encompass case studies of societies failing to respond adequately to environmental variability.

This volume commends itself to a wide audience of archeologists, geographers, economic and ecological anthropologists, climatologists, and economic historians. With the caveat that it gives little attention to instances of overt adaptive failure, the conceptual tools and potential for historical analogies it presents should be of interest to anyone concerned with the implications of present-day or future environmental changes for human well-being.

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Asteroids Updated

Asteroids II. RICHARD P. BINZEL, TOM GEHRELS, and MILDRED SHAPLEY MATTHEWS, Eds. University of Arizona Press, Tucson, 1989. xii, 1258 pp., illus. $50. Space Science Series. Based on a conference, Tucson, AZ, March 1988.

Asteroids II is to asteroids as the *World Book Encyclopedia* is to the world: encyclopedic. As a 1258-page, overwhelmingly comprehensive book, it will serve as the reference work on asteroids for the next decade, as did its predecessor volume, *Asteroids* (University of Arizona Press, 1979), for the past decade.

This book is the 16th in the distinguished space science series published by the University of Arizona Press, under the general editorship of Tom Gehrels. As is characteristic of the series, the book was preceded by a conference on its subject. However, the standards and expectations of the editors, as well as a rigorous editor's pencil, ensured a stylistic unity that makes the book easy to read.

The introductory chapter by Binzel, which provides a good overview of the book's contents, is followed by more than 200 pages on astronomical observational techniques and laboratory experiments, grouped under the optimistic heading Explorations. Then follow almost 400 pages, 17 chapters, on structure and physical properties, 11 chapters on origin and evolution, and 2 chapters on future space-based studies. Useful features include almost 200 pages of tabulated data, the "Asteroids II Database," current as of March 1988, and a glossary of terms and symbols. The chapter on asteroid taxonomy by Tholen and Barucci is also a helpful reference.

Although not described as an encyclopedia, *Asteroids II* shares some of the advantages and disadvantages of one. That is, though it is comprehensive, its contents are not sorted; all chapters have equal weight. For example, the current state of virtually all the observational techniques that have been applied to asteroids is described, including ones that may never yield any new knowledge about asteroids, such as speckle interferometry, or that are no longer yielding new knowledge, such as polarimetry. Sizes, masses, shapes, rotation rates, colors, temperatures, texture, mineralogy, and other such properties are all described. Wading through this wealth of information to find the overall state of knowledge about asteroids is not easy, and providing such an overview is probably not the purpose of the book.

Following the descriptive sections of the book, challenges for the theorists emerge. Despite the tremendous progress in gathering observations of asteroids over the past two decades, major gaps in our knowledge persist. This problem is well stated by George Wetherill, writing on the origin of asteroids:

> The author regards it fortunate that this is only a review chapter, and therefore he is not under obligation to actually report the solution of any of these problems, but only to discuss their present status. We are probably far from understanding what is actually happening during the formation of the asteroids. To confine discussion to what is really known to be true would limit it to the trite. In such circumstances, it is preferable to consider what might conceivably be true, in hope that it may at least prove interesting.

And in fact much interesting theory and speculation can be found in part 4 of *Asteroids II.*

Reading an encyclopedia can be entertaining, as well as enlightening. This voluminous volume conveys the sense of the vigorous scientific community drawn from a variety of disciplines in many different countries. All the cadres in the field are represented, from such patriarchs as Dollfus and Wetherill to many who pushed the field in the 1970s—Chapman, Veverka, Matson, Greenberg, and Bowell—to the next generation full of new ideas and enthusiasm. Some of the chapters are truly outstanding. Gaffey, Bell, and Cruikshank's chapter on reflectance spectroscopy and surface mineralogy is a fine review of this topic, with a wealth of useful figures. Data from IRAS (the Infrared Astronomical Satellite), which constitute a new and important source of information about asteroids, are covered in three short chapters, which give a taste of what is to be learned from that successful space mission. Davis and coauthors take on the difficult challenge of the collisional evolution of the asteroid belt and present a clear exposition of the current inconsistencies between theory and observations.

Several chapters, including that of Gaffey, Bell, and Cruikshank, address the relationship between asteroids and meteorites. The chapter by Lipschutz, Gaffey, and Pellas draws on the breadth of knowledge about meteorites and gives the meteoriticist's perspective of the relationships to asteroids. Bell and coauthors have spun a nice tale in their chapter "Asteroids: the big picture." Such cosmopoetry requires major assumptions; these are clearly stated so the reader will know if the authors' "big picture" prevails or fails.

This book is a must for anyone studying asteroids. It's all here.

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Superconducting Organics

Organic Superconductors. T. ISHIGURO and K. YAMAJI. Springer-Verlag, New York, 1990. x, 288 pp., illus. $59.50. Springer Series in Solid-State Sciences 88.

Although superconductivity in a metal (mercury) was first discovered in 1911, it was not until the mid-1950s that a detailed theory of the superconducting mechanism (phonon-mediated electron coupling) of electron pairing (Cooper pairs) was developed, in the form of the well-known BCS (Bardeen-Cooper-Schrieffer) theory. At about the same time, the first organic "synthetic metal" (a material that behaves as a metal even though it contains no metal atoms) was discovered by the Japanese. Then began a steady worldwide search for new organic conducting systems, stimulated by the theory of Little. The search culminated over two decades later (1979) in the discovery, by Bechgaard and Jérome, of the first organic superconductor, which was based on the organic electron-donor molecule TMTSF, tetramethyl(tetraselenafulvalene). In the decade since this discovery, increases in the superconducting transition temperatures (T_c's) have occurred regularly; they have risen from 1 K to 12.5 K along with a similar order-of-magnitude rise (to 125 K) for the ceramic copper-oxide superconductors over the same period.

Many review articles have dealt with organic superconductors, but this is the first book devoted entirely to the physics of these systems. It deals with all known types of organic superconductors—these are based on the molecular species TMTSF, BEDT-TTF or "ET", DMET, MDT-TTF, and $Ni(dmit)_2$—and the authors qualitatively describe the crystal structures associated with the relevant salts insofar as they affect physical properties. For detailed descriptions of structures, chemical synthesis, and crystal growth, the authors direct readers to other texts, such as Ferraro and Williams's *Introduction to Synthetic Electrical Conductors* (Academic Press, 1987). Although *Organic Superconductors* describes, in commanding detail, the physics of organic superconductors, its readership should not be limited to physicists. Chemists, materials scientists, and anyone interested in superconducting organic materials can greatly profit from this comprehensive volume. Non-physicists will find that the introductory chapters provide useful background for the later discussions of the physics of these novel systems.

All of the rich electrical and magnetic phenomena associated with organic superconductors such as low dimensionality, charge density waves (CDW), spin density waves (SDW), Peierls transitions, and competing ground states, as well as the experimental methods used to study them, are presented in this volume. Every attempt is made to compare theory and experiment, and some background reading in a solid-state physics text will be required for those not acquainted with the field.

Seven of the ten chapters of the book are written by Ishiguro and the remaining chapters, dealing with theoretical aspects, are written by Yamaji. One major chapter deals with the mechanism, as yet unknown, of superconductivity in organic materials. From the outset, it is pointed out that the mechanism is "exotic" and may differ from that of the BCS theory. A central point is made that understanding the superconducting mechanism may lead to clarification of the magnitude that the T_c's can attain in these materials (the Holy Grail in the general field of superconductivity) and how to reach them. The authors review the several existing models and wisely point out that these studies are still in their initial stages and that there are, as yet, no firm conclusions. A chapter is also devoted to magnetic-field-induced spin density waves (FISDW) and the rich variety of phenomena associated with them.

Anyone interested in superconductivity will find the final chapter fascinating in that it discusses the many similarities between the high-T_c ceramic and organic superconductors. The authors suggest that the superconducting mechanisms operating in both of these types of materials may in the future be described by a theory other than that of BCS. Their conclusion, based on these similarities, is that since "high-T_c" is now a reality there is every reason to expect it to occur some day in organic systems. All in all, this book will richly reward the reader with new physical insights into the nature of organic superconductors.

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Ecological Interactions

Perspectives on Plant Competition. JAMES B. GRACE and DAVID TILMAN, Eds. Academic Press, San Diego, CA, 1990. xiv, 484 pp., illus. $79.95.

The study of plant competition is undergoing a period of major change, as researchers meld traditional demographic approaches with approaches that explicitly include the dynamics of limiting resources. This collection of papers provides an important overview of the field.

The stated purpose of the book is "to explore various perspectives on plant competition" and to clarify "underlying definitions, goals, and concepts associated with each perspective." The first goal is nicely achieved. A broad variety of topics related to plant competition (primarily resource competition among terrestrial plants) are reviewed and assessed. The second goal, a difficult one because of the changing nature of the field, is only partly achieved. One problem is that researchers have slightly different operational definitions of "competition," which, as is pointed out in several chapters, can lead to some confusion. Some authors define competition in terms of population densities or growth rates, others in terms of individual growth rates, others in terms of the ratio of biomass to area. Each usage has its own nuances and applications. There are several other discrepancies among chapters both in definitions of terms and in interpretation of data.

Most experimental studies in plant ecology over the last 30 years have involved manipulating the density of one or more populations and quantifying the response of others. This approach is well represented in this book by chapters on density-yield relationships in plants, as well as reviews of the role of competition in succession, biogeography, and agriculture. Turkington and Mehrhoff provide an interesting example of this approach from a series of density manipulations in permanent pastures that attempt to determine the ecological and evolutionary effects of competition on patterns of species abundance.

Perhaps more important, several chapters discuss two developing issues that must be considered in future research. The first issue has been especially important in the development of this field: an appreciation of the mechanistic basis of plant competition. Resource competition is controlled by an individual plant's effect on and response to resource availability. Though this fact has long been recognized, it generally has not until recently been applied in understanding and making predictions about competitive outcomes. The implications of understanding competition as an indirect interaction through resource effect–response are discussed by Goldberg, who also suggests that plants affect resource levels in many ways other than just through resource uptake. Berendse and Elberse also explicitly discuss competition as an effect–response phenomenon, with examples from heathland and grassland research. Tilman, who has pioneered a resource-based understanding of competition, provides a theoretical justification for using a single parameter for each species (R^*) to understand the outcome of competition. At this time, the best examples of the application of resource-based models of competition come from aquatic systems. Sommer provides a clear example from phytoplankton communities.

The second important issue discussed in this book is the role of competition in the context of the real, complex world. Many other forces, such as herbivory, disturbance, and abiotic stress, are important in determining species abundance and diversity. What is the relative importance of competition, and how might it interact with these other forces? In his contribution Connell points out that most of what is accepted as experimental evidence of plant competition could also be explained as representing indirect interactions mediated through a third species, especially by species at a higher trophic level. Though he perhaps overstates the case, this is an important concern for those looking at competition in the field. Other forces discussed in this volume with respect to their interactions with competition include herbivory, mycorrhizal and other fungal associations, and "harsh" environments (low resource levels). Oksanen takes a particularly interesting approach using an evolutionarily-stable-strategy model to predict the optimal growth form for plants as a function of light competition, herbivory, and primary productivity.

This is certainly a required book for those working on plant competition, and an important reference for ecologists and biologists in general. In many ways, it will be a landmark, providing a snapshot of research at a critical time in the development of this field.

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