

BOOK REVIEWS

Monteregian Treasures, the Minerals of Mont Saint-Hilaire, Quebec. By J. A. Mandarino and V. Anderson. Cambridge University Press, New York, 1989, 281 pages, U.S.\$85.00.

In less than thirty years Mont Saint-Hilaire, Quebec has emerged as one of the world's most important mineral localities. Over 220 confirmed species have been found to date, 15 of which are new to science, and a long list of unknowns still awaits further investigation. The majority of these minerals occur in well-developed crystals and are eagerly sought by collectors from the amateur and professional communities alike. Large, high-quality crystals of such exotic species as leifite, carletonite, serandite, catapleite, petarasite, and numerous others have not been found elsewhere.

Monteregian Treasures is the first comprehensive work to deal with the mineralogy of Mont Saint-Hilaire. The text is divided into four parts. Part one presents an abbreviated history of the evolution of Mont Saint-Hilaire as a significant mineral locality and gratefully acknowledges the role of the amateur in its development. A brief discussion of the geology and petrology of the occurrence identifies ten geological environments of mineralogical interest: pegmatites, altered pegmatites, sodalite syenite, silicate-dominant cavities in nepheline syenite, carbonate-dominant cavities in nepheline syenite, igneous breccia cavities, hornfels, marble xenoliths, sodalite xenoliths and rock-forming minerals. The distributions of minerals among chemical classes, of chemical classes among environments and of chemical elements among environments also are considered.

Part two constitutes the bulk of the text and provides descriptive and illustrative information for 221 species. Individual descriptions are presented alphabetically by species or group and include introductory remarks, notes on appearance, physical properties, occurrence and associated minerals, optical properties, chemical data, crystallography, distinguishing features and other data. Computer-generated crystal drawings, photomicrographs (both color and black and white) by Violet Anderson and sketches by Robert Fisher and Garry Glenn provide a pleasing visual impact and illustrate well the species they depict.

Part three consists of five useful appendices that will be invaluable to those who routinely work with Mont Saint-Hilaire minerals. Appendix A consists of an alphabetical tabulation of species by crystal system and determinative tables arranged by axial ratios (Donnay tables) for each of the six crystal

systems. Appendix B gives X-ray powder-diffraction data in two separate sections: as an alphabetical species list with the six strongest reflections, and as a search index patterned after the Hanawalt method of JCPDS. Appendix C tabulates the species according to the ten geological environments outlined in Part one, Appendix D is a Dana classification of the observed species, and Appendix E contains an exhaustive compilation of chemical analyses of Mont Saint-Hilaire minerals presented in 41 tables according to chemical class. A comprehensive list of references is given in Part four.

The text is clearly written throughout and can be read with ease by both professionals and educated amateurs. Though not intended to be a comprehensive petrological treatise, the section on the geology of the occurrence is disappointingly brief. There are no geological or location maps given for the locality. Similarly, the paragenetic organization of species according to their modes of occurrence is both desirable and instructive, but could have been much more informative if developed further. A number of pages have noticeable blank spaces, which some readers may find objectionable, though others will probably welcome this space to add their own notes and new information as it becomes available. Similarly, opinions will probably be divided on the decision to use only photomicrographs to illustrate specimens known to exist plentifully as much larger specimens; but neither is that of serious consequence, as Violet Anderson has done an admirable job in accurately rendering each species photographed, an extremely difficult task considering the subject size and technical limitations imposed by photomicrography. Lastly, it would have been helpful to those readers who may lack a firm understanding of crystallography if the forms described in the figure captions were also labeled on the crystal drawings.

Regardless of any minor shortcomings, *Monteregian Treasures* is a comprehensive, up-to-date descriptive mineralogical text that successfully bridges the gap between the amateur and professional mineralogist, and is certain to remain the definitive work on this classic mineral locality for a long time to come. Though moderately expensive at U.S. \$85.00, it will be worth every penny to all serious collectors and professionals interested in the mineralogy of Mont Saint-Hilaire or alkali syenite complexes in general.

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Introduction to Crystal Chemistry (student edition). By H.W. Jaffe. Cambridge University Press, Cambridge, 1988, 161 pages, £9.00 (soft-bound only).

This student edition is Part I (Chapters 1–11: *Principles of Crystal Chemistry and Refractivity*) of a larger two-part monograph volume, *Crystal Chemistry and Refractivity* (reviewed in *Can. Mineral.* 14, 535). Part II of the larger volume is titled *Descriptive Crystal Chemistry*. The student edition is softbound, with a cover illustration by M.C. Escher ("Stars").

The book begins with a comprehensive review of atomic structure and the periodic table, followed by a chapter on spectra, ionization potential, electronegativity, and chemical bonding. Chapters 3–5 deal with Pauling's rules and the chemistry of covalent and ionic bonds. Chapter 6 looks at external (nontranslational) and internal (translational) symmetry. Chapter 7 serves as a short introduction to crystal-field theory. The next two chapters (8–9) deal with polyhedral distortion, diadochy, and isostructural crystals. Density, volume, unit cells and packing are considered in Chapter 10. The book concludes with an excellent introduction to refractivity and polarizability, in which both the Lorentz–Lorenz and Gladstone–Dale relationships are described; these topics are rarely mentioned in introductory textbooks. Each chapter is followed by a summary and bibliography, and there is a limited appendix of crystal-structure diagrams.

The illustrations consist of line drawings and black-and-white photographs of packing models. Some of the line drawings are confusing; more descriptive figure-captions would help. One diagram (Fig. 1.2) is labeled incorrectly; the d_{x^2} and d_{xy} orbitals should be defined as d_{x^2} and d_{xz} , respectively. The photographs are generally clear and informative.

In some areas, this book is not up-to-date. A comprehensive listing of ionic radii ends with Whittaker & Muntus (1970); there is no mention of the studies by Shannon & Prewitt (1969) and Shannon (1976). Zachariasen's early (1963) paper on bond strengths is mentioned, but not Brown's (1981) study of the bond-valence method. These omissions may limit the book's usefulness as a reference handbook.

Introduction to Crystal Chemistry is an excellent introduction to the relationship between mineral optics and structural crystallography. It is suitable for advanced undergraduate and beginning graduate students who have completed courses in introductory mineralogy. In general, *Crystallography and Crystal Chemistry* by F.D. Bloss (1971) is more comprehensive, but it is also more expensive. It should be pointed out that several references in *Introduction to Crystal Chemistry* refer to chapters in Part II of *Crystal Chemistry and Refractivity*. For this

reason alone, the professional would probably prefer to buy the complete monograph volume.

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Mineralization and Shear Zones. Edited by J.T. Bursnall. Short Course Volume 6, Geological Association of Canada, Department of Earth Sciences, University of Newfoundland, St. John's, Newfoundland A1B 3X5, 1988, 229 + xii pages. \$25.00 for members of GAC; \$35.00 for nonmembers (ISBN 0-919216-39-0).

Owing the economic significance of Archean vein gold deposits, a large number of symposia, conferences, and short courses have held over the last few years to examine aspects of the geology and geochemistry of these deposits. This volume is the product of one such short course, held in conjunction with the 1989 GAC–MAC national convention and focussing on the structural and geochemical relations of Au mineralization to shear zones. In view of the close genetic link between the evolution of shear zones and the formation of vein mineralization, the material dealt with in this volume should be of interest to geologists from industry, government and universities, who are involved in the exploration for or research on vein lode-gold deposits.

The book basically covers three aspects of the relations between shear zones and lode-gold mineralization: 1) Structural geology of shear zones, 2) Geochemistry of fluids associated with shear zones and gold mineralization, and 3) Application of structural analysis to the understanding of gold mineralization in the Superior Province of Ontario and Quebec.

The first four chapters deal with reviews of the principles of structural geology as applied to shear zones, and some of the implications to the genesis of mineralization. Chapter 1 "Review of Mechanical Principles, Deformation Mechanisms and Shear Zone Rocks" covers the basic concepts of stress and strain in relation to the formation of shear zones and much of the experimental and theoretical data on which the concepts are based. In addition, the role of fluids in deformation and the controls on variations in the brittle–ductile behavior of rocks are summarized. The chapter is clear and succinct; however, it to some extent preempts much of the material contained in the next three chapters. Chapter 2 "Tectonic Environment and Metamorphic Characteristics of Shear Zones" focuses on a more macroscopic, tectonic view of the structural controls on formation and evolution of shear zones, as well as some aspects of fluid chemistry. Unfortunately, the same material

is covered in many of the first five chapters. Chapter 3 "Patterns of Mineralization" is one of the most useful and significant contributions in the volume. The chapter contains a detailed review of the link between the nature of deformation and the form of orebodies. With numerous examples from deposits worldwide and the documentation of the structural controls involved in the formation of the deposits, this chapter by Dr. C.J. Hodgson could serve as a standard reference for the documentation of how the structural evolution of a shear zone controls orientation, shape and continuity of mineralization.

Chapter 4 "Geodynamic Setting and Hydraulic Regimes: Shear Zone Hosted Mesothermal Gold Deposits" and Chapter 5 "Geochemical Evidence on the Sources of Fluids and Solutes for Shear Zone Hosted Mesothermal Au Deposits" constitute a relatively succinct overview of Dr. R. Kerrich's contributions to the understanding of shear-zone-hosted Au mineralization over the past ten years. In chapter 4 Dr. Kerrich reviews some of the larger scale tectonic aspects of the hydraulic regimes associated with shear zones. The material overlaps with some of the information presented in chapter 2, but places more emphasis on the movement of fluids in response to deformation. Chapter 5 is a relatively extensive review of the geochemistry of Archean Au deposits covering major, minor and trace element ratios and radiogenic and stable isotope geochemistry. Much of the chapter is directed toward the evaluation of various models for the origin of fluids involved in the genesis of Archean lode-gold deposits.

Chapters 6 through 8 contain specific examples of the application of structural analysis to regional structures and lode-gold deposits in the Superior Province of Ontario and Quebec. Chapter 6 "Recognition of Regional Shear Zones in South-central and North-western Superior Province of Ontario and Their Economic Significance" is a well written report on the studies by the Ontario Geological Survey of two differing structural regimes in central and western Ontario. As documented in the chapter, the two regimes differ substantially in their structural styles and, consequently, possess gold mineralization with differing structural characteristics. The chapter also presents a clear and well-documented record of the use of relatively small-scale structural indicators in deciphering the characteristics of large-scale structures. Chapter 7 "Structural Framework of the Abitibi Greenstone Belt of Quebec and its Implications for Mineral Exploration" is composed of two parts, with the first part characterizing the large-scale structural style of the Abitibi greenstone belt in Quebec, and the second part focussing on details of the structure in the Dumagami structural zone. Chapter 8 "Shear Zones and Gold; Practical Examples from the Southern Canadian Shield" draws on material presented in the first four chapters

in presenting applications of the use of structural data in solving specific problems in mine geology.

In summary, I give the volume an overall good to very good rating and recommend its purchase to professionals and graduate students interested in gold deposits and structural controls on mineralization in general. The quality of printing is good, the book is relatively error-free, and at \$25 for GAC members and \$35 for nonmembers, it is a good buy. However, there are some aspects of the book which keep it from being what I consider a complete success. Firstly, there is simply too much redundant material in the first four chapters. Some repetition is good for emphasis, but here it becomes monotonous. Secondly, the presence of chapter 5 on the geochemistry of Au veins in this otherwise structurally oriented volume seems incongruous. In the short course from which the book was derived, there was an additional presentation on the structure and geochemistry of Au vein systems; unfortunately, a contribution from this oral presentation is not present in the volume. Finally, it would have been quite useful to include one or two chapters to summarize the results of studies of fluids, structure and mineralization in younger, analogous shear systems, such as are exposed in the Alps or New Zealand.

In spite of these problems, the book is useful as a summation of modern structural interpretation related to shear zones and gold mineralization and is worth purchasing.

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Spectroscopic Methods in Mineralogy and Geology. Edited by Frank C. Hawthorne. Reviews in Mineralogy, volume 18, Mineralogical Society of America, Washington, D.C. 1988, 698 pages U.S. \$18 (soft-bound) (ISBN 0-939950-22-7).

This book should be in a readily accessible spot on the bookshelf on every mineral spectroscopist. It contains up-to-date reviews of mineralogical applications of all the major spectroscopies, including both older methods, such as optical spectroscopy (reviewed by G.R. Rossman) and Mössbauer spectroscopy (reviewed by F.C. Hawthorne), and newer areas, such as solid-state NMR spectroscopy (reviewed by R.J. Kirkpatrick and J.F. Stebbins) in separate articles on static and dynamic properties) and X-ray absorption spectroscopy (reviewed by G.E. Brown, Jr., G. Calas, G.A. Waychunas and J. Petiau). There are also two very useful introductory chapters on spectroscopic methods in general (by Calas and Hawthorne) and on symmetry, group theory and quantum mechanics (P.F. McMillan and

A.C. Hess). The book is self-contained enough to serve as a textbook for a graduate course on mineral spectroscopy, and its price compares very favorably with that of most textbooks. My only disappointment with the book lies in the small amount of attention given to theoretical studies of mineral spectra in some of the chapters.

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Platinum-Group Element Exploration. By Dennis L. Buchanan. Developments in Economic Geology, 26. Elsevier, Amsterdam, The Netherlands, 1988, 185 pages. U.S. \$79 (ISBN-0444429581).

This book was written "...to present a practical set of guidelines for implementing a program of PGE exploration, detecting subtle indications of mineralization and assessing the economic potential of a group of mafic or ultramafic rocks." The author has sought to achieve these goals by stressing the magmatic features of the Bushveld deposits, which he knows most intimately.

The first chapter is a classic commodity review to set the scene, including history, inorganic chemistry, geological associations, industrial uses, marketing, and strategic considerations. This is immediately followed by a discussion of sulfide solubility controls, based largely on the author's own experimental research. Chapter 3 is devoted to pyroxenes. The succeeding chapter, titled "Phase chemistry of mafic magmas: primary and secondary processes", includes a rather sparse section on PGE mineralogy.

Chapter 5 is titled "Mining geology of the principal deposits" but is largely devoted to the Bushveld complex. There are a few paragraphs describ-

ing komatiite-hosted Ni deposits, Sudbury, the U.S.S.R. and Chinese deposits (both covered in 19 lines), and Stillwater. The review of the Bushveld deposits is interesting: for example, the importance of grade control is stressed owing to the 35% dilution required for mining the narrow widths of the Merensky Reef. Unfortunately, other parts of this chapter lack useful detail. For example, mention is made of MINTEK's research into the problem of processing UG2 ore, but no reference is given to an article by Overbeek *et al.* in MINTEK's 1985 Review, which deals with this topic.

The next three chapters are of particular interest to exploration geologists because target selection, exploration guidelines, and guidelines for evaluation of prospects are discussed. World-wide examples of target selection are given. These are based on known occurrences of mafic and ultramafic rocks hosting PGE mineralization, and are classified according to tectonic settings, after numerous publications on the subject by A.J. Naldrett. The largest section of the chapter on exploration guidelines is devoted to the lithogeochemistry of the Bushveld complex. The book ends with a summary, bibliography, and index.

The technical production of the book has its good features: the 16.5 × 25 cm format is handy, paper quality is good, and no typographical errors were found. It is unfortunate that the text, produced by word processor, was printed with a somewhat thin (to my eyes) dot-matrix type. I believe the book is a useful compilation for those interested in PGE deposits, provided that it is understood that only the Bushveld-complex deposits are discussed in any detail. The book is, unfortunately, somewhat expensive for the individual, but within reach of companies and many libraries.

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ERRATUM: CHARACTERIZATION OF PHASES AND TWINS IN ALKALI FELDSPARS BY THE X-RAY PRECESSION TECHNIQUE

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Two sets of figures are wrongly positioned in the above article. Figure 11 was printed above the caption for Figure 4, and *vice versa*. Figure 6 was printed above the caption for Figure 7, and *vice versa*. The error escaped the attention of the editor and the managing editor, both of whom check the page proofs; we offer sincere apologies to the authors and to our readers.