

Books for Geoscientists

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Manganese Ores of Supergene Zone: Geochemistry of Formation

By Igor M. Varentsov, Kluwer Academic Publishers Group, P.O. Box 989, 3300AZ Dordrecht, The Netherlands, 1996, xii + 342 p., hardcover (ISBN 0-7923-3906-1): \$185.00.

Academician Varentsov is one of the world leaders in research on manganese ores and has written many interesting and provocative articles about them. Therefore, a book from him is very welcome. The current offering, in fact, gives many new insights but also has some flaws that will make it less useful for the broader geological audience than I had hoped.

The topic covered is the geology and geochemistry of supergene manganese deposits, that is, those formed by severe weathering of pre-existing Mn-rich rocks. The book's great contribution is documentation of how widespread this kind of alteration really is. Many features that other workers have attributed to primary depositional or early diagenetic effects are shown here to be produced in the zone of weathering. Most, if not all, manganese ores seem to have been Mn-carbonates by the time they passed through the early diagenetic phase. Their present occurrence as oxides is, in many cases, a late weathering overprint.

Varentsov describes in detail how this transformation to supergene oxides occurs. To do so, he presents several well documented case studies. The first is Groote Eylandt in northern Australia, generally regarded as a primary oxide deposit, but here shown to be largely supergene, a view that has been confirmed recently by radiometric dating (Damas and others, *Economic Geology*, v. 91, 1996, p. 386-402). The book also extensively discusses the ores at Moanda in Gabon, as well as karst-hosted Mn at Urkút, Hungary, at Postmasburg, South Africa, and at Imini, Morocco.

There are two flaws with the book from my perspective. First, it is written in a very dense "Russian English" with an erratic distribution of the article "the." The result is a text that is very tough going. I doubt any student would have the persistence to read much of it. This lack of good editing confines use of the book to manganese specialists. Specialists, however, will find a curious omission - there is no treatment of battery-active manganese oxides. In several deposits, most notably at Nsuta in Ghana but also at deposits like Molango in Mexico, the high-value product is not the high-volume metallurgical manganese oxide but small amounts that can be used directly in making batteries. Why this material is battery active and how best to explore for it are unknown (the mines assesses ore quality by making

sample batteries). The geochemistry of formation of this material is the major unsolved problem of manganese ore genesis, and I had hoped to learn more about it.

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Chemical Fundamentals of Geology

Second Edition, by Robin Gill, Chapman and Hall, 2-6 Boundary Row, London, United Kingdom, SE 1 8HN, 1996, xiv + 290 p., softcover (ISBN 0 412 549930 1): \$31.00.

Every so often a new geochemical text appears on the bookshelves of college and university bookstores. Typically, these textbooks are an unsatisfactory melding of elementary chemistry with elementary geology, the net result being similar to "your friend the atom" meets "your friend the rock." Fortunately, the latest addition to this expanding list is the recently published *Chemical Fundamentals of Geology* written by Robin Gill of the University of London, the second edition of a book originally published in 1989. In this edition, the author expands on his original effort "...to introduce the ordinary geology student to chemical principles which are fundamental to the science of geology." He does this admirably with a well written text that clearly and concisely presents chemical principles ranging from the concept of energy (mechanical, chemical, free energy, equilibrium, phase diagrams, and so forth) to a comprehensive discussion of geologically important elements. Among the chapters are discussions of equilibrium, kinetics, aqueous solutions, atomic structure, the Periodic Table, silicate systems, and elements in the universe.

What sets this book off from standard geochemistry texts is the author's use of "boxes" to expand and elaborate on concepts only briefly mentioned in the main text. There are over 50 boxes that include discussions of significant detail to satisfy the more advanced students, even those at the graduate level. Of particular note are boxes dedicated to explaining activation energy, diffusion and cooling rates, redox, fluid inclusions, and ion pairs in sea water. This approach allows the more casual reader to concentrate on basic geochemical concepts during the first reading while allowing the chemically literate reader to pursue details provided in the boxes.

The author is not deterred in this introductory text from presenting concepts such as wave mechanics and quantum numbers to describe atomic structure. This approach adds greatly to the overall presentation of chemical bonding and description of the Periodic

Table, including discussions of electronegativity, valency, and atomic spectra. One failing, however, is that the author does not fully link these fundamental concepts in follow-up discussions of various forms of chemical bonding occurring in specific mineral groups. Additionally, and more noteworthy, the book relies too heavily on examples of igneous and other high-temperature processes. Discussions of aqueous and environmental applications are limited, despite comments to the contrary in the preface. Clay minerals are mentioned only in the brief discussion of sheet silicates.

The textbook is extremely well illustrated with numerous high-quality figures and charts supplementing the main text and the boxes. Each chapter includes a short bibliography of references for further reading, and a set of exercises with answers given in an appendix. A glossary, discussions of general mathematics and solution chemistry, and a list of chemical elements comprise separate appendices. The most attractive feature of the second edition of *Chemical Fundamentals of Geology*, released only in paperback, is its affordable price (\$31.00). It is nice to see a publisher intentionally keeping the price low so that all students can afford a high-quality geochemical text.

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Practical Formation Evaluation

By Robert C. Ransom, John Wiley & Sons, Inc., 605 Third Avenue, New York, New York 10158, 1996, xiv + 490 p., hardcover (ISBN 0-4711-0755-7): \$79.95.

This book provides good discussions and some new information that may not be available in other well-logging textbooks. Many illustrations, however, especially logs, are not readable, to the point that they fail to illustrate intended concepts. Although poor quality in original logs may be the reason, illustrations should have been modified and adapted for the size of the book before inclusion.

Development and discussion of petrophysical models underlying well-log analysis is good. It appears, however, to be somewhat outdated regarding use of currently available computer tools (hardware and software) for well-logging operations and interpretation. Most references cited in the book appear to be rather dated. In fact, references to well-logging research conducted in the 80s are limited, and almost no references from the 90s are cited.

The book starts with a description of the reasons for using well logs in formation evaluation, followed by discussions of logging environment, types of logs used historically, and those currently available. The first seven chapters are devoted to describing various types of open-hole wire-line well logs and their principle of measurement. The material presented in these chapters also illustrates the interpretation procedures. Chapter 2 addresses spontaneous potential measurement and considers the relationship between measured potential and the borehole environment. Chapter 3, dealing with gamma-ray logs, usefully discusses the effect of logging speed on the

measured GR response. It also presents practical methods of extracting clean sand reading and 100 percent shale reading based on GR response. Most of Chapter 4, on resistivity logs, closely resembles that available in most other logging books and service-company literature.

Chapters five through seven are about density and neutron- and acoustic-porosity logging, respectively. Chapter 5 has good illustrations and matrix density, capturing cross-section data for most relevant natural materials. Chapter 6 well illustrates operational aspects of neutron-porosity tools and data related to the hydrogen content of many geological materials. Chapter 7 has data on the compressional sound velocity through relevant geological materials and presents the principles and applications of acoustic logs.

Chapters eight through seventeen deal with interpreting petrophysical properties based on logging measurements described in chapters two through seven. Material in these chapters describes and illustrates use of cross plots to obtain reservoir characteristics, such as effective, non-effective and secondary porosity; fluid saturations; formation factor and saturation exponent; clay types and mineral distribution; and organic matter index and pore pressure.

Chapter 10 discusses estimating effective and non-effective porosity and the resistivity of free and bound water when limited log information is available. The book, however, does not complete the loop on saturation determination, and the examples given are rather superficial. Chapter 12 discusses the phenomenon of invasion and its effect on radial-resistivity profile. Chapter 13 explains determination of organic matter in source rocks. However, the book's presentation of OMI (organic matter index) determination is rather vague. Chapter 14 discusses the unique response of thin-bedded sands and methods for determining effective saturation in thin-bedded hydrocarbon reservoirs. It presents good discussions relevant to obtaining improved reserves estimates in thinly laminated shale sands. As in the earlier chapters, however, this chapter lacks quantitative examples.

Chapter 15 is devoted to identifying over-pressured zones from logs. As before, examples are generally qualitative. Chapter 16 presents qualitative information/discussions on methods for identifying secondary porosity and fractures. The book, however, omits some of the most important and generally available direct methods of identifying fractures, such as those based on acoustic response and on formation-micro-scanner tools.

Chapters 17 and 18 are related to production logging and essentially focus on the special topics of Pulsed-Neutron capture cross-section logs and temperature logs, respectively. Chapter 17 provides balanced descriptions, discussions, and quantitative analysis of Neutron sigma methods and log-inject-log methods. Relevant mathematics for using these methods are also included in the book.

Appendices A and B list symbols and subscripts, respectively, used in formation evaluation. Appendix C provides a tabular listing of the response of different logging tools in commonly encountered geological

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