

## BOOK REVIEWS

GRAVEL BED RIVERS—FLUVIAL PROCESSES, ENGINEERING AND MANAGEMENT, edited by R. D. Hey, C. R. Thorne and J. C. Bathurst (1982). J. Wiley and Sons, New York, 875p. (£Stg 47.00).

This volume comprises papers and discussions of the first International Workshop on "Engineering Problems in the Management of Gravel-Bed Rivers" held at Gregynog, Newtown, U.K. in June 1980. The book is far superior to the majority of proceedings volumes, however, in that it presents a comprehensive summary of what is presently known about gravel-bed rivers, logically arranged in a satisfying progression through hydraulic theory, sediment transport, bank erosion, bar dynamics, modelling and regime equations to river regulation and training, land-use effects and ecological impacts. This tight organisation is very appropriate to the first meeting on what seems to be a new sub-discipline of river mechanics, and clearly great care has been taken both by the organisers and the individual contributors to restrain flights of fancy in favour of establishing and presenting the extent of existing knowledge.

Space precludes a discussion of all thirty papers in the book. Almost all summarise existing published work; some chapters are largely familiar, having been prominent in recent literature; a few present new data and concepts, and several suggest important directions for future research. The publication of discussions with the individual papers serves the useful purposes of applying a gentle brake to an author's enthusiasm for a particular approach, or of presenting material which was at the time unpublished and has appeared only recently, or of quoting practical cases to illustrate an author's concepts. The discussions also lend a welcome sense of immediacy to a rather weighty tome. Some chapters which seem particularly relevant to workers in New Zealand include "Flow resistance in gravel-bed rivers" by D. I. Bray; "Transport of graded gravel material" by W. R. White and T. J. Day; "Channel bars in gravel-bed rivers" by M. Church and D. Jones; "Flow resistance in boulder-bed streams" by J. C. Bathurst; "Mathematical modelling of sediment movement" by W. A. Thomas; "Regime equations for gravel-bed rivers" by D. I. Bray; "Effect of river regulation on channel stability" by R. Kellerhals; and "Effect of sediment transport and flow regulation on the ecology of gravel-bed rivers" by R. T. Milhous. Several papers deal in part with braided rivers, and it is refreshing to see that the problem of describing a braided river in quantitative terms is being recognised, even if no adequate solution seems to be within reach.

In my view this is the most important book to appear for many years on the subject of river behaviour. It is particularly timely for those concerned with rivers in New Zealand, since the need to understand and predict the behaviour of our rivers in response to "development" strategies is becoming urgent; the book provides a comprehensive platform of knowledge from which such understanding may be developed. In spite of its price, this volume is strongly recommended for all with a professional

interest in gravel-bed rivers; indeed, the technical quality of its contents and the excellence of its presentation make it well-nigh indispensable.

*Tim Davies*

**RIVERS—FORM AND PROCESS IN ALLUVIAL CHANNELS**, by Keith Richards (1982). Methuen and Co. Ltd., London, 358p. (£Stg 8.50, paperback).

In recent years several books have appeared on the subject of geomorphological processes, usually in the form of collections of contributions from a variety of authors, usually with a predominantly qualitative approach and usually including a summary chapter on fluvial processes. Following these rather bland productions, Keith Richards' book is refreshing in its completeness, in its attempt to provide quantitative insight where possible, and in its dedication to fluvial processes (which, in New Zealand at least, surely merit a complete volume). This is essentially a basic textbook for students of geomorphology, sedimentology, hydraulics, and river management. It fulfils many of the criteria by which textbooks are judged—it is inexpensive; its covering of relevant topics is logical and comprehensive; its nomenclature seems to be consistent; it is quite readable; and concepts are explained clearly. The book fills a gap in the literature between essentially geomorphological texts, such as Schumm's "The Fluvial System", and engineering-orientated works such as those of Yalin and Raudkivi; in some ways it may be seen as a successor to "Fluvial Processes in Geomorphology" by Leopold, Wolman and Miller, but it has advantages over this "classic" text in being more up-to-date and in covering a much wider field of literature (understandably!). Richards has in fact produced a remarkably complete and well-balanced summary of progress in fluvial processes up to the early 1980s, and so as well as being an excellent undergraduate text the book will serve as a valuable source for researchers, both new and old. Indeed, in conjunction with an undergraduate fluid mechanics course and books such as Yalin's "Mechanics of Sediment Transport" and the recently-published "Gravel-bed Rivers" (which is reviewed elsewhere in this issue), an excellent reference basis is now available for all who are professionally involved with river processes in New Zealand. One hopes that final year civil and agricultural engineering students will be directed to use Richards' book, giving as it does a wider perspective to river processes than the purely mechanistic approach of engineering hydraulics.

The book's contents demonstrate the qualities referred to above:

- a discussion of the nature and significance of alluvial channels, including treatment of time-scales and the status of variables;
- the drainage basin—networks, hydrograph generation, sediment sources, yield and storage;
- open channel flow, sediment transport mechanics and processes;
- channel-forming flows;
- channel morphology—cross-section, channel pattern, slope and long profile;
- channel changes;

—channel management and design.

There are some minor quibbles which could be made; incorrect definitions of stream power and friction factor suggest that care should be exercised in using the book, for example, and the diagrams are often crowded and confusing at first glance (although amply repaying the sort of study which a textbook deserves).

In summary, this is a book which will be of great value for undergraduate courses in geomorphology and engineering, and is highly recommended to students, teachers and researchers as well as to river engineers and others concerned with river behaviour.

*Tim Davies*

LANDFORMS OF NEW ZEALAND, edited by J. M. Soons and M. J. Selby (1982). Longman Paul Limited, Auckland, 392p. (\$34.95).

I have been awaiting this book for quite a while; now when I am asked to explain some landscape feature I shall no longer profess ignorance but quietly sneak a glance at "Landforms of New Zealand". Of course, a book of this size cannot hope to be comprehensive, and a comparison of the 14 page chapter on "The Geological Perspective" by R. P. Suggate and the 819 page "Geology of New Zealand", edited by Suggate indicates the amount of compression that has been necessary.

This volume consists of 19 chapters written by 27 contributors, who include many eminent names in contemporary geology and geomorphology in New Zealand. One might expect, then, an authoritative treatment of the subject, and by and large this has been achieved. As the editors note in their preface, coverage cannot be even, because of the nature of the country and the small number of earth scientists available to study it; the depth of the presentations is accordingly somewhat variable, ranging from a quite detailed discussion of the central volcanic region to a thumbnail sketch of Fiordland.

The book commences with six chapters which take a systematic look at various topics, and the remainder consists of 13 chapters reviewing the regional geomorphology of New Zealand. I found the arrangement of the chapters somewhat curious, and responsible for a degree of both repetition and omission. The systematic chapters cover (1) The geological perspective, (2) The age and development of the New Zealand Landscape, (3) The stability of hillslopes, (4) Erosion processes in the mountains, (5) Coasts, and (6) Karst. The respective treatments are such that these chapters, which one presumes were intended to provide some sort of general introduction to the New Zealand landscape, actually provide a grabbag of information which does not present a coherent picture of the landscape from either a process, lithologic, or chronological point of view. Much of the content in fact shows up in the later "regional" chapters, while there are some surprising omissions, for example of any systematic discussion of fluvial or glacial processes.

The regional chapters are also arranged in a somewhat curious way, regions apparently being delineated on the basis of lithology (the Central Volcanic Region), gross landform type (Basins and Lowlands of the South

Island), geographical location (Fiordland), structural considerations (Hawkes Bay), and on other considerations that are never explained. And then there is D. H. Bell's extremely interesting chapter on the geomorphic evolution of the Kawerau Valley, which seems an "odd-man-out". It would perhaps be unfair to criticise the basis for the arrangement of the chapters, except that the present arrangement has led to a patchiness of presentation which virtually omits coherent treatment of large areas of country—East Cape, or the uplands of Otago and Canterbury (Chapter 4 notwithstanding) — or subject matter — fluvial, glacial, periglacial and fluvio-glacial processes particularly. One feels that had a consistent scheme been adopted for the book, it could have been more comprehensive and coherent than it is, with less repetition. It appears that a major control on the chapter arrangement was the specific interests of the contributors; since they were writing on topics or areas on which they were expert, rather than which conformed to a neat chapter arrangement, one may be confident of the authority of what is included.

In their preface, the editors almost invite comparison with C. A. Cotton's books on the New Zealand landscape. It is remarkable that Cotton is referred to in only three or four chapters, and only in one is his work given any prominence. "Landforms of New Zealand" is, in comparison with Cotton's "Geomorphology", a compilation of an abundance of hard fact, but with less synthesis than Cotton was perhaps able to achieve with the "cycle of erosion" as an underlying model. Perhaps plate tectonic theory, used extensively by several contributors to the present volume, will eventually provide a basis as satisfying to today's geomorphologists as the cycle was to Cotton and his contemporaries. But it is a daunting thought that, with the volume of information available today, it requires 27 scientists to put together a textbook to replace the work of one man forty years ago.

*Paul Mosley*

**CARBON DIOXIDE; FRIEND OR FOE?** by Sherwood B. Idso. IBR Press, Tempe, Arizona. 96p. (US\$9.95).

This author makes some very pertinent comments and criticisms of the current main stream establishment modelers in their treatment of the question: "What will happen if the level of atmospheric CO<sub>2</sub> is doubled?"

His style is light and easy to read. His strong philosophical emphasis may give the impression that he is not as scientifically qualified as he in fact is, as a leader in infra-red sensing and measurement.

The subject is extremely important. The massive volume of fossil fuels being burnt, along with the destruction of vegetative matter, due to deforestation and urbanisation, is giving an exponentially increasing level of atmospheric CO<sub>2</sub>. Consequential global warming could be as high as 2 to 4°C according to "establishment" modelers. This would be catastrophic for agriculture as it is likely to melt a great deal of ice and raise sea level to cover much coastal arable land, as well as giving major changes in rainfall patterns. Thus it is vital that the best possible work be done to give the most reliable predictions to planners and politicians.

In a very straightforward way the author has raised serious criticisms of current predictions. He points to glaring inconsistencies in the modelers' own published work. For example, modelers have carefully extended their models to use separate latitudinal zones, each with their own 'recorded' temperature history for the past century. The models are then empirically tuned to fit the observed data, and extrapolated into the future with a rising global mean temperature resulting. However the author notes that there has been a rapid rise in CO<sub>2</sub> since 1945, largely due to emissions in the Northern Hemisphere, yet over this same period 1945-1980, the temperature history shows decreasing temperatures in the Northern Hemisphere.

Dr. Idso's own work, and that of a small number of others, suggests that the global temperature increase due to a doubling of CO<sub>2</sub> is not likely to exceed about 0.25°C; in fact, it may decrease.

Dr. Idso further suggests that increased CO<sub>2</sub> will benefit growing plants. This point is well taken but it must also be related to the whole weather-soil-management complex before it can become a positive contributor to world food. It is disturbing to see the lack of note or concern for the other linked issues; the depletion of non-renewable resources, and the rapid depletion of soil fertility which has accompanied "development" powered by fossil fuels.

For those who are sincerely concerned about the likely effects of increasing CO<sub>2</sub>, this book is essential reading. It is hoped that "conventional" modelers will also read it with objectivity and open minds, so that we all might see a resolution of the issue for the benefit of everyone on this planet.

*Neil Cherry*

## FORTHCOMING EVENTS

19-24 March 1984: Third International Symposium on Land Subsidence, Venice, Italy. (IAHS/UNESCO).

Papers are sought on legal, socio-economic and environmental effects of land subsidence due to fluid withdrawal, and on engineering theory and analysis, karst "sink-hole" type subsidence, and subsidence due to dewatering of organic deposits or to application of water (hydrocompaction).

Contact: A. Ivan Johnson, Program Chairman, 7474 Upham Court, Arvada, Colorado 80003, USA.

24 June 1984: International Symposium on Impermeable Barriers for Soil and Rock, Denver, Colorado, USA. (ASTM).

Contact: A. Ivan Johnson, 7600 E. Orchard Road, Englewood, Colorado 80111, USA.

23-27 July 1984: International Symposium on Challenges in African Hydrology and Water Resources, Harare, Zimbabwe. (IAHS/UNESCO/WMO).

Groundwater exploration, assessment, development and management; soil erosion assessment and control.

Contact: Zimbabwe Conference Board, P.O. Box 1898, Harare, Zimbabwe.

7-12 January 1985: International Congress on the Hydrogeology of Rocks of Low Permeability, Tucson, Arizona. (IAH/GSA/AGU/ASCE).

Program: Flow in low permeability fractured rocks, nature of fracture systems, hydrogeology, environmental isotopes, hydrogeochemistry.

Contact: E. S. Simpson, Department of Hydrology and Water Resources, University of Arizona, Tucson, Arizona 35721, USA.

3-5 September 1985: International Symposium on Erosion, Debris Flow and Disaster Prevention, Tsubaka, Japan. (Sabo).

Contact: Dr. S. Kobashi, Department of Forestry, Kyoto University, Kyoto 606, Japan.