of thousands of tons every year, while the crystals are of comparatively rare occurrence?

Apatite is usually shown in hexagonal prisms, and in crystalline masses, forms which have little or no commercial importance. Phosphate rock, the commercial type, which bears the same relation to apatite that limestone does to calcite, is commonly not even mentioned.

Other minerals the crystallized forms of which are in many instances allowed to gain undue prominence in the student's mind are garnet, pyrite and quartz.

Most text-books classify minerals on a chemical basis, and while this is justifiable, such a classification throws abundant and rare minerals into the same groups, and tends to confuse the student as to their relative importance. Thus in Dana's System of Mineralogy, more space is given to sternbergite than to chalcocite. Furthermore, of the minerals that are abundant the space devoted to descriptive matter may mislead students as to their relative value. For example in the text to which reference is made above the valuable mineral kaolinite occupies 3 pages, and the practically worthless epidote 5 pages.

From a chemical, physical and morphological standpoint such apparently disproportionate discussion may be fully justified, but if the student is to maintain a well-balanced concept of relative values, some effort should be made to emphasize the economic importance of all minerals studied.

The suggestion is therefore offered that all teachers of mineralogy endeavor to present the subject in such a way that the student will gain a clear idea of the relative economic value of various minerals, that he will not overestimate the importance of crystallized forms, and that he will become familiar with the commercial types.

BOOK REVIEWS

THE MICROSCOPIC DETERMINATION OF THE NONOPAQUE MINERALS. ESPER S. LARSEN. 294 pages. U. S. Geological Survey *Bulletin* **679**, Washington, 1921. (Obtainable from the Superintendent of Documents, Washington, D. C., for 30 cents.)

Tables for the identification of minerals by the immersion method under the petrographic microscope have been available for some years, but they have covered only the commoner minerals, and some of the data have been inaccurate or contradictory. Realizing the usefulness of this method, Dr. Larsen set out to collect more complete information, not only checking previous work in doubtful cases, but

actually determining the chief optical constants of over 500 species never before so studied. As a result of this splendid piece of work, he estimates that there remain optically unknown not more than 30 of the very rarest minerals, which were not represented in any of the collections accessible to him—not even in Colonel Washington A. Roebling's. In presenting the results, he points out the need for further work, however, especially the determination of optical data on crystallographically and chemically characterized material.

The methods used in determining optical constants are described in a 20 page chapter. These are in general those described in standard works, altho some practical hints from the author's experience are given, and new immersion media suggested, especially for the highest and lowest indices. There is also a brief statistical treatment of the distribution of intermediate index and double refraction, with a table of the "specific refractive energies" of the chief constituents of minerals. Incidental results of the study are the demonstration of the distinctness of certain supposed varietal minerals, as priceite, lithargite, and secondary allanite, while others supposed to be distinct are shown to be identical, notably mazapilite and arseniosiderite, liebigite and uranothallite, and bementite and caryopilite.[1] The author's personal measurements, covering hundreds of species, require 125 pages for presentation, and a like space is devoted to the tabulations.

The principal tables are divided into the optical groups, isotropic, uniaxial positive and negative, and biaxial positive and negative; and the minerals are arranged in these groups in the order of increasing index-*n*. Successive columns contain: The index; the name and formula of the mineral, formulas being given in expanded form, thus avoiding controversy as to constitution; 2V and dispersion; optical orientation; the crystal system and habit; cleavage; color; hardness and specific gravity; and remarks.

The mere mention of these features is sufficient to demonstrate the great value of the work. A few minor criticisms suggest themselves. The discussion of the principles of crystal optics is somewhat confused, the term "embedding is substituted for "immersion" now and then in a rather puzzling way, the list of immersion media does not include such useful liquids as monochloronaphthalene ("Halowax"), and the discussion of the relation between refractive index and chemical composition is not as full as it might be. Altho it is pointed out in two places that many of the minerals are variable in composition and accordingly in optical properties, this fact is easily lost sight of in the tables. After a worker determines a set of indices with care, he is likely to be impressed with the exactness of his data, and then, on not finding anything in the tables that corresponds very closely, or even (apparently) rather remotely, he may conclude that he has discovered a new mineral. This danger might have been lessened by stating at least three sets of index values for each of the more variable minerals—two extremes and a mean—and inserting a downward pointing arrow (or dagger) beside the low values, a double pointed one beside the mean ones, and an upward pointed symbol of like kind beside the high values. Moreover, when a mineral varies from + to −, some other symbol should have been introduced to call attention to the fact.

On the whole, however, the work is highly praiseworthy. There are fewer typographical errors than would have been expected in such technical matter, and

[1] Nomenclatorial changes not already noted in this magazine will be discussed in our new minerals column.

the mineralogical data give evidence of great care in compilation. "Larsen's Tables" are likely to remain the last word on the subject for a long time to come.

EDGAR T. WHERRY.

DANA'S TEXT-BOOK OF MINERALOGY. 3rd edition, revised by WILLIAM E. FORD. New York: John Wiley and Sons, Inc. 8vo, 720 pages. $5.00.

The preface to this welcome new edition of the well known Text-Book announces that the changes involved are chiefly those of addition, altho much of the description of optical characters of minerals and of drawing crystals has been rewritten to bring them into accord with modern developments.

In part I, Crystallography, the diagrams of the various crystals and projections are now plainly labeled as to either mineral represented or forms shown, so that it is no longer necessary to search for reference to a figure somewhere in the text. In cases where the clinographic projection does not clearly show the complete habit and symmetry of the crystal, orthographic plan-views are added. In the discussions of the calculations in the several systems, the use of the stereographic and gnomonic projections is introduced, with the aid of actual examples. Two-circle goniometry, and Professor Victor Goldschmidt's methods, are briefly but cordially described.

In part II, Physical Mineralogy, methods, apparatus, and literature references are brought up to date. The rewritten discussion of optical properties and their determination brings the subject into accord with modern practice. Part III, Chemical Mineralogy, has not, however, been changed enough to make it appear modern. It still records the number of chemical elements as 80; bismuth, gallium, silicon and some rare earth metals retain long discredited atomic weights; columbium masquerades as niobium; the misspelling of Avogadro's name is copied from the previous edition; while ionization (and its bearing on reactions and formulas) is not mentioned. The "Table of Periodic System" given is particularly disappointing,—several elements, including noble gases, being omitted, and nothing being mentioned as to atomic number or other modern developments. There is a paragraph on colloidal minerals, but it is hardly adequate.

In Part IV, Descriptive Mineralogy, there has wisely been no attempt to change essentially the arrangement of species, since the time for changes will be the preparation of a new edition of Dana's System. However, numerous recently described minerals, mineraloids, and mixtures have been introduced at various points, so that the book now represents a fairly complete record of the known and alleged mineral species. Other valuable additions are the paragraphs headed "Micro.," just after the older "Pyr., etc.," in which mineragraphic data are given for opaque minerals, and petrographic data for transparent ones; and the refractive indices of a considerable number of species.

In the introduction of new minerals some effort has been made to indicate their rank by the type used, species names being printed in bold face, and varieties or uncertain substances in small capitals. However, the judgment of the author and of the reviewer are not always in agreement as to the rank to be assigned (nor as to the proper location in the sequence). For instance villamaninite, sanguinite and xanthoxenite are made species, altho their original descriptions seem insufficient to justify this; while cryolithionite, cristobalite, and priceite, in spite of essential differences in crystallization from the nearest important species, are made varieties.

Some old errors in formulas of minerals are repeated, as Ag_6Bi for chilenite, $Cu_8Sb_2S_7$ for tetrahedrite, and a carbonate-free composition for hydrotalcite.

Appendix A, on crystal drawing, is greatly improved by the introduction of Penfield's and Goldschmidt's methods. Appendix B now includes a table of "minerals arranged according to chemical composition" in which are given lists of minerals containing each basic element, arranged in the order used in the body of the work. It is rather difficult to find any particular mineral in these lists, and horizontal lines separating oxides from carbonates, carbonates from silicates, anhydrous from hydrous silicates, etc., might well be added to help out in this respect.

The make-up of the book is good. There are a few compositors' errors, but mostly of an inconspicuous nature, as for instance phernacite (p. 211), itano-silicates (583) and rutite (676). This journal is not indicated as continuing on page 4 (a dash should follow the date). On the whole this new edition of Dana's Text-Book is a decided improvement on the preceding one. W.

PROCEEDINGS OF SOCIETIES

NEW YORK MINERALOGICAL CLUB

Regular Monthly Meeting of January 18, 1922

The regular monthly meeting of the New York Mineralogical Club was held in the American Museum of Natural History on the evening of January 18th, at 8:15 P. M. The President, Dr. George F. Kunz, presided and there was an attendance of 20 members. The name of Mr. Rodney B. Miller of Newark was submitted to the Committee on Membership by Mr. Broadwell. The committee on summer excursions reported progress.

Madam Arctwski, of the University of London, was introduced by the President and spoke on the vital educational needs of Poland since the War. She spoke on the scarcity of laboratory platinum, of the lack of reference literature and collections, and appealed to the Club for collections of minerals for Lemberg University. Contributions of mineral specimens from members of the Club may be sent through the Secretary to the Society of Science in care of Prof. Twbett, Warsaw, Poland.

Dr. Kunz showed several new publications including the new edition of Dana's Text-Book. He also exhibited some quartz crystals showing inclusions and embedded in sand rock.

The program for the evening consisted of "A symposium on the zeolitic and associated minerals of New Jersey." Mr. Manchester showed a number of fine lantern slides of the excavations of the Erie cut and some exceptional specimens obtained from that locality. Pectolite, cemented and pseudomorphed by quartz, also chabazite and analcite from Weehawken were exhibited by Mr. Ashby. Mr. Wintringham called attention to the recent work on the Microscopic Determination of Nonopaque Minerals, by Dr. Esper S. Larsen of Washington. Mr. Broadwell showed polished pectolite from Paterson and calcite coated on the rhombohedral planes $(02\bar{2}1)$. Mr. Maynard exhibited zeolites from Golden, Colo. and compared them with the New Jersey zeolites.

Mr. F. I. Allen called attention to the ditetragonal prisms on apophyllite from Paterson and stated that the interest of this crystal form was often disregarded. He also mentioned the "build up edges" around the termination of the West