



Book Reviews

***Sinkholes and Subsidence: Karst and Cavernous Rocks in Engineering and Construction.* Tony Waltham, Fred Bell and Martin Culshaw. Springer Verlag, Berlin, Heidelberg, New York, and Praxis Publishing Ltd., Chichester. [Springer-Praxis books in geophysical sciences.] ISBN 3-540-20725-2. Published price £100.00.**

- Buried sinkholes and rockhead features;
- Sinkholes in insoluble rocks;
- Rock failure under imposed load over caves;
- Sinkholes induced by engineering works;
- Ground investigation in sinkhole terrains;
- Hazard and risk assessment of sinkholes;
- Prevention and remediation of sinkholes;
- Construction in sinkhole terrains.

At last – a book about engineering geology (and related topics) that is dedicated to karst and karst-related issues, written by a team that knows about and appreciates karst. The author team is strong and knowledgeable, to say the least, but there is also a list of additional contributors drawn from the worlds of engineering geology, karst geology/geomorphology, and beyond.

This review does not set out to examine and debate the detailed ins and outs of the recommended engineering practices that form the bulk of this 382-page book. Such reviews will appear elsewhere (if they have not appeared already). However, the novelty of the book is such that it is worthy of examination purely from the viewpoint of its potential place in karst – rather than engineering geology – literature. Before embarking upon an appreciation of the “karst” content of the book, it is as well to list the spectrum of topics that it covers. There are 12 descriptive chapters, plus chapter 13, which provides a number of pertinent and informative case studies, and it is here that the depth of knowledge provided by the team of additional contributors comes into its own.

The first twelve chapters are entitled:

- Rocks, dissolution and karst;
- Sinkhole classification and nomenclature;
- Rock failure in collapse and caprock sinkholes;
- Soil failure in subsidence sinkholes;

Inevitably, many interesting aspects of karst science (and pseudokarst science) crop up throughout all of these chapters but, from a purely karst viewpoint, the first and second chapters contain the most concentrated interest.

Chapter 1, “*Rocks, dissolution and karst*”, needs less than 23 pages to provide a sound introduction to the major aspects of karst science, interwoven with appropriate “hooks” to the engineering topics that are covered in more detail in the cross-referenced chapters later in the book. Fundamental karst topics such as limestone lithologies and dissolutional processes are neatly covered, along with aspects relating to dolomitic rocks, evaporite rocks and chalk, as well as a short section touching upon the wide and ever more visible topic of anthropogenic influences on karst. The long and cosmopolitan experience of the first named author in the actual study of caves and karst and, more importantly, in getting across the important aspects of this knowledge to a mixed-experience readership, is immediately obvious. This chapter contains all that is needed to provide a basic understanding of the fundamentals of cave and karst development. Clearly there is more (much more) to karst science as a whole, but this chapter is exactly what it sets out to be – fit for purpose and up to date. What’s more, the chapter, like the others in the book, is supported by a series of pertinent and informative figures and photographs.

Chapter 2 moves from the general to the specific, looking at dolines or, as many English-speaking engineers prefer to call them, sinkholes, features that maintain a high profile throughout much of the book. Whereas several pages could be written on the use, abuse, misuse and implications of the terms sink, sinkhole, swallow, swallet, swallow hole and doline (in several flavours) over the years, and the potential that remains for confusion in archival documents, the decision of the authors to adopt and “go with” the term sinkhole is sensible in context. A little of the history of the terminology is provided and discussed – objectively – leading to the conclusion that the terms sinkhole and doline are effectively the same but, for consistency, the former term is used throughout the remainder of the book. This chapter deals generically, and in terms that are easy to understand, with sinkhole classifications, sinkhole development and evolution and – importantly – with sinkholes in karstic rocks other than carbonates. It also introduces the vital topic of the interface between sinkholes and engineering practices. Once again this chapter is carried forward on a raft of fine photographs and line illustrations, and I can think of no better illustrated or more clearly written English language introduction to sinkholes, whether in specific engineering texts or in more general karst textbooks.

From my own layman geologist’s point of view the specialized engineering geology discussed in chapters 3 to 12 seems more than sound. Some might argue that detailed study of each chapter’s central topic could fill a textbook on its own, but these chapters seem comprehensive in width of coverage, and bang up to date. They are also well illustrated throughout with appropriate, in some cases spectacular, photographs and a plethora of line illustrations, some based on diagrams seen before, some original.

Chapter 3 includes considerations of the manifestations of “collapse”, in a variety of rock types, rounding off with a brief consideration of the hazards that collapse presents. A similar pattern is followed in chapter 4, which examines the mechanisms and effects of subsidence and the various subtypes of subsidence sinkholes. In chapter 5 the important issues of buried sinkholes and related irregular rockhead features (such as pinnacles and unroofed caves) are considered. Chapter 6 is dedicated to sinkholes in insoluble rocks – dwelling mainly on those related to lava tubes, but with a brief consideration of other pseudokarst situations including piping effects in unconsolidated materials. Moving more deeply into practical engineering, chapter 7 examines the effects of loading the surface above karstic voids,

and chapter 8 looks at other important engineering issues such as reservoir construction and groundwater abstraction. The remaining chapters (9 to 12) delve still more deeply into engineering practices, covering the major topics of ground investigation methods, hazard/risk assessment, prevention and remediation strategies and construction methods. There are fewer photographs overall throughout these last few chapters, but there are many clearly drawn line figures and tables. Those photographs that are used are appropriate to the topics and in many cases they make a telling impression.

Chapter 13 comprises 16 case studies that cover a spectrum of karst-related “problems” in a variety of geographical and geological situations, all documented by acknowledged experts in the fields being considered. Here again the photographic coverage is excellent, as too are the many line figures including clear and informative site plans and schematic cross sections.

Scattered through the first half of the book are a number of “boxes” containing short discussions of well-illustrated and self-supporting examples of the features or issues being presented in the adjacent pages. These “boxes” add a specific level of reality to the theoretical considerations that would not be provided even by passing, in-text, references to named examples. Of course the latter are also plentiful throughout the book, and they are immensely useful in their own right.

At the front of the book a short but interesting Preface, plus lists of contributors, figures, tables and boxes, are augmented by a brief but useful glossary of “sinkhole terminology”. The book is completed by an extensive and up to date, but obviously not exhaustive, reference list, a locational index and a subject index, with both of the latter seeming fairly well and accurately populated, and hence really helpful.

To me this seems to be a useful, user-friendly and well-written reference text that carries significant interest for lay readers (whether or not they be geologists), even those who might just start by glancing at the illustrations before being drawn into the related discussions. It will inevitably also provide an accessible way into the intricacies of karst and its related issues for those wishing to gain a deeper knowledge. Mainly, however, it is designed to educate all those – engineers or otherwise – who might need to plan for, or deal with, the many unique problems and hazards associated with karst landscapes (and buried karst landscapes). The only negative comment has to relate to the published price. Whereas at £100 per

copy the book will probably attract an initial bulk sale to libraries and a few corporate organizations, it seems unlikely that it will find much of a market among the general public, even among karst researchers and those interested in the exploration and study of caves. This is a shame and a seeming waste of the work that went into the book and the thought that must have underlain the authors' choice of illustrations.

In closing I cannot resist quoting verbatim from a postscript to the book's Preface. After brief discussion of a recent karst-related incident in Florida, USA, the authors note:

Press comments that "*A sinkhole as deep as this is undetectable*", "*It was just a bizarre event*", "*A*

small problem with the soil, something 1–6m across, is easy to miss; if you try to find every one, you could not afford the project", and "*It was an act of God*" showed a complete lack of understanding of the karst. The authors hope that this book will improve understanding in the future.

Amen to that.

Dave Lowe

C/o BGS

Keyworth

Nottingham

NG12 1AQ

UK