between state industry and state education; and the third part outlines the service that the Pennsylvania State College is rendering to the mining and the mineral industries and to the people of Pennsylvania." Copies of this bulletin can be secured by writing the Dean, School of Mines and Metallurgy, State College, Pa.

Dr. Max von Laue, professor of theoretical physics in the University of Berlin, and Dr. Arnold Sommerfeld, professor of theoretical physics in the University of Munich, have been elected honorary members of the Leningrad Academy of Sciences.

On March 21 the U. S. Geological Survey celebrated its fiftieth anniversary. Clarence King was appointed the first director on March 21, 1879. The appropriations for the work of the Survey have increased from $100,000 for the fiscal year 1880 to over $2,000,000 for the fiscal year 1930.

The Council of the Geological Society of America has decided to hold the next annual meeting in Washington, D. C., Thursday to Saturday, December 26–28, 1929. The Mayflower Hotel will be the headquarters of the Society, and the regular scientific sessions, as well as the annual dinner, will be held in the same place. The Mineralogical Society of America will hold its meetings at the same time.

REVIEWS

ÜBER DIE RAUMGRUPPE DES STAUROLITHS UND SEINE GE-SETZMÄSSIGE VERWACHSUNG MIT CYANIT. Gabriel Martin Cardoso. *Berichte über die Verhand. d. Säch. Akad. d. Wissenschaften z. Leipzig, math.-phys. Klasse.* Vol. **80,** pp. 165–199, 1928. Price 2.80 R.M. Verlag von S. Hirzel.

The dimensions of the unit cell of staurolite are given as $a_0 = 7.81$Å, $b_0 = 16.59$Å, $c_0 = 5.64$Å. They correspond to an axial ratio of 0.4726:1:0.3400. The value for the c axis is, therfore, half of that usually given. Two molecules of Niggli's formula $(SiO_6)_4Al_9Fe_2H$ can be accomodated in the unit cell. The formula $Si_2Al_5FeHO_{13}$ gives no satisfactory values. C. Gottfried's space group V_h^{11} is probably wrong. V_h^{17} seems to be correct. The well known crystallographic intergrowth of staurolite and cyanite is explained by the pseudo-orthorhombic character of cyanite. Intergrowth takes place along the plane (010) of staurolite and (100) of cyanite. This causes the b axis of cyanite to be nearly parallel (difference 5 1/2′) to the a axis of staurolite. A normal to the plane of the b and c axes of cyanite almost coincides with the crystallographic direction [411]. X-ray study shows that this direction is a relatively short primitive translation or, in other words, a line of relatively close atomic spacing. By using this direction as the a axis in the pseudo-orthorhombic unit cell of cyanite we have $a_0 = [411] = 26.87$Å, $b_0 = [010] = 7.88$Å, $c_0 = [001] = 5.65$Å.

Comparison with staurolite shows that the translations along the c axes are almost identical and that the translation of staurolite along the a axis is almost the same as along the b axis in cyanite. The two minerals, then, have almost identical primitive translation in the plane which is common to both when intergrown.

John W. Gruner

BEZIEHUNGEN ZWISCHEN LICHTBRECHUNG, DICHTE UND CHEMISCHER ZUSAMMENSETZUNG IN DER GRANATGRUPPE. H. V. PHILIPSBORN. *Abhandl. d. math.-phys. Klasse d. Säch. Akad. d. Wissensch*, Nr. III, vol. 40, 1928. 42 pages, 15 figs. Price 2.50 R.M. Verlag von S. Hirzel.

The number of components that need to be considered in the relationships of chemical composition to refraction of light and density in the garnet group is discussed. It is shown that only three components are sufficient, if no fourth component is present in amounts exceeding 2 per cent. Tetrahedral diagrams are used for plotting the four components, pyrope, grossularite, almandite and andradite. The diagrams show planes of equal refraction, planes of equal specific gravity, and planes of equal dispersion of light ($n_{Li}-n_{Tl}$). A number of examples are given to illustrate their use in finding the percentages of components for a given garnet. The analyses are to be published in another paper. Sixteen new measurements for dispersion in garnets are added. Many numerical tables for the construction of large tetrahedral diagrams to insure greater accuracy are contained in the paper. The use of X-ray powder diagrams for the interpretation of the composition of garnets is discouraged because it does not offer sufficient accuracy. Finally the graphical solution for five component isomorphous mixtures (addition of spessartite or uvarovite) is discussed.

JOHN W. GRUNER

THE DETERMINATION OF MINERALS UNDER THE MICROSCOPE. JOHN W. EVANS. 110 pages, 51 figures including 4 plates, and frontispiece. Thomas Murby & Co., *London*, 1927.

This book as stated in the preface represents "a revision and amplification of communications on the same subject published in the Proceedings of the Geologists' Association, 1909, Vol. XXI, pp. 79–94, and in the *Journal of the Quekett Club*, 1915, Vol. XII, pp. 597–630." It is a non-mathematical, elementary text dealing with the principles of optical mineralogy.

The ten chapters have the following headings: The Petrological Microscope; The Nature and Properties of Light; Examination of Minerals in Polarized Light; Phenomena between Crossed Nicols; The Object Image; The Directions Image; Dispersion in the Directions Image; Other Determinations; Summary of Procedure; and Minute Cyrstals, Grains, and Fragments of Minerals.

The text will be found helpful to students of crystal optics although the beginner may find, in places, the style somewhat involved.

W. F. H.

THE GENESIS OF SOME TYPES OF FELDSPAR FROM GRANITE PEGMATITES. OLAF ANDERSEN. Reprinted from Norsk geologisk tidsskrift. B. X, h. 1–2, 1928, pages 116–205, 9 plates, in English.

Dr. Andersen recognizes that "perthites may have been formed largely through three different processes: (1) simultaneous crystallization, (2) exsolution, and (3) replacement." The first and second theories are based upon hypothetical phase rule diagrams. He believes that notwithstanding the stimulation which these diagrams have had on feldspar investigations, their importance as expressions of actual phase relations has been exaggerated. Hence, he attempts to discuss some of the feldspar problems independent of the hypothetical phase rule diagrams.

In 1885 Lehmann suggested that perthites were formed in connection with contraction cracks. Andersen reproduces the thermal expansion curves of six feldspars as determined by Kôzu and Saiki. The thermal expansion of five of these specimens was determined in three directions: a-axis, b-axis, and the direction perpendicular to (001). The temperature range was from normal to 1000°C. The direction along the a-axis showed a greater expansion. The direction of maximum expansion in the alkali feldspars lies in the plane of symmetry (assuming these feldspars to be monoclinic), at an angle of 18° to 20° to (001). The direction perpendicular to the axis of maximum expansion coincides with the orientation of many perthite intergrowths.

Andersen argues that on contraction due to loss of heat, a number of parallel cracks would be produced in the direction of maximum expansion before it is attained in other directions, but the direction of maximum expansion would also be the direction of maximum stress. On further cooling it may be assumed that cracks transverse to the direction of the mean expansion will occur. By these two systems of cracks the feldspar is divided into a number of rectangular blocks. It is along these cracks that the pegmatitic solutions can enter and bring about a replacement. He recognizes that the crystallization history of pegmatites is a complicated affair.

A large portion of the paper is devoted to a description of chemical and optical studies of feldspars from granite pegmatites of Norway. He uses a number of interesting terms in connection with these. (1) String perthite, where the blebs of albite form very small narrow rods. (2) Film perthite, where the blebs assume thin plates running in a direction perpendicular to (010) to an angle of about 73° to (001). He notes other directions which these films may take. (3) Vein perthite, which is self explanatory. (4) Patch perthite. It is allied genetically with the vein perthite. The blebs are elongated in the direction of the b-axis as well as the c-axis. He also mentions interlocking perthite and antiperthite.

There are 48 very fine photomicrographs of different types of feldspars from Norway.

I would point out that the small irregularities or cusps in the thermal expansion curves of Kôzu and Saiki have been ignored by Andersen. Kôzu and Saiki indicate in their table[1] that there are optical and thermal expansion changes at certain critical temperatures, and I[2] have shown that these critical points can be fitted in with the suggestions of Winchell.[3]

Andersen's recent contribution to the feldspar problem is a very helpful paper and should be consulted by all those interested in these minerals. It should be emphasized, however, that the theory of replacement to explain perthites should be chiefly confined to perthites of pegmatitic origin. Andersen's paper deals with feldspars from pegmatites, yet, I fear that many mineralogists and petrographers may assume that all perthites are due to replacement and ignore the other theories of simultaneous crystallization and exsolution. I believe there are many feldspars which have to be explained by using all of the above mentioned theories.

HAROLD L. ALLING

[1] S. Kôzu and S. Saiki, *Sci. Repts., Tohoku Imp. Univ.*, Ser. III, Vol. 2, No. 3, 1925, page 235.

[2] *Jour. Geol.*, Vol. 34, 1926, page 602.

[3] *Jour. Geol.*, Vol. 33, 1925, pages 714–727.