Book Reviews

African Prehistory

Background to Evolution in Africa. Proceedings of the symposium "Systematic Investigation of the African Later Tertiary and Quaternary," Burg-Wartenstein, Austria, July–Aug. 1965. WALTER W. BISHOP and J. DESMOND CLARK, Eds. University of Chicago Press, Chicago, 1967. 935 pp., illus. $27.50.

Since man realized that he has a remote prehistory and an evolutionary biological origin, the main frontier of his studies of his ancestry has shifted geographically. Prehistoric archeology was born in France, and the early discoveries and studies in both fields were mostly European. Interest in that continent has not abated, but it has taken on a somewhat classical character as to some degree a standard or methodological basis for more pioneering efforts elsewhere. Asia, both the Near and the Far East, was a major focus for a time, but now the most energetic advances and exciting discoveries relate to Africa. That is evident not only in innumerable individual studies but also in the sequence of Pan-African congresses, the institution in Paris of the "F.T.A." (*fiches typologiques africaines*), and other group activities.

Among the most interesting of such efforts devoted largely or wholly to African anthropology in the broadest sense have been several conferences sponsored by the Wenner-Gren Foundation for Anthropological Research, New York, and held at Burg-Wartenstein, the foundation's conference center in Austria. The most ambitious of its symposia in this field were three held successively from 14 July to 9 August 1965 under the general title of "Systematic Investigation of the African Later Tertiary and Quaternary." The three subtopics were "Palaeontological Considerations," "Stratigraphical Considerations," and "Archaeological Considerations." A measure of continuity was maintained by four of the 36 members who attended all three sessions and seven others who attended two each.

The present hefty tome, with its less explicit and rather enigmatic title, is the report of those symposia. It includes formal papers presented to the conferences, partly verbatim and partly paraphrased discussions of those papers, introductions and an appraisal written after the conferences, and a lengthy list of recommendations agreed upon there. In addition to the other apparatus the volume contains 50 articles by 40 authors (four of whom were not physically at the conference). Articles in English have French summaries, the eight articles in French have English summaries, and the recommendations are published in parallel English and French versions. The summaries are not entirely adequate, but they maintain a friendly connection between what sometimes tend to be linguistically and geographically separate schools.

The paleontological section includes duplicated mammalian faunal lists for the East African Miocene and single lists for the Pleistocene of the same region. More general summaries for some other parts of Africa and certain groups of mammals are given by seven other authors. It is a striking fact that, although these studies began more than 50 years ago, there is still no really complete and fully reliable faunal list for any major locality. It now seems probable that the South African deposits containing *Australopithecus* and *Paranthropus* are comparable in age to those in East Africa, not considerably younger as hitherto sometimes claimed. In the only nonzoological paper palynological evidence for climatic changes in sub-Saharan Africa is reviewed. This and other evidence, faunal and stratigraphic, casts serious doubt on previously usual attempts to base subdivision and correlation of the African Pleistocene on supposed successions of pluvial and interpluvial episodes. There is, however, evidence of changes in temperature that may eventually correlate with European glacial chronology.

The stratigraphic part of the symposium consists mainly of brief reviews of local Pleistocene stratigraphy in regions scattered from Egypt and Tunisia to South Africa. These data are of interest to geographically limited specialists, but they suggest that attempts at broader generalization or synthesis are still premature. On a broader level, techniques of potassium-argon dating are discussed, and the complexity and, in some respects, weakness of current stratigraphic nomenclature are illustrated by a lexicon and commentary for the Pleistocene of East Africa. That is followed by a quotation of a proposed code derived from one in use in Australia.

The third, archeological, part is longer than the other two together and ranges from Oldowan or possibly earlier so-called Pebble Cultures through the Iron Age or "Protohistoric," a term rejected by some but accepted by others of the present authors. Descripton is minimal, but general characteristics of artifacts or other cultural materials are exemplified for the Paleolithic (four papers), Neolithic (three papers), and Iron Age (four papers) but are in no case followed through in a single region. Finally, five papers on methodology and terminology in Paleolithic archeology are perhaps the most generally interesting and most controversial of those in this section.

The problems here treated are taxonomic, that is, they involve the principles and practices of classification and nomenclature. Indeed, throughout this work taxonomic questions are constantly in the background and often in the foreground: biological taxonomy, stratigraphic taxonomy, and archeological taxonomy. To a reviewer much involved in the first two but not in the last, those first two seem to have reached states of considerable sophistication while the latter still seems quite naive. In biology and geology different classifications may be based on alternative or sometimes even on conflicting principles, but at least each has clear and internally consistent principles and involves pragmatic validation. Specific classification in archeology, that is, the recognition and designation of kinds of artifacts, seems still to rest on intuitive, subjective, or purely arbitrary erection of types and not on conceivably natural groupings into variable taxa. Criteria proposed (morphology, technique, function, and the like) are confused not only among classifications but even within them. Attempts to establish cultural categories and taxa, which are analo-

gous not with zoological or botanical but with ecological or community classifications in biology, are even less satisfactory. An analytical technique (cumulative graphs of artifact types) attacked in one chapter but even more strongly defended in others is downright absurd. The conference finally recommended a "cultural stratigraphic nomenclature" which, as is elsewhere pointed out in this volume, is misnamed and which is unlikely to stand up. It suffers not only from mixed and inadequately defined criteria but also from confusions of concept (for example, between a hierarchy of nested sets and one of levels of abstraction) and of terminology (for example, between "horizon" as a point in time, as a physical plane, and as a unit of association).

It is not an adverse criticism but a recommendation in the present state of knowledge that this book raises more questions than it settles. It brings together a great body of data and of erudition. Always by implication and often explicitly it indicates deficiencies and likely points of attack. It is a tired cliché to say, "This book is a must for anyone interested in . . ." whatever it may be, but that is true of this book for anyone professionally concerned with any phase of African prehistory.

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Light Transmitters

Fiber Optics. Principles and Applications. N. S. KAPANY. Academic Press, New York, 1967. 447 pp., illus. $17.50.

Technological progress in fiber optics, especially during the past ten years, has given the engineer an important additional tool for transferring information by means of light. The medical investigator can use a bundle of flexible fibers both to illuminate internal parts of a living body and to return an image or other analytical information. Fibers assembled in the form of plates are surfaced with flat or curved faces for use in photographic or other optical systems or, when fused vacuum-tight, in photoelectronic systems such as cathode ray tubes, image converters, and image intensifiers. The initial flexibility of the fibers is advantageous for producing image dissectors and scramblers. Fibers made of luminescent or lasing materials and excited to produce their own radiation are highly efficient in collecting and relaying this light. Simplified, the mechanism underlying the propagation of an image through a fiber is the entrapment of energy by total internal reflection. Ray tracing is quite adequate to describe image formation by a fiber several wavelengths or larger in diameter. Wave theory accounts for the propagation of light through fibers of small diameter, as well as for coupling between fibers, certain radiation effects, and coherence. A sufficiently small fiber becomes a dielectric wave guide capable of sustaining predictable modes. Each fiber in a packed bundle should be clad with a material of lower refractive index to help minimize leakage of light across fiber walls. Fiber bundles result in space-variant imagery and are converted to space-invariant systems by such means as spatial filtering and dynamic scanning.

The author of the present monograph is a pioneer in the field. He has relied heavily on his own contributions and has added sufficient material to form a comprehensive treatment. The book will be especially helpful to the optical engineer with some undergraduate training and certainly of interest to those who may have an application for fiber optics. Fundamental phenomena, methods of analysis, results of calculations or experiments, and applications are discussed and illustrated. Obviously, detailed considerations of complicated shapes and assemblies could not be included. In some areas the book has a quality more often found in a first book concerning a new technology, namely, catalog-type photographs of the exteriors of instruments and allusions to further possible developments and to what might be done to improve procedures or equipment.

Three additional scientists contribute appendices. Two of these add to the analysis of image transmission and space-variant imagery of fiber bundles. The third writes about vision, comparing the retina to a bundle of fibers. The visual receptors of mammals are nonhomogeneous, nonisotropic, photosensitive cells that exhibit waveguide properties, and visual properties such as directional sensitivity, color detection and resolution are reviewed in the light of what is known about fiber optics.

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Irreversible Processes

Statistical Mechanical Theories of Transport Processes. ROBERT M. MAZO. Pergamon, New York, 1967. 180 pp., illus. $9.50. International Encyclopedia of Physical Chemistry and Chemical Physics, vol. 9, part 1.

Our understanding of the molecular basis of irreversible processes has undergone vigorous development in recent years. However, aside from a scattering of review articles in archival journals and some introductory material in textbooks (for example, in F. Reif's *Fundamentals of Statistical and Thermal Physics*), little of this development is easily accessible to the student. Mazo's book provides an excellent introduction to some recent developments.

Attention is focused on a rather limited area, the phenomena of fluid flow, heat flow, and diffusion in simple fluids. The systems discussed most are those composed of spherically symmetric molecules interacting by means of pairwise additive potentials, in classical mechanics. Even in this limited area of the theory of irreversible processes some fundamental work is omitted, in particular the remarkably successful approach followed by Henry Eyring and his collaborators; for various reasons this seems to be not regarded as sufficiently well founded to be generally accepted.

The main lines of development discussed here are associated with the names Boltzmann, Enskog, Bogolyubov, Choh and Uhlenbeck, Kirkwood, and Rice and Allnatt. Except for Boltzmann's kinetic theory of dilute gases, which is known to be correct and well substantiated by experiment, all the other theories leave something to be desired. They suffer either from obscure difficulties of principle or from practical difficulties in application; and agreement with experiment is often no better than within factors of 2 or 3. The difficulties are discussed carefully and candidly by Mazo.

The book ends with two chapters that supply a bridge to currently active areas of research; they deal with the use of time-correlation functions to calculate transport coefficients, and with the use of perturbative techniques (both diagrammatic and operational) in classical many-body systems.

Even a quick scanning of this book will give a student a good feeling for what has been going on during the last few decades and will bring him up