BOOK REVIEWS

THE PERIODIC SYSTEM OF CHEMICAL ELEMENTS, A HISTORY OF THE FIRST HUNDRED YEARS. J. W. VAN SPRONSEN, Elsevier Publishing Co., Amsterdam, The Netherlands, 1969, xv+368 p., 7 tables, 139 illustrations, 22 photographs. $18.00.

Much more than a simple discussion of the periodic table, this fine account of the first hundred years of our system of classification of the elements approaches a history of chemistry. Exhaustively documented, a particular feature of the work is the profusion of illustrations, many of them redrafted for maximum legibility. The book is appropriately divided into five chapters culminating in the discovery of the periodic system 1862–1871, and ten chapters of detailed analysis of developments since. The periodic chart grew out of early recognition of similarities in the chemical behaviour of different elements and a preoccupation with numerical relationships among their equivalent weights. Dr. Spronsen has concluded that priority for the periodic classification must be assigned to Béguyer de Chancourtois, a geologist-mineralogist who succeeded Elie de Beaumont at the Ecole des Mines and assumed with him that the test of a natural system of classification would be the associations of elements in nature. This might be taken as a fitting rejoinder to Haüy, who introduced the chemical classification of the minerals. The relatively simple two-coordinate table that evolved one hundred years ago was a numerologic and pedagogic success leading to chemical prediction of high significance, but as fan, cone, spiral, spring, domino, pretzel, helix, and even a kind of tree model attest, the ultimate complexity of nature has proven inexhaustible and in the end (or at least on the end-papers) we are back to a two-dimensional chart albeit a bit complicated by the lanthanide and actinide series. " . . . the filling of the atomic shells with electrons is erratic. This must be considered as the decisive factor in the discovery of the periodic system of elements . . . "

Thorough, clear, and informative, this volume represents a significant addition to the mineralogist's library. But although each major topic is treated from the beginning, this is not a book for chemical innocents. The emphasis is on the history of the periodic system and the reader is expected to be familiar with the laws of classical chemistry-the law of Dulong and Petit, for example, and at least the rudiments of the work of Moseley and Rydberg, or Bohr. Mineralogists still wrestling with the problems of Béguyer and the natural and structural associations of the elements will find in this example of the almost limitless prolixity of electronic organization, a worthy model for the patience that will be required before a similar ordering can be extended to the mineral world.

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VON DER BERGAKADEMIE ZUR TECHNISCHEN UNIVERSITÄT BERLIN, 1770 BIS 1970. By HUGO STRUNZ. Förderer der Berliner Fakultät für Bergbau und Hüttenwesen e. V., 1000 Berlin 12, Charlottenburg, Germany (West). 1970, 151 p.

This volume is an important historical account of a famous mining school—the "Königlichen Bergakademie Berlin". The Bergakademie has graduated a long line of distinguished scientists and engineers who have strongly influenced the geological sciences, and the mining and metallurgical industries. Various aspects of the history and development of the Bergakademie are given in Part I following the chronological outline: Die Bergakademie from 1770 to 1810; Das Bergbaustudiun from 1810 to 1860; Die Bergakademie from 1860 to 1916; Die Technische Hochschule from 1879 to 1945; Die Technische Universität from 1946 to 1970. The description is illustrated with a photograph of the emblem of the Institution and seven photographs of various buildings.

The largest part of this volume presents biographies of former and present members of the faculty with photographs of most of them. Those included in the section entitled "Geowissenschaften" are:

1. *The mineralogists*—Karl A. Gerhard, D. L. G. Karsten, Christian Samuel Weiss, Gustav Rose, Christian Ernst Weiss, Robert Scheibe.
2. *The petrographers*—Julius Hirschwald, Felix Tannhaüser, Ferdinand Bernauer and Walter Schmidt.
3. *The geologists and paleontologists*—H. E. Beyrich, Louis Beushausen, Felix Wahnschaffe, C. F. H. Rauff, Walter Gothan, Axel Born, L. von zur Mühlen, Heinrich Quiring, Wilhelm Simon.
4. *The economic geologists*—Franz Beyschlag, Paul Kursch, Erich Harbort, F. K. Drescher-Kaden, Richard Stappenbeck, Martin Donath, Ferdinand Friedensburg.

There are 24 biographies of the faculty of mining science of which the names Rudolph von Carnall, Wilhelm Hauchecorne, Wilhelm Bornhardt are familiar because minerals were named after them.

There are 20 biographies of the faculty of the metallurgy department of which the mineralogical chemists Karl F. Rammelsberg and Otto Pufahl are well known to mineralogists.

The chemist Martin Heinrich Klaproth became a Dozent at the Bergakademie in 1784.

The concluding portion of the volume describes the present Bergakademie as it is incorporated in the Technische Universität Berlin 1970. It covers the present faculty and the students. It is customary in mining schools in Germany for the institution to have a statue of the patron saint of miners "Saint Barbara" in their halls. The frontispiece of the volume is a photographic copy of the "Berliner Barbara" created especially for the institution.

Students of earth science history will find this volume a very useful source. It should be in geological and mineralogical libraries.

GEORGE T. FAUST

MINERALOGISCHE TABELLEN, 5th revised and expanded edition. By HUGO STRUNZ with the collaboration of CHRISTEL TENNYSON. Akademische Verlagsgesellschaft Geest und Portig K.-G., Leipzig, 1970. p. viii+621. Price 47-DM Available through Buchhandlung Rothacker, Hardenbergstrasse 11, 1000 Berlin 12 (West).

This treatise appeared in four previous editions which have been reviewed in this journal as follows: First edition reviewed by A. F. Rogers, v. 33, p. 95–196, 1948; Second edition reviewed by Adolf Pabst, v. 35, p. 608, 1950; Third edition reviewed by Duncan McConnell, v. 43, p. 619, 1958; Fourth edition reviewed by Adolf Pabst, v. 52, p. 931, 1967.

This reference work has stood the test of time as judged by its frequent appearance in new editions. The fifth edition is a superb accomplishment. It is the only up-to-date and complete work on systematic mineralogy in existence. It is absolutely indispensable for every mineralogist and should be at the student's elbow in mineralogical and petrological laboratories where it should be frequently consulted. Museum curators and advanced collectors will profit from a study of this work.

In the fifth edition, 1745 minerals have been classified in the tables. The data given for each mineral, where available, include the reference to the first describer and the year of its description, the chemical formula, symmetry, cell dimensions, cell content, and short explanations of the structure type. In addition pertinent notes and brief comments are abundantly used in the text and the register at the end of the volume.

The late Dr. Waldemar T. Schaller commented to this reviewer, on several occasions,

that the notes in the register demonstrated Professor Strunz' acumen and splendid judgement as an interpreter of mineralogical data. He ranked these decisions with those of James D. Dana in his "System of Mineralogy".

The "Tabellen" contain numerous references to the original literature which will be very useful to the research scientist. The register of mineral names and of mineral names which have been withdrawn from the nomenclature is a most useful and valuable part of the treatise.

Although this book is printed in German the almost identical spelling of most mineral names in both German and English makes it possible to use this book with no knowledge of German. Such terms as are needed to translate the notes can be found in a German dictionary of scientific words. The language is no barrier to the major use of this book.

This treatise is introduced by a 90-page summary of crystal chemistry which contains Strunz' classification of the silicates. This classification, first introduced in 1938 as "Stereochemie der Silikatmineralien" [*Z. Gesamte Naturwiss.* **1938,** (5) 181–189], gradually became accepted and is now widely used by mineralogists.

The fifth edition of the Mineralogische Tabellen will be found to be an invaluable aid in the pursuit of mineralogical research.

GEORGE T. FAUST

CRYSTAL GROWTH IN GELS. By HEINZ K. HENISCH. The Pennsylvania State University Press, University Park and London, index, 1970, 111 pages. $6.95.

This is a brief monograph on the history, theory, methods, and problems of the growth of single crystals in gels. Profusely illustrated with a handsome color frontispiece tipped in, there are bibliographies for each of the five chapters. The first chapter on *History and Nature of the Gel Method* contains some practical recipes but the following section on *Gel Preparation and Properties* refers the reader to a laboratory manual. The theoretical discussion (p. 52) is marred by equations with undefined (s) and misprinted (T) letters. In any event, the reader must turn to the references for a full treatment. Using the volume is difficult since a particular topic may be discussed in several places. More responsible editing would have helped. Are most gels " . . . Anisotropic, except when under strain," p. 42? Is the fracture *conoidal* or conchoidal, p. 43? Nevertheless, the book is knowledgeable and informative and the author has style. " . . . there are not many fields left in the physical sciences which provide self-funded amateurs and unfunded professionals alike, with such a beautiful, congenial, and useful field of endeavor."

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ITALIENISCHE VULKAN-GEBIETE I AND II (SAMMLUNG GEOLOGISCHER FÜHRER 51 and 52). By HANS PICHLER. Gebrüder Borntraeger Verlagsbuchhandlung, Berlin, 1970. Vol. I, 258 pages, DM 37.50; Vol. II, 186 pages, DM 34.

During the spring of 1965, Hans Pichler introduced me to many of the classical volcanic areas of Italy, none of which had, to my dismay, an adequate geologic guidebook available to the non-Italian-speaking geologist. He was then compiling detailed notes and collecting numerous rock specimens with the idea in mind of eventually attempting to fill this gap. These two volumes, which cover Tuscany to the Gulf of Naples, represent two-thirds of his effort (a third volume on the Eolian Islands and Sicily is forthcoming), and, for anyone capable of even a little German, they provide an outstanding Baedeker to the late Tertiary-present volcanic regions of Italy.

Volume I begins with a clear discussion of rock terminology used in the book (the Streckeisen scheme), and a very useful appendix correlates old rock names based largely on type localities with corresponding Streckeisen ones. A 41-page introductory chapter outlines the overall geologic setting of the volcanic areas and their temporal and spatial relationship to Apennine tectonics, gives a brief resumé of pertinent radiometric age data, and speculates on parental magma types, their genesis, and their modes of differentiation. This speculation is, to me, the least successful part of the book, and at least some petrologists will blink at the easy acceptance of a "sialic-anatectic" origin for the parental magma in most Italian volcanic regions (Vol. I, p. 37–39 and many other places). Still, the speculation presents in summary form many challenging ideas from the Rittmann school—ideas that probably haven't been considered fully enough by some American petrologists. Numerous references make these introductory pages especially valuable.

The individual volcanic areas are grouped into three large provinces for the purpose of discussion: Tuscan (Monte Amiata and the Larderello hydrothermal area among others), Roman (Lake Bolsena, Lago di Vico, Lago di Bracciano, and the Alban Hills near Rome), and Campanian (Vesuvius, Phlegraean Fields, and Ischia among others). The Roman and Campanian Provinces together form H. S. Washington's famous Roman Comagmatic Region. Most space is naturally devoted to the most widely known and best studied areas; thus the Vesuvius section is 94 pages long, the Phlegraean Fields, 79 p., and Ischia, 56 p. For each individual area, Pichler sets the geologic and petrologic scene through a few pages of text, maps, and chemical analyses and plots. He then carefully describes selected important outcrops and their significance, outlines how to find them (complete with references to pertinent topographic and geologic maps), and presents chemical and petrographic data where available. Detailed recommended excursions and helpful hints to public transportation and overnight facilities highlight the longer sections. References are numerous, and many conflicting interpretations are presented (if not always dispassionately! See Vol. I, p. 177–179 on the evolution of Vesuvius magma). Pichler's interpretations of the petrology of some areas will be questioned by many petrologists, but this does not detract much from the overall usefulness of the book as a field guide.

Volume I contains sections on the Tuscan and Roman Provinces and the Vesuvius area, and Volume 2 deals with the rest. The division into two volumes was made so that neither would be overly bulky, a wise decision because of their intended field use. Both volumes have what look to be fairly complete subject and locality indexes and their own bibliographies. Either volume could thus stand by itself, but one would be foolish to go halfway, especially since the long introductory chapter and a useful tectonic map only occur in Volume I. I would have liked a regional geologic map to provide a better setting for the volcanic areas, but Pichler evidently decided that the geologic maps that he references for each area are sufficient. Armed with these volumes, a visiting foreigner will be able to locate most important outcrops and receive an excellent introduction to peninsular Italian volcanism.

These volumes are, however, much more than simply field guides. Together they provide, so far as I know, the best available source book on central Italian volcanism. This is largely because of their extensive bibliography, essentially complete up to, and including at least some references from, 1969. Volume I lists 431 references, and Volume 2, 239; some are duplicates, but the numbers give an idea of the worth of this bibliography to anyone who has delved into the hodge-podge of publications on Italian volcanism. A minor amount of confusion unfortunately results from the grouping of references according to chapters, and a few small errors typical of most bibliographies were noted. The book is also a good source because of its brief summaries of the geology and petrology of these classic volcanic areas, including the presentation of new interpretations and data in places (see especially

Vol. I, p. 130ff, on the development of Somma and Vesuvius, a substantial modification of Rittmann's 1933 interpretation.)

The sections on Vesuvius and the Phlegraean Fields are especially useful summaries. Many good papers dealing with these two areas have been published in relatively obscure journals of several languages, and Pichler's coordination of all this work into a concise, informative presentation will be much appreciated by volcanologists and petrologists.

The volumes are handsome, sturdily bound between flexible soft covers, and moderately priced (about $9.75 and $8.85 respectively). They should find a home in the jacket pocket or rucksack of every geologist visiting Italy, and their value as a source book also dictates that your office bookshelf be widened by one and one-quarter inches to accommodate them.

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X-RAY EMISSION AND ABSORPTION WAVELENGTHS AND TWO-THETA TABLES. Second Edition, prepared by E. W. WHITE AND G. G. JOHNSON, Jr. ASTM Data Series DS37A. American Society for Testing and Materials, Philadelphia, Pa., 1970. 293 pages. $54.00.

This work will be useful to any analyst employing methods of X-ray fluorescence or electron microprobe spectroscopy. It contains comprehensive and concise two-theta values for absorption edges and emission lines of the elements; appropriate two-theta values are given for 23 analyzing crystals that range between lead melissate ($2d = 160$ Å) and topaz ($2d = 2.71$ Å). The tables also contain entries for relative intensities of lines for a given element, estimated precision of λ, literature sources, and the electronic transitions involved in line production.

The two-theta data are arranged in two tables, separated by a convenient periodic table containing the wavelengths of the major lines for each element. The description of the tables is best taken from the *Foreword* of the work.

> "The first section presents all wavelength lines and X-ray absorption edges shorter than 160 Å*. Data in this section are listed on the basis of atomic number ($Z = 3 \rightarrow 98$) with decreasing λ within each element. The two-theta values are shown for a selection of the 15 most commonly used analyzing crystals.
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> "The second section gives all the lines shown in the first section arranged on the basis of increasing wavelength. Lines having a relative intensity of 1.0 or less are carried only to the third order. The most intense lines are carried to a maximum of the tenth order or until $n\lambda$ exceeds 160 Å*."

The data entries are small enough to allow compact listing in a book of reasonable dimensions, yet are sufficiently coarse for easy legibility. The book is thus convenient to handle, store, and read. An annoying aspect of the work lies in incomplete documentation and descriptions of the symbols used to code data in the tables. For example, Mg*AK* refers to the *K* absorption edge of magnesium, yet the designation *A* is nowhere explained in the description of the Tables. Similarly, MgSK_β' probably refers to a magnesium K_β line whose wavelength has been shifted because of chemical bonding effects, but the significance of this nomenclature is left to the readers discretion. Because of these instances of incomplete documentation, some practise will be required by individual users before the data in this book will become conveniently accessible. Even so, the scope and organization of the work should make it a valuable addition to the libraries of many rock and mineral analysts.

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ZUR GESCHICTE DER GEOLOGIE, GEOPHYSIK, MINERALOGIE UND PALEONTOLOGIE. By PETER SCHMIDT. Bibliothek Bergakademie Freiberg (Sachs), 1970. 134 p. Available from the author at Hochschulbibliothek, Nonnengasse 22, 92 Freiberg, Germany (DDR).

This is a comprehensive guide to source material on the history of earth sciences in the area that is now the DDR. In addition to a bibliography of nearly 700 citations to original works and biographies, it also lists primary source material of 150 scientists. These vary from single manuscripts or letters in some instances, to complete archives of scientific papers and collections. Even where these are held by families or individual collectors, addresses are given. Of course A. G. Werner leads the list of mineralogists, but significant amounts of primary material are also catalogued for A. G. Bergeat, J. F. A. Breithaupt, Serge von Bubnoff, C. F. H. Credner, K. W. F. von Fritsch, J. W. von Goethe, C. F. Naumann, C. C. Ochsenius, C. F. M. Websky, and C. W. Weiss. Mineralogical and petrographical collections include notations as to whether they contain type materials, and on that score alone the volume will be of direct interest to mineralogists. But as a guide to source material for historians of science it is a unique and powerful tool. Although it cannot pretend to be complete, it stands as an example that might well be followed in other countries.

WILLIAM T. HOLSER

THE ORE MINERALS AND THEIR INTERGROWTHS. RAMDOHR, PAUL (1969) (English translation of the 3rd edition by a team organized by Chr. Amstutz, with additions and corrections by the author). Oxford, Pergamon Press, 1174 pages, $54.00.

All students of the ore minerals know Ramdohr, but not so many of them feel at home with his sprightly German. This translation makes Ramdohr's 1960 work—and much more!—available to English readers. The additions and changes made by the author really make the English edition a new book, so that those who use the 1960 German edition or the 1962 Russian edition may find a few surprises and extra pleasures in the English version. An unobtrusive bonus of the English version is the inclusion or expansion of descriptions of about 40 additional ore minerals, more than half of them recently described or validated sulfides and sulfosalts.

The book is divided so: genesis of ore deposits, 77 pages; the fabric of ore minerals, 204 pages; descriptions of minerals, 811 pages (how the descriptions are organized, and how to study the ore minerals, 26 pages; descriptions of ore minerals, 762 pages; descriptions of common gangue minerals and alteration products, 23 pages); a list of typical occurrences—a locality index—41 pages; references (about 900), 32 pages; triple-column index, 4 pages; illustrations—mainly photomicrographs by Ramdohr—more than 600. About 340 ore minerals and 22 associates are described. The 340 ore minerals represent fully 70 percent of the extant species. The individual descriptions are comprehensive, the 12 separate parts clearly marked for ready reference: general data (formula and substitutions, space group, lattice parameters, habit and other important megascopic properties, including tarnish); polishing properties, including polishing hardness; reflection behavior, both qualitative and quantitative, emphasizing the color distinctions detectable to the trained eye; etch behavior, both "diagnostic" and structural; physical chemistry; fabric; special fabric elements; diagnostic features; paragenesis (mineral association) and its genetic significance; occurrences investigated, supplemented by the separate locality index previously noted; literature; abbreviated powder data, much of it in this edition from Berry and Thompson (1962), Mikheev (1957), and the ASTM powder data file.

Ramdohr's decision to exclude most of the highly-absorbing meteorite minerals and

their fabrics must have been a difficult one. Those of us who confess complete ignorance of this field of mineralogy can only hope that a Ramdohr *Meteoritmineralien* to match *Die Erzmineralien* will soon appear.

The section on the genetic systematics of ore deposits (p. 5–82) is a book in itself, likely to be overlooked by those who view the work only as a compendium of ore microscopy. This brief section could provide the outline for a breezy course in mineral deposits. The concluding chapter of this section presents in more detail a summary of metamorphic ore deposits that, as part of the 1960 edition, presaged a decade of search for and research on deposits whose distinctive features were long unrecognized.

The user of the English version should bear in mind that the German book was written largely b.p. (before the widespread availbility of the microprobe), a limitation of which Ramdohr was fully aware; before the completion of a prodigious number of experimental investigations of sulfide systems and their relatives; and before the burgeoning of modern quantitative data on reflectance, microindentation hardness, and rotation properties. What among the quantitative properties Ramdohr chooses to include, and why, gives the book much of its distinctive character.

Other reviewers have pointed out that the translation is expensive (U. S. price $54.00), out of date (more papers on the ore minerals were published in the last decade than in the preceding 50 years), and in places un-Englishly faithful to the original language (there were 32 translators and an author who sought accuracy, occasionally at the expense of easy English). But at 4.6 cents a page or about 7 cents an ore-mineral description, one can see the whole realm of the ore minerals through Ramdohr's microscope and camera—almost with his very eyes. For sight and insight, there's nothing to match Ramdohr (1969).

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SELECTED X-RAY CRYSTALLOGRAPHIC DATA, MOLAR VOLUMES AND DENSITIES OF MINERALS AND RELATED SUBSTANCES. Richard A. Robie, Phillip M. Bethke and Keith M. Beardsley. U. S. Geol. Surv. Bull. 1248, U. S. Govt. Print. Office, 1967, 87 pp., $0.35.

This small Bulletin would be most useful for anyone who needs cell volumes, X-ray densities, or cell dimensions of some 450 pure minerals and other inorganic compounds. It should be noted that these values both supersede and are more complete than Robie *et al.*'s earlier tables in the new Handbook of Physical Constants. For example, the cell volume for hedenbergite was rightly revised upwards from 65.97 in the Handbook to 68.30 cc. in this Bulletin. The only criticism this referee would offer is regarding substances with possible order-disorder. The 298°K cell volume for the fully-ordered substance is likely to be significantly smaller than for an only partially ordered synthetic substance. Thus the volume given for Ernst's synthetic (partially ordered) glaucophane II is 264.0 cc., whereas Borg has estimated the natural end-member (more fully ordered) glaucophane to be 262. cc. And low (ordered) cordierite has a volume listed in this Bulletin which is larger than that given for high (disordered) cordierite. A few phases of possible interest (magnesioferrite, chromite, ulvöspinel, halloysite, chrysotile, and merwinite) were omitted from this Bulletin but Robie *et al.* do give their cell volumes in U. S. Geol. Surv. Bull. 1259. This is an excellent reference book and a remarkable bargain at 35 cents.

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DIFFERENTIAL THERMAL ANALYSIS, Volume 1. Edited by R. C. Mackenzie. Academic Press, London and New York, 1970. 775 pages. $12.00.

Volume 1, "The Fundamental Aspects" (of Differential Thermal Analysis) is an impressive first of a two-volume set on the use of temperature-dependent thermal methods to identify, analyze, and characterize a wide variety of naturally occurring and artificially produced substances. Minerals are generously treated in the book, but almost equal space is given to metals and alloys, various salts of inorganic chemical compounds, organic compounds, polymers, biological materials, and solid fuels.

The book is broad, comprehensive, interdisciplinal in scope, and international in authorship. Although written entirely in English, it is authored by 25 specialists working in 9 different countries from both hemispheres. The individual papers do repeat some essentials and do overlap some, but not seriously and, although written in somewhat different styles, are straightforward and easy to read, probably because of careful editorial grooming.

Section A contains chapters on the historical development and basic principles of DTA, and its theory, instrumentation, and techniques, including various complementary methods, such as thermogravimetry, derivative thermogravimetry, evolved gas analysis, electrical conductivity, and high-temperature X-ray diffractometry. Mackenzie traces historically the thermal treatments of ores, rocks, and metals from antiquity as far back as 1000 B.C., through the marriage of pyrometry and clay minerals by Le Chatelier in the 1800's, and thence to the modern surge in DTA after 1945. Theory of DTA is treated with rigor. Commercial equipment of a dozen designs or suppliers, most of which is illustrated by photographs and schematic diagrams, is described in terms of technical specifications.

Section B, the largest, 450 pages long, is concerned with inorganic materials: metals, alloys, sulfides, selenides, tellurides, chlorates and perchlorates, oxides, hydroxides, carbonates, oxysalts, hydrated and anhydrous salts, zeolites, silica minerals, the gamut of clay minerals, tecto-, ino-, cyclo-silicates, zircon, and metamict phases. It is impossible here to say more than that the coverage is extremely thorough, and examples of materials, researches, data, and illustrations are drawn from world-wide occurrences.

Section C includes organic compounds of natural occurrence and synthetic preparation. Biological materials ranging from pollen and spores through tissues from higher plants, to humus, peat, coal—even to fluidized-bed DTA of fuel—are treated in detail.

Presentation of subject matter is soundly factual, pointing out what has been done with DTA, and also the difficulties that may arise and precautions to be observed in DTA, and observed limitations to quantitative analysis by the method. Reading the book is a stimulating experience. It is a delightful visit with many eminent investigative minds who lead the reader to many doors partly opened by their researches to inquiry and relationships far wider than most of us could visit alone.

A list of references concludes each chapter. Subject and author indices conclude the book. Twenty-five pages of author names, sampled at 80 authors per page, and estimated at 3 paginated references per author, yield a probable 50,000-plus, important, useful references in the book. Comprehensive coverage, authoritative authors, and good editing characterize this book; it is a volume that every serious worker in DTA must have at hand. It is the "last word" on DTA as of publication date.

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