can also be made for hotel accommodations. The Mineralogical Society and Paleontological Society will hold their meetings at the same time.

Mr. Charles D. Campbell of Ann Arbor, Michigan, has been appointed teaching fellow in mineralogy at Stanford University for the year 1932–33.

Two recent publications of the U. S. Geological Survey that are of unusual interest to all mineralogists are Bulletin 832, The Crystal Cavities of the New Jersey Zeolite Region, by Waldemar T. Schaller; and Bulletin 833, Mineralogy of Drill Cores from the Potash Field of New Mexico and Texas, by Waldemar T. Schaller and Edward P. Henderson.

The eleventh meeting of the Mineralogical Society of Southern California was held in the Lecture Hall of Pasadena Public Library on Monday, May 9. Dr. William Morris Davis, professor-emeritus of Harvard University spoke on "Illustrations of the Relations of Geography to History." The sixth field trip, held jointly with the geology classes of Pasadena Junior College on May 7–8, included visits to the mines at Borate, Calico and Barstow, and to the vertebrate fossil beds of that region.

Dr. Henry S. Washington, of the Geophysical Laboratory, Washington, D. C., has been elected an honorary member of the Mineralogical Society of Great Britain and Ireland.

George Frederick Kunz, internationally known mineralogist and gem expert, and vice president of Tiffany & Co., died June 29 in his seventy-sixth year. A memorial summarizing the major events of his long and active career will be published in a later issue of this Journal.

BOOK REVIEW

THE MICROSCOPIC CHARACTERS OF ARTIFICIAL INORGANIC SOLID SUBSTANCES OR ARTIFICIAL MINERALS. ALEXANDER NEWTON WINCHELL, Professor of Mineralogy and Petrology, University of Wisconsin. With a Chapter on the Universal Stage, by Richard Conrad Emmons, Associate Professor of Geology, University of Wisconsin. Second edition. John Wiley and Sons, Inc., 440 Fourth Avenue, *New York*, **1931**, xvii+403 pp. Illustrated. 15×23.5 cm. Price, $5.00.

The appearance of this book marks an important step in the education of the chemical fraternity in the application of the methods developed by mineralogists for the description and identification of crystalline compounds. No one who has had an opportunity to make use of these methods can fail to be impressed with their power and convenience, and the rapidly increasing use of the petrographic microscope in research and industrial laboratories shows that they are appreciated. There has long been a need for a book of tables and synoptic geometrical and optical crystallographic data for crystalline compounds. There is also a need for a text-book of optical crystallography in English that would teach the fundamental principles and main facts, and the methods by which they are applied in the measurement and observation of crystallographic properties.

Winchell's book represents the most complete set of tables and synoptic data for artificial inorganic compounds thus far published and as such will be found very

valuable by all who use the polarizing microscope. This assemblage of crystallographic data constitutes Part II of Winchell's book. Part III comprises a well arranged set of determinative tables based on the assemblage of data in Part II. In connection with Parts II and III the reviewers commend Plate V (in pocket inside of back cover) as a very useful chart classifying artificial inorganic solid substances on the basis of birefringence, optic sign, and refringence. Part I entitled "Principles and Methods" "consists in large part of revised selections from the author's 'Elements of Optical Mineralogy,' Part I, 3d Edition." It represents an attempt to give the reader an understanding or working knowledge of the methods whereby the data of Parts II and III have been obtained and are applied. The phenomena observed in crystals in convergent light are not discussed, however; Winchell refers the reader to his "Elements of Optical Mineralogy, Part I" (Chapters XIV and XVIII) for a treatment of this subject, which of course must be understood by all who intend seriously to use microscopic methods for the description and determination of crystalline compounds. The treatment of crystallographic principles and methods contained in Part I suffers from serious faults, several of which are carried over from previous books by the same author, and some of which are found in other books on crystal optics. A reasonably thorough discussion of these errors requires reference to other text-books and is too long to be included in this review; such a discussion will be found in an article entitled "Some Correct and Some Incorrect Statements of Elementary Crystallographic Theory and Methods in Current Textbooks" on page 365 of this issue of the AMERICAN MINERALOGIST.

More than half of "The Microscopic Characters of Artificial Minerals" is devoted to a description of the properties of artificial inorganic solid substances (chiefly crystalline compounds) and determinative tables, and the information here assembled, which is available in no other one place, makes the volume invaluable to all who use the polarizing microscope for general determinative work.

The amount of critical judgment that it is fair to expect of an author of tables is difficult to fix. It should be noted, however, that Winchell himself states in the introduction that "the general rule in this book is to give the values of the indices of refraction of pure substances to the fourth decimal place and in three kinds of light (C, D and F). . . . The indices of refraction of some pure substances have not been measured with accuracy and accurate measures have not always been made on strictly pure material; in such cases the indices of refraction are given only to the second or third decimal place." This implies a critical discrimination that has not been carried out.

The inclusion of the inaccurate values of Weber for the three principal indices of refraction of $CuSO_4 \cdot 5H_2O$ and the exclusion of the accurate and closely agreeing values of Kohlrausch and of Lavenir is illustrative of the lack of discrimination. The inaccuracy of the values of Weber had been pointed out in a paper by Posnjak and Tunell cited by Winchell (p. 228) in connection with the sulphates of copper; Posnjak and Tunell stated, moreover, that the values of Kohlrausch and of Lavenir had been further checked essentially by H. E. Merwin. (Merwin has, however, only published his experimental values for the dispersions of this substance; he has not published his experimental values of the refractive indices. The values of the refractive indices given by Merwin in the International Critical Tables are the mean values of Kohlrausch and Lavenir.) The minimum of discriminative effort required to calculate the optic axial angle from Weber's values of the refractive indices would

have shown the large discrepancy with the measured angle quoted by Winchell; moreover, the value calculated from the indices of Lavenir (similarly that calculated from the indices of Kohlrausch) agrees very closely with the measured axial angle.

Optic Axial Angle, 2V, of $CuSO_4 \cdot 5H_2O$	
46°38′	Calculated from Weber's refractive indices by the reviewers.
56°02′	Measured by Lavenir (and quoted by Winchell).
55°57′	Recalculated from Lavenir's refractive indices by the reviewers.
55°31′	Calculated from Kohlrausch's refractive indices by the reviewers.

Although Winchell states that "The indices of refraction of some pure substances have not been measured with accuracy . . . in such cases the indices of refraction are given only to the second or third decimal place," in the cases of the following compounds he gives more than one set of values of the indices all expressed to four places of decimals but differing among themselves in the third place: $NaNO_3$, KNO_3, $NiSO_4 \cdot 7H_2O$, NH_4Cl.

Winchell quotes refractive indices of the following compounds to four places of decimals although the measurements were made by means of an indefinite series of wave-lengths through colored screens; several of the values thus obtained are inaccurate in the third place owing to the high dispersions of the compounds and the failure to use monochromatic light. Examples: $Nd_2(MoO_4)_3$, $Ce_2(MoO_4)_3$, $CaWO_4$, $SrMoO_4$.

Little or no attention has been given by Winchell to recorded divergences of measurements, or to irregularities in the curves of dispersion or of optic axial angle, 2V, such as are indicated in International Critical Tables, Volume VII. In the following instances Winchell quotes the refractive indices to four places of decimals although plots of the dispersions (or of the measured and calculated axial angles) show such irregularities that the values can scarcely be considered certain in the third. Examples: MgO, $(NH_4)_3H(SO_4)_2$, KBF_4, $KLiSO_4$, and numerous compounds in the series of the types $R''R_2(SO_4)_2 \cdot 6H_2O$, $R''R_2(SeO_4)_2 \cdot 6H_2O$, $R''R_2(CrO_4)_2 \cdot 6H_2O$.

The exercise of critical judgment is of course difficult and laborious and the reviewers do not state that the author of a table is bound to exercise it. The reviewers consider it necessary to point out, however, that the claim made by Winchell that he has exercised such judgment is not made good in his tables. Moreover, he has not taken advantage of careful critical work previously done.

This review may be summarized and concluded with the statement that Winchell's "The Microscopic Characters of Artificial Inorganic Solid Substances or Artificial Minerals" contains a very valuable collection of optical and geometrical crystallographic properties to which has been added a rather unsatisfactory account of selected aspects of optical crystallography.

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