drowned with Ludwig of Bavaria." Ludwig II, the quite mad inveterate castle-builder and patron of Wagner, drowned himself in 1886. His attending physician, Bernhard von Gudden, died with him. Auguste Forel died in 1931, and in 1886 the birth of the Monist League was 20 years in the future. One has the feeling that some words have been left out here.

Occasionally, Bramwell overlooks rather important connections. Her chapter "The Steiner connection" is concerned with the fascinating topic of how Rudolf Steiner, probably best known as the founder of Anthroposophy, strongly influenced many members of the National Socialist Party which, when in power, would persecute his followers (Steiner himself died in 1925). Steiner was directly influenced by Haeckel, with whom he had been in correspondence in the 1890s. Bramwell does not mention this.

Some of Bramwell's criticisms, in the opinion of this reviewer, are very much on the mark, and the book often evidences solid research and analytical shrewdness. Yet throughout the book it appears that she is concerned with settling scores of some sort, with the left, with feminism, with liberal or left-liberal interpretations of the Nazi phenomenon (a concern prominent in her earlier book on Darré), and, of course, with the modern ecology movement. In any event, *Ecology in the Twentieth Century*, for all its erudition and the fine style in which this is articulated, must be read with caution.

ROBERT A. POIS
Department of History, University of Colorado, Boulder, CO 80309

The Hominin Clade

A Theory of Human and Primate Evolution. COLIN P. GROVES. Clarendon (Oxford University Press), New York, 1989. xii, 375 pp., illus. $75.

This is a somewhat idiosyncratic work by a scholar very knowledgeable about primate morphology and systematics. It will certainly be of use to biologists and anthropologists for its presentation and analysis of the traits that appear to define clades among the primates.

Yet it is surprisingly difficult to locate just what the "theory" promised by the title is. Indeed, this is principally a book about what to name things. It centers on the question, How would we name the various groups of primates, assuming cladistic classifications were really desirable in biology? Cladism is the school of thought that maintains that classifications must be based solely on recency of common ancestry (synapomorphy), and not on any consideration of divergence (autapomorphy). Thus the category fish cannot exist, since some of them are more closely related to tetrapods than they are to other fish.

Yet if a classification is a communicative device and a phylogeny is a hypothesis, then the general purpose of classifying can easily be defeated. The hypotheses are constantly being tested, rejected, and amended. Do we rename things every time we revise our phylogenies? This would spell trouble for a phylogenetically volatile field, like biological anthropology.

In the case of primates, the perceived need for a strictly cladistic classification of the apes and humans has systematics in a pretty thorough state of confusion. Traditionally, we have recognized the great apes (chimpanzee, gorilla, orang-utan) at the family level (family Pongidae) and humans and their close fossil relatives at the same level (family Hominidae)—thus we talk about "hominid evolution." An alternative cladistic classification, however, calls the orangs the Pongidae, humans, chimps, and gorillas the Hominidae, and the human fossil record the subfamily Homininae—thus, hominine evolution. Groves, advocating another cladistic approach, calls humans, chimps, gorillas, and orangs the Hominidae, humans, chimps, and gorillas the Homininae, and the human fossil record the tribe Hominini—thus, hominin evolution.

Can't we just keep the great apes, keep the hominids, and leave the chimp-gorilla-human clade as a sniglet? Even Groves continues to write of the "australopithecines," though they are neither a clade nor a hominid subfamily here.

The evolutionary theory, at the beginning and end of the work, is principally a collage of various broad ideas, some of which have enjoyed a brief recent vogue (such as those of Goldschmidt) and some of which have never enjoyed a vogue (Løvtrup, Krassilov). Groves, adopting some of the more eccentric views of others, appears to advocate in this work an essentially macromutational (here synonymized with punctuational) and orthogenetic (here referring to hypothetical directed mutations) view of the evolutionary processes.

Groves also sees more taxa than do most other workers. For example, in the evolution of the hominids, or hominines, or hominins—well, in the genus *Homo*—most workers recognize three species: *Homo sapiens, Homo erectus*, and *Homo habilis*. They also grumble about elevating neanderthals to species status and a second *Homo* species in East Africa alongside *H. habilis*. Groves gives no fewer than eight species in this genus: an unnamed species found at Hadar; *H. aethiopicus* (based on ER-1482); *H. rudolfensis* (based on ER-1470, 1590, and 3732); *H. habilis* from Olduvai; *H. ergaster* (based on ER-992 and ER-1813); another unnamed species (based on ER-3733 and 3883); *H. erectus*; and *H. sapiens*—without even reckoning the neanderthals to be a separate species. This is not to say that the classification is "right" or "wrong"—only radical.

The great strengths of the book are the high level of expertise the author brings to the morphology, the comprehensive references to the fossil literature, and the explicit diagnosis of each taxon. There are also a lot of data and critical thought about interpretations of the fossil material—a welcome contrast to the all-too-common practice of simply reporting the conclusions of other studies. The book is significantly underillustrated, however, and the illustrations are not of particularly high quality. The discussion of genetic processes and patterns is weak, and there is a considerable amount of anatomical (especially dental) jargon. Nevertheless, in conjunction with a sound fundamental textbook of primate biology, such as Fleagle's *Primate Adaptation and Evolution*, Groves's book should prove to be a useful and certainly provocative contribution to the library of any scientist interested in human evolution.

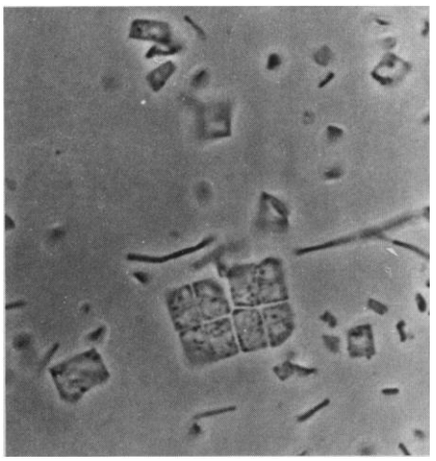
JONATHAN MARKS
Departments of Anthropology and Biology, Yale University, New Haven, CT 06520

Halophiles and Their Milieu

Hypersaline Environments. Microbiology and Biogeochemistry. BARBARA JAVOR. Springer-Verlag, New York, 1989. viii, 328 pp., illus. $59. Brock/Springer Series in Contemporary Bioscience.

No one doubts the importance of past and present interactions between microorganisms and the lithosphere. The disciplines of microbiology and geochemistry have only recently begun to be integrated in environmental studies, however. This book is a laudable and generally successful attempt to fuse aspects of the two in the consideration of one particular class of microbial environment. Having a background in microbiology and geochemistry, Javor is equipped to comment authoritatively in both areas.

The book opens with introductory chapters on general geochemical and biological aspects, followed by a couple of chapters on the interactions between carbon and sulfur and evaporites, including a necessarily speculative account of the presumed importance



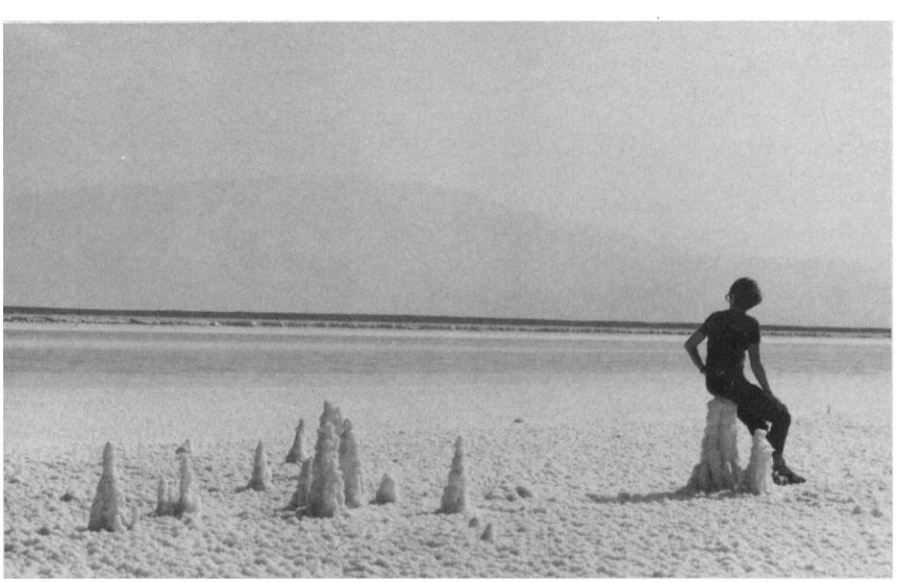
"Square-shaped bacteria [such as] were noted by Walsby (1980) in a brine pool of the Gavish Sabkha, Sinai. The bacteria appeared to divide in two dimensions, giving rise to floating, gas-vacuolated, 'postage stamp'-like sheets of cells." Cells in the center here are about 2 micrometers wide. [From *Hypersaline Environments*]

of dissolved organic carbon in evaporite formation. There follows an account of the biology of the microorganisms that inhabit hypersaline environments, in which the organisms are treated chapter by chapter according to physiological type—archaebacteria, anoxygenic phototrophs, cyanobacteria, and so on. The final part of the book consists of a series of chapters devoted to hypersaline environments, in some cases particular lakes such as the Dead Sea, in others particular classes of environment such as solar salterns. These chapters contain geochemical and microbiological details of each environment and are in places repetitious of the earlier sections, but it is difficult to see how else the subject could be treated.

The author's background in geochemistry is evidenced by the unusually comprehensive discussion of different brine chemistries and the technical problems involved in brine analyses. This part of the book ought to be a mandatory introduction for any microbiologist working with hypersaline environments. Nevertheless, an opportunity has been lost in that there is no clear account of the factors that determine why a brine develops in a particular way, for example why a lake becomes a soda lake or a bitter lake. Such accounts exist in the geological literature, but they are ferociously difficult for the nonspecialist.

With its wealth of other valuable geochemistry, however, this book is something of a tour de force as a reference work. It is true that some areas are equally well covered by other recent publications (such as, *Halophilic Bacteria* edited by Rodriguez-Valera and published by CRC Press), but this book is unique in that in it one can find every saline environment from deep-sea basins to the Antarctic lakes complete with relevant geology, geochemistry, and microbiology appropriately referenced, including useful coverage of the older literature. There are a few inaccuracies in the microbiological content (for example the misapprehension that sesterterpanyl lipids are present only in haloalkaliphiles), and where is the coverage of alkaline salterns? However, these matters do not detract from what will be a classic reference work for halophilologists.

W. D. GRANT
Department of Microbiology,
University of Leicester,
Leicester LE1 9HN, United Kingdom



"View of the southern basin [of the Dead Sea], showing the extensive salt deposits which have developed at the periphery of the lake." [From *Hypersaline Environments*]

Nuclear Physics

Treatise on Heavy-Ion Science. Vol. 8, Nuclei Far from Stability. D. ALLAN BROMLEY, Ed. Plenum, New York, 1989. xxiv, 727 pp., illus. $125.

In the first few decades after World War II our understanding of the inner workings of the atomic nucleus and the forces that govern the motion of its constituents reached a comfortable state of maturity. It was realized, however, that our knowledge was not broadly based. The most abundant data from this period were obtained from stable nuclei or their immediate neighbors, nuclei close to stability. If the studies were extended to a larger number of nuclei, conclusions concerning nuclear phenomena could be improved and strengthened.

The study of nuclei far from stability began in earnest about two decades ago and rapidly evolved into one of the most vibrant areas of nuclear physics research. Experimental investigtion of such nuclei is more difficult than in the case of nuclei close to stability, but the rewards increase as well. For each problem of interest, a particular nucleus that is likely to provide the clearest and most unambiguous evidence is selected for study. If interesting results are obtained, then the investigations are extended to neighboring nuclei and a strong case is built on systematic observations of similar effects. Furthermore, not only are nuclei far from stability much more abundant than those close to it, their composition is also radically different, with "abnormal" ratios of protons to neutrons. It is, therefore, reasonable to expect that many interesting, previously unobserved phenomena will occur only among such nuclei.

This book proves how well-founded the aspirations for this new field of nuclear physics were. It does not attempt to treat all aspects of nuclei far from stability, a task that would be impossible in a single volume. However, it gives a good representation of the diverse activities in this field.

Two chapters are devoted to the technical problems associated with the production and study of nuclei far from stability. The nuclei of interest are typically produced in small amounts and are accompanied by an abundance of unwanted species. Ingenious methods have been devised to filter away unwanted products so as to isolate the species sought. These impressive technological advances have been a prerequisite to scientific achievement.

The progress in our knowledge of nuclear sizes and shapes, as well as the identification of regions where they change surprisingly quickly, is described in two other chapters.