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BOOK REVIEWS

PHASE EQUILIBRIA IN MULTICOMPONENT SYSTEMS by L. S. PALATNIK AND A. I. LANDAU, translated from the Russian by Joseph Joffe (1964). Holt, Rinehart and Winston, Inc., New York, 1964, x+454 pp., 27 tables, 260 figures, $15.00.

This book, originally published in Russian in 1960, reads well, being free of the grammatical awkwardness commonly found in translations. Understanding of the text does require an appreciable background in higher mathematics and chemical thermodynamics on the part of the reader. Methods of mathematical analysis, matrix algebra, vector spaces, multidimensional geometry, and topology are used freely. Some sections are comparatively free of mathematical treatment as indicated by the following quotation from the authors' preface: "Those who wish merely to acquire a practical grasp of the above rules and to use them in reading complex phase diagrams may omit the chapters containing the analytic material and study only Chapters I, II, and III, Section 2 of Chapter VI, and Sections 2 and 4 of Chapter VII." Part of this reference is clearly erroneous as there is no Section 4 of Chapter VII, and Section 2 of Chapter VI appears to the reviewer to be "analytic" in character. The correct parts seem to be Section 2 of Chapter VII and Sections 2 and 4 of Chapter VIII. Other editorial difficulties are evident in some of the derivations, where subscripts and other details of symbolism have not been accurately copied; this leads to considerable confusion on first reading. The pagination listed in the Table of Contents is also erroneous for all of Chapter VI and the first part of Chapter VII.

The following quotations from the authors' preface indicate the general features of the book: "The authors have attempted to develop a general topo-analytic theory of multicomponent systems. . . . The authors have attempted to utilize all the characteristic features of the Gibbs analytic method and of Kurnakov's topological (geometric) method, and to unite them in a single method. As a result, definite rules have been established for the geometric structure of phase diagrams (and their plane sections); schemes for various plane sections have been constructed; and laws relating to certain thermodynamic properties of multicomponent heterogeneous systems have been deduced."

In spite of these indications of broad coverage, the book is quite restricted in scope. It includes treatment only of eutectic and peritectic crystallization of compounds exhibiting no solution in the solid state from liquids with complete miscibility. Even the discussion of peritectic relations is very limited. Extension of the derived principles to systems of major interest in igneous and metamorphic petrology, where solid solution is common, or to sulfide systems, which involve both marked solid solution and liquid immiscibility, would require a large increase in complexity of the mathematics. Nevertheless, intensive study of the book by some mineralogists and petrologists seems worthwhile. Probably useful application of the rules and laws could be made in the investigation of evaporite deposits and mineralogy and in other complex systems in which solid solution is not prevalent.

PAUL CLOKE
The University of Michigan

DATA OF GEOCHEMISTRY, 6th ed., MICHAEL FLEISCHER, ed., Chapters F, G, K, T and Y. *U. S. Geological Survey, Prof. Paper* **440,** Govt. Printing Office, Washington, D. C.

Chapter F, 1963, Chemical Composition of Subsurface Waters by DONALD E. WHITE, JOHN D. HEM AND G. A. WARING.

This chapter begins with a genetic classification of subsurface waters, and then proceeds to a good brief review of the chemistry of various constituents. This presents the main features of recent investigations and gives many references. Most of the text deals with the characteristics of specific types of waters, the source of the constituents, and comparison with other types of waters. Frequent reference is made to literature related to genesis of the various types. Many excellent data are presented which should greatly aid research efforts of several sorts.

Chapter G, 1963, Chemical Composition of Rivers and Lakes by DANIEL A. LIVINGSTONE.

After the introductory statements, the factors controlling the composition and variability of lake and river water are discussed extensively. Supporting data from the tables presented are often cited. The relationship of composition to biological factors is stressed. A long discussion points out many sources of error and the difficulty of making proper interpretations due to a lack of uniformity in sampling, treatment, and analysis. Approximately the last half of the text draws generalizations and brief descriptions of the waters on a local and a worldwide scale. This is done first for the principal constituents, and then for the minor ones.

Chapter K, 1963, Volcanic Emanations by DONALD E. WHITE AND G. A. WARING.

For the most part the text describes observed chemistry and relations and generalizes from these data. Some commentary relates the data to genesis and discussions in the literature.

Chapter T, 1962, Nondetrital Siliceous Sediments by EARLE C. CRESSMAN.

The principal parts of the text of this chapter consist of a description of the occurrences of nondetrital sediments, which makes a useful addition to the tabulated data, a resume of the mineralogy, a section on the chemistry of the sediments with considerable discussion on the sources of the various elements and interpretations of the data, and a review of literature on the origin of such rocks.

Chapter Y, 1963, Marine Evaporites by FREDERICK H. STEWART.

This excellent treatment of the subject combines information from the literature, numerical and geological data, and interpretation by the author. Some sections are purely descriptive in character, others largely interpretation, and some vary from one to the other. The mode or occurrence, physical chemistry, natural deposits, and secondary changes comprise the longest portions of the text.

PAUL CLOKE
The University of Michigan

OPTISCHE BESTIMMUNGSVERFAHREN UND GERÄTE FÜR MINERALOGEN UND CHEMIKER (Technisch-physikalische Monographien Bd. 16). Goniometrie, Refraktometrie, Mikroskopie, Kolorimetrie, Photometrie, Spektrometrie, und Polarimetrie. HORST MOENKE AND LIESELOTTE MOENKE-BLANKENBURG. 568 pp., 264 Figs., 14 tables. Leipzig, 1965. Akademische Verlagsgesellschaft Geest & Portig, K.-G. 62.50 DM.

The text *Optical Determinative Procedures and Instruments for Mineralogists and Chemists* covers in a rather general way the use of a number of kinds of optical instruments. In the first chapter, one and two-circle goniometers and refractometers are described. The use of the optical goniometer for measuring interfacial angles and for measuring the refractive indices of crystals by using properly oriented prisms is discussed. Refractometers are explained in more detail, including a discussion of interferometric gas refractometers and of automatic refractometers used in process control.

Microscopy with transmitted and reflected light is discussed, along with many brief descriptions of instruments not usually covered in the mineralogical literature. Among such instruments are ultraviolet, infrared, interference, phase contrast, television, vacuum, high and low temperature microscopes. Fifteen pages are given to an explanation of electron microscopy.

The most lengthy discussion (319 pages) is devoted to colorimetry and photometry, and spectrometry. A large number of spectrophotometric instruments are described, as well as ultraviolet, vacuum ultraviolet, infrared, and Raman spectrographic equipment. Direct reading instruments, densitometers, and x-ray fluorescence spectrometers and the electron probe are also described.

The authors discuss polarimeters in Chapter 4 and conclude the text proper with a brief chapter on new developments in instrument design. The bibliography of twenty-eight pages, arranged by chapters, contains well selected references from textbooks, journals and manufacturers' literature.

The book is noteworthy in that specific instruments of many manufacturers are described and listed. Such a compilation is particularly useful. The discussion of the theory and operation of the instruments is not sufficiently detailed to serve as a fundamental grounding in their use, but it is adequate for the intended purpose. I believe that the book will be of unique value to students using the instruments described, laboratory technicians, directors responsible for the purchase of new instruments, and gadget-oriented scientists. The book can be of value to interested persons whose reading knowledge of German is quite marginal.

R. M. Denning
The University of Michigan

INTRODUCTION TO SOIL BEHAVIOR by Raymond Yong and Benno P. Warkentin. 451 pp. The Macmillan Co., 60 5th Ave., New York 11, N.Y. 1966, $12.95.

The dust jacket states that the book is:

> "A complete and modern introduction to soil behavior—emphasizing the latest research findings of several disciplines, and integrating physical-chemical principles essential to engineering usage:"

Unfortunately, the volume does not bear out this statement. The following, is a partial list of serious deficiencies:

1) In their discussion of layer silicate structures there is no mention of Radoslovich's extensive series of articles in *Am. Mineral.*, 1962.
2) The Gouy-Chapman theory applied to clay systems requires a constant surface charge, not the classic constant surface potential treatment. This distinction and its importance was made clear by van Olphen (*An Introduction to Colloid Chemistry.* Interscience, New York, 1963).
3) There is complete reluctance by the authors to admit the significance of particle contacts, a point which has been amply documented in the literature. See for example, Norrish, K. and Rausell-Colom, J. A. in *Clays and Clay Minerals,* Pergamon Press, New York, v. 10, p. 123–149, 1963. Schofield, R. K. and Samson, H. R. in *Clay Minerals Bulletin,* **2,** 45–50, 1953.
4) The dominant role of fabric in controlling fluid flow through a clay bed has been clearly demonstrated by numerous investigators. (See for example, Michaels, A. S. and Lin, C. S. in *Ind. Eng. Chem.* **46,** 1239–1246, 1954, and Olsen, H. W. in *Clays and Clay Minerals,* Pergamon Press, New York, v. 9, p. 131–161, 1962.) In this volume all fluid flow peculiarities are attributed to the fluid itself.

5) Hydrogen bonding of water to clay has long been a popular notion. The authors perpetuate the opinion without noting one of the very few experiments where precise data were obtained which came to the conclusion that H bonding does not exist even in vermiculite at the two water layer phase (*Jour. Chem. Phys.*, **40,** 540–550, 1964).

The ambiguous handling of many topics covered is illustrated by the section on clay mineral identification.

The excessive peak breadth and distorted relative amplitude on the *x*-ray traces for reference clay minerals would not be recognizable if not labeled. Figure 3–22 which is purportedly a typical diffraction trace of a soil clay shows numerous reverse curves that one must attribute to sloppy draftsmanship. The authors are apparently completely unaware of standard *x*-ray diffraction procedure in reporting powder data. Identification does not require an intimate knowledge of n. In fact, if enough information is available to make a legitimate use of n, the species are already well identified. In analyzing the data in Fig. 3–22 the authors list 18 peaks but only identify 12. If the six unidentified are insignificant, some readers may wonder why they are listed. The assignment of Peak 3 at 8.4 Å to amphibole illustrates a common fallacy of making mineral identification on peak position only. Disregarding relative intensity can be serious, if Peak 3 is from amphibole then there must be several other much stronger peaks from amphibole in the diffraction trace (making due allowance for orientation effects).

This hodgepodge of incomplete and misinformation concerning *x*-ray diffraction data is very adequately summed up in problem 3.4.

"An *x*-ray diffraction pattern spectrometer tracing of a clay sample shows peaks at $2\theta = 5°$, 10°, 12.2°, 24.7°, and 25.5°. Copper K_α radiation is used, for which $\lambda = 1.541$Å. What minerals are present in the sample?"

The authors apparently consider this adequate information for mineral identification because the problem continues—

"If the measured cation exchange capacity is 40 me/100 g, what is the approximate proportion of the two clay minerals in the sample?"

Another fine example of the treatment given each topic is found in the discussion of interparticle forces. On p. 65 the reader is told—

"The forces of attraction can be manifested only if the conditions do not favor repulsion."

whereas on p. 169 authors state—

"A sample allowed to swell without being loaded will increase in volume until forces of attraction balance the forces of repulsion."

Soil engineers in general should be pleased with the elevation of void ratio, water content, and bulk density to basic property status which eliminates the need for such secondary properties as strength, permeability, and compressibility. Apparently most students are unable to grasp the significance of such basic properties; therefore, the authors attempt to clarify some of these secondary properties in the ten subsequent chapters.

R. Torrence Martin
University of Minnesota