# BOOK REVIEWS

*Gemology* (second edition). By Cornelius S. Hurlbut, Jr. and Robert C. Kammerling. John Wiley & Sons, Inc., 1991, 236 pages. CDN$77.50 (hardbound). (ISBN 0-471-52667-3).

The first edition of *Gemology* was published in 1979, the authors being Cornelius S. Hurlbut, Jr. and George S. Switzer. The second edition sees a change in one of the authors and a greater emphasis on the diagnostic gemmological characteristics of gem materials, while retaining the basic text and format. Gem mineral localities have been updated, and three gem minerals (charoite, sugilite and tugtupite) have been added to the descriptive section, while five (hambergite, painite, pollucite, sepiolite and zincite) have been removed.

The first nine chapters are devoted to mineralogical principles and concepts, followed by four chapters covering gemmological topics including gem synthesis, imitation and assembled gems, artificially induced alterations of properties (gem enhancement), and cutting and polishing of gemstones (fashioning). Chapter 14, comprising about one third of the book, carries descriptions of gem materials arranged alphabetically in four categories: important (most commonly used) gemstones (30), less important gemstones (49), organic gem materials (7), and synthetic gem materials (15). Each of these chapters ends with a list of references and suggested reading. The final chapter outlines a procedure for use in the identification of gem materials and gives a table of properties listed in order of index of refraction.

Throughout the text, there is a linkage of identification techniques to properties and principles, making this a useful laboratory manual as well as a textbook of gemmology. The principles upon which gemmological instruments are based are explained, except in the case of the reflectivity meter. Mineralogical instruments such as the electron microprobe, spectrophotometer and infrared absorption spectrometer are described only briefly, since they are not generally available for use by gemmologists.

The book is well illustrated with 277 figures consisting of diagrams and black-and-white photographs. There are 16 pages of color plates, which include 80 excellent color photomicrographs of internal characteristics of gemstones.

Technically, this edition is superior to its predecessor. The print is slightly larger, there is more effective use of bold type, and appendices have been incorporated into the appropriate text. There are few typographical errors (spalerité, Frazier River, seperated), and some missing data (crystal system for malachite, optic character and sign for talc). The use of abbreviations in the descriptions are consistent, except for fracture, which is indicated usually as *F*, but occasionally as *fracture*. The use of spectral color terms to describe color is commendable. The authors depart from the conventional method of stating a range of values for specific gravity and for indices of refraction, which may be both cumbersome and confusing, *e.g.* corundum SG 4.00, +0.10/-0.05, and RI $\omega = 1.770$, $\varepsilon = 1.762$, +0.009 to –0.005.

The book encompasses virtually the entire syllabus of current gemmology courses; as such, it succeeds in its stated purpose, which is to serve as a textbook for the student of gemmology. To be useful as a textbook at the university level, or as a supplemental reference for gemmology students, would require a discussion of topics such as geological processes, genesis, origin of inclusions, crystal growth, structural explanations of properties, and origin of color.

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*Gems and Jewelry* (second edition). By Joel E. Arem. Geoscience Press Inc., 12629 N. Tatum Boulevard, Suite 201, Phoenix, Arizona 85032, USA, 1992, 176 pages. US$ 9.95 (softbound). (ISBN 0-945005-09-1).

This compact book is most attractive and informative. It is lavishly illustrated, for a small paperback, with 186 color photographs and figures, and presentation and paper quality are excellent. Good design turns its small size to an advantage; it takes up little space on the desk, and provides good value for a modest price. The main section of the book provides a coverage of the better-known gem stones, with some organic gems and ornamentals, followed by a section on collectors' stones. For each gemstone, there is a description of the mineral and its varieties, its gemmological properties, its history, and the origin of its name. Geological origin, sources and type of mining are generally covered and, true to the mention of jewelry in the title, information is given for those interested in jewelry and the value of gemstones. Consumer tips are included for the buyer, and possible problems such as mislabeling, treatments, synthetic gems and imitations are raised, where appropriate.

An introductory section explains what gems are, how they were formed, the properties of gemstones, and their cutting and marketing. A final section further examines synthetic gems, imitations, composite stones, gem treatment and gem testing. Jewelry metals, popular cuts and birthstones are discussed. An appendix provides additional information and tables. There is here much information and practical advice for those who want to learn more about, and possibly purchase, gemstones.

The book is a second edition; however, since the first edition was copyrighted in 1975, one would assume that, after 17 years, this edition would be much updated. Unfortunately, this is not the case. The second edition

keeps to the same format and page numbers as the first, although sections have been partly rewritten to include a few sentences of new information. Much has happened in the world of gemstones in the last 17 years, in terms of new sources, new synthetic stones and new technology; this is barely reflected in the new edition. An illustration of sapphire from the Umba River, Tanzania, appears, but there is no mention in the text of this important recent source of unusually colored sapphire. A glaring omission, in the section on synthetic diamonds, is the achievement of Sumitomo Electric Industries of Itami, Japan, which has made considerable advances on the featured work of the General Electric Company by growing large synthetic diamonds more economically. The section on diamonds in industry makes no mention of a most important recent development, which also has a gemmological application - diamond thin films.

Only flame-fusion synthetic phases are mentioned in any detail in the section on synthetic ruby, despite the fact that flux-fusion stones present more of a challenge to the gemmologist. The section on ivory makes no mention of fossil ivory, despite the fact that it is ideologically sound and fairly easily available in jewelry in North America. The section on pearls could have mentioned the cultured black pearls of French Polynesia, which are so different and have caused much interest since the 1980s. Such matters as these are important gemmologically, and information about them has been easily available in gemmological periodicals for some years. It is to be expected that an up-to-date book by an expert in the field would mention them as new directions to be followed.

In summary, the book is an excellent pocketbook, well-priced, with a broad but in many cases detailed coverage of its subject. More intelligent than most of its type, it unfortunately lacks significant updating in its second edition. It will appeal to the person interested in buying gemstones and to students of gemmology. It should also interest the mineralogist as an accessible and knowledgeable entry into the world of gemstones.

Gayle Webb
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*Gemstones of East Africa.* By Peter C. Keller. Geoscience Press, Phoenix, Arizona, 1992, 160 pages. US$50.00 (hardcover). (ISBN 0-945005-08-3).

This book will be welcomed eagerly by gemmologists and those mineralogists and geologists interested in gem deposits. It is the first comprehensive text on this important area, written by an expert gemmologist and geologist and gathering together material from a variety of sources. The author's excellent style of writing renders the information interesting and readily assimilated and enables him to explore the subject at some depth, while keeping to a concise format. The subject is a particularly important and fascinating one, as the rich gemstone deposits of East Africa remained undiscovered and undeveloped until the 1950s. During recent years, new deposits have emerged and with them, beautiful new gem varieties of minerals such as zoisite and garnet. Well-known gems such as sapphire have appeared in new colors, and a number of rare gemstones have surfaced. The range of microscopic inclusions in gemstones also has generated much interest.

Peter Keller has established himself as a writer who relates the finished gemstone to its geological source in some detail so that the reader may readily see it as a product of natural forces rather than a decorative item in a jeweller's window. The Foreword, by John Sinkankas, mentions that the author intends this book to be the first of a series of such monographs on notable gem-rich regions of the world.

The book begins with a geological overview of the gem fields of Kenya and Tanzania (collectively called East Africa). Subsequent chapters explore the major gemstones and their deposits in detail, with an accompanying map. The geology, history and mining of the deposits are covered, and the gemstone properties, including microscopic inclusions, are well described. Where possible, important stones from the deposit are mentioned. At the end of each chapter, a generous list of references is provided, showing a comprehensive range of sources.

Paper quality and photographic reproduction are excellent; a focal point of the book is the luscious but precise photography of Harold & Erica Van Pelt and Tino Hammid. Readers of *Gems & Gemology* will feel a sense of *déjà vu* with some of these illustrations, since they emerged in that periodical about the same time the book came into this reviewer's hands. Interesting and possibly unique photos of mining localities and sorting, taken by Dr. Edward Gübelin, lend human and historic interest to the text. Mention must be made of John Koivula's magnificent photographs of gemstone inclusions, which show excellent detail and true color.

A slightly jarring note is struck by the layout of the text, with its frequently single column only on one side of the page and subsequent large blank spaces on the other. It would have been a useful space for note-taking, but the book is far too attractive to write on.

The final chapter on less important gems of East Africa is nevertheless one of the most interesting, covering the rarer collectors' stones, and mentioning such amazing finds as Tanzanian sinhalite and transparent, facetable gem tremolite and actinolite.

At the end of the book are three Appendixes, the first giving exact positions of noteworthy localities of East African gemstones. The following two are most interesting lists of East African gemstones in the collections of the Los Angeles County Museum of Natural History and

the National Museum of Natural History (Smithsonian), Washington D.C.

After first seizing upon this book as an important new text on a subject where little information was available, the reader is left with an impression of attractive presentation backed by meticulous method and research. Considering the scope and quality of the book, the price of US$50 seems a reasonable one. Though doomed to become quickly out of date as new deposits are discovered, it will be needed in specialists libraries, by students, and by professional gemmologists, mineralogists and geologists interested in gemstones.

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*R.O. Chalmers, Commemorative Papers* (Mineralogy, Meteoritics, Geology). Records of the Australian Museum, Supplement 15. Edited by F. Lin Sutherland. Australian Museum, 6 College Street, Sydney, NSW 2000, Australia, 1992, 136 pages. AUS$32.00 + postage AUS$2.50 (Australia, New Zealand) or AUS$6.00 (overseas), (softbound). (ISBN 0 7305 9990 6).

The volume consists of ten papers that were presented at a symposium in June 1989 to honor the 60 years of mineralogical activity of Oliver Chalmers, who started work in the Mineral Section of the Australian Museum in June 1929. This volume shows the sphere of interest of his colleagues and Museum associates. The breath and depth of Australian mineralogy are well illustrated. The articles range from ten to twenty pages.

There are five articles on mineralogy. The chemical composition of pyromorphite from Broken Hill, New South Wales, is described by A.I. Inegbenebor, P.A. Williams, R.E. Bevins, M.P. Lambert and A.D. Hart. Auriferous limonitic stalactites with up to 26 ppm Au are described from the Bimbimbie gold mine, New South Wales by Laurie J. Lawrence. The possible origins and ages of sapphire and diamond from the central Queensland gem fields are discussed by A.D.C. Robertson and F.L. Sutherland. Chabazite, phillipsite and natrolite from Ben Lomond, New England region, New South Wales, indicative of a silica-undersaturated environment, are described in the paper by Brian M. England. Laumontite and heulandite or clinoptilolite occur as pseudomorphs after Jurassic gastropods from Ponganui, New Zealand, and are described in the paper by K.A. Rodgers and N. Hudson.

The two historical articles: minerals in the Australian Museum from 1901 to 1945 by Oliver Chalmers, and Samuel Stuchbury and the Australian Museum by Dave Branagan make fascinating reading. The article on the documentation of a one-hundred-year-old rock collection as a computer catalogue database by L.M. Barron shows the advantages and problems in this large undertaking. The deserts or semi-arid land provide conditions for prolonged preservation of the Australian meteorites described in the longest article by A.W.R. Bevan, with a seven-page appendix, which gives name, classification, year, and locality of all Australian meteorites. The artefacts made of obsidian in West New Britain, Papua New Guinea have been discriminated with ion beam analyses of their chemical compositions by R. Torrence, J. Specht, R. Fullagar and R. Bird.

The printing is easy to read on good-quality paper. Therefore, the photographs show fine details. No spelling errors were found. One of the problems that is common to volumes of many authors is the lack of consistency between papers; however, the editor must be congratulated on an excellent volume. The book represents good value for money since the Australian dollar is only $0.88 Canadian, so that it is highly recommended.

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*Meteorites: The Key to Our Existence.* By Robert Hutchison and Andrew Graham. Natural History Museum Publication, London, 1992, 61 p., £5.95.

This book is popular science at its best, designed as an outreach to the general public, to present the essentials of meteoritics in lucid prose, with magnificent illustrations. It will interest anyone in the laity from about 10 years of age up; for the professionals, it will provide a succinct response to the question "Why are you interested in meteorites?"

The reader is successively informed of the kinds of meteorites, where they come from, where they fall (and are sometimes retrieved), what they are composed of, how old they are, and what they tell us about cosmological topics.

The *natural history* aspects of meteorite studies are well brought out, both in the text and in the choice of photographs, ranging from the Australian desert to the Antarctic icefields to the high-flying aircraft that bring back interplanetary dust particles. The perpetual challenge, of photographing a meteorite specimen in such a way as to make it interesting to the layman, is almost solved in this book, and is greatly aided by the top-quality color printing on stout glossy paper (the best mineral color photograph I have *ever* seen is the pallasite on p. 37).

The choice of what to exclude is difficult in a book that probably was designed to the stipulated page budget of a Museum series, especially for a discipline that touches on so many scientific and human activities. It would have been good to see a little more of the text devoted to the *chronology* of meteorites, which has been

such a major contribution to science, but perhaps this could not be fitted in.

One may carp a little at the choice of the title, designed perhaps to suggest a social significance to an austere subject. But, since mankind has signally failed up to now to find any key to its existence, the presence of abiotic carbonaceous compounds in some kinds of meteorites may serve as well as any other clue.

The authors are distinguished practitioners of meteorite studies; they and the Museum are to be congratulated on a slendidly achieved book, in a convenient format (20.5 × 19.5 cm): buy a copy for your child, or for your grandmother.

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*Crystal Data, Systematics of Minerals.* By Alexander R. Hölzel. Ulmenring 11, D-6501, Ober-Olm, Germany, 1992, 173 pages, (hardbound).

*Crystal Data* is an excerpt from the *Systematics of Minerals*, which has previously been reviewed in *The Canadian Mineralogist* (**29**, 177, 1991). The crystal data are taken from a computer mineralogical database, which is kept up to date. The preface gives examples of the system of mineral classification and abbreviations used. An alphabetical list of mineral names (57 pages) in two-column format gives the unique number in the system of mineral classification. A systematic table (113 pages) in single-column format gives the unique number in the classification, mineral name, chemical formula, density, *Z*, crystal system, crystal class, space group, *a*, *b*, *c*, α, β, γ, and volume. The systematic table is ordered by the unique classification number.

There are four different mineral classification numbers used presently (Strunz, Lapis, Nickel and Nichol, and Hölzel), so that this unique classification number must first be looked up in the alphabetical list of mineral names to use the systematic table. At present, the Commission on Classification of Minerals of the International Mineralogical Association is looking at these numbers in order to achieve a common system of numbering.

The most common order for a systematic table of crystal data would be to arrange by unit-cell order. The next most common order would be alphabetically, by name of mineral species. The listing does have one distinct advantage in that varieties are brought together with their relevant mineral species (*e.g.*, quartz and chalcedony, gold and electrum). This book contains only one variety of quartz compared to the 36 varieties in the 1988 edition, a step in the right direction. In my opinion, all varietal names should be removed. Some of the abbreviations used will cause problems to the casual user.

At present, there is no book that lists crystallographic data of all mineral species in an inexpensive format. If you are unable to afford an expensive compilation of crystallographic data of all mineral species, then this book will fulfil your needs.

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*The Elements* (Second edition). By John Emsley, Oxford University Press, 70 Wynford Drive, Don Mills, Ontario M3C 1J9, 1991, 251 pages. $32.50 (ISBN 0-19-855568-7).

This is a well-organized no-frills reference book on the chemical elements, which currently tally to 105, from the familiar hydrogen to the unfamiliar unnipentium. It is a serious and up-to-date compilation of data that the author began as a hobby and now, years later, has run through a first edition and on into a second.

The layout of the book is simple and consistent: a facing pair of pages for each element, arranged alphabetically from actinium to zirconium. A heading for each gives atomic number, mass, discovery, and etymology. Data are then presented under five headings: chemical, physical, nuclear, electron shell, and environmental. Of particular use to mineralogists, petrologists, and geochemists under each of the headings are the following: Chemical: radii, standard reduction potentials, and oxidation states; Physical: thermodynamic properties and mass-absorption coefficients; Nuclear: isotopes with their abundances, half-lives, and decay schemes; Electron-shell: main lines in atomic spectra; Environmental: abundances and geological data. A nine-page introduction to the book explains the sources and presentation of data. Ten pairs of tables close the book. Each pair covers a topic, ranging from the discovery, melting points, boiling points ..... to crustal abundances. For each of the ten, one table follows the order of the elements by atomic number, the other by magnitude, from the earliest-discovered element to the most recent, from the element with the highest melting point (carbon) to the one with the lowest (helium), and so on.

I enjoyed going through this book. I was fascinated by the brief descriptions (Li: soft, white, silvery metal), the etymology [Nb: Niobe, the daughter of Tantalus (see your periodic table)], and the complex history of discoveries. I was able to check up on a song, popular when I was growing up, that stated that we're just made up of "Ninety-eight cents worth of elements." In fact, we're composed of nine major elements: O (61.4%), C (22.9), H (10.0), N 2.6), Ca (1.4), P (1.1), K (0.2), S (0.2), Na (0.1), and measurable pinches of 23 others to make up the remaining 0.1%. If combined in common salts, these can in fact be obtained for 98¢, even in today's devalued currency.

The book is not without shortcomings. The use of the slash is sloppy throughout (Melting point/K; Thermal conductivity/W $m^{-1}K^{-1}$: 0.152 [300 K]; Cell dimensions/pm; Electron affinity ($M \rightarrow M^-$)/kJmol$^{-1}$: 156; Seawater/p.p.m.; Reserves/tonnes; and so on). Better editing is needed here. The geological data are rudimentary, and some are badly out of date, particularly on the "high-tech" metals. I was left in the dark as to which element is the most electronegative: He or F? (p. 2). A few typos have crept in, but none is serious. The physical shape of the book (28 cm high and only 14 cm wide) is awkward.

For a third edition, I encourage Dr. Emsley to collaborate with a geochemist to widen the scope (and the audience!) of this fine book. A geochemist would be able to improve and update the geological data and to add such bread-and-butter topics as chondrite abundances, element substitutions, and standard heats of formation, free energies of formation and entropies of the elements (and their oxides or simple compounds).

Although compiled by a chemist and bearing a strong chemical (as opposed to mineralogical) slant, *The Elements* is a compact reference useful to earth scientists and should be available to them in their departmental or divisional libraries.

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*An Introduction to the Rock-Forming Minerals* (Second edition). By W.A. Deer, R.A. Howie, and J. Zussman. Longman, Essex, England, 1992, 696 + xvi pages. CDN $59.95, (ISBN 0-582-30094-0). Available in Canada from Copp Clark Pitman Ltd., 2775 Matheson Blvd. E., Mississauga, Ontario L4W 4P7.

Write the three letters "DHZ" and a majority of mineralogists and hard-rock geologists around the world will recognize the tireless trio of British professors, W.A. Deer, R.A. Howie, and Jack Zussman. Well, the three are now Professors Emeriti, but this transition seems not to have retarded their productivity. A second edition of *Introduction to the Rock-Forming Minerals* now follows the enormously successful first edition, published in 1966.

The first edition of "*Introduction*" must be one of the most widely used basic references in the earth sciences. Well-thumbed copies stand on the bookshelves and lie on the lab benches of countless mineralogists and geologists, be they workers in academia, industry, or government. Clearly, this book is so familiar that to describe its second edition is best done by pointing out how it departs from its predecessor. This I shall do in two parts: scientific content and graphical presentation.

Scientific content: Fundamentally, the format of the second edition mimics that of the first. Nevertheless, mineralogy has made great strides in the past quarter-century, and this progress is well displayed in the second edition. Some minerals have been shifted about in the classification because their structures have become better known. The data on many minerals have exploded, and this is reflected in selectively more complete coverage. Recent revisions of amphibole and pyroxene nomenclature have been embraced. Deerite, howieite, and zussmanite are at least mentioned (under stilpnomelane), although their interesting optical properties are not given. A handful of minerals have been dropped; personally I was saddened to see catapleiite go. Unit-cell data are provided throughout, as are reflected-light data for opaque minerals. The subject of plate tectonics is mentioned, and the moon is recognized as a mineral locality. An appendix on end-member calculations and a fold-out birefringence chart in color have been added. Seven pages of black-and-white photomicrographs and a two-color plate recycled from DHZ volume 4 add little and could have been omitted.

Graphical presentation: It is only here that I must express disappointment. Whereas the first edition is small enough so that it never seemed to get in the way on an already crowded microscope bench, the second edition is a real "grosse brique" which *will* get in your way. It is a much bigger book in all dimensions. It has 168 pages more than the first edition, and at 1 kg it weighs nearly twice as much. Does this physical expansion reflect the increase of information contained in the second edition? Only partly. For example, the second edition uses larger type and broader line spacing; thus, even though physically 20% more spacious, each page of the second edition carries some 80 words *less* than a corresponding page of the first edition. Layout, in general, could have been better executed to conserve space. Another example: whereas under the mineral descriptions, the parameters dispersion, density, and hardness are given on a single line in the first edition, each rates a line of its own in the second. For nearly a hundred minerals, that consumes a lot of space. And so on.

Do I recommend this book? Yes, I certainly do. It is mandatory for undergraduate and beginning graduate students in optical mineralogy and petrography. If you have been using the first edition, replace it with the second. In spite of its inconvenient swollen dimensions, the updated mineralogical content makes it all worthwhile. In my view, the DHZ "*Introduction*" will continue to be the fundamental reference in its field for many years to come.

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# Experiments at High Pressures and Applications to the Earth's Mantle

**Mineralogical Association of Canada Short Course**
**University of Alberta, Edmonton, Alberta**
**15-16 May 1993 (before GAC-MAC meeting)**

Techniques for experimentally simulating the outer ~1000 km of the Earth have evolved over the past several decades. With the refinement of multiple-anvil devices, experiments in $mm^3$-size volumes at pressures to 25 GPa have become possible. The scientific community in Canada has available a national facility that offers this capability in the C.M. Scarfe Laboratory of Experimental Petrology at the University of Alberta. The USSA-2000 'Superpress' can achieve simultaneously pressures of 27 GPa and temperatures >3000°C. Use by members of the research community external to the University of Alberta is actively encouraged.

A Mineralogical Association of Canada Short Course is scheduled for the 1993 GAC-MAC meeting in Edmonton. This Short Course will focus on experimental studies of the lower crust and upper mantle. The topics will range from 'nuts and bolts' of actually doing the experiments, to broader discussions of what we know about the Earth's mantle, what we think we know, and—most importantly—what we don't know.

The audience for the Short Course consists of two groups: (1) researchers and students interested in using the experimental apparatus for their own research, and (2) earth scientists interested in the general field of mantle petrology, evolution, and high-pressure geochemistry who wish to get an overview of current research in the field.

The Short Course will consist of three parts. First, an overview of apparatus and techniques for high-pressure experimentation will be given, focussing on what is possible to do both in Canada and in collaboration with colleagues in other countries. Second will be a series of talks focussing on both techniques and results of experiments at high pressures, and the application of those results to the Earth. The emphasis will be on the current state of understanding of equilibrium and kinetic processes that are taking place at high pressures and temperatures. The final portion of the Short Course will consist of an afternoon spent 'hands-on' in the Superpress lab, where interested participants will assemble and conduct an experiment. This exercise will give prospective users of the facility a better idea of what is involved in multi-anvil experimentation.

For more information or for a registration form, write

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