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BOOKS REVIEWS

Gems, Granites, and Gravels. By Richard V. Dietrich and Brian J. Skinner. Cambridge University Press, Cambridge, England, 1990, 173 pages plus a 32-page color section with 51 plates. US$24.95 (cloth), ISBN 0-521-34444-1.

"Knowing and using rocks and minerals" is the subtitle of this relatively slim book, and this transmits the concept that the book is an elementary introduction to mineralogy and related specialties, such as petrology and crystallography. The titles of the eight chapters comprising the book further clarify the point. These are: 1. The mineral world; 2. Crystal realms; 3. Mineral chemistry; 4. Rocks; 5. Soils, dust and muds; 6. Ores and ore minerals; 7. Building materials, and 8. Rocks and minerals in diverse environments. The text is well written, as would be expected from such highly regarded and experienced authors, at a level slightly below the average of most first-year introductory geology textbooks. The authors' approach to numerous topics from a historical context is particularly interesting.

Regrettably, most of the half-tones are of substandard quality. On the other hand, the color plates are beautifully produced and illustrate minerals and gems (about 20 of the 51 plates), as well as a group of unrelated geological-mineralogical subjects, *e.g.*, a thin section of granodiorite, a lava flow, an exposure of chalk, Ayers Rock, chemical weathering, a smelting operation, various illustrations of the use of building materials (the Central Library, University City, Mexico; the Alhambra in Granada, Spain; and the First Interstate Tower, Dallas), and the Grand Canyon. The book is enthusiastic and will interest rock and mineral collectors and those of the general public inclined toward natural history. It is not designed for the specialist.

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Gemstones and Their Origins. By Peter C. Keller. Van Nostrand Reinhold, New York, 1990, 144 pages. U.S. $49.95 (cloth), ISBN 0-442-31945-2.

This scientifically interesting, beautifully and lavishly illustrated (in color), carefully prepared, large size (27.5 x 21.5 cm; double-column format) book is a welcome addition to the gemological literature, and it will also appeal to those with academic and applied mineralogical interests. Readers will not find the usual mineralogical-optical properties, localities, explanations for the color of varieties, characteristics of synthethic gems and simulants, and other data for a great number of gemstones we have come to expect in gemological books. Rather, they will find that this book is organized on the basis of the various geological origins of gemstones and that these origins are discussed using well-known classical deposits (except for diamond; see below). This procedure results in a volume in which only nine gem localities are considered in detail; nevertheless, this unique approach is a success.

Based on geological origins for gemstones, the book is divided into four parts, each of which has detailed descriptions of two or three specific gem deposits.

Part I. Gemstones Deposited by Water on the Earth's Surface uses the alluvial deposits of Sri Lanka and the groundwater-derived opal deposits of Australia as examples.

Part II. Gemstones of Igneous-Hydrothermal Origin draws examples from the hydrothermal emerald deposits of Colombia, the pegmatites of Minas Gerais, Brazil, and the ruby deposits of Chanthaburi-Trat, Thailand, which form directly from magma and which are transported to the surface as xenocrysts in basalt.

Part III. Gemstones Formed by Very High Temperatures and Pressures discusses the ruby deposits of Mogok, Burma, formed by low-pressure, high-temperature metamorphism, and the jadeite deposits of Tawmaw, Burma, formed by high-pressure, low-temperature metamorphism.

Part IV. Gemstones Formed at Great Depths uses as examples the mantle thrust sheet peridot deposit at Zabargad (St. John's Island), Red Sea, Egypt, and the newly discovered (1979) lamproite diamond pipe at Argyle, Western Australia, which presently is the largest producer of diamonds in the world (about 35,000,000 carats, mostly industrial, annually).

In addition to the geological aspects, the discussions of all the deposits include interesting historical aspects, location and access, production both past and present (all are in production except the Zabargad peridot deposit), and they generally contain an excellent selection of references, many of which are obscure and, therefore, are particularly welcome. Presentation is generally excellent, although it would have been instructive to have indicated in the figure captions of the mining operations the year(s) in which the photographs were taken. Some of the figure captions associated with conceptual models for the formation of individual deposit (*e.g.*, Figs. 2.1, 2.2, 3.1, 4.1) would benefit from expanded captions so that those choosing only to peruse the volume would not have to search the text for detailed explanations.

The use of the Argyle deposit in lamproite to illustrate the origin of primary diamonds has both advantages and disadvantages. The advantages are that it points out that kimberlite is not the only rock type in which primary diamonds are found. It also enables the reader to feel that the book is up-to-date. The main disadvantage is that the classical deposits of southern Africa (also those in the USSR and elsewhere) in kimberlite are barely mentioned. Of greater concern is the fact that the author has missed the unique opportunity to be the first to clearly emphasize in a general textbook the now-well-known facts that: (a) diamonds are at least as old, and generally much older, than the kimberlite or lamproite which brought them to the surface; (b) (most) diamonds crystallize from peridotite and eclogite; and (c) diamonds are xenocrysts in kimberlite and lamproite, and these two rock types are merely the "elevators" that brought diamonds to the surface. Because the objective of the book is to discuss gemstones from the viewpoint of their origins, this less than complete and accurate discussion is particularly regrettable.

Notwithstanding my disappointment with the treatment of the origin of diamonds, I can still recommend this book highly. It is the only book to cover numerous classical localities in a highly original and interesting manner, and with some fascinating illustrations that can be found nowhere else. In addition to being a valuable addition to a geological library, the book would be an ideal gift book for anyone interested in the mineral kingdom.

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Crystals. By Ian F. Mercer. Harvard University Press, Cambridge Massachusetts, 1990, 60 pages, CDN$12.95 (softbound).

Crystals is, in the current publishing climate, unusually pleasing, a scientifically written book for young people (and nonspecialists) on a topic dominated by the words healing, mystic, and other hocuspocus. All sixty 21 x 20 cm pages (and the covers) of this book are filled with excellent full-color photographs, along with explanatory line-drawings. A well-written text complements the photographs. The main text in each section is simple enough for 10- to 12-year-olds, whereas secondary boxes have theory appropriate for high-school students. The boxes are written in more formal language, and provide definitions and details of processes.

The book is divided into three sections: "The Inside Story", an introduction with definitions, occurrences, structures, and classification; "See How They Grow", which includes descriptions of how crystals form; and "Crystals and You", a catch-all of properties, examination and collection techniques, and industrial uses of crystals. *Crystals* ends with a brief history of crystallography, the crystal systems, a few significant measurements, and an index.

The subject material of this book is difficult to simplify for the average reader; however, the author has been quite successful at this simplification, even though there are a few sections that could be clearer. Many beginners have difficulty separating cut gemstones from naturally formed crystals, and a photograph of a faceter at work seems an obvious omission. Whereas most of the text is exemplary, the references to crystals in rocks could cause some confusion. And even though all the crystal and mineral photographs and images are very good, the photographs of rocks are generally poor; one includes a conglomerate described as a sandstone, and a schist in deep shadow (Fig. 20). Purists may also take exception to some photo captions, lack of scales in photomicrographs, and some unusual terminology. Nevertheless, this book is much better than most of its type.

Who should buy this book? Obviously it is not intended as a reference for professional mineralogists. However, it would make an excellent gift to an interested young adult or amateur collector. The wealth of photographs also make this an attractive book for anyone looking for illustrations of crystals. Many university students would also appreciate the line drawings that illustrate basic crystallographic principles.

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Recent Advances in Coal Geochemistry. Edited by L.L. Chyi and C.-L. Chou, Geological Society of America Special Paper 248, 1990, 99 pages. Price US$22.50 softcover, ISBN 0-8137-2248-9.

Recent Advances in Coal Geochemistry is the proceedings volume of a symposium held at the North-Central section meeting of the Geological Society of America at Kent State in 1986. The volume includes eight papers from the symposium; one additional paper, by Francis Ting, is included in the volume. The papers in this volume deal exclusively with the inorganic geochemistry of coal. They mainly present elemental compositions, and little mineralogical data. As is now standard fare, all papers that incorporate trace- and minor-element chemistry (most of them) utilize instrumental neutron-activation analysis as the principal analytical tool. The mineralogy, where reported, was determined by X-ray diffraction of the low- or high-temperature ash. Most papers in this volume are based on studies of Carboniferous coals from the eastern United States.

The only paper in this volume on peat is by Raymond *et al.*, who describe the inorganic geochemis-

try of 12 peat samples from various geographic locations representing different depositional and ecological settings. The analytical methods utilized in the paper are impressive; however, the authors attempt to draw conclusions about factors influencing the geochemistry of peat based on twelve samples from widely different areas with essentially no statistical considerations, which detracts from the quality of the paper. The remaining papers in the volume deal exclusively with coal and associated roof and floor strata. The paper by Coleman and Bragg on the distribution of arsenic in coal is based on analyses of some 5,000 samples from all major coal areas of the United States. They conclude that most of the arsenic is associated with sulfides and is epigenetic in origin; no predictable trend in arsenic occurs with age or coal rank, although coals from some regions have higher As contents than others. The paper by Ting on coals from the Williston Basin and that by Demier *et al.* on coals from the Illinois basin both document the abundance and distribution of Na and some other elements. Sodium and other alkali elements are important in that they cause corrosion and fouling in boilers in coal-fired power plants. Ting concludes that the Na content is inversely proportional to Ca; low-Na lignites occur mainly in areas where immediate overburden is glacial drift or thin and eroded. Demir *et al.* show that Na is mainly associated with mineral matter. The papers by Murray *et al.* and Chyi and Medlin summarize the inorganic geochemistry of specific coal seams in Indiana and western Kentucky. Chyi and Medlin suggest that a triad plot of Al–La–Sc can be used to characterize coals seams. Plots of Br–Cs–Na and Co–Ga–Th, although not useful for "fingerprinting", may be useful locally to identify coal beds. Palmer *et al.* describe a method of determining organic *versus* inorganic affinity of trace elements in coal utilizing the ratio of concentrations of specific elements in vitrinite to the concentration in companion whole-coal samples. They conclude that most of the 34 elements they analyzed for are concentrated in the whole coal relative to vitrinite, with some exceptions. Interestingly, in some coals they found some elements (*i.e.,* Sb) concentrated in the vitrinite fraction, whereas in other coals the same elements are concentrated in the whole-coal fraction, which attests to the complex genesis and affinities of some elements. One of the most interesting papers in the volume is that by Rimmer and Davis, which describes the ash-fusion characteristics of the Lower Kittanning seams in western Pennsylvania. They show that high temperatures of ash fusion result from the presence of kaolinite. The distribution of kaolinite in turn reflects the distribution of freshwater depositional environments along the margin of the basin. The paper by Morrison *et al.* reviews the causes of acid mine-drainage and shows, based on simulated weathering experiments, the importance of carbonate carbon and surface area of pyrite on the amount of acidity, sulfate and total iron.

Although this volume includes some interesting papers, they are for the most part of local interest only. The analytical methods and interpretations are standard; unless the reader is specifically interested in the trace-element chemistry of a specific coal seam or peat, this volume offers little that is new. The papers do not now provide up-to-date references, because the papers are four years out of date, and some of the papers include data that are readily available elsewhere (*i.e.,* published before). Some of the authors are guilty of simply presenting tables of data with little or no thoughtful discussion or interpretations. In conclusion, this volume in no sense lives up to its ambitious title. The book neither has breadth nor evenness of treatment of the important subject of coal geochemistry, and thus cannot be considered as a general reference. I do not recommend that readers purchase this book, unless they are currently involved in a study of trace- and minor-element geochemistry of coals in the Appalachian coalfield.

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The *Encyclopedia of Igneous and Metamorphic Petrology*. Edited by D.R. Bowes. Van Nostrand Reinhold, New York, 1989, viii + 666 pages, CDN$135.95 (hardbound). Distributed by Nelson Canada, 1120 Birchmount Road, Scarborough, Ontario MlK 5G4. ISBN 0 442 20623 2.

With 262 main entries, 400 illustrations, and 70 tables, the Encyclopedia fulfills the need for a reliable reference work on igneous and metamorphic petrology. Each entry is well defined, with many bibliographic references. Information is provided on the mineralogical, chemical, and textural characteristics of various rocks, the development of concepts, definition of commonly used petrological terms, classification and nomenclature schemes, *etc.* The Encyclopedia is an excellent compilation of data, quite comprehensive in coverage, and could serve as a source book for all earth scientists. More than one hundred professionals from 18 countries have contributed to this volume. This diversity is reflected in the varied usage and spelling of terms.

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Emeralds of Pakistan: Geology, Gemology and Genesis. Edited by Ali H. Kazmi and Lawrence W. Snee. Geological Survey of Pakistan - Van Nostrand

Reinhold Co., 1989, 269 + xii pages. CDN$52.95. Distributed in Canada by Nelson Canada, 1120 Birchmount Road, Scarborough, Ontario MlK 5G4. ISBN 0 442 30328 9.

Carat-for-carat, the value of fine emerald exceeds that of diamond. The origin of these exquisite crystals of deep green beryl remains a much-discussed topic. Their extreme rarity is explained by their unique chemical concoction: a combination of beryllium with the chromium that colors emerald its characteristic intense green. Beryl, the most common Be-bearing mineral, is in itself rare because of the low crustal abundance of Be, about 3 ppm. Beryllium is an incompatible element and is concentrated only in highly evolved igneous rocks such as granitic pegmatites. Chromium, 30 times more abundant than Be in the crust, follows a distinct geochemical path and is found chiefly in primitive (non-evolved) ultramafic igneous rocks. In Pakistan and several other places, tectonic processes have juxtaposed Be-rich continental rocks and Cr-rich primitive oceanic rocks or their altered equivalents. Examples are geosutures such as the Main Mantle Thrust in Pakistan, and the joins between greenstone belts and granite-gneiss terranes in Africa and elsewhere.

In the past, the bibliography on the subject of emerald was relatively thin. Then, beginning ten years ago with the publication of Capt. John Sinkankas's summary work "Emeralds and Other Beryls", the pace has quickened. Emerald has become a fashionable research topic, and GEOREF lists 235 references dated from 1981 to 1990. The book here under review reflects this trend. In Sinkankas's *oeuvre*, a description of all types of beryl (including emerald) from Pakistan took up less than two pages.

Emeralds of Pakistan covers far more than is implied by the title alone. The book is, as expressed by E.J. Gübelin in the foreword, "one of the most comprehensive reference books ever published about emeralds in general, and especially about emeralds from Pakistan". The editors are particularly qualified: the Director General of the Geological Survey of Pakistan (Kazmi) and a geologist-geochemist with the U.S. Geological Survey (Snee). These men and a dozen other people are the authors; six Pakistanis, seven Americans (three from the USGS and four academics), and one Swiss. Summary biographies of the authors are given at the close of the book. The first seven chapters (164 pages) are devoted to the various aspects of Pakistani emeralds and stress the important Mingora and Gujarkili deposits. These are followed by the longest individual chapter (no. 8, 64 p.), which treats the geology of world emerald deposits; those of Afghanistan, Australia, Austria, Brazil, Bulgaria, Colombia, Egypt (Cleopatra's mines), India, Madagascar, Mozambique, South Africa, Tanzania, the USSR, the USA, Zambia, and Zimbabwe. Chapter 9 presents a classification of emerald deposits based on the sources of Be and Cr. This works for many deposits where the parentage of these exotic elements can be identified. However, "the sole possible exception to our classification is, of course as nature would have it, the most important emerald deposits in the world - those of Colombia... their origin remains unclear" (p. 234). Yes, the presence of emerald in pockets and calcite veins in bituminous black shale awaits explanation. Chapter 10 is a convenient selected bibliography on world emeralds (478 entries that date from 1881 to 1989).

The most serious shortfall of *Emeralds of Pakistan* is a weakness of presentation. For example, much of the writing is awkward (though none is unintelligible), and much of the graphic presentation could be improved. Idioblastic is misspelled throughout. The reader is challenged to relate Fig. 3.9 to 3.10 and to deduce the scale of Fig. 8.6. Table 5.1 undergoes a change of scale in passing from p. 100 to p. 101, which renders the right half unreadable. No emerals have from 12.4 to 14.6% V_2O_3 (Table 6.7). The site of samples ES (Table 7.1) is not given. In the Bolshoi Reft River Emerald Belt, the Central Zone is 0.5 to 0.7 km (not m) wide (p. 184). The use of the discarded term "oellacherite" (p. 201) for barian muscovite is unwarranted, and I was unable to discover what is the mineral "guembelite" (p. 203). Finally, the elevation of the Chivor mine is 1850 m (p. 212), and the reference Bruce (1814) is in error (p. 239).

The potential reader should not be dissuaded by these relatively minor flaws. *Emeralds of Pakistan* is a fount (dare I say mine?) of useful and up-to-date information about nearly all aspects of emeralds in Pakistan and elsewhere. It signals areas of current study and offers guides to paths that researchers should follow in the field and laboratory.

The low price of this attractively printed book, which features 81 color photographs, good-quality paper and a bound-in cloth ribbon book mark, is presumably due to its having been printed in Karachi. It is a useful reference that many mineralogists may wish to consult for answers to questions about Nature's most esoteric mineral.

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Sediment-Hosted Stratiform Copper Deposits. Edited by R.W. Boyle, A.C. Brown, C.W. Jefferson, E.C. Jowett and R.V. Kirkham. Geological Association of Canada, Special Paper 36, 1990, 710 p. CDN$95 (members), $125 (non-members). ISBN 0-919216-36-6.

Among the first things one learns in reading this volume is that, in spite of the title, many of the deposits described therein are not stratiform but may be discordant both on a local and regional scale. This behind-the-scenes secret is divulged to the startled reader in each of the first two chapters. After a brief rationalization, this minor discrepancy is happily accepted by both authors (Kirkham and Brown) and, indeed, apparently by all subsequent authors in this magnificent reference tome.

No sooner has the reader settled down again to digest the wealth of detail chronicled in this volume than another diversion is presented. This time, the reader learns there are two types of "sediment-hosted stratiform copper deposits": Kupferscheifer-type (KST) and red-bed type (RBT). This time not only do Kirkham and Brown reveal this fact, but so does a review chapter by Eugster. After perusing the many papers in this volume, the reader will relate well to the admission by Eugster (p. 124) that "a distinction is not always made between KST and RBT..". Very few of the individual papers identify the deposit described as being either KST or RBT and, in perpetuating this lack of distinction, the editors of this book missed a golden opportunity to enhance the educational aspect of this compendium. After a quick examination of the approximately 30 case-histories of deposits available, this reviewer could find hardly any that, in their description, were identified as being of KST, RBT, or a transitional type (save for five that are grouped together as KST). The reader is left to decide for him(her)self into which pigeon-hole a given deposit should be placed. This is somewhat regrettable, because the characteristics, depositional environment, and, presumably, genesis differ in detail between the two end-member types. Inasmuch as three experts, in their review chapters, agreed on the existence of both KST and RBT, an opportunity has been missed to make this point in what will obviously become the authoritative volume on stratiform copper deposits.

The volume opens with a collection of 13 papers, which include an introduction, a discussion of terminology, and reviews of general principles and geochemical aspects. These are all excellent, but this reviewer is puzzled as to why the editors accepted two wide-ranging and somewhat rambling papers that discussed the geochemical aspects of Pb and Zn in addition to Cu. Another paper discusses the possible overlap between unconformity-type uranium and stratiform copper deposits. Some readers will view these discussions as a strength of the volume, others as an unnecessary diversion.

The remaining 31 papers are essentially case histories of individual deposits or metallogenic belts, divided into groups either by continent or country as follows: North and South America (12), Africa (7), Australia (1), Europe (5), Iran and Israel (2), and China (4). The reason for a geographic rather than a geological grouping is not revealed by the editors. Two other possible, potentially more instructive, groupings occurred to this reviewer: 1) by subtype (KST, RBT, or transitional), or 2) by age of host rock (either by era, period, or whatever). With respect to the latter possibility, four eras or periods (Early Proterozoic, Middle Proterozoic, Late Proterozoic, and Permo-Carboniferous) were identified by Kirkham as being the most prolific bearers of stratiform copper deposits. Again, in avoiding a geological grouping, an educational possibility was missed to compare and contrast deposits of either similar type or age. To this reviewer, a geographic grouping serves little useful purpose save simple convenience. Topics of individual papers range from a description of small, subeconomic occurrences in Alberta and British Columbia to a discussion of the stratiform copper metallogeny of the entire Andes.

At $95(CDN) for GAC members, the volume is not cheap, and this may prevent its being on many personal shelves. Nor is it small: 710 pages weighing 2.5 kg (heavy reading indeed!). In terms of value, however, readers should be aware that the cost is amortized at about $0.13/page (about the cost of a photocopy page) or $2.16 per article.

After all is said and done, however, this reviewer remains secure in the knowledge that the discriminating reader will conclude (as he did) that the few minor negative points that received undue attention in the above discussion are more than compensated by the many, many positive aspects of this volume. The volume will serve as an authoritative reference for many years to come and will be useful as such to both explorationists and educational institutions, especially at the graduate level. Educators in particular will love the format. The large type, double-column pages, several hierarchies of headings in bold type, a plethora of full- and half-page diagrams, and excellent reproduction of photographs all lend themselves to instant reproduction on overhead transparencies for classroom illustration. This large volume concludes (fortunately!) with a 24-page index.

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Nomenclature of Inorganic Chemistry (third edition). Edited by G.J. Leigh. Oxford University Press, 1990, 289 pages. CDN$39.50 softbound. ISBN 0-632-02494-1.

Since the second edition in 1970, the Commission on the Nomenclature of Inorganic Chemistry of the International Union of Pure and Applied Chemistry has had several committees working on various aspects of nomenclature. This, the resultant book,

is excellent. The text is written in a precise and easy to understand manner. The different chapters integrate well with each other, even though thirteen authors contributed to this volume. The quality of the paper, printing and drafting is high.

Some of the interesting aspects of this volume for mineralogists follow. The spelling of the chemical elements are "caesium" and "sulfur" compared to "cesium" in American-language and "sulphur" in English-language mineralogical literature. Ionic charge on atoms of symbol A is shown by A^{n+} or A^{n-} and not by A^{+n} or A^{-n}. The periodic table should be based upon 18 columns rather than 8 columns. When the variable x is limited to small values in a chemical formula (*e.g.*, $Fe_{1-x}S$), this may be done by using ϵ or δ instead of x. The italicized symbol V is preferred to a square box □ (which is not a standard computer character) for a vacant site. When the single-letter chemical symbols I, V are inappropriate, such as when they might be confused with Roman numerals, the chemical symbols Id and Va may be used for iodine and vanadium, respectively.

In the past, polymorphic compounds have been designated with Greek letters (*e.g.*, αSiO_2); however, these trivial labels are discouraged. A rational system based upon Pearson symbol type or crystal-structure type (or both) should be used. Since the endings -ous and -ic do not describe the same oxidation state in different atoms, older names such as ferrous for iron(II) and cupric for copper(II) are no longer recommended. Endings such as -oan and -ian are not mentioned, so that they appear also not to be recommended. The rare-earth metals include Sc, whereas only Y and the lanthanides are used in the rare-earth mineralogical nomenclature, because Sc does not always form isostructural compounds with Y and the lanthanides.

If the compound contains more than one kind of cation, the names should be cited in alphabetical order of the initial letters instead of the traditional way of increasing valency; however, hydrogen is always cited last amongst the cations. Similarly, the names of anions are cited in alphabetical order. When compounds with analogous structures are compared, deviations from alphabetical order are allowed (*e.g.*, $CuFe_2O_4$, $ZnFe_2O_4$). In the absence of any ordering criterion, the alphabetical order of the symbols is used to give what is called the empirical formula.

For phases with variable composition caused partially by substitution, the symbols of the atoms that replace each other are separated by a comma, placed between parentheses, and cited in alphabetical order. For example, (Cu,Ni) denotes the complete range of compositions from pure Cu to pure Ni regardless of the relative proportions of each. This contrasts to mineralogical literature. For example, native copper with (Cu,Ni) means Cu > Ni, whereas native nickel with (Ni,Cu) means Ni > Cu. In the complete range of composition, the mineral name changes at the Cu:Ni = 1:1 atomic composition.

The book is up-to-date, and there are no other books in this field. Each of the subjects is treated in sufficient detail to allow a full understanding of the topic. Many examples are given to back up the principles enunciated in the text. The cost represents excellent value for money. Such a book will make a valuable addition to any specialist's professional library and is a must for every general library.

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Famous Mineral Localities of Canada. By Joel D. Grice. National Museum of Natural Sciences - Fitzhenry & Whiteside Limited, 1989, 190 pages. CDN$35.00 (hardbound). Issued in French under the title: *Sites miniers célèbres du Canada.* ISBN 0-88902-898-2.

Joel Grice, head of Mineral Sciences at the Canadian Museum of Nature, has produced an attractive, authoritative and most welcome popular-style book on selected Canadian mineral localities. The author's stated goal is to stimulate interest and appreciation of natural resources, and to promote understanding of some basic concepts in mineralogy and geology. In this he has succeeded admirably.

He has done this by selecting unique features of each locality to explain and illustrate a scientific concept, such as properties and structure of minerals, atomic structure, natural and synthetic crystal growth, mineral and rock genesis, and geological processes (sedimentation, glaciation, mountain-building, tectonics, continental drift, volcanism). The explanations are clear, with sufficient detail to arouse the young reader's curiosity and, hopefully, to channel it toward a career in the geosciences.

For the would-be mineral collector, the author explains the reasons for collecting, the "how-to" of mineral collecting, the naming of minerals, the value of mineral specimens, the identification of minerals in the field and in the laboratory, mining methods, metallurgy, modern and archeological uses of metals and their economic importance, geological history and the fossil record. The unique properties of gemstones are addressed using British Columbia jade, Thunder Bay amethyst, Jeffrey mine grossular, Baffin Island lapis and oligoclase, and Nain labradorite as examples.

Each of the 19 chapters, which follow the introductory chapter on geological regions of Canada, is devoted to a famous mineral locality,

either a single locality, the Rock Candy, Cassiar, Bernic Lake and Jeffrey mines, or multiple localities, including the classics: Bancroft, Cobalt, and Sudbury. The localities are presented geographically, from the Klondike goldfields to the Bay of Fundy basalt cliffs. In between are the newer and currently popular Rapid Creek, Mont Saint-Hilaire and Francon treasure-houses. Each locality comes to life with informative and entertaining glimpses into the local, mining, geological and archeological histories, the thrills of discovering minerals and deposits that became the most celebrated mines of Canada, and the prospecting rushes and mining booms that have electrified mining history in Canada.

The final section of the book contains three appendices: a glossary of technical terms, a list of chemical elements and symbols, and a comprehensive list of minerals (with brief descriptive notes and bibliography) from each of the nineteen mineral localities.

The book, printed on high-quality paper, is prolifically and beautifully illustrated. There are 77 modern and archival photos, including 47 in superb color; mineral localities, mining scenes and mineral specimens, most of them from the National Mineral Collection, are the featured subjects. There are 12 black and white modern and ancient drawings, 9 locality maps, and 7 diagrams. Production deficiencies include a few typos, a missing descriptive note for francolite in Appendix 3, and the map on page 13 shows the Canadian Shield extending through southern Ontario and misses the extension of the Cordilleran to include Vancouver Island.

This book will appeal mainly to the amateur mineral collector, the naturalist, local historical societies, and anyone curious about mines and minerals in Canada. The list of minerals in Appendix 3 is a most useful reference for novice and advanced mineral collectors and for curators. As a valuable tool to stimulate interest in the earth sciences, there should be a copy of this book in every school and public library in Canada.

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