BOOK REVIEWS

MICROSCOPY OF CERAMICS AND CEMENTS, INCLUDING GLASSES, SLAGS AND FOUNDRY SANDS, by HERBERT INSLEY AND VAN DERCK FRÉCHETTE (with a chapter on Abrasives, by H. N. BAUMANN, JR.). Academic Press, Inc. New York, 1955. xii+286 pages, 1 fold-in color plate Michel-Levy scale of birefringence). Price $7.50.

Many of the subjects treated in this attractive volume have been covered individually in journal articles, by publications of the *ASTM*, or as chapters in text-books. Such publications cover singly, for example, the microscopy of ceramic glazes, refractories, glass, cement clinker, aggregate for concrete, porcelain enamels, and slags. But the volume under review presents all of these subjects together for the first time, and in addition useful information on microscopic studies of raw materials, structural clay products, foundry sands, and abrasives. It should, therefore, be a most useful textbook in courses dealing with glass technology, metallurgy, cement products, refractories, porcelain, etc., as well as finding wide application as a reference book in research and control laboratories of the corresponding industries.

Perhaps a book that can be highly recommended should simply be recommended and no more said, but rare indeed is a book with no minor faults—and the reviewer can do a service to both reader and author by calling attention to such real or fancied faults as he is able to discern. In the volume under review only 20 pages are devoted to optical mineralogy, obviously not nearly enough to provide an adequate background for the complicated microscopy required to make headway with the difficult materials that form the subject matter of the book. In the opinion of the reviewer, if inadequate space was available, it would have been better to depend on standard textbooks of optical mineralogy for background in this subject, and devote the 20 pages to more details of the microscopic characteristics of raw materials, where many of the mineral descriptions are inadequate. Also, the nomenclature is confusing in some respects. For example, in the table on p. 70 illite is shown as a member of the mica group, as the equivalent of hydrous mica (which is only partly true), whereas in the text the "illite group" is treated as correlative with the montmorillonite group.

There are several usages in the book which are open to question. For example "indices of refraction" is to be preferred to "refractive indices." For symbols of indices of refraction the N_x, N_y, N_z used by Insley and Fréchette are better than nX, nY, and nZ, but the simpler and more generally used α, β, and γ would have been still better. In the footnote on p. 63 "alkaline" should read "alkalic" and the preferred meaning of "presently" (p. 121 par. 2) is still "in a little while" rather than "currently."

In the chapter on optical mineralogy there are a number of statements that do not hold rigidly as written. For example, on p. 18, paragraph 2, lines 14–16, the amount by which E differs from O in an oblique section also depends on their limiting values for a given mineral. The statements concerning extinction angles (footnote, p. 17, and pp. 23–24) are accurate only for principal sections: in others (commonly seen in thin section) the rules as stated are quite misleading, because orthorhombic minerals, for example, can show inclined extinction in oblique sections, and triclinic minerals can show parallel extinction. Also in the footnote on p. 17 the statement is made that tetragonal and hexagonal minerals (are) elongate parallel to c only. This is commonly true, but minerals in these systems are by no means uncommonly platy parallel to the basal pinacoid and thus exhibit elongation *normal* to c. Less commonly they are elongate parallel to a pyramidal or rhombohedral face and thus oblique to c.

In the next to last paragraph on p. 24 the reader is referred to the colored Michel-Levy scale on p. 267, but it is in reality an insert between pp. 268 and 269. In this same para-

graph the reader should be told that the grains he is directed to study for flash figures and maximum birefringence are those showing the highest colors.

In the last paragraph on p. 33 a very unsatisfactory method is described for getting a mineral grain in the proper position for measuring a given index. At least two better ones are in common use—embedding the grains in the surface of viscous water glass (Lindberg, *Am. Mineral.*, **29**, p. 317) or on gelatine-coated slides (Fairbairn, *Am. Mineral.*, **28**, p. 396) before the index liquid is added.

On page 63, paragraph 3, the rule for changing volume per cent to weight per cent is incomplete. After multiplying the volume per cents by the respective specific gravities, the figures thus obtained must be recalculated to 100%.

The reference to Austria-Hungary near the middle of p. 83 should probably be just "Austria."

The shorthand method of expressing chemical composition used in the legend of Fig. 10.11, p. 192, should either be explained in the text, or not used.

These minor shortcomings could easily be corrected in a second edition, but even if they are not, they do not detract seriously from what is by all odds the most complete and best treatment of the microscopy of ceramics, cements, and related materials ever attempted.

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PRAKTISCHE EDELSTEINPRÜFUNG, a German rendering by W. F. EPPLER of the fifth edition of B. W. ANDERSON'S GEM TESTING FOR JEWELLERS. Octavo, 262 pages, 5 colored plates, 64 illustrations in the text, and 12 tables. Rühle-Diebener-Verlag K.G., Stuttgart, Germany, 1955. Price, bound, 24.90 marks.

The first edition of Anderson's GEM TESTING FOR JEWELLERS appeared in 1942 and was reviewed in some detail on pages 60 and 61, Vol. **28**, 1943, of this journal. The book was well received and in subsequent editions was expanded and the illustrations increased. It is now in the fifth edition.

Eppler's rendering in German is exceptionally well done. The English version was closely followed, but in cases where new material became available after the English text was published, Eppler supplied this and other pertinent information in brief footnotes. The book is well printed on good paper. The colored plates—one on absorption spectra, and four showing cut gemstones, not in the English text—are excellent. A worthwhile addition to German gemological literature has been made by Eppler.

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REPORT OF THE COMMITTEE ON THE MEASUREMENT OF GEOLOGIC TIME, 1953–1954. PUBL. **333** NATL. ACAD. SCI.—NATL. RES COUNCIL, DIV. EARTH SCI. 193 pp. 1955. $1.75.

This will be the last report of the Committee on the Measurement of Geologic Time under the auspices and leadership of the late John P. Marble. Since the death of A. C. Lane the results of the work of the committee have been coordinated by Dr. Marble, who devoted much time to the organization and preparation of the annual reports. These reports have always been informative summaries, and since the enormous expansion of research work on the geology and mineralogy of radioactive materials they have become additionally useful, particularly for the annotated bibliographies they contain. The report for 1953–1954 follows the arrangement pattern of its predecessors, with the following entries: (1) Report of the chairman—a general summary of activities and results in the field of geologic time measurement both for radioactive techniques and other methods;

(2) Annotated bibliography of articles related to geologic time (131 pp.), compiled by Marble; (3) Recent work on natural variations in the ratios of the stable isotopes by Marble—an eight page summary with a 76-entry bibliography; (4) A translation by Marble and Dr. Taisia Stadnichenko from the Russian of an article by G. R. Rik and G. V. Avdzyeliko, entitled "On the question of the variation of the isotopic composition of common lead" (*Dokl. Akad. Nauk, U.S.S.R.*, **90**, 829–831, 1953); and (5) Reports from overseas collaborators.

As has been the case for previous reports, this summary, too, will be a valuable reference tool for anyone in mineralogy or geology interested in age determination methods or "radioactive geology" in general.

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A DESCRIPTIVE GLOSSARY OF RADIOACTIVE MINERALS, by James W. Crosby III. Washington State Institute of Technology, Bull. **230**. 148 pp. Paper cover, multigraphed. 1955. State College of Washington, Pullman, Washington (no price indicated).

This bulletin presents brief mineralogical descriptions of about 200 radioactive minerals (exclusive of varieties and synonyms) under the four major categories originally used by Frondel and Fleischer (*U. S. Geol. Survey, Circ.* **74**, 1950):

I. Minerals containing uranium and thorium as major constituents.
II. Minerals containing uranium and thorium as minor constituents.
III. Minerals that, if investigated by modern analytical methods, might show uranium or thorium content (a category abandoned by Frondel and Fleischer in *U. S. Geol. Survey, Bull.* **1009-F**).
IV. Minerals that are non-uranium or non-thorium bearing, but that have been reported to contain impurities or intergrowths of uranium, thorium, or rare-earth minerals.

Each of the species is described in capsule form under numerous entries including: name, composition, crystal system, habit, radioactivity, cleavage, color, luster, specific gravity, hardness, fracture, optical (properties), occurrence, tests, varieties, remarks, and references. The bulk of the data has been obtained from Dana's System of Mineralogy, 6th and 7th ed.; U. S. Atomic Energy Commission **RMO-563** by D'Arcy George; Dana-Ford Textbook of Mineralogy; Winchell's Elements of Optical Mineralogy, 3d ed., Part II; and U. S. Geol. Survey Circulars **74** and **194** by Frondel and Fleischer. In the introduction it is stated that the " . . . bulletin is designed primarily to meet the needs of the geologist or mining engineer . . . not to fill the requirements of the highly skilled mineralogist . . . or the prospector and amateur. . . . "

Compilations of this type can be useful and informative, provided that the data are listed accurately and have been chosen with discrimination. There is little purpose, however, in a book that purports to aim at such an *intermediate* level in describing in detail all of the numerous rare mineral species whose radioactivity is very minor and whose occurrences are severely limited (lovozerite, melanocerite, rinkolite, etc.). Nor does it seem worthwhile to describe the properties of minerals of markedly questionable validity in a glossary of this type (medjidite, hokutolite, randite, uraconite, etc.), when a mere listing of invalid species would suffice.

The glossary also contains many errors, and for some species the information is incomplete or outdated; e.g., aldanite does not contain V; bassetite is not a monoclinic modifica-

tion of autunite; the most significant occurrence of brannerite, that in the Blind River Ontario region is not mentioned; djalmaite is a synonym of microlite and is not a valid species; the composition of gummite cannot be represented by a formula and hardly by $UO_3 \cdot nH_2O$; studtite does not contain Th; no mention is made of meta-tyuyamunite; the description of metazeunerite is incomplete; davidite is not a mineral with *minor* U content; Khabina for Khibina; no description is included of uraniferous collophane-francolite; and the "Bulletins of the Mineralogical Society of America," referred to in the introduction, are non-existent; what is meant, of course, is *The American Mineralogist.*

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THE MICROSTRUCTURES OF DIAMOND SURFACES, by S. TOLANSKY, N.A.G. Press, Ltd., 226 Latymer Court, Hammersmith, London, W. 6, 1955, 67+viii pages, 9 Figures, 143 Plates, Price, 40 s.

Professor Tolansky's THE MICROSTRUCTURES OF DIAMOND SURFACES presents a summary of his work on the nature of irregularities of crystal faces, cleavage surfaces, and polished and etched surfaces of diamonds. The techniques are those developed by the author—multiple-beam interferometry and the light-profile.

After an introductory chapter, a qualitative description of the methods employed is given. A more thorough treatment was published in "Multiple-Beam Interferometry of Surfaces and Films," Oxford, 1948. Some characteristics of diamond are briefly dealt with in the third chapter. The nature of the surface markings on octahedron faces, especially the characteristic trigons, are described in Chapters 4, 5, and 6. It is interesting to note that diligent search over a period of years has failed to disclose on diamond the appearance of growth spirals which are so prevalent on some crystals.

The linear discontinuities which Professor Tolansky considers may be due to slip, although he suggests twinning as an explanation, are described in Chapter 7. It seems to the reviewer that these lines are more likely thin twin-lamellae. None of the "perfect" diamond crystals on which hardness studies have been made at the University of Michigan has been free of twinning, which often manifests itself as lines (similar to those illustrated) on polished surfaces. Since these lines are parallel to octahedron planes, the distribution of trigons along such lines may be associated with other structural disturbances which are characteristic of twin boundaries in the diamond.

Etching is described in Chapter 8. In the chapter on cleavage (Chapter 9), it is pointed out that the mineralogical texts describe the cleavage of diamond as "perfect," whereas from an interferometric point of view the cleavage is far from perfect. Of course, the term "perfect cleavage" in the mineralogical sense is a relative one used to describe semiquantitatively the relative completeness of specular reflection of broken surfaces of crystals as determined by inspection with the unaided eye. Actually there are various degrees of perfection within this category. Since these terms are used primarily in the identification of minerals (cleavage is probably the most constant of the easily determined properties of crystals) much as hardness is used, a more precise statement is unwarranted. In this sense diamond does have a perfect cleavage.

The interesting fact that the two parts of a cleaved diamond do not match in detail is illustrated. Examples of a much better match of parts of cleaved topaz and mica are given. Possibly other substances could be found which behave as does the diamond.

Shadow casting, a less sensitive method for the study of larger features, is described in Chapter 10. In Chapter 11 are described both natural and induced percussion cracks.

In the final Chapter (12) studies on polished surfaces are described. The limit of attain-

able flatness on a diamond surface is discussed. It is concluded from the studies that no Bielby layer exists in diamond polishing, a conclusion which seems most reasonable.

Directional hardness measurements of E. M. Wilks, using the Grodzinski and Stern hardness microabrasion method, are described. The sensitivity of symmetry to orientation is in agreement with the reviewer's published findings. The multiple beam interferogram of a diamond hemisphere ground on Grodzinski's apparatus shows a high degree of perfection over the small area shown in the photograph. The tremendous directional hardness variation in diamond makes such accuracy quite difficult to attain.

The core of the work is a truly remarkable series of 143 plates, most of which are multiple-beam interferograms of diamond surfaces. Many of these rival in beauty the extraordinary photographs of interference phenomena of an entirely different nature published early in the century by Hauswaldt.

The general format and the quality of presentation are excellent. Reading would be made more pleasant if the plates were located closer to their textual references. Page references in the table of contents would facilitate the location of specific material.

This book is a must for all investigators whose work deals with diamond surfaces. It should be of general interest to mineralogists and crystallographers.

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SMALL-ANGLE SCATTERING OF *X*-RAYS, by ANDRÉ GUINIER AND GÉRARD FOURNET, translated by Christopher B. Walker. John Wiley and Sons, Inc., New York, N. Y., 1955. 268 pages, 78 figures, bibliography of 569 references. Price $7.50.

The authors deserve much credit both for recognizing the need for such a book and for satisfying it so admirably. As they state in the preface: "Since the late 1930's many theoretical works have appeared in this field; starting from different points of view, these have occasionally arrived at different, but non-contradictory, results. In a parallel manner, apparatus based on quite varied principles have been used in experimental methods. We believed that it was now time to collect and evaluate the results that have been obtained from the different approaches."

The key role played by Professor Guinier in the development of small-angle scattering methodology and its applications qualifies him singularly for the task of writing the first monograph on the subject. His co-author, Dr. Fournet, is well known for substantial theoretical contributions in the field. The number of workers employing the small-angle scattering technique is growing rapidly as the fields of its application are extended, and it is these new recruits who will feel particularly grateful for this book. At the same time experienced workers are sure to regard it as an indispensable reference work.

After a short introductory chapter, the authors devote the 78 pages of chapter 2 to a comprehensive treatment of the present theoretical state of the subject. Lack of space precludes presentation of many of the mathematical derivations, but all the significant formulas are given together with a thorough appraisal of their meaning and accuracy. The reader is referred to appropriate original papers for any details necessarily omitted.

The third chapter describes the kinds of equipment employed and the proper choice of experimental conditions to yield different types of information, such as long spacings, radius of gyration, and specific surface. The fourth chapter shows how the theory is applied to the interpretation of the experimental data. Chapter 5 compares particle sizes measured by small-angle scattering with values obtained by other physical methods.

Chapter 6 is devoted to applications in chemistry, biology, and metallurgy, which gives it special practical importance. Included are descriptions of studies of such subjects as

virus molecules, proteins, hemoglobin, natural and synthetic fibers, catalysts, adsorbents, and heterogeneities and age-hardening in metals. The usefulness of the book is enhanced by the inclusion of an extensive bibliography of small-angle scattering literature consisting of 569 references. This is a revision of a 398-title bibliography compiled by K. L. Yudowitch and issued in 1952 by the American Crystallographic Association.

The authors and translator have produced a lucid, readable text; however, it is understandable that a thorough grasp of the theoretical portions requires both painstaking attention and occasional reference to the original literature. The reviewer found a few typographical and grammatical errors and a number of more consequential errors in the references at the chapter ends. However, these defects are trivial in relation to the high quality of the book in all major respects.

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ANNOUNCEMENT OF A SPECIAL DOUBLE NUMBER OF GEOCHIMICA ET COSMOCHIMICA ACTA, JULY–AUGUST, 1956

This issue will contain the following papers:

(1) Silica in Hot-Springs Waters
Donald E. White, W. W. Brannock, and K. J. Murata, U.S.G.S.

(2) Dissolution and Precipitation of Silica at Low Temperatures
Konrad B. Krauskopf.

(3) Potassium-argon Dating
R. E. Folinsbee.

Subscribers who wish extra copies of this special issue may obtain them for $4.20; non-subscribers for $7.00. For $2.80 additional non-subscribers may obtain the entire current volume of 6 numbers. Orders may be sent to:

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New York 22, New York

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