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BOOK REVIEWS

HANDBOOK OF MINERALOGY: VOLUME I. ELEMENTS, SULFIDES, SULFOSALTS. By J.W. Anthony, R.A. Bideaux, K.W. Bladh, and M.C. Nichols. Mineral Data Publishing, Tucson, Arizona, 1990. viii + 588 pages. $82.50.

This volume represents the first in a series "conceived in order to gather in convenient form the data crucial to identification of all mineral species and to provide relatively up-to-date references containing information central to the definition of each species." In large measure, the authors have succeeded in their quest and have provided data on 588 distinct mineral species. Although subtitled "Elements, Sulfides, Sulfosalts," the volume also includes alloys, antimonates, arsenites, bismuthinites, intermetallics, selenides, sulfhalides, sulfoxides, and tellurides. Each mineral, listed alphabetically from acanthite (Ag_2S) to zvyagintsevite [$(Pd,Pt,Au)_3(Pb,Sn)$], is accorded one page, on which is given crystal data, physical properties, optical properties, cell data, X-ray powder pattern, chemistry, occurrence, association, distribution, name, type material location, and references. The information varies in quantity and quality but provides a snapshot of what the mineral looks like, its composition, and its mode of occurrence. With the exception of the chemical analyses (usually two to three plus the ideal formula), the data are probably insufficient for absolute identification but are certainly helpful in confirming a suspected species and providing comparative information.

The authors are to be congratulated for their completeness; it is no small task to have gathered the data for minerals such as cuprorhodsite ($CuRh_2S_4$), geffroyite $(Ag,Cu,Fe)_9(Se,S)_8$, imiterite (Ag_2HgS_2), and morozeviczite [$(Pb,Fe)_3Ge_{1-x}S_4$] as well as more well-known phases such as daomanite ($CuPtAsS_2$) and uchucchacuaite ($AgPb_3MnSb_5S_{12}$). It is fun, as well as educational, just to marvel at the variety of minerals and to consider the origins of the names.

For those working on rare minerals, the book is especially valuable in giving references (usually for the original descriptions) and comparative chemical data. Unfortunately, the references for some of the more important minerals are not very up to date; thus the newest citation for pyrrhotite is 1963, that for pyrite is 1969, for sphalerite, 1944, and for gold, 1953. Consequently, there is no clarity in distinguishing between the hexagonal and monoclinic varieties of pyrrhotite or among the constraints on the broad range of Fe contents found in sphalerite. Also absent are some of the textural data (e.g., the flame structure of pentlandite, the internal reflections of sphalerite, the development of violarite on pentlandite, and the triangular pits in galena) that are so characteristic and valuable in identification. More serious omissions are the absence of varietal names (e.g., the widely used term electrum), the absence of older names (perhaps now superseded but still found in the older literature), and absence of any chemical listing or index. This last omission is especially serious because, even with some good chemical data, the reader has no easy way to determine what known minerals might be similar. Hence, the reader must know the name of a mineral to locate it in this book.

Despite some shortcomings, this volume will become an important reference and will serve valuably as a starting point for those who encounter rare and unusual minerals.

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AN INTRODUCTION TO METAMORPHIC PETROLOGY. By Bruce W. D. Yardley. Longman Group/John Wiley & Sons, New York, 1989. xii + 248 pages.

The author is to be commended for writing a concise, well-organized, and easy-to-read text that serves as a good introduction to principles and concepts in metamorphic petrology. I have used the book as one of two texts for our combined igneous and metamorphic petrology course at the junior and senior level and found it quite satisfactory. The information presented is divided into seven chapters of varied lengths and an appendix. These chapters provide a broad overview of metamorphic petrology, with some emphasis on the mineral assemblages produced from several protoliths through a range of temperatures and pressures; in virtually all cases the discussion focuses on equilibrium assemblages.

Chapters are arranged in a logical sequence, introducing the concepts of metamorphism and chemical equilibria before the various pressure-, temperature-, and composition-controlled metamorphic mineral assemblages. The exception in this case might be Chapter 6, which deals with metamorphic textures and processes. Although most of the information presented here (e.g., crystal defects, dislocation, diffusion, nucleation, etc.) indeed belongs in a chapter that has been preceded by ones covering introductory concepts, some elements in the section on textures of recrystallization should have appeared in Chapter 1. Texture being an important criterion for the classification of metamorphic rocks, an extended discussion of its many meanings is essential early in the book.

An important strength of the text is the discussion in the last chapter that relates preserved metamorphic mineral assemblages to tectonic processes. Not only are the characteristics of metamorphic belts described, but how they might be linked to specific processes at different plate boundaries is also discussed. Much of this discussion, particularly as it relates to regional metamorphism, concentrates on processes at convergent plate boundaries. Geophysical observations of presently active boundaries are important in this regard, but they need the "extra dimension of variation in metamorphic conditions with time" (p. 187) for a more comprehensive assessment. Yardley cites a few modern pressure-temperature-time (*P-T-t*) studies that have revealed a great deal about the thermal and kinematic evolution of Earth's crust. Further, in light of new and better-constrained *P-T-t* data from various belts, the concept of paired metamorphism is reexamined. It is found to be viable, albeit not in as many belts as previously believed. Other important studies are cited that show that rock slices that were tectonically juxtaposed and last equilibrated at the same metamorphic conditions reached the end point by entirely different *P-T* paths.

There are a few minor errors scattered throughout the book, but they do not detract from the scientific information being conveyed. Also, to make the figures more effective, some of the captions could have been more explanatory (e.g., Figs. 7.6 and 7.9) and maps better labeled (e.g., Fig. 3.6). These minor problems aside, the book is a very good introductory text, and I recommend it highly for undergraduate and beginning graduate petrology courses.

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