5410-675-1.

The book attracted my attention because I had not seen before a review which claimed to treat the subject on a global scale. However, as the editor says in his introduction, several generic works on aggregates have been produced this decade in Europe and North America and a list is given. So how should his publication be viewed?

The book is a collection of 27 papers, plus an introduction written by the editor who works for the British Colombia Geological Survey. The papers are organized into five themes covering production and legislation, geological and environmental issues, landuse issues, technical aspects, and case study examples: these are the author’s words. However, there is a strong emphasis on aggregate resource assessments and the effects of quarrying on landuse and the environment. 14 of the papers are from North America, nine from the rest of the world and four concern more generalized topics such as aggregate classification and assessment techniques. These last papers on general topics are particularly good, especially the contribution from a Dutch author on the value of petrographic evaluation for aggregate durability. I had a strong feeling that the book was built around the contributions from the North American authors: the papers from the rest of the world are a curious mixture of countries and subjects: for example, the aggregate resources of South Africa and Norway and the Netherlands together with the effects of sand extraction in Kenya and the environmental effects of quarrying in the Lebanon. That is not to say that this incongruity devalues the book. Each paper stands by itself and contains a wealth of information, especially the aggregates resources papers, which will be of much interest to industrial geologists and general practitioners. The bibliographies given at the end of each chapter are exhaustive. However, I did not feel that the book was suitable for the beginner because there are no chapters on basic principles of exploration and evaluation: but there are plenty of other references available for that aspect.

I thought that the book would have been better organized on a geographical basis, thus a section on aspects of North American aggregate production, another on production in other parts of the world and a final section on more general topics. It may be, however, that the subjects of some papers would overlap too much. For example, there are three papers on aspects of aggregate production in British Colombia, three on Ontario, two on Alberta and one paper on the Canadian aggregate market!

The book is quite expensive but sturdily bound and in general is well produced. However, some of the diagrams are not clear and the photographs would have been more appealing in colour. Nevertheless it is a valuable contribution to this important subject.

M. E. Woodbridge