find in Susskind's book many of these assertions. For example, "opponents of technological advance" would not be so bold "if they realized that it would mean a return to, say, outdoor privies" (p. 69). Engineers should listen to warnings regarding hazards of "nuclear weapons, electronic computers [etc.]" only if the warnings are "logically derived from facts and visible trends" (p. 88). "Blaming engineers for the shortcomings of technological society makes about as much sense as blaming the failure of a new play on the stage hands" (p. 118). "Technology, the source of the problem, will once again prove to contain within itself the germs of a solution compatible with the betterment of man's lot and dignity" (p. 132). The list could be easily doubled in length. Such assertions simply provoke counterassertions, which effectively stifle discussion.

Finally, Susskind the engineering professor deals with dissenting and protesting students. He observes that there was little problem among students of medicine, engineering, or the other professions. The "true believers" in student movements were "more likely to be students of the humanities and social sciences." The reason? They were "demoralized by the devastating thought that they, who should be the future leaders if there was any justice, might turn out to be unwanted and unnecessary," made obsolete by technologists. My counterassertion: the suggestion that this is what the student movement was all about is simply fatuous.

EUGENE S. FERGUSON
Department of History, University of Delaware, Newark and *Hagley Museum, Wilmington*

Atmospheric Physics

Earth's Magnetospheric Processes. Proceedings of a symposium, Cortina, Italy, Aug. 1971. B. M. McCORMAC, Ed. Reidel, Boston, 1972. viii, 420 pp., illus. $37.50. Astrophysics and Space Science Library, vol. 32.

Every two years, B. M. McCormac organizes a two-week international conference on magnetospheric physics. The conferences are always well attended, because McCormac carefully promotes interaction between participants. Every two years, a well-edited conference proceedings appears. I have found these to be the best summaries of the current status of this sprawling field. These proceedings will provide the future historian of science with a series of snapshots of the development of magnetospheric physics. Our future historian may well conclude that the 1971 Cortina conference symbolically marked a turning point. It certainly was for McCormac's conferences themselves. Originally conceived in part to educate a fledgling European space science community, they now, by the number of high-quality European papers in the 1971 volume, announce the growing size and sophistication of the European program. More important, 1971 found a fundamental change in magnetospheric physics. No longer would simple discovery suffice, the physics had to be addressed. With the geometry of the magnetosphere settled, its time dependences had to be understood. These concerns permeate the volume.

Earth's Magnetospheric Processes contains over 30 papers by acknowledged experts grouped under the headings Magnetospheric Structure and Processes, Magnetospheric Particles, Magnetic Fields and Currents, Electric Fields and Plasma Convection, Acceleration and Diffusion (of particles), and Magnetospheric Substorms. The papers in their diversity illustrate the many different physical processes—and the different measurements they require—we need to synthesize into a working model of the time-dependent magnetosphere. The very fact that they are collected in one volume, rather than dispersed throughout the journal literature, clarifies the task ahead. Of the many papers presented, I would like to single out two whose topics seem to have stimulated incessant discussion afterward. It now appears that whenever the solar wind magnetic field changes direction the magnetosphere adjusts by changing its internal plasma flow, creating a characteristic sequence of events in the auroral zone, called a substorm by its discoverer, S. I. Akasofu. The controversy provoked at Cortina by M. P. Aubry's tart review of substorms continues to this day. V. M. Vasyliunas's theoretical paper on the interrelation of magnetospheric processes, published only in these proceedings, became a foundation of future work in magnetospheric convection theory. Vasyliunas wrote down and used the full set of equations describing the coupling of the magnetosphere to the highly conducting ionosphere to produce calculations of the flow for the special case of a magnetosphere loaded with energetic protons during magnetic storms. Although definitive results are still to be obtained from the research program so initiated, there seems to be general agreement that this is the way all time-dependent magnetospheric flow problems should be solved.

All in all, *Earth's Magnetospheric Processes* is indispensable for libraries and serious magnetospheric physicists. Since some papers are tutorial in nature, it is also useful for students, though its price is a drawback.

CHARLES KENNEL
Department of Physics and *Institute of Geophysics and Planetary Physics, University of California, Los Angeles*

Widespread Mineral

Apatite. Its Crystal Chemistry, Mineralogy, Utilization, and Geologic and Biologic Occurrences. D. MCCONNELL. Springer-Verlag, New York, 1973. xvi, 112 pp., illus. $17.40. Applied Mineralogy, vol. 5.

Apatite is a mineral which is widely distributed in nature. It is the major constituent of the hard tissue of vertebrates, forms the tests of some invertebrates, and is ubiquitous in rocks. It is also the major raw material used by the chemical industry for the production of phosphorus and its compounds.

McConnell's studies of the mineralogy, crystallography, and crystal chemistry of apatite extend over more than 35 years and have been paramount in the advancement of the field. It therefore is fitting that he should prepare this volume on apatite. McConnell stresses the crystallography and crystal chemistry of the compound. This emphasis is found even in the chapters entitled "Phosphorites," "Geology: igneous and metamorphic occurrences," and "Biological apatites." Since the size of the book—11 chapters are included in little over 100 pages—precludes complete coverage of the many and diverse topics related to apatite, it is fortunate that this common denominator is stressed.

The author's style of writing, blunt statements, and critical comments will be amusing to some readers, serve as admonitions to others, and be irritating to still others. Regardless of one's disposition toward this style, it does serve to identify and alert the reader to controversial matters and important reservations concerning apatite studies. In the final chapter, a critique, the author gives a cautionary review of some practices and techniques in the

field. This critique will be carefully studied by many readers.

The author describes the procedure by which he has selected the 253 references he cites. Some other citations could aid the balance of contrary theories and hypotheses. Some subjects of widespread interest and importance —such as fluoridation in regard to caries susceptibility—receive very brief treatment, and some subjects of lesser immediate concern are covered in considerable detail.

The book is intended and is suitable for readers at the level of graduate students in the physical and biological sciences. It can be profitably studied by those engaged in apatite research. It will undoubtedly stimulate further development of the field.

DALE R. SIMPSON
Department of Geological Sciences,
Lehigh University,
Bethlehem, Pennsylvania

Fragile Ecosystems

Proceedings of the Colloquium on Conservation Problems in Antarctica. Blacksburg, Va., Sept. 1971. BRUCE C. PARKER, Ed. Virginia Polytechnic Institute and State University, Blacksburg, 1972 (available from the editor, Department of Biology, Virginia Polytechnic Institute). vii, 356 pp., illus. $10.

Described as "a continent for science," Antarctica has truly become so through researches and an international treaty now 14 years old. Recently some of the scientists, particularly those who study the unique biology of that austere land and its frigid seas, have become aware that man, a recent invader, can, and already has, set in motion the seeds of possible destruction of Antarctica's fragile ecosystems.

In 1971, a conference was called by those scientists to consider human impact and conservation problems in Antarctica, particularly near American bases. The proceedings of that conference provide insight into the problems and their possible solutions. Most of the 19 papers can be categorized into two groups: those that report scientific results indicating the uniqueness and instability of the ecosystems, and those that describe environmental damage and suggest methods of prevention. In the first group are papers about the benthos, the freshwater organisms, including fungi, and their environments; and the terrestrial ecosystems of East Antarctica. In the second are papers that consider trace elements in the atmosphere; contamination of snow by engine exhaust, heavy metals and chlorinated hydrocarbons in marine organisms and marine-feeding birds, radioactive contamination from global fallout and scientific experimentation, destruction of native subantarctic vegetation by man and introduced animals, and problems of human waste, trash disposal, and environmental contamination with exotic microorganisms. There are a few papers that do not easily fit into these categories and would likely be overlooked by those who saw only the title of the volume or its table of contents. For example, I. E. Wallen's paper "Why preserve the Antarctic?" is a general discussion of management in conservation that describes already-tried measures in various parts of the world not Antarctica, and Jay T. Shurley's paper considers psychoecological viewpoints, particularly in isolated human small groups.

The information in this volume will be of most interest to those who have worked, or will be working, on antarctic research. This is especially so because George Llano's paper gives references to relevant conservation recommendations and the appendices contain the texts of the Antarctic Treaty, the "agreed measures" for the conservation of antarctic fauna and flora from the various Antarctic Treaty Consultative Meetings, and recent agreed measures for the conservation of antarctic seals. There are also four work group summaries of recommendations for future conservation measures, both general and specific, including consideration of tourism and scientific projects, and valuable comments in the printed discussions of the papers. I believe that others interested in environmental problems will find this volume of interest because it considers an area of the globe where there has been very little human influence and where unique ecological conditions exist. It could give us some insight into problems of man's impact on space exploration environments, as Roy E. Cameron notes in his paper.

I feel obliged to comment on the editing and printing of this volume. It is unfortunate that there are so many typographical errors and printing mistakes, including a few dropped lines, slanting lines, and imperfect letters. This, together with some poor photographic reproductions, inclusion of many, sometimes interesting, "special figures" which do not relate to the text, and large conspicuous numbers on all figures, detracts from the readability of a volume which has much to tell those interested in the problems of man's ability of sustaining his environment, including the environment which provides material for his own research activities.

EMANUEL D. RUDOLPH
Institute of Polar Studies and
Department of Botany,
Ohio State University, Columbus

Gamete

The Genetics of the Spermatozoon. Proceedings of a symposium, Edinburgh, Scotland, Aug. 1971. R. A. BEATTY and S. GLUECKSOHN-WAELSCH, Eds. Published by the organizers of the symposium, Edinburgh, 1972. 406 pp., illus. For copies, apply to the Librarian, Department of Genetics, University of Edinburgh.

Spermiogenesis constitutes one of the most sophisticated seriations of differential events to be observed in multicellular organisms; its end result, the mature spermatozoon, is one of the most complex and highly specialized cells known. These facts alone would amply justify extensive and diverse efforts to study this facet of development. The function of the spermatozoon is, *sensu stricto*, the transmission of genetic material from the male parent to the zygote. The realization of this naturally evokes numerous practical aspirations ranging from the identification and selective elimination of genotypically abnormal sperm to the use of specifically appropriate sperm in animal breeding programs.

The first symposium on the genetics of the spermatozoon has brought together electron microscopists, immunologists, and developmental geneticists. The resulting breadth provides an excellent perspective for the primary concern of the symposium, gene expression in the various cells of the male germ line, and renders the proceedings valuable to functional anatomists, reproductive biologists, and developmental geneticists alike.

Although it contains a paper on *Chlamydomonas*, an occasional micrograph of a cat or a chinchilla spermatid, an occasional reference to a freemartin or a hinny, the volume is clearly dominated by studies of fruit flies, mice, and men. This is as it should be. Included are accounts of