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BOOK REVIEWS

Gold – the Noble Mineral. ExtraLapis English No. 5, R.B. Cook, E.R. Coogan, G. Neumeier and G.A. Staebler, editors. Lapis International LLC, P.O. Box 263, East Hampton, Connecticut, U.S.A., 2003, 112 p. US$24 (plus $2 for shipping to non-US addresses), soft cover (ISBN 3–921–656–23–0).

According to a summary statement on this issue's back cover "Beginning with the basics of gold mineralogy and enrichment, our expert team of authors traces the history of gold and man from the Egyptians to the modern-day, technoprospectors. Along the way, they describe localities, share stories and offer tips for evaluating specimens and avoiding fakes. Each article is lavishly illustrated with maps, diagrams and unforgettable, full-color photographs of some of the world's finest examples of crystallized gold".

The following are the titles in order from the Table of Contents: "What is gold" and "Gold and man: since the dawn of civilization" (K.-L. Weiner); "North America's first gold rush: gold fever in the southeastern USA" (R.C. Tacker); "California and all that is *gold*en" (W.C. Leicht); "Australian gold: mega-nuggets from down under" (D. Henry and W.D. Birch); "The rush for gold turns north to Canada and Alaska" (M. Mauthner); "The great electronic gold rush" (E.R. Coogan and R.B. Cook); "Gold deposits – an overview" (K.L. Webber, R. Hochleitner and R.B. Cook); "The mineralogy of gold – a review" (S. Weiss); "Golden pseudomorphs" (D. Ellis); "The British gold rush of 1854" (M.P. Cooper); "British gold: rare and collectable" (photo gallery); "Farncomb Hill: Colorado's finest gold specimens" (E. Raines); "Colorado gold – gold in Colorado" (photo gallery); "Gold mining and investment" (H.-G. Bachmann); "Gold records" (G. Mason), "All that glitters: testing gold" (H.-G. Bachmann), "Evaluating gold specimens" (W.C. Leicht); "Gold in medicine" (J. Spiller).

The authors listed total seventeen, yet eighteen authors are formally named (p. 112). The missing acknowledgment (in the Table of Contents) is evidently that owed to Katherine Dunnell, coauthor with Mark Mauthner of the contribution on the gold rush north to Canada and Alaska.

The summary statement (above) concerning the content of this issue promises a good deal more than is delivered. But then it could hardly have been otherwise, the history of gold and mankind being set on rather grander scales than can be synthesized in a 112-page volume. Even so, there are unfortunately major gaps in coverage. Next to nothing appears on South American and Mexican gold, and worse, scant reference (one photograph of a quartz-pebble conglomerate and less than half a page of text on the Witwatersrand) to the fabulous goldfields of South Africa. Most remarkably, apart from coinage and a single handsome gold disc (p. 15) from Peru, no gold artifacts are illustrated. In contrast, all previous extraLapis English numbers include examples of jewelry or gemstones or both. Even *Calcite* dedicated two full pages to faceted gemstones! For some unknown reason, or possibly no good reason at all, jewelry is essentially overlooked in *Gold – the Noble Mineral*. Further detracting from the overall merit of the issue is the inclusion of vastly overblown cartoons (fortunately few) such as those (p. 58-59) intended to explain deposition of gold by flowing surface waters.

A brief consideration of gold jewelry would have been a perfect fit at almost any juncture in this issue, but especially so following two key introductory chapters. The first of those includes an interesting note on gold alloys, yet curiously makes no mention of "990gold", already in the late 1980s hailed as the only significantly different jewelry (and coinage) alloy that has appeared in recent times. For the record, according to Gafner (1989), "990gold" is 990 gold–titanium, equivalent to 23.75 ct gold. Sadly, there are no flashbacks in *Gold – the Noble Mineral* to marvellous Minoan ornaments, or captivating Celtic torcs mysteriously fashioned in (crystallized!) gold, nor for that matter, New Era designer gold trinkets. Yet such artifacts speak eloquently of gold's noble nature and the tantalizing tales associated with it throughout history and mythology.

Redeeming features of the issue include: magnificent photographs contributed by a host of expert photographers; well-illustrated stories of gold rushes [southeastern USA (1779), California (1894), Australia (1851), Canada (1858), Alaska (1849)], and in several cases, notes on their lasting societal ripple effects; an entertaining account of the British gold rush of 1854, a fever aptly described (p. 76) as a "...short lived and unproductive infection." The "Great electronic gold rush" sets out the availability and applicability of gold-spe-

cific detectors – top prize here in the specimen category, and impressive proof positive in the awesome "Dragon" of the applicability factor! Central to the whole theme of course, is the overview on gold deposits, and the review of the mineralogy of gold, in which we learn that over twenty-five minerals contain gold as an essential element, with eighteen of these described as new minerals after 1956. Among other instructive notes are those on gold testing, mining and investment, and evaluation of specimens. Kudos to student J. Spiller for her brief contribution on the medicinal uses of gold – totally relevant to "the history of gold and man". If anything, this aspect ought to have been amplified.

Quibbles are unfortunately numerous. Many words and formulae are misspelled, among them: "emperor" (p. 12), "Europeans" (figure caption, p. 15), "Meguma" (p. 36), "Areas" (p. 41), "Brian" (p. 42), "Timmins" (p. 46, 52), "specimens" (p. 47), "McIntyre" (figure caption, p. 52), "because" and "strongest" (p. 59), "beginning" (p. 64), Jambor (p. 71), "its" (caption, p. 95), "$AuSb_2$" (p. 110), "Au Pb_2" (p. 111), "Tyrrell" (p. 111), "Crystallographica" (p.111), Chemistry (p.111), "Jamie" (p. 112), etc. There is a displacement of figures (or captions) on p. 47; the statement (p. 51) that "Massive sulfide deposits often contain gold, though not in large quantities." is patently incorrect, Noranda's Horne mine being but one notable exception. "Gossan" is not a German word, it is Cornish (p. 54). Figure caption (p. 95) describing the vault of the Federal Reserve bank of New York as unique, and sited "...on the bedrock of Manhatten – one of the few foundations strong enough to support the weight of both the gold and the vault" calls for qualification. Then, on p. 94, "one of the only means" surely must translate as "the only means".

These numerous oversights speak to an overall tarnish on the precious object of enquiry. Alongside Tolkien's Gollum, one has come to expect nothing less than magic of gold. It is quite possibly these inflated expectations that cause extraLapis No. 5, despite the given glitter, to fall far shorter of perfection than previous English numbers.

Reference

Gafner, G. (1989): The development of 990gold–titanium: its production, use and properties. *Gold Bull.* **22**(40), 112-122.

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Geology and Health: Closing the Gap. Edited by H. Catherine W. Skinner and Antony R. Berger (English edition). Oxford University Press, 2003 180 p., $56.25 US , hardcover (ISBN 0–19–516204–8).

The title of the book clearly identifies what is intended by the editors, and this is a very ambitious undertaking. Within the few opening pages of the book, the editors attempt to link the two very large and distinct fields, human health and geology, and identify the *gap* between these two areas as a "new field of science". They present a strong argument for more and better cross-disciplinary research. I applaud the forward thinking of the editors and their desire, to not only link the two fields, but to focus the direction of work toward a comprehensive understanding of the cause and effect relationships that are both predictable and beneficial to our health and well-being.

With the above in mind, the editors have organized a representative selection of twenty-five papers into three distinct parts: i) Natural Geologic Hazards (covering both physical and chemical aspects), ii) Anthropogenic Changes to the Geologic Environment, and iii) Identifying the Hazards. It is clear from the selection of papers and their organization that these are being used to highlight how the *gap* is currently being addressed. A number of key examples, such as those involving the well-known poisons of arsenic, mercury, and lead, are presented amongst other lesser known or recently identified systems, such as endocrine-disrupting chemicals and their links to breast and prostate cancer.

This book is clearly intended to be used as a resource book, and could easily be adopted for an upper-year case-study course. However, the book is not merely a collection of papers. The theme of the book is brought out in the commentaries preceding each Part. I would recommend reading these commentaries along with the introduction before reading all of the papers in any one Part. The individual topic of a paper can be discussed in specific detail, and at the same time the *gap* can also be addressed accordingly.

Despite being a well-organized and logically prepared text, there are a few issues that I feel were not adequately addressed in preparing this book. None of them are serious enough to cause major concerns, yet I feel that readers should be aware of some of them. On occasion, there are poorly identified chemical symbols [*e.g.*, on page 37, arsenic is a group (Va) element, not (VI) and more commonly now called a group-15 element; on page 38, ionic charges are not identified) and improper units (*e.g.*, on page 38, units of mg l^{-1} instead

of the correct symbol mg L^{-1} are used, and on page 120, it is unclear whether the units should be μg/dL or mg/dL for Pb in blood). Finally, a third example shows the need for more interdisciplinary work. In Chapter 26, on page 160, the figures that are shown are identified as *mass spectra* resulting from the analyses that were conducted, but these are clearly the *total ion chromatograms* (TICs) and not mass spectra. In part, these and other typos are related to the style of the multiple authors, and their variation in science and specific disciplines or backgrounds. More importantly, however, the writing styles of the authors and the change in content between papers makes this collection difficult to read as a book. Moving from one paper to the next, there is commonly an abrupt change in topic. However, one example of where the connection is made well is where *iodine* is a focus in Chapter 8, *Biogeochemical Cycling of Iodine and Selenium and Potential Geomedical Relevance* and Chapter 9, *Environmental Iodine Deficiency Disorders with a Sri Lankan Example*. The papers appear to immediately conflict with each other, since in the conclusion of Chapter 8, it is suggested that iodine "deficiency problems would mostly occur in regions far from oceans." Chapter 9, however, is clearly not an example of this, but the exact opposite. Later, Stiennes's paper (Chapter 8) is referenced (in bold, in the text only), and refers to the oceanic cycling of iodine and its complexity and how this is poorly understood, throwing into question Stiennes's conclusion. Not all chapters relate to each other so nicely.

The few examples reviewed above, plus others, unlisted here, indicate a weakness in our own cross-disciplinary work, which also needs to be strengthened while we attempt to bridge the *gap*.

Geology and Health: Closing the gap is a good example of how we should looking at our environment, understanding it and learning from the work we have done and will continue to do.

The book is a useful resource and a beginning for those who are interested in the *gap*.

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Mind over Magma: the Story of Igneous Petrology. By Davis A. Young, Princeton University Press, 41 William Street, Princeton, New Jersey 08540, U.S.A. 2003, 686 + xxii pages. $US69.95. ISBN 0–691–10279–1.

My first impression upon finding this tome on my doorstep for review was one of uncertainty, nearly dismay. Apart from a colorful dust jacket, the book gives an impression of aridity: nearly 700 pages of rather fine print only sparsely illustrated. Well, how quickly my initial impression changed. The book, in spite of its abominable title (more on that later), is an absolutely wonderful work and a delight to read (more on that later, too).

Young's book opens with an 8-page preface that gives an overview of what's out there on the subject, stresses the importance of a historical perspective (bravo!), and lists the author's acknowledgements. The core text of Young's history of igneous petrology is subdivided into six "eras", each covered in from 3 to 7 chapters (there are 30 in all). A voluminous bibliography (~1300 references, from Abelson to Zirkel, on 58 pages), and two slightly undernourished indexes conclude the volume. Let me here just touch on some of the high points of each of Young's six eras.

The first is "The Foundational Era", which (in part) deals with the interminable dispute of the Wernerites (= Neptunists) and the Huttonites (= Plutonists) concerning the origin of basalt, and the eventual triumph of the Brits and the (temporary) acceptance of the magmatic origin of granite.

Next is "The Primitive Era", where chemical considerations are ascendant and some early adumbrations that were to prove downright fallacious make their entrance. Outstanding among these was the contention that feldspar, with a relatively low point of fusion, occurring as euhedra against anhedral and refractory quartz, constitutes a powerful argument against the igneous origin of granite. Early schemes for the classification of igneous rocks make their appearance, and the vision of two primitive magmas, acidic and basic, gained acceptance following the proposal by Robert Bunsen, a chemist.

"The Microscopic Era" began, in a sense, with the chance encounter of Henry Clifton Sorby and Ferdinand Zirkel in 1862 (p. 151). The introduction of the thin section as a research tool was at first received cooly, but soon gained acceptance and eventual dominance, owing in large part to the huge influence of Zirkel and his contemporary, Henry Rosenbusch. The era saw the demolition of the long-held idea of correlating rock types with geologic age, the erection of petrographic provinces, the maturation of schemes to classify igneous rocks, and the growing application of whole-rock chemical analyses.

"The Experimental Era" was basically the era of Norman L. Bowen (the subject of an earlier book by Young (Mineralogical Society of America, Monograph 4), and coworkers at the Geophysical Laboratory of the Carnegie Institution in Washington, D.C. The rebirth of granitization, the fundamentalists' view of the non-

igneous origin of granite, led to arresting broadsides between the "soaks" and the "pontiffs". The end came with the publication of Geological Society of America Memoir 74 on the origin of granite by Bowen and Frank Tuttle in 1958. Again, victory to the magmatists. Other earmarks of this era were a classification of igneous bodies from akmoliths, through cactoliths (p. 338), to stocks, and a proliferation of inconsistent petrographic classifications.

Vast improvements in analytical techniques (chiefly for trace elements) and the birth of crystal chemistry ushered in "The Geochemical Era". The key early role of V.M. Goldschmidt is emphasized. Instrumentation became not only more sensitive and reliable, but ever so much more expensive as well. Enter now the plate-tectonics paradigm and the influence of space exploration. With the study of stable isotopes, the age of specialization reaches new heights (to know more and more about less and less, until one knows everything about nothing). The science now has REE and trace-element diagrams, and their pitfalls, as well as better hydrothermal bombs, $f(O_2)$ buffers, and melting experiments of truly complex systems. Young ends this era with the IUGS (Streckeisen) classification. Will this be the last chapter of a nagging topic? It began in 1823 with Karl Caesar von Leonhard (p. 110).

Today, igneous petrology finds itself in "The Fluid Dynamical Era", which deals with the mechanical, as opposed to the chemical-mineralogical aspects of igneous rocks. The dynamics of magma in large chambers in response to gradients of viscosity, density, temperature, and volatile activities, the calculation of adumbrations, and the construction of scale models with a variety of fluids are developed in some detail. The roles of double-diffusive convection and repetitive injections of magma assume an importance heretofore largely neglected. The thorny topic of layered mafic and ultramafic intrusions is a current subject of active research, where "compaction, infiltration metasomatism, double-diffusive convection, crystal settling, *in situ* bottom crystallization, density currents, and oscillatory nucleation" (p. 600) are mechanisms called upon by various petrologists. The diversity of opinion is vast.

In summary, this is a superb book. The text is smooth and unusually well written; the book is a pleasure to read. The biographical snippets scattered through the text of the major figures of igneous petrology, past and present, are instructive and absorbing, as are the formal and informal portraits of many of these toilers. The last 300 pages are a "fast forward" to this reviewer's professional experience. Teachers of igneous petrology not versed in the roots of their subject will do well to read this splendid book. Today's students, most of whom hold that nothing of value was discovered more than a year or two ago, will find astounding how much could be achieved with only rudimentary equipment by motivated and dedicated scientists. It is, in fact, a lesson for us all.

The book is not wholly error-free. Chrétien-Guillaume de Lamoignon de Malesherbes died a natural (?) death in 1786 (p. 16), and then lost his head to the guillotine eight years later (p. 17). Perhaps with such a protracted name, one achieves the right to die twice. Playfairs (for Playfair, p. 73), rock (for rocks, p. 311), and nephheline (for nepheline, p. 315) are but minor typos. In pointing out the now universal importance of the English language in igneous petrology, Young states that since its inception, the Journal of Petrology "published almost exclusively in English" (p. 436). This reviewer cannot recall a single non-English paper in the long life of that august journal. Finally, the author indiscriminately mixes heavy with dense, and light with less dense (p. 560, 565, 591).

Three omissions are worth bringing up. The major textbooks of igneous petrology from the mid-19th century on, are mentioned at their appropriate places in the text, and all are in the references. It would have been helpful, however, to list these texts chronologically in tabular form, with comments. Then, a pair of seminal papers are omitted. The first, in the midst of the renewed granite controversy of the mid-20th century, is A.F. Buddington's remarkably cogent synthesis "Granite emplacement with special reference to North America" (Geological Society of America Bulletin, v. 70, p. 671-747). The second, published at the dawn of Young's final era, is Paul Komar's "Flow differentiation in igneous dikes and sills" (Geological Society of America Bulletin, v. 83, p. 3443-3448).

My slings and arrows, however, are directed at the book's atrocious title: *Mind over Magma*, which the astute reader will notice has been assiduously excluded from my review until this sentence. The cheerless title is worthy of a self-help book from the "power of positive thinking" section of a New Age bookstore. In alphabetical order, *Mind over Magma* would be shelved between Concentration over Confusion on the left, and *Powerthinking over Chaos* on the right. Shameful. The book here under review is a serious, scholarly, professional work on a focussed subject. It is an exceptional oeuvre that will stand the test of time and be an indispensable reference for decades to come. It deserves an authoritative and distinguished title: *The History of Igneous Petrology*. Period.

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Structural Classification of Minerals. Volume 3. *Minerals with ApBq...ExFy...nAq. General chemical Formulas and Organic Minerals*. By José Lima-de-Faria (2004). Kluwer Academic Publishers, 101 Philip Drive, Norwell, Massachusetts 02061, U.S.A. 131 pages. US$61 (hardcover). ISBN 1–4020–1749–9 or US$160 (hardcover) ISBN 0–7923–6893–2 (set of three volumes).

The first volume was reviewed in *Canadian Mineralogist* **40**, 1236 (2002), and the second volume in *Canadian Mineralogist* **41**, 1070-1071 (2003). This volume completes the three-volume series with the more complicated crystal structures that contain H_2O molecules and organic minerals. The systematic tables contain mineral name, chemical formula, structural formula, space group, unit-cell dimensions, equivalent positions, structure-type, and abbreviated references (88 pages). The tables of structure-type list minerals under the headings of close-packed, group, chain, sheet, framework, tentatively classified, and not yet classified (18 pages). The book concludes with a mineral name index (11 pages), complementary information (one page), typographical errors in volume 2 (one page), acknowledgments (one page), references (one page), and conclusions (two pages).

A general table of mineral structure-types (one page) describes the tabulation inside the back cover (42 × 59 cm). The structure-types (214) are plotted on a grid of 13 different chemical-formula types (A, AB, *etc.*) *versus* five different chemical-arrangements (close-packed, group, chain, sheet, framework). Some structure-types such as cobaltite and saponite are missing, whereas the structure-types pyroxferroite and pyroxmanganite are isostructural. The polytype symbol after wollastonite "*T*" should have been changed to "*A*".

This primary classification based on structure challenges our thinking with a quotation from Maurice de Broglie: "The more men are learned, the more they have loaded their minds with acquired knowledge, the less they are fit to examine from a critical stand-point the bottom of the thoughts which have shaped their conception of things. It is in this sense that it has been rightly stated that it is what we know that prevents us from finding out what we do not know." These volumes appear to be the first published structure-based classification of the whole mineral kingdom, although an unpublished list based upon the Pearson Symbol Code exists. Authors who are preparing a new edition of Dana's System of Mineralogy and Strunz Mineralogical Tables should actively consider a move into the twenty-first century with a structural classification.

The conclusions indicate a clear tendency toward close-packing, with probably several hundred minerals overlooked as close-packed. Bischofite is clearly shown not to be a structural analogue of nickelbischofite. Very few errors were detected. The mineral index in each volume only covers the minerals in that volume, so that the reader needs to know something about the chemical formula in order to locate the correct volume in which to find a mineral. The book could have been shortened by removing the dozen blank pages. Strunz & Nickel (2000) should have been used as a reference rather than Strunz (1982).

The great strength of this book lies in the information in the tables. The book is printed on good-quality paper with clear type. Compared to other mineralogical books, the price is reasonable. Earth Science libraries will find a copy useful as a reference text, and the price may be low enough to justify a personal copy.

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Pegmatology: Pegmatite Mineralogy, Petrology and Petrogenesis. By W.B. Simmons, K.L. Webber, A.U. Falster and J.W. Nizamoff. Published by Rubellite Press, New Orleans, Louisiana 70122, 2003, 176 pages. US$59.00 (ISBN 0–9740613–0–1).

Pegmatites have fascinated geologists since the days of Haüy, who first proposed the term *pegmatite* to refer to graphic granite. I don't know who more recently coined the term *pegmatology*, but it was about time; the same could be said about *Pegmatology* the book. Despite at least two centuries of scientific interest in these deposits and many recent advances in the scientific understanding of pegmatites, this is the first book ever devoted to the study of pegmatites.

To gain a reasonable perspective on the nature of pegmatites, it was heretofore necessary to comb the geological literature for relevant scientific papers, assimilate all the information, weigh the interpretations of a variety of researchers, and integrate it all into cohesive package. The authors of *Pegmatology* have done all that, and the result is an authoritative and very readable contribution to the geological literature.

This book grew out of a guidebook written for the Maine Pegmatite Workshop, first held in May 2002. In the authors' words: "This book is not intended for the professional mineralogist or petrologist, but does contain a sufficiently comprehensive coverage that the serious reader can develop a thorough understanding of pegmatite mineralogy and genesis." In recognition of their intended audience, namely miners and serious collectors interested in learning more about pegmatites, the authors have endeavored to limit scientific jargon to

only that necessary for their presentation and to explain the mineralogical and geological concepts and processes clearly. In general, they have succeeded well; however, readers with little or no background in geology and mineralogy will probably find themselves a bit lost at times. At the other extreme, the authors' disclaimer notwithstanding, professional mineralogists and petrologists will find this book a great place to start in getting up to speed on recent advances in the study of pegmatites.

Chapter one provides a brief overview of what a pegmatite is and how pegmatites are classified. Chapter two explains key geological and mineralogical concepts (*e.g.*, plate tectonics, the composition of the Earth's crust, the atomic structure of minerals, and the rock cycle) that are essential for the subsequent explanation of pegmatite formation. Chapters 3 through 8 take the reader stepwise through the genesis of pegmatites. These chapters are titled: "Magmatic Differentiation", "Origin of Magmas", "Plate Tectonic Setting for Magma Generation", "Granite to Pegmatite", "Zonation of Pegmatites", and "Pocket Formation".

Chapter nine, by far the largest chapter, is titled "Pegmatite Mineralogy". In this chapter, the authors describe the most important and scientifically significant minerals found in pegmatites. The descriptions, for the most part, focus on those aspects of the minerals that pertain to their occurrence in pegmatites. The treatment is very uneven, with some minerals or mineral groups receiving much more attention than others, but this approach was obviously followed because of the special insights that these minerals provide. Still, it does seem a bit lopsided to devote 18 pages to the tourmaline group and just one paragraph to topaz.

The last six chapters pick up where the first eight left off. The final chapters are titled: "Classification of Pegmatites", "Pocket Indicators", "Volatiles in Pegmatites", "Cooling and Crystallization of Pegmatites", "Petrogenetic Indicators", and "Geophysical and Geochemical Exploration Methods". It isn't clear why the authors chose to separate the last six chapters from the first eight (with the mineral descriptions in between). Presumably, this reflects the way they organized the Maine Pegmatite Workshop. Nevertheless, the authors should consider placing the "Pegmatite Mineralogy" chapter last in subsequent editions. Speaking of chapters, it might also be useful to begin each chapter with the chapter number (*i.e.*, Chapter 1) rather than simply giving its title.

The book concludes with a list of references and an appendix. The reference list is quite extensive and includes virtually every important contemporary contribution to the scientific understanding of pegmatites. The appendix includes several pages on basic crystallography, a periodic table, a list of elements with crustal abundances, and a diagram showing the classification of igneous rocks. The authors apparently found these resources useful while teaching the pegmatite workshop. Two additions that I would recommend in future editions are an index and a glossary of terms.

The version available for review was the second printing of the first edition. It improved upon the first printing by correcting a few typos and making a few minor refinements. Even the first printing was remarkably error-free. The text is liberally illustrated with well-chosen photos, diagrams and tables; however, the overall quality of these illustrations could be much better.

I have one final criticism and suggestion for the authors. The book contains very little background on the fascinating history of pegmatite study. The addition of a chapter on this topic would add flavor to the book and put the modern studies into better context.

In conclusion, I highly recommend this book. It should be read by every Earth scientist involved in the study of igneous processes. It would be an excellent supplementary textbook for any course in igneous petrology or economic geology, and it could certainly be the basis for a undergraduate- or graduate-level course in pegmatology.

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