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## BOOK REVIEWS

*Crystals: Growth, Morphology and Perfection* by I. Sunagawa, Cambridge University Press, Cambridge, U.K., 2005, 295 + xii pages. CAN $127.95. Hardbound. ISBN 0–521–841–895.

The English version of this book has been prepared based on the author's translation, with a few modifications, of the Japanese version (2003; Kyoritsu Publishing Co.). The main purpose is to treat the subject of perfection and variability of crystal forms in the mineral kingdom based on the laws of symmetry and the conditions and mechanisms of crystal growth. The monograph includes 14 chapters incorporated in two parts: Part I covers Fundamental Concepts (chapters 1–8, 163 pages), and Part II covers Application to Complicated and Complex Systems; Case Studies (chapters 9–14, 112 pages). After each chapter, the author cites references to fundamental works. He displays an excellent knowledge of different mineralogical schools in the East and in the West, including leading Russian and Bulgarian scholars from the last century, and suggests reading for further study.

In Chapter 1 (Introduction), the author deals with a brief historical review of the science of crystallography, and with basic concepts in crystal growth and morphology. Crystal morphology, described by the German terms *Tracht* (variation of forms) and *Habitus* (crystal habit), are treated in Chapter 2 (Crystal forms); it provides a basic background for understanding crystal perfection in terms of symmetry (relation between the unit-cell size and the crystal habits). Chapter 3 (Crystal growth) includes in more detail problems ranging from equilibrium thermodynamics, heat and mass transfer, to the main mechanisms of crystal growth and the so-called morphodroms (morphological sequences and changes of crystal habits in relation to growth conditions according to temperature, pressure, saturation, *etc*.). Chapter 4 (Factors determining the morphology of polyhedral crystals) deals with structural equilibrium (in terms of the "periodic bond chain" or PBC theory of Hartman and Perdok), and growth forms of polyhedral crystals. In the same chapter are discussed the major factors determining the habits of crystals in time and space (*Tracht*): impurities, ambient phases and solvent components, temperature, pressure and driving force. Three types of crystal faces bounding a polyhedral crystal [1) mirror-flat faces, 2) faces characterized by striations, and 3) faces with rugged or rounded forms] and the methods of their observation are discussed in Chapter 5 (Surface microtopography of crystal faces). Chapter 6 (Perfections and homogeneity of single crystals) gives a condensed exposition on the subject, including "anatomy" phenomena in crystals, *i.e*., growth banding, growth sectors, and dislocations. Special interest is paid in Chapter 7 (Regular intergrowth of crystals) to twinning, parallel intergrowth, epitaxy, exsolution, and some other cases of regular crystallographic orientation between two or more single crystals of the same or of different species. A short Chapter 8 (Forms and textures of polycrystalline aggregates) gives an overview of the rich variety of mineral aggregates, including development of texture in multicomponent systems.

The case studies in Part II deal with single mineral species such as diamond (Chapter 9), rock-crystal (quartz) (Chapter 10), pyrite and calcite (Chapter 11), and with genetically related mineral systems formed by vapor growth (Chapter 12), by processes of metasomatism and metamorphism (Chapter 13), and those formed through biological activity (Chapter 14). The last chapter is of particular interest because the origin of life is related by many scholars to crystal-growth phenomena. In addition to the role of bacteria, crystal habits of viruses is another problem in the vast area of biocrystallography. Biomineralization and biomineralogy as a modern science have been intensively studied in recent years by numerous scientists in the interdisciplinary field of Earth sciences and biology.

The chapters on diamonds and quartz are excellent accounts of the author's authoritative research in the field of strategic industrial and common minerals, in the first case closely contributing to gemology. Valuable data on trapiche emerald and trapiche ruby are provided in Chapter 13.

*Crystals: Growth, Morphology and Perfection* is richly illustrated throughout, with over 160 figures; it includes appendixes (the crystal axes, the fourteen Bravais lattices, the seven crystal systems, indexing of crystal faces and zones, symmetry elements, stereographic projections of the thirty-two crystal classes of symmetry) and a materials and subject index. It will serve as a useful reference book for specialists and students alike who are particularly interested in crystals in natural and artificial systems. I can recommend it to any mineralogist who can appreciate new ideas in the theoretical approach to crystal forms and

in different methods and techniques for internal and external study of crystals. This up-to-date work has a place also in introductory courses in crystallography and mineralogy.

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*Kerch Iron-Ore Basin*. By Nikita V. Chukanov. Mineralogical Almanac, volume 8. Ocean Pictures Ltd., 4871 South Dudley St., Littleton, Colorado 80123, USA. 2005, 109 + iv pages.

The slender volume here under review is volume 8 in a series of sumptuous publications of the *Mineralogical Almanac,* printed in Russia. Earlier numbers may be purchased from: Mineralogical Almanac, 5341 Thrasher Drive, Cincinnatti, Ohio 45247, USA (www.minbooks.com).

Where is the Kerch Iron-Ore basin? It's just east of the Crimea, on a peninsula that separates the Black Sea from the Sea of Azov (p. 15). This reviewer admits to never having heard of Kerch, nor was it so much as mentioned in the texts (Lindgren, Bateman) that he used as a student. After reading this lean volume I knew a great deal, except perhaps just how the iron ore got there.

The Kerch Iron-Ore basin is composed of fossil-rich Pliocene sedimentary rocks. It has an ample archeological and historical heritage, having been exploited for iron and ochres from the 7$^{th}$ century, B.C., until 3:18 pm on 25 September 2002, when the last operating mine declared bankruptcy (p. 54). Geological study of the Kerch ores began late in the 18$^{th}$ century. The most important ore economically, "tobacco ore", is an oxidized hydrous oolite of ill-defined mineral composition. The origin of the Kerch ore is largely unknown. In some fashion, it may be related to the numerous mud volcanoes that dot the basin. The history of mining at Kerch is well documented and given in grinding detail (p. 48-54).

For mineralogists, the most engaging part of this publication will be the closing section, "Description of Minerals" (p. 55-104). In all, some 158 mineral species (listed on p. 58) have been identified in the Kerch basin. The more important ones are presented following chemical categories: phosphates and arseniates (*sic*), sulfates, carbonates, borates, silicates, oxides and hydroxides, silica minerals, halides, native elements, and sulfides. The basin is particularly unique for its phosphates (especially vivianite and anapaite), as well as stunning (but small) crystals of barite. Mineral descriptions are accompanied by outstanding color photographs of the foremost species, chiefly in enlargements. Examples that this reviewer found arresting are sections of gastropod and pelecypod shells replaced by pink rhodochrosite, and containing splendid euhedra of blue vivianite, green anapaite, and clear barite. The volume concludes with three pages of references (nearly 100 in all, and most in Russian), a mineral index, and a bit of colorful mineralogical advertising.

On the down side, many descriptions in the text are hard to relate to the maps (Figs. 1, 3, and 5). Some mineral formulas are non-standard, and at least one is wrong (siderite, p. 92). Most trying, however, is the text. It is raw, written by an author whose grasp of English apparently is restricted. Errors of grammar, spelling, syntax, punctuation – the works – flourish. Nevertheless, and quite surprisingly, even as awkward and wanting in quality as it is, the text is fully comprehensible. At times, the reader may lose patience, but he or she won't lose the thread. (Here I'd like to interject that I've had students with a somewhat better command of language who've been capable of writing wholly incomprehensible text!). Notwithstanding, it is regrettable that the text escaped the hand of an editor.

To conclude, this richly illustrated work will be of particular interest to those treading the turbulent waters of phosphate mineralogy. All will learn something about an unfamiliar mineral district, but no one will be the wiser as to the genesis of this curious and geologically youthful deposit.

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