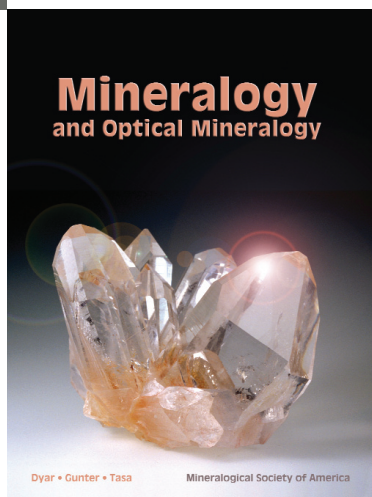


MINERALOGY AND OPTICAL MINERALOGY¹

I believe that mineralogy is the core discipline of the geosciences; that it is the subject which underpins our understanding of the Earth in the way that molecular biology underpins our understanding of the life sciences. This has yet to be appreciated by many of our colleagues in other disciplines and by many of the young people starting their studies in colleges and universities around the world. Convincing our colleagues of the importance of mineralogy and the cognate subjects of petrology and geochemistry is one of the challenges being addressed by *Elements*, but attracting the interest of new generations of students is the job

of teachers and those who produce textbooks and course materials. This was the challenge facing the authors of *Mineralogy and Optical Mineralogy* and one to which they have responded admirably. Of course, Darby Dyar and Mickey Gunter are experienced teachers and were themselves taught by the finest mineralogists of the previous generation. They fully appreciate that many beginning students find mineralogy either difficult or just dull, and that it is the job of teachers and textbooks to bring alive its fascination and its relevance in the modern world.

In a lengthy preface, the authors point out what is different about this book when compared with other books covering the same or similar ground. Emphasised are the way in which it uses modern pedagogy and an integrated DVD-ROM that covers all of the material in the text rather than only being a supplement to it. Also, rather than having a comprehensive mineral database within the text or as a written appendix, this information is placed on the DVD-ROM and can readily be searched. The preface also addresses the issues facing the teacher of mineralogy in how best to make use of the book, which is logically structured from the simpler material to the more complex and in which sections could certainly be used for teaching at different levels.

This is a hefty volume – over 700 pages in ‘A4’ size with a double-column format. Twenty-four chapters cover topics ranging from hand-specimen identification, elementary crystallography, crystal chemistry and optical mineralogy to more advanced aspects of crystallography or optics; the book also covers more specialized areas, such as the chemical analysis of minerals, mineral nomenclature and mineral classification. Some quite challenging areas, which are not usually addressed in detail in such textbooks, are included; for example, a chapter is devoted to mathematical crystallography and another to an extensive discussion of X-ray diffraction. The writing throughout is clear, with a more informal style than is customary in science textbooks. Each chapter begins with a one-page personal statement by one of the authors, often including an anecdote relating to their own experience of the subject matter to be presented in the chapter. I found this a little strange at first, but it is an approach to engaging the students’ interest that many teachers use when standing in front of a class, and if it helps to make the subject more accessible, that can only be a good thing. The hard-copy text contains many illustrations, all in black and white; this could be a problem were it not for the accompanying DVD-ROM, which is a *tour de force* of this relatively new art form. Not only are the text figures produced in colour on the DVD, but many are animated or interactive. And some are inventive or just plain fun. I particularly liked the ‘do it on screen’ Becke line test and the pig race illustrating the Heisenberg Uncertainty Principle.

What might be termed ‘systematics’ and commonly occupies a substantial percentage of the space in more traditional textbooks is covered here in just two chapters, one on silicate minerals and the other on non-silicates. The emphasis in the text is on concepts and principles, rather than on what can be a laboured account of all the mineral groups (elements, oxides, sulphides, sulphates, chlorides, carbonates, silicates, etc). The authors also emphasise the great geological importance of a very small number of minerals, what they term their ‘big ten minerals’. That said, for the student or more experienced worker, the mineral database provided on the DVD-ROM is a remarkable resource, with information on a very large number of minerals – certainly almost all that a student might encounter. This includes data on physical properties, chemical composition, crystal class and habit, optical properties, crystal structure and geological occurrence, as well as full-colour pictures of hand specimens and photomicrographs in transmitted or reflected light under various conditions. Data can be accessed via an alphabetical listing of mineral names, or the whole database can be searched via the input of data on properties.

This book certainly does live up to the claims made by its authors of being ‘different’. Its refreshingly new approach to teaching the basics and certain higher-level aspects of mineralogy is most welcome, and the authors and the publishers (unusually here, a learned society rather than a commercial publishing house) are to be congratulated on their achievement. It belongs on the bookshelves of all who teach the subject, and should help to inspire a new generation of mineralogy students.

David Vaughan

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Mineralogy and Optical Mineralogy
by Darby Dyar and Mickey Gunter
Illustrated by Dennis Tasa

- A textbook designed for college-level courses in rocks and minerals, mineralogy, and optical mineralogy
- Covers crystallography, crystal chemistry, systematic mineralogy, and optical mineralogy
- Organized to facilitate spiral learning of increasingly complex material
- DVD-ROM (included) with well over a thousand animations plus full-color images of all figures in text
- Printable, searchable mineral database on DVD-ROM to allow customized creation of lab manuals
- DVD-ROM has demo versions of CrystalMaker software to view mineral structures and simulate their power and single crystal diffraction patterns.
- Ordering info, book and DVD-ROM content at www.minsocam.org/MSA/DGTtxt
- Non-member price: \$90, member price: \$67.50
ISBN 978-0-939950-81-2

¹ Dyar MD, Gunter ME, Tasa D (2008) *Mineralogy and Optical Mineralogy*. Mineralogical Society of America, 708 pp, ISBN 978-0-939950-81-2

BIOGEOCHEMISTRY OF ESTUARIES²

Estuaries are zones where land meets sea, and throughout history, they have been the loci of intensive human colonization for reasons such as food and transportation. As an interface, this zone is thus home to many interesting geochemical reactions, especially ones forced by the frequently intense biological activity in this environment. Indeed, there are few environments that have so many strong interfacial gradients in such close proximity to one another and that change so frequently. Understanding the biogeochemistry of this environmental interface has not been optimized by the ways in which educational and funding structures are organized; they usually focus on one side or the

other of the interface. Despite common themes in terrestrial and marine environments, many features differentiate them: ionic strength and plant types come quickly to mind. Thus, people coming to study this interface usually must approach it from either the marine or the terrestrial side.

Biogeochemistry of Estuaries, by Thomas Bianchi, provides both introductory and encyclopedic coverage of this interface. It can thus serve students from non-geochemical backgrounds who wish to work in estuaries and need to learn their biogeochemical side. Likewise, it can serve as an extended review of the biogeochemical peculiarities of this environment for geochemists working in other realms.

As befits a zone defined partially by its geomorphology, the book starts with a discussion of the shapes of estuaries. Acknowledging the central role of topology in affecting so many estuarine processes, the book provides the reader with both an appreciation for the geological forcings that created estuarine shapes and the variety that ensued. It moves on to consider water movements, starting with those originating in the watershed and continuing on to styles of mixing with the sea. The next two chapters consider the addition of chemicals and particles to the water and provide brief introductions to basic concepts of water chemistry in an estuarine context. The intellectual tools introduced in these physical science chapters are vital textbook material for persons without previous exposure.

The chapter on gases is a welcome introduction to a body of problems and literature that is assuming increasing significance in a world whose atmosphere is changing. The chapter on sediments follows the approach of the hydrodynamics chapter by acquainting the student with both land-based supplies of sediment and the physical aspects of sediment movement within the estuarine zone, which, later in the book, will be seen to affect chemical distributions. An isotope chapter provides an extensive review of radioactive and stable isotopes and their applications in estuarine situations.

The chapter on organic matter production and cycling begins with a necessary, albeit brief, survey of biological production in estuaries. This introduction places ecosystem functions into geomorphic and hydrodynamic contexts, especially as they relate to the penetration of light into the water column. This extensive chapter then reviews the mass fluxes of organic matter inputs, processing, and burial in estuarine environments. Unlike many marine treatments, it gives attention to processing of the vascular plant detritus that is especially important in estuarine systems. A follow-on chapter enlarges on this theme by examining the

various organic compound classes, drawing together a wealth of biomarker, elemental, and isotopic literature, and showing their great usefulness in untangling the complicated mix of fuels that drive biogeochemistry at the land–water interface.

The book next moves into consideration of biogeochemical cycling of those elements most strongly affected by biology. These chapters take an approach more familiar to geochemists raised on the milk of Goldschmidt's *Geochemistry*. The nitrogen, phosphorus, and silica chapters are extensive, as befits the enormous literature on these elements that frequently limit some types of biological activity, and cover water column and sediment cycling. Emphasis is placed on budgets and residence times of these bioactive elements. The following chapter on sulfur mainly concerns sedimentary processing of this element but includes some useful information on organic sulfur compounds. The chapter on carbon cycling revisits organic matter from a perspective that includes inorganic carbon, thus covering total carbon cycling. Much of the rest of the periodic table is then summarized in a chapter on trace-metal cycling, in which the author considers elements in the context of estuarine variations in complexation, oxidation–reduction, sorption, and colloid chemistry. While a book of this size would be hard pressed to cover this literature exhaustively, enough examples are given to alert the reader to the main themes that might be found elsewhere.

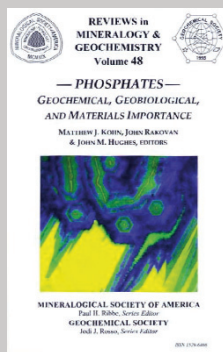
Next up is a chapter focusing on the environmental biogeochemistry of estuaries, highlighting the Anthropocene notion of human takeover of Earth's surface processes. This chapter applies principles developed earlier in the book to high contaminant and nutrient loadings, and necessarily emphasizes more strongly the interface with estuarine biology. The book closes with a short section on estuaries in their regional and global contexts.

The book has many strengths and some weaknesses. The survey and syntheses in the chapters on various elements are excellent, although it would have been nice to link aspects of cycling (particularly their budget sections) more closely to the treatment of hydrodynamics and geomorphology in the introductory chapters. More work on connecting these dots will perhaps be carried out as a result of this book. The book is filled with data compilations, especially in tabular form, which will be useful to professionals and students. An extensive glossary will help students master a large variety of new material. Last, Professor Bianchi's strengths are in the biological and organic chemical areas, and the presentations here are solid. However, the phrasing and even substantive details of some material involving physical or inorganic chemistry are occasionally on weaker ground. The volume is generally well produced and contains excellent graphics illustrating important points.

This volume is highly recommended for students and professionals alike. There's nothing else out there quite like it, and increased attention to the estuarine zone is clearly in society's future.

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REVIEWS IN MINERALOGY & GEOCHEMISTRY

Mineralogical Society of America
and Geochemical Society

Volume 48 PHOSPHATES: Geochemical,
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² Bianchi TS (2007) *Biogeochemistry of Estuaries*. Oxford University Press, 720 pp, ISBN 978-0-19-516082-6, hardcover