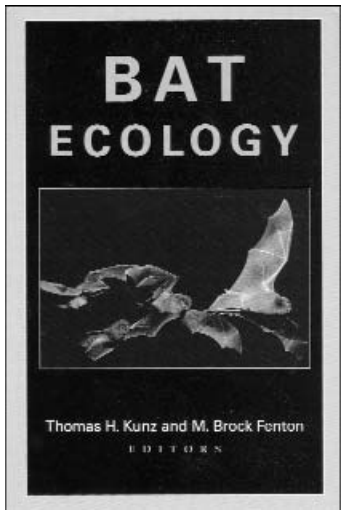

Bat Ecology

Thomas H. Kunz and M. Brock Fenton, eds. The University of Chicago Press, 798 p., 19 halftones, 112 line drawings, 28 tables, 6 x 9 inches. Available from http://www.press.uchicago.edu/cgi bin/hfs.cgi/00/15369.ctl. ISBN 0-226-46206-4 (hardbound), $55.00. ISBN 0 226 46207 2 (softbound) available fall 2005, $35.00.

Bats are the second-largest group of mammals, with approximately 1100 species currently known and new species described at the rate of several per year. Overall, the information about their life history is small in comparison to other orders. But the level of interest and rate of bat research has greatly accelerated in the last decade or so and continues to grow. Bat Ecology nicely summarizes much of the current state of knowledge and points out many of the areas in which we are still deficient.

This hefty (>1kg) book consists of 15 chapters by 30 contributing authors, divided into 3 sections.

Part 1, Life History and Social Biology, starts with "Ecology of Cavity and Foliage Roosting Bats" by Tom Kunz and Linda Lumsden, emphasizing natural roosts such as tree cavities, loose bark, bird nests, leaf structures, open foliage, termite and ant nests, and so on. Next, John Altringham and Brock Fenton discuss "Sensory Ecology and Communication in the Chiroptera". This is a rapidly growing field, as we learn more about the auditory, olfactory, visual, and contact cues used by bats. Gerry Wilkinson and Gary McCracken follow with one of the best titles in the book, "Bats and Balls: Sexual Selection and Sperm Competition in Chiroptera", which is just what it sounds like. In "Ecology of Bat Migration," Ted Fleming and Peggy Eby explain the types, advantages, and consequences of migration and concisely summarize the similarities and differences in migration between bats and birds. The last topic in this section, "Life Histories of Bats: Life in the Slow Lane," by Robert Barclay and Lawrence Harder, contains an analysis of a number of reproductive, developmental, and longevity factors of numerous bat families in comparison to other similarly sized insectivores (shrews), with speculation on their evolutionary ecology.

Part 2, Functional Ecology, begins with a chapter by Sharon Swartz, Patricia Freeman, and Elizabeth Stockwell entitled "Ecomorphology of Bats: Comparative and Experimental Approaches Relating Structural Design to Ecology." Analyses of body mass, skull shape, etc., show that form does indeed follow function. Gareth Jones and Jens Rydell follow with "Attack and Defense: Interactions between Echolocating Bats and their Prey," another look at echolocation, prey selection, foraging strategies, capture success, and the various insect strategies to avoid being eaten. In line with the feeding theme, Otto von Halverson and York Winter look at food resources and energy costs in "Glossophagine Bats and Their Flowers: Costs and Benefits for Plants and Pollinators." Betsy Dumont supplements that chapter nicely with "Bats and Fruit: an Ecomorphological Approach." She covers fruit distribution and abundance and how bats partition and process the fruit. "Physiological Ecology and Energetics of Bats" by John Speakman and Don Thomas follows. The thermodynamic equations may turn off casual readers, but, in summary, interactions between body temperature and ambient temperature and associated energy budgets control everything from torpor to reproduction to flight.

Part 3, Macroecology, opens with a detailed chapter by Nancy Simmons and Tenley Conway on "Evolution and Ecological Diversity in Bats," which traces the fossil history of bats, the evolution of flight and echolocation, feeding specializations, and diversification of body size. "Trophic Strategies, Niche Partitioning, and Patterns of Ecological Organization," by Bruce Patterson, Michael Willig, and Richard Stevens, delves deeply into resource partitioning, and taught me a new word: animalivory (what most of us would call carnivory). The same authors also contribute "Patterns of Range Size, Richness, and Body Size in Chiroptera." Sharon Messenger, Chuck Rupprecht, and Jean Smith offer "Bats, Emerging Virus Infections, and the Rabies Paradigm," which covers one of the most commonly overlooked causes of bat mortality, disease. They also address how the way we perceive and prevent known diseases (such as rabies) and emerging diseases may impact our conservation efforts. The final chapter, "Conservation Ecology of Bats" by Paul Racey and Abigail Entwistle, discusses the need for additional knowledge of current status, threats, ecological requirements, and development of conservation approaches for the world's bats.

I had mixed feelings about reviewing this book. While I know many of the authors personally, I still found several chapters difficult to understand because I have little background in those particular disciplines, even with more than 20 years of experience working with bats. However the last chapter, "Conservation Ecology," should be read by every caver who thinks he knows something about bats. One of the best features of the book is the inclusion of suggestions for future research. Other selling points are that the book is well edited, the photos and figures are clear, and the literature cited is extremely thorough, totaling some 168 pages. The normal Subject Index is supplemented by contributors' contact information, a Species Index, and an Author Index. On the down side, I had my copy less than a week before the binding tore at the back cover. For $55, one expects it to last a little longer.

Another weakness, at least from a caver's perspective, is the failure to include almost any material on cave roosts and cave roosting ecology. The largest section devoted to caves, 8 pages, is in the section on rabies. Another half page, in the Conservation Ecology chapter, points out the importance and

fragility of caves. I realize that the majority of bat species are not cave dwellers, but not to include caves (or artificial roosts) in a chapter similar to the one for cavity and foliage roosting bats seems a disservice. Perhaps no prominent author was available to write it.

This book is definitely not for the average bat lover, but it is an invaluable reference for more involved researchers . It is not a picture book, not a field guide, and doesn't tell you how to capture or study bats. But there is a wealth of information for those who can wade through the jargon. If one wants to start a scholarly bat library, this book belongs right next to Kunz's earlier *Ecology of Bats* (1982), John Hill and James Smith's *Bats – A Natural History* (1984), Paul Racey and Susan Swift's *Ecology, Evolution, and Behaviour of Bats* (1995), John Altringham's *Bats – Biology and Behaviour* (1996), Kunz and Racey's *Bat Biology and Conservation* (1998), and the all-too-rare *Biology of Bats*, edited by William Wimsatt (1970).

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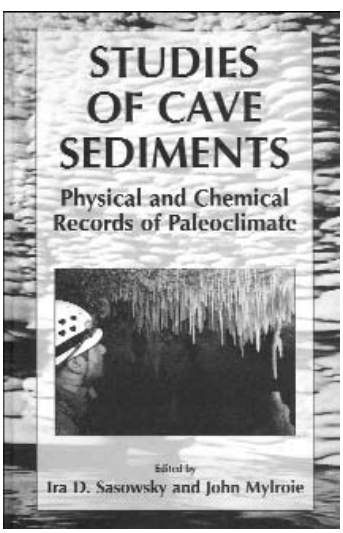

Studies of Cave Sediments: Physical and Chemical Records of Paleoclimate

Ira D. Sasowsky and John Mylroie, eds., 2004. New York, Kluwer Academic/Plenum Publishers, 329 p. ISBN 0-306-47827-7, hardbound, 6.4 x 9.5 inches, $155. Available on-line at http://www.springeronline.com.

This book has the stated goal of demonstrating to the scientific community the utility of cave deposits and the sophistication of current studies in the field. It is based mainly on papers presented at a symposium at a national meeting of the Geological Society of America. Paleoclimate is the theme woven throughout this book. The two major kinds of cave deposits, detrital and chemical, apply to paleoclimates in different ways. Climatic evidence from detrital sediments is indirect, as it is based mainly on interpretations of past flow conditions and grain petrology. Carbonate speleothems give a more explicit record of temperature and vegetation cover with time.

The 17 chapters in this book are divided almost equally between the two topics, but the combined length of those on chemical precipitates is about 1.5 times longer. Some of the chapters on detrital sediments do not specifically address climate, but they are solid complements to those that do. There are three kinds of chapters: descriptions of new projects, updates of older work, and broad syntheses inspired by the symposium topic. This book contains a good balance of all three. Illustrations are clear and well reproduced. Photos and diagrams include a mix of color and black-and-white.

In the book's preface, the editors give a good introduction to the subject and the papers in the volume, and they also throw their gauntlet into the ring to defend karst studies against the agnostic hordes. The chapters on detrital sediments include the following: Rachel Bosch and William White describe through several case studies the variety of transport phenomena and sediment facies in karst aquifers. Barbara Mahler and coauthors use data from the Edwards Aquifer of Texas to demonstrate the mobility of sediment and that up to 90% of bacterial contamination is associated with surface-derived sediment. R.J. Musgrave and J.A. Webb use paleomagnetic analysis to show the great antiquity (late Tertiary) of certain Australian caves compared to those in other more tectonically active continents. Ira Sasowsky and coauthors apply paleomagnetics and stratigraphic data to sediments in Kooken Cave, Pennsylvania, to illustrate how rapidly thick sediments can accumulate in a flood-prone cave. Using clay mineralogy, Leo Lynch and coauthors trace the detrital sediment in Barton Spring, Texas, mainly to the surface catchment areas up to tens of kilometers away. Elizabeth Knapp and coauthors show that sediments in certain Virginia caves provide a record that of warm/wet and cold/dry climates. France Šušteršič gives examples from Slovenia of how sediments can be used to recognize ancient unroofed caves and interpret their original catchment areas.

The chapters on speleothems begin with a broad but detailed overview of the topic by William White. This chapter provides a convenient reference for the more specific contributions that follow. Jeffrey Dorale and coauthors describe the techniques and constraints involved in U-series speleothem dating. Russell Harmon and coauthors discuss the use of stable isotopes in speleothems to obtain paleoclimate data, as well as the uncertainties in the method. Peter Kolesar and Alan Riggs show how the various depositional facies in Devil's Hole, Nevada, relate to their depositional environment. Christopher Spötl and coauthors use data from a cave in the Austrian Alps to contrast the carbon-oxygen isotopic signatures in interglacial deposits with those of cold-climate deposits.

Stein-Erik Lauritzen and Joyce Lundberg use speleothem data from near the Arctic Circle in Norway to decipher the climate and vegetation during the "super-interglacial" of about 500 ka. Steven Turgeon and Joyce Lundberg establish a speleothem chronology in Oregon Caves and correlate it with ice cores, showing the global nature of the signal. Victor Polyak and Necip Güven describe silicate deposition in caves and show that amorphous silica is most common in association with rapidly deposited calcium carbonates, whereas quartz and trioctahedral smectite are products of slower deposition. Finally, Donald McFarlane and Joyce Lundberg describe catastrophic flood deposits in West Indies caves caused by abrupt

climate changes during the last interglacial stage. The book's most serious omission is the topic of dating quartz-rich sediments by cosmogenic radionuclides, as the potential authors (limited to one or two) were unavailable at the time of writing.

The dual nature of the subject and the wide range of topics and analytical approaches might give the superficial impression of a heterogeneous group of papers cobbled together into a book. On the contrary, these topics are well integrated into a fairly coherent picture. Even the local studies provide wide-ranging concepts. Although, much of the information is available elsewhere, it is scattered throughout the literature. The only other book that covers comparable ground is the proceedings of a symposium held about 10 years ago in Norway (Lauritzen, 1996). Although it covers similar topics, it consists mainly of short, site-specific papers and has limited distribution.

Paleoclimatology has become such a popular and well-funded field that there are many researchers who know little about caves but are using speleothems to further their research. Let us hope that the Sasowsky-Mylroie book is a step toward broadening their perspective.

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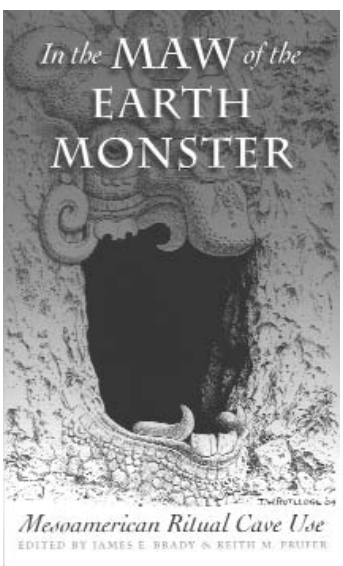

In the Maw of the Earth Monster: Mesoamerican Ritual Cave Use

James E. Brady and Keith M. Prufer, eds., 2005. Austin, TX, The Linda Schele Series in Maya and Pre-Columbian Studies, University of Texas Press, 445 p. First Edition, ISBN 0-292-70586-7, hardcover with dust jacket, 9.25 x 6.125 inches, $60.

This highly anticipated book is the first edited volume specifically about ritual cave use among Mesoamerican people, from Pre-Columbian times to the present. *In the Maw of the Earth Monster* is based on symposia presented at annual meetings of the American Anthropological Association and Society for American Archaeology in the mid-to-late 1990s. The 20 contributors come from various fields including archaeology, linguistics, cultural anthropology, art history and epigraphy. Its multi-disciplinary approach is the strength of this volume.

The book is organized into sections on Central Mexico, Oaxaca and the Maya area. The latter region dominates the book and accounts for more than half the chapters. Chapter 1 presents a brief history of Mesoamerican cave interpretation and summarizes the more significant contributions, including those of J. Eric Thompson, Doris Heyden, Barbara MacLeod and Dennis Puleston, Andrea Stone, and Evon Vogt. The editors point out that many scholars were not aware of works by their colleagues in other regions, and that this lack of collaboration may have hindered scholarly advancement in the field. With the rise of Mesoamerican cave specialists in the late 1980s, scholars became more multidisciplinary and methodical in their approaches to cave research, and as a result "interpretations have tended to be less speculative and more heavily grounded in data." The section on Central Mexico (Part 1) begins with an updated paper by Doris Heyden that was originally published almost 30 years ago but which never received proper recognition because it was written in Spanish. Heyden surveys colonial documents and modern ethnography in relation to creation myths and modern ceremonies and/or rites of passage related to caves. Her data demonstrate that rituals concerning all phases of life from birth to death can be linked to caves.

Alan Sandstrom offers a rare glimpse into a modern cave pilgrimage carried out by Nahuas (Nahuatl speakers) in the Huasteca region of Veracruz, Mexico. He discusses how Nahua beliefs stem from observations of natural phenomena and an understanding of how geographic features such as caves relate to the landscape. Because of the observed link between caves, water, and rain, the pilgrimage petitioned the cave spirits for rain during an unprecedented drought. The importance of caves in the Mesoamerican rain/water complex was underscored by the arduous 12-hour trek to the top of a sacred mountain in weather so hot that several pilgrims fainted.

The last chapter in Part 1 examines a complex of artificial caves at the archaeological site of Acatzingo Viejo, Puebla. The authors, Manuel Aguilar, Miguel Jaen, Tim Tucker, and James Brady, relate their field data to the sixteenth-century map of Cuauhtinchan No. 2 and argue that the caves represent a constructed Chicomoztoc, i.e., a mythical "Place of the Seven Caves." Many indigenous groups in Mexico consider Chicomoztoc to be a sacred place of their origin. Thus, the cave complex at Acatzingo Viejo is part of a long tradition in Central Mexico of constructing sacred spaces, as at Cholula, Teotihuacán, and Xochicalco.

Part 2, on Oaxaca, begins with Janet Fitzsimmons' site report on Blade Cave, which was investigated in the mid-1980s as part of the Huautla Cave Project. Her chapter offers a detailed description of the artifacts discovered in the cave along with numerous illustrations showing their context. Fitzsimmons argues that Blade Cave was a place where elite practitioners conducted rituals for rain and propagation.

In another chapter on Oaxaca, Carlos Rincón Mautner presents an interesting analysis of the Colossal Natural Bridge, a

large cave in the northern Mixteca region. Armed with ethnohistorical data, Rincón makes comparisons between art in the cave and images from codices to argue that the cave is actually depicted in the codices from the Coixtlahuaca Basin, and that the cave relates to regional stories of Quetzalcoatl and origin myths.

Part 3, on the Maya region, begins with Evon Vogt and David Stuart's work on ancient glyphs and modern ethnography of Highland Chiapas. The article starts with the first publication of Stuart's deciphering of the glyph CH'EEN as "cave." The authors argue that caves are viewed by both the ancient and contemporary Maya as places of political or communal importance, and that caves provide religious and political identities for many communities. Finally, caves serve as sacred locations where elaborate rituals take place that involve communication with powers of rain, water, and lightning.

Two chapters concern investigations in Belize. Keith Prufer discusses the socio-political roles played by contemporary ritual specialists and relates these to his archaeological investigations in the Maya Mountains. A chapter by Jaime Awe, Cameron Griffith, and Sherry Gibbs documents the erection of stelae and other megalithic monuments in three caves in western Belize. They suggest a pattern of cave stelae/monument placement and argue that they were assembled to demarcate sacred space within the caves.

Two chapters focus on the relationship of artifact distribution in caves to cave morphology and use of sacred space. Andrea Stone believes that by examining the material remains in caves in a spatially based context, we can better understand the order conceptualized by the ancient Maya for use of sacred space. From ethnographic data she suggests that deliberate placement of materials by a spiritual leader was necessary to achieve successful ceremonies, and that therefore the use of space and the distribution of artifacts is non-random. With a similar goal, Holley Moyes used GIS in her spatial analysis of the Main Chamber of Actun Tunichil Muknal in western Belize. Moyes used cluster analysis to examine artifact distribution and suggests a cave-use model derived from a basic quincuncial (four directions with a center) arrangement encircled by boundary markers that delineate sacred space.

Several chapters offer interpretations of contemporary cave use based on direct observations of rituals performed in caves by indigenous practitioners. Abigail Adams and James Brady discuss the Q'eqchi' Maya religion and its relation to the sacred geography of Alta Verapaz, Guatemala. They focus on the archeological context of rituals related to a cave pilgrimage and examine the gender roles surrounding the rituals. Pierre Colas has translated from German perhaps the earliest ethnographic article describing a Maya cave ceremony. Jaroslaw Petryshyn's 1968 account of a pilgrimage to a cave in the Lacandon area is augmented by the editors' notes that provide additional data from other investigators. The article summarizes the little that is known about Lacandon cave ritual.

Rounding out the Maya area are two chapters covering the Yucatan Peninsula. Dominique Rissolo conducted a regional cave survey in the Yalahau region of Quintana Roo, which examined the spatial relationship of caves to surface sites and their sacred roles as places for acquiring resources such as water, speleothems, and white rock. In agreement with Prufer, Rissolo finds that rockshelters were treated as sacred space by the ancient Maya. In the second chapter on Yucatan, Clifford Brown examines karst geomorphology at Mayapan to demonstrate that settlement choices were influenced by the locations of caves and cenotes. Not only was civic and ceremonial architecture arranged with religious significance, but also residential groups with emphasis on family lineages and ancestor worship which were related to caves and cenotes.

The final chapter consists of concluding comments by Prufer and Brady. They note the significance of this volume to Mesoamerican cave studies and how interpretations have changed from speculation to those that are empirically grounded from data on archaeology, ethnography, ethnohistory, and art history.

This book is a valuable contribution, not only because it is the first book published on Mesoamerican cave use, but it also reveals how the field has matured in recent years. It also offers the final contributions of pioneers Evon Vogt, who passed away in 2004, and Doris Heyden, who was incapacitated by a stroke in 1999. The book presents compelling information on central Mexico and Oaxaca, but their under-representation relative to the Maya area demonstrates the need for more investigations in those areas. Finally, while the field has suffered from a lack of the ethnographic data, this volume offers a glimpse at the richness of information available in several ethnographic chapters that provide an unprecedented amount of published material.

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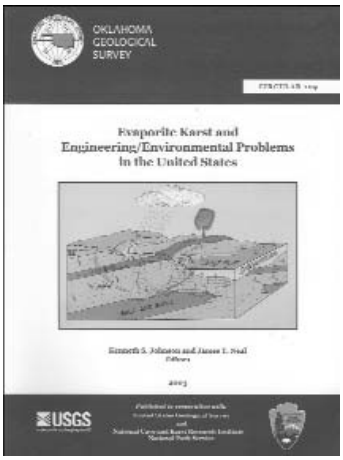

Evaporite Karst and Engineering/Environmental Problems in the United States

Kenneth S. Johnson and James T. Neal, eds., 2003. Oklahoma Geological Survey Circular 109. US Geological Survey and National Cave and Karst Research Institute, National Park Service, 353 p. ISBN 0078-4397, softbound, 8.5 x 11 inches, $20.00 plus $4.00 shipping. Order from Publication Sales, Oklahoma Geological Survey, University of Oklahoma, 100 East Boyd St., Suite N-131, Norman, OK 73019 or on-line at http://www.ogs.ou.edu/pubs.htm.

This is the first book that specifically addresses evaporite karst in the United States. It is based on papers presented at a theme session at the 2002 annual meeting of the Geological Society of America. Its 50 authors include the most authoritative American researchers in evaporite karst. The two editors are among them. It is interesting to note the very little overlap between this group and those who specialize in carbonate karst. This is not as odd as it may seem, because a book on engineering problems tends to draw mainly from the pool of regional engineers and environmental scientists – in this case, from those who work in the semi-arid West.

Stability problems in evaporites are caused by their rapid dissolution rate, which accentuates the problems typical of karst in general. These problems are accelerated where inflow of fresh water takes place from the surface (e.g., along well casings and into mines). Collapse at the surface is often caused by evaporite dissolution more than 1000 feet below. In some areas of the humid eastern states, salt mining has caused large-scale land subsidence.

The introductory section of the book includes a description of evaporite karst problems, the need for evaporite karst maps, and the effects of karst processes on gypsum mining. A variety of maps show the distribution of evaporite karst in the US. The remaining chapters are devoted to a mixture of broad overviews and detailed case studies of evaporite-related problems. Most of the coverage focuses on the western US, where evaporite strata are exposed, but there are also individual chapters on Michigan, New York, Virginia, and Louisiana, where evaporites are present below the surface. The overall emphasis is on site-specific problems, rather than on the geomorphic or geochemical aspects of karst.

Topics in the book fall into several categories: (1) overviews of evaporite karst regions, which include cave descriptions and discussion of geomorphic processes, (2) techniques for locating subsurface voids by geophysical and subsurface imaging techniques, as well as surveying and GPS applications, (3) effect of evaporites on groundwater flow, hydraulic conductivity, and water quality, and (4) engineering problems, such as subsidence and collapse, and how to avoid and remediate them. The role of evaporites in gas explosions, stability of petroleum reserves, waste-isolation practices, dam failures, breccia pipes, and mining are also described. The negative effects of pork-barrel economics are well demonstrated. There is inevitably some overlap in subject matter between chapters, but the unique aspects of each region give each chapter a fresh field for discussion. Photos are grayscale and span a wide range of definition from good to poor. Diagrams are clear and well presented.

This is a substantial and important contribution to a field that is poorly represented in the American literature. It is most useful for land managers and engineers who need to recognize and circumvent the problems of building on evaporites, but it can also serve general readers as a good introduction to evaporite karst. Such readers will find it clearly written and not overly technical. In comparison, the book *Gypsum karst of the world*, edited by Alexander Klimchouk and others, gives greater attention to geomorphic and geochemical aspects, and of course global coverage. José Calaforra's *Karstologia de yesos* (Gypsum karst studies) has a similar approach and is useful even to those with a limited knowledge of Spanish. Regrettably, all three books have limited distribution.

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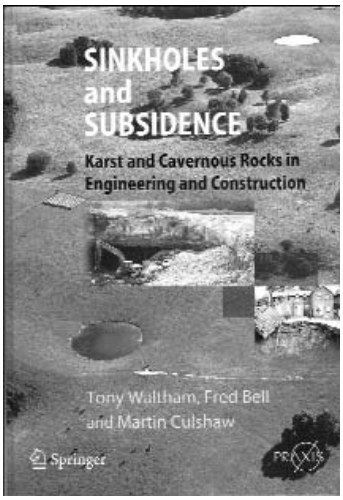

Sinkholes and Subsidence: Karst and Cavernous Rocks in Engineering and Construction

Tony Waltham, Fred Bell, and Martin Culshaw, 2005. New York, Springer-Verlag, 382 p. ISBN 3-540-20725-2, hardbound, 6.9 x 9.7 inches, $189. Order on-line at www.springeronline.com.

This book was written by geologists for engineers. It provides a thorough and practical overview of subsidence processes, effects, detection, and remediation. Those who design structures in karst terranes may be competent engineers, but they rarely have an adequate understanding of the subsurface processes that cause land instability. There is a great communication gap between the professional engineer, whose training is quantitative and standardized, and the karst specialist whose background is more qualitative and field-oriented. Engineers act on what they see at the surface and in boreholes. Karst specialists argue that surface collapse cannot be understood without detailed knowledge of caves and subsurface processes. Neither side is right or wrong, but because engineers are the ones who design and sign off on construction projects, the burden is on them to understand what they are doing. This book should go a long way toward bridging the gap. It is comprehensive, covering every type of collapse whether generated by karst processes or not, and its scope is international.

It opens with a description of rock types, their properties, and modes of dissolution. This is followed by a chapter on sinkhole classification that is well illustrated by diagrams that emphasize that a sinkhole is merely part of a large underground system, and that any impact on one will affect the other. There are chapters on rock failure and soil failure as important mechanisms in forming sinkholes. A discussion of buried sinkholes and karren demonstrates the uncertainty of building on unconsolidated material in karst, where foundations must be fixed to bedrock that varies greatly and unpredictably in depth. A chapter on rock failure due to imposed loads over caves includes a discussion of the effects of stress on caves with varied roof types. Sinkholes induced by water-table decline are described along with several case studies, such as the catastrophic collapse due to mine dewatering in the gold-mining district of South Africa. Coverage includes insoluble rock and pseudokarst. There is a good section on the instability and collapse of lava caves.

Later chapters examine how to avoid stability problems in karst through the use of geophysical methods, remote sensing, and direct observation such as well borings. Remedial measures are described. Non-engineers will be interested in the various ways in which attempts are made to stabilize sinkholes, for example with thick plastic reinforcement. The book also includes assessment strategies concerning hazards, risks, and insurance. The final section consists of 16 case studies by invited specialists who describe subsidence problems around the world. Five are from the eastern and south-central US. There is also a short but helpful glossary that clarifies ambiguous terms such as "rockhead."

The book is remarkably compact, with no superfluous parts and little redundancy. The presentation is seamless and well organized despite the triple authorship and international team of guest contributors. The grayscale photo reproduction is very sharp, with wide tonal gradation, and the diagrams are clear and informative. Classifications are meaningful and easily applied; they are not mere exercises in nomenclature. Although quantitative in places, the book focuses on fundamental concepts without becoming trapped in a morass of experimental data.

Other books on this topic have different perspectives and goals. The several books by Petar Milanovic (e.g., 2000) are based mainly on his experience as an engineer with a strong background in karst, but his viewpoint is strongest at the surface and gets fuzzy with depth. Barry Beck and his associates have provided a series of volumes on sinkholes and related topics that are based on professionally oriented karst conferences held biennially in the US (e.g., Beck, 1984). These are compilations of papers presented at the conferences, and they contain a great deal of technical information of a highly site-specific and individualistic nature. Johnson and Neal (2003) have assembled a similar volume on evaporite karst problems in the US, based on a similar conference (see review elsewhere in this issue). In contrast to these books, the Waltham-Bell-Culshaw volume presents a more unified synthesis and fewer descriptions of site-specific engineering strategies.

We recommend this book enthusiastically to anyone involved in the engineering aspects of karst, as well as to karst specialists. In presentation and utility it is in a class by itself. It is easy to imagine that engineers who read this book will look forward with eager anticipation to the next catastrophic collapse, so they can attack the problem with newly gained confidence.

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