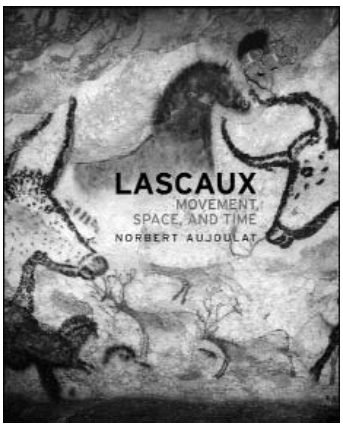
BOOK REVIEWS



Lascaux: Movement, Space, and Time

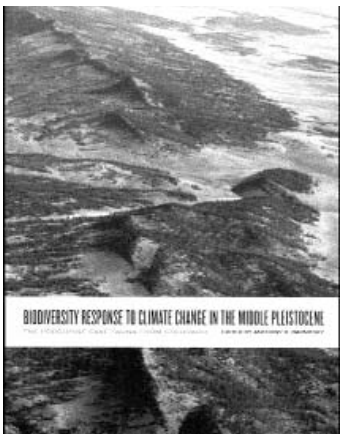
Norbert Aujoulat and Henry Abrams, 2005, New York, 274 p. ISBN 0-8109-5900-3, hardbound, 10.5 x 13.5 inches, $65.

Yet another coffee-table book on European Paleolithic cave art. In fact, at six pounds and too tall for any bookshelf in my house, it might well serve *as* a coffee table. The text was translated from the French original, *Lascaux: le geste, l'espace et le temps*, by Martin Street. There is also a British edition of the same book, titled *The Splendour of Lascaux*.

The cave at Lascaux is the most famous of the cave-art sites in southern Europe, with art made around seventeen thousand years ago. This book consists primarily of 226 color illustrations printed on paper as thick as the covers of some paperbacks. Some of the photos cover two full pages, and the largest, a double foldout, is forty inches wide. As is frustratingly customary, almost all the photos lack anything for scale, and it is hard for the viewer to appreciate how large the paintings are. Fortunately, there are a couple of exceptions near the beginning of the book.

The text is relatively brief, with widely spaced type never covering more than two-thirds of the parts of pages not occupied by photographs. Even so, few buyers of the book will do more than dip into it here and there, because it consists almost entirely of very dry descriptions of the cave, the artists' techniques, and the art. But of course the text is not the point, and anyone interested in a picture book of Paleolithic art should consider it. It is probably one of the few such books available, because these books go out of print quickly. I've seen previous similar books by the same publisher on remainder tables within a year or two.

Reviewed by: Bill Mixon, 14045 N Green Hills Loop, Austin TX 78737-8627. (billmixon@worldnet.att.net), October 2005.



Biodiversity Response to Climate Change in the Middle Pleistocene: The Porcupine Cave Fauna from Colorado

Anthony D. Barnosky, ed., 2004, University of California Press, Berkeley, 385 p. ISBN 0-520-24082-0, hardcover, 8½ x 11¼ inches, $135.00.

In the absence of appropriate changes in worldwide government attitudes and policies, the growing consensus among scientists is that Earth's temperature will continue to rise. As this alarming trend in global warming continues, scientists predict an average increase in global mean temperature of 1.4–5.8º C by the year 2100. Regional warming may be even more extreme. These changes may have planet-wide impact on dwindling ecosystems, especially on the diversity of existing species. Biodiversity is of concern because it is believed to be a direct measure of the health of an ecosystem, and, by extension, a proxy for how safe the environment is for human habitation.

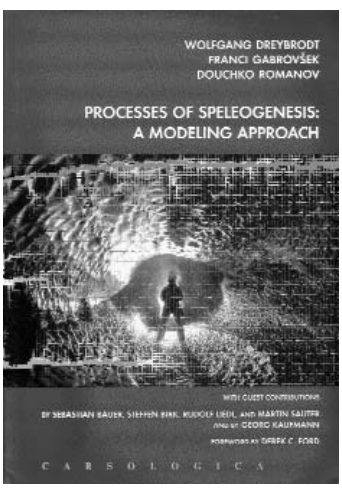
Porcupine Cave is located in the Colorado Rockies, at an elevation of 2900 meters in the South Park intermountain basin. It is developed on three levels, with approximately 600 meters of mapped passages. Since the mid 1940s, the cave has been a popular site for beginner caving trips. The cave's wealth of middle Pleistocene fossils (dating from approximately 600,000 to one million years ago–a span characterized by repeated advance and retreat of glaciers) was first recognized in 1981. Since 1985, its fossils have been excavated by teams from three major institutions: the Carnegie Museum of Natural History, the Denver Museum of Nature and Science, and the University of California Museum of Paleontology. Hundreds of thousands of fossils have been excavated from the cave's interior, tens of thousands of which have been subjected to rigorous analysis. They provide the best evidence about the animals that once lived at high elevations in North America and form the basis for hypotheses about the local habitat of South Park during the middle Pleistocene. They also provide unique insight into how global climate change might affect living ecosystems today.

This is a scholarly work focused principally on description and analysis of the vast array of fossil remains excavated from Porcupine Cave. Preliminary chapters introduce the cave and its environs. Throughout the text, emphasis is placed on taphonomic relationships–the various forces and circumstances that govern the movement and physical condition of bones following an animal's death. Despite the book's title, it is only in the last few chapters that the discussion moves away from the fos-

sils themselves to a short, theoretical consideration of the potential impact of climate on ecosystem diversity, past and future. Mitigation of global warming and prevention of habitat fragmentation are presented as major elements in forestalling widespread ecological disaster.

This book will be of interest primarily to paleontologists concerned with vertebrate evolution, as well as ecologists and conservationists focusing on the long-term preservation of ecological diversity. Although the editor intends the caving community to be among the book's intended readership, it is appropriate mainly to cavers with a strong interest in paleontology. The level of descriptive detail is likely to be overwhelming for the general reader. On the other hand, many in the caving community, most of whom have undoubtedly seen fossilized remains underground and who may be interested in knowing how scientists go about studying them, may be impressed by both the amount of work involved in excavating underground fossil sites and the wealth of information that can be derived from such finds.

Reviewed by: Danny A. Brass, 70 Livingston St. Apt. 3K, New Haven, CT 06511-2467 (brassda@yahoo.com), October 2005.



Processes of Speleogenesis: A Modeling Approach

Wolfgang Dreybrodt, Franci Gabrovšek, and Douchko Romanov, with contributions by Sebastian Bauer, Steffen Birk, Rudolf Liedl, Martin Sauter, and Georg Kaufmann, 2005. Postojna-Ljubljana, Slovenia, Carsologica, ZRC Publishing, 376 p. + CD. ISBN 961-6500-91-0, softbound, 6.6 x 9.3 inches, 33.2 euros. Order on-line at www.zrc-sazu.si/zalozba.

This book draws together the results of digital modeling of cave origin over the past 15 years. It represents the combined work of Dreybrodt at the University of Bremen, Germany, and his recent PhD graduates Gabrovšek (Slovenia) and Romanov (Bulgaria), plus complementary work by researchers at other German universities. The authors do not attempt to cover all aspects of karst, nor do they deal specifically with aquifer modeling, but the methods and conclusions in this book give valuable insight into these fields. Most of this material has already been published elsewhere, but in scattered locations. This book synthesizes all the authors' prior work and ties it together with a narrative thread. The fact that all or most of the authors are familiar with real karst and caves enhances the book's credibility.

The usual approach to digital modeling of karst is to design a grid of primitive fissures, which is then subdivided into many small segments. Boundary conditions such as head and chemical values are assigned, and the dissolutional growth of each segment is calculated over small time increments. As the results of each time step are accumulated, the evolution of cave passages can be tracked. Finite-difference analysis involves the use of a fixed grid (normally rectangular). Nearly all karst models are of this type. Finite-element analysis uses irregular grids that may change shape with time. Digital karst modeling originated in America and England around 1980, but it is in Europe that the technique has blossomed over the past 15 years. Most of these advances have been the work of Prof. Dreybrodt and his colleagues.

This book is an extraordinary achievement that warrants close attention by anyone interested in speleogenesis. The English is good, with only minor irregularities that do not interfere with the reader's understanding. Still, the book may be intimidating for those unfamiliar with hydraulics and chemical kinetics. There are 250 figures, most with multiple panels, which consist almost entirely of computer-generated grids that track conduit growth under various boundary conditions. There are no photos, except on the cover, nor are there any maps or diagrams of real karst or caves. Happily, the book also contains an interactive CD with animated clips that show the results of the most significant models. The software is clear, user-friendly, and seems to be bug-free. It is possible to retrace steps to facilitate close examination of model progress. Use of color in the book and CD is effective and essential to the clarity of the presentation.

Some readers may criticize digital models as too idealized, and unable to predict exact field conditions. This attitude misses the point. Models are not designed to reconstruct the evolution of real caves, but to examine the interaction between the many variables involved. The results show what happens under the exact boundary conditions chosen. A great deal can be learned about real systems by examining how they differ from idealized models whose boundary conditions are precisely known.

Chapters in the book are as follows: (1) Introduction to concepts; (2) Equilibrium chemistry and dissolution kinetics of limestone in H_2O-CO_2 solutions; (3) Evolution of single fractures; (4) Evolution of two-dimensional networks under constant head; (5) Unconfined aquifers; (6) Karstification below dam sites; (7) Conclusion and future perspectives. Two final chapters are by guest authors: Simulation of karst aquifer genesis with a double permeability approach, by Bauer, Birk, Liedl, and Sauter (University of Tübingen); and Structure and evolution of karst aquifers – a finite-element approach, by Georg Kaufmann (University of Göttingen). There is some overlap among the three major sections, but readers can benefit from multiple views of these complex subjects.

For the sake of clarity and repeatability, models in the book are given fairly simple boundary conditions. Even so, the internal complexity of the models makes it necessary to look at general trends rather than specific details. It will take many

readings to absorb the book's full message. Conclusions are necessarily veiled in technical terms, and they do not stand out as bold concepts that can be applied to one's favorite cave. This is probably a good thing – if presented with a bulleted list of guidelines to cave interpretation, readers would be tempted to apply them without understanding the inner workings of the models. The book has no index, but the topics are complex enough that it would be difficult to find individual words to describe them.

I have cautiously selected a few representative conclusions from the book, to show the nature of the topics discussed. They must not be taken at face value without close scrutiny of the book, because their validity depends on the exact model design. [In the following statements, breakthrough time (***T***) is the time required for initial openings to undergo slow gestation prior to the rapid growth that produces caves; cave development is favored when ***T*** is small.]

T decreases if CO_2 is introduced at points along the flow path, rather than just at the upstream end. The effect is greatest if the sources are located in the downstream half. Mixing corrosion, at junctions of flow paths having different CO_2 values, is greatest where mixing takes place about half-way through the conduit length. But mixing corrosion is not essential to cave development, because water is not fully saturated with calcite when it enters the ground.

T is reduced where there is a single major sequence of fissures that extends through an initial network of narrow fractures. Inflow of saturated water from the surrounding network increases ***T***. Where water is introduced at only a few points, proto-solution conduits tend at first to finger outward in the downstream direction, but this pattern is later overwhelmed by convergent flow when rapid cave development takes over. In contrast, if calcite-saturated water enters the main flow routes from the network of surrounding fissures, mixing between the two water types increases ***T***, and the conduits tend *not* to branch downstream.

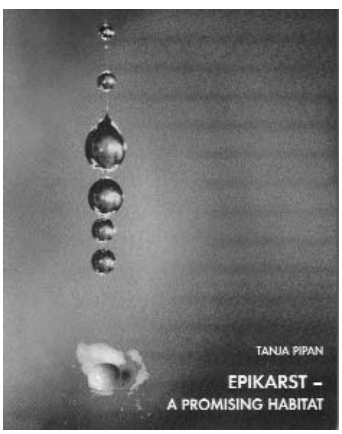
In unconfined settings, cave development concentrates at the water table, whether or not prominent fractures are present. But adding prominent fractures can lead to a few deep phreatic loops, if they develop before the preferred water-table route is established. Depth of penetration of solution conduits below the water table is hardly affected by aquifer thickness, because water at depth is mainly saturated. Erosional downcutting of the outlet valley, followed by aggradation, tends to establish nearly horizontal water-table caves. Leakage through limestone beneath dams can cause a great deal of water loss within about 50 years by the solutional enlargement of fissures, especially if the reservoir water is at less than 50% calcite saturation.

How do the results compare with earlier conceptual models of the past 30–40 years? There is a satisfyingly close fit to the earlier work, and anyone who has contributed to this field will find supporting evidence somewhere in the book. But the modeled time scales for cave development seem too short compared to those verified in the field. That is because the models consider ideal dissolution processes unhindered by such factors as sediment accumulation and degassing of CO_2 through openings to the surface, which extend the time frame.

This book is ideal for researchers in speleogenesis who have a solid grasp of the technical aspects. Most of the necessary background information is outlined in the first chapter, but the subtle aspects will be clear only to those who already have a good background in geochemistry and computer modeling, especially when interpreting the figures. This book is not aimed at groundwater hydrologists, although the results would be eye-opening to anyone in that field who denies the importance of solution conduits in carbonate aquifers.

This book poses a challenge: If you can understand intuitively why the different models produce the results they do, you are well on the way toward being able to interpret the origin of typical caves and the behavior of karst groundwater.

Reviewed by Arthur N. Palmer, Dept. of Earth Sciences, State University of New York, Oneonta, NY 13820-4015 (palmeran@oneonta.edu).



Epikarst, a promising habitat. Copepod fauna, its diversity and ecology: a case study from Slovenia (Europe).

Tanja Pipan. 2005. ZRC Publishing, Karst Research Institute at ZRC SAZU, 101 p. ISBN 961-6500-90-2. Softbound, 6.5 x 9 inches, 16 EUR. Order online at www.zrc-sazu.si/zalozba.

This monograph summarizes part of the dissertation research of Dr. Tanja Pipan. Her work focused on the diversity and distribution of organisms from the epikarst habitat from six cave systems in southwestern Slovenia. This volume deals with copepods, a group of microscopic crustaceans commonly found in most marine and freshwater habitats, and, as revealed by Pipan, also ubiquitous in ceiling drips and drip pools in caves.

Although there is healthy debate among karst scientists on various aspects of the epikarst, including the definition of the term epikarst itself (Jones et al., 2004), there is no doubt that the soil-rock interface above the vadose zone in caves has tremendous capacity to store water. It is the common experience of cavers world-wide that, no matter how dry the surface seems, one does not need to penetrate far into a cave before encountering ceiling drips. Biologists have long suspected that water in the epikarst may harbor many species. Pipan's work is significant in that it is the first quantitative and systematic survey of epikarst organisms over time.

This volume is divided into four sections. The first section provides an introduction to the epikarst, clearly lays out the goals of Pipan's research, and includes an excellent introduction to copepods in general and a detailed summary of copepod diversity and distribution in the Dinaric region and Slovenia. In the second section, Pipan describes her field sites, sampling method, and statistical tools for data analysis. A most interesting part of this section is her simple, inexpensive, yet ingenious method of sampling organisms from drips and drip pools.

The third and fourth sections detail the results of Pipan's work. Here she shows an impressive number of specimens belonging to a wide variety of taxa collected from drips and pools in each of the six cave systems. Her data definitively shows that the epikarst is indeed a habitat harboring a distinctive set of organisms. For example, among 37 species of copepods collected, she identified 27 as stygobionts and 11 of them are new to science. She also shows statistically that her results were based on a fully representative sampling of the fauna. Besides high diversity, the large number of specimens dripping into the vadose zone implies that this is also an important pathway of energy into the cave ecosystem.

Beyond demonstration of the richness of this fauna, Pipan's analysis gives additional insights into this interesting habitat. She uses canonical correspondence analyses to reveal physical and chemical factors that potentially control the distribution of each species. One result is that some species are highly specialized for certain ecological conditions. Pipan also compares the community of copepods at different geographic scales, and conclusively reveals a high degree of heterogeneity in the species distributions. Her analysis shows that the epikarst is a much more complex environment than previously anticipated.

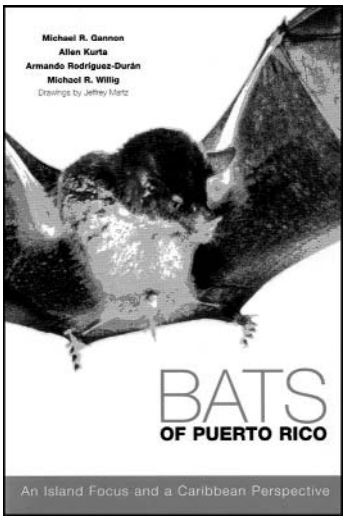
Although this is a small volume, one should be prepared to take some time to go over it slowly. Many of the figures are extremely dense and pack in a lot of information, such as the ordination diagrams from the canonical correspondence analyses. I found the summary figures for the abundance of species over time slightly difficult to follow. Overall, this monograph is well written, well organized and contain much information presented in a logical order.

I think with time this will prove to be a seminal work. I anticipate that the results will stimulate activity to examine the up-to-now much neglected epikarst fauna in many parts of the world. This work should be of interest not only to biologists concerned with cave organisms, but to any karst scientist wanting some insight into this "promising habitat."

REFERENCE

Jones, W.K., Culver, D.C., and Herman, J.S. (eds.), 2004, Epikarst: Charles Town, WV, Karst Waters Institute Special Publication 9, Proceedings of symposium held in Shepherdstown, West Virginia, 2003, 160p.

Reviewed by Daniel W. Fong, Associate Professor, Department of Biology, American University, Washington, D.C. 20016 (dfong@american.edu).



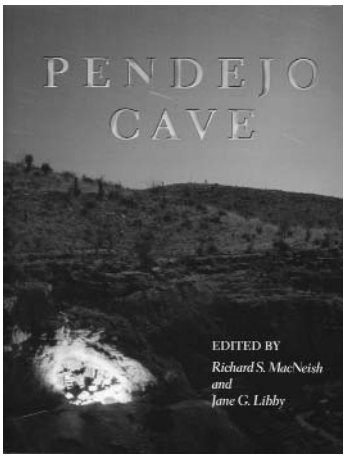
Bats of Puerto Rico: An Island Focus and a Caribbean Perspective

Michael R. Gannon, Allen Kurta, Armando Rodríguez-Durán, and Michael R. Willig, 2005, Texas Tech University Press, Lubbock, TX, 239 p., ISBN 0-89672-551-0, softbound, 6 x 9¾ inches, $19.95.

The Caribbean islands are fragile ecosystems, highly vulnerable to natural and human impact. Because of various factors, species richness is considerably less than that of mainland sites at comparable latitudes. Hence, even minor environmental damage can have major ecological consequences for island fauna. *Bats of Puerto Rico* is divided into three sections: (1) a well-balanced description of Puerto Rico as an island ecosystem, (2) a general section on basic bat biology, and (3) an in-depth discussion of Puerto Rico's 13 species of bats – the only mammalian fauna native to the island. Section 3 includes a discussion of bat taxonomy, distribution and status, external anatomy, and various aspects of their natural history. A nice feature is the inclusion of the etymologic derivation of both genus and species names for all bats discussed. Distribution maps show the range of each species across the island. The text concludes with a chapter on conservation of Caribbean bats and two keys for the identification of Puerto Rican species (one based on external morphology and the other on cranial and dental characteristics).

This is the first comprehensive treatise on the biology of Puerto Rican bats to be published. It should appeal to persons interested in the ecology, natural history, and biology of bats. It is quite readable and well written, with minimal use of technical jargon. Several detailed appendices, an extensive list of references, and a glossary of selected terms are provided. It should be easily grasped by anyone having a basic grounding in biology.

Reviewed by: Danny A. Brass, 70 Livingston St. Apt. 3K, New Haven, CT 06511-2467, (brassda@yahoo.com).



Pendejo Cave

Richard S. MacNeish and Jane G. Libby (eds.), 2003, University of New Mexico Press, Albuquerque, NM, 526 p. ISBN 0-8263-2405-3, hardcover, 8½ x 11¼ inches, $85.00.

Modern humans are generally believed to have first arisen in Africa some 150,000 to 200,000 years ago. From there, they slowly spread into the Old World and then across the globe. They appeared in the New World relatively late compared to elsewhere. The major obstacle to peopling of the New World was the Bering Strait, which now separates Siberia and Alaska. However, during the time of the last major glaciation (between 75,000 and 12,000 years ago), when much water was tied up as ice, a land bridge connected the two continents. Many scholars believe that 40,000 years ago was the earliest practical time for the movement of modern humans across the Bering Strait because of the cold conditions. However, some scholars see no obstacles to an earlier crossing, and that it likely for humans to have occupied the Americas as early as 50,000–70,000 years ago.

According to the scenario most widely accepted by modern anthropologists and archaeologists, the first unimpeachable evidence of human occupation of the Americas is that of the Clovis people, whose artifacts have been dated to between 10,900 and 11,600 years ago. These sites have been found throughout the contiguous United States, as well as in Mexico and Central America. However, no unassailable evidence for an earlier culture yet exists in the Americas.

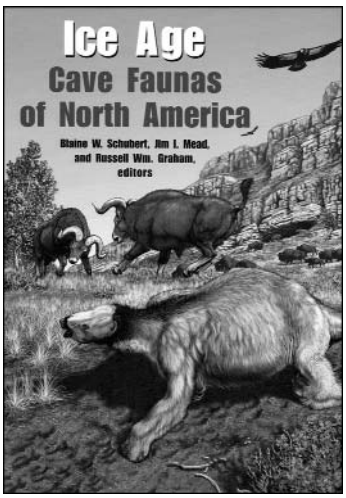
Since the initial discovery of Clovis artifacts, there have been numerous challenges to the widely accepted doctrine that the Clovis people were the first humans to inhabit the Americas. Several well-studied sites, such as Pendejo Cave in southern New Mexico, suggest a chronology of human habitation that pre-dates the Clovis culture by tens of thousands of years. But, like all presumed pre-Clovis sites (many of which are discussed in the text), their validity is questionable and a high degree of skepticism remains widespread within the scientific community.

The discovery of Pendejo cave in modern times was reputedly made in 1975 as part of a geological survey of the region by the U.S. Army. The Army maintains the area as a weaponry and training site. This "off-limits" status has been instrumental in protecting the site from vandals. Pendejo Cave was excavated between 1990 and 1992, under the watchful eye of MacNeish, an experienced archaeologist and ardent proponent of pre-Clovis civilization in the Americas. For the most part it is the accuracy of the interpretations that have raised criticism and which remain in dispute. Artifacts unearthed at Pendejo Cave, such as the various "stone tools" found within the deeper layers in the floor, were sent to various outside experts for detailed analysis. Typically, the results were inconclusive, some experts supporting the view that these "tools" were fashioned by humans and others considering them to be artifacts of natural, non-human processes. Even Mark Stoneking – one of the original architects of the mitochondrial Eve theory (as dubbed by the popular press) and the geneticist who performed MtDNA analysis of human hair from the cave deposits, which dated as early as 19,180 years ago – could not rule out the possibility of sample contamination.

In any event, this book presents an interesting and detailed account of the excavation of this potential pre-Clovis site. Its multi-authored text contains 19 chapters divided into three main sections: (1) *Paleoecology*, in which the environment of the cave and its surroundings (including geological, zoological, and botanical aspects) are discussed, (2) *Evidence of Human Occupation*, in which the in-cave excavation and the recovery and analysis of ancient artifacts (including stone tools, imported stone, modified bone, burned bone, friction skin imprints in fired clay, cordage samples, hearths, and hair) are discussed in detail, and (3) *Conclusions*, in which the findings are put into theoretical perspective as to past climates, vegetation, and animal habitats during the time of potential pre-Clovis human occupation, as well as aspects of life, and culture of the people. On the basis of their findings at Pendejo Cave, the authors present speculative timetables for the early migration of human populations out of Asia and into the New World.

Whether or not you agree with the basic thesis of a pre-Clovis civilization in the Americas, the authors of *Pendejo Cave* present an excellent study of cave archaeology. It is written in a matter-of-fact and readable style, but clearly not intended as a popular account. Their finds make us pause to think and, perhaps, to re-consider current doctrine concerning the peopling of the New World. In this way, the book offers a valuable contribution to the ongoing debate over how long humans have lived in the Americas.

Reviewed by: Danny A. Brass, 70 Livingston St. Apt. 3K, New Haven CT 06511-2467 (brassda@yahoo.com).



Ice Age Cave Faunas of North America

Blaine W. Schubert, Jim I. Mead, and Russell W. Graham (eds.). Indiana University Press, Bloomington, and the Denver Museum of Nature & Science (2003). Hardcover, 299 pages, 7¼ x 10¼ inch format, ISBN 0-253-34268-6, $65.00.

This is an interesting collection of papers that discusses the fossil finds of largely extinct animals from various North American caves. Study locations include fossil-bearing caves of Mexico, Arizona, Kentucky, Iowa, Missouri, Texas, and Alaska. The number of fossil sites for each location varies from one to several dozen. Discussions of vertebrate paleontology are also included. This book will be of most interest to paleontologists, geologists, comparative anatomists, and zoologists. Speleologists and cavers with an interest in these disciplines may also find the book of interest. Indeed, many of the original fossil finds were made by observant cavers, which points out how important their contributions can be to paleontology. In fact, portions of the book have previously been presented at the 1997 NSS Convention, at a cave paleontology symposium co-chaired by Blaine Schubert and Jim Mead.

With notable exceptions, descriptions of the studied caves are included to help provide context to the various finds. When the fossil evidence permits a suitable interpretation, limited reconstructions of life histories and paleoenvironments are made, and an animal's natural history is discussed. Individual chapters include a detailed discussion of osteology (bone structure), especially in relation to identification of fossils, aspects of the animal's natural history, and taphonomy of the finds. Biostratigraphy analysis and fossil-dating studies are also included for most of the study sites.

The value of excavated fossils is only as good as the descriptions of their context. Such descriptions help to provide important taphonomic information about fossils. Taphonomy considers the context of death assemblages, as well as the later disposition of fossils. For example, did an animal die a natural death within the cave, one that was consistent with a cave-related life history? Or did it live in the outside world but became trapped in the cave by circumstances beyond its control? On the other hand, perhaps it died in the light of day, but its bones were somehow carried inside the cave after death. In the latter case, were the bones (or carcass) washed into the cave by floodwaters, transported by local geologic forces (*e.g.*, slope wash), carried in by carnivores, deposited as fecal remains, dragged in by pack rats, or did they fall through a vertical entrance that formed either a natural trap or a convenient disposal chute beneath a predator's favored tree or ledge? Were the bones weathered by exposure, preserved by rapid burial, or chewed by carnivores and corroded by digestion, or even separated into assemblages of large and small bones? A careful analysis of fossil remains can tell the experienced "bone detective" much about their transit, from the original site of an animal's death to the final resting place of its bones within a cave or elsewhere. To the extent that site analysis permits, this information is presented for most finds. In addition to the final disposition of an individual animal's remains, such studies help paleontologists to characterize the environment and natural history of local inhabitants.

Reviewed by: Danny A. Brass, 70 Livingston St. Apt. 3K, New Haven CT 06511-2467 (brassda@yahoo.com) October 2005.

FROM THE EDITOR

THESIS AVAILABILITY

The last issue of the *Journal of Cave and Karst Studies* (vol. 67, no. 2) published the abstract for Stefan Eberhard's Ph.D. thesis. Since then, Dr. Eberhard's thesis has been made available for download via the web ex of the Australian Digital Thesis program at:

http://wwwlib.murdoch.edu.au/adt/browse/view/adt-MU20051010.141551

ERRATUM

While typesetting the paper by Ira Sasowsky and Cory Dalton "Measurement of pH for field studies in karst areas" (vol. 67 no. 2, pp. 127–132) two errors were inadvertently incorporated into the text.

Error 1
The final sentence of the paragraph directly beneath the equation discusses two parameters that were incorrectly swapped in the text. The sentence should correctly read: "In that expression the values in brackets are molar concentrations of the species, γ is the calculated activity coefficient for the species, and K_2 is the 2nd dissociation constant for carbonic acid."

Error 2
The caption for Table 1 should read "Geochemical parameters for three water samples from Scott Hollow Cave, West Virginia (Davis, 1999)"