



BOOK REVIEW

Petroleum Geochemistry and Geology, by JOHN M. HUNT. 2nd Edition. W. H. Freeman and Company, New York. 1995. 743 pp. ISBN 0-7167-2441-3. Hardback. Price \$59.95.

Sixteen years ago (1979) John Hunt published one of the first textbooks for petroleum geochemistry, entitled "Petroleum Geochemistry and Geology". This book was a monumental achievement which has served as a guide and reference for many with an interest in the application of geochemistry to petroleum exploration. As the author points out in the **Preface** of his second edition, this book "is not just a revision of the first edition; it is a whole new book", and the reader will quickly discover how true this statement is. The new book is larger (743 pp. vs 617 pp.) and more comprehensive, but it retains the very readable style of the original.

Starting with the **Contents**, the reader is presented with a comprehensive outline. The logical organization of the book is then interrupted, unfortunately, by the **Color Plate Legends** for a set of illustrative and informative plates, inserted between pages 396 and 397. These legends should have been placed with the plates. Next, a **Foreword** by Gerard Demaison is followed by the author's **Preface**, which elegantly and succinctly describes what this book is all about. "The objective of this book is to explain the basic principles of petroleum geochemistry and to show how they can be integrated with geology and geophysics to reduce the risk in petroleum exploration". The title of the next section, **Abbreviations Used in the Text***, ends with an important asterisk that directs the reader to other abbreviations which appear elsewhere in the book. For completeness, more abbreviations should have been included in the main list, such as BOE (barrel of oil equivalent), FTB (fold and thrust belt), HI (hydrogen index), OI (oxygen index), ROF (reservoir oil fingerprinting), Rr (random reflectance), TBOE (trillion barrels of oil equivalent), and TM (thermal maturity).

The text of 16 chapters is divided into four parts—**Introduction** (3 chapters), **Origin and Migration** (6 chapters), **Habitat** (3 chapters), and **Applications** (4 chapters); there is a total of 272 figures and 8 color plates. Each part is preceded by an excellent photograph depicting an aspect of the petroleum industry, and each chapter begins with an introductory statement and concludes with a concise summary. A busy reader can get the essence of each chapter by reading these elements only. The book is truly international in outlook, with examples of oil-producing fields and regions from throughout the world. Units are usually given in metric and English systems, and **Appendix 1** provides a guide to units of measurement. Additional conversions which should be added to the list include gal/ft³ to l/m³, ft³ to bbl, bbl to metric tons, psi to kPa, ppm to gm/l, ft³/bbl to ppm, m³ to ft³, and bbls/acre-ft to metric equivalent. **Appendix 2** is the Geologic Time Scale followed by a **Glossary** [which could be improved by correcting the definition of CPI (Carbon Preference Index) and adding such items as OEP (Odd–Even Predominance), and Vitrinite Reflectance (Ro)]. Next are the **References** (911 entries), **Name Index**, and **Subject Index**, all of which are quite complete. The book is remarkably free of error.

There are a few problems with references to page and figure numbers, but I found only six other typographical errors.

As the author notes in his **Preface**, "A major problem in writing this book was in selecting examples of the key concepts from the large number of good papers published in the last few years....Summarizing all this became a monumental task". The author has accomplished this difficult task very well, creating a lasting legacy that clearly reflects the fundamentals of petroleum geochemistry, particularly the progress that has been made during the past fifteen years. It is ironic that during these same years of spectacular advancement of this science, the interest by major operators in the petroleum industry has waned. However, interest may be rekindled by this compelling book.

In only a few places do problems occur in the orderly development of the text from basic concepts to practical applications. For example, the author mentions vitrinite reflectance, a most important facet of petroleum geochemistry, on p. 106 and p. 214 without explanation, yet he could easily have directed the reader to detailed discussions beginning on p. 365 and p. 507. Likewise, he introduces catagenesis without explanation on p. 17, whereas he could have directed the reader to p. 62 for more information. Fortunately, 'catagenesis' can be found in the **Glossary**. In addition, in his lucid description of stereochemical nomenclature beginning on p. 91, he illustrates the concepts with steranes and 'non-hopanes' before these compounds are formally described. I was surprised that pages of the first edition were referenced in the second edition. It turns out that the new book contains some, but not all, of the important information of the original. Only Chapter 3 on petroleum refining and a few short sections in other chapters are similar to the first book. Therefore, it is necessary to consult both first and second editions for a really comprehensive view of petroleum geochemistry.

In structuring the second edition, the author elected to exclude two important items from the first edition. First, the equations for low-temperature reactions occurring during diagenesis (Fig. 4-11, first edition) are not detailed in the second edition. Second, the pressure–volume diagram (Fig. 5-5, first edition) for identifying gas hydrates in a pressure core test is not included in the new version. This diagram, in my opinion, was the centerpiece in the original discussion of gas hydrate, and this discussion set the stage for much of the research that followed in the succeeding fifteen years. Unfortunately, the author has not updated his discussion of gas hydrate significantly; he includes old information (for example, Table 7-3) that can be misleading. Also the role of gas hydrate as a permeability barrier is probably overstated.

Some of the high points of the new book include: (1) a superb introduction to organic molecules found in petroleum, (2) probably the clearest explanation of petroleum generation pathways ever written, (3) an excellent summary of biological markers as source and paleoenvironmental indicators, (4) good descriptions of isotopes and stereochemistry, (5) a lucid discussion of the role of transgressions and regressions of the oceans, (6) clarification of the concepts of oil window and bitumen window, (7) excellent examples of the application of time–temperature history to source rocks, (8) clear discussion of the processes

leading to natural gas, (9) worldwide examples of petroleum occurrence, (10) a thorough consideration of source rocks, (11) summary charts of biomarker and organic maturation, (12) excellent illustrations of biodegradation, (13) dramatic evidence of the power of the petroleum geochemical approach to find oil and gas, (14) a careful analysis of the pros and cons of geochemical prospecting, and (15) numerous practical applications of petroleum geochemical techniques. The only thing missing from this new book is a discussion of environmental concerns resulting from petroleum exploration and particularly from petroleum exploitation, such as oil spill clean up from surface and ground waters and bioremediation.

The style of the book is one of confidence in understanding the petroleum processes—formation, migration, occurrence, and alteration. It presents an outstanding summary of much of the new knowledge gained over the last fifteen years. The writing is very clear, as is typical of the author; one can almost hear him speaking. An example is from p. 550 where he writes "Nearly all the alkanes used for correlation are long gone before the steranes are attacked." I wonder how the expression 'long gone' will appear in translation in other languages, which certainly will happen with a book of this high caliber and utility.

My main reservation about this new book is that it may be too good! Some readers may be seduced into thinking that petroleum geochemistry is synonymous with organic geochemistry. When, in fact, petroleum geochemistry is a subset, albeit a large subset, of the major earth science discipline of organic geochemistry. No doubt my worry is minor in that John Hunt's book has greatly enhanced both petroleum and organic geochemistry. This book is an absolute must for petroleum explorationists, petroleum geologists, petroleum geochemists and all organic geochemists. It will benefit the petroleum industry from managers to technical personnel. The book will also be a great read for anyone with an interest—from those with even the slightest interest to those with an abiding interest—in the transformations and implications of organic matter in the crust of the earth.

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