

BOOK REVIEWS

GLACIO-FLUVIAL SEDIMENT TRANSFER: AN ALPINE PERSPECTIVE. A. M. Gurnell and M. J. Clark (Editors). John Wiley and Sons Ltd., Chichester, 1987, xv + 524 pp., £stg 42.50 (hard cover).

The stated aim of this volume is to provide an integrated, state-of-the-art review of research dealing with sediment transfer in alpine glacier basins. It contains 18 articles, all by European authors, and is therefore heavily, but not entirely, slanted towards research in the European and Scandinavian Alps.

The volume is well-organised, being divided into four sections. The table-of-contents is excellent. It contains a detailed but nicely structured listing of the main topics, so that, at a glance, one can quickly establish the content of each chapter, each section, and the volume as a whole and also focus quickly on a particular topic of interest. The chapter contents are also summarised by abstracts. References are listed at the end of each chapter, and there is a subject index at the end of the book.

The first section includes general review chapters on mountain sediment systems, periglacial processes, sediment transfer by ice and water, and hydrogeomorphology in alpine proglacial areas. The aim of these introductory chapters is clearly to set-up the framework that ties together the rest of the volume. I believe that introductions should be clear, concise, and easily read. Unfortunately, the first three chapters, shared by the editors Gurnell and Clark, qualify on none of these counts. They suffer from too many big words, much waffle, and plain bad English. For example: "*However, there are limits to the advantages of reductionism, and signs that a more integrative priority may soon be in the ascendancy.*" (p. 17) Much of the verbiage is to do with attempts by the authors to make complex the simple fact that alpine sedimentary systems are complex. In short, the first three chapters are a slog, and instead of whetting appetites for the good stuff that follows, they serve as a barrier. Fortunately, the day is saved in Chapter 4 by C. R. Fenn who covers much the same ground as Gurnell and Clark but does so in a few pages of lucid writing. I would suggest that all but masochists begin this book at Chapter 4. K. J. Gregory's chapter on hydrogeomorphology is well organised and informative, but is also wordy in places.

The second section focusses on the details of en-, sub-, and supra-glacial sediment transport and deposition and on moraine sediment budgets. R. J. Small's treatments of en- and supra-glacial systems (Ch. 6) and then of moraine sediment budgets (Ch. 8) are informative and well written. He has expertly spiced review and description with case examples from a variety of glaciers. His discussion of these case examples provides a "well" of ideas which the reader could use when documenting and interpreting his/her own glacial system. The few references in these two chapters attest to the wide field experience and depth of knowledge of the author. In contrast, the chapter by R. A. Souchez and R. D. Lorrain on sub-glacial sediment is poorly organised and cluttered with facts and page-long paragraphs. The reader has to search diligently for the main point; fortunately, these are identified in the short conclusion. The final chapter in this section, also by R. J. Small and titled "*The glacial sediment system: an alpine perspective*", promises but fails to tie together the preceding four chapters. Instead, it is more a continuation of Small's exposition on supra-glacial sediment.

The third section centres on glacial hydrology and the transfer by meltwater of solutes, suspended load, and bedload. It contains the best and "meatiest" papers in the volume. H. Rothlisberger's and H. Lang's chapter on glacial hydrology is excellent. Although lengthy, it is well organised, clear, and instructive and the main points are nicely tied together in an interesting conclusion. R. A. Souchez's and M. M. Lemmens' treatment of solutes in meltwater is of similar quality. A. M. Gurnell provides an excellent, well balanced review and discussion on suspended sediment in proglacial streams. This includes a refreshingly honest analysis of data deficiencies. Her conclusion contains a useful list of topics for further research. B. Gomez's chapter on bedload, while a well-written up-to-date review of bedload transport in gravel-bed rivers, belongs in another book. It does not focus at all on glacial environments; indeed, the part-word "glacier" is mentioned only three times! This is disappointing given the obvious importance of bedload in proglacial channel processes. The expected references to bedload sources, sinks, transport dynamics and kinematics, etc, are simply not there. C. R. Fenn provides a chapter examining the ways that electrical conductivity has been used in hydroglaciological studies. It is clearly written, giving a good background to the subject as well as good focus on glacial applications. A. M. Gurnell uses the final chapter of this section to draw together and consider the relative importance of the components of total sediment load from alpine glacial catchments. This includes a far from comprehensive list of data on sediment yields from various basins.

The fourth section claims to look at the implications of alpine glacial sediment transfer as applied to proglacial channel processes and to a case-study of a hydro-electric power scheme in the Swiss Alps. C. R. Fenn and A. M. Gurnell discuss proglacial channel processes. Their emphasis is on rates and modes of channel adjustment and relationships between channel form and size and transmitted discharge and sediment load, rather than the sedimentary aspects. At 50 pages, this chapter is a mite too long for easy reading, and, while clear and informative in places, it tends to be hamstrung by some poor paragraph structuring. I hate technical paragraphs that run for one and a quarter pages! Generally, good use is made of case-examples to illustrate points, but Section 16.5, looking at adjustments in channel cross-sections, is out of scale and style with the rest of the book. In this, 18 pages are given to a detailed, rambling presentation of what is clearly the authors' own fieldwork. The main points of this "barrow push" could easily have been set out in 3-4 pages at most. The case study by A. Bezingé of meltwater streams influenced by the Grande Dixence HEP scheme adds little to the book but a further 25 unnecessary pages. It provides less detail and less-pointed case-examples than can be found in the preceding specialist chapters. The only new material concerns suspended sediment deposition in "near glacial" HEP lakes, which is a considerable deviation from the book's topic. Also, the abstract is not an abstract but an introduction. The final chapter of the book, by M. J. Clark, discusses and evaluates the state of research in the four main study areas of alpine sediment systems: contemporary processes, sediment budgets, paleoenvironmental reconstruction, and practical studies such as water quality and quantity and mountain hazards. Some interesting discussion is presented, but, as with other chapters by Clark, the writing style is bombastic and the reader has to work hard to interpret the message. The very last section is the best part.

The text is well set-out and easy to read. Typographical and grammatical errors are few; these lapses being most common in the chapters written by the editors! The illustrations are printed to a high standard and most are useful. Again, most redundant figures belong to the editors. The average number of references per chapter is 53; of these, 38% were published during or since 1980.

I would recommend this book to any serious and/or beginning student of alpine glacial sediment systems. It collects together a large amount of useful information, experience, and ideas for future research. To a large degree, it meets its aims. The main shortcomings are its European bias, a lame review of bedload transport in proglacial channels, and excessive verbiage by the editors in introducing and winding-up the volume.

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DEVELOPMENT IN HYDRAULIC ENGINEERING — 4. P. Novak (Editor)
Elsevier Applied Science, London, 1987, 352 p. £stg 40.00.

The volume contains six chapters, each by different authors, that are intended to give a state of the art review of knowledge in the areas of lake hydraulics, tidal power generation and groundwater flow. The first chapter on lake hydraulics starts with a brief discussion of field measurements. This is followed by an introduction to the equations of motion and boundary conditions. It is assumed in developing these equations that hydrostatic pressure distributions occur along vertical lines, that temperature changes from conduction are relatively small and that Reynolds stress terms in the equations of motion can be approximated by using an eddy viscosity. Then a discussion is given of the relative importance of the terms in these equations, and applications of the equations to surface and internal seiches, other types of wave motion and wind-induced circulation are discussed. This discussion is written in a general way and does not become concerned with mathematical and numerical details of solving the equations.

The second chapter on tidal power generation gives a general overview of the planning and design of tidal power stations. Computational aspects are not considered, so that this chapter alone is almost devoid of equations. The chapter concludes with a discussion of some of the notable tidal power stations that have been built throughout the world.

The third chapter on multiphase flows in porous media considers two and three phase flows such as air and water, water and oil or water, air and ice through a porous medium. The author states in his first sentence that the chapter is not intended to be an elementary introduction, and perhaps it is a consequence of this that the chapter contains a very large number of different mathematical equations and symbols. Solutions involving one spatial dimension and time for the movement of air and water through soil (partially saturated flow) are discussed in some detail. Then two-dimensional two-phase flows are discussed by considering oil recovery from horizontal aquifers that contain both oil and water. Finally, the chapter concludes by considering a one-dimensional three-phase flow that involves the movement of water, air and ice through a porous matrix.

The fourth chapter considers groundwater flow and pollution in fractured rock aquifers. A review is given of some of the various equations that have been used to model groundwater flow and pollutant transport in fractured rock aquifers. In some models flow is assumed to occur only through fractures, while

other models allow flow through both fractures and the surrounding unfractured porous rock. Deterministic equations are derived for various combinations of fracture geometry and rock permeability, and solutions of these or similar equations obtained by different research workers are discussed.

Numerical groundwater models are discussed in chapter five. The details of particular numerical technique are avoided, for the most part, and attention tends to be focussed upon effects such as nonlinearities, vertical velocity components and changes in transmissivity that occur with drawdowns in unconfined aquifers when permeabilities change significantly with depth. A number of equations in this chapter are written with different permeabilities and transmissivities in each of the coordinate directions, but it is not explained that these equations have been written in a very special form that assumes that the coordinate axes are aligned with the principal directions of the permeability or transmissivity tensor. Also, a discussion of radial flow models emphasizes the generality and flexibility of numerical models for modelling flow to wells but ignores the fact that the quality and quantity of field data is not sufficient in most applications to make use of these attributes.

The final chapter is entitled "Groundwater Utilisation and Protection". The first part of this chapter discusses groundwater exploration with the use of wells and permeameters to measure point values of permeabilities, geophysical techniques to explore groundwater geology and piezometric surveys to determine directions of groundwater movement. This is followed by a description of several different types of wells and a brief discussion of the analysis of well test data to obtain values for aquifer parameters. Then a rather long section gives details of well and well filter design, followed by sections on springs and groundwater protection.

Only three of the 29 references listed in this final chapter are written in English, and many of the formulae are given, without supporting developments, from these references. This would make it difficult for anyone without a reading knowledge in these languages and/or without access to the references themselves to apply these formulae with confidence. Furthermore, not all of the symbols in these equations are defined very carefully, all of which is further complicated by the author's awkward use of English.

Finally, it should be pointed out that none of the references for any chapter are listed in alphabetical order, and page numbers showing the location of cited material are not given for books. In the writer's opinion these are major editorial errors, since references are one of the chief values of any book or paper that professes to give a state of the art review of a subject.

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