priority for the predictions, made by Shugar and his co-workers, of subsequent observations by others. Such predictions—for example, those of thymine dimers as an explanation of photochemistry of polypyrimidines and their relations to photobiology (pp. 249 and 261)—were either one of a number of possibilities or appeared at the same time as the experimental observations.

Despite the above shortcomings, everyone working on the photochemistry of proteins and nucleic acids should have access to this book. They will be stimulated by it, and they will profit immeasurably from it.

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The Maryland Piedmont

The Geology of Howard and Montgomery Counties. Ernst Cloos, G. W. Fisher, C. A. Hopson, and Emery T. Cleaves. Maryland Geological Survey, Baltimore, 1964. xvi + 373 pp. Illus. Plates. Paper, $3; cloth, $4.

This book is a milestone in the understanding of the geologic history of the core of the central Appalachians. Its meat is Hopson's long chapter (pp. 27 to 208) on the crystalline rocks. There are shorter chapters on history and geography, on post-Triassic rocks, and on structural geology, by Cloos, and on the Triassic rocks and mineral resources by Fisher and Cleaves, respectively.

Hopson's fresh insights into the complex and long-disputed geology of the Maryland Piedmont within these counties and beyond make his chapter far more than conventional descriptive geology. His most significant contribution is the recognition of graded graywacke and other sedimentary features within the metamorphosed Wissahickon Formation of the Glenarm Series. He proves it to be a thick flysch-like sedimentary mass; associated pebbly mudstones had earlier been termed Sykesville Granite and Laurel Gneiss. He also convincingly dates this sequence as late Precambrian.

The oldest rocks of the area are those of the Baltimore Gneiss in the cores of mantled domes in eastern Howard and Baltimore counties. Although alteration and migmatization obscure the original character of the gneiss in most places, its composition, where least altered, indicates its derivation from volcanic rocks of intermediate to silicic composition.

Unconformably above the gneiss are quartzose rocks of the Setters Formation and the Cockeysville Marble. These are overlain by the Wissahickon, which in the western part of the area is overlain by the Ijamsville Phyllite. In contrast to the flysch-like graywackes of the Wissahickon, the Ijamsville contains crossbedded quartzite that shows a change of sedimentary environment to that of shallow water molasse.

Plutonic rocks consist of an earlier mafic series, including the Baltimore Gabbro and related rocks, and a later granitic series. The Baltimore Gabbro, where best preserved, displays rhythmic graded layers that were apparently formed as flat-lying sheets prior to folding of the enclosing Glenarm Series. With continuing deformation, the basement Baltimore Gneiss was partially mobilized to produce the migmatitic Gunpowder Granite, and synkinematic magmatic quartz diorite, quartz monzonite, granite, and pegmatites were emplaced.

Radiogenic mineral ages give essential information on the temporal spacing of these events. Zircon and microcline from the Baltimore Gneiss give ages between 1000 and 1100 million years and indicate a major metamorphic or plutonic event at that time. Zircon ages from early granitic intrusive rocks give dates of 570 million years, and younger ages of other granitic intrusive rocks are confirmed by radiometric ages as low as 370 million years.

The Wissahickon Formation is thus older than 570 million years but younger than 1000 million years, and therefore is comparable in age to the Ocoee Series of the Southern Appalachians, which has similar sedimentary characteristics and stratigraphic relations. The Cambrian or Ordovician age that had been widely suggested for the Glenarm Series is thus rejected.

Hopson's observations include a wealth of petrographic and chemical information with which pertinent experimental data are compared. His chapter is a model of the application of the newer developments in geology in combination with old-fashioned good field observation to yield definitive solutions to classical problems in earth history.

Although 89 photographs convincingly supplement the text, the county geologic maps that were issued separately some years ago do not accompany this volume. Instead, there is a crude sketch map of the two counties (at 1:125,000 scale) which conflicts in several respects with the earlier maps and with the report. Maps of these and the other counties of the Maryland Piedmont that are consistent with Hopson's findings should now be prepared.

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Mathematical Analysis

The Elements of Real Analysis. Robert G. Bartle. Wiley, New York, 1964. xvi + 447 pp. Illus. $10.95.

A course variously described as an introduction to mathematical analysis, real analysis, or the theory of functions—a replacement for the former advanced calculus—now serves as a bridge between the intuitive and manipulatory courses in the freshman and sophomore years and the courses in advanced analysis, topology, and geometry in graduate school. It is an essential course that should be taken by every undergraduate in preparation for graduate work in mathematics.

The Elements of Real Analysis is an excellent textbook for this undergraduate course in mathematical analysis. The definitions are precise, the proofs rigorous, and the exposition good. The chapters have the following titles: "A glimpse at set theory," "The real numbers," "The topology of Cartesian spaces," "Convergence," "Continuous functions," "Differentiation," "Integration," and "Infinite series." The theoretical nature of the treatment of these subjects is indicated by the following sample of theorems: Bolzano-Weierstrass theorem, Heine-Borel theorem, Cantor intersection theorem, Lebesgue covering theorem, Baire's theorem, fixed point theorem for contractions, Stone-Weierstrass theorem, Tietze extension theorem, Arzelà-Ascoli theorem, Riesz representation theorem (for bounded positive linear functionals), Cauchy-Hadamard theorem, and Bernstein's theorem. There is no mention of functions of a complex variable nor of Lebesgue measure or integration.

Most of the book presents a multidimensional theory in the language of vectors. A sequence is a function whose

domain is the set of positive integers and whose range is contained in p-dimensional Cartesian space; the convergence of such sequences is treated in the fourth chapter. The typical function is one whose domain and range are contained in p- and q-dimensional Cartesian spaces respectively.

There are more than 500 well selected problems, with hints and answers for the more difficult ones; 33 of the problems are projects consisting of connected sequences of exercises which develop a part of the theory. For example, the text treats only Cartesian spaces, but the projects include brief introductions to metric spaces, linear spaces, and normed linear spaces.

The printing is good, and typographical errors are rare.

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Mineralogy

Aspects of Theoretical Mineralogy in the U.S.S.R. A collection of papers translated from the Russian. M. H. Battey and S. I. Tomkeieff, Eds. Pergamon, London; Macmillan, New York, 1964. viii + 507 pp. Illus. $30.

The 35 papers here translated were published between 1943 and 1960, but mostly between 1954 and 1959, in Soviet scientific journals. They can be divided into three groups, dealing, respectively, with the meaning of the term *mineral*, the classification of minerals, and the correlation of their physical and chemical properties.

The first group of six papers deals with the definition of the term *mineral*. They may be collectively oversimplified to the point of saying that a mineral is a phase in the Gibbs' phase-rule sense. This is usually qualified by requiring it to be a solid, natural phase, but liquids (rarely also gases), and artificial phases are recognized by some mineralogists. A. S. Uklonskii even includes some inhomogeneous objects like "colloidal and amorphous minerals . . . [that] are made up cryptocrystalline aggregates." D. P. Grigor'yev (1943) examines current definitions and finds them "static" or "dynamic," a distinction based on the verb used in the definition—that is, "minerals exist" versus "minerals develop"; he prefers the latter usage. He also includes fluids such as liquid oil-droplets and gases in otherwise void openings like negative crystals or in the channels where helium is seeping from the ground, and dispersoidal or colloidal objects such as incrustations of opal and the "monomineralic aggregate," geyserite. Grigor'yev describes how this new definition affects the objectives of mineralogy, and, in the last article of this section, he answers to his satisfaction, and to that of many others, the question, "What is a mineral?"

In the second section, on the classification of minerals, Uklonskii's classification (1948) is primarily by economically important elements; but minerals with several elements present are not uniquely classified. This tends to emphasize associations of elements more than the conventional crystal-chemical classifications like that of *Dana's System of Mineralogy* (1898; ed. 7, 1944), which in modified form is adopted by Kostov (1954), Bokii (1956), Povarennykh (1955–1956), and Barsanov (1959), whose classifications seem to have much in common.

The third section contains somewhat more specialized papers dealing with melting temperatures, solubilities, hardnesses, compressibilities, magnetism, and optical properties; in many of these papers the approach is distinctly theoretical, starting with known crystal structural details and inferring the physical properties.

Most papers in this book will be of considerable interest to mineralogists only; some will interest the solid-state physicist, and a few should appeal to chemists.

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Practical Handbook

Waterfowl Tomorrow. Joseph P. Linduska, Ed. U.S. Department of Interior, Washington, D.C., 1964 (order from Superintendent of Documents, Washington, D.C.). xiv + 770 pp. Illus. $4.

Waterfowl Tomorrow is a practical handbook for waterfowl specialists as well as a mine of information for sportsmen and lay readers. Prepared by the U.S. Department of Interior "with the assistance of officials and representatives of State, Provincial, and National Governments. . . ," it is profusely illustrated with several hundred excellent and well chosen photographs. Each chapter is prefaced by an artistic drawing by Bob Hines. More than 100 American and Canadian authors contributed the 69 chapters that make up the bulk of the book.

Multiple authorship inevitably results in considerable duplication. Many facts (for example, goldeneyes nest in cavities) as well as topics (pollution and pesticides) are repeated in various chapters, but on the whole the book seems to have been carefully planned, skillfully prepared, and well edited. Some of the repetition, moreover, is probably intentional, for a major theme —loss of habitat by drainage, drought, pollution, and changing land use—is driven home in nearly every chapter.

Most chapters portray a gloomy situation, yet manage to end on an optimistic note. Can we—in the face of exploding populations, increasing demands for food and fiber, use and misuse of our wetlands—preserve enough land to produce waterfowl in quantities adequate for future hunting? The verdict seems to be that, with adequate vision, research, and careful management, we can.

Although *Waterfowl Tomorrow* is not a comprehensive technical treatise on the family Anatidae, it is surprisingly comprehensive from the management standpoint. In addition to expected chapters on predators, diseases, nesting success, and the like, there are chapters on topics which at first glance might seem only remotely related to waterfowl: glaciation, geology, water, weather, farming practices, fires, cattle, and carp, to mention only a few. These topics are not summarily dismissed but are treated in great detail by experienced personnel. According to the brief biographical sketches appended (a very useful feature since so many of the authors will be unknown to many readers) nearly all of the authors have had from 10 to 20 or more years of experience in the fields they are writing about.

All in all, *Waterfowl Tomorrow* will be a useful handbook for everyone interested in the subject, for it covers a vast background of information otherwise available only from experience or in the thousands of published papers dealing with waterfowl.

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