ments of the older, more conventional segments of the ceramic industry. The inadequate supply of college graduates can be traced to the fact that the general public, and especially junior and senior high school students and their guidance counselors, are not aware of the meaning of ceramics and its possible impact on their careers or mode of living. *Ceramics: Stone Age to Space Age* will provide the high school student who is interested in science or engineering with a broad concept of the field and a basis for making decisions about a career. Other high school students as well as high school teachers should find it a valuable source of information.

Mitchell has seriously attempted an impossible task: that of covering all aspects of ceramics in ten chapters. The last two chapters, "Carbon ceramics" and "The new ceramics," constitute an excellent introduction to the new requirements made by the electronics, nuclear, and space age industries, but these chapters must be supplemented by other current literature—for example, the article (in two parts) "U.S. in space" published in *Chemical and Engineering News* (23 and 30 September 1963).

The illustrations are excellent, especially those in the last two chapters. The glossary is valuable, because many high school students and teachers are not familiar with the special language of ceramics. The very limited bit of "selected readings" provided at the end of the book should have been greatly expanded for well-qualified students and high school teachers who are eager to learn about "the new ceramics."

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Operations Research

Models for Production and Operations Management. Elwood S. Buffa. Wiley, New York, 1963. xii + 632 pp. Illus. $9.25.

In his preface, Buffa writes that the book "is designed for the individual or for a course where the objective is to develop a comprehension of these new methods so that in operations situations one can make intelligent decisions based on the results of analysis by staff specialists." He hits this target somewhat off center. For nonstaff specialists there is too much "this is what your technical staff should do," and not enough "this is what your technical staff should be trying to accomplish and this is why they should go about it this way." For example, in part 5, "Linear Programming," there is an excellent three-page discussion entitled "Linear programming—distribution methods," but he then devotes 26 pages to calculating techniques, including nine pages on short cuts which are of no interest to managers and of doubtful value to anyone else, since such problems almost inevitably are run on computers. The next chapter, on simplex, does not have initial pages on uses and is wholly devoted to the algorithm.

Perhaps Buffa's selection of material may be described as conventional, since it so nearly agrees with that used by Bowman and Fetter in *Analysis for Production Management*. However, the sequence and grouping are somewhat different, and they are perhaps better. Part 2, "Models of Flow and Man-Machines Systems," contains a load of tabulated data, helpful in indicating what is available: the dimensions of average men and women, comfort ranges for temperature and humidity, and the like, all of which is more suitable for a reference volume than for a textbook. Part 3, "Statistical Methods," seems lopsided—too much on quality control compared with the space devoted to the vastly more important experimental design. Part 4, "Waiting Lines," is rather more adequate than most treatments found in general works. It exhibits a greater variety of applications and is really very well done. I could wish for less focusing on Poisson distributions and first come, first served, queue discipline. Part 6, "Investment Policy," seems somewhat overly concerned with calculating techniques. Part 7, "Inventories Models," seems a first-rate job and so does part 8, "Simulation." Part 9, "Synthesis," is only seven pages long and regrettably slight.

The mathematical level requires about a year of high school algebra. Equations are given, rarely derived, and often no effort is made to obtain intuitive acceptance. Incremental costs are stipulated and occasionally illustrated. Limitations of techniques are sometimes recognized.

The illustrative material is well chosen and adequately presented. The problems are realistic and some of the best I have seen. The references for further reading are excellent. The section entitled "Review questions" seems useful to readers for self-testing and to teachers for use in pushing students into study. I prefer thought-provoking questions that lead to the exploration of managerial purposes and problems and perhaps to social implications and ethics.

Buffa's style is clean, lucid, matter-of-fact—and not very exciting. At times a bit superficial, more often somewhat dogmatic, the book could do more to explain *why* models succeed, *why* they are designed as they are.

On the whole, Buffa's book stands up well in comparison with competing textbooks. I expect it will be widely adopted and generally liked. While much more a textbook than a trade book, managers may well buy it and browse to get some idea as to what the "new management" is all about.

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Geological Society Memoir

Supai Formation (Permian) of Eastern Arizona. Geological Society of America Memoir 89. Stephen S. Winters. Geological Society of America, New York, 1963. viii + 99 pp. Illus.

The Supai Formation of east-central Arizona is strategically situated between well-known and documented Permian sections of West Texas and those of the Grand Canyon region. Winters has made an excellent contribution in providing objective stratigraphic and paleontologic information about this important area and in making a logical synthesis and interpretation of its paleogeography. His purpose in providing lithologic and paleontologic data and thereby contributing to an understanding of the transition between the Colorado Plateau and the New Mexico–Texas Permian sedimentary rocks was realized.

From his 13 detailed surface stratigraphic sections, strategically located in the Fort Apache Indian Reservation, Winters obtained lithic and faunal information that permitted recognition of four members in the Supai Formation: Amos Wash (at the base), Big A Butte, Fort Apache, and Corduroy; with the exception of the Fort Apache Member, all are proposed as new. The author points out that the Supai Formation totals about 1300 feet of reddish-brown

sandstone, siltstone, mudstone, claystone, gypsum, and gray limestone; the latter lithic type characterizes the Fort Apache Member and contains the rich molluscan fauna. The Supai was interpreted as having accumulated marginal to and in a shallow epeiric sea under warm dry conditions; the cyclicity of sedimentation indicates eustatic fluctuations and a periodic encroachment of a Permian sea from the south.

In this memoir Winters provides geologists with details of the stratigraphy in 13 well-located surface sections in addition to detailed systematic description and illustration of their fauna. Three new genera were among the 22 genera of gastropods collected, and 12 new species are described; the 15 genera of pelecypods contain 20 forms. And of the two brachiopods recognized, one is a new productid genus. The fauna is superbly illustrated.

Winters has done a commendable job in providing objective data and subjective interpretation for these Early and Medial Permian sedimentary rocks. The systematic paleontology by itself is an outstanding contribution, because it provides information necessary for biostratigraphic studies in this and contiguous areas. This memoir should prove of inestimable value to stratigraphers and the paleontologists who wish to make documented correlation with the standard West Texas sections. It is self-evident that its value will be enhanced as its utility is applied in such areas as the eastern Great Basin and the Colorado Plateau. The author is to be highly complimented.

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Space Age Aerodynamics

Aerodynamics. A space-age survey. John E. Allen. Harper and Row, New York, 1963. 128 pp. Illus. $2.95.

Readers of this engagingly written little book should begin in the middle of the volume with the author's account of natural aerodynamic phenomena, for that is a fascinating story, spiced with anecdotes of men lifted by tornadoes, of wind-tunnel tests of the Rock of Gibraltar, of galloping bridges, cables, and circus tents and with accounts of other caprices of the earth's atmosphere.

Equally interesting are the subsequent chapters devoted to the streamlining of cars and trains, to the industrial use of moving air, and, of course, to the airplane. Here the narrative follows the historical acceleration from low speeds through subsonic, transonic, and supersonic to hypersonic flight. It culminates in the aerodynamics of space, including not only guided missiles and re-entry vehicles but also the small molten marbles called tektites whose extraterrestrial origin is being so hotly disputed by the experts. Treatment of such fashionable subjects as radiation and magnetohydrodynamics makes this a thoroughly modern survey of the science of air in motion.

The author is less successful in his first four chapters, where he attempts a brief summary, in simple terms, of all of aerodynamic theory. The specialist would quibble with many details: for example, Figure 5 is almost a "what's wrong with this picture?" puzzle. The nonspecialist—to whom the book is addressed—will be discouraged by a proliferation of mathematical formulas which call for a knowledge of partial differentiation and vector analysis and which could have been avoided with a bit more ingenuity.

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Note

Electronic Spectra

Volume 4 of *Organic Electronic Spectral Data* [Interscience (Wiley), New York, 1963. 1189 pp. $20], edited by J. B. Phillips and F. C. Nachod, covers spectral data published during 1958 and 1959. The text, which is similar to that of the earlier volumes in the series, is a comprehensive compilation of the data on electronic spectra of organic compounds reported in some 90 journals. Metallic salts and complexes are included. The data consist of listings of the wavelengths of all reported absorption maxima, together with logarithms of molar absorptivities at these maxima for each compound listed. Compounds are cataloged by molecular formula in a manner similar to that used in *Chemical Abstracts.* Solvents or phases used are given, as are references to the sources of the data. Volume 4, which is similar in size and format to the previous volumes, includes about 18,000 listings. The printing is satisfactory. This series continues to be the most comprehensive available listing of electronic spectra.

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New Books

Mathematics, Physical Sciences, and Engineering

The Adiabatic Motion of Charged Particles. Theodore G. Northrop. Interscience (Wiley), New York, 1963. 123 pp. Illus. $5.95.

Advances in Glass Technology. pt 2. History papers and discussions of the technical papers of the sixth International Congress (Washington, D.C.), July 1962. Frederick R. Matson and Guy E. Rindone, Eds. Plenum Press, New York, 1963. 428 pp. Illus. $15.

Advances in Heterocyclic Chemistry. vol. 2. A. R. Katritzky, A. J. Boulton, and J. M. Lagowski, Eds. Academic Press, New York, 1963. 472 pp. Illus. $14.

Advances in Photochemistry. vol. 1. W. Albert Noyes, Jr., George S. Hammond, and J. N. Pitts, Jr., Eds. Interscience (Wiley), New York, 1963. 453 pp. Illus. $16.50.

Analytical Chemistry of the Actinide Elements. Alfred J. Moses. Pergamon, London; Macmillan, New York, 1963. 147 pp. Illus. $6.75.

Astrophysics. The atmospheres of the sun and stars. Lawrence H. Aller. Ronald, New York, ed. 2, 1963. 662 pp. Illus. $15.

Atlas of Electron Spin Resonance Spectra. Theoretically calculated multicomponent symmetrical spectra. Ya. S. Lebedev, D. M. Chernikova, N. N. Tikhomirova, and V. V. Voevodskii. Translated from the Russian edition. Consultants Bureau, New York, 1963. 233 pp. Illus. $15.

Atomic Structure Calculations. Frank Herman and Sherwood Skillman. Prentice-Hall, Englewood Cliffs, N.J., 1963. Unpaged. Illus. Paper, $13.

Automatic Data Processing. Frederick P. Brooks, Jr., and Kenneth E. Iverson. Wiley, New York, 1963. 520 pp. Illus. $10.75.

Basic Topics in Mathematics. John Riner. Prentice-Hall, Englewood Cliffs, N.J., 1963. 293 pp. Illus. $6.95.

Biochemistry of Industrial Micro-organisms. C. Rainbow and A. H. Rose. Academic Press, New York, 1963. 728 pp. Illus. $22.

Boron Hydrides. William N. Lipscomb. Benjamin, New York, 1963. 285 pp. Illus. $14.

Breakthroughs in Mathematics. Peter Wolff. New American Library, New York, 1963. 285 pp. Illus. Paper, 75¢.

The Changing Concept of the Universe. Directorate of General Education Reading Material Project, Aligarh Muslim University. Asia Publishing House, New York, 1963. 120 pp. $4.75.

Chemical Analysis by Flame Photom-