PROCEEDINGS OF THE ELEVENTH ANNUAL MEETING OF THE MINERALOGICAL SOCIETY OF AMERICA AT TORONTO, CANADA

FRANK R. VAN HORN, *Secretary.*

The Mineralogical Society of America held its eleventh annual meeting on December 29 and 30, 1930, in conjunction with the Geological Society of America, at the University of Toronto, Toronto, Canada. On Monday, December 29, at 2:00 P.M., in Room 56, Mining Building, President H. E. Merwin called the regular annual meeting to order. On motion of the Secretary, the reading of the minutes of the last annual meeting was dispensed with, in view of the fact that they had been printed on pages 109–122 of Volume **15** (Number 3) of the *American Mineralogist.*

ELECTION OF OFFICERS AND FELLOWS FOR 1931

The Secretary announced that 177 ballots had been cast unanimously for the officers as nominated by the Council. For fellows there was a unanimous vote of 81 ballots in the affirmative. All officers and fellows were declared elected.

The officers elected for 1931 are the following:

President: Alexander H. Phillips, Princeton University, Princeton, New Jersey.

Vice-President: William F. Foshag, U. S. National Museum, Washington, D. C.

Secretary: Frank R. Van Horn, Case School of Applied Science, Cleveland, Ohio.

Treasurer: Waldemar T. Schaller, U. S. Geological Survey, Washington, D. C.

Editor: Walter F. Hunt, University of Michigan, Ann Arbor, Michigan.

Councilor, 1931–1934: William S. Bayley, University of Illinois, Urbana, Illinois.

The fellows elected follow:

Mr. Harry Berman, assistant in the Mineralogical Museum, Harvard University, Cambridge, Massachusetts.

Dr. Paul Niggli, professor of petrography and mineralogy, Eidgenössische Technische Hochschule, Zürich, Switzerland.

Dr. Paul Ramdohr, professor of mineralogy and economic geology, Technische Hochschule, Aachen, Germany.

REPORT OF THE SECRETARY FOR 1930

To the Council, Fellows and Members of the Mineralogical Society of America: The Secretary herewith begs to report that the roll of the Society now comprises 114 fellows and 274 members in good standing, which is exactly the same number as last year. Three fellows, A. R. Crook, L. McI. Luquer, F. A. Wilder and one member, W. E. Mumford, have died during the year. In addition to the 388 fellows and members, there are 214 subscribers, a gain of 15 for the year. A total of 602 paid copies of the journal are mailed monthly, an increase of 15 over last year. Actually during the past year 3 fellows, 53 members and 26 subscribers, a total of 82, were added to the list, but deaths, resignations, with non-payment of dues and subscriptions, have reduced the mailing list by 67 names. The Secretary wishes to acknowledge the efficiency of the Treasurer, Professor A. B. Peck, and express his regret that he no longer feels able to serve in that capacity.

Respectfully submitted,
FRANK R. VAN HORN, *Secretary*

On motion, the report of the Secretary was accepted and ordered filed.

REPORT OF THE TREASURER FOR 1930

The Treasurer read his report, and on motion made and seconded, it was accepted and ordered filed. On motion an auditing committee composed of nonmembers of the Council was appointed by the President. This committee, consisting of L. S. Ramsdell, C. B. Slawson and N. L. Bowen, later during the meeting reported to the Society that they found the books of the Treasurer correct and that they had also inspected the securities owned by the Society. The Treasurer's report follows:

To the Council of the Mineralogical Society of America: Your Treasurer herewith submits his annual report for the year ending November 30, 1930.

RECEIPTS

Cash on hand December 1, 1929	$1,557.04	
Dues and subscriptions	2,107.52	
Advertisements	491.32	
Sale of back numbers	325.01	
Interest on endowment	2,534.00	
Miscellaneous	4.78	
		7,019.67

DISBURSEMENTS

Printing and distribution of the Journal (12 issues)	$3,591.60	
Printing of separates	147.56	
To the Editor, Secretary, and Treasurer	720.00	
Postage and stationery	199.09	
Miscellaneous	212.40	
1—$1000 Bond, Denver Gas and Electric Light Co., 5% due 1951	1,051.61	
	5,922.26	
Cash on hand November 30, 1930	1,097.41	
		7,019.67

The endowment funds of the Society as of November 30, 1930, consist of:

45	$1000 bonds of the City and County of Honolulu, Water Works, 5%	$45,000.00
4	Liberty bonds, $100 each, 4th, $4\frac{1}{4}$%	400.00
4	$100 bonds, Great Northern R. R., $5\frac{1}{2}$%	400.00
2	$1000 bonds, Trenton Mort. and Title Guar. Co., $5\frac{1}{2}$%, due 1937	2,000.00
2	$1000 bonds, Trenton Mort. and Title Guar. Co., $5\frac{1}{2}$%, due 1938	2,000.00
1	$1000 bond, Denver Gas and Electric Light Co., 5%, due 1951	1,000.00
		$50,800.00

Respectfully submitted,
ALBERT B. PECK, *Treasurer*

REPORT OF THE EDITOR FOR 1930

The Editor read his report, and on motion it was accepted and ordered filed. The report follows:

To the Council, Fellows and Members of the Mineralogical Society of America: It would seem entirely proper to judge the achievements of the journal for the current year by the number and character of its articles, and by the size of the volume that has been issued. If this criterion be accepted the accomplishments of the *American Mineralogist* for 1930 must be considered as highly satisfactory, since on only one other occasion has a volume of approximately the same size been published.

Volume 15, which represents the current volume, contains about six hundred pages of text, which is an increase of one hundred pages when compared with Volume 14, and equals the outstanding record made in 1928. This attainment was brought about largely through the publication of another large special number issued in August which contained eleven articles and contributed 116 toward the grand total of 582 pages. The high total of two years ago can likewise be attributed to one unusually large issue. It would seem therefore, based upon past experience, that at the present time and under normal conditions volumes aggregating about 500 pages might be considered as representing more nearly the average size. However, on those occasions when special issues are offered new records are quite likely to be established.

An analysis of Volume 15 shows it to contain forty-seven leading articles that cover practically every phase of mineralogy. While it is rather difficult to classify accurately some of these articles as many are not confined to any one division, an attempt has however been made with the following results. Fifteen articles might be classified as falling within the realm of descriptive mineralogy, while fourteen place special emphasis upon chemical composition and hence have been assigned to the division of chemical mineralogy; ten deal with optical data or relate to crystal structure and have been included under physical mineralogy; three are purely of a crystallographic nature and five articles are of a miscellaneous character as they include addresses and memorials.

A general survey also shows that forty-two of these articles came from contributors within the States while five were received from Canada. During the past year forty-seven individuals representing twenty-five different universities, research bureaus and technical laboratories have contributed one or more leading articles, and the space devoted to these articles constitutes 86.2 per cent of the total space of the journal.

One rather unique feature of Volume 15 is the unusually large number of new mineral species described in detail for the first time: eleven new minerals, of which eight are phosphates. This establishes a record for our journal for any one year period.

Aside from the forty-seven leading articles fourteen additional shorter contributions were submitted that have been incorporated under the division of "Notes and News," thus increasing the total number of articles published to sixty-one and the number of contributors to sixty.

As in the past the *Mineralogist* has devoted considerable space to record brief items of interest, book reviews, abstracts of new species described in foreign journals and the proceedings of five mineralogical societies. In the current volume approximately eighty pages have been devoted to the items just enumerated. The journal has also been very profusely illustrated as is shown by the 156 illustrations distributed throughout the text.

Four years ago it was found necessary to reprint the first five volumes of the journal to meet the urgent demand for complete sets. This venture was a financial success as the returns have already exceeded the actual total cost of reproduction. It is interesting to note in this connection that approximately $300 is realized annually from the sale of back numbers and it seems logical to believe that this source of revenue will continue. These facts are mentioned as serious inroads have been made in the surplus copies of volume 6 (1921) and very shortly it will be necessary for the Council to authorize the reprinting of that volume. The approximate cost for two hundred copies has been estimated at $225.

A year ago considerable delay was experienced by the publishers in printing and distributing authors' reprints. I am pleased to report that with the installation of a new press this difficulty has been remedied and that reprints are now available within a period of thirty days after the appearance of the article.

In conclusion one suggestion might be offered which if put into effect should stimulate still greater interest in the journal. This suggestion relates to the number of free reprints furnished the authors. At present the Society is financially responsible for fifty reprints of each article. The number could be doubled with only a moderate increase in cost to the Society. I am sure this action would be welcomed by all our contributors and might even have the effect of attracting additional manuscripts.

The concluding table of contents summarizes the distribution of subject matter in Volume 15.

DISTRIBUTION OF SUBJECT MATTER IN VOLUME 15

Subjects		*Articles*	*Pages*	*Per cent of Total*
Leading articles				
Descriptive mineralogy	15			
Chemical mineralogy	14			
Physical mineralogy	10			
Crystallography	3			
Addresses, memorials, etc.	5			
		47	501½	86.2
Proceedings of societies		25	30	13.8
Notes and news		45	33	
Book reviews		14	8	
Abstracted accounts of new mineral names		31	9½	
Total of text		162	582	100.0
Illustrations		156		
Covers, advertisements, index			120	
Total			702	

Respectfully submitted,

WALTER F. HUNT, *Editor.*

REPORT OF THE NEW COMMITTEE ON NOMENCLATURE AND CLASSIFICATION OF MINERALS

W. T. Schaller, Chairman, read the report which follows:

The Committee on Nomenclature and Classification held two long sessions yesterday, December 28, 1930, all members being present except E. T. Wherry. The committee unanimously reached some conclusions and left others in abeyance for future consultation with a similar committee of the Mineralogical Society of Great Britain and Ireland. A full report will be sent to each member of our Society and to the English committee for future action, and for acceptance or rejection by this Society next December.

The committee asks that it be continued.

W. T. Schaller, *Chairman*
W. F. Foshag
E. S. Larsen
J. F. Schairer
T. L. Walker
A. N. Winchell

It was moved, seconded and carried that the committee be continued.

REPORT OF THE REPRESENTATIVE ON THE NATIONAL RESEARCH COUNCIL

The representative of the Society, W. T. Schaller, read the following report:

At the annual meeting of the National Research Council, held May 3, 1930, the following reports submitted are those of special interest to our Society.

1. Committee on potash-soda feldspar. Reports progress, especially in the application of spectroscopic chemical analysis.
2. Committee on clay minerals. Made substantial progress, completing work on kaolin minerals, full report of which is being published as a professional paper by the U. S. Geological Survey. Preliminary note on dickite, a new kaolin mineral, was published in the January (1930) number of the *American Mineralogist*. Fifty new analyses on carefully selected and studied material are now available.
3. Committee on measurement of geologic time by atomic disintegration. Submitted an eleven page report with an appendix of thirteen additional pages, a total of twenty-four pages giving a remarkably complete and exhaustive review of the work done on this subject for the last year.
4. Committee on processes of ore deposition: Subcommittee on criteria of paragenesis of ore minerals. Completed their task and assembled a report, with numerous illustrations, entitled: "On Criteria of Age Relations of Minerals, with Especial Reference to Polished Sections of Ores."

NEW BUSINESS

It was moved by Dr. Winchell that a committee be appointed to investigate the question of a medal to stimulate interest in the work of the Society. This was seconded and carried, and the President appointed E. H. Kraus, A. N. Winchell and E. S. Larsen.

It was moved by Dr. Schaller that a committee be appointed to co-operate with the Secretary of the XVI International Geological Congress which meets in Washington in 1932, along the lines of mineralogy and petrology. This was seconded and carried, and the President appointed W. F. Foshag, W. T. Schaller and J. F. Schairer.

According to a suggestion in the Editor's report, Dr. Phillips moved that one-hundred reprints be given to authors of leading articles appearing in the *American Mineralogist* instead of fifty as at present. This was seconded and carried.

MEMORIAL BIOGRAPHIES

In view of the fact that none of the authors of the memorial biographies were present, and also that the articles will be printed in full in this issue of the Journal, it was moved and carried that they be read by title. They were as follows:

Memorial of A. R. Crook (died May 30, 1930), by A. J. Walcott.
Memorial of L. McI. Luquer (died January 30, 1930), by P. F. Kerr.
Memorial of F. A. Wilder (died March 8, 1930), by J. J. Runner.

PRESENTATION OF PAPERS

At 2:50 P.M., there being no further business, the Society proceeded to the reading of scientific papers. The papers presented with short abstracts follow:

W. T. SCHALLER: *The Chrysocolla Group.* The name chrysocolla should be restricted to a group name, like mica, feldspar, and should not be applied to a single species. The chrysocolla group comprises the green and blue hydrous copper silicates. Two well defined and described "chrysocollas" require new names. A third new "chrysocolla" occurs at Bisbee, Arizona. About eight distinct species are placed in the chrysocolla group, including bisbeeite, cornuite, dioptase, plancheite, and shattuckite. Many specimens labelled chrysocolla are not single species but are mixtures of several substances, including silica, iron oxide, and manganese oxide.

E. POSNJAK AND N. L. BOWEN: (Presented by N. L. Bowen). *New Light on the Rôle of Water in Simple Amphiboles.* A peculiar, porcelain-like product frequently obtained from dry melts of the composition $MgSiO_3$ has hitherto been regarded as pure magnesian amphibole, kupfferite. This conclusion has tended to support the idea that water is not essential to the make-up of an amphibole. *X*-ray photographs show that the supposed amphibole is a submicroscopic intergrowth of forsterite (Mg_2SiO_4) and glass.

A further study of water in amphiboles was made by observing the changes produced in tremolite upon heating. It has been claimed that tremolite loses water on heating without significant change of optical properties and apparently without loss of its amphibole structure. We find that loss of water is accompanied by distinct changes in optical properties, and *x*-ray study shows that the amphibole structure is completely destroyed, giving place to a pyroxene structure. The essentially hydrous character of tremolite is thus proved and the detailed results are in strong confirmation of Schaller's definite formula, $Ca_2Mg_5H_2(SiO_3)_8$.

J. W. GREIG, E. POSNJAK AND H. E. MERWIN: (Presented by J. W. Greig). *On $Fe_2O_3-Fe_3O_4$ Solid Solutions.* A brief review of the data on which previous investigators have based their opinions as to the existence or non-existence of solid solutions of Fe_2O_3 and Fe_3O_4, and a description of some experiments designed to check the earlier work. Illustrated with photomicrographs of structures due to oxidation, reduction, and unmixing.

J. F. Schairer: *Crystallization in the System, $Na_2O-Fe_2O_3-SiO_2$.* As a consequence of the incongruent melting of acmite (aegirite) $Na_2O \cdot Fe_2O_3 \cdot 4SiO_2$ and the shape of the hematite-acmite boundary curve in the system, $Na_2O-Fe_2O_3-SiO_2$, very interesting crystallization paths result. By fractional crystallization of certain mixtures widely different mineral assemblages may result, depending upon the amount of fractionation. The mode of origin of certain mineral assemblages should be of great interest to the mineralogist and petrographer.

A new compound, $5Na_2O_3 \cdot Fe_2O_3 \cdot 8SiO_2$, appears as a crystalline phase. This compound may occur in certain types of alkalic rocks, but has not yet been found in nature.

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At 3:57 P.M., the Society adjourned to attend a joint session with the Geological Society of America at 4:00 P.M. before which the presidential address of Dr. Herbert E. Merwin on "Some Associations of Ore Minerals" was given. This paper is published in full in this number. Following this address with H. E. Merwin presiding, papers of the Geological Society of a mineralogical and petrographic nature were presented. The joint session adjourned at 5:25 P.M.

On Tuesday, December 30, at 9:20 A.M., President Merwin called the second session of the Society to order, and the reading of papers proceeded according to program.

M. L. Huggins and G. O. Frank: (Presented by M. L. Huggins). *The Crystal Structure of Potassium Dithionate,* $K_2S_2O_6$. Potassium dithionate crystallizes in the trigonal trapezohedral class of the hexagonal system. An x-ray study, using the oscillating crystal method, shows the space group to be D_3^1, the dimensions of the unit cell, containing three "molecules," being $a_0=9.8$Å and $c_0=6.45$Å. The sulfur atoms are in pairs on the three-fold symmetry axes. From the intensities of the reflections approximate values of the parameters determining the positions of all of the atoms have been obtained.

Some measurements were also made on rubidium dithionate, $Rb_2S_2O_6$. It has a unit cell, also containing three molecules, with the dimensions, $a_0=10.0$Å and $c_0=6.45$Å. In all probability it is isomorphous with the potassium compound.

M. L. Huggins: *Principles Determining the Arrangements of Atoms and Ions in Crystals.* Practically all known arrangements of atoms in crystals can be accounted for on the basis of a few simple principles, such as the following: (1) Interatomic forces decrease rapidly with distance. (2) Like atoms tend to be surrounded similarly. (3) There is a tendency toward neutrality, in both large and small regions; hence negative ions tend to be surrounded by positive, and vice versa. (4) The number of atoms B which can stably exist around a given atom A is limited by the relative magnitudes of the forces between A and B and between B and B; it can conveniently be considered as determined by the relative sizes of A and B. (5) Atoms or ions with spherical or nearly spherical force fields tend to form as close-packed structures as possible, consistent with the foregoing principles. (6) The number of electron pairs in the valence shell of an atom is limited by their mutual repulsion; for electronegative atoms it is usually four. (7) Atoms frequently complete their valence shells by sharing electron pairs with other atoms. (8) The valence electron pairs in electronegative atoms tend to be as close as possible to the surrounding positive atoms. (9) Atoms and ions can be given relative dimensions which are approximately constant for a given element in similar environments.

L. S. BROWN: *Euhedral Quartz Crystals and Quartz Rosettes from Salt Dome Cap Rock Anhydrite.* In dissolving cap rock anhydrite, euhedral quartz crystals have been noted before as residuals by Dr. Goldman of the U.S.G.S. The author has recently observed these quartz crystals in thin sections of anhydrite, and found them to be present as inclusions within anhydrite crystals, thus being older than the latter. This, with the absence of any earlier or detrital markings, seems to indicate direct crystallization from the sea.

A unique and beautiful structure is the rosette, in which crystals with perfect terminations radiate in all directions from a center or kernel of pure sulphur. First observed in thin section, these have since been obtained by solution of the anhydrite. They are quite constant in size, averaging 0.25 mm. in diameter, with the sulphur core about 0.06 mm.

These quartz crystals and rosettes are important for several reasons: (1) They constitute one evidence of the primary origin of the anhydrite by direct precipitation from the sea. (2) The existence of free sulphur prior to the crystallization of the anhydrite is demonstrated. (3) Their presence in the secondary calcite cap shows its origin by direct alteration of the anhydrite. (4) Their primary crystallization in this case indicates a similar origin possible for those quartz crystals so common in gypsum deposits elsewhere.

W. T. SCHALLER: *Ammonioborite, A New Mineral.* Ammonioborite is probably more abundant at Larderello, Tuscany, Italy, than larderellite, as four out of six specimens examined are ammonioborite. Its formula is $(NH_4)_2O \cdot 5B_2O_3 \cdot 5H_2O$. The formula of larderellite is either the same or $(NH_4)_2O \cdot 4B_2O_3 \cdot 4H_2O$. Optically the two minerals are readily differentiated, ammonioborite not occurring in the characteristic sharply defined rhombs of larderellite and having indices: $\alpha = 1.470$, $\beta = 1.487$, $\gamma = 1.540$, those of larderellite being $\alpha = 1.493$, $\beta = 1.52 \pm .01$, $\gamma = 1.561$. Neither mineral has been made artificially whereas the 1:5:8 salt, easily obtained by mixing boric acid and ammonia, has not been found in nature.

W. T. SCHALLER: *Crystals of Sulvanite.* Crystals of the rare mineral sulvanite, Cu_3VS_4, from Utah are isometric, being cubes with small faces of the rhombic dodecahedron and the octahedron. Chemically, sulvanite contains copper, vanadium, and sulphur, and may be considered the vanadium analogue of enargite. Crystallographically it is different, enargite being orthorhombic.

C. S. ROSS, E. P. HENDERSON AND E. POSNJAK: *Clarkeite, a New Uranium Mineral.* (Presented by C. S. Ross). Specimens of uranium ores from Spruce Pine, North Carolina, commonly show a zonal arrangement of minerals. The central core is uraninite; this is surrounded by a zone of very dark brown material with pitchy luster; this by orange red gumite; and the outermost zone is lemon yellow uranophane. The dark brown mineral proves to be a new mineral with distinct chemical, optical and x-ray properties. This has probably been previously assumed to be impure gumite, although its optical properties are different from those given for gumite and are much more definite than for any gumite secured from Spruce Pine. It is proposed to name this new mineral clarkeite after Professor Frank W. Clarke. The composition is $RO \cdot 3UO_3 \cdot 3H_2O$ in which R is chiefly alkalies and lead.

A. F. Rogers: *Castanite, a Basic Ferric Sulfate from Knoxville, California.* The status of castanite, a basic ferric sulfate, described from Sierra Gorda, Chili, by Darapsky in 1890, is in doubt. Specimens recently obtained from the old Redington or Boston quicksilver mine at Knoxville, Napa County, California, furnish results which indicate that castanite is a valid mineral species with the formula $Fe_2O_3 \cdot 2SO_3 \cdot 8H_2O$. It is triclinic. Axial elements, indices of refraction, and pleochroism are given. The mineral occurs in a much altered impure gray opal which in turn is an alteration of serpentine. It is probably of solfataric origin.

W. F. Foshag: *A New Sulfate of Iron and Potash from California.* From a large pocket of sulfates of iron found in some cherts at Borate, San Bernardino County, California, there was collected among other sulfates of iron, a mineral occurring in clear green monoclinic crystals. This has proven to be a new mineral, a hydrous sulfate of iron and potash which is named krausite in honor of Professor E. H. Kraus of the University of Michigan and first president of this Society.

Stephen Richarz. *Contact metamorphism of the Pre-Cambrian formations near Mellen, Wisconsin.* In the Penokee Iron Range near Mellen, Wisconsin, the original sideritic cherts have been metamorphosed into amphibole-magnetite rocks. The amphiboles, formerly designated as actinolite, are now on the basis of optical properties differentiated as ten varieties with β varying from 1.621 to 1.692. Towards the east amphiboles are absent from the iron formation and mica is found in fibers and sheaf-like aggregates. Still farther east unmetamorphosed ferruginous cherts prevail.

Above the iron formation lies the Tyler slate, also highly metamorphosed towards the west. Van Hise and Leith ascribed the metamorphic effect to the gabbro which in the west is close to the iron formation and cuts the Tyler slate, while in the east it is more distant from both. In this paper it is shown that a granite intrusion in the gabbro has been more active in producing changes than the gabbro. The gabbro is cut by veins and large dikes of granite. The metamorphism of the gabbro begins with the formation of pale green rims of amphibole around pyroxene. In a more intense stage of metamorphism the amphibole replaces all of the pyroxene. The plagioclase, at first without visible alterations, becomes in a later stage filled with sericite, epidote minerals and a basic core of 50–60 percent An. is rimmed with a plagioclase of about 25 percent An. A complete change to albite was not observed, nor is there any complete assimilation of the gabbro by the granite.

J. H. C. Martens: *Persistence of Feldspar in Beach Sand.* Microscopic analyses of many samples show that the ratio of potash feldspar to quartz in the beach sand of the Atlantic coast varies from 0.062 near Charleston, South Carolina, to 0.001 at Miami, Florida. The feldspar content of the sand decreases with increasing distance southward from the original source in the Piedmont region. Examination of sands of different textures, and of coarse and fine portions of the same sand show that there is more feldspar in the fine sand than in the coarse. The large decrease in feldspar toward the south is due in part to the greater coarseness of the sand on the southern part of the east coast of Florida.

K. K. Landes: *A Paragenetic Classification of the Magnet Cove Minerals.* The Magnet Cove intrusive complex is elliptical in plan with a maximum diameter of about 15,000 feet. The peripheral intrusives through differential erosion have formed a rim which makes the cove. The rocks are alkalic in composition and contain a large number of unusual minerals. Contact metamorphism of both sandstone and limestone country rock has caused further mineralization. Lastly, secondary minerals have been formed through weathering processes. The minerals are further classified in each primary group according to paragenesis.

D. W. Trainer, Jr.: *"Zebra Rock" from Western Australia.* This peculiarly banded, highly quartzose rock of lower Cambrian age, which occurs in East Kimberley, Western Australia, is described both megascopically and microscopically. Theories regarding the origin of the rock itself and the interesting banding are postulated.

A. F. Rogers: *Granite Pegmatite from Salt Creek, Tulare County, California.* The striking feature of this pegmatite is the large size (up to 12 cm.) euhedral crystals of oligoclase of peculiar habit (110 and $1\bar{1}0$ are almost lacking).

The associated minerals are microcline, smoky quartz (up to 20 cm.), schorlite (black tourmaline), graphic granite, and altered muscovite.

The oligoclase shows both albite and pericline polysynthetic twinning and from the angle of the rhombic section it is judged to be about Ab_6An_1.

The oligoclase is a replacement of microcline. This is proved by the quartz relicts of the graphic granite in hand specimens of the oligoclase and by the microcline relicts in thin sections in the oligoclase.

A. C. Lane: *Philosophic Classifications of Mineral Structures.* Various terms applied to mineral aggregates, habits, growth and structure may perhaps be classified philosophically around the dominant directions (remembering that the degree of dominance is less and there is a tendency to higher symmetry the slower the growth and the higher the temperature. The importance of centers of crystallization relative to velocity of crystallization should also be regarded) as follows:

1. (a) One dominant direction (a) of greatest growth (and atomic crowding): prismatic cleavage? Silky luster? Structures such as a circular capillary filiform; aggregates about rare centers; stellated, etc.
    (b) One dominant direction (b) of least growth (and atomic crowding): basal or clinopinacoidal cleavage, pearly luster, structures such as foliated, tabular; aggregates such as concentric, orbicular, etc.
2. One dominant direction of greatest growth and one of least growth: structures such as bladed, lath shaped; aggregates such as sheaflike, plumose.
3. No one or two dominant directions, equidimensional, commonly isometric, (a) with three equal directions
    A. Not at right angles, rhombohedral habit
    B. At right angles, cubic, octahedral or dodecahedral cleavages.

W. T. Schaller: *The Crystallography of Kornelite.* A second locality of this rare hydrous ferric sulphate is the Tintic Standard mine, Utah. The crystals show two kinds of terminations: (1) normal forms of simple indices, all included in the unit rectangle of the gnomonic projection, (2) very steep corrosion pyramids, with indices like (12.6.1) and $(\overline{14}.7.1)$, most of which are inclined less than 20° to the prism zone. These steep forms are derived from the normal terminal forms, to which they show crystallographic relation, by solution. The faces of the steep forms have a high luster but are broken, striated and rounded, and reflect many signals.

At 12:10 P.M., Dr. W. F. Hunt moved to adjourn until 2:00 P.M. This action was explained as being due to the small attendance and the fact that the program could probably be completed early in the afternoon. The motion was seconded and carried.

President Merwin called the third session of the Society to order at 2:10 P.M., and the reading of papers was resumed according to program.

GILBERT GREENWOOD (introduced by A. L. Parsons), read by Q. D. Singewald: *Optical Properties of Triphenylbismuthine Dichloride, an Example of Crossed Axial Dispersion.* Triphenylbismuthine dichloride, $(C_6H_5)_3BiCl_2$, crystallizes in colorless orthorhombic crystals. The face development is holoaxial. Etch figures also are in agreement with holoaxial symmetry. The acute bisectrix is the *b* axis. The axial planes are (001) and (100), the dispersion being strong. The wave length for which the crystal is uniaxial, varies with the temperature according to a straight line law. When the (010) face is viewed in parallel polarized light and brought into the extinction position, it does not extinguish but transmits light green in color. This is probably the result of rotatory polarization.

A. F. ROGERS: *The Nomenclature of Geometrical Crystallography.* Attention is called to the great variety of terms used in geometrical crystallography. A uniform system of nomenclature is greatly to be desired. Instead of working out a new set of names, the writer presents arguments in favor of Fedorov's names of forms based upon geometry, and of Groth's names of classes based upon the name of the general form (with simplification in the isometric system), and six crystal systems instead of seven. Names referring to merohedrism are discarded since crystal classes and not crystal systems are fundamental.

A. F. ROGERS: *Structural Crystallography.* For the science concerned with the internal structure of crystals, various terms such as leptonology, leptology, stereochemistry of the solid state, new or modern crystallography, and *x*-ray crystallography have been used.

For this important branch of science I propose the name *structural crystallography* co-ordinate with geometrical, physical and chemical crystallography. Attention is called to some of the important events in the development of structural crystallography. It is not generally recognized that there are seven primary space lattices. These, however, cannot be made the basis of crystal systems.

L. S. RAMSDELL: *The Identification of Psilomelane by Means of its Physica Properties.* Although there is considerable doubt as to the true composition of psilomelane, there are certain physical properties which are usually attributed to it. Important among these are the smooth botryoidal, reniform or stalactitic surfaces, and a hardness of 5–6. A study of the *x*-ray diffraction patterns from a large number of specimens of psilomelane shows that its identification by means of physical properties is uncertain, and cannot always be relied upon.

JOHN W. GRUNER: *A Simple Device for the Application of Differential Pressures in Experiments on Hydrothermal Mineral Alteration.* In order to reproduce natural conditions under which changes take place, as for example from pyroxene to hornblende, differential pressure besides a hydrothermal environment seems to be necessary. A small cylinder of invar steel was used. A fragment of the mineral was placed between two semi-cylindrical blocks of copper and tightly fitted into the cylinder.

This apparatus was placed in a bomb containing various solutions and gases. Mr. R. C. Gebhardt in this manner succeeded in changing hypersthene to hornblende at 250°C.

WM. A. P. GRAHAM: *Optical and Chemical Notes on the Transformation of Green to Brown Hornblende.* The cause for the change of green hornblende to brown hornblende is shown by chemical analyses to be the result of the oxidation of ferrous iron. Experiments have been performed to determine the causes of the accompanying changes in optical properties. Evidence is presented to show that sufficient oxygen to oxidize the ferrous iron cannot be obtained through the dissociation of the combined water. X-ray diffraction pattern studies indicate that no structural changes take place in the hornblende in changing from a green to brown color.

H. W. MORSE AND J. D. H. DONNAY, introduced by A. F. Rogers: *Spherulite Optics.* (Presented by A. F. Rogers). 1. General. Artificial spherulites of slightly soluble substances can be obtained by slow diffusion in jellies. New forms are found: *e.g.*, barium carbonate gives both a positive and a negative sphere.

2. Optical. The spherulites are either isotropic or birefringent. Between crossed nicols, the latter show the *spherulitic black cross* and a series of *concentric colored rings* of equal retardation. The retardation increases from zero at the center to a maximum at about two-thirds of the radius from the center, then decreases from this maximum to zero at the periphery.

3. Experimental. The retardation R for successive rings is numerically determined; the diameter $2r$ of the spherulite and the radii $r \cdot \cos\phi$ of the colored rings are measured. The ratio $R/2r$, plotted against $\cos\phi$ for various rings, gives a curve which is independent of the size of the sphere.

4. Theoretical. The unit crystal is assumed to be uniaxial and is oriented with its optic axis along a radius. A beam of light, along a vertical path, traverses a multitude of crystals variously oriented. The total retardation is the sum of the individual retardations of the superimposed units.

In a first approximation, simple integration leads to the formula $R=2r \cdot (n_\gamma - n_\alpha) \cdot \phi \cdot \cos\phi$, in which: R=retardation of a ring with a radius $r \cdot \cos\phi$; $2r$=diameter of the spherulite; 2ϕ=angle at the center, subtended by a chord equal to the length of the vertical path of light through the sphere; n_γ and n_α=high and low refractive indices. The maximum retardation, $R_{\max}/2r=0.561\ (n_\gamma - n_\alpha)$, occurs for $\cot\phi=\phi$, at $\cos\phi=0.652$. This simplified solution holds for all substances and for both positive and negative forms. A more accurate solution, involving a new application of Legendre elliptic integrals, gives different curves for positive and negative spherulites.

The check between the experimental and theoretical curves is satisfactory even in the approximate solution; it is almost perfect in the more exact treatment.

E. S. LARSEN AND HARRY BERMAN (Presented by Harry Berman): *Composition of the Amphiboles.* From x-ray structural data the general formula already derived by Warren for several members of the amphibole group is shown to be valid for all members of the group. This general formula may be expressed as follows:

$$(\mathrm{Na, K, Li, Ca})_{2-3}(\mathrm{Mg, Fe^{II}, Fe^{III}, Al, Ti})_5\,(\mathrm{Al, Fe^{III}, Ti, Si})_8(\mathrm{O, OH, F})_{24}.$$

A. N. Winchell: *Further Studies in the Amphibole Group.* Using the new type formula for amphiboles derived by Warren from *x*-ray studies, an attempt is made to graph the relations between composition and optic properties in various parts of the amphibole group. The results are satisfactory in the anthophylite, cummingtonite and tremolite-actinolite series, but no solution has been found for the alkaline amphiboles, and only a partial solution for hornblende. The problem is complicated in the case of hornblende and pargasite by the large number of molecules which are independent variables and by the possibility of optical effects due to oxidation of ferrous iron.

E. P. Henderson and F. L. Hess (Presented by E. P. Henderson): *Fervanite—A New Vanadium Mineral.* Fervanite is a fibrous golden yellow mineral occurring in the vanadium bearing rocks of southwestern Colorado and southeastern Utah. It is a hydrous iron vanadate with a formula $2Fe_2O_3 \cdot 2V_2O_5 \cdot 5H_2O$. Fervanite is found in the cracks in the dark colored oxides of vanadium and also as a thin coating on the sandstones. In all the specimens, so far found, fervanite is closely associated with gypsum.

The last paper was finished at 4:07 P.M. after which Dr. W. J. McCaughey moved that the thanks of the Society be extended to the authorities of the University of Toronto, to the local committee and to Mrs. D. A. Dunlap for their kindness and hospitality. This was seconded by Dr. A. F. Rogers and was unanimously adopted by a rising vote of those present. The Society then adjourned.

During the sessions of the Society, a total of twenty-nine scientific papers were presented, none being read by title. Ninety-five fellows, members and guests were present at the various meetings. The following registered at the meetings:

Adams, F. D.; Agar, W. M.; Allen, V. T.; Alling, H. L.; Bannerman, H. M.; Bascom, F., Miss; Bayley, W. S.; Beaton, H. S.; Berman, H.; Billings, M P.; Bowen, N. L.; Branner, G. C.; Brown, L. S.; Bruce, E. L.; Buddington, A. F.; Colburn, B. S.; Colburn, W. B.; Colony, R. J.; Cook, C. W.; Corbett, C. S.; Currier, L. W.; English, G. L.; Ferrier, W. F.; Fettke, C. R.; Foreman, F.; Foyles, E. J.; Foshag, W. F.; Fretz, A. H.; Fuller, R. E.; Furcron, A. S.; Gilluly, J.; Goddard, E. N.; Graham, R.; Graham, W. A. P.; Grawe, O. R.; Gruner, J. W.; Hawley, J. E.; Henderson, E. P.; Holland, S. S.; Howland, A. L.; Huggins, M. L.; Hunt, W. F.; Ichimura, T.; Jensen, D. E.; Jolliffe, F. T.; Kerr, P. F.; Kerr-Lawson, D. E.; Kerr-Lawson, Mrs. D. E.; Kraus, E. H.; Kraus, J. D.; Kunz, G. F.; Landes, K. K.; Landon, R. E.; Lane, A. C.; Larsen, E. S., Jr.; Lewis, J. V.; Lindgren, W.; Longley, C. S.; Lonsdale, J. T.; Martens, J. H. C.; Mathews, E. B.; McCaughey, W. J.; McNairn, W. H.; Mertie, J. B., Jr.; Merwin, H. E.; Miller, B. L.; Miller, V. B.; Moore, E. S.; Morton, J. F.; Osborne, F. F.; Parsons, A. L.; Peck, A. B.; Perkins, E. H.; Phillips, A. H.; Ramsdell, L. S.; Reavely, G. H.; Richarz, S.; Ries, H.; Rogers, A. F.; Ross, C. S.; Sampson, E.; Schairer, J. F.; Schaller, W. T.; Senstius, M. W.; Singewald, Q. D.; Slawson, C. B.; Spence, H. S.; Stow, M. H.; Stadnichenko, T., Miss; Thomson, E.; Tolman, C.; Trainer, D. W., Jr.; Van Horn, F. R.; Walker, T. L.; Winchell, A. N.

LIST OF FORMER OFFICERS AND MEETINGS, WITH DATES

By recommendation of the Council, a complete list of past officers is printed in the proceedings of the annual meeting of the Society.