Preparing for Scarcity

Bad Year Economics. Cultural Responses to Risk and Uncertainty. PAUL HALSTEAD and JOHN O'SHEA, Eds. Cambridge University Press, New York, 1989. x, 145 pp., illus. $49.50. New Directions in Archaeology.

Using the data of prehistory, archeologists seek explanations for long-term patterns in the development of human societies. The shift from foraging to agricultural production systems that accompanied the domestication of plants and animals and the expansion of political organization that led to the development of state-level societies are among the more complex of the transformations to be explained. Despite the unique advantages offered by its long temporal perspective, the direct evidence afforded by archeological investigation often is limited to a highly selective and potentially biased sampling of material culture and its residues. For this reason, the causal variables or conceptual frameworks the analyst selects play a large role in the generalizations that will be reached. Among the popular choices are population growth, technological innovation and economic developments linked to production efficiency, and the usurpation and consolidation of political power by classes or administrative elites.

Bad Year Economics makes an important and convincing case for adding unpredictable resource fluctuations to this list. Such fluctuations are ubiquitous across environments and production systems. Depending on their temporal and spatial qualities, they invoke a limited and potentially predictable set of sociocultural responses; these responses entail important consequences for social organization and long-term social change.

Risk associated with food supplies receives the most detailed treatment. The volume sandwiches nine case studies between introductory and concluding chapters by the editors. It predominantly is the work of archeologists and historians from the University of Michigan or various English or Dutch departments of prehistory. The cases span social formations from hunter-gatherers to peasants living within modern nation states; they lie mainly within the temperate zones of North America and Europe.

Much of the strength of the volume lies in the clear conceptual framework set out in the introductory chapter and the high degree of fidelity to this scheme in the case studies. Halstead and O'Shea note that environmental variability affecting production can be characterized in terms of its timing, frequency, duration, severity, spatial scale, and regularity (or predictability). These qualities can be related in systematic ways to four types of cultural response: mobility, diversification, physical storage, and exchange (social storage based on reciprocal obligations couched in terms of kinship, other social relationships, or a currency). For instance, mobility is an effective buffer only if the environmental stress is spatially unsynchronized over the potential range of movement of goods or people, that is, if food shortages are localized. Physical storage is best suited to short-term temporal fluctuations affecting foodstuffs that can be produced in abundance and easily preserved.

With this framework the individual case studies pose these questions: "(1) How do societies buffer themselves against periodic variation in food availability? (2) How do these coping activities influence other aspects of cultural organization? (3) To what extent can these coping strategies provide the impetus for social change?" (p. 2). The brief concluding chapter offers a comparative review of the answers.

Several examples will give a sense of the breadth of the analyses. In an ethnohistorical analysis of Pawnee and Huron subsistence, O'Shea notes the importance of abundant fallback foods (for example, anadromous fish, bison, wild rice, or nuts) that fluctuate independently of agricultural crops. He argues that the Neolithic Revolution developed more slowly in the New than in the Old World because societies located in the Americas did not have the option of buffering agricultural risk by the concomitant domestication of large mammals. Further, O'Shea inverts the standard argument to suggest that regional integration (as manifested, for example, in Woodland Ceremonial complexes) may have preceded a high degree of reliance on food production. In effect, extensive spatial integration may have been necessary to buffer the localized risks of corn agriculture. Halstead examines the problematic role of a "surplus" in sociocultural evolution. Some theorists have suggested that a surplus is necessary to provision the non-producing elites that underwrite the development of civilization, others that such a surplus will exist only if its production is compelled by an elite. Citing the archeological record of Thessaly (Greece), Halstead argues (p. 80) that a "normal surplus probably did, eventually, support new economic classes, but it was first wrung from the soil as a strictly domestic initiative" in the face of recurrent agricultural risk.

Forbes analyzes mechanisms of risk avoidance (polycropping, field dispersion, and storage) in a subsistence-oriented agricultural community in modern Greece. In this instance, coping mechanisms are integral to the conservatism of peasant households, making them resistant to socioeconomic change initiated by the state. In the right circumstances, environmental variability can discourage instead of promote socioeconomic change. And, citing examples from Imperial Rome and late medieval and early modern Europe, historians Jongman and Dekker note that the urbanization of preindustrial Europe required regular state intervention in food markets to protect nutritionally vulnerable but politically threatening consumers. Owing to the inelasticity of demand, small fluctuations in supply could generate unacceptably large fluctuations in the price of basic foodstuffs.

A willingness to synthesize diverse sources of data is characteristic of these papers. One finds here the curses read triennially by the city magistrates of Teos (around 470 B.C.) against aristocrats seeking to manipulate grain imports (Garnsey and Morris), mythological representation of patterns in regional resource fluctuations (Minc and Smith), and the use of fine-grained temporal evidence on annual variability in subsistence gleaned from careful excavation of a single refuse pit in the Middle Uruk Period (3300 B.C., Western Iran; Wright *et al.*).

Gaps in the volume arise from limits of regional and historical coverage and, more important, from methodology. The archeological and historical methods employed in most of the case studies have the advantage of a long-term perspective but largely are blind to the detailed processes by which households and local groups adjust to environmental risk. Another recent volume, *Risk and Uncertainty in Tribal and Peasant Societies* (Elizabeth Cashdan, Ed., Westview, 1990), offers a useful complementary perspective. There also is a bias here toward analysis of successful adjustment. One wonders how the conclusions might change if they were to

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