Hominid Evolution: A Search for Models

The Evolution of Human Behavior. Primate Models. WARREN G. KINZEY, Ed. State University of New York Press, Albany, 1987. xvi, 299 pp., illus. $39.50; paper, $14.95. Williams Press, Inc., Series. SUNY Series in Primatology. Based on a symposium, Chicago, Nov. 1983.

In trying to account for the evolutionary origin of the human family, anthropologists have often turned to studies of the nonhuman primates in order to put behavioral flesh on the bones found in the fossil record. This book, containing nine papers from an American Anthropological Association symposium and one invited commentary, reports on the current state of this art.

Fifteen years ago, it was common practice to use an extant primate species as a model for the common ancestor of humans and today's African apes, and for this purpose there were two major candidates: the baboon, for the ecologically minded, and the chimpanzee, indisputably our closest living relative. This book makes it quite clear that such a simplistic approach is no longer possible. Neither the baboon, an early favorite of the male chauvinists, nor the chimpanzee, adopted by the feminist revisionists, is likely to represent our earliest ancestor adequately. Several contributors emphasize that it is a mistake to regard the trajectory of human evolution as a continuum, with a chimpanzee-like creature at one end, a hunter-gatherer at the other, and all the intervening forms strung neatly like beads in between. Humans are unique in many ways, they believe, and any theory that seeks to account for our origins must also account for this uniqueness.

Many of the chapters present ideas that have been developed more fully by their authors elsewhere. Tanner continues to regard chimpanzees as an appropriate model for early hominids and reminds us that selection can be expected to operate on both sexes. Potts makes a plea for human uniqueness and restates his hypothesis that many Plio-Pleistocene sites previously touted as hominid home bases may actually have been stone caches. Continuing to build on his seminal paper (1980) on primate social organization, Wrangham suggests that a comparison of all African apes might identify phylogenetically conservative traits that were present in our common ancestor, although he ends on a note echoed by other contributors: "We are thrown back again on behavioral ecology and other evolutionary principles."

R. L. Susman believes that the pygmy chimpanzee is the most forest-adapted of the African apes and thus is important for understanding *Australopithecus afarensis*. The extent to which this early hominid made use of trees is controversial, but Susman makes an important point: the idea that hominization involved our ancestors' leaving the trees and moving "out onto the savannah" is not supported by the paleoenvironmental data.

Disavowing baboons as direct models for early humans, Strum and Mitchell draw attention to some characteristics of baboon society that could be useful in considering early hominid behavior. Kinzey's essay on monogamy in primates places this mating system, whose role in human evolution is by no means certain, in a wider perspective. Though howler monkeys have neither a close phylogenetic nor a close ecological affinity with early humans, Crockett uses this longest-observed of all primate species to make some telling points about the role of evolutionary biology in human paleontology.

Marks and R. W. Sussman discuss new approaches to behavioral reconstruction, Marks seeking to correlate primate socioecology with cytogenetic variability and Sussman exploring how the dietary patterns, tooth morphology, and intestinal physiology of all primates, including humans, might combine to provide a picture of early hominid subsistence.

If it is no longer feasible to use particular primate species as referential models in reconstructing the behavior of our ancestors, what is the alternative? In an invited essay that spans one-quarter of the book, Tooby and DeVore take up suggestions made by several of the other authors: the best prospects for a solution lie in a rigorous application of the principles of behavioral ecology. These are set forth in great detail, and it is proposed that a strategic modeling approach be applied to all the data available. Their emphasis is on methods, and Tooby and DeVore do not produce yet another version of the transition from hominoid to hominid; nonetheless it is clear that, in contrast to the other contributors, they would assign a major role to hunting were they to devise such a scenario.

Research on human evolution is studded with "creation myths" of varying sophistication and plausibility. Abandoning the pretext that the early hominids were either baboonlike or chimpanzeelike should remove yet another possible source of error, and treating their behavior as a problem in behavioral ecology is a promising avenue of research. Behavioral ecologists are just as capable of creating adaptationist "Just-So Stories" as naïve physical anthropologists, however, and so it is vital that hypotheses generated through this approach be testable if there is to be progress in this most speculative of fields.

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Phosphorite Sedimentation

Phosphate Deposits of the World. Vol. 1, Proterozoic and Cambrian Phosphorites. P. J. COOK and J. H. SHERGOLD, Eds. Cambridge University Press, New York, 1986. xviii, 386 pp., illus. $99.50. International Geological Correlation Programme Project 156, Phosphorites.

This massive volume is a model of productive international cooperation on a project of global scientific and humanitarian importance: developing a better understanding of the world's irreplaceable and dwindling mineral phosphate resources. The first of a projected series of four such volumes, it is the English-language product of 46 authors, more than half having other first languages.

Despite predictable unevenness among its 26 chapters, the production has been skillfully orchestrated by editors Peter Cook and John Shergold, who also provide an orientational introduction and an illuminating summary chapter that deals with the nature and origin of the nearly 350 known deposits reviewed in the book. A general chapter by A. G. J. Notholt and R. P. Sheldon summarizes the distribution of the 14×10^9 tons of identifiable phosphorite ores known to have formed between approximately 2.2 and 0.5×10^9 years ago (about 10% of the known global resource). The remaining 23 chapters consist of regional reviews, accounts of particular deposits, and interpretative studies that provide much of the database from which the three summary chapters are distilled.

Readers primarily interested in origins or exploration will find the meat of the book in the summary chapter by Cook and Shergold and the immediately preceding chapter on phosphogenesis by S. R. Riggs. All support the classic view of A. V. Kazakov that upwelling is and probably was the primary source of mineral-bearing waters and that warming shallow shelves and platforms at low to intermediate latitudes are favored sites of phosphorite sedimentation.

Cook and Shergold see climatic change and plate tectonism as the primary driving mechanisms, operating at a range of scales

by means of complex interactions. They guide the reader through a plexus of related processes at varying scales that eventually converge to result in a phosphorite deposit. Global oceanic circulation, local tectonism, changing sea level, evolutionary events, calcium and phosphorus enrichment, biochemical (and perhaps inorganic) precipitation, and reworking of initial deposits all play roles leading to final concentrations in generally organic-rich sediments. The contributory processes must act in concert in order for major phosphorite deposits to form, often contemporaneously with records of onshore aridity. Such deposits, as a result, are unevenly distributed in time and space, resulting in phosphogenic episodes and provinces, both in the Proterozoic and Cambrian and also later.

This work is a major and timely resource for students of nonmetallic mineral deposits, mineral economics, and historical geology. It is likely to remain so for decades to come, and one hopes it will soon be joined by the promised three companion volumes.

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Icy Estuaries

Fjords. Processes and Products. JAMES P. M. SYVITSKI, DAVID C. BURRELL, and JENS M. SKEI. Springer-Verlag, New York, 1987. x, 379 pp., illus. $85.

Much has been written about estuaries, but books about "fjords," deep, high-latitude estuaries that have been evacuated or modified by land-based ice, are few. This volume presents an excellent summary of the geological, physical, chemical, and biological aspects of the complex fjord system, as well as demonstrating the interaction of these aspects.

The authors have done their homework, carefully documenting and supporting the information they present. Their 328 pages of text, containing 216 figures and 20 tables, are supported by an additional 38 pages of references, containing more than 1100 citations. As a convenience for readers, four of the book's nine chapters contain summaries of the symbol notation used.

Since I devote most of my time to assessing needs and priorities in several icy-polar disciplines, I was glad to see that the final chapter of the book carefully identifies problems and projects that need to be resolved in fjord oceanography, fjord biogeochemistry, fjord biology, and fjord geology. Suggestions for a methodology and approaches to answering these questions are also presented.

"Characteristic U-shaped profile of McBeth Fiord, Baffin Island." [From *Fjords*]

The authors identify advanced students, research professionals, and environmental scientists in the earth science and oceanographic communities as their intended audience. The book is divided into three parts: an introduction with two chapters that define the fjord environment; a processes and products section that details the fluvial-deltaic environment, circulation and sediment dynamics, subaqueous slope failure, biotic processes, and biogeochemistry; and an implications and applications section that presents case histories of environmental problems caused by various types of pollutants and points to future fjord research needs. The long-standing involvement of each of the authors in fjord studies is evident in the completeness of the presentation. The only aspects of the book with which I find fault are: the very limited mention and attention paid to Southern Hemisphere fjords (of more than 230 fjords presented in the book, only 14 are south of the equator); the failure to include many references to foreign-language sources on Chilean and Argentinian fjords and the fjords of Antarctica, a consequence of not examining the Southern Hemisphere fjords in detail; the omission of any mention of the recent work by Austin Post and Mark Meier on the factors responsible for the advance and catastrophic retreat of tidewater glaciers; and the fact that the authors barely touched on the south-central Alaskan fjords I study.

Despite its few shortcomings, I like this book very much. It nicely blends information from at least ten different disciplines (biogeochemistry, biology, environmental geology, geomorphology, geophysics, geotechnology, glaciology, hydrology, oceanography, sedimentology) into a readable presentation that can serve as both a reference and textbook. There is a place for this book in all earth sciences libraries.

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Wind Processes

Aeolian Geomorphology. WILLIAM G. NICKLING, Ed. Allen and Unwin, Boston, 1986. xx, 311 pp., illus. $39.95. From a symposium, Guelph, Ontario, Canada, Sept. 1986.

The characteristics of aeolian (wind-formed) landscapes and the processes involved in their development have attracted increasing attention in recent years, as a result of the problem of desertification, the recognition that wind action is a significant process on Mars, and the importance of aeolian sandstones as oil and gas reservoirs. The 16 papers in this volume are not, as the editor admits, fully representative of the state of aeolian research today, but they do show clearly the diversity of approaches to aeolian geomorphology and the variety of disciplines involved.

There is a major emphasis in the volume on studies of aeolian processes, especially the mechanisms of sediment transport by the wind. These latter studies are characterized by a rigorous experimental approach and a sound theoretical basis, continuing a tradition established by R. A. Bagnold. Wind tunnel modeling of processes is an