

of the dynamic method of argon analysis, the chapters on argon measurement and potassium measurement present a lucid and informative description of experimental techniques. Contrary to the authors' statement, leak systems for the dynamic method need not be more complicated than a constricted capillary, a hole formed by drawing a wire through hot glass, or an ordinary, commercially available leak valve. For example, with a commercial leak valve, we obtain a Graham's law relationship among the three stable argon isotopes. Of course, we must plot the isotopic data as a function of time, as in the static method, and not average the isotope ratios as stated by the authors (p. 82). The Graham's law relationship provides an additional boundary condition which must be satisfied for a good analysis. The increased sensitivity obtainable with the static technique makes it essential to use this method for very young samples requiring larger air corrections. For older samples, however, the dynamic method provides ample sensitivity and is free from the bothersome memory effects that are frequently encountered in the static method. Dalrymple and Lanphere do not mention that mass spectrometers employing low-voltage ion acceleration, such as the MS-10, trochoidal tubes, and omegatrons, are said to be relatively free of memory effects by workers who have used them.

The chapter on accuracy and precision, in accord with the authors' intent, is simplified but quite adequate. In the chapter on extraneous argon, the authors state that "in order to test for excess Ar^{40} , it is necessary to establish the age of the rock or mineral by some independent means" (p. 122). In fact, when different minerals from the same rock are analyzed, the expected age of the rock need only be known in a very general way. Graphical techniques for analyzing data, which are not discussed by the authors, frequently make clear the existence of extraneous argon and, in addition, yield a good approximation to the correct age of the rock. Except for minor points not worth mentioning, I find this the only flaw in an otherwise excellent chapter.

Many readers will find chapter 10, entitled "What can be dated?", alone worth the price of the book. It clearly answers the most frequent questions concerning the amount, purity, and suitability of various materials for dating purposes.

In the final chapter, the authors give

case histories of some of the most important potassium-argon dating problems: the dating of early man (*Zinjanthropus*), age of mineralization, chronology of geomagnetic reversals, and dating Precambrian rocks, as well as the use of potassium-argon dating to establish an "absolute" time scale and to evaluate provenance of detrital components of sedimentary rocks. One fault is the absence of any discussion of the dating of metamorphic rocks. The determination of "cooling" ages and "overprint" ages can be a valuable tool for evaluation of geotectonic and petrologic problems.

For some time now there has been a difference of opinion between Arizona and California geochronologists concerning the dating of the Precambrian of Arizona. Although outnumbered, we Arizonans have the advantage of living in the midst of Arizona's Precambrian terrain. Californians are welcome here, but we do wish they would read all of our papers (and more carefully) and spend a little more time in the field studying Arizona's Precambrian rocks. The fact is, contrary to the impression left by Lanphere (p. 221), we had dated 1600- to 1800-million-year-old igneous rocks in Arizona and Sonora long before the publication of the paper by Wasserburg and Lanphere in 1965 (Damon *et al.*, Annual Report No. 3 to Research Division USAEC, Contract AT[11-1]-689, July 1961, and subsequent papers and publications prior to 1965). However, it was a fellow Californian, L. T. Silver, not referenced by the authors, who first became aware that the antiquity of the Arizonan Precambrian was greater than had previously been suspected (Silver and Deutsch, *Ann. N.Y. Acad. Sci.* **91**, art. 2, 279 [1961]). Silver is in agreement with Wasserburg and Lanphere concerning the great antiquity of the Mazatzal Revolution. However, our late Arizona colleague Eldred Wilson, who defined the Mazatzal Revolution, agreed with our conclusion that this Revolution was terminated by the intrusion of approximately 1400-million-year-old batholiths and thus was of lesser antiquity than was supposed by the Californians. It will probably take somebody from back East to settle our differences. At any rate, potassium-argon dating can be not only controversial but also fun.

It is far easier to criticize an excellent book like this than to write it. The authors have fulfilled the hope they

expressed in their preface that "both students and working earth scientists will find this book valuable not only as an introduction to potassium-argon dating but as a practical guide to its use."

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Computer Science

Theory of Automata. ARTO SALOMAA. Pergamon, New York, 1969. xii, 264 pp., illus. \$12. International Series of Monographs in Pure and Applied Mathematics, vol. 100.

Theories of Abstract Automata. MICHAEL A. ARBIB. Prentice-Hall, Englewood Cliffs, N.J., 1969. xviii, 414 pp., illus. \$14.95. Prentice-Hall Series in Automatic Computation.

In the past few decades, mathematical automata theory has been developed. It is now firmly established as a basic course in almost all computer science departments. At the research level, there are now deep results which exhibit surprising connections with logic, algebra, probability theory, linguistics, and computer programming.

In this context, the two books under review offer an interesting contrast. The book by Salomaa is intended as an advanced undergraduate text. It is a book that attempts to cover only certain basic areas but does so quite thoroughly. Salomaa's book is organized around finite deterministic automata and regular expressions. The language of regular expressions characterizes the manner in which finite automata behave. These topics are generalized and studied in various ways; examples include two-way automata, nondeterministic finite automata, and probabilistic automata. Salomaa has contributed a great deal to the study of the algebra of regular events, and he summarizes much of his research in the book. There is a concluding chapter on formal languages and their characterizations by automata. To summarize, Salomaa builds a textbook around a few basic notions, and it is a rigorous and clear introduction to the subject.

Arbib's book is in many ways the opposite of Salomaa's. Arbib wishes to exhibit the many diverse aspects of automata theory. The book begins with an overview and a chapter on algebraic background. The section

entitled *An Introduction to Automata Theory* consists of chapters on finite automata (including circuits), a chapter on Turing machines, and a chapter on Post systems and context-free languages. The last section of the book has chapters on partial recursive functions, computational complexity, algebraic decomposition theory, stochastic automata, and constructors. Unfortunately, the mathematical side of Arbib's book is the weakest. There are a number of errors in the proofs. Many arguments are sketched vaguely, and nontrivial gaps are left. In some cases, proofs are lifted from the literature (almost word for word). This is unfortunate, since proofs in the open literature often omit steps too difficult for students to supply. To summarize, Arbib's book is an excellent survey of the different sides of automata theory, but I would not recommend it as a textbook.

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New Journals Received

Artificial Intelligence. An International Journal. Vol. 1, Nos. 1 and 2 (combined), Spring 1970. Four numbers per volume. Editor-in-chief: Bernard Meltzer (University of Edinburgh). Associate editor: Bertram Raphael (Stanford Research Institute). American Elsevier Publishing Co., 52 Vanderbilt Ave., New York, N.Y. \$20 plus \$1 postage; single numbers \$6.50, double numbers \$13.

Behavioral Research in Highway Safety. An Independent Journal. Vol. 1, No. 1, January 1970. Quarterly. Editor: Theodore Kole. Behavioral Research in Highway Safety, 2852 Broadway, New York, N.Y. \$12.

Comparative and General Pharmacology. Vol. 1, No. 1, March 1970. Quarterly. Editor: G. A. Kerkutt (University of Southampton). Scientifica, 823-825 Bath Road, Bristol, England. \$40; single copy \$11.

Computer Programs in Biomedicine. An International Journal. Vol. 1, No. 1, January 1970. Quarterly. Managing editor: W. Schneider (Uppsala University Data Center). North-Holland Publishing Co., P.O. Box 3489, Amsterdam. \$30.

Environmental Pollution. An International Journal. Vol. 1, No. 1, July 1970. Quarterly. Editor: Kenneth Mellanby (Monks Wood Experimental Station, Huntingdon, England). Elsevier Publishing Co., Ripple Road, Barking, Essex, England. \$15.60.

Ferroelectrics. Vol. 1, No. 1, March 1970. Four issues per volume. Editors: I. Lefkowitz (Philadelphia) and G. W. Taylor (Princeton). Gordon and Breach, 150 Fifth Ave., New York, N.Y. To institutions \$53, to individuals \$14.50.

Indian Journal of Pure and Applied Mathematics. Vol. 1, No. 1, January 1970. Quarterly. Executive Editor: F. C. Auluck (Delhi). Editor of Publications, National Institute of Sciences of India, Bahadur Shah Zafar Marg, New Delhi 1. \$12; single issue \$4.

Inorganic Macromolecules Reviews. The Chemistry, Physics and Technology of Macromolecular Inorganic Compounds and Materials. Vol. 1, No. 1, January 1970. Quarterly. Editors: F. G. R. Gimblett and K. A. Hodde (Brunel University, London). Elsevier Publishing Co., P.O. Box 211, Amsterdam. Dfl. 90 plus 4.50 postage.

The International Journal of Biochemistry. Vol. 1, No. 1, February 1970. Bimonthly. Editor: G. A. Kerkut (University of Southampton). Scientifica, 823-825 Bath Road, Bristol, England. \$40; single copy \$8.

Journal of Behavior Therapy and Experimental Psychiatry. An Interdisciplinary Journal. The journal of the Behavior Therapy Society. Vol. 1, No. 1, March 1970. Quarterly. Editor: Joseph Wolpe (Temple University Medical School). Pergamon Press, Fairview Park, Elmsford, N.Y. To institutions \$35; to individuals \$12; to members of the American Psychological and Psychiatric Associations \$9; to students and residents \$6.

Journal of Molecular and Cellular Cardiology. Vol. 1, No. 1, March 1970. Four issues per volume. Editors: R. J. Bing (Huntington Memorial Hospital, Pasadena) and L. H. Opie (Hammersmith Hospital, London). Academic Press, 111 Fifth Ave., New York, N.Y. \$15 plus 50¢ postage.

Journal for Research in Mathematics Education. Vol. 1, No. 3, May 1970. Quarterly. Editor: David C. Johnson (University of Minnesota). National Council of Teachers of Mathematics, 1201 16th St. NW, Washington, D.C. \$6; to members (concurrently with membership) \$5.

Microstructures. An Official Journal of the International Metallographic Society. Vol. 1, No. 1, August-September 1970. Bimonthly. Editors: Hal Spector and Martin H. Waldman. A. Z. Publishing Corp., 647 North Sepulveda Blvd., Bel Air, Los Angeles. \$15; single issue \$3.

Nouvelle revue d'optique appliquée. Vol. 1, No. 1, January-February 1970. Bimonthly. Editor: R. Dupeyrat (Faculté des Sciences de Paris). Masson et Cie., 120, Boulevard Saint-Germain, Paris 6^e. 146 F.

Research Communications in Chemical Pathology and Pharmacology. Vol. 1, No. 1, January 1970. Six numbers per volume. 10 Oakdale Drive, Westbury, N.Y. To institutions \$18, to individuals \$12.

Nordic Hydrology. An International Journal. Vol. 1, No. 1, March 1970. Quarterly. Editor: Arne Forsman (Toppbrinken 16-18, S-163, Spånga, Sweden). Munksgaard, 47 Prags Blvd., Copenhagen. \$17.10.

Studies in History and Philosophy of Science. Vol. 1, No. 1, May 1970. Quarterly. Editors: Gerd Buchdahl (University of Cambridge) and L. L. Laudan (University of Pittsburgh). Macmillan (Journals) Ltd., 4 Little Essex St., London.

\$13.50, Canada \$14.50; single copy 30s.

Theoretical Population Biology. An International Journal. Vol. 1, No. 1, May 1970. Editors: J. F. Crow (University of Wisconsin); S. Karlin (Stanford University); N. Keyfitz (University of California, Berkeley); R. MacArthur (Princeton University). Academic Press, 111 Fifth Ave., New York, N.Y. Per calendar year (3 issues in 1970), \$16 to institutions, \$10 to individuals.

Thermochimica Acta. Vol. 1, No. 1, March 1970. Bimonthly. Editor: W. W. Wendland (University of Houston). Elsevier Publishing Co., P.O. Box 211, Amsterdam. \$22.50 plus \$1.50 postage.

Books Received

Abuse of Central Stimulants. A symposium, Stockholm, November 1968. Folke Sjoqvist and Malcolm Tottie, Eds. Raven, New York, 1969. 536 pp., illus. \$9.75.

Advances in Behavior Therapy, 1968. A symposium, San Francisco, August 1968. Richard D. Rubin and Cyril M. Franks, Eds. Academic Press, New York, 1969. xviii, 246 pp., illus.

Advances in X-Ray Analysis. Vol. 13. Burton L. Henke, John B. Newkirk, and Gavin R. Mallett, Eds. Proceedings of a conference, Denver, Colo., August 1969. Plenum, New York, 1970. xii, 682 pp., illus. \$25.

Aerodynamics for Engineering Students. SI Units. E. L. Houghton and A. E. Brock. St. Martin's, New York, ed. 2, 1970. viii, 458 pp., illus. \$15.

Air Pollution and Its Control. Wayne T. Sproull. Exposition Press, New York, 1970. 110 pp., illus. \$4.

Analyse binaire. R. L. Vallée. Masson, Paris, 1970. Vol. 1, Théorie et applications aux circuits combinatoires (iv, 152 pp., illus. Paper, 60 F); vol. 2, Clef des automates numériques (iv, 188 pp., illus. Paper, 80 F).

Annual Review of Plant Physiology. Vol. 21. Leonard Machlis, Winslow R. Briggs, and Roderic B. Park, Eds. Annual Reviews, Palo Alto, Calif., 1970. x, 654 pp., illus. \$10.

Architectural Acoustics. Anita Lawrence. Elsevier, New York, 1970. xvi, 224 pp., illus. \$11.75.

Automatic Data Processing. Principles and Procedures. Elias M. Awad. Prentice-Hall, Englewood Cliffs, N.J., ed. 2, 1970. xvi, 496 pp., illus. \$13.25; student's edition, \$9.95.

Biologie et physiologie des éléments nerveux. P. Laget. Masson, Paris, 1970. viii, 174 pp., illus. Paper, 29 F. Structures et fonctions du système nerveux, vol. 1.

Biology and Its Relation to Mankind. A. M. Winchester. Van Nostrand Reinhold, New York, ed. 4, 1969. x, 726 pp., illus.

Can the Red Man Help the White Man? A Denver Conference with the Indian Elders. June 1968. Sylvester M. Morey, Ed. Church, New York, 1970. xii, 118 pp. Paper, \$1.95.

Carbonium Ions. George A. Olah and
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