The Bee Situation

Africanized Honey Bees and Bee Mites. GLEN R. NEEDHAM, ROBERT E. PAGE, JR., MERCEDES DELFINADO-BAKER, and CLIVE E. BOWMAN, Eds. Horwood, Chichester, U.K., and Wiley, New York, 1988. xviii, 572 pp., illus. $94.95. Ellis Horwood Series in Entomology and Acarology. From a conference, Columbus, OH, March–April 1987.

The last three decades have brought unanticipated problems of tremendous concern for world beekeeping, particularly where colonies of the European honey bee, *Apis mellifera*, are managed. A few swarms of an aggressive tropical African race of this species, *A. mellifera scutellata,* were accidentally liberated in Brazil in the mid-1950s, resulting in "Africanization" of millions of colonies of bees through most of South America and northward toward Mexico. The honey bee tracheal mite, *Acarapis woodi*, was introduced from Europe into South America and central Asia in the 1950s and has spread recently throughout most of Mexico and the United States. The varroa mite, *Varroa jacobsoni*, which occurred originally on the Asian honey bee, *Apis cerana*, readily transferred to colonies of the European honey bee brought into eastern Asia in the 1950s and then was introduced with shipments of these bees into Europe and South America in the 1970s, spreading to southern Mexico by 1986. These problems have also brought beekeeping into an unfavorable light through exaggerated media reports on "killer bees." An international conference was convened at Ohio State University to assess the problems, and this book, presenting 75 papers by 121 contributors representing 20 countries, constitutes the published proceedings of the conference.

There is stimulating reading here for anyone interested in bees or beekeeping, though some papers may be too technical or theoretical for general audiences. Not surprisingly, the papers on Africanized bees reveal how much more advanced is our knowledge of the honey bee than of its parasitic mites. Various authors emphasize the need to distinguish African races of *Apis mellifera*, of which there are about 10, from the Africanized honey bees that have arisen from the escape of *A. mellifera scutellata*. Although the Africanization of some 2 million colonies of bees of mixed European races through South and Central America would have been expected to diminish the undesirable characteristics of the original African genome, various authors note how Africanized bees remain mostly "African" in behavior and morphology, discussing mechanisms that may thwart hybridization effects and European characteristics. Papers on bee thermoregulation provide data showing that African(ized) bees may be capable of inhabiting regions with extended cold climatic conditions. Some papers may surprise readers in discussing the breadth of bees' learning ability and in pointing out that some of the African races of bees, whose behavior is inadequately known, may actually have some traits useful for bee management. For useful as well as accurate identification of bee races, two papers recommend the use of combined types of data, including behavioral, morphometric, and biochemical analyses and brood cell size. Above all, from a management perspective, breeding for the most manageable and productive bees is put forward as the primary goal, including the search for and control of beneficial attributes among colonies showing intermediate levels of Africanization.

Among the papers on bee mites that offer new observations or thoughts for further research are those dealing with factors enhancing resistance to mites. A discussion of factors affecting the severity of infestation by varroa mites in European and in Africanized bees points to the need for experimental data on varroa population growth in native African races. Behavioral mechanisms by which varroa's natural host, *A. cerana*, resists infestation indicate factors that may be bred for in *A. mellifera*. One paper documents that the impact of varroa on bee mortality is increased by the presence of acute paralysis virus, which the mite transmits and enhances in virulence. The reported development of an artificial diet and rearing technique for varroa is a major advance for facilitating observation of this mite's behavior. In a paper that contrasts the mouthpart morphology of *Varroa* and *Tropilaelaps* mites, the latter is viewed as a predator that is not necessarily restricted to bees and perhaps can overwinter on alternative hosts in areas where bees become broodless during winter. This calls in question recent predictions that *Tropilaelaps* would not pose a dangerous threat to apiculture if introduced into colder regions.

Only nine papers, with relatively few new observations, are devoted to the tracheal mite, *Acarapis woodi*. Whereas the first of the papers is inaccurate in stating that the nymphal stage has been eliminated in the life cycle of this mite, the second correctly gives observational data on the inert pharate nymphal stage, separate from the larval and adult stages, and also notes behavioral differences between *Acarapis dorsalis* and *A. woodi* that would be interesting to pursue with *A. externus*, the species of external mite morphologically closest to *A. woodi*. A paper on ELISA detection of *A. woodi* within intact bees represents an exciting advance, though the capability of the technique to distinguish *A. woodi* from *A. dorsalis* or *A. externus* is not convincing as yet.

This book as a whole provides a good current review of its subject and is attractively produced and well organized. Six months after the Columbus meeting was held, infestations of varroa mite were found [illegible] spread in the United States and Af[illegible] bees had crossed the Isthmus of Tehuantepec in Mexico; the number of species of honey bees of the genus *Apis*, accepted as four or five in the present book, has now gone into flux with the discrimination of several more species; and during 1988 three new books—one each in English, German, and Russian—were published on the varroa mite, providing new compilations of knowledge of its anatomy, biology, detection, and control. As a result of these changes and advances in our knowledge this book will become dated in part. However, it will remain useful in focusing on questions that need to be resolved.

EVERT E. LINDQUIST
Biosystematics Research Centre,
Agriculture Canada,
Ottawa, Ontario K1A OC6, Canada

Water-Formed Structures

Geomorphology and Hydrology of Karst Terrains. WILLIAM B. WHITE. Oxford University Press, New York, 1988. xiv, 464 pp., illus. $45.

The title of this book accurately represents its content: the concepts and theories of two scientific disciplines applied to a special geologic setting. The literature of karst has traditionally been spread through a wide range of journals covering specialized aspects of geomorphology, geochemistry, geohydrology, sedimentology, and petrology and also collected in newsletters and bulletins of cave exploration clubs and societies. The author has been a major contributor to this diverse literature, and in this book he provides a useful and comprehensive review of the topic.

Although limestone caves are an obvious component of karst terrains, this is not a speleology book. It takes a broader view and synthesizes the parts of geochemistry that relate to dissolution and precipitation of limestone; the parts of fluvial geomorphology that relate to stream flow over and within soluble rocks; the parts of geomorphology that consider karst landscapes; the parts of geohydrology that concern fluid flow over and through solution conduits; and the parts of environmental geology that consider the hazards of ground subsidence and collapse. That some of the conduits are large

enough to be explored by human beings and hence called caves is a secondary, although obviously enjoyable, concern of the author.

The first four chapters describe and classify the landforms of karst terrains, including both surface and underground morphology. The complex and ethnocentric terminology of karst landforms, drawn largely from Slavic, Spanish, and German research, is conveniently tabulated and reduced to a minimum of English-language terms. Even so, the descriptive terminology of karst remains formidable, and to a nonspecialist the economy of substituting "cutter and pinnacle" for "grike and clint" is not obvious. Chapters 5 and 7, on the chemistry of carbonate dissolution and the geochemistry of karst waters, form the heart of the book. These are excellent chapters for outside reading by students in geohydrology and geomorphology courses. They specifically apply to karst evolution, but because carbon dioxide dissolved in ground water is the most important factor in chemical weathering of other rocks as well, these chapters have wide applicability. Similarly, chapter 6, on karst hydrology, is a good review of the special problems of water movement through soluble rocks: Is the concept of a water table, or the application of Darcy's law, appropriate to karst terrains? When water flows through large interconnected conduits, should we apply surface-water or ground-water flow formulas? These are provocative and interesting topics.

The book weakens a little in its chapter on the Pleistocene history of karst evolution. Climate change has been important in karst development, and cave deposits are becoming useful as clocks and thermometers for the Pleistocene. Unfortunately, this topic is developing too fast to be reviewed in a general book on karst, and the concept the author espouses of only four Pleistocene ice ages is out of date. The recent increased appreciation of microorganisms in aqueous geochemistry is also not emphasized, given the physical-chemical approach of the book.

Following tradition and his own experience, the author concentrates on the landforms and processes in well-lithified and generally ancient carbonate rocks of Paleozoic and Mesozoic age. The widespread karst development on late Cenozoic tectonically emerged coral limestone terranes of tropical island arcs is barely mentioned. The classic "phytokarst" of Grand Cayman is noted but not defined, and a few references are made to coastal weathering of limestone, but the extensive, young, nearly pure limestones of coralline tropical islands are not otherwise mentioned. In a book about the weathering of limestone, it is odd that the word "coral" is never mentioned.

We are indebted to the author for this authoritative integration of a large, complex, and scattered polyglot literature. The book is an admirable cross-disciplinary synthesis applied to one of the more romantic landscapes of our planet.

ARTHUR L. BLOOM
Department of Geological Sciences, Cornell University, Ithaca, NY 14853

Geothermometry

Thermal History of Sedimentary Basins. Methods and Case Histories. NANCY L. NAESER and THANE H. MCCULLOH, Eds. Springer-Verlag, New York, 1988. xiv, 319 pp., illus. $64. From a symposium, New Orleans, LA, March 1985.

Over the past decade, various thermal models have been proposed to explain the formation of sedimentary basins. At the same time, geological and geochemical studies have shown that certain sedimentary features provide an imprint of well-constrained temperature ranges.

Verification of thermal models of basin evolution by analysis of thermal imprints is one of many challenges in sedimentary basin analysis. This book has met the challenge by providing an outstanding demonstration of the type of imprints available from low-temperature geothermometry that can be used to evaluate such models. The book begins with a definitive overview chapter by the editors on various available methodologies for sedimentary geothermometry. Next follows an equally definitive paper by Blackwell and Steele on the significance of thermal conductivity measurements in sedimentary rocks. They demonstrate the importance of contrasting global heat budgets used in geophysical modeling with respect to internal thermal characteristics of basins controlled by magmatic intrusions, variation in radioactive heat production from both basement and sedimentary rocks, and lateral and vertical variation in thermal conductivity. Such local effects influence the thermal history of a sedimentary basin more than global effects. Because thermal conductivity measurements are limited, certain model assumptions lead to large-scale error in estimating thermal histories and organic maturation trends. Consequently, several published examples relying on unconstrained thermal conductivity measurements of shale have overestimated thermal budgets and hydrocarbon generation.

Next are three papers (by Creaney, Curiale *et al.*, and Barker) dealing with reactions of organic matter to geological heating, thermal organic maturity indicators, and temperature and time considerations in organic maturation. Although their approaches differ, they show that different organic parameters in sediments constrain the temperature range a sedimentary basin and its sediment fills experience. A related paper by Armagnac *et al.* utilizes vitrinite reflectance to determine postdepositional erosional history.

Seven papers follow dealing with various mineralogical and geochemical indicators of low-temperature geothermometry. Approaches reviewed include utilization of selected trace element concentrations in formation waters (Kharaka amd Mariner), fluid inclusions (Burruss), transformation of smectite to illite (Pytte and Reynolds), $^{40}Ar/^{39}Ar$ determinations of cooling histories of reheated detrital microclines (Harrison and Burke), and fission track dating (Naeser *et al.*, Green *et al.*, and Feinstein *et al.*). These techniques can be combined to calibrate temperature determinations (Feinstein *et al.*). A chapter on simulation methods (McDonald *et al.*) is included also.

The book closes with three excellent papers verifying geodynamic basin models from organic maturation data, clay mineral assemblages, and diagenetic mineral phases in extensional basins (Issler and Beaumont), a foreland basin (Hagen and Surdam), and transform margin basins (Heasler and Surdam). These chapters demonstrate clearly that well-constrained geodynamic models may be verified by a variety of geological observations and that combined approaches lead to fuller understanding of basin evolution and predicting occurrences of hydrocarbon and mineral resources.

In summary, the book is well worth reading, and any researcher interested in the evolution of sedimentary basins should possess a copy.

GEORGE DEV. KLEIN
Department of Geology, University of Illinois, Urbana, IL 61801–2999

Books Received

Advanced Turbo C Programming. Keith Weiskamp. Academic Press, San Diego, CA, 1988. xiv, 559 pp., illus. $45.95.

Advances in Contemporary Neurology. Fred Plum, Ed. Davis, Philadelphia, 1988. xviii, 211 pp., illus. $45. Contemporary Neurology Series, vol. 29.

Analysis of Psychiatric Drugs. Alan A. Boulton, Glen B. Baker, and Ronald T. Coutts, Eds. Humana, Clifton, NJ, 1988. xx, 547 pp., illus. $79.50. Neuromethods, vol. 10.

Animal Liberators. Research and Morality. Susan Sperling. University of California Press, Berkeley, 1988. xvi, 247 pp., illus. $19.95.

Black Families in Crisis. The Middle Class. Alice F. Coner-Edwards and Jeanne Spurlock, Eds. Brunner/Mazel, New York, 1988. xiv, 305 pp. $30.