Book Reviews

Leakey's Report: The Geology and Fauna of Olduvai Gorge

Olduvai Gorge, 1951–1961. vol. 1, *A Preliminary Report on the Geology and Fauna*. L. S. B. Leakey, with contributions by P. M. Butler, M. Greenwood, G. Gaylord Simpson, R. Lavocat, R. F. Ewer, G. Petter, R. L. Hay, and M. D. Leakey. Cambridge University Press, New York, 1965. xiv + 118 pp. Plates and map. $14.50.

During the past few years, sensational discoveries of early human fossils at Olduvai Gorge in Tanganyika, together with public controversy concerning the great antiquity of these specimens, have served to make the site world-famous. The scientific results of the recent work have been published only in brief preliminary accounts, and one cannot fail to welcome an endeavor to bring together the most significant data in book form. When new discoveries are coming thick and fast, there is always a tendency to put off the preparation of a major report and Leakey is to be commended for his courage in setting a terminal date (1961) and in sticking to it.

The present volume picks up the threads of the story where it was left with the publication of Leakey's earlier *Olduvai Gorge* (1951). From 1931 until 1959, work in the Gorge was severely restricted by limited funds, although each season produced significant finds. The scale of operations changed radically in 1960, when adequate financial support was provided by the Research Committee of the National Geographic Society. As Leakey says in his introduction, during the season February 1960 to February 1961, "some 92,000 man-hours of work was completed, compared with only about 40,000 man-hours in all the preceding thirty years." It is the results of this year, in particular, and of the basically new interpretations which result from it, that form the substance of the new series. Volume 1 deals mainly with the geological setting and the fauna. The forthcoming volume 2 will set out the new cultural sequence and will also contain a detailed account of the australopithecine *Zinjanthropus boisei* and other hominid remains found up to 1961. Volume 3 is planned to contain a detailed description of the whole cultural succession.

In the volume under review, the major emphasis is on the mammalian fauna, an excellent cross section of which is illustrated in 86 of the 97 photographic plates. A short chapter reviews changes in the interpretation of the fauna since that of 1951. At that time, the mammals known from the lower series (Bed I) comprised 24 species, 10 of which were regarded as living forms; no living species can now be recognized from Bed I, and at least one-third of the species belong to extinct genera. It would have been helpful if Hopwood's identifications of 1951 and the recent determinations had been compared in tabular form. Changes in composition of the fauna within Bed I are now apparent, although details remain to be worked out. Earlier concepts of continuity between the faunas from the lowest to the highest levels (Bed IV) are in error, and it is clear that Bed I is more archaic than was previously supposed, being placed now as probably upper Villafranchian.

About one-half of the text is devoted to a systematic consideration of the mammalian fauna, several groups being described briefly by collaborating scientists (Insectivora and Chiroptera by Butler and Greenwood; Galagidae by Simpson; Rodentia and Lagomorpha by Lavocat; Carnivora by Ewer; Viverridae by Petter; and Chalicotheriidae by Butler) while the majority are dealt with by Leakey. Monographic accounts will appear elsewhere in due course. Three new Suidae (including two new genera) and ten new Bovidae (including one new genus) are named here for the first time. It is clear that many other new species await description. It is perhaps unfortunate that several of the diagnoses of new forms, especially the Suidae, are deficient in metrical data comparable, for example, to those given in the much briefer accounts by Ewer. Throughout the text descriptions often fail to refer to the relevant plates, and the plates themselves commonly lack specimen numbers, localities, or horizons. One minor inconsistency is that "*Panthera* sp." of Ewer's text becomes "*Felis* cf *tigris*" in plate 14. In general the descriptions are good, although individual scientists may differ in their own interpretations in some instances. Since the objective is to give an overall view of the fauna for the first time and not to attempt to be monographic, these and other minor defects do not detract from the great value of this presentation.

The geological discussions are somewhat disjointed. Leakey gives an excellent account of the geological background in chapter 1, although it might have been improved by references to the appropriate photographic plates and by the inclusion of a general view of the Gorge. The admirable study of the stratigraphy and lithology published by Richard L. Hay in *Science* [**139**, 829 (1963)] is reproduced in full as Appendix 1 and might more happily have followed directly after chapter 1. On the other hand, chapter 8 reproduces from *Nature* the succession of controversial communications regarding potassium-argon age determinations (about 1.7 million years for Bed I); these would perhaps have been better placed in an appendix. It is unfortunate that the exact volume and page citations for the articles reprinted from *Nature* are not given.

Appendix 2, by Mary Leakey, describes the individual named localities in the Gorge, usually designated only by letter abbreviations in the text and in previous literature. There is an accompanying foldout map on a scale of about 1:50,000; this map, together with the descriptions, will be an invaluable aid in understanding the past (and future) descriptions of individual finds.

A study of this volume is essential for anyone who has a serious interest in Olduvai and its unique hominid remains, cultural material, and faunal succession. By its very nature, the volume is not easy reading, and it will be of most value in reorienting the thinking

of those who are familiar with earlier accounts. As G. G. Simpson says in his foreword, all will "applaud Leakey's decision to bring out the present strictly preliminary publication, and will admire the energy and devotion that have given us so prompt and useful a record of results up to 1962." Further volumes in the series are awaited with great interest.

H. B. S. COOKE
Dalhousie University, Halifax, Canada

Mathematics

Special Functions and Their Applications. N. N. Lebedev. Translated from the revised Russian edition (Moscow, 1963) by Richard A. Silverman. Prentice-Hall, Englewood Cliffs, N.J., 1965. xii + 308 pp. Illus. $16.

This book may be strongly recommended either for reference purposes or as a textbook for use in a graduate course in special functions. The development is clear, readable, economical, and efficient. For reference purposes the book is surprisingly complete. The student will find himself learning a great deal of analysis with the minimum of trouble.

Considerable attention is given to applications of the special functions studied. A list of problems is given at the end of each chapter. Many asymptotic expansions of special functions are needed in the applications. The derivations given are unusually concise.

Chapter 1, "The gamma function," includes a derivation of the leading term of Sterling's formula. Chapter 2, "The probability integral and related functions," includes application to heat conduction and to the theory of transverse vibrations of an infinite rod. Chapter 3, "The exponential integral and related functions," includes an application to the electromagnetic radiation from a linear half-wave oscillator. Chapter 4, "Orthogonal polynomials," gives a general theory of orthogonal polynomials, including many specific results for Legendre polynomials, Hermite polynomials, and Laguerre polynomials. The latter are applied to the theory of image transmission of transients in a long transmission line.

Chapter 5 is, for this type of volume, a rather complete treatment of cylindrical functions, including Bessel functions and modified Bessel functions of both types and Hunkel functions, as well as one section on Airy functions. Chapter 6 gives some of the many applications of cylindrical functions, particularly applications to several Dirichlet problems.

Chapters 7 and 8 are concerned with spherical harmonics and their applications. Further properties of Legendre functions are developed. Dirichlet problems feature heavily in the applications. Laplace's equation is separated in spherical and spheroidal coordinates. It is also solved in toroidal and bipolar coordinates, a valuable feature of the book.

A good general theory of hypergeometric functions is given in chapter 9. In chapter 10 Laplace's equation is separated in parabolic cylindrical coordinates; the solutions are expressed in terms of Hermite functions. These are used in the Dirichlet problem for a parabolic cylinder, and in the quantum mechanical study of a harmonic oscillator.

EDMUND PINNEY
Department of Mathematics, University of California, Berkeley

Missile and Space Technology

Space Science and Engineering. Ernst Stuhlinger and Gustav Mesmer, Eds. McGraw-Hill, New York, 1965. xxviii + 457 pp. Illus. $20.

This book is based on a series of lectures that cover space engineering science; the lectures were given to graduate-level students, during 1960 and 1961, at Washington University (St. Louis, Mo.) by staff members of the Marshall Space Flight Center (Huntsville, Ala.). It takes considerable courage to issue a survey textbook in a field that is enlarging and changing as rapidly as the field of space science and technology. Certainly the treatment of basic physics, astronomy, and chemistry in the various chapters is as sound and appropriate now as when the chapters were written. On the other hand, a number of statements that describe the space environment, the moon, and Mars, as well as some concerned with power, instrumentation, and propulsion technology, were very obviously written before reports on recent developments were available—the Ranger closeups of the moon or the Mariner views of the surface of Mars, and developments made during the past year on bombardment ion thrustors, for example. But this is inevitable in a field where knowledge is increasing at such a pace.

The book contains a voluminous amount of interesting information intended to give the physical scientist and engineer a peek at some of the many disciplines and areas involved. It is also worthwhile reading for those who are knowledgeable in the space program, because workers tend to specialize and not to diversify their interests among allied areas to the extent that they should.

I am most tempted to criticize the book on the basis of the selection and interconnection of the wide variety of specific topics and examples in the individual chapters. Although the detailed organization of the book appears to be an arbitrary potpourri of topics, personal contact with and respect for the Stuhlinger group at Huntsville force me to recognize at least two bases for such a feeling. First, a survey course cannot mention everything, much less provide discussion in depth. Second, every person who reviews a book of this type in his own field would have organized such a course differently and written a different book.

In summary, I certainly recommend this work to the scientific worker who is interested in a glimpse of the variety of scientific and technological disciplines and to the experienced worker who works in some area of the field.

HENRY L. RICHTER, JR.
Electro-Optical Systems, Inc., Pasadena, California

African Wildlife Today

Rhinos Belong to Everybody. Bernhard Grzimek. Translated from the German edition (Frankfurt, 1962) by Oliver Coburn. Hill and Wang, New York, 1965. 207 pp. Illus. $12.50.

In this fine book the well-known director of the Frankfurt Zoo, with his intimate understanding of wild animals in their African habitat, gives a clear picture of what to expect when one visits East Africa today. The book is outstanding, not only because of the quality of his vivid and superb photographs (of which more than 60 are in color), but because the text de-