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BOOK REVIEW

EARTH'S MATERIALS: MINERALS AND ROCKS. By Gautam Sen, Prentice-Hall, Inc. New Jersey, 2001, 542 p. Available from Textbook Source at $69.27.

This is an important book because it is one of the first serious attempts I have seen to produce a combined mineralogy and petrology book. Although it is not appropriate for any course taught at our University, instructors who teach "earth materials" classes instead of separate mineralogy and petrology classes may wish to look at this book to see if it will work for them.

A major strength of this book is that is does not attempt to do everything. As Sen acknowledges, it is impossible for one book (or course) to cover all of mineralogy and petrology and do it well. Nor, I think, is it desirable. Bombarding students with information is not a good way to educate them. Instead, instructors must focus on a few things, and must emphasize fundamental learning and thinking skills. Because different instructors come to an introductory class with different backgrounds, they are unlikely to agree exactly on what they should include. So, authors (and teachers) decide which topics they wish to cover, and how much emphasis to put on each. The topics covered in Sen's book, and space devoted to each, reflect Sen's particular interests in igneous petrology, chemical geology, and quantitative analysis. Nearly 40% of the book discusses some aspect of igneous petrology. About 10% covers phase diagrams. Nearly 20% is on metamorphism and metamorphic rocks, and only 10% is on sediments and sedimentary rocks. Sen includes no discussion of water (or snow or ice), although they are the most abundant materials at the Earth's surface: In that respect, the book's title is misleading.

I find this book to be especially intriguing because it covers the main aspects of geology that I find most exciting. On the other hand, I am disappointed because the book is very traditional in its pedagogical approach. I think that modern textbooks need to do more than just present information. Today it is generally acknowledged that introductory science courses must give students information and skills they can use after the course is over. Simultaneously, students must learn why knowledge of earth materials is important to their lives. Additionally, the trend now in earth science education is to use an "earth system science" approach rather than traditional subdisciplines as Sen does.

Sen has clearly developed a highly successful combined mineralogy/petrology course. Over the years he has refined the course, and includes things that work best in his classroom. This book undoubtedly provides a good supplement to his lectures. I am not so sure that it will work for others who do not have the same background and expertise as Sen. The major problem is that there is much specific information that has been omitted. Sen, no doubt, fills many of the blanks while lecturing, but most of us do not have the same background that he has. So, in some ways, this book is too short. Sen intends this text for a two-semester course sequence, so it could include more material. It could focus instead of just skimming lots of things. He could expand many sections to aid student comprehension. As written, the book covers more topics than an instructor can reasonably cover in one or two semesters. Sen notes this and suggests that individual instructors must decide which parts to include in their classes.

The depth of coverage is highly variable and at times seems arbitrary. Chapter 1 is a general overview of the Earth and plate tectonics. Chapter 2 begins with more general information about elements and chemical bonding. Then it gets much more specific with discussions of Pauling's Rules, symmetry and crystallography. Much of this chapter is highly abstract and, because Sen has not explained things in as much depth as in traditional mineralogy books, may be difficult for students to understand. Chapter 3 begins with brief discussions of polymorphism and solid solution—although it is not clear why. It then switches to mineral classification, and then to a brief introduction to mineral properties. The other chapters, too, seem to jump around from one topic to another, sometimes lacking segues. In some places, important ideas get sidetracked needlessly. For instance, Chapter 4 includes brief confusing discussions of uniaxial and biaxial indicatrices that will not help students use an optical microscope. Chapter 16 uses jargon to describe chemical systems (e.g., NCMASH) and abbreviations (inconsistently) for mineral names that add needless complexity.

The book suffers in some places because it presents information out of context, or with no apparent useful purpose. For example, Figure 8.16 gives LeMaitre's classification scheme for volcanic rocks. The scheme includes lots of terms that petrologists have rarely used. Furthermore, it is based on alkali:SiO_2 values, so students probably cannot use it to name a rock (unless they have a chemical analysis). Nowhere does Sen explain why this scheme, or these names, has any importance or usefulness.

Sen says in the Preface that one of his goals is to show students that mineralogy and petrology can be quantitative. So, he includes equations. In Chapter 2, for example, he gives the formula for the attractive force between ions, but does not explain what it should be used for. In Chapter 7, he presents many classical equations of thermodynamics and even derives the Clausius-Clapeyron equation. In later chapters he gives equa-

tions describing flow, and magmatic segregation, but uses none of his equations to prove any specific points or add to student understanding. So, he falls short of his goal to "leave students with a deep sense of how quantitative . . . " mineralogy and petrology are.

Technically, this book is quite sound. I found no major errors of fact or interpretation. Furthermore, Sen is a good writer and good graphics support his writing. Unfortunately, some of his black and white photos did not reproduce well, and some things (such as interference colors) just do not work in grayscale. Also, I was annoyed because the binding began to break down two days after I received the book.

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