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BOOK REVIEWS

Transformation Processes in Minerals. S.A.T. Redfern and M.A. Carpenter, editors. Reviews in Mineralogy, v. 39, Short Course, Mineralogical Society of America, Washington, D.C., U.S.A. 361 pages. US$32 for non-members, US$24 for members. ISBN 0 93 9950510.

This volume arose from a MSA Short Course held in Cambridge (U.K.) in early September 2000. The emphasis of this Short Course was to present detailed examples of mineral transformations from well-studied systems. The main types of transformation covered are displacive (Angel, Bismayer, Carpenter, Dove), cation order–disorder (Heaney, McCammon, Redfern) and associated magnetic order–disorder (Harrison). The individual chapters range from thorough introductions to formalisms (*e.g.*, Carpenter's analysis of elastic properties at phase transitions, and Angel's analysis of the effect of phase transitions on equations of state) to comprehensive surveys of wide fields (*e.g.*, Heaney's chapter on solid solutions, Parise's on the applications of synchrotron radiation, and Ewing's on radiation-induced transformations). Three chapters describe the application of spectroscopies to study of transformations, including their dynamics and timescales: hard-mode infrared/Raman (Bismayer), NMR (Phillips) and Mössbauer (McCammon). Salje's chapter on meso-scale-twinned structures and their use and potential for catalysis, phase preparation and superconductive surfaces in insulating matrices is fascinating, and clear pointers are given as to the significance such meso-structures have for mineral weathering, leaching and alteration.

In all, about thirty different minerals and phases are used to illustrate in detail the breadth, depth and richness of phenomena associated with structural transformations. Several species appear in multiple chapters (*e.g.*, silica polymorphs, titanite, perovskites, åkermanites, tungstates), and this continuity allows readers to explore related aspects of structural behavior without constantly having to familiarize themselves with new mineral structures. Indeed, most of the minerals or phases discussed have structures that are familiar and accessible, so that the physical significance of the experimental data presented is easily appreciated. Helpful worked examples are given at the end of each chapter, and the bibliographies are a comprehensive and rich resource.

In my opinion, the only significant omission is a treatment of polytypic transformations, which are very common in natural specimens. It would also have been interesting to have included some classic examples of proton-driven phase transitions, *e.g.*, in $PbHAsO_4$ (schultenite).

This volume will appeal to a wide cross-disciplinary readership, including petrologists, mineralogists, solid-state chemists, solid-state physicists and material scientists. It is suitable course material for M.Sc. and Ph.D. students and final-year undergraduates in these disciplines. The whole volume is exceptionally well presented and produced, with very few errors. The volume editors, contributors and MSA are to be congratulated on a job very well done.

Mark D. Welch
Department of Mineralogy
The Natural History Museum
Cromwell Road
London SW7 5BD, U.K.

Potassic Igneous Rocks and Associated Gold–Copper Mineralization (third edition). By Daniel Muller and David I. Groves. Springer-Verlag, Berlin, Germany, 2000. 252 pages, US$79.95 (hardbound), ISBN 3-540-66371-1.

The third edition of this book is a slightly revised and updated version of their 1995 and 1997 publications. The book discusses rocks having K>Na, especially those with high K contents relative to typical igneous rocks. They range from high-K calc-alkaline rocks and shoshonites to alkaline lamprophyres and orogenic ultrapotassic rocks, but Group-II kimberlites, lamproites and kamafugites are excluded, mainly because of their unusual mineralogy. These potassic rocks have attracted increasing attention, since some of them are associated with epithermal gold and porphyry copper–gold deposits.

The book focuses on the geochemistry of these rocks, the tectonic environments of their emplacements, and the geochemical differences between barren and mineralized potassic igneous complexes. It defines five tectonic settings in which the potassic igneous rocks occur: (1) continental arcs, (2) post-collisional arcs, (3) oceanic arcs (initial), (4) oceanic arcs (late), and (5) within-plate environments, and devises a geochemical scheme showing how to discriminate among them on the basis of the geochemical composition of the rocks. The authors present examples of the type-localities of the potassic igneous rocks from the five tectonic settings, and give brief descriptions of their geology, petrography, mineralogy and geochemistry. This is followed up by a review of some recent studies on the distribution of precious metals, particularly gold, palladium, and platinum in shoshonitic and alkaline lamprophyres.

The well-documented example of Paleozoic alkaline lamprophyres with elevated gold contents from South Australia is particularly instructive. A large section of the book discusses two distinct associations of potassic igneous rocks with gold and copper mineralization. The first one includes potassic igneous suites, mainly of Cenozoic age, showing a direct genetic link with porphyry copper–gold and epithermal gold deposits. The second association encompasses mainly Precambrian shoshonitic lamprophyres that usually show an indirect relationship with mesothermal gold deposits. The associations are discussed through numerous well-explained examples, including Ladolam (Papua New Guinea), Bingham, El Indio (Chile), Grasberg (Indonesia), Yilgarn Block and Superior Province. The authors also discuss the possible geochemical differences between mineralized and barren suites and propose the use of the halogen contents of micas as a measure of gold–copper mineralization potential in potassic igneous suites.

The book is well produced and organized, and adequately illustrated. Twenty-four pages of tables summarizing the characteristics of some gold–copper deposits associated with potassic igneous rocks as well as 27 pages of references are useful and enhance the value of the book. The writing style is smooth and readable.

The book provides a modern review of potassic igneous rocks. As the appearance of a third edition implies, it is a much sought after volume that fills a gap in the literature on these rocks. This book will be a valuable resource for a wide geological audience, but particularly for those interested in mineral deposits and the geochemistry–petrology of potassic igneous rocks, although it could be easily grasped by non-specialists. It will also stimulate discussion in graduate seminars where the emphasis is on the connections between magmatic rocks and mineral deposits.

Jaroslav Dostal
Department of Geology
Saint Mary's University
Halifax, Nova Scotia B3H 3C3

Minerals in Thin Section. By Dexter Perkins and Kevin R. Henke. Prentice-Hall, Upper Saddle River, New Jersey 07458, U.S.A., 2000, 125 + xi pages. US$44 (paper), (ISBN 0-13-010997-5).

Optical mineralogy, enhanced by such innovations as the spindle stage, Nomarski differential-interference contrast techniques, and advanced staining methods, is the centerpiece of so much of mineralogy and petrology. From laboratory research to site studies to field studies, optical mineralogy plays a pivotal role in the identification of phases, the deduction of paragenetic sequences, and the interpretation of textures. Individual members of solid-solution series commonly can be identified within a few mole percent and, armed with only a pinch of crushed and sieved rock, an experienced practitioner can run down all the contained phases precisely, using but three or four immersion oils (a tip of the hat here to Howard Jaffe). Not only is this accurate and inexpensive procedure fast, but it can be done back in camp during field work. However, and this is the crucial caveat, all these wonderful tested techniques with their manifest advantages require a firm grounding in optical mineralogy. A superficial overview alone is just not enough.

Let us now look at the dark side. Imagine how diminished would be our disciplines if optical mineralogy were to be taken from our geological tool kit or, even worse, were it to be applied with uncertainty or fallaciousness. Yet, this somber situation indeed may be what the future holds, as more and more universities across North America relegate the once rigorous one- or two- semester course in optical mineralogy to a mere add-on, a skimpy appendix to the standard introductory mineralogy course. As a teacher and practicing geologist, I find this tendency odious and unacceptable. It is a prime example of "dumbing down" through shameful and short-sighted administrative decisions that, in my view, should be condemned by serious mineralogists and geologists.

The above preamble has been necessary because *Minerals in Thin Section* must be viewed in the framework of this new reality, and not in a traditional context. Thus, from the outset, let me make it clear that this book is wholly inadequate as a text for a stand-alone course in optical mineralogy. The authors say as much in their preface, where they state (p. ix): "So this book may be appropriate for instructors who teach abbreviated optical mineralogy courses."

Minerals in Thin Section is a slender, spiral-bound paperback of large (20.5 × 27.5 cm) format, made up of 125 pages of text, diagrams, and tables, plus 32 pages of color plates (mostly photomicrographs), and a half-dozen blank pages at the end, presumably for notes. The text is separated into thirty opening pages of optical theory, followed by 70 pages of mineral descriptions, six appendices, a list of the color photomicrographs, and a three-page alphabetical mineral index.

The thirty pages of theory are simplistic and inadequate. Even the careful reader will be left unsatisfied and bewildered. I shall touch only on three of the many points that merit clarification. First, the concept of relief is given short shrift: “We do not differentiate between positive and negative relief in this book” (p. 12). What a shortcoming! The student is thus denied a clear mechanism to distinguish coexisting orthoclase and cordierite (both have “low relief”), and fluorite resembles garnet in that both are isotropic minerals with “high relief.” The student isn’t helped, either, by the woefully inadequate diagrams of fluorite ($n = 1.43$) and grossular ($n = 1.75$) used to demonstrate Becke lines (Fig. 12). Secondly, interference colors are treated in a cavalier fashion, and their relation to birefringence is not developed. The cause of the Newtonian scale of colors (Plate 2) is inadequately explained. Thirdly, almost no correlation between optical and crystallographic directions is offered. The student will have no clue as to how some minerals may have extinction angles greater than 45°. This is particularly pertinent in the determination of plagioclase compositions, a subject not treated in the book.

These shortcomings are not alone. There are four (not three, p. 22) principal biaxial interference figures, and the quartz wedge (Figs. 20e, f) does not normally have a knob to hold. Fourteen citations of general texts and reference works are given (p. 30). Citing the full DHZ volumes is truly overkill; better, and more in line with the limited grasp to be gained by the hapless student who follows *Minerals in Thin Section*, would have the abbreviated DHZ *An Introduction to the Rock-Forming Minerals*.

The 67 pages of “detailed” mineral descriptions that follow the theory don’t fare any better. They carry too many errors and omissions. Sad examples are numerous, and I shall refer only to a few. The common alteration of nepheline, or its conversion to the showy mineral cancrinite, useful criteria in identification, are not mentioned (p. 40). The birefringence of scapolite is not 0.002–0.004 (p. 44). Beryl is not length-slow (p. 45), and not all chlorites are length-fast (p. 55). Sillimanite is not optically negative (p. 62), and all tourmaline crystals are length-fast (p. 68). Olivine does not possess “one good cleavage” (p. 70). What is meant by “but good figures are hard to obtain because crystals always have at least one short dimension” (sillimanite, p. 73)? “Sphene”* is commonly rather markedly colored, not “colorless or very weakly colored” (p. 76). Allanite is not a rare earth-bearing mineral, it is a rare-earth-bearing mineral (p. 80). Apatite fares especially poorly (p. 102). Its birefringence is not 0.019–0.05. It does not have “several poor cleavages in one direction”, nor are “basal (semi-hexagonal) sections length-slow.”

My global impression in reading *Minerals in Thin Section* was that the publisher bought some sort of spell-checking software and fired the proof readers. I found but a single misspelling (“sauserite”, p. 38), but plenty of grammatical errors: poor punctuation, lack of agreement between subject and verb and, above all, the undue use of adverbs of time. Some examples of this abuse are: The mineral identification tables do not “sometimes list whether a mineral is...”, interference colors are not “often a key property”, cleavage is not present solely “when it can be seen with a microscope”, staurolite does not “frequently contain inclusions”; or, how about twice in one sentence: “often twinned; sometimes alters” (p. 46). On Thursdays, but never on Sunday?

Finally, the formula for ferroactinolite is wrong (p. 65). The text on page 23 is cut in mid-sentence, and nowhere has a continuation. Also on page 23, the first line in Box 5 is botched.

No, I cannot recommend this book. The theory is inadequate, and the mineral descriptions are unsatisfactory. The real problem here, however, is that the foundation is all wrong. Optical mineralogy is a demanding subject that requires rigor and time. It is untenable to teach the subject as an appendix, an add-on, or as an afterthought.

Thomas Feininger
Department de géologie
Université Laval
Québec, (Québec) G1K 7P4

Dalnegorsk: *Notes on Mineralogy*. By V.V. Moroshkin and N.I. Frishman, with three chapters written by O.L. Sveshnikova. Edited by I.V. Pekov. Mineralogical Almanac, volume 4. Ocean Pictures Ltd., Moscow, Russia, 2001, 136 pages. US$35. ISBN 5-900395-28-6.

The book represents the fourth issue in a series on Russian mineral localities and mineral collections produced by the Ministry of the Natural Resources of Russia, the Russian Geological Society and the Lomonosov State University in Moscow. It is a welcome addition to the literature on a world-famous ore district, that at Dalnegorsk (formerly Tetyukhe), in Primorie (the Russian Far East).

* Editor’s note: The term “sphene” is shown in quotation marks here to indicate that it was formally discredited by the International Mineralogical Association in favor of titanite in 1983!

At first glance, the authors appear to have a tough time deciding whether to write an honest-to-goodness scientific text or a popular history for mineral collectors. In reality, the book is a worthwhile effort to bring together rather dispersed information, which results in a readable and often entertaining text. An impressive number of high-quality photographs on mineral species (108) and textural and crystallographic drawings (24) enhances the usefulness of the book, which is likely to be a very popular item in the library.

The book is divided into two parts, preceded by an introduction, a description of the geological setting and a list of mineral species found so far at Dalnegorsk, followed by a geographic appendix and a list of references. The list of Dalnegorsk minerals (141 species) is particularly impressive and abundantly illustrated in the whole work. The two parts of the volume, which have the same basic structure, refer separately to the polymetallic (essentially base-metal) and boron-bearing ore deposits in the district. The four polymetallic deposits (*i.e.*, Verkhneye, Sovetskoye-1, Nikolaevskoye and Partizanskoye) are treated comprehensively in the first part of the volume, whereas the sole boron-bearing deposit, that at Borosilikatnoye, is treated separately in the second part.

The history of the mineral discoveries in the area, as well as a brief description of the mining activities, constitute a welcome introduction to a thorough description of the geological setting of the two types of deposit. Geographic and geological maps, including the historical one of Briner (1915), and a number of cross-sections and block-diagrams familiarize the reader with the topography and the geological particularities of each deposit in part. The treatment of the various topics in the book is uneven, however. Significant attention was paid only to the attempt to offer basic mineralogical data on the main mineral species. This information deals essentially with the crystal morphology (habit, combination of faces, twinning, intergrowths, and crystal size), textures, mineral relationships and associations, which is meritorious for the understanding of the mineral ontogenesis. The depth of detail given is in some cases substantial, especially for the more important species for collectors; calcite from the polymetallic deposits, for example, occupies 11 pages illustrated by five crystal drawings, 14 color and one black-and-white photograph. The most unfortunate absence is the lack of any information on mineral chemistry, except for the ideal formulae given for each species in the introductory list and scarce and imprecise verbal rendering on the chemical particularities of some mineral species. This absence is regrettable if one takes into account that most of the species described are in fact solid-solution series between two or among many end-members. Forty-seven mineral species from the polymetallic deposits (14 skarn, 16 secondary and 17 ore minerals) and 51 mineral species from Borosilikatnoye (10 skarn, 20 secondary and 21 ore minerals) are briefly described or only mentioned. These minerals are originally classified as rock-forming and ore minerals, but also as minerals in hydrothermal alterations in skarns, minerals in oxidized zones in sulfide ores, minerals in cavities or minerals in brecciation zones, following their location inside the ore or skarn bodies, but also their supposed genesis. This classification, of real interest for the field collector, does not serve well for a paragenetic view on the deposits. Most of the minerals described as "rock-forming" by the authors (*i.e.*, andradite, manganaxinite, danburite, datolite, hedenbergite, wollastonite, ilvaite) compose some of the most famous boron-bearing skarn bodies in the world, whereas some others (*i.e.*, barite, aragonite, fluorite, quartz) are, together with prehnite, fluorapophyllite, clinochlore, epidote, hisingerite, of clear hydrothermal origin. The scarcity of references on metasomatic zoning, on the relationships between the boron-bearing and the barren skarn, and on the relations between the various types of skarn and their protolith are the other major shortcomings of the book. Data on mineral deposits are scarce; consequently, economic geologists will find the approach proposed by the authors particularly unsatisfactory.

Although the quality of the English is generally good, there are numerous slips that should have been caught by the editors. A random example: "Alumosilicate rocks at the contact with limestones were skarned very insignificantly.... The bi-metallic (*sic*!) replacement at the contact between limestones and alumosilicate rocks was very weak." (p. 20).

In spite of its declared goal to "provide a description of the Dalnegorsk deposits to the collectors without pretending to become a solid fundamental monograph", the book has many elements of a modern volume in topographical mineralogy, incorporating much up-to-date information and giving a comprehensive list of references (112 citations). Given this, the book can be recommended not only to the mineral collector, who remains the main target of such kind of work, but also to any mineralogist and ore geologist interested by the study of skarns and skarn deposits.

Finally, the publishers are to be congratulated for the particularly clear printing on glossy paper on better quality and, again, for the excellent quality of the photographs.

Ştefan Marincea
Department of Mineralogy
Geological Institute of Romania
1 Caransebes Str., Bucharest, RO-78344, Romania