BOOK REVIEW

LES MINÉRAUX ET LES ROCHES, ÉTUDES PRATIQUES DE CRISTALLOGRAPHIE, PÉTROGRAPHIE ET MINÉRALOGIE, 6e ÉDITION. H. BUTTGENBACH. Professeur à l'Université de Liége, Membre de l'Académie royale de Belgique, de l'Institut royal colonial belge et de l'Académie des sciences coloniales de Paris. Paris, Dunod, éditeur, 92, rue Bonaparte (VIe). Liége, Vaillant-Carmanne, imprimeur, 4, place St. Michel. **1935.** Printed in Belgium. XII+730 pp., 16 by 24 cm., 609 figs., 4 pls. Bound in half cloth.

When an author decides to write a *practical* textbook, he is apt to stress the facts rather than their explanation, to omit the proof of the theorems, and to present results without adequate derivation. The outcome of such a procedure is at best a catalogue of rules of thumb, or mnemonic recipes, by means of which a student is expected to find his way through a maze of disconnected phenomena. Buttgenbach's self-styled "practical studies of crystallography, petrography, and mineralogy" proceed from a wholly different viewpoint, giving eloquent proof that a practical approach to the subject can be handled in a scientific way. The policy adopted is to outline the fundamentals in such a manner as to provide methods of reasoning that can be applied in determinative work. The new edition (the 6th since the war) strives in this direction with even more success than the preceding ones. The aim, for fact, is fully realized.

The author is well qualified to understand, and to meet the needs of the practical man. He has long been active in colonial prospecting and development; since 1921, when he succeeded his former professor G. Cesàro, he has been teaching at the University of Liége. The influence of his own field experience, and that of Cesàro's teaching, can be sensed throughout the book.

The crystallography (roughly 300 pages) is largely that of the French School. The bulk of mathematical proof is collected in a separate section (*Compléments*), which may make it easier to read the text proper. A few salient features may be mentioned: (1) Derivation of crystal forms by truncations of the Lévy "primitives," use of merohedry, and the so-called Law of Symmetry. Only crystal classes of practical interest are studied in detail; all 32 are listed, however. Alternating symmetry is merely mentioned for the sake of completeness. (2) In harmony with the truncation method, the logical Haüy-Lévy form symbols are exclusively used for descriptive purposes; in the tetragonal system the primitive form is placed with the prism faces parallel to the Miller axes, thus avoiding unnecessary complication.[1] (3) Although the symmetry of the lattice is made the basis for the division into 7 systems, the 5 trigonal classes are considered only as rhombohedral, never as hexagonal. (4) The Miller symbols are used only in calculations. The choice of coordinates axes, therefore, is less important from the standpoint of symmetry than it is for crystallographers who use the Miller symbols exclusively. Three axes (*xyz*), right-handed, are used in the hexagonal system; they are obtained by omitting the 3rd horizontal axis of the Bravais set (*xyuz*). The faces of the hexagonal protoprism are then written: (100), (010), $(\bar{1}10)$, . . . instead of: $(10\bar{1}0)$, $(01\bar{1}0)$, $(\bar{1}100)$, ... In the rhombohedral system, a left-handed set (*xyz*) is used, corresponding to ($\bar{u}xz$) of the Bravais set. The symbols of the rhombohedral faces are: (111), $(\bar{1}01)$, $(0\bar{1}1)$, . . . instead of (100), (010), (001), . . . in the Miller axes, or $(10\bar{1}1)$, $(0\bar{1}11)$, $(\bar{1}101)$, . . . in the Bravais axes. Faces of the same crystal form thus do not show their symmetry by cyclic permutation of indices. This does not

[1] If the Lévy notation were likewise "Millerized" in the trimetric systems, it would probably be, at least in its simplified form, the best set of significant letters our Nomenclature Committee could hope for. (Note of the reviewer.)

matter (in Buttgenbach's treatment) since the Lévy form symbols are to be determined anyway at the close of the calculations. (5) Knowledge of spherical trigonometry (taught in secondary schools in Belgium) in presupposed. One-circle goniometry is used. It is interesting to note that the first step recommended in crystal calculation is to determine the ϕ and ρ of all faces and poles of coordinate axes, whence a straightforward solution follows, even in triclinic cases. (6) Stereographic projection is fully explained. (7) Worthy of mention is a very simple derivation of the general formulae for the angle between two faces, in terms of their Miller indices and axial elements of the crystal. (8) The statement that the law of rationality does not imply simplicity of indices (p. 103) will be questioned by many who regard simplicity of indices as the very law. (9) As to the chapter on twinning, it seems unfortunate that no mention of Friedel's generalized explanation is given; the *groupements de complément* could be more accurately described in the light of the Friedel theory. (10) The treatment of crystal optics is truly remarkable for its simplicity and logic, chiefly due to the exclusive use of the index ellipsoid as the only optical surface.[2] Its derivation is based on the elasticity theory. (11) Refractive indices are designated by n_p, n_m, n_g in the theoretical part, and by α, β, γ (courteous compromise!) in the descriptive section. (12) Many more specialized topics have been added or revised, *viz.:* universal stage, reflected light, magnetic and electric properties, x-rays, radioactivity, mechanical properties, isomorphism, etc. The major principles are outlined in each case; the book can thus touch on a large number of subjects related to mineralogy, so as to satisfy or (which is just as well!) arouse the curiosity of the reader.

The second and third parts (petrography 50 pages, and metallogeny 20 pages) are essentially given as an aid for the understanding of mineralogy; they offer an excellent summary of the general rules covering the occurrence, genesis, and alteration of minerals. The section on igneous rocks is recast. The French classification is used, but the C.I.P.W. method is also explained and some classification problems worked out.

The descriptive mineralogy covers nearly 300 pages and includes well over 300 minerals. The index lists over 800 mineral- and rock-names. Many species have been added. The choice has been made so as to embrace: all minerals of crystallographic or petrographic importance, minerals having industrial usefulness, minerals found in association with the more common species, and finally all minerals from Belgium or the Congo (the latter are the author's special field). Dana's chemical classification is followed. The Lévy notation is universally used because of its descriptive value. The figures are excellent, in spite of their free-hand lettering. Most crystal drawings are in cavalier perspective. Appropriate sketches illustrate the optical orientation. Distinguishing features are given for every species. All chemical characters mentioned have been checked (by J. Mélon) for each mineral.

The chapter on the determination of minerals has been revised. The appended determinative tables are an attractive feature of the book, especially Table VIII, which divides 134 cleavable minerals, according to the optical appearance of cleavage plates in convergent light, into 7 groups further subdivided by the optic sign of the mineral, maximum birefringence, cleavage birefringence, refractive index, and optic angle (2V and 2e). Examination of cleavage flakes as an aid in mineral determination is a tradition at the School of Liége; Buttgenbach was the first to publish the data in tabular form; the table has been expanded in the 6th edition. Table IX is a handy dichotomous key for the determination of about 40 rock-forming minerals. An alphabetical index for minerals and rocks is appended.

[2] Although the sole use of this indicatrix has been advocated in the English literature (Fletcher, F. E. Wright), the proposal has not been generally followed in our textbooks. I use the method in my course and find it most satisfactory. (Note of the reviewer.)

The book is very well printed, slightly marred by some inevitable typographical errors. It is cheaply bound, but can be procured in any type of binding.

It may be safely predicted that this new edition will enjoy the wide popularity of its predecessors.

J. D. H. DONNAY

NOTES AND NEWS

The Magazine *Rocks and Minerals* of Peekskill, New York, is sponsoring a mineralogical tour through Norway from July 4 to Aug. 13, 1936. Ample opportunity will be given to visit the famous mineral localities and to collect specimens. The Open Road, 8 West 40th St., New York City, will have charge of travel and business arrangements. While the rate of $382 includes steamship passage in Third Class, Tourist Class accommodation may be secured at an additional charge of $49. Those desiring further information should address Mr. Richmond E. Myers, 222 E. Union St., Bethlehem, Pa., who will serve as Director of the tour.

Professor W. J. Mc Caughey, Chairman of the Department of Mineralogy, at Ohio State University, has been selected as the Edward Orton, Jr., Fellow Lecturer for 1936. Dr. Mc Caughey is an eminent authority on the application of petrographic methods to the study of ceramic materials. "Contribution of mineralogy to ceramic technology and ceramic research" has been chosen as the title of the lecture which will be given on March 31 before the American Ceramic Society which is to hold its annual meeting at Columbus, Ohio.

TEACHING FELLOWSHIP IN MINERALOGY

A teaching fellowship in mineralogy has been established at Stanford University. The fellowship is open to graduate students who intend to specialize in mineralogy, and preference will be given to those who have had one or two years of graduate work. The chief duty of the fellow is to assist in laboratory instruction. Not more than eight or nine hours work a week will be required. The amount of the fellowship is $750.

Application for the year 1936–37, accompanied by testimonial letters, should be made to Professor Austin F. Rogers, Box 87, Stanford University, California.

Correction

The theoretical composition to correspond to the formula given in Column 4, Table 4 (Analyses of vesuvianite), page 8, January issue of *The American Mineralogist*, should read:

SiO_2	37.89
Al_2O_3	14.29
FeO	0.75
MgO	5.23
CaO	39.31
H_2O	2.53