Physical and Chemical Hydrogeology, 2nd edition

This book attempts to be both introductory and comprehensive. This is an ambitious undertaking, yet it appears to have anticipated real needs as evidenced by the publication of a second edition. This edition has 21 chapters compared with 18 in the first edition; however, more than 3 new chapter titles have been added as other rearrangements have been made. The additional material focuses on multiphase flow (Chapter 19), remediation (Chapter 20), and risk assessment (Chapter 21).

This book is encyclopedic in nature. It presents a wide range of subjects. While the authors provide a clear general framework, at times individual topics appear without a clear context. This leads to the impression that the inclusion of many topics was a higher priority than synthesis into an integrated whole. As a reference work, this book is valuable. The reader, however, must use the material with caution. As a textbook, this book requires considerable emendation and correction.

This book purports to provide a quantitative view of hydrogeology. As such, a large number of equations are presented and described; however, this is a book written about mathematics rather than on how to apply mathematics. Thus, the book is actually a qualitative view of hydrogeology. This distinction is important to warn the reader that either prior mathematical skills are needed or at best only an appreciation (as opposed to facility in the use) of equations can be expected from this book.

Two examples of the concerns mentioned above are illustrated. The first involves the orthogonality of equipotentials and streamlines. This principle is correctly stated in words. But a number of graphs violate the principle (Fig. 4.9 and 5E1, page 78, for example). This may mislead the novice. The second example involves the principle of superposition. On page 119 it is stated: “Linearity in differential equations is synonymous with the principle of superposition,” whereas actually both linearity and homogeneity are needed for superposition. Subsequently, Eq. [6.42] is presented as a direct result of superposition. In fact it is limited as a general statement of superposition (see p. 103 of Mathematics Applied to Deterministic Problems in the Natural Sciences by C.C. Lin and L.A. Segel for a better mathematical statement of superposition). The quantitative implementation of Eq. [6.42] treats superposition as equivalent to simple addition (as also stated on page 119) without mentioning the need (or mechanism) to ensure that the correct boundary conditions are satisfied. The authors then attempt to apply superposition inappropriately (as also stated on page 119) without mentioning the need (or mechanism) to guarantee that the results are physically meaningful. The authors recognize that the results are unreasonable. The only saving grace here is that the authors earlier on page 112). The problem is clearly nonlinear due to changes in transmissivity (as noted by the authors on page 125). This may mislead the novice. The authors then attempt to apply superposition inappropriately (as also stated on page 119) without mentioning the need (or mechanism) to guarantee that the results are physically meaningful. The authors recognize that the results are unreasonable. The only saving grace here is that the authors earlier on page 112). The problem is clearly nonlinear due to changes in transmissivity (as noted by the authors on page 125) without mentioning the need (or mechanism) to guarantee that the correct boundary conditions are satisfied. The authors then attempt to apply superposition inappropriately (as also stated on page 119) without mentioning the need (or mechanism) to guarantee that the results are physically meaningful. The authors recognize that the results are unreasonable. The only saving grace here is that the authors earlier on page 112).

The content of the book includes chapters on preparation and cleanup of samples, liquid chromatography, nuclear magnetic resonance (NMR), UV spectroscopy, microchemical techniques, enantiomers, and electrophysiological methods. The emphasis in both volumes is on useful advice and not commonly provided in texts and from instrument manufacturers. Indeed, this is the essence of this book.

For the chemical methods in chemical ecology, two aspects require emphasis. One is the preparation of compounds of absolute purity, and often only small amounts. The other is the use of instrumental analysis to elucidate structure. The result is the use of many techniques, where different instruments are connected in series, and also the modification of instrumentation of sample fractions from machines normally used for destructive analysis. Clearly there is a lot of art and skill in chemical ecology, a discipline in which creative advice is crucial and not commonly provided by instrument manufacturers. Indeed, this is the essence of this book.

The content of the book includes chapters on separation and cleanup of samples, liquid chromatography, nuclear magnetic resonance (NMR), UV spectroscopy, microchemical techniques, enantiomers, and electrophysiological methods. The emphasis is on advice as one might give to a favorite graduate student. For example, one chapter discusses the use of chromatography methods and lists the abbreviations: DQF-COSY, TOCSY, HOHAHA, NOESY, HETCOR, COLOC, HMQC, and HMBC. The emphasis is on advice as one might give to a favorite graduate student. For example, one chapter discusses the use of chromatography methods and lists the abbreviations: DQF-COSY, TOCSY, HOHAHA, NOESY, HETCOR, COLOC, HMQC, and HMBC.

Some highlights for me were Chapter 2, where the logical sequence of chromatography methods are described. Chapter 1 describes the use of chromatography methods and lists the abbreviations: DQF-COSY, TOCSY, HOHAHA, NOESY, HETCOR, COLOC, HMQC, and HMBC.