are the paper on pelagic sediments (by Arrhenius) and that on the clays of the Pacific Ocean floor (by Griffin and Goldberg). These writers give a comprehensive account of the composition, geochemistry, and distribution, both areally and vertically, of pelagic sediments. Many of the papers primarily concerned with topography and structure also include important material in this area.

Ginsberg and his associates provide a comprehensive account of calcareous sediments in shallow water, and Guilcher covers the whole of the continental terrace in his discussions of the sediments of estuaries, deltas, shelf, and slope.

The contributions to stratigraphy and geology that have resulted from work on, and study of, the micropaleontology of deep-sea sediments are summarized by Ericson and Riedel (in separate papers). The last paper in the volume is by an especially noteworthy combination of two authorities on the continental and marine Pleistocene record (Flint and Emiliani).

One hazard that the professional researcher must accept in contributing to a volume of this type is that of delay—one contributor, or the publisher, may delay publication to such an extent that the papers are out of date before they are in print. Many of the papers in this volume were written more than three years ago, but the volume was so seriously delayed that these early birds had an unexpected dividend: the manuscripts could be revised to include references to work published into 1962.

This volume, a "snapshot" of the working oceanographer who is studying the sea floor, is concerned with the ocenographer's latest works and with his methods of working. It is not a textbook, nor is it comprehensive. The editors, however, obviated any criticism of an unbalanced presentation with M. N. Hills's qualifying remarks in the preface. A fully balanced and complete treatise would have occupied several more volumes. Professionals in the field can only be grateful to the contributors for the immense labors they have devoted to writing and editing this volume; for many years *The Earth Beneath the Sea* will be a valuable reference work on the geology of the sea floor.

E. L. HAMILTON
U.S. Navy Electronics Laboratory, San Diego, California

Technology and Development

Science, Technology, and Development. The United States papers prepared for the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas. vol. 1, *Natural Resources.* Energy; Water and river basin development (378 pp. $1.25); vol. 2, *Natural Resources.* Minerals and mining; Mapping and geodetic control (355 pp. $1); vol. 3, *Agriculture* (262 pp. 75¢); vol. 4, *Industrial Development* (190 pp. 55¢); vol. 5, *Transportation* (155 pp. 50¢); vol. 6, *Health and Nutrition* (196 pp. 60¢); vol. 7, *Social Problems of Development and Urbanization* (89 pp. 35¢); vol. 8, *Organization, Planning, and Programming for Economic Development* (144 pp. 45¢); vol. 9, *Scientific and Technological Policy, Planning, and Organization* (60 pp. 30¢); vol. 10, *International Cooperation and Problems of Transfer and Adaptation* (63 pp. 30¢); vol. 11, *Human Resources—Training of Scientific and Technical Personnel* (204 pp. 60¢); vol. 12, *Communications* (162 pp. 50¢). Superintendent of Documents, G.P.O., Washington, D.C. Paper.

A Selected List of U.S. Readings on Development. Prepared for the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas. Saul M. Katz and Frank McGowan. Agency for International Development, Washington, D.C., 1963 (order from Superintendent of Documents, G.P.O., Washington, D.C.). 363 pp. $1.25.

In February 1963 the United Nations held a world conference, at Geneva, on the application of science and technology for the benefit of the less developed areas. Participating countries were invited to submit papers related to a wide-ranging agenda. The response from around the world was so overwhelming that only a portion of the offerings from major countries could be accepted and reproduced by the conference secretariat. Therefore, those who were organizing the participation of the delegation from the United States —a special science conference staff (directed by David Tilson, assisted by a public advisory board chaired by Walsh McDermott of Cornell University Medical College) in the Agency for International Development of the Department of State—conceived the brilliant idea of making all of the U.S. papers available for separate distribution and for future reference and study in a paperback series. The 12 volumes in the series included all the American papers prepared for the conference, among them some crowded out of the official conference documentation. The resulting five-and-a-half-inch bookshelf on science, technology, and development, together with a separate volume which is a selected and annotated bibliography of American books and articles on development, was distributed by the U.S. delegation at the conference and subsequently by U.S. missions overseas.

The papers touch nearly every major area of science and technology, always with the focus on problems of newly developing countries. All are succinct (to meet conference requirements). The authors were chosen as recognized experts and scholars in their fields, and many have done admirable jobs of pithy elucidation. Broad scope, brevity, and authoritativeness make these volumes something like a small encyclopedia of current knowledge on the opportunities and problems that arise when countries in the early stages of modernization turn to science and technology for help in rising out of poverty.

Papers on natural resources range from "Rural electrification and rural development" to "Modern techniques and instruments for surveys and mapping"; on agriculture, from "Organizing for agricultural development" to "Basic principles in weed control"; on health, from "Principles of health service planning" to "Advances toward prevention and control of trachoma"; and on communications, from "Basic planning for a communications system" to "Low power drain television receiving systems."

The conference agenda interpreted science and technology to include not only the physical and biological sciences and the corresponding technologies but also the social sciences and the social technologies. This was wise, for the fact emerges, from paper after paper, that the major obstacles to better utilization of existing physical and biological knowledge, for bettering human life in the newly developing countries, are social obstacles. The willingness to accept technological innovation, the creation of a favorable environment for

scientific research, the improvement of science education, the development of human resources (including the training of more scientists and engineers) are all social problems. These and other social aspects of the use of science and technology are illuminated in many papers, especially in volumes 9 to 11.

James R. Killian, Jr., in a discussion entitled "Science and public policy," says that "This new domain of political science—the relating of science and scientists to government policy—has gained new importance from the unfolding opportunities to put science to work for the less developed nations." Charles V. Kidd's essay, "The loss of scientists from less to more developed countries" is a thoughtful analysis of that problem. Jerome B. Wiesner writes on policies for scientific and technological education, Wilbur Schramm and Gerald F. Winfield on new uses of mass communication, Hollis W. Peter on guidelines in the process of change, and F. M. Tiller on cooperative programs for strengthening engineering education. These and many other contributions are well worth reading.

These volumes are recommended for enjoyable browsing, for use in courses or seminars that deal with social implications of science and technology, and for convenient reference to obtain a short summary of applicable knowledge on the topics covered. It would also be a good idea to suggest that professional colleagues and institutions in newly developing countries request a set through the local United States A.I.D. mission.

EUGENE STALEY
Stanford Research Institute, Menlo Park, California

Solar Research

Solar Flares. Henry J. Smith and Elske v. P. Smith. Macmillan, New York; Collier-Macmillan, London, 1963. xii + 322 pp. Illus. $12.95.

A great many of us find that writing is the most difficult task of the day. I, for one, must enlist the aid of friends to review the end result, an imposition on their time. But even after I have forced the manuscript upon my friends, it often proves difficult to get honest criticism—to have them really chop up my work and say what they think. Certainly the friends and coworkers of the Smiths have failed them, if they saw the manuscript of *Solar Flares*. And one wonders about "the expert and painstaking assistance" of the editorial adviser.

In this book the Smiths attempt to provide a critical survey of recent research, both theoretical and observational, on the subject of solar flares in all their varied aspects. The project is ambitious, and it was undertaken conscientiously. But the book should begin with chapter 6, "The nature of flares and stellar activity," for it is in this chapter that a flare is defined. Chapters 2 through 5 then follow in order. Chapter 1, "Solar phenomena," should be reorganized and rewritten. It is too confusing, abounds in incorrect statements, and fails to supply the reader with adequate background.

Chapter 2 begins with a discussion of the instrumentation for observing the optical phases of flares. Figure 3 is wrong. Section 1.2 covers the analysis of photographs for flare positions, area, and brightness. In section 1.3 we learn that the classification of flares by "importance" is based primarily on corrected areas, but area corrections to flare observations are not discussed until section 3.1. The sections that follow cover the published sources of flare data; the statistical interpretation of the relation of flares to sunspots; and the characteristics of flares—durations, brightness, areas, shapes, behavior, and effect on prominences.

The physical processes related to flares, as they are obtained by the analysis of spectroscopic observations, are the subject of chapter 3. Here the Smiths have collected and summarized a large body of data, some of it from European sources, including a great deal from the Crimean Astrophysical Observatory. The expert well understands the shaky ground and the inconsistencies in the interpretation of the Balmer line profiles discussed in section 4; indeed, the expert himself has contributed to the inconsistencies—let others beware. This discussion is followed by a good account of other elements that can be detected by their emission lines. Section 11 covers ultraviolet radiation and x-rays.

I am not competent to review chapter 4 (31 pages) which deals with radio emission from flares. Chapter 5, "Solar corpuscular emission and geophysical phenomena," is excellent. The solar-modulated phenomena, 1 year, 27 days, and the sudden Forbush decreases are described and interpreted on the basis of the many proposed mechanisms that have been set forth. High- and low-energy cosmic ray emission is treated in detail and well. The geomagnetic field with its variations and finally the physics of the ionosphere are briefly touched upon.

This book is a survey, but it is not suitable for use as a textbook. It is well indexed and well referenced; apparently there are no serious omissions of relevant research. The authors are to be congratulated on their excellent coverage of the research contributions from Eastern Europe.

A. KEITH PIERCE
Kitt Peak National Observatory, Tucson, Arizona

Astronomical Data

Stars and Stellar Systems. Gerard P. Kuiper and Barbara M. Middlehurst, General Eds. vol. 3, *Basic Astronomical Data*. K. Aa. Strand, Ed. University of Chicago Press, Chicago, 1963. xviii + 495 pp. Illus. $12.50.

This book, the fourth published volume of an announced nine-volume series, is of the same high quality, interest, and usefulness as its predecessors. It is especially valuable inasmuch as no book like it has previously been published, yet it deals in a detailed and authoritative way with the classification of astronomical data that is at the very heart of progress in this observational science. Little attempt has been made to discuss instrumentation, observational techniques, or reduction methods, for these topics were covered in volumes 1 and 2.

The 22 chapters and the two appendixes were written by 28 authors, each an active worker and an authority in his field. The first seven chapters deal with positions and proper motions and associated star catalogs. The next four chapters deal with stellar classification through spectra or by photometric observation. Chapters 12 and 13 discuss interstellar absorption; chapters 14 and 15 give empirical physical data on stars, and chapter 16 is concerned with interstellar polarization. The next three chapters describe surveys of, and