

diagrams of mining areas and sections of uranium deposits, particularly of occurrences in France and elsewhere in Europe, will be found useful.

The emphasis of the book is primarily what one would expect from an able student of mineral deposits who writes for others in the same field. The principles of uranium occurrence take precedence, and an abundance of illustrative material has been introduced to support the text. Future books, written in English, on the geological occurrence of uranium will doubtless show the influence of this French text.

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Manual on Rockets and Satellites. vol. 6, *Annals of the International Geophysical Year, 1957-1958.* L. V. Berkner, Ed. Pergamon, New York, 1958. xx + 508 pp. Illus. \$25.

One of the greatest scientific achievements of recent times—the International Geophysical Year—has just been completed. A very large part of the Geophysical Year program was centered around the use of rockets and satellites, the subject of this book. The book is a compilation of articles by authors from all of the many countries which participated in this gigantic, world-wide undertaking. The fact that publication of this book was possible, that the IGY itself was possible, is a tribute to the willingness of scientists everywhere to cooperate in a difficult, complex, and closely integrated scientific effort.

Lloyd Berkner, who edited the volume, was the reporter for rockets and satellites of the Comité Spécial de l'Année Géophysique Internationale; he was greatly assisted in accumulating and preparing the information for publication by associate editors Reid, Hanessian, and Cormier. The editors are also indebted to scientists too numerous to mention who were responsible for the individual articles. Although it was published in 1958, the book was prepared in the middle of the IGY effort; in the main, therefore, it discusses the plans of the various countries for carrying out their IGY programs in the areas of satellite research and rocket probing of the upper atmosphere. Now that the IGY is officially over and has been succeeded by the program of International Geophysical Cooperation, one can see in retrospect that the planning for the IGY was good; the experiments as actually carried out are described quite well in this book.

An excellent introduction by Berkner gives in capsule form the reasons for the IGY rocket and satellite effort and ex-

plains the principal experiments that were planned to implement this effort. The book then describes many of the programs in detail, each chapter being made up mainly of articles by individual experimenters. Despite the diversity of the contributors, there is good continuity.

The first 100 pages are devoted to a description of the rocket programs planned by Australia, Canada, France, Japan, the U.S.S.R., the United Kingdom, and the United States. This section is replete with photographs and drawings of the experimental equipment and of the rockets. Included also are reports of some of the earlier results—data on pressures, densities, and temperatures in the upper atmosphere. The section ends with a detailed schedule of the types, dates, locations, and principal experiments of the United States rocket firings.

It is interesting to note that the principal objectives of the U.S.S.R. and United States programs were remarkably similar. These dealt primarily with the following areas of research: structural parameters and optical properties of the atmosphere; ultraviolet, x-ray, and corpuscular solar radiation; aurorae; cosmic rays; ionospheric phenomena; the magnetic field of the earth; micrometeors and meteorites; and physical and chemical processes in the upper layers of the atmosphere.

The next 330 pages of the book give a description of the satellite programs planned by the United States and the U.S.S.R. This is an excellent treatise on the problems that arise in the launching and use of close-in earth satellites. This section, again, is a compilation of separate articles, but it is a well-integrated, effective treatment of the satellite problem and of the principles employed by these two countries to conquer the problem during the IGY. The section deals first with general satellite information, with problems relative to the orbit and its determination, and with the scientific information that can be garnered from the expected perturbations of the orbit. This is followed by a presentation of the U.S.S.R. satellite program, in which the experimentation is dealt with in very general terms; the experimentation plan closely resembles that for the rocket program. Following this is a treatment of the United States satellite program; much more detailed information is given on the launching vehicles and on the experiments planned. Quite a bit of space is given to the optical and radio satellite tracking programs and to the effort that was made to interest groups in the United States and abroad to participate in them.

One of the major problems in an effort of this magnitude is that of gather-

ing the large number of data received and of assembling them in world data centers where they will be available to students for years to come. The planning for this is treated in the 20 pages that follow. The book closes with two addenda, which report the first three successful satellite launchings.

This book is of great interest in that the reader will see evidence of the tremendous effort made by many groups to allow man to break away from the environment in which he has been confined since the beginning of history. The plan was successful. New objects in nature have been created, and the door is now open for us to make full use of this new frontier. Our knowledge of the universe had been limited to what we could see through our murky atmosphere. Now, through the medium of satellites, we can see the rest of the universe in its full spectrum, and we are only beginning to sense the increase in our knowledge which will thereby be made possible. For any who desire an understanding of the problems and pains involved in work with rockets and satellites, this book brings together as does no other single source a wealth of useful information.

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Geology of the Great Lakes. Jack L. Hough. University of Illinois Press, Urbana, 1958. xviii + 313 pp. Illus. \$8.50.

The Great Lakes occupy deep basins in ancient crystalline and sedimentary bedrock, but they are truly a product of the Ice Age. Hough has published a summary of information on the lakes and their formative history, but in the same year that the basic concept of multiple glaciations has been subject to severe criticism. Accordingly, this book represents an era of thought on the records of the Great Lakes which may be subject to revisions of interpretation in the future.

Changes of concept in lake history have been many over the years. In 1915 Frank Leverett and Frank B. Taylor summarized the information to that time in a U.S. Geological Survey monograph. Twenty-four years later the evidence for an important submerged lake stage unknown to those authors was discovered and described by George M. Stanley; this altered the accepted understanding of the historical record and introduced new problems. These Hough, whose long experience in the Great Lakes has given him extensive knowledge of their sediments, has endeavored to

explain. The hard-rock geology and the qualities of the lake water, temperatures, and currents are amply treated. Maps of the bottom topography of each lake are furnished, with a contour interval of 100 feet.

Most of the book is devoted to glacial and postglacial history, interpreted against a background of four glacial stages and relatively much longer interglacial ages. The duration of time since the Ice Age and of successive intervals thereafter is critically discussed in the light of carbon-14 dating. The author confesses an attempt "to present a review which proceeds from the more probably correct interpretations to inferences that are less well founded, and to indicate the degree of doubt or certainty existing in the conclusions."

His more controversial points include a Two Creeks low-water stage; the concept of Valdres and Cochrane deposits as tills resulting from ice readvances rather than deep-water deposits of ice-berg drift; a claim that Lake Algonquin evidence is lacking in the Superior basin; and a return to consideration of supposed marine waters (Gilbert Gulf) in the Ontario basin. Hough considers the name *Champlain* no longer appropriate and suggests "St. Lawrence Sea" to replace it. This may create difficulties of nomenclature with respect to a classic time unit now being recognized in the Hudson Bay area and on the Pacific Coast.

Such incidents furnish problems for research in the future, and this research will be given stimulus by this interesting treatise.

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Climatology and Microclimatology. Proceedings of the Canberra Symposium. UNESCO, Paris, 1958 (order from Columbia University Press, New York). 355 pp. Illus. \$11.

In October 1956 the Advisory Committee on Arid Zone Research of UNESCO sponsored a technical meeting in Australia. The theme was arid-zone climatology. This volume contains 50 papers which were presented at the meeting. It is a companion to an earlier UNESCO publication, *Arid Zone Research X* (Paris, 1958). This preceding volume contained the eight introductory addresses on the major phases of arid-zone climatology and microclimatology which opened the eight sessions of the symposium.

As one might expect, a wide compass of topics is covered. The session titles indicate this: "Evaporation and water

balance"; "Radiation and thermal balance"; "Interrelationships of climate and flora"; "Interrelationships of climatic elements and fauna"; "Microclimate of man and domestic animals"; "Modification of microclimate"; "Salting and chemistry of rainwater"; "Climatological observational requirements in arid zones."

The papers and the brief summaries of the ensuing discussions are very useful contributions to the subject of arid climates. This shares with other symposium volumes the problem of wide variety in scope and quality. In this case the variation is, fortunately, more in the size of the contributions than in the contents. Some papers are merely extended abstracts. A great many new data are presented. This is partially due to the fact that 31 papers were contributed by Australians and deal with the arid lands on their continent. Much of this material summarizes original research of the authors. Other areas of the globe were represented by—among others—such well-known experts as Thornthwaite, Geiger, Emberger, and Ramdas, so that a high standard of presentation was assured. A discourse by the U.S.S.R. academician Dzerdzevskii gives a useful survey of aridity indices and defines an evaporation deficit concept which has been useful in the synoptic climatic analysis of dryness in Russia.

Most encouraging is the physical and quantitative approach now being taken in dealing with problems of arid climates that is apparent throughout the volume. This approach permits a clear assessment of the risks of land utilization in arid lands. It also leads to rational attempts at adaptation and amelioration. This symposium brings together the viewpoints of many minds and disciplines. It will stimulate thinking and new basic and applied research into the climatic problems of arid zones. The wisdom of UNESCO in promoting studies along this line is obvious if one considers, in frustration, the presently unusable dry lands of the earth that might help to relieve the increasing population pressure.

This volume on climatology is a worthy addition to the list of earlier UNESCO arid-zone symposia publications, such as those on human and animal ecology and on wind and solar energy. I regret that the anonymity of the editor of this volume prevents me from giving personal credit for excellent bilingual printing and beautiful make-up. The book can be highly recommended to meteorologists, agronomists, ecologists, geographers, and conservationists.

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The Physical Theory of Neutron Chain Reactors. Alvin M. Weinberg and Eugene P. Wigner. University of Chicago Press, Chicago, Ill., 1958. xii + 801 pp. Illus. \$15.

Research in the neutron physics of reactors is preponderantly done in large laboratories which generally issue their own reports. Since few of these reports are published in journals, even in abbreviated form, it has not been easy to infer from the readily accessible literature just what are the principle problems of the moment, and what methods are being used on them.

Weinberg and Wigner have now given us a work which goes far toward filling the partial void. This is a book which begins properly with a selective review of relevant parts of the theory of nuclear reactions, which proceeds to a thorough treatment of the transport of neutrons interacting with matter, and which then applies these subjects to the theory of neutron chain reacting systems. To this extent the book resembles others which have appeared in the past. The features which most distinguish this work from earlier ones are its thoroughness, its careful consideration of fundamental concepts, and the modern character of the treatment. For instance, this is the first general book on reactor theory to take into account the wide use of high-speed computing machines in dealing with reactor calculations, and to discuss the methods used.

These features, as well as the clear and precise language used, elevate the book into a class by itself. It will without doubt now become the standard work on reactor theory, both for reference and for teaching. As a text, some will probably choose to use it in advanced courses. It need by no means be used only at this level, however, because *The Physical Theory of Neutron Chain Reactors* presupposes no required prior knowledge of reactor theory. A good course in nuclear physics is, however, a prerequisite.

It is a pleasure to recommend this book, with no essential reservations, to all concerned in the field.

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The Pulse of Radar: The Autobiography of Sir Robert Watson-Watt. Dial Press, New York, 1959. x + 438 pp. \$6.

In 1925 King George V asked scientists of the British Admiralty whether they could not detect aircraft by radio echo ranging in a fashion similar to the detection of submarines acoustically. His Majesty's scientists did not think the