REVIEWS.

Handbuch der Mineralchemie. Herausgegeben von C. DOELTER. Vol. i, part 1, pp. 1–160, with 14 text-figures. (Dresden: Theodor Steinkopff. 1911. Price 6·50 Marks.)

This is the first part of what promises to be an extremely important work of reference, which will be found useful, not only to mineralogists, but also to chemists. It is to be completed in four volumes, each of 800–900 pages. The list of fifty-two contributors includes names of well-known workers in many countries, who are responsible for articles on branches of the subject with which they are specially acquainted. A work written on these lines is certain to be authoritative. The plan of the work is to give for groups and for species of minerals: analytical methods, tables of analyses, physico-chemical constants, methods of synthesis, modes of origin, alteration products met with in nature and prepared in the laboratory, and methods of treatment for technical uses. The subject is treated largely from the standpoint of physical chemistry. Very full references to the literature are given.

The present part includes a general introduction, and commences with carbon and the carbonates. Of the sixteen signed articles, mention may be made of: Analytical methods in general, and the analysis of carbonates, by M. Dittrich; Diamond, by C. Doelter; Graphite—chemical and physical characters, by W. Heinisch; Graphite—artificial production and technical applications, by R. Amberg; Chemical reactions of carbonates, by W. Meigen; Formation of calcium, magnesium, and iron carbonates, by G. Linck; Sodium carbonates, by R. Wegscheider.

We regret to have to draw attention to the large number of misprints; even in the list of contributors several of the names are printed incorrectly. One loses confidence in a work of reference so marred by careless editing. It is to be hoped that future parts will be improved in this respect.

Crystallography and Practical Crystal Measurement. By A. E. H. TUTTON. Pp. xiv + 946, with 720 text-figures and 8 plates. (London: Macmillan & Co. 1911. Price 30*s.* net.)

Almost all treatises of crystallography having hitherto been written by mineralogists, it is an advantage now to have the subject presented by one whose training has been that of a chemist. By bringing together these two different, and each no doubt somewhat limited, points of view, we gain a truer perspective of the common ground. The present volume treats, however, of chemical crystallography only to a limited extent, the underlying principles being those of the accurate measurement of crystals and their properties, and the elaboration of instruments for performing such measurements. It is, in fact, essentially a detailed record of the author's own methods, which he has worked out with infinite patience, and applied with signal success to the study of the isomorphous relations of certain groups of salts. This tendency is shown in the opening chapters on 'The preparation and selection of measurable crystals', 'The goniometer', and 'The measurement of crystal angles as exemplified on a crystal of potassium sulphate'. The subject-matter is divided into two parts—morphological and physical, and in all there are fifty-five chapters. We miss from these chapter-headings any mention of the electrical and magnetic properties of crystals, thermal conductivity, pseudo-symmetry and optical anomalies, polymorphism, morphotropy, homoeomorphism, &c.; nor are any of these subjects mentioned in the index. On the other hand, we find interesting chapters on 'Crystals as homogeneous structures' and 'Fedorov's theory of cubic and hypo-hexagonal types'.

To the worker in crystallography the book will be of great value in offering hints and suggestions as to methods of research, and the construction and use of instruments. The student would, however, we think, find some difficulty in discriminating between essential and unessential details, and would perhaps be discouraged by the mass of material presented. Certain special pieces of apparatus are described in the same minute detail as in the author's original memoirs in the Philosophical Transactions. In the examples of crystal calculations given for each system we find several similar zones each worked out in exactly the same way in the fullest possible detail. It seems almost unnecessary to devote two pages to the explanation of Napier's rules for the solution of right-angled spherical triangles; whilst to repeat the explanatory diagram no less than 68 times throughout the volume does not presume much intelligence on the part of the student.

Again, a diagram to illustrate the working of the anharmonic ratio is given 36 times. The illustrations (apart from the 99 just mentioned), and the printing and get-up of the volume leave nothing to be desired.

Leçons de Cristallographie. By G. FRIEDEL. Pp. iv + 310, with 383 text-figures. (Paris: A. Hermann & Fils. 1911. Price 10 francs.)

This excellent textbook on elementary crystallography is based on the author's lectures to engineering students of mineralogy at the National School of Mines of St. Etienne, of which school he is director. Starting with the idea of vectorial properties and the space-lattices of Bravais, the principles and more important details of geometrical crystallography (109 pp.) and of physical crystallography (98 pp.) are logically developed in such a manner as to be of educative value to the student. In the second part of the book the subject of complex crystalline structures (twins) and transformations is developed on the same lines. There are short chapters on isomorphism and polymorphism, and an appendix on Schoenflies's theory of crystal-structure. By reason of his experience in teaching and the amount of original work which he has done in several branches of crystallography, the author is well qualified to write a suggestive book of this kind. Unfortunately, the numerous text-figures are poorly, and often incorrectly, drawn, being rather of the nature of rough diagrams.

The Optical Properties of Crystals, with a general introduction to their Physical Properties. Being selected parts of the *Physical Crystallography* by P. GROTH. Translated from the fourth German edition by B. H. JACKSON. Pp. xiv + 309, with 121 text-figures and 2 coloured plates. (New York: John Wiley & Sons; London: Chapman & Hall. 1910. Price \$3·50 = 15*s.* net.)

Professor Groth's classical work, 'Physikalische Krystallographie,' which first appeared in 1876 and reached a fourth edition in 1905, should surely have been translated into English before now; for, until recently, there has been no good book in our language on the physical branches of crystallography. The present translation, however, covers only one-quarter of the original, being confined to the optical portion. Pages 1–252 of the translation correspond exactly with pages 1–176 of the fourth German edition, whilst the remaining 38 pages give an abridgement, with some rearrangement in the order, of the influence of other physical characters on the optical properties of crystals. The work of translation has been exceedingly well done by Mr. B. H. Jackson, of

the University of Colorado, at Boulder, Colorado. A few explanatory notes and references to recent work are added. In an appendix, giving the names and addresses of mineral dealers and instrument makers, those of American firms are included. The book is one that may be strongly recommended to students of crystal optics.

Rock Minerals: their Chemical and Physical Characters and their Determination in thin Sections. By JOSEPH P. IDDINGS. 2nd edit., pp. xiii + 617, with 500 text-figures and coloured plate. (New York: John Wiley & Sons; London: Chapman & Hall. 1911. Price \$5·00 = 21*s.* net.)

The first edition of Professor Iddings's excellent treatise on rock-forming minerals was published in 1906 (noticed in this Magazine, vol. xiv, p. 416), and the fact that it has so soon reached a second edition speaks well for its usefulness and popularity. It takes the place of the author's earlier translation and abridgement of Rosenbusch's 'Microscopical Physiography of Rock-making Minerals'. The only alterations made in the new edition are by way of additions, there being an increase of 69 pages. In the first portion, dealing with general principles, the new matter relates to pleochroic halos, and Michel Lévy's diagram of extinction angles in the plagioclases. In the descriptive portion, 82 additional species of minerals are described. These include benitoite, the new felspars anemousite and carnegieite, and the new amphibole rhönite; the others (beryl, columbite, barytes, galena, diamond, &c.) are simply copied from Dana. The book otherwise remains exactly as before, even to the misprints.

Der Diamant. Eine Studie von A. VON FERSMANN und V. GOLDSCHMIDT. Pp. xvii + 274, with 206 text-figures and Atlas of 43 plates (292 figs.). (Heidelberg: C. Winter. 1911. Price 10 Marks.)

This is the most elaborate monograph on the crystallography of diamond that has yet appeared. But apart from this fact, the book will be of special interest to crystallographers in that it develops a hitherto neglected method of research. The light-figures reflected from the surfaces of crystals were long ago noticed by Sir David Brewster, and they are seen every day when crystals are measured on the goniometer, but very little advance has been made in their systematic study. The present authors have realized that crystals of diamond, with their striated, curved, and etched surfaces, form excellent material for this study. The majority of diamond crystals give no clear and sharp reflected image of

a spot of light, but only streaks, curved bands, stars, and patches. Such crystals cannot be satisfactorily examined by the ordinary methods of goniometric measurement; it becomes necessary to record the positions of the bands, &c., with the aid of a two-circle goniometer, and to plot these carefully on a projection. Of the 289 crystals which were so examined, detailed descriptions are given of 131; these are represented by beautifully executed shaded drawings and by coloured gnomonic projections. This has been done with a thoroughness that characterizes all Professor Goldschmidt's work. The list of forms of diamond, instead of being increased (with one exception, viz. the form 322), is reduced to the following eight typical forms, which are the only ones present as plane faces:

(100) (211) (322) (111) (332) (221) (331) (110).

Of still further general interest is the very clear and philosophical discussion of the growth and solution of diamond crystals as evidenced by their surface characters and the forms of the light-figures. Light-figures of one type are characteristic of processes of growth, and those of another type of processes of solution. Comparatively few crystals exhibit evidences of growth alone; some show that growth and solution have taken place simultaneously on different areas; whilst the majority show unmistakable signs of solution. In diamond, the octahedron is the face of maximum growth, and the cube that of maximum solution.

An historical chapter and a useful bibliography of 402 titles are given. The latter contains several misprints and rather unnecessary abbreviations: some of the English words as curtailed in titles look quite unfamiliar.

British and Foreign Building Stones. A descriptive catalogue of the specimens in the Sedgwick Museum, Cambridge. By JOHN WATSON. Pp. viii + 483. (Cambridge: University Press. 1911. Price 3*s.* net.)

The instructive collection of building stones brought together and installed in the Sedgwick Museum by Mr. Watson consists of 1,126 specimens, mostly in the form of $4\frac{1}{2}$-inch cubes with one face polished. The particulars given in the catalogue for each example include: trade-name, petrographical name, colour and texture, name of quarry and its situation, name of donor, percentage chemical composition when known, specific gravity and weight per cubic foot, and crushing strain per square foot. There are 420 examples of British building stones, arranged in the following groups: igneous rocks (plutonic), igneous rocks (volcanic),

metamorphic rocks, and sedimentary rocks, the last in eight subdivisions according to geological age. The colonial and foreign building stones are also arranged on the same plan. A very full index of 53 pages facilitates reference to the catalogue. One-half of the volume is occupied by an introduction and 'descriptive notes'; this is especially interesting and readable, and gives a general account of the distribution and working of the stones of each group in different countries all over the globe. Mention is also made of buildings, with their dates of erection, in which the different kinds of stone have been employed.

The book is issued in a handy form and at a moderate price. It is full of facts and useful information, and will be found of value to many others besides the geological student for whom it is intended as a guide to the collection. We await with interest the companion volumes promised for the collections of 'Ornamental and decorative rocks', 'Stones suitable for paving and road making', and 'Roofing slates and flags'.

Tables for the Determination of Minerals, by means of their physical properties, occurrences, and associates. By E. H. KRAUS and W. F. HUNT. Pp. vii + 254. (New York and London: McGraw-Hill Book Co. 1911. Price \$2·00 = 8*s.* 6*d.* net.)

These tables give a somewhat elaborate key for the determination of 250 common minerals, and are based on the following easily determined characters: (i) lustre (metallic or non-metallic); (ii) colour (by which five groups are recognized); (iii) streak (two sub-groups); and hardness (H. = 1–3, 3–6, or over 6). In this way 41 pigeon-holes are provided for the 250 minerals, but as many of the species are repeated several times (some as many as eight times) there is in places considerable overcrowding; and this, in a rule-of-thumb method, would no doubt confuse the beginner. Other prominent characters (chemical composition, crystalline form, cleavage, specific gravity, &c.) are mentioned for each mineral, and of special interest are the statements of modes of occurrence and associated minerals; but no simple chemical tests by which the determinations could be confirmed are given.

Calcites of New York. By HERBERT P. WHITLOCK. 4to, pp. 1–190, with 27 plates. (Albany: New York State Museum, Memoir 13, 1910.)

This work supersedes the much-quoted monography of J. R. McIrby (1879) on the crystallography of calcite. The beautiful and well-known

crystals from the old lead mines near Rossie in St. Lawrence Co., as well as those from nineteen other localities in the State of New York, are described in detail. In addition is given a very full bibliography of 196 titles on the crystallography of calcite in general, and a list of 313 crystal-forms, together with a supplementary list of 115 doubtful forms, observed on this mineral. The symbols of Naumann, Miller, Bravais-Miller, Lévy, and Mohs, and the first observer, date, and locality are given for each form. A gnomonic projection of the forms is given on a large sheet (measuring $3\frac{1}{2}$ feet across). Finally, there is a brief but interesting discussion on the influence of the genetic conditions on the habit of the crystals. Crystals bearing the steep hexagonal pyramid γ (8.8.$\bar{1}$6.3) appear to have been deposited from solutions rich in silica, whilst those with negative scalenohedra in the zone [01$\bar{1}$2, 11$\bar{2}$0] occur in iron-ore deposits.

The Growth of a Crystal. By HENRY A. MIERS. Pp. 32. (London: H. Frowde. 1911. Price 1*s.* net.)

This pamphlet contains the substance of the eighteenth Robert Boyle lecture delivered before the Oxford University Junior Scientific Club on May 20, 1911, a day which happened to be the fifteenth anniversary of the author's inaugural lecture as Waynflete Professor of Mineralogy in 1896. He therefore very appropriately gives, in an interesting and popular manner, a general summary of the results of the important work on the growth of crystals which was performed by him and his pupils during the thirteen years he remained in Oxford. Stress is laid on the importance of analogies in suggesting lines for future work, and several interesting ideas are presented; amongst others, that the particles of crystals should be regarded as being in rhythmical motion rather than as being rigidly fixed in position.

Die kristallinen Schiefer des Laacher Seegebietes und ihre Umbildung zu Sanidinit. By REINHARD BRAUNS. 4to portfolio, pp. 61, with 18 plates. (Stuttgart: E. Schweizerbart'sche Verlagsbuchhandlung, Nägele und Dr. Sproesser. 1911. Price 24 Marks.)

In a series of sixty-eight beautifully reproduced photomicrographs of thin rock-sections clear evidence is given of the complex mineral changes that have taken place in the blocks of schistose rocks ejected by the volcanoes of the Laacher See district. These schistose rocks (gneiss, mica-schist, and phyllites), themselves produced by the dynamo-

metamorphism of sedimentary rocks of Lower Devonian age, consist of quartz, muscovite, and biotite, with red garnet, staurolite, kyanite, sillimanite, &c. By the action of contact-metamorphism andalusite has been developed in them. But when the blocks have been caught up in the magma they have undergone a more profound alteration (pyro-metamorphism), their constituent minerals having been fused and re-constructed. The new generation of minerals so produced include spinel, corundum, magnetite, cordierite, sanidine, hypersthene, biotite, &c. That such changes are chemically possible is shown by the equation:

Muscovite. Biotite. Quartz.

$$4\,KH_2Al_3Si_3O_{12} + 4\,KH(Mg,Fe)_2Al_2Si_3O_{12} + 14\,SiO_2 =$$

Sanidine. Cordierite. Hypersthene. Corundum.

$$8\,KAlSi_3O_8 + H_2(Mg,Fe)_4Al_8Si_{10}O_{37} + 4(Mg,Fe)SiO_3 + 2\,Al_2O_3 + 5\,H_2O.$$

It is therefore concluded that the ejected blocks of sanidinite have been produced by the pyro-metamorphism of schistose rocks.