limnological studies have resulted in fragmentation that makes it difficult for an investigator to keep abreast with all developments. This volume is an attempt to bring together much scattered information on the historical progression and current status of limnology in the complex and vastly different environments in North America. To accomplish this objective, the continent was divided into a number of regions and at least one active limnologist in each area summarized its limnology. In chapters devoted to such descriptions, 19 geographic areas are discussed: Wisconsin (the Birge-Juday Era and the years 1940 to 1961); Michigan; New England; Illinois; the Middle Atlantic States; the Central States; the South Atlantic States; the Central Gulf States and the Mississippi Embayment; Minnesota and the Dakotas; the Mid-Continent States; the Rocky Mountain States; the Pacific Coast and Great Basin; the American Southwest and Middle America; the West Indies; Western Canada; Ontario and Quebec; the Atlantic Provinces of Canada; the St. Lawrence–Great Lakes; and Alaska, the Yukon, the Northwest Territories, and Greenland.

Several chapters deal with topics that do not fit into the regional approach—the impact of reservoirs, farm ponds, paleolimnology, sanitational limnology, and a history of the American Society of Limnology and Oceanography.

In an appropriate concluding chapter entitled the "Prospect before us," G. E. Hutchinson discusses directions for research which range from paleolimnology to cross-disciplinary studies in biogeochemical processes and relationships. He appeals for imagination in pursuing theoretical interpretations, using mathematical apparatus, models, and information theory, and emphasizes the need for developing more perfect instruments and techniques and for studies on new aspects, such as the challenging study of running waters.

Perhaps the greatest criticism of a work of this scope in which so many authors were involved, will be that, owing to the relative interest of the various contributors, some regions or topics are more intensively explored than others. However, no previous book has sampled the literature on the limnology of North America as extensively as this one does, and the volume should stimulate limnologists to follow-up with publications of their own work.

Limnology in North America should be widely used as a reference source, for it supplies valuable basic and introductory information, concisely presented, on the many facets of aquatic environments; thus, it will free instructors to emphasize recent findings and students to work on special topics.

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Geology

Geologie von Paraguay. Hannfrit Putzer (Beiträge zur Regionalen Geologie der Erde, vol. 2. Alfred Bentz, Ed.). Borntraeger, Berlin, 1962. xii + 183 pp. Illus. DM. 78.

Paraguay, the "Garden of South America," is divided geographically by the Paraguay River into a hilly eastern region that is rich in water and covered with tropical and subtropical forests and a western region, the Chaco Boreal, that is a vast area of lowlands with swamps, savannas, and brush forest.

Three distinct geological units characterize this country: Eastern Paraguay, the western border of the Parana Basin, is made up of Pennsylvanian, lower and middle Permian, and Triassic sediments, together with a few local remnants of beds of Cretaceous age; the north-south trending Central Paraguayan Swell, a continuation of the pre-Cambrian crystalline rocks of the Brazilian Shield, unconformably covered in the north by marine sequences of pre-Cambrian and Cambrian age, in the south by Silurian sandstones, and along the Paraguay River by Triassic beds; and the geosynclinal Chaco Boreal where the basement rocks are overlaid in the northeast with outliers of early Paleozoic carbonate sediments; the center of the geosyncline is filled with a thick series of marine Silurian and lower Devonian rocks that are covered by terrestrial red beds of Triassic age and by semiconsolidated clastic Cenozoic deposits.

About half of Putzer's book is devoted to a detailed description of the stratigraphy of each of the three mentioned geological units; this is followed by short chapters on tectonics, paleogeography, and mineral resources. The country, however, is poor in ores. Shortly after World War II the Union Oil Company of California drilled nine wells without finding deposits of gas and oil suitable for commercial development, but Putzer is of the opinion that the last word has not been said with respect to this matter. If properly mined and exploited, nonmetallic minerals—such as mica, feldspar, talc, kaolin, and bauxite—may become economically important to the country.

Friedrich Bender contributed a chapter on the hydrogeology of the immense Chaco Boreal region (which comprises 60 percent of Paraguay's total area). This chapter, as well as the chapter on soils (by Putzer), should be of great interest to future settlers in Paraguay.

The book, which is based on Putzer's personal experience, incorporates all the pertinent geological facts and observations so far published. A colored geological sketch-map and two plates with fossils from Silurian and Devonian sediments are included. Two earlier compilations [by Horacio Harrington (1956) and Edwin B. Eckel (1959)] also treat this area, but Putzer's well-written and well-printed book is so far the most complete one that deals with all aspects of the geology of this landlocked country in the center of the South American subcontinent. *Geologie von Paraguay* will be of great value to any future geological exploration in Paraguay.

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Chemistry of the Universe

Space Chemistry. Paul W. Merrill. University of Michigan Press, Ann Arbor, 1963. 166 pp. Illus. Cloth, $5; paper, $1.95.

Space Chemistry was designed by the late Paul Merrill as a short book on the present state of knowledge of the chemistry of the universe as well as a discussion of some of the most pressing problems now being investigated. The book, which is intended for general readers, is so full of interesting information and discussion that the strictly general reader may find it a bigger bite than he can comfortably chew. On the other hand, the scientific reader who is not intimately connected with the field (and I include myself in this group) will find it most valuable and enjoyable. The emphasis is placed on understanding the synthesis of astronomy, chemistry, and physics in research on the nature and evolution of the universe. Dr. Merrill's distinguished career literally grew up with the development of modern spectros-

copy; the historical context within which he discusses the progress of man's knowledge of the constitution of his physical environment is as authoritative as it is fascinating.

The topics discussed are the cosmic abundances and behavior of several of the most important elements and molecules; the general chemistry and classification of bodies in our solar system—meteorites, comets, the planets, and the sun; and the compositions and nature of different types of stars, nebulae, and galaxies. In the final chapter Merrill outlines some advantages of our new ability to escape from the bottom of our "ocean of air" and conduct experiments from rockets or orbiting vehicles. It is lamentable that Merrill died 18 months before the closeup investigation of the chemistry of the atmosphere of Venus by Mariner II.

The figures are numerous and well presented; most are sample spectrograms, photographs of astronomical bodies in light of important wavelengths, graphic illustrations of stellar spectral classifications and the like. The index could be much more complete and more references to more detailed and advanced literature would be helpful to scientific readers, but these shortcomings do not materially detract from the excellent overall presentation. One can only wish that the book were longer.

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Arid Lands

Land and Water Use. A symposium. AAAS Publication No. 68. Wynne Thorne, Ed. AAAS, Washington, D.C., 1963. x + 364 pp. Illus. Members, $7; others, $8.

One of the better ways of tying things together is to consider them in a specific geographical context. Such is the aim of this book, a collection of 22 papers on the problems of land and water resources in the plains and mountain regions of the western United States. Twenty-one of the papers were presented at the 1961 annual meeting of the AAAS (Denver, Colo.). The contributors are almost exclusively from the land-grant colleges of the intermountain West or from the federal agencies (in Washington, D.C.) responsible for the administration of government land and monies in that vast area. Thirteen papers are devoted to the resource setting of the intermountain states; the remainder are concerned with conflicting interests among users and with goals, criteria, and public policy with respect to resources administration. Grazing, recreation, and water receive the principal emphasis. There is no consideration of minerals, and little of timber management.

In the arid West, where so much of the land is in the public domain, decisions about the allocation of resources tend to be made by the courts and government agencies rather than in the "marketplace." Economic and noneconomic considerations are equally involved, and personal value judgments loom large. Providing better data, so that decision making in this area can be as effective and rational as possible, is the concern of most of those who contributed to this volume. With some agricultural economists it is almost an article of faith that eventually it will be possible to assign quantitative values to such nonmarket uses as recreation, wilderness, and big game; this will, they believe, open the way to programming for maximum economic benefits or "optimum use." Others are less optimistic, or some would say more realistic. In the concluding essay, Luna Leopold warns that monetary value is not the total substance of public worth and that the fiscal yardstick "could lead us into a cultural desert where all the signposts are dollar signs."

Demands for land and water in the West are numerous, varied, and increasing. In one of the most thoughtful essays, Stephen C. Smith emphasizes the importance of clarifying the issues and the relative roles and responsibilities of public and private agencies in allocating (rationing) these resources, which so often have been underpriced. Treading where few economists have trod, Maurice Kelso calls attention to the cost of space in the West; he compares the space-affected costs of services with the unmeasurable satisfactions that are derived from spaciousness, or "room, lots of room." More than 30,000 farmers and ranchers graze livestock on public lands in the western states, and they are capable of generating a lot of heat. Yet, according to M. L. Upchurch, these public lands supply only one-eighth of the livestock feed consumed within the area; recently, we have been shipping abroad nearly twice as much feed as we get from public lands. In marked contrast to the contemporary, problem-solving orientation of the other contributors is Homer Aschmann's perceptive essay on the manner in which different types of societies have evaluated and used the world's dry-land environments through time. One may wonder how it came to appear in this volume, but nevertheless be pleased that it does.

Despite a certain repetitiousness, this is a worthwhile book that should have a considerable circulation. Although it is largely concerned with the intermountain West, there is no adequate geographical characterization of the region and no good map. A subtitle that indicated the regional focus of the volume would have been appropriate.

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New Books

Economics and the Social Sciences

Aboriginal Cultural Development in Latin America: An Interpretative Review. Betty J. Meggers and Clifford Evans, Eds. Smithsonian Institution, Washington, D.C., 1963. 155 pp. Charts. Paper.

Computer Simulation of Personality. Frontier of psychological theory. Silvan S. Tomkins and Samuel Messick, Eds. Wiley, New York, 1963. 339 pp. Illus. $5.

Creativity and Psychological Health. Origins of personal vitality and creative freedom. Frank Barron. Van Nostrand, Princeton, N.J., 1963. 304 pp. Illus. $6.50.

Ekade Ektab. Die Felsbilder Fezzans. Leo Frobenius. Akademische Druck, Graz, Austria, 1963. 104 pp. Plates.

The Hard Way to Peace. A new strategy. Amitai Etzioni. Collier, New York, 1962. 285 pp. Paper, 95¢.

Independent Adoptions. A follow-up study. Helen L. Witmer, Elizabeth Herzog, Eugene A. Weinstein, and Mary E. Sullivan. Russell Sage Foundation, New York, 1963. 463 pp. Illus. $7.50.

Man the Tool-Maker. Kenneth P. Oakley. British Museum (Natural History), London, ed. 5, 1963. 104 pp. Illus. Paper, 4s.

The Paliau Movement in the Admiralty Islands, 1946–1954. Theodore Schwartz. American Museum of Natural History, New York, 1962. 210 pp. Illus. Paper.

The Prehistory of East Africa. Sonia Cole. Macmillan, New York, ed. 2, 1963. 382 pp. Illus. $7.95.

Primitive Classification. Emile Durkheim and Marcel Mauss. Translated from the French edition (1903) by Rodney Needham. Univ. of Chicago Press, Chicago, 1963. 144 pp. Illus. $3.

Textbook of Abnormal Psychology. N. H. Pronko. Williams and Wilkins, Baltimore, Md., 1963. 470 pp. Illus. $7.50.