

PROCEEDINGS OF THE THIRTEENTH ANNUAL MEETING OF THE MINERALOGICAL SOCIETY OF AMERICA AT CAMBRIDGE, MASSACHUSETTS

FRANK R. VAN HORN, *Secretary*.

The Mineralogical Society of America held its thirteenth annual meeting on December 28 and 29, 1932, in conjunction with the Geological Society of America, at Cambridge, Massachusetts, as guests of Harvard University, Massachusetts Institute of Technology, and the Geological Society of Boston. On Wednesday, December 28, at 2.00 p.m., President A. N. Winchell called the regular annual meeting to order in the Mineralogy Lecture Room of the Geological Museum of Harvard University. 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 have been printed on pages 108-119 of volume 17, (Number 3) of *The American Mineralogist*.

ELECTION OF OFFICERS AND FELLOWS FOR 1933

The Secretary announced that 161 ballots had been cast unanimously for the officers as nominated by the Council. For fellows, there was a unanimous vote of 66 ballots in the affirmative. All officers and fellows were declared elected.

The officers elected for 1933 are the following:

President: Herbert P. Whitlock, American Museum of Natural History, New York City.

Vice-President: Frank N. Guild, University of Arizona, Tucson, Arizona.

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 1933-1936: Kenneth K. Landes, University of Kansas, Lawrence, Kansas.

The fellows elected follow:

Dr. Victor T. Allen, Associate Professor of Geology, St. Louis University, St. Louis, Missouri.

Lawson H. Bauer, Assistant Chief Chemist, New Jersey Zinc Co., Franklin, New Jersey.

Dr. Joseph P. Connolly, Professor of Mineralogy and Petrography, South Dakota School of Mines, Rapid City, South Dakota.

James Gilluly, U. S. Geological Survey, Washington, D. C.

George Tunell, Geophysical Laboratory, Washington, D. C.

REPORT OF THE SECRETARY FOR 1932

To the Council and Members of the Mineralogical Society of America:

The Secretary herewith begs to report that the roll of the Society now consists of 117 fellows and 280 members in good standing, which is a loss of 28 men over last year. One fellow, Dr. George F. Kunz, and two members, Dr. George I. Adams and R. D. Harvey, have died during the year. It should be noted that Dr. Kunz showed his interest in the Society by leaving a bequest of \$1000.00. In addition to the 397

fellows and members, there are 253 subscribers to the Journal, an increase of 20 over the previous year. Actually, during the past year, 5 fellows, 31 members and 38 subscribers, a total of 74, were added to the mailing list, but deaths, resignations, with non-payment of dues and subscriptions, have reduced the list by 3 fellows, 56 members and 11 subscribers, a total of 70, making a net loss in all classes for the year of 10. A total of 650 paid copies of *The American Mineralogist* are mailed monthly, which is a loss of 10 over last year. It is felt that the Society has done very well to maintain its position with such a small loss under present conditions.

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

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

REPORT OF THE TREASURER FOR 1932

To the Council of the Mineralogical Society of America: Your Treasurer submits herewith his annual report for the year beginning December 1, 1931, and ending November 30, 1932.

RECEIPTS

Cash on hand December 1, 1931	\$1,224.72	
Dues and subscriptions	1,984.74	
Advertisements	436.92	
Sale of back numbers	173.11	
Interest on endowment	2,559.00	
Bank interest	3.56	
	<hr/>	\$6,382.05

DISBURSEMENTS

Printing and distribution of the Journal (12 issues)	\$3,683.06	
Printing and distribution of separates	365.43	
To the Editor, Secretary, and Treasurer	720.00	
Postage and stationery	126.21	
Refunds on dues	3.50	
Safety deposit box	7.50	
Bank exchange on foreign checks	3.44	
Check tax	0.40	
Checks returned	6.00	
Clerical help, Treasurer	32.00	
Filing case, Editor	46.55	
Nomenclature Committee (Mimeographing, printing)	32.47	
	<hr/>	5,026.56
Cash balance November 30, 1932	1,355.49	
	<hr/>	\$6,382.05

The endowment funds of the Society as of November 30, 1932, are the same as a year ago, and consist of:

45 \$1,000 bonds of the City and County of Honolulu, Water Works, 5%, due 1954	\$45,000.00
4 Liberty bonds, \$100 each, 4th, 4 $\frac{1}{4}$ %, due 1933-1938	400.00
4 \$100 bonds, Great Northern R. R., 5 $\frac{1}{2}$ % due 1952	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 \$1,000 bond, Denver Gas and Electric Light Co., 5%, due 1951	1,000.00
	\$50,800.00

Respectfully submitted,
W. T. SCHALLER, *Treasurer*

It was moved that the Treasurer's report be accepted and filed.

Early in December, at the request of the Treasurer, President Winchell appointed an auditing committee consisting of three non-members of the Council, George Tunell, A. H. Koschmann and James Gilluly, all of Washington, D. C., who reported as follows:

Washington, D. C., December 20, 1932

To the President of the Mineralogical Society of America: The Auditing Committee has examined the books of the Treasurer and verified their correctness; the Committee has also verified the presence of the securities belonging to the Society in the safe deposit box in the vaults of the American Security & Trust Co. in Washington, D. C., and certifies that all future coupons are intact and attached to these securities.

GEORGE TUNELL, *Chairman*
A. H. KOSCHMANN
JAMES GILLULY

REPORT OF THE EDITOR FOR 1932

To the Council, Fellows and Members of The Mineralogical Society of America:

In the Editor's report of a year ago it was pointed out that in the sixteen years that the Journal has been in existence, on only three occasions have volumes been issued that have totaled 600 pages. Also, at that time, it was stated that an attempt would be made to again reach that same total in 1932. That year is now drawing to a close and an examination of the December issue of the *Mineralogist* reveals an attainment for the present year only a few pages short of that desired goal. The accomplishments, therefore, for the current year should be considered as very satisfactory, especially at a time when most enterprises are being forced to curtail their operations. It might be mentioned in this connection that sufficient manuscripts were on hand this past year to substantially enlarge the Journal and establish a new record for size, but it seemed a wiser policy to keep expenditures well within our assured income.

It is undoubtedly true that our Society has felt, to a certain extent, the effects of reduced budgets, but the slightly lower income derived from subscriptions, advertisements and from the sale of back numbers, has been offset, in part at least, by a new contract with our publishers which is more favorable to the Society, as the present rates are about 10% lower than a year ago.

In briefly summarizing some of the major points of interest in volume 17, reference should be made to the attractive July issue of 112 pages with 47 illustrations. This special number represents another series of 11 contributions from the Department of Mineralogy and Petrography of Harvard University. This unusually large number was largely instrumental in bringing our total pagination for the year close to the 600 page mark.

Also the number of leading articles published this year is considerably larger than usual. The current volume contains 65 of these contributions which were received from 55 individuals representing 26 different Universities, research bureaus and technical laboratories. Aside from the 65 longer contributions, 13 equally interesting but shorter articles have appeared under the division of notes and news, thus increasing the total number of published manuscripts to 78.

In glancing over the titles of these articles one is impressed with the unusual range of subject matter represented. For here will be found contributions dealing with descriptive, chemical and optical mineralogy; structural and geometrical crystallography; mineralography (= chalcography) and petrography; as well as addresses, memorials and locality articles. Included in the list are the detailed descriptions of seven new mineral species—alleganyite, galaxite, ashtonite, clinoptilolite, sanbornite, juanite and magnesiosussexite.

Also, as in previous years, considerable space in volume 17 is devoted to book reviews, abstracts of articles in foreign journals dealing with new mineral names, news items and the monthly proceedings of mineralogical clubs and societies.

In some quarters it was felt that our Society should undertake to compile an up-to-date list of the more important mineral collections, both public and private, in the United States and Canada. This arduous task was willingly undertaken by Mr. Samuel G. Gordon of the Philadelphia Academy of Science and after considerable effort, extending over the greater part of two years, by employing published notices in scientific journals, a questionnaire and other means, he was able to collect data on about 700 mineral collections. This material might well serve as a basis of a regional directory. As soon as possible this information, printed in installments, will be made available to our readers.

The concluding table of contents summarizes the distribution of subject matter in volume 17.

DISTRIBUTION OF SUBJECT MATTER IN VOLUME 17

<i>Subjects</i>	<i>Articles</i>	<i>Pages</i>	<i>Per cent of Total</i>
Leading articles			
Descriptive mineralogy.....	18		
Chemical mineralogy.....	9		
Optical mineralogy.....	15		
Structural crystallography and mineralography.....	10		
Geometrical crystallography..	3		
Petrography, memorials, etc..	10		
	65	503	87.6

Proceedings of societies	22	25½	} 12.4
Notes and news	35	26	
Abstracts of new mineral names	8	4	
Book reviews	17	17½	
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Total of text	147	576	100.0
Illustrations	176		
Covers, advertisements, index		116	
Total		692	

Respectfully submitted,

WALTER F. HUNT, *Editor*

REPORT OF THE NEW COMMITTEE ON NOMENCLATURE AND CLASSIFICATION OF MINERALS

The chairman, W. T. Schaller, announced that the report of the committee had been mailed to the membership. He discussed the report which, upon motion, was accepted with approval. The committee asked that it be continued in order that it might have a meeting with members of a British committee during July, 1933, during sessions of the XVI International Geological Congress.

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, C. S. Ross, reported that the National Research Council was to be reorganized with a reduction in the number of members. This would be communicated to the Secretary in due time. The report of the representative was ordered accepted and placed on file.

REPORT OF COMMITTEE ON COOPERATION WITH THE SECRETARY OF THE XVI INTERNATIONAL GEO- LOGICAL CONGRESS ALONG THE LINES OF MINERALOGY AND PETROLOGY

In the absence of W. F. Foshag, Chairman, W. T. Schaller reported that little had been or could be done but suggested that the committee be continued in the event of some emergency arising.

W. F. FOSHAG, *Chairman*
W. T. SCHALLER
J. F. F. SCHAIRER

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

NEW BUSINESS

At the Toronto meeting, a committee was appointed consisting of E. H. Kraus, A. N. Winchell and E. S. Larsen, to investigate the question of a medal to stimulate interest in Mineralogy. The chairman, E. H. Kraus, reported that the committee recommended that the Society initiate such a custom to be known as the Washington A. Roebling Medal for meritorious achievement in Mineralogy and allied sciences. It was further suggested that the sum of one hundred dollars be set aside during 1933 toward the cost of such a medal. It was moved, seconded and carried to adopt these suggestions, and to continue the committee.

It was announced that following the custom initiated at Tulsa, the Society would have an informal luncheon at the Harvard Faculty Club at 12:45 P.M. on Thursday, December 29, and that those interested should notify the Secretary or Professor Charles Palache who was in charge.

MEMORIAL BIOGRAPHY

The only biography was a Memorial of George F. Kunz (died June 29, 1932), which was read by P. F. Kerr.

PRESENTATION OF PAPERS

At 3:11 P.M., there being no further business, the Society proceeded to the reading of scientific papers. The papers presented with short abstracts follow:

R. D. BUTLER AND M. J. BUERGER: *Immersion Liquids of Intermediate Refraction*. Sets of immersion media are placed in two categories; those consisting of a few pure liquids which cover the desired range through the use of the Emmons' double variation method, and those used in ordinary immersion technique, consisting of a series of mixtures of two essentially pure end members. The set described in this paper is of the latter type, utilizing a monochloronaphthalene and a high boiling point kerosene fraction as end members. The liquids closely approach ideal solution, and the properties within the series are strictly continuous from one member to the next. After eighteen months of laboratory use, the properties remain unchanged; the liquids are therefore excellent for ordinary immersion technique, and it is suggested that they might find use in the double variation method.

A. F. ROGERS: *Symbols of Crystal Optics*. The various symbols used for the directions of the optic ellipsoids and for the principal indices of refraction are discussed. Uniformity in the use of these symbols is very desirable.

Arguments are advanced in favor of the use of α , β , and γ for the axes of the triaxial ellipsoid and $n\alpha$, $n\beta$, and $n\gamma$ for the corresponding indices of refraction. For uniaxial crystals α and γ are used for the axes of the ellipsoid and $n\alpha$ and $n\gamma$ for the corresponding indices.

A. F. ROGERS: *Cleavage and Parting in Quartz*. The absence of cleavage in quartz is stressed in elementary mineralogy, but as a matter of fact imperfect rhombohedral cleavage is rather common for quartz. It is noted in hand specimens and in quartz crystals on the edges of thin sections. A metamorphic quartzose rock from Meteor Crater, Arizona, is unique in that the quartz grains in thin sections show well-defined rhombohedral cleavage.

Unusual vein quartz from a locality in Mariposa County, California, shows prominent parting as well as imperfect cleavage. The parting is either in one direction or in two directions at angles of about 86° . The parting is parallel to the positive unit rhombohedron and is due to polysynthetic twinning.

C. B. SLAWSON: *A New Objective for the Petrographic Microscope*. A variable diaphragm is placed at the rear focal plane of a high aperture objective. This diaphragm may be used to give depth of focus, increase relief, and flatten the field of vision. Interference figures form in the rear focal plane so that by calibrating the objective diaphragm it may be used for direct measurement of the apparent optic angle. The accuracy of these measurements may be greatly increased by using an objective of high aperture but low magnification which gives an interference figure four times larger than the ordinary objective.

G. TUNELL, E. POSNJAK, AND C. J. KSANDA: *Atomic Structure and Geometrical Constants of Tenorite*. The monoclinic symmetry of thin tenorite crystals from Vesuvius was established by Tunell and Posnjak; the proof consisted in demonstration that the extinction position remained stationary when the crystal was rotated around the b axis. The b axis also bisects the angle formed by the traces of the two perfect cleavage planes.

The monoclinic symmetry of an artificial single crystal of cupric oxide prepared for this crystallographic study was established independently by x -ray analysis. The identity of artificial cupric oxide and the thin tenorite crystals from Vesuvius was established by a number of powder photographs. The unit cell dimensions a_0 , b_0 , c_0 , and β of artificial cupric oxide were calculated from measurements made on rotation and Weissenberg pictures.

The structure of tenorite previously described by Niggli was based on powder photographs only and is not correct. The conclusion of Kalkowsky and of Niggli that tenorite is really triclinic (pseudomonoclinic) is without foundation in experiment, and is shown to be erroneous.

J. D. H. DONNAY and J. MÉLON: *Hairy-Bravais Lattice and Other Crystallographic Data for Sodium Molybdo-Tellurate*. Ideal axial elements for any crystalline species should give as much information as possible regarding the forms which occur on crystals of that species. By mere inspection of such axial elements, one should be able to infer the list of the known crystal forms and their order of importance (frequency of occurrence and perfection of development).

The concept of "simplicity of indices" for the known faces has been much over-emphasized. Axial elements determined from that viewpoint alone have much less significance than axial elements whose choice is based on a correct expression of the Law of Bravais. The method, expounded by G. Friedel in his "leçons de Cristallographie" (1926), is applied to the study of a new compound, sodium molybdo-tellurate, prepared by S. R. Wood.

F. R. VAN HORN AND KENT R. VAN HORN: *X-ray Study of Pyrite or Marcasite Concretions in the Rocks of the Cleveland, Ohio, Quadrangles*. Concretions of iron sulfide have long been found in the Devono-Mississippian shales and sandstones in the vicinity of Cleveland. In some places pyrite crystals could be identified but in many localities nodular masses were found which showed a massive or columnar radiated structure which was not determinable. In July, 1931, when Bulletin 818 of the

U. S. Geological Survey was published, marcasite was mentioned more frequently than pyrite, consequently in October, 1931, a collection and x-ray study of the occurrences was begun which to date shows the presence of no marcasite in the district. However, the Olentangy shale around Delaware, Ohio, seems to have nothing but marcasite.

After this paper, the Society adjourned at 5:35 P.M., to meet at 9:00 A.M., on Thursday, December 29.

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President Winchell called the second session of the Society to order at 9:10 A.M., on Thursday, December 29, and the reading of papers proceeded according to program.

A. C. LANE: *Five Fold Check of Uraninite Age?* Uraninite contains radioactive elements which disintegrate into Pb_{206} , Pb_{207} , Pb_{208} , and He, as it originally is UO_2 (with some thorium replacing uranium) the uranium originally present might be inferred from the oxygen. When physical data are accurately enough known, we may, assuming insignificant or calculable chemical weathering, have five methods of estimating age, but at present authors vary much as to the values of the physical data for the age. Those for the disintegration from radium to lead seem most reliable, for instance, for the Wilberforce, Canada, uraninite, the age in millions of years is by radium $14260 \log (1+1.156 (Pb\ 206=7.95))/(52.00 \text{ to } 44.60)=985 \text{ to } 1850$. By actinium, $57160 \text{ to } 906 \log (1+1.153 (Pb\ 207=.77))/(0.53 \text{ to } 8.92)=2290 \text{ to } 365$. By thorium, $59800 \text{ to } 39700 \log (1+1.115 (Pb\ 208=.53/10.37))=1360 \text{ to } 868$. By oxygen, $14205 (\log .746 \times (O=1006) - \log 53.52)=1700$.

Varying values come from various data used by different authors.

M. J. BUERGER: *Pyrite-Marcasite Relation.* A critical study of the analyses indicates that while pyrite approximates rather closely to the composition FeS_2 , marcasite is invariably too low in sulfur. Specific gravity and cell volume evidence shows that the additional iron atoms take the places normally occupied by some sulfur atoms. The marcasite structure rather than the pyrite structure is then required by the greater covalence of the iron atoms proxying for sulfur. In general, a marcasite-like packing is also required in any FeS_2 -like compound if the S position is occupied by a heavy atom with many bond possibilities (as in löllingite), and is also favored by large S positions atoms. Thermal agitation is more favorable to the pyrite structure, hence pyrite results at high temperatures. Pyrite and marcasite are not necessarily strictly polymorphous forms of the same compound FeS_2 , because they are chemically distinct.

C. E. TILLEY AND J. F. SCHAIRER: *Some Carnegieite Solid Solutions.* Pure nephelelite ($NaAlSiO_4$) inverts to carnegieite at $1248^\circ C$. In the system, Na_2SiO_3 - $NaAlSiO_4$, this inversion is changed by solid solution with a maximum lowering of the inversion temperature to $1163^\circ C$. In the system, $Na_2Si_2O_5$ - $NaAlSiO_4$, the inversion remains at $1248^\circ C$. Studies of the system, Na_2O - Al_2O_3 - SiO_2 , indicate that the compound $NaAlSiO_4$ is capable of considerable variation due to solid solution.

W. T. SCHALLER: *Johannsenite, A New Manganese Pyroxene.* Johannsenite, named after Professor Albert Johannsen, University of Chicago, is the manganese analogue of diopside and hedenbergite. Its formula is MnO , CaO , $2SiO_2$, this compound being dimorphous, the other modification with lower density, refractive indices, and birefringence, being bustamite.

Johannsenite occurs as a hydrothermal vein forming pyroxene in the Bohemia district, western Oregon, and as a product of contact metamorphism at Schio-Vicentin in northern Italy. One specimen from Italy contains about 95 per cent of the MnO , CaO , 2SiO_2 , molecule, while a second specimen from the same locality has about 16 per cent each of isomorphous diopside and hedenbergite. The mineral from Oregon contains about 12 per cent each of diopside and hedenbergite.

Johannsenite has the typical diopside structure, as shown by x -rays. Optical orientation agrees with monoclinic symmetry, the axial plane is parallel to b (010), optically positive with medium large axial angle, large extinction angle, polysynthetic twinning, and the indices of refraction are: $\alpha = 1.709$, $\beta = 1.718$, $\gamma = 1.738$.

R. E. LANDON: *Colusite, A New Tin-Bearing Tennantite from Butte, Montana*. (Read by title.) Small amounts of tin in ores from the Leonard, West Colusa, Mountain View, and Tramway Mines of the Anaconda Copper Mining Company at Butte, Montana, have been noted for a number of years. The tin-bearing mineral was provisionally named "colusite" after the Colusa claim near which it occurs. Its chemical composition corresponds to tennantite, with tin isomorphous with copper. Its physical properties are similar to tennantite excepting for its color which is bronzy. Under the polarizing microscope colusite is isotropic, and its polished surface has the peculiar color of the so-called "pink enargite." It is contemporaneous with tetrahedrite from which it separated, producing the well-known unmixing texture.

PHILIP KRIEGER: *Occurrence of Strontianite at Sierra Mojada, Mexico*. The occurrence of strontianite in unusually large quantities as one of the principal gangue minerals associated with lead and silver ores at Sierra Mojada differs in several important respects from other mineralizations in this well known district. So far as known, strontianite has not been observed as a gangue mineral, even in minor amounts, in any of the ore bodies previously mined in this district. In the comparatively recently discovered Suiza ore body, however, it is one of the principal gangue minerals. The occurrence of strontianite and its association with the ore in the Suiza body has been noted over a horizontal distance of approximately 3,500 feet. The abundance of strontianite over such a distance and its apparent confinement to the one ore body presents an interesting problem in limestone replacement deposits. From a study of this section and the association of strontianite with the ore, it appears that strontium must have been an important constituent of the same solutions which were responsible for ore deposition.

W. A. TARR: *Origin of the Sand Barites of the Lower Permian of Oklahoma*. (Read by C. J. Roy.) The Garber formation (a sandstone) of the Enid group of the Lower Permian of south central Oklahoma contains barite rosettes (concretions) along a number of horizons, but especially in the lower 200 feet. These sand barites are aggregates of barite crystals that incorporated the sand in which they were deposited. The origin of the barite in these sand crystals is discussed.

J. S. STEVENSON: *Vein-like Masses of Pyrrhotite in Chalcopyrite from the Waite-Ackerman-Montgomery Mine, Quebec*. The paper presents a study of some peculiar masses of pyrrhotite which were found in specimens of ore from the Waite-Ackerman-Montgomery Mine. The most interesting habit of the pyrrhotite is that of small vermiform masses. The author concludes that the latter are neither residual

nor introduced veins but are the results of exsolution. The vermicules are attributed to exsolution because each consists of but one crystal, they are intergranular with respect to the chalcopyrite and are not developed in the sphalerite or magnetite but only in the chalcopyrite.

P. F. KERR: *Tungsten Deposit at Mill City, Nevada*. The most important tungsten mine in the United States is located near Mill City, Nevada. Scheelite ore occurs in a series of steeply inclined and metamorphosed beds in hornfels. The mineralized beds were originally limestone, but in the vicinity of an igneous intrusion have been altered, forming a group of contact minerals containing scheelite.

Two generations of faults have cut the ore bodies: one previous to metamorphism, the other following it. The scheelite-bearing layers have been split by these faults into a series of segments.

Granitic dikes cut the mineralized beds in various directions. Intense silicification has followed this phase of the intrusion, and appears to be connected with the introduction of the scheelite.

STEPHEN RICHARZ: *Peculiar Gneisses of a Late Formation in the Cascades, Washington*. The paper deals chiefly with gneisses of Tertiary or late Mesozoic formation in the Cascades, Washington. The gneisses are migmatites of argillaceous and of igneous material. The injected material, free of potassium feldspar, must have been derived from an intrusive granodiorite to quartz diorite which is in contact with the gneiss. However, only the more acid portions of this intrusive were injected into the argillaceous sediment, in which besides mica and quartz, garnet and cyanite developed.

The contact of diorite and gneiss is marked by a fault zone accompanied by crushing and decomposition and mineralization on a large scale. The main ore is pyrrhotite, frequently associated with chalcopyrite, sphalerite and, at places, with arsenopyrite.

CHARLES PALACHE AND EDWIN OVER, JR.: *Pegmatites of the Pikes Peak Region, Colorado*. The distribution of the pegmatites in the Pikes Peak granite is shown areally and their relation to occurrences of fluorine-bearing compounds is traced. There seems to be considerable evidence of a late period of fluorine replacement at least in some parts of the region. The origin of the zircon at St. Peter's Dome in the same region was described.

At 11:47 A.M., the Society adjourned to meet at 12:00 o'clock, noon, in joint session with the Geological Society of America, and listen to the presidential address of our retiring president, Dr. A. N. Winchell on "The New Mineralogy."

LUNCHEON MEETING

An informal luncheon meeting was held at 12:45 P.M., Thursday, December 29, at the Harvard Faculty Club. This was attended by 51 persons, and was presided over by Vice-President Joseph L. Gillson who asked each one present to rise, give his name, position, and sphere of interest in mineralogy. The meeting was enjoyed by all present.

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The third session was called to order at 2:15 P.M. by President Winchell, and the reading of papers proceeded according to program.

A. F. ROGERS: *Use of Plane Angles in Geometrical Crystallography*. Modern works on crystallography give practically no information concerning plane angles of crystal faces, evidently on account of the difficulty of accurate measurement of these angles.

Plane angles are as characteristic as interfacial angles and it seems probable that many of the more common crystallized minerals are recognized by means of these plane angles. A method of determining plane angles graphically was shown.

J. D. H. DONNAY: *Theory of Determinants Applied to Crystallography*. The theory of determinants and matrices is a very useful tool in a great many questions in physics and mathematics, such as problems which involve systems of linear equations in several variables. Such problems are often encountered in crystallography where the methods of solid analytical geometry find constant application.

The aim of the paper is to present the results of the application of determinants to the study of tautozonal faces. The derivation of the equation of zone control is greatly simplified. So is the demonstration of the "Law of Addition and Subtraction," a special case of the latter equation.

CHARLES PALACHE AND LAURENCE LA FORGE: *Crystallographic Notes*. The minerals anapaite and eudidymite are described with the choice of new positions for the axes and reasons given therefore. They serve as an illustration of some of the problems met with in the revision of crystallographic data for the new edition of Dana's SYSTEM.

M. A. PEACOCK: *Crystallography of Emplectite*. Crystals of this mineral, apparently of much better quality than any measured before, have yielded a series of 26 forms and a new axial ratio. The new crystals clarified the relation with zinkenite and chalcostibite.

A. H. KOSCHMANN: *Differentiation as Expressed by Intrusive Stocks in the Magdalena District, New Mexico*. In the Magdalena district, pre-Cambrian, Carboniferous, and Tertiary rocks are cut by several Tertiary stocks. Attention is here confined to four closely related stocks that consist mainly of monzonite and granite, with gabbroic and granophyric facies.

One stock, which consists almost entirely of typical monzonite, has a chilled apophysis whose composition is that of a gabbro, and indicates an original gabbroic magma from which the rocks of the stocks have been differentiated in situ. However, margins of the main stock are typical monzonite. This stock and adjacent rocks are cut by small salic dikes, some of which approach typical granite aplite in composition, and some contain considerable epidote.

Other stocks are more complex. In one, typical monzonite grades into typical granite and the granite into granophyre; in another, monzonite grades directly into granophyre.

S. S. PHILBRICK (Introduced by E. B. Mathews): *Contact Metamorphism of the Onawa Batholith, Piscataquis County, Maine*. Within a wide belt of regionally metamorphosed slate, which occupies much of south central Maine, are several small, apparently concordant, intrusive granitic bodies. One of these is the Onawa Batholith. The granite with its basic border occupies an area of about 33 square miles and forms a complex physiographic basin which is surrounded by ridgelike mountains produced by strongly resistant contact metamorphic rocks.

The metamorphic rocks are divided into three zones forming an aureole about three-quarters of a mile in width which surrounds the entire batholith with breaks in only two places. The zones, proceeding from the country slate toward the batholith, are: (1) andalusite (frequently chiastolite) schist, (2) andalusite hornfels, and (3) injection hornfels carrying many small quartz-microcline aplites.

J. T. ROUSE (Introduced by F. R. Van Horn): *Structure and Alteration of the Deer Creek Intrusive, Wyoming*. A detailed study and structural survey has been made of a small laccolith on Deer Creek, a tributary of the south fork of the Shoshone River, near Valley, Wyoming. The laccolith is composed of quartz-diorite-porphry intruded in Tertiary (Eocene?) basic breccias and basalt flows. This intrusive was first mapped as a stock and then later considered a sill, but the structural survey, especially the direction of alignment and pitch of the hornblende needles, showed it to be a laccolith. It is believed that the difference between the outer undecayed rock and the central decayed zone is due to hydrothermal alteration of the rock.

J. W. PEOPLES (Introduced by Edward Sampson): *Stillwater Igneous Complex, Montana*. A study of a banded igneous complex exposed for a length of thirty miles along the Beartooth Mountain front, Montana, has shown that it is a sheet, or lopolith, of pre-Cambrian age intrusive into pre-Cambrian sediments; that it has a basal chill zone of norite; that its top has been eroded; that each extremity is probably faulted; and that, as now exposed, it has a total thickness of about 11,000 feet.

Three zones are distinguished: a lower, or basic, zone of bronzitite, harzburgite, and related rocks; a middle, or banded, zone of norite, anorthositic norite, anorthosite, and troctolite, and an upper zone of anorthosite, anorthositic gabbro (or norite), gabbro, and norite.

H. N. FISK (Introduced by F. R. Van Horn): *Differentiation in Columbia River Basalt*. A glassy basalt flow, sixteen feet thick, from Grand Coulee, Wash., was sampled at one foot intervals. Each specimen was sectioned both parallel to and normal to the surface of flow. Work to date shows the holocrystalline portion of the flow limited to the lower two feet where there is a concentration of magnetite and olivine. Above this, augite and magnetite vary inversely with the percentage of tachylyte which is frequently rendered opaque by these minerals in a finely divided state. The percentage of plagioclase is remarkably constant throughout the flow, with a tendency toward the concentration of more basic plagioclase in two definite horizons.

T. F. W. BARTH AND C. J. KSANDA: *Structure of the Polymorphic Forms of Niter*. Potassium nitrate, KNO_3 , an orthorhombic form of which is known as the mineral niter, has two additional modifications, both trigonal, one of these being stable at higher pressures, the other at higher temperatures.

In these two modifications the same general type of crystal structure is encountered (related to that of calcite), but the pressure form displays a space lattice in which all the atoms have stationary positions, whereas in the high-temperature form the group NO_3 is rotating around the central N-atom.

ALFRED C. HAWKINS: *Beidellite in the Cretaceous Clays of New Jersey*. Microscopic crystals observed during microscopic study of the fire clays of Middlesex Co.,

N. J., prove to be a kaolin mineral which is much like beidellite, but in its optical properties shows a tendency toward nontronite.

The crystals appear monoclinic. They are well developed and angles can be measured and some optical properties determined. This must be a new mineral. (Identification checked by C. S. Ross.)

ALFRED C. HAWKINS: *Helically Twisted Millerite Crystals*. The millerite crystals occur in cavities of a quartz vein which cuts the Mills coal vein at Nanticoke, Pa.

The crystals are brilliant and untarnished. The coarser ones have a radiated arrangement; many smaller ones form a felt of matted acicular prisms. A number of the most slender ones have a very regular helical twist, which must have been developed during the growth of the crystals.

S. G. GORDON: *The New Museum Cases of the Academy of Natural Sciences of Philadelphia*. (Read by title.)

The last paper was finished at 5:13 P.M., after which Dr. A. C. Hawkins moved that the thanks of the Society be extended to the authorities of Harvard University, Massachusetts Institute of Technology, the Geological Society of Boston, and to the local committee, for their kindness and hospitality. This was seconded by Dr. J. Ellis Thomson after which the Society adjourned.

During the sessions of the Society, a total of thirty-one scientific papers were presented, two being read by title. 102 fellows, members, and guests were present at the various meetings.

The following registered at the Cambridge meetings:

W. M. Agar	N. G. Dumbros	A. H. Koschmann
J. Anshel	F. C. Edson	P. Krieger
E. J. Armstrong	C. M. Farnham	L. LaForge
V. L. Ayers	C. R. Fettke	A. C. Lane
G. J. Baker	L. W. Fisher	E. S. Larsen
J. W. Baker	H. N. Fisk	J. V. Lewis
T. F. W. Barth	F. Foreman	G. D. Louderback
J. S. Beach	D. Gallagher	G. F. Loughlin
N. S. Beaton	E. A. Goranson	H. E. McKinstry
N. L. Bowen	J. L. Gillson	E. B. Mathews
M. L. Brashears, Jr.	J. Gilluly	J. E. Maynard
L. S. Brown	F. A. Gonyer	E. B. Mayo
A. F. Buddington	G. M. Hall	B. L. Miller
M. J. Buerger	J. B. Hanley	C. E. Miller
N. W. Buerger	A. C. Hawkins	R. B. Miller
R. D. Butler	C. S. Hitchen	D. Modell
R. J. Colony	G. R. Heyl	E. S. Moore
F. M. Chase	H. C. Horwood	J. F. Morton
H. D. Chase	W. F. Hunt	J. H. Moses
N. E. Chute	C. S. Hurlbut, Jr.	R. Murphy
M. E. Cooley	F. E. Ingerson	C. Palache
L. W. Currier	E. C. Jacobs	M. A. Peacock
C. G. Doll	P. F. Kerr	J. W. Peoples
J. D. H. Donnay	A. A. Klein	E. H. Perkins
R. K. Doten	E. H. Kraus	E. L. Perry

S. S. Philbrick	J. F. Schairer	T. L. Tanton
A. H. Phillips	W. T. Schaller	E. Thomson
A. W. Quinn	G. F. Seager	G. Tunell
S. Richarz	G. Selfridge	F. R. Van Horn
A. F. Rogers	B. M. Shaub	S. Varni
C. S. Ross	C. B. Slawson	T. L. Walker
J. T. Rouse	L. W. Staples	R. C. Wells
C. J. Roy	L. F. Stevens	E. Wigglesworth
E. Sampson	J. S. Stevenson	A. N. Winchell

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.

HONORARY PRESIDENT for life..... Edward S. Dana, 1925

PRESIDENTS

- 1920 Edward H. Kraus
- 1921 Charles Palache
- 1922 Thomas L. Walker
- 1923 Edgar T. Wherry
- 1924 Henry S. Washington
- 1925 Arthur S. Eakle
- 1926 Waldemar T. Schaller
- 1927 Austin F. Rogers
- 1928 Esper S. Larsen
- 1929 Arthur L. Parsons
- 1930 Herbert E. Merwin
- 1931 Alexander H. Phillips
- 1932 Alexander N. Winchell

VICE-PRESIDENTS

- 1920 Thomas L. Walker
- 1921 Waldemar T. Schaller
- 1922 Frederick A. Canfield
- 1923 George F. Kunz
- 1924 Washington A. Roebing
- 1925 Herbert P. Whitlock
- 1926 George Vaux, Jr.
- 1927 George L. English
- 1928 Lazard Cahn
- 1929 Edward Wigglesworth
- 1930 John E. Wolff
- 1931 William F. Foshag
- 1932 Joseph L. Gillson

SECRETARIES

- 1920-1922 Herbert P. Whitlock
- 1923- Frank R. Van Horn

TREASURERS

- 1920-1923 Albert B. Peck
- 1924-1929 Alexander H. Phillips
- 1929-1930 Albert B. Peck
- 1931- Waldemar T. Schaller

EDITORS

- 1920-1921 Edgar T. Wherry
- 1922- Walter F. Hunt

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- 1920 Arthur S. Eakle, Frank R. Van Horn, Fred E. Wright, Alexander H. Phillips
- 1921 Frank R. Van Horn, Fred E. Wright, Alexander H. Phillips, Austin F. Rogers
- 1922 Fred E. Wright, Alexander H. Phillips, Austin F. Rogers, Thomas L. Watson
- 1923 Alexander H. Phillips, Austin F. Rogers, Thomas L. Watson, Esper S. Larsen
- 1924 Austin F. Rogers, Thomas L. Watson, Esper S. Larsen, Arthur L. Parsons
- 1925 Thomas L. Watson, Esper S. Larsen, Arthur L. Parsons, William F. Foshag