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BOOK REVIEWS

CARBONATES: MINERALOGY AND CHEMISTRY, edited by Richard J. Reeder. Volume 11, Reviews in Mineralogy; series editor, Paul H. Ribbe. Mineralogical Society of America, 394 pages, soft cover. US$13, 20% discount to M.S.A. members.

This book represents the eleventh in the important series on mineralogy and mineral chemistry published by the Mineralogical Society of America. Partly due to their importance in sedimentology, and partly due to a relative lack of high P–T data, this book emphasizes aspects of low-temperature carbonates.

The crystal chemistry and phase relations of the common rhombohedral and orthorhombic carbonates and $CaCO_3$ polymorphs are described by R.J. Reeder, J.R. Goldsmith, J.A. Speer and W.D. Carlson, in four well-documented (tabular and graphic) chapters. The data include precise review material as well as the more recent crystallographic refinements; in this respect alone, the text can serve as a valuable handbook.

Of more general interest to sedimentary carbonate petrologists are the chapters on Mg-calcite, $CaCO_3$ dissolution and precipitation kinetics, and trace element–isotope geochemistry in carbonates by F.T. Mackenzie (and others), J.W. Morse and J. Veizer, respectively. Each of these are timely and largely up-to-date reviews.

E.J. Essene presents the uses and limitations of solid solutions in metamorphic carbonates as geological thermometers and barometers. The last chapter, by H.-R. Wenk (and others), is perhaps the best description and evaluation available to date of microstructures in carbonate minerals as determined by various S.E.M. and T.E.M. techniques.

Each of the nine chapters is well written and organized, with very little overlap. The references are lumped together at the end of the book, and this, together with their small print and "vertical" direction, makes their use somewhat unwieldy. Although we are now accustomed to typewriter-style printing of texts, certain of the diagrams and relevant captions have been reduced to bifocal range. The book lacks at least a brief chapter on igneous-type carbonates and a summary of the large amount of fluid-inclusion data published over the past 15 to 20 years. However, notwithstanding these few limitations, it is a long-awaited and important contribution and, I feel, a must for those of us involved in some aspect of carbonate research.

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INTERNATIONAL TABLES FOR CRYSTALLOGRAPHY. Volume A. Space-Group Symmetry edited by Theo. Hahn (1983). Published for the International Union of Crystallography by D. Reidel Publishing Company, Dordrecht, Holland and Boston, U.S.A. 854 pages. Price: US$165 (institutional), US$90 (individual).

This is the first of the new series of *International Tables,* the successor to *Internationale Tabellen zur Bestimmung von Kristallstrukturen* [throughout referred to as IT(35)] and *International Tables for X-Ray Crystallography* [abbreviated to IT(52)]. With a larger page format than IT(52) and a 50% increase in the number of pages, the book is big, very big; the first impression the reader gets of this book is the almost overpowering wealth of information it contains. One is tempted, at first sight, to add, mentally, the jocular subtitle "Everything you wanted to know about a space group – and previously had to work out from first principles." Just as the full title of *International Tables* was changed in going from IT(35) to IT(52), so it is changed again: the qualifier "X-Ray" is now dropped, probably reflecting the wider scope of crystallography, away from diffraction and structure determination. The numbering is also changed, this being Volume A, the successor to Volume I.

The book is divided logically into two parts: Part I contains a fairly detailed introduction, a description of the contents of the space-group tables, details of all symbols used in the Tables, as well as chapters on space-group determination. There follow over six hundred pages of space-group tables. Part II comprises an entirely new concept, new in that neither IT(35) nor IT(52) treated space-group tables as anything more than a tabulation, albeit a very systematic and useful tabulation. The present volume gives a theoretical introduction to space-group symmetry (Ch. 8), covers crystal lattices (Ch. 9), point groups and crystal classes with names of morphological forms (Ch. 10), symmetry operations (Ch. 11) and tables of comparison of space-group symbols [Schoenflies, Shubnikov, IT(35) short and full, and present edition, short and full], (Ch. 12). The last two chapters in this section cover isomorphic subgroups of the space groups, and lattice complexes.

So much for first impressions. On reading through the book and coming across new material not previously included in IT(52), I was often asking myself: "Why here?". Maybe this is a matter of personal philosophy as to what is the purpose of space-group tables: my own has always been that this is a work-bench tabulation, that should be no further than two paces away from a precession camera and a viewing screen. The number of copies of IT(52) that I have had in my hands, where spines were missing and pages loose, bear witness to the fact that others have shared my philosophy, and that these were indeed work-bench books. IT(83) has been written with a totally different philosophy in mind. How much of Part II of this volume will ever be read by structural crystallographers is a matter of conjecture. Whereas no one can deny that the bringing together of the majority of the contents of Part II is a very worthy undertaking, one is tempted to ask whether Volume A is the place for this. If one is a theoretical crystallographer, an exponent of group theory, perhaps the answer is "Yes"; for me, the answer is "No" – a matter of philosophy! Maybe Volume A should have been split into two separate parts; both would have been more manageable from the point of view of handiness, size and weight.

A detailed examination reveals the reasons for the vast increase in page area: each space group is now described on a minimum of two pages, with the diagram and a new paragraph listing the symmetry operations (which generate the equivalent sites of the Wyckoff general position) on the left page and the sites themselves on the right page, facing the diagram. Surely this is a retrograde step, relative to IT(52) where diagram and positions appeared next to each other. This feature and the now larger page format (larger than 8½ × 11″) mean that it is not as convenient to photocopy a page with the space-group diagram and equivalent sites for use in a laboratory workbook. Much more information is provided about each space group than was present in IT(52): details of maximal subgroups and minimal supergroups are provided. One basic asymmetric unit is defined for each space group. This is a useful item for anyone who has calculated an electron-density map, only to find with some chagrin that the wrong portion of the cell had been chosen as the asymmetric unit. However, in view of the space wasted beneath most space-group diagrams, it is a pity that only one such unit was defined. The Patterson symmetry is now given for each space group – a welcome addition. The data for each space group are now much more extensive: new diagrams are included for triclinic, monoclinic and orthorhombic groups, with possible origin and cell choices described, where applicable. An important feature that was dropped in going from IT(35) to IT(52) has now returned: cubic space-group diagrams, in a form completely revised from the IT(35) edition, and based upon those in Buerger's *Elementary Crystallography* are now included, and very welcome they are, too.

The book is explicit as to which conventions are folowed in the text with respect to classification into crystal systems, and in general, the classification that was introduced in IT(52) is still followed: the space groups of the hexagonal crystal "family" (???, a new word for an old concept) are now grouped into two "crystal systems". All space groups belonging to point groups 3, $\bar{3}$, 32, 3*m* and $\bar{3}m$ form the *trigonal* crystal system, whereas those of the seven point groups 6, $\bar{6}$, 6/*m*, 622, 6*mm*, $\bar{6}2m$ and 6/*mmm* form the *hexagonal* crystal system. The seven rhombohedral space groups (symbol *R*) along with those that have a hexagonal lattice (symbol P) are thus included in the *trigonal* crystal system, as they were in IT(52). The retention of this classification is a severe disappointment to many mineralogists who favor a *hexagonal/rhombohedral* division of the crystal systems, where the twelve crystal classes listed above (with symbol *P*) form the *hexagonal* crystal system, whereas the seven rhombohedral space groups (symbol *R*) form the *rhombohedral* crystal system. The latter classification makes much more sense from the standpoints of lattice symmetry and morphology. Maybe we have gone too far along the road that was laid down by IT(52) for us to turn back now; maybe the nunbering of space groups, as given in IT(52) , is now sacrosanct: to change it now would mean the rewriting of many crystallographic computer-programs, where symmetry is encoded to a specific space-group number. However, such considerations have not prevented changes in certain space-group symbols, *e.g.*, #205, *Pa*3 of IT(52) has now become *Pa*$\bar{3}$ in the abbreviated form; in fact, the whole *m*3 class has now become *m*$\bar{3}$.

Many points about the book are annoying; here is a partial list of some trivial and some not so trivial complaints:

1. Direct unit-cell vectors are now defined as (1 × 3) row matrices, with the consequence that matrices of transformation (Section 5, pp. 70-79) have rows and columns interchanged when compared to IT(52). Although there is an explanation for this (p. 70), the effect could be disastrous for anybody casually switching from IT(52) to IT(83) without reading in detail the way this should be carried out. For example, the transformation from rhombohedral to hexagonal is given as:

in IT(52), p. 21
$$\begin{matrix} 2/3 & 1/3 & 1/3 \\ \bar{1}/3 & 1/3 & 1/3 \\ \bar{1}/3 & \bar{2}/3 & 1/3 \end{matrix}$$

in IT(83), p. 78
$$\begin{matrix} 2/3 & \bar{1}/3 & \bar{1}/3 \\ 1/3 & 1/3 & \bar{2}/3 \\ 1/3 & 1/3 & 1/3 \end{matrix}$$

Obviously, if what was previously defined as a column matrix is now a row matrix, the end result is the same. There may be logic and reason for the change, but old habits die hard.

2. In a new edition, typographical errors are to be expected, and this book is no exception: *e.g.*, p. 753, point group $\bar{4}$, the indices of the tetragonal prism are given as $(hk0)$, $(\bar{h}\bar{k}0)$, $(h\bar{k}0)$, $(\bar{h}k0)$. This should read $(hk0)$, $(\bar{h}\bar{k}0)$, $(k\bar{h}0)$, $(\bar{k}h0)$.

3. The clarity (quality?) of the printing is extremely variable where the heights are given in space-group diagrams: *e.g.*, p. 508, the heights ⅓+, ⅔−, *etc.* are so faint as to be virtually illegible and certainly cannot be photocopied. Comparable symbols for heights on p. 518 are perfectly clear and very satisfactory; why the difference?

4. Finally, for $165 (U.S.), I would expect to get a book with a binding that will last. The strip of cloth reinforcing the binding of book to cover is no more than an inch wide, far smaller than on IT(52), and how many of the latter have disintegrated at the work-bench? With a book 50% heavier than its predecessor, I would have hoped for a really strong binding that would last for years under laboratory conditions. Time alone will tell whether or not this comment is fair, but my copy of IT(83) is already loose in the binding after two months of reading and use.

A generation of crystallographers grew up with IT(35), and more than one generation with IT(52). Just as we accepted IT(52), maybe the next generation of crystallographers will accept this *magnum opus,* referring to it and learning from it. Maybe, but I for one will treasure my own copy of the 1965 reprint of IT(52) and will continue to use it. The new edition I will consider a supplement to the old, but I would have to get used to it a lot more before considering it a replacement for the old.

Finally the matter of price: at $165 (U.S.) [private individual price $90 (U.S.)], the book is expensive, close to three times the price of Volumes II, III and IV, which are still available. If one can make a payment in £(Sterling), the price is about one third cheaper than the price in $(U.S.) at present exchange rates. For anyone intending to buy the book as a private user, this way of reducing the price is worth remembering, and at that price, any reduction is welcome!

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COMMISSION ON ORE MICROSCOPY

International Mineralogical Association

I.M.A. MEETINGS AT STANFORD 1986

CALL FOR PAPERS

The Commission on Ore Microscopy is organizing a Symposium within the context of the I.M.A. meetings. Six sessions are planned, dealing with ore petrology, genetic studies, sulfosalts and platinum-group minerals, quantitative identification, applications of ore microscopy in the mining and mineral processing industries, and an open session with emphasis on new instrumentation, including the ion microprobe and accelerator mass spectrometry. Each session will be introduced and chaired by an eminent keynote speaker who will also have assisted the organizers in selecting a coherent, topical group of papers. Titles of contributed papers should be sent to the COM Secretary, Dr. B. Cervelle, Laboratoire de Minéralogie-Cristallographie, Tour 16, 4 place Jussieu, F-75230 Paris Cedex 05, France, by March 1985. It is intended to publish selected contributions in a special issue of an international journal.

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