REPORT OF THE COMMITTEE ON NOMENCLATURE

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

Herewith is presented the second report of the Committee on Nomenclature. The term "nomenclature" is used in a broad sense for the sake of brevity and is intended to cover several subjects. Though based on the report circulated among the membership of the Society in the fall of 1932, it has been considerably changed therefrom, new matter added, old material deleted, and the results of the second meeting, as a joint session with the similar British sub-committee, incorporated.

It was decided at the annual meeting held in New York City, December 26, 1935, to postpone action on its adoption to December 1936. The members of the Society will thus have more time in which to consider the report. Please write the Chairman, Dr. W. T. Schaller, U. S. Geological Survey, Washington, D. C., concerning any changes, or modifications, or new items, you may wish to present.

It is hoped that the full Committee may meet again sometime this coming summer (1936), especially in cooperation with those in charge of and contributing to the preparation of the 7th edition of Dana's *System of Mineralogy*, and others interested, and that a third and final report will be sent to all members of the Society early in the fall of this year.

Your Committee has held three meetings, the first in Toronto on December 28, 1930; the second in Washington (joint session with the British sub-committee) on July 25, 1933; and the third in Washington on April 26, 1935. At no meeting has it been possible for all members of the Committee (Dr. W. F. Foshag, Prof. E. S. Larsen, Dr. J. F. Schairer, Dr. W. T. Schaller, Prof. T. L. Walker, Prof. E. T. Wherry, and Prof. A. N. Winchell) to attend. At the first meeting Professor Wherry, at the second meeting Professor Winchell and Doctor Foshag, and at the third meeting Professors Walker and Wherry, were unable to be present.

The report of the first meeting was sent to the members of the Society in the fall of 1932.

The second meeting was held during the sessions of the 16th International Geological Congress, in Washington, D.C., on July 25, 1933, in joint session with a British Sub-Committee, representing the Mineralogical Society of Great Britain and Ireland. The British Sub-Committee consisted of Sir John Flett, Director of the Geological Survey of Great Britain, Chairman; Mr. W. Campbell Smith of the Mineral Department, British Museum; and Prof. Charles G. Cullis, Professor of Economic Mineralogy, Imperial College of Science and Technology, London.

The wide distribution of the American publications in economic and mining geology in Great Britain and its Colonies has had an important influence in spreading the American usage in words and spelling throughout the world. The marked tendency of the members of the British Committee to accept the widespread usage of terms as published in American journals greatly facilitated the progress of arriving at uniformity and has considerably increased the hope of agreement of English-speaking peoples in the use of scientific terms.

Shortly after their return to Great Britain the British Sub-Committee, which met with us in joint session in Washington, submitted a report of the results of the joint session to the Nomenclature Committee of the British Mineralogical Society (Sir John S. Flett, Chairman, Sir Henry A. Miers, Dr. L. J. Spencer, and Mr. W. Campbell Smith). It is very gratifying to note that this British Committee approved almost entirely the conclusions arrived at by the Washington joint meeting. The British Committee notes that no attempt at international agreement was made. As the results of such earlier attempts at international agreement by the British Committee were futile, your Committee feels that such attempts may not at present be successful and joined heartily with the British Committee in concentrating attention on obtaining uniformity in English-speaking countries.

At the third meeting of your Committee the results of the second meeting were read and discussed and certain changes were made in the report of the first meeting, in part due to the reply made by the British Committee of the results obtained at the joint session of the British and American Committees.

At the first meeting held in Toronto it was agreed that no recommendation would be made unless the Committee approved unanimously, and that any adopted suggestion should make as little change in existing conditions as possible, striving for simplicity and clearness. Well established practice or usage should not be changed. This attitude is in agreement with that of L. J. Spencer (London) who has written "Anything that is done must be quite simple and in gradual and persuasive (give and take) steps. It is not the slightest use to propose any drastic changes."

No subject should be discussed unless there seems to be a good chance of "putting it across" and adopting the conclusion in our Society by giving our Editor authority to enforce our decisions in his editorial work on *The American Mineralogist*. A copy of this report, if adopted by the Society, should be sent to the editors of similar journals (*American Journal of Science*, *Economic Geology*, etc.) with a request that they likewise follow our decisions editorially.

The Committee presents the various items discussed under three heads: I. Review of former Committee reports (1921–1924); II. New items; III. The symbolism for the indices of refraction and vibration directions.

The items under headings I and II have the unanimous approval of the entire Committee and therefore are recommended for adoption by the Society. The item under III was unanimously approved by those present at the joint session with the British but does not carry the approval of all the members of the Committee and hence is not recommended.

I. REVIEW OF FORMER COMMITTEE REPORTS (1921–1924)

1. Definition of mineral species, subspecies, and variety. (*The American Mineralogist*, vol. **8**, p. 50, March, 1923.) No action was taken on the definition of the terms species, subspecies, and variety. The use of subspecies should be restricted as much as practical and variety names of a strictly mineralogical nature may gradually disappear if a descriptive phrase, like that proposed by Schaller in *The American Mineralogist*, vol. **15**, pp. 566–674, December, 1930, be adopted. See under II (1) below. Some variety names such as ruby, emerald, etc., should remain.

2. Termination of mineral names. (*The American Mineralogist*, vol. **8**, pp. 50–52, 1923.) The Committee is in general strongly opposed to changing existing names in common usage. It does not approve either the former minority report favoring changes (realgar to realgarite, rutile to rutilite, corundum to cordundite, etc.) or the former majority report on similar changes for 43 mineral names ending otherwise than in *ite*, such as galena to galenite, trona to tronite, cinnabar to cinnabarite, etc. The Committee recommends that authors use the ending *ite* whenever possible, in the coining of new mineral names, though other endings, such as *ine*, may be used.

3. Spelling of mineral names. (*The American Mineralogist*, vol. **9**, pp. 60–63, March, 1924.) All five numbered suggestions of the preliminary mimeographed report are approved. Also the additional items (6 and 7). These are printed in *The American Mineralogist*, vol. **9**, p. 61. The alternative spellings of the 57 names listed in the preliminary report are approved with the following exceptions. Salammoniac is preferred to salammonite, cerusite and hydrocerusite (one *s*) are wrong if the name is derived from Latin cerussa, and luenebergite should be spelled lueneburgite.

4 and 5. The Committee makes no recommendation on (4) Division into classes, or (5) Numbering of species.

6. Nomenclature of isomorphous groups. In general agreement with earlier report, with no specific recommendations. Latitude must be allowed for future development.

7. Pronunciation of mineral names. This Committee recommends that a new Committee be appointed to consider the question of pronunciation in cooperation with the British. The British Sub-Committee was very anxious to reach an agreement on this question.

8. Subdivision of mineral classes. This Committee makes no recommendation.

II. New Items

1. The Committee recommends the adoption of Schaller's proposal on the use of a uniform adjectival ending for the names of chemical elements used as modifiers to mineral names, as published in *The American Mineralogist*, vol. **15**, pp. 571, 572, December, 1930. The British Committee took no action on this question, at first considering it too artificial an attempt at word building, but on further discussion they decided to hold the matter in abeyance.

2. Use of standard abbreviations (symbols) for physical and optical properties.

(a) Your Committee recommends the use of the abbreviation G in place of D or Sp. Gr., thus obviating discussion as to whether value given represents density or specific gravity. The British Committee reports that the particular abbreviation used "is really a trivial point and can give rise to no ambiguity; but in original papers it should be made quite clear if the correction d_4^{20} has been applied."

(b) Both your Committee and the British Committee recommend the use of the lower case italic English letters "*r*" and "*v*" for expressing dispersion, instead of the Greek letters rho and upsilon.

3. (a) Crystallographical nomenclature. The Committee recommends the following names for the six systems: Isometric (abbrev. I) instead of cubic, tetragonal instead of quadratic, hexagonal (abbrev. H), orthorhombic (abbrev. O), monoclinic (abbrev. M), and triclinic (abbrev. T) instead of anorthic. The British Committee agreed to triclinic for anorthic and had no real objection to isometric but preferred cubic.

Your Committee does not approve of the use of *XYZ* instead of *abc* for the three crystal axes.

(b) The Committee feels it is not yet time for definite approval of any one scheme of nomenclature for the 32 classes. In general, it suggests that Dana be followed. The new names which recently appeared in *The American Mineralogist* are not formally adopted by the Committee. This is without prejudice—the Committee feels that it is not yet time for a formal adoption of any one scheme.

(c) The Committee fully approves of Spencer's statement that "Standardization and agreement are also much needed for the orientation, axes of reference, and the letters assigned to the crystal forms of each mineral species."

4. Names of species. Your Committee and the British Committee both recommend the following names and spellings of mineral species. The names to be discarded are placed in parentheses. Some of these names have been discussed by the Committees on account of previous attempts to recommend the names and spellings now recommended to be discarded.

The confusion in the use of the two names calamine and smithsonite in the English-speaking countries should now end. Among the British calamine has been used where we use smithsonite, and smithsonite where we use calamine. By mutual agreement the term calamine is now dropped as a mineral species name. Hemimorphite is approved by both Committees as the name for the zinc silicate, $H_2Zn_2SiO_5$, and smithsonite for the zinc carbonate, $ZnCO_3$.

Analcime (analcite)
Anatase (octahedrite)
Argentite (argyrite)
Arsenopyrite (mispickel)
Autunite (calcouranite)
Azurite (chessylite)
Bornite (erubescite)
Chabazite (chabasite)
Chalcopyrite (chalkopyrite)
Chrysoberyl (cymophane)
Cinnabar (cinnabarite)
Cordierite (iolite, dichroite)
Euclase (euklase)
Feldspar (feldspat, felspar)
Fluorite (fluorspar)
Gypsum (gypsite)
Halite (salt, rock-salt)
Hematite (haematite)
Hemimorphite (calamine) Zinc silicate
Idocrase (vesuvianite)
Kyanite (cyanite)
Labradorite (labrador)
Magnesite, Magnesium carbonate
Nepheline (nephelite)
Olivine (chrysolite)
Orthoclase (orthoklase)
Phenakite (phenacite)
Plagioclase (plagioklase)
Pyrite (pyrites, iron-pyrites)
Scapolite (wernerite)
Sepiolite (meerschaum)
Sillimanite (fibrolite)
Smithsonite, Zinc carbonate
Sphene (titanite)
Spodumene (triphane)
Stibnite (antimonite)
Torbernite (cuprouranite)

A few of the approved names may seem unusual to some of our members, but the British Committee was most generous in yielding some of their preferred names. The compromise list is an example of the benefits to be derived from a mutual "give and take" policy.

5. Cooperation with the authors of the proposed new (7th) edition of Dana's *System of Mineralogy.*

Dr. Schairer reported that Prof. W. E. Ford, Editor-in-Chief of the new edition, would adopt any recommendations unanimously made by this Committee and approved by our Society. Several other authors of standard books in mineralogy (Larsen, Winchell) have expressed similar veiews.

III. Symbolism of the Indices of Refraction and Vibration Directions

At the second meeting of your Committee it was approved unanimously by those present in joint session with the British to adopt alpha, beta, and gamma as the symbols for both indices of refraction and vibration directions. This does not, however, have the approval of all seven members of your Committee and therefore is not recommended.

The Committee recognizes that there are other items worthy of consideration which have not been acted on. They do feel, however, that considerable progress has been made. Perhaps its greatest achievement has been in its success at arriving at agreement on several questions with the British, so that uniformity in usage in great part seems assured, at least with the English-speaking people of the world.

Respectfully submitted,

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

PRESENTATION OF PAPERS

The address of Dr. Clarence S. Ross, retiring President of the Mineralogical Society of America, was delivered Friday, December 27 at 11:10 A.M. in the Grand Ballroom before the joint assembly of all socieites. The address is printed in full in this issue of the Journal.

MINERALIZATION IN THE VIRGINIA TITANIUM DEPOSITS

BY CLARENCE S. ROSS, *Washington, D. C.*

(Abstract)

The titanium region of Nelson and Amherst Counties, Virginia, is the world's largest producer of rutile, and also has large supplies of ilmenite. The titanium ores are associated with a feldspathic rock. However, they were probably derived from a deep-seated, highly ferromagnesian rock, of which only a few highly altered and mineralized apophyses reach the surface. The feldspathic rock was intruded as a mush of crystals, and thoroughly granulated during the process. Therefore, the relations are those of an anorthosite, although the plagioclase is andesine, rather than labradorite.

The titanium ores occur as disseminations in the feldspathic rock; and as dike or vein-like lenses which are largely confined to this rock. Both types of ore were deposited by invading solutions, since they were formed after the intrusion and granulation of the feldspathic rock.

A group of associated secondary silicates show that the introduced materials were titanium, ferric iron, magnesium, and very minor amounts of silica and alkalies. The simple chemical composition of the replaced feldspathic rock and the small number of introduced elements presents an unusually favorable opportunity for the study of the chemistry of mineralization. Near feeding channels, a restricted zone of iron-bearing minerals formed; farther out magnesian minerals and iron-free rutile were deposited, and almost throughout the granulated feldspar rock important mineral changes occurred without marked transfer of materials.

THE ORIGIN OF KERNITE AND BORAX IN THE KRAMER BORATE FIELD, CALIFORNIA

BY WALDEMAR T. SCHALLER

Presented on program of General Session, Geological Society of America, by invitation

The sodium borates (kernite and borax) of the Kramer borate field, Mohave Desert, Calif., lie from 350 to 800 feet underground in bedded Tertiary clay deposits. The buried borate basin is about four miles long and one mile wide. The deposits of kernite and borax are about 100 feet thick and consist of about 75 per cent of sodium borates. Ulexite and colemanite beds occur above and below the kernite and borax.

In one of the three mines, where the continuous and parallel clay layers are neither folded nor broken, borax is the only sodium borate present. In the other two mines, where the clay layers are folded and considerably broken, kernite is present in millions of tons, in large and small crystals. In places the clay beds have been pushed aside and molded around the kernite crystals. The kernite has formed from the borax by recrystallization due to increased temperature and pressure.

The deposit is unusual in the absence of other saline minerals, such as the carbonate, chloride, and sulphate of sodium, calcium, and magnesium. A derivation of the borax from the change of ulexite to colemanite would yield borax free from these other saline minerals. The known extent of the ulexite-colemanite deposits is sufficient to furnish the known quantity of borax and kernite.

MINERALOGY AND PHYSICAL-CHEMICAL MINERALOGY

Thursday Afternoon, December 26th

PSEUDOWOLLASTONITE AND WOLLASTONITE SOLID SOLUTIONS WITH DIOPSIDE AND AKERMANITE, by J. F. Schairer and N. L. Bowen.

Recent detailed laboratory studies of the systems, $CaSiO_3$-$CaMgSi_2O_6$ and $CaSiO_3$-$Ca_2MgSi_2O_7$, show that both systems are binary.

Wollastonite (β-$CaSiO_3$) forms a series of solid solutions with diopside ($CaMgSi_2O_6$) extending to about 22 per cent diopside. Pseudowollastonite (α-$CaSiO_3$) takes little if any diopside into solid solution. As a consequence of this difference in concentration of the solid solutions the inversion wollastonite$\rightleftharpoons$pseudowollastonite is raised from about 1130°C. to 1368°C. and wollastonite solid solutions appear in equilibrium with liquid. The eutectic between pure diopside and wollastonite solid solution is at 1358°C. and 62 weight per cent diopside.

The system, $CaSiO_3$-$Ca_2MgSi_2O_7$ (akermanite), is of the simple eutectic type with no solid solution. There is a eutectic between α-$CaSiO_3$ and akermanite at 1398°C. and 57 weight per cent akermanite. The inversion of β-$CaSiO_3$ to α-$CaSiO_3$ is at about 1130°C. for all compositions of this system, a reflection of the failure of solid solution of akermanite in both forms of $CaSiO_3$.

DETERMINATION OF THE MINERAL COMPOSITION OF MINE DUST BY MEANS OF *X*-RAYS, by T. L. Walker.

Chemical analyses of mine dust and of mill feed from the same mine indicate that certain minerals settle from the air more quickly than others with the result that they form a smaller percentage of the dust than of the ore. This is most marked in the case of quartz. Minerals with best cleavage concentrate in the dust. At the suggestion of the author, experiments were undertaken by Professor G. L. Clark, University of Illinois, which have developed into an established method for determining the amount of quartz in mine dust by means of a study of *X*-ray diffraction patterns from dust and of the densitometer curves prepared from them. By this method a mixture of crystalline substances may be analysed, giving the per cent of each crystalline component. The accuracy of this method for the determination of quartz has been shown to be within five per cent of the quartz present. It is believed that this method will be of service in the study of dusts which give rise to silicosis.

BABINGTONITE FROM WESTFIELD, MASSACHUSETTS, by Charles Palache.

Babingtonite was first found at this well-known datolite locality in 1935. Form and chemical composition are practically identical with those recently described for babingtonite from Holyoke. Associated with it are prehnite, datolite, epidote, calcite and quartz. Epidote is of two habits, one very dark and shown by analysis to be richer in iron than any epidote optically studied. The optical data effect slight modification of accepted curves.

SEPARATION PLANES IN MAGNETITE, by J. W. Grieg, H. E. Merwin and E. Posnjak.

Faces on magnetite crystals may show striations, and pieces, when broken, frequently separate along planes. It has usually been supposed that this was due to spinel twinning, but goniometric observations on crystals and plane faced fragments of magnetite together with microscopic examinations of polished sections of artificially oxidized magnetite show that several planes of separation occur, none of which are necessarily associated with detectable twinning.

IMMERSION LIQUIDS OF HIGH REFRACTIVE INDEX, by C. D. West.

A set of immersion liquids for the refractive index range $n_D = 1.78 - 2.06$, made up of the components phosphorus, sulfur and methylene iodide, is described. From five months' experience with these liquids it is concluded that they are practically stable and safe to use with proper precautions.

CHEMICAL COMPOSITION AND OPTICAL PROPERTIES OF SOME CALCIC PLAGIOCLASES, by A. H. Phillips and H. H. Hess.

Chemical anslyses and indices of refraction of five calcic plagioclases were presented and discussed. The work was undertaken in an attempt to improve the curves for optical properties at the calcic end of the plagioclase series (labradorite to anorthite). The material was especially collected for this purpose from the Stillwater Igneous Complex of Montana. Separation of the plagioclase from the hypersthene and diallage with which it occurred as well as removal of minute inclusions in some cases present within the plagioclase was accomplished by means of the Frantz isodynamic magnetic separator.

THE MELTING OF DANBURITE, by G. W. Morey and Earl Ingerson.

Danburite melts with formation of two ternary liquid layers, a type of melting never observed before. The two liquids are one pair of a continuous series of immiscible liquids extending from the binary system, CaO-SiO_2, to the binary system, CaO-B_2O_3. In the ternary system, the region of immiscibility extends to regions of higher CaO content than in either of the binary systems. In other words, addition of B_2O_3 to the binary system, CaO-SiO_2, or of SiO_2 to the binary system, CaO-B_2O_3, causes the two coexisting liquids to diverge further in composition. Because of the fact that in the one binary system the crystalline phase in equilibrium with two liquid layers is one of the components, silica, while in the other binary system it isthe compound, $CaO \cdot 2B_2O_3$, the invariant points containing two liquid phases, two crystalline phases and vapor show some novel features, made more interesting by one of the coexisting liquids containing only a small amount of CaO. The effect of adding Na_2O, that is, the surface of separation of the immiscible region in the quaternary system, Na_2O-CaO-B_2O_3-SiO_2, has been outlined, and similar experiments are under way in the system, H_2O-CaO-B_2O_3.

A THIRD STUDY OF CHLORITE, by A. N. Winchell.

A revised diagram has been prepared showing the relations between variations in composition and in optic properties in the main chlorite system (antigorite-amesite-daphnite-ferroantigorite). The relations between optic properties and the various types of chlorite have been shown in another diagram. A new graph for the antigorite-amesite-kaemmererite system has been prepared. Finally, the effects produced on optic properties by oxidation of ferrous iron in certain chlorites have been expressed graphically.

MINERALOIDS, by Austin F. Rogers.

It is proposed to use Niedzwiedzki's term *mineraloid* not only for the less definite mineral-like substances such as palagonite, sideromelane, chlorophaeite, volcanic glass, and hydrocarbons (amber, ozokerite, asphaltum, etc.), but also for the more definite amorphous equivalents of crystalline minerals now usually classed as minerals. On account of the variation in both chemical composition and physical properties, these amorphous mineral substances, such as opal, cliachite, limonite, and collophane, cannot be as accurately defined as crystalline minerals are. However, they deserve recognition from the scientific as well as the economic standpoint. It seems best to consider them mineraloids rather than minerals proper.

There are two general classes of mineraloids: the hyaline (glasses) and the porodine (hydrogels), to use Breithaupt's terms.

Hyaline mineraloids include lechatelierite, maskelynite, and volcanic glass.

To the porodine mineraloids I would assign patronite, xanthochroite, hydrotroilite, opal, melaconite, pyrolusite, psilomelane, cliachite, limonite, collophane, evansite, pitticite, bindheimite, greenalite, hisingerite, neotocite, halloysite, allophane, stevensite, cornuite, and the metamict equivalents of zircon (malacon), thorite, allanite, gadolinite, homilite, yttrotantalite, and yttrocrasite.

HIGH IRON TOURMALINE FROM THE MARQUETTE IRON RANGE, by C. B. Slawson.

Iron tourmaline is a characteristic mineral in the quartz veins of the Marquette iron range. These quartz veins are derived from the Republic batholith lying to the south of the range. Quartz tourmaline veins cutting the magnetite ore bodies of the Greenwood mine show little alteration of the magnetite. Non-tourmaline bearing quartz veins alter the magnetite to specular hematite. Chemical and optical data are given for high iron tourmaline from the Champion iron mine.

DICKITE IN MISSOURI, by W. A. Tarr and W. D. Keller.

The finding of dickite in Missouri is reported for the first time. These new occurrences are described and its mode of occurrence, association with sulphides, and optical properties are given.

MICROCHEMICAL METHODS IN DETERMINATIVE MINERALOGY, by Lloyd W. Staples.

Microchemical methods for the determination of the non-opaque minerals have not received the attention which they deserve. These methods frequently result in a saving of time, labor, and reagents. A comparatively few reagents, most of which are inexpensive and available in blowpipe laboratories, satisfactorily meet most determinative problems. If only small amounts of minerals are available for testing, or in the case of minerals with high indices of refraction, microchemical methods are very valuable. They will probably find their most efficient use in supplementing the study of minerals in crushed fragments by the immersion method.

Microchemical determinative methods are not without their attendant difficulties. These may be due to a variety of causes such as poor technique, difficult solubility of minerals, or lack of good tests for certain elements. In spite of these difficulties, the advantages to be gained from these methods are sufficient to strongly recommend them.

Several new, simplified, or improved tests are discussed. Aluminum, iron, and manganese may be detected by ammonium paramolybdate and the fluosilicate test developed by Boricky and Behrens has been improved so that it provides a simple and adequate test for silicon. Crystalline precipitates are to be preferred to color reactions for most work. The technique of microchemical testing is very important and suggestions regarding improvements and simplification of it are made.

CONFERENCE ON METHODS OF MINERAL EXHIBITION

Thursday, 4:00 P.M., December 26th

EXPERIMENTS IN MOUNTING MINERALS FOR EXHIBITION, by Charles Palache.

For hand specimens of moderate size a plaque of plaster of Paris is employed, proportioned to the specimen. The plaques are arranged on broad sheets of plaster lining the case. The plaster has a pleasing matte surface, does not discolor with age, is easily cleaned, and gives good spacing to specimens.

Cut stones and small gem crystals are mounted on plaques of colorless plate glass, held by a drop of rubber cement.

MINERALOGY IN THE COMMERCIAL MUSEUM, by Charles R. Toothaker.

The mineral exhibits in the Philadelphia Commercial Museum are arranged on a commercial basis, not from the standpoint of scientific mineralogy. They show the ores of the important metals and the various mineral substances which have commercial value. The plan of arrangement begins with iron and follows on with the alloy metals, then lead, silver, copper, gold, aluminum and the rarer metals. Following are such things as mica, asbestos, ceramics, potash, salt and building stones. Petroleum and coal are in a parallel line which puts coal and iron alongside each other.

The Museum displays as a rule fairly large and showy ore specimens and these are, if possible, held in place by invisible wrought iron brackets.

The exhibits are supplemented by a number of miniature models of such things as an iron mine, a blast furnace, an open hearth steel mill, a coke works, a coal mine, a marble quarry, a granite quarry, etc.

HOW TO MAKE THE PUBLIC OBSERVE AND THINK IN THE MINERAL GALLERY, by T. L. Walker and A. L. Parsons.

In order to attract visitors to the mineral gallery of the Royal Ontario Museum it has been found useful to have attractive displays visible from the entrance. A case showing the attractive colors of minerals, another showing fluorescence of minerals and an automatic balopticon with pictures connected with the study of minerals serve as efficient baits. A lodestone compass which is known to thousands of school children brings great numbers of visitors. In addition to the systematic collections of minerals and rocks there are series of gem stones, series of genetically related minerals, valuable minerals of Ontario, Canadian minerals and large ore specimens mostly from Ontario. The outstanding feature that characterizes the Royal Ontario Museum of Mineralogy is the series of descriptive labels that are used to call attention to special features in large specimens or series of specimens. Large specimens are put in high cases interspersed in the systematic collections, but no specimen is displayed unless an instructive label can be prepared. Paragenetic series are arranged in large table cases and a single explanatory label describes the association. All labels are printed, and the descriptive labels have sufficient material for an elementary textbook on mineralogy and petrography.

NEW CASES FOR THE DISPLAY AND STORAGE OF SPECIMENS, by Samuel G. Gordon.

New low-cost museum cases for more effective display of specimens have been designed. The cases are practically "envelopes" of glass, beveled and grooved to fit together without wood or metal edges, and joined to welded metal bases. The construction admits of 100% lighting and visibility. While all hardware and locks are concealed, provision has been made for easily opening or securely locking the cases. The new designs include wall, table (with horizontal or sloping glass top), floor, and pedestal cases. A storage case, equipped with steel or wooden trays, for compact and economical storage of specimens has also been developed, and cases which combine a display unit with a storage cabinet.

THE SMALL LABORATORY MUSEUM COLLECTION, by Austin F. Rogers.

In case there is not sufficient space or funds available for a large museum, it is convenient to install a small museum collection at one end of the laboratory.

In this way the better specimens are protected and the museum collection supplements the study collections to which students are allowed direct access.

THE TEACHING MUSEUM, AN AID TO CLASS INSTRUCTION, by C. B. Slawson and M. V. Denny.

The museum practice as followed in the Mineralogical Museum of the University of Michigan is outlined, especially in reference to the use of material from the museum for lecture, class, and laboratory purposes. A more liberal museum policy is advocated which allows the student the use of museum grade material which is commonly held in reserve as "dead storage."

THE MINERAL MUSEUM AND THE PEOPLE, by H. P. Whitlock.

Deals with the general problems of presentation and crowd psychology including such details as the use of colors in direction arrows and charts, means of breaking monotony in installation and the study of mounts, labels and backgrounds.

PRESENTATION OF PAPERS

PETROGRAPHY

Friday Afternoon, December 27th

THE DIKES OF CAPE NEDDICK, MAINE, by John C. Haff.

A petrologic study is being made of the dikes of Cape Neddick, Maine, and the adjacent coast. The eastern portion of the Cape is underlain by a gabbro stock of small area which intrudes the Kittery quartzite (Pennsylvanian). There are at least two major hypabyssal successions although others may be distinguished. The older succession consists of diabases, lamprophyres, granophyres and quartz-porphyries, all of which were intruded into the quartzite prior to the invasion of the gabbro. The younger succession comprises the aplites, bostonites, trachytes, and diorite-porphyries (among others) which are definitely post-gabbro. Considered as a swarm the dikes in the quartzite strike predominantly N. 50–70° E., making varying angles with the highly foliated quartzite which trends northeasterly. The dikes in the gabbro itself are much more erratic in behavior.

There is a prevalence of complex structural relationships and many breccias are developed. Forty examples of contiguous and partition types of multiple dikes are known. The intrusion of four and five lithologically divergent rocks into one repeatedly eviscerated dike is common. True composite relations are difficult to prove.

The various breccias may be separated into genetic types depending on the source and condition of fragments, mode of emplacement, and localization within dikes or at contacts. Questions of age relationships, of the development of mixed types, and of xenoporphyritic structures are believed to be clarified.

A PECULIAR FORM OF DIFFERENTIATED IGNEOUS INTRUSION, by Bennett Frank Buie.

A dike-like body of shonkinitic rock showing marked differentiation is intrusive into the flat lying sandstone at the east side of the Highwood Mountains, Montana. The upper contact is conformable with the sedimentary bedding, and the rounded top gives the appearance of an aqueduct or a great tube. In cross section the body is bulb shaped, narrowing downward to a feeder dike. The transverse dimension averages about 100 feet. The body has been mapped for a distance of three and one-half miles. Throughout this extent an earlier but related dike, 4 feet to 8 feet wide, cuts the sandstone above and is cut off by the main body of igneous rock.

After emplacement, magmatic differentiation occurred, causing a concentration of 50 per cent of pseudoleucite in the rock near the upper contact, and a concentration of augite in the lower part. The increase in proportion of augite with depth is gradational. The body is well exposed, and appears to be an excellent example of gravitative differentiation.

The pseudoleucite occurs in trapezohedrons, the marginal portions of which are feldspar. The question of the origin of the pseudoleucite is considered.

A SCHEELITE-LEUCHTENBERGITE DEPOSIT IN THE PARADISE RANGE, by Paul F. Kerr and Eugene Callaghan.

A scheelite-leuchtenbergite vein, about 900 feet in length and averaging about 4 feet in thickness, occurs in the Paradise Range, Nevada. The scheelite was deposited originally with quartz associated with a few crystals of epidote and vesuvianite, under high-temperature conditions of crystallization related to a granodiorite stock not far distant and perhaps more immediately to a perthitic orthoclase dike along the vein. Hydrothermal replacement has left much of the scheelite in lumps surrounded by rims of talc and scattered through a matrix of leuchtenbergite. It is believed that the scheelite in such masses is residual, and that the matrix of quartz in which the scheelite originally occurred has been replaced by talc and leuchtenbergite.

Carbonate rock consisting of both dolomite and magnesite forms the wall rock on both sides of the vein. Remnants of an altered perthitic orthoclase dike occur along the vein. Granophyre dikes cut through both the wall rock and the vein. Postmineral faults follow the vein and branch off into the wall rock in several places.

Scheelite is irregularly distributed in the vein, but the amount so far developed is small.

DIFFERENTIATION IN THE SHONKIN SAG LACCOLITH, by Cornelius S. Hurlbut, Jr.

A remapping of the Shonkin Sag laccolith has shown it to be of much greater areal extent than formerly believed. Good exposures along much of its periphery indicate an almost circular plan. Changes in mineral composition from top to bottom of a single rock layer point to differentiation in place, but in an unusual manner. Several hundred specific gravity determinations show a change in density from top to bottom compatible with the change in mineral composition.

VEIN QUARTZ PSEUDOMORPHOUS AFTER ASBESTIFORM ACTINOLITE FROM THE BLUE RIDGE OF FAUQUIER COUNTY, VIRGINIA, by Lincoln R. Thiesmeyer.

The Blue Ridge in the western part of Fauquier County, Va., is capped by altered amygdaloidal volcanic rocks belonging to the so-called catoctin greenstone. At numerous localities they contain veins of cross-fiber asbestiform actinolite, partially to almost completely replaced by quartz. The veins vary from a few millimeters to fifteen centimeters wide and show a distinct en echelon arrangement. Post-vein deformation is indicated by a pronounced series of monoclinal flexures across the veins. The quartz in these veins consists mostly of coarse, rather brittle fibers, each of which is an aggregate pseudomorph of bundles of actinolite and has inherited the structures of the latter. The quartz fibers are sometimes crowded with hairlike inclusions of actinolite, and residual bundles of this material occur between them. Some recrystallization of actinolite and epidotisation of the wallrock accompanied the replacement. The orientation of vein minerals is discussed.

PLAGIOCLASE, PYROXENE AND OLIVINE VARIATION IN THE STILLWATER COMPLEX, by H. H. Hess.

Detailed changes in the composition of plagioclases, pyroxenes and olivines of the Stillwater Igneous Complex were studied. This complex, a lopolith, has been strongly differentiated presumably by crystal sorting and fractional crystallization (J. W. Peoples, 1932). Thus the variation in the pyroxenes from the base of the complex upwards should correspond to the variation of the pyroxenes crystallizing from the magma as differentiation proceeded. Variation in the plagioclases upwards in the lopolith might indicate whether the plagioclase settled or floated in the melt as differentiation took place.

As might be expected, the Mg-Fe ratio of the pyroxenes and olivines decreases from the base of the complex upwards and the ratio of monoclinic pyroxene to orthorhombic pyroxene increases. With a few reversals, the plagioclases change from An_{85} near the base of the plagioclase-bearing rocks to An_{60} at the highest point exposed. The reversals appear to be due to additions of new magma.

DEPOSITS OF RADIOACTIVE CERITE NEAR JAMESTOWN, COLORADO, by E. N. Goddard and Jewell J. Glass.

Small deposits of cerite occur in the pre-Cambrian rocks of the Front Range near Jamestown, 9 miles northwest of Boulder, Colorado. They are near the north border of a stock of Silver Plume granite, to which they are genetically related. Linear structures indicate that the stock was intruded steeply from the south and an abundance of lenticular schist areas in the granite suggest proximity to the roof.

The gray to brown cerite occurs as irregular lenses one-fourth to 15 inches wide in narrow aplite-pegmatite zones along the borders of small schist areas. Narrow veinlets of black allanite border the cerite and in places cut through it. Minute grains of pitchblende(?) and of pyrite are locally present.

Microscopic examination of the cerite shows it to be finely intergrown with varying amounts of yttrocerite, törnebohmite, allanite and other rare earth epidotes, parisite, pitchblende(?), and quartz. An analysis of some of the purer cerite showed 56 per cent Ce_2O_3.

A gray variety consisting of cerite, yttrocerite, and a rare earth epidote was found to show mild radioactivity on a photographic plate. An analysis of this material by J. G. Fairchild showed 28 per cent Ce_2O_3, 27.20 per cent $(La, Tb)_2O_3$ etc., 2.94 per cent Y_2O_3 etc., 0.513 per cent U_3O_8, and 0.28 per cent ThO_2, and gave an age determination of 940,000,000 years. This figure accords with the supposed pre-Cambrian age of the Silver Plume granite and with its field relations to the Pikes Peak granite whose determined age is 1,000,025,000 years.

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PRESENTATION OF PAPERS

MINERALOGY, CRYSTALLOGRAPHY, CRYSTAL STRUCTURE AND X-RAY STUDIES

Saturday Morning, December 28th

REFRACTIVE INDICES OF NATURAL RESINS, by A. E. Alexander.

Through the courtesy of Dr. Charles L. Mantell and the American Gum Importers Association, Inc., samples of natural resins were forwarded the writer for optical study.

Gums are amorphous and under polarized light such substances react isotropically. They consequently possess only one index of refraction. The indices of refraction of the natural resins, as determined, are:

CW Kauri	1.546	Pontianac	1.540
#3 Pale Kauri	1.546	Loba B. Manila	1.539
#3 Brown Kauri	1.544	Hard Manila	1.539
Pale East India	1.543	Bold Damar	1.538
Zanzibar	1.542	Batu	1.538
Ivory Congo	1.541	Tacamahac	1.538
Dark Congo	1.541	Ghatti	1.528
Black East India	1.541	Senegal	1.528
Benguela	1.541	Gutta Percha	1.528

MINERALS IN THE BATES LIMESTONE, LEWISTON, MAINE, by Lloyd W. Fisher.

The Bates Limestone of probable Cambro-Ordovician age is intruded by at least 16 basic dikes and two pegmatite dikes in the type locality in the city quarry, Lewiston. The limestone shows varying degrees of metamorphism. In some places, large calcite plates and crystals have developed; in other places diopside has been abundantly formed. Some beds of limestone have been changed to biotite schist. Graphite is abundant in some of the acid intrusives.

The variety and abundance of the various minerals of the limestone have been studied with reference to the effect of the intrusives in the region. The possible effects of contact regional metamorphism are discussed.

AN OCCURRENCE OF FELDSPARS REPLACING FOSSILS, by Bronson Stringham.

Several rock specimens were collected from the Provo River damsite, Utah. Among these is included an almost pure limestone of Mississipian age, which is tentatively correlated with the Madison formation. The limestone contains fossils and fossil fragments, some of which have been replaced by albite-oligoclase which is in many instances euhedral. Apparently the occurrence of the feldspars is confined to one horizon in the Madison formation.

Inasmuch as there has been no evidence found for the introduction of the feldspar and the fact that no igneous intrusives or mineralization are present in the vicinity, it is suggested that the feldspars are of authigenic origin.

IDENTIFICATION OF ROCKS BY REFLECTED LIGHT, by Fred E. Wright.

Minerals in the thin section and in powder form are commonly determined by the effects they have on transmitted light. Reflected light is rarely used and then only when observations on transmitted light are not possible, as in the case of lunar surface materials where the observer is restricted to a study of the effects produced by those materials on sun's rays on reflection and to comparison of these effects with those produced by terrestrial materials under similar conditions of illumination. The changes produced on reflection are of two kinds: (a) the relative intensities of light of different wave lengths are altered (selective reflection), and polarized light is introduced. These changes occur both in the visible and in the ultraviolet and infra-red parts of the spectrum. Several different methods have been used for measuring these changes: a visual method, polarization spectrograph, photoelectric cell together with a compound Wollaston prism, vacuum thermoelement with the same Wollaston prism. The percentage polarization of radiant energy in the visible spectrum is best ascertained by use of a special polarization eyepiece; the results obtained with it prove that the amount of plane polarization induced on reflection depends on a number of factors, such as character of material, condition of the reflecting surface, angle between the incident and outgoing rays, wave length of light, and so on. Extended series of measurements have been made on different types of rocks and other substances and the possibilities and limitations of the method thus ascertained.

ALTERATION OF GABBRO NEAR PHILADELPHIA, PENNSYLVANIA, by E. H. Watson.

Gabbroic rocks are the most abundant intrusives into the crystalline schists and gneisses of southeastern Pennsylvania. The largest body extends as a somewhat discontinuous mass 25 miles westsouthwest from the Schuylkill River to beyond West Chester. Far the greater part of this mass has been altered by later granitic and pegmatitic injections producing composite flow gneisses or migmatites. The injections caused flowage and shearing, and locally developed mylonitized zones. Widespread chemical reaction occurred: plagioclase becomes progressively more sodic, accompanying dilution by potash feldspar and quartz; the original pyroxenes of the gabbro are replaced by a reaction series in the order—pyroxene, hornblende, biotite, garnet.

Smaller areas of massive unaltered gabbro are gradational into these composite flow gneisses and the metamorphic structures produced are believed due to injection and not to regional metamorphism. Also, the evidence indicates that the injections, although magmatic in character, were introduced largely in the form of hydrothermal solutions.

HYDROTHERMAL ALTERATION OF MONTMORILLONITE TO FELDSPAR AT 245°C. AND 300°C., by John W. Gruner.

Montmorillonite was heated in gold-lined pressure bombs in aqueous solutions of $KHCO_3$ (10%). Seven days at 300°C. produced very good orthoclase. The *X*-ray powder photograph is identical with adularia. At 272°C. the feldspar pattern became distinct after 10 days. At 245°C. the stronger lines of orthoclase appeared after 42 days heating. No changes were noticeable after four weeks at 200°C. KCl solutions do not seem to alter the montmorillonite in 19 days at 300°C.

ANORTHITE FROM DUKE ISLAND, ALASKA, by Jewell J. Glass.

During a recent study of the rocks of Duke Island, Alaska, by A. H. Koschmann of the United States Geological Survey, a plagioclase feldspar unusually high in calcium was recognized. Chemical analysis, confirmed by the optical properties, show this feldspar to be an unusually pure (An_{96}) anorthite. The massive feldspar, pearl gray on a freshly broken surface, weathers white and forms bands or vein-like masses intergrown with glossy black crystals of hornblende two feet long. The rock in which the plagioclase occurs is a coarse-grained hornblende pegmatite, striking in appearance.

Plagioclase feldspars high in the anorthite molecule are found rarely in nature. Those to which the Alaskan anorthite are comparable occur as crystals in volcanic bombs.

OUTLINE OF A CLASSIFICATION OF THE SILICATES, by Harry Berman.

A chemical classification based on ideas relating to crystal chemistry developed from recent structure studies is proposed for all the silicate minerals. It is shown that the physical properties of each structural type are closely related to the chemical characteristics and are a further indication of the proper position of any silicate in the classification. It is this close relation between physical and chemical characteristics which is the fundamental concept in the classification.

OPTICS AND STRUCTURE OF THREE-DIMENSIONAL SPHERULITES, by H. W. Morse and J. D. H. Donnay.

The shape and optical characters of artificial spherulites and related aggregates were studied in order to help elucidate their internal structure. Although these aggregates vary widely in external shape most, if not all, belong to one and the same type of "aggregation," due to radiating crystallization. Observation of possible transitional stages leads to a working hypothesis as to the mechanism of formation of spherulitic structures, *viz.* that a continuous branching out of the fibers makes an aggregate appear like a sheaf of fibers opening at both ends, in fan-like manner, as growth proceeds until spherical shape is reached or approximated.

The optical unit of the structure is the fiber, which behaves like a uniaxial entity. The refractive indices of the fiber, however, differ from those of the crystalline species that builds up the fiber. Various factors are considered in an attempt to explain this discrepancy: (1) crystal orientation along the fiber, (2) presence of a less refracting interstitial medium, (3) form-birefringence, in case the constituents of the fiber are smaller than the wave length of light.

The circular outline of spherulites, immersed in certain media, appears elliptically distorted. This optical effect, previously observed by Spangenberg, may give information on the fiber indices, not on the indices of the crystals constituting the fiber.

Some of our preparations show the artificial duplication of the "supplemental growth" found by Cross in natural spherulites.

ON ROSELITE AND THE RULE OF HIGHEST PSEUDO-SYMMETRY, by M. A. Peacock.

Ill-considered application of the Rule of Highest Pseudo-Symmetry has sometimes led to unsatisfactory crystallographic elements. A clear case is that of roselite, $6(Ca, Mg, Co)O \cdot 4As_2O_5 \cdot 5H_2O$, which Schrauf (1874) referred to pseudo-orthorhombic triclinic elements giving abnormal form symbols. A restudy largely confirms Schrauf's measurements, but leads to monoclinic elements and normal symbols, and indicates that some of Schrauf's forms are fictitious. The conclusion is that the lattice with the highest pseudo-symmetry may be a multiple lattice of the proper crystal lattice.

THE CHEMICAL COMPOSITION OF SEPIOLITE (MEERSCHAUM), by W. T. Schaller.

Sepiolite (meerschaum) is supposed to consist of one of two minerals: α-sepiolite or parasepiolite, $2MgO \cdot 3SiO_2 \cdot 4H_2O$, and β-sepiolite, $2MgO \cdot 3SiO_2 \cdot 2H_2O$. A compilation of 56 analyses shows 15 analyses agreeing with β-sepiolite, 34 analyses agreeing with α-sepiolite, and 7 intermediate analyses.

A reading of the original papers has shown that all but three of the 15 analyses of β-sepiolite were made on material variously dried (in some samples by heating to 200°C.), before analysis, thus expelling half the water content.

Critically reviewing the analyses and making corrections for water loss, there remain only two old analyses supporting β-sepiolite and two intermediate analyses. The remaining analyses support the formula of α-sepiolite.

There is then only one sepiolite with the formula $2MgO \cdot 3SiO_2 \cdot 4H_2O$ and the name parasepiolite, as different from sepiolite, is to be discarded.

AN *X*-RAY STUDY OF ALLEMONTITE, by Ralph J. Holmes.

Kalb, Van der Veen, Walker and others have established the non-homogeneous character of "allemontite" but obtained no conclusive data regarding the nature of either of the two components.

The following conclusions are based on an *x*-ray study of "allemontite" from Allemont, France; Pribřam, Czechoslovakia; Atlin, B. C.; and Alder Island, B. C.

1. "Allemontite" consists of two components which are apparently identical in all the material studied.
2. One of these components "A" is native arsenic or arsenic bearing an insufficient amount of antimony in solid solution to produce any change in *x*-ray pattern from that of pure arsenic.
3. The other component "B" is an antimony-arsenic "compound." Whether this is a true chemical compound or a member of a solid solution series is not definitely known.
4. The variable chemical composition of "allemontite" is a consequence of the wide variation in the relative proportions of the components "A" and "B."
5. It is probable that under the original conditions of formation arsenic and antimony formed an unlimited solid solution series. Under changed later conditions only that combination of arsenic and antimony represented by component "B" was stable. Any arsenic present in excess of that necessary to form "B" was released as free arsenic.

6. It is believed advisable to restrict the name allemontite to the component "B" rather than to apply it to the intergrowth of "A" and "B" as proposed by Van der Veen.

The Relationship Between the Structural and Morphological Elements of Krennerite, Calaverite, and Sylvanite, by G. Tunell and C. J. Ksanda.

The structural lattices of krennerite, calaverite, and sylvanite have been determined by means of the Weissenberg *x*-ray goniometer. Although these three minerals all crystallize in different space-groups and the unit cells of the three minerals are of different sizes and shapes and contain different numbers of atoms—the unit cell of krennerite contains 8 "molecules" of $AuTe_2$, that of calaverite, 2 "molecules" of $AuTe_2$—and that of sylvanite 2 "molecules" of $AuAgTe_4$—a very close and simple relationship has been found between the three structural lattices. In krennerite and calaverite there is also a small amount of silver present in solid solution; in sylvanite there is a small amount of gold present in solid solution; thus the actual compositions of the three minerals as found differ slightly from the compositions of the pure end-members mentioned in the preceding sentence. The relationship between the morphological axial elements previously used and the new röntgenographic axial elements for the three minerals has also been established.

The Crystal Structure of the Arsenopyrite Group, by M. J. Buerger.

Members of the arsenoyprite group have the following cells each containing 8 formula weights:

	Arsenopyrite, Franklin, N.J. (rotations and oscillations)	Arsenopyrite, Spindelmühle, Bohemia. (Weissenberg)	Gudmundite, Gudmundstorp, Sweden. (Weissenberg)
a=	6.42Å	6.41Å	6.68Å
b=	9.55	9.51	10.04
c=	5.71	5.65	5.93

The diffraction effect symbol for the material used is definitely mmmC - - -, which would require either space group Cmmm, Cmm, or C222 (possibly $C222_1$). $\frac{1}{2}a$, $\frac{1}{2}b$, and *c* for arsenopyrite correspond closely with the mean marcasite-löllingite *a*, *b*, and *c* respectively; the same relation holds between the dimensions of gudmundite and the mean of the marcasite—$FeSb_2$ axes. Certain intensity series also correspond between double salt and simple salt: thus, arsenopyrite and marcasite types of structures are characterized by a series of approximately equally spaced (100) sheets of duplicate atomic population. It is thus virtually certain that the arsenopyrite group has the general marcasite type of packing. No marcasite structural type, however, nor any simple modification of it, can be fitted into any of the space groups included in the diffraction symbol. On the other hand, a marcasite-like structure can be developed from one of the several subgroups of less than orthorhombic symmetry, namely: C2/m, C2, Cm, $C\bar{1}$, or C1 (possibly $C2_1/m$, and $C2_1$). It follows as a consequence that the arsenopyrite group is of probable monoclinic or lower symmetry and, since orthorhombic symmetry is indicated in Weissenberg and Laue photographs, the crystals are not individuals, but consist of polysynthetically twinned aggregates. The actual existence of the twinned lamellar structure has been confirmed by etching and by observation of polished crystal surfaces in reflected polarized light.

The crystal structure appears to be based upon $C\bar{1}$, in which the sulfur pairs of marcasite are proxied by arsenic and sulfur or by AsS pairs. Structures with somewhat similar characteristics can be developed from C2 and Cm but are less likely from bonding considerations.

CRYSTALLOGRAPHY OF THE VIVIANITE GROUP, by Tom. F. W. Barth.

By optical goniometry the crystallographic constants of a mineral can be established only if a sufficient number of external faces is developed. If there are few or poorly developed faces no values, or uncertain values for the constants will result.

By using an x-ray goniometer accurate values can be obtained even though no external faces may be present. As seen from Table 1, the accuracy of the x-ray method is quite satisfactory. It is believed that greater accuracy can be secured with the reflection goniometer only if the crystal faces are of a high degree of excellence. The most accurate values for erythrite are therefore believed to be those obtained with the x-ray goniometer.

Some of the other members of the vivianite family are encountered in such imperfect crystals that no determinations of the crystallographic constants have been attempted. For other members the constants were known only approximately.

New x-ray measurements on this series of minerals have been conducted, and the crystallographic constants of the several members established. In addition to the axial ratio, $a:b:c$, the x-ray measurements give the absolute dimensions of the unit cell, a_0, b_0, c_0. In usual crystallographic orientation of these crystals we have: $a:b:c=f(a_0, b_0, c_0)$. This relation will be discussed in a forthcoming publication.

TABLE 1

Crystallographic Elements of Vivianite and Erythrite

	a	b	c	β	Author
Vivianite	0.7488	1	0.7020	104° 33¼′	Cesàro
	0.7498	1	0.7017	104° 26′	Goldschmidt
	0.7499	1	0.6996	104° 18′	Barth (x-ray)
Erythrite	0.7502	1	0.7006	105° 01′	Green
	0.7648	1	0.7122	105° 02′	Barth (optical)
	0.7634	1	0.7092	105° 01′	Barth (x-ray)

CRYSTALLOGRAPHY OF LIVINGSTONITE, by Wallace E. Richmond, Jr.

Goniometric and röntgenographic measurements on livingstonite from the type locality, Huitzuco, Mexico—the first to be made on this mineral—give the following result. Monoclinic, holohedral; $a:b:c=3.758:1:5.366$, $\beta=104°\ 10'$ (reflecting goniometer); forms, $a(100)$, $c(100)$, $d(101)$, $e(\bar{1}01)$, $p(\bar{1}11)$, $q(122)$; habit, acicular parallel to [010]; cleavage, (001), perfect; lustre, submetallic with internal reflections. Unit cell, $a_0=15.14$, $b_0=3.98$, $c_0=21.60$, $\beta=104°$, giving $a_0:b_0:c_0=3.804:1:5.427$. Using Dana's formula $HgSb_4S_7$, and density 4.81, the cell contents are $Hg_4Sb_{16}S_{28}$.

CALCITE TWINS FROM NORTH PLAINFIELD, NEW JERSEY, by Alfred C. Hawkins.

Two heart-shaped calcite twins showing identical forms occurred together in a cavity along a fault-zone in the basalt of First Watchung Mountain.

Twinning plane is the minus rhombohedron $e(01\bar{1}2)$ and the forms shown on the crystals are scalenohedrons and rhombohedrons. They will be described.

SOME NOTES ON THE STRUCTURE OF STILPNOMELANE, by John W. Gruner.

Eight analyses of stilpnomelane suggest the formula $(OH)_{20}K(Fe''Mg)_9\ (Fe'''Al)_{5-6}$ $Si_{16}O_{39\ 40}$.

Five of the eight were x-rayed, three of them not being available. The photographs suggest a layer structure similar to chlorite and mica with the following dimensions $a_0=5.4$Å, $b_0=9.3$Å, $c_0=24.1$Å. This unit cell contains two molecules of the formula above.

So far it has been impossible to arrange sheets of the mica, brucite, or kaolinite type in such a way that the intensities of the basal reflections of the photographs can be explained satisfactorily. Very many plausible combinations have been tried. Also heating of the mineral up to 740°C. has offered no clue. It is stable at temperatures at least as high as 560°C, but its structure is destroyed at 740°C.

The Crystal Structure of Cubanite, by M. J. Buerger.

An equi-inclination Weissenberg study of cubanite leads to the following data:

Diffraction symbol: mmmPc-n

Space group: Pcmn $=V_h^{16}$, on the basis of holohedral morphological development.

Unit cell, corrected to Peacock's axial ratio:

$a=$ 6.45Å
$b=$ 11.07
$c=$ 6.21
$Z=$ 4 formula weights per unit cell.

The following structure, based upon a substituted wurtzite framework, is proposed:

in 4*c*

	u_a	v_c
Cu	$\frac{11}{12}+\delta_1$	$\frac{1}{12}+\delta_2$
S_I	$\frac{11}{12}+\delta_3$	$\frac{5}{12}+\delta_4$

in 8*d*

	x_a	y_b	z_c
Fe	$\frac{5}{12}+\delta_5$	$\frac{1}{12}+\delta_6$	$\frac{1}{12}+\delta_7$
S_{II}	$\frac{5}{12}+\delta_8$	$\frac{1}{12}+\delta_9$	$\frac{5}{12}+\delta_{10}$

where the δ's are small corrections necessary to improve the intensity fit. All atoms have tetrahedral co-ordinations. A unique feature of the structure is the occurrence of the iron atoms in pairs; the vectors connecting the pairs have greatest components in the direction of the *b*-axis. This is believed to be responsible for the ferromagnetism of cubanite, whose magnetic axis is the *b*-axis.

The Probable Identity of the Structures of Greenalite (Mesabi Range), by John W. Gruner.

Four samples of greenalite from different points on the Mesabi range were carefully cleaned by the dialectric method. *X*-ray photographs of their powders were compared with those of various serpentines. The agreement between the diagrams of these two minerals is so good that their structures must be alike. A theoretically pure iron serpentine would have the composition $SiO_2=32.3$, $Fe=58.0$, and $H_2O=9.7$. These figures agree closely with the analyses by Leith (U. S. Geol. Survey Mon. 43), but not at all with those by Joliffe (Am. Mineral., vol. 20, p. 418).

The Crystal Structure of Berthierite, by M. J. Buerger.

The original Kisbanya, Carpathian, berthierite described by Zsivny and Zombory has been studied by the equi-inclination Weissenberg method. This investigation leads to the following data:

Diffraction symbol: mmmPna-.

Space group (as a result of intensity considerations): Pnam $=V_h^{16}$.

Unit cell:	absolute	ratio
$a=$	11.44Å	.810
$b=$	14.12	1.
$c=$	3.76	.2663

$Z=4$ formula weights per unit cell; excess iron and antimony shown by the chemical analysis is housed in interstitial solid solution.

The following structure, based upon a substituted diamond framework, is proposed: all atoms in 4*c*, with following parameters:

	u_a	v_b
Fe	$\frac{1}{16}+\delta_1$	$\frac{1}{4}+\delta_2$
Sb_I	$\frac{3}{16}+\delta_3$	$-\frac{1}{8}+\delta_4$
Sb_{II}	$\frac{3}{16}+\delta_5$	$-\frac{3}{8}+\delta_6$
S_I	$\frac{1}{16}+\delta_7$	$0+\delta_8$
S_{II}	$\frac{3}{16}+\delta_9$	$\frac{1}{8}+\delta_{10}$
S_{III}	$\frac{3}{16}+\delta_{11}$	$\frac{3}{8}+\delta_{12}$
S_{IV}	$\frac{1}{16}+\delta_{13}$	$-\frac{1}{4}+\delta_{14}$

where the δ's are small corrections necessary to improve the intensity fit. Fe, Sb_I, S_I, S_{II}, and S_{IV} have tetrahedral co-ordination, while Sb_{II} and S_{III} have trigonal co-ordination at tetrahedral angles.

The structure is characterized by empty channels parallel with the *c* axis. Presumably the interstitial solid solution has its origin in this feature.

The Crystal Structure of Valentinite, by M. J. Buerger.

An equi-inclination Weissenberg study of both natural valentinite from the Su Suergiu mine, Sardinia, and of artificial valentinite made by subliming chemically pure Sb_2O_3 in an atmosphere of nitrogen, leads to the following data:

Diffraction symbol: mmmPccn

Crystal class: definitely orthorhombic holohedral because of three detectable glide planes.

Space group: Pccn $= V_h^{10}$.

Unit cell:

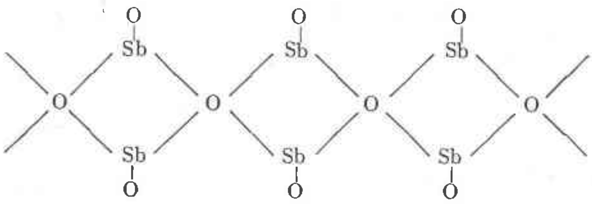
	absolute	ratio
$a=$	4.92	.395
$b=$	12.46	1.
$c=$	5.42	4.35

$Z=4$ Sb_2O_3 per unit cell.

$d=5.75$

The structure has been determined by straightforward methods. The antimony atoms are in the general position, 8e, with parameters $x_a=.1215$, $y_b=.207$, $z_c=.175$.

One-third of the oxygen atoms are on the two-fold axes, 4_c, with parameter, $u_c=-.075$. The other two-thirds of the oxygen atoms are in the general position with parameters which can be determined only approximately: $x_a=-.11$, $y_b=.156$, $z_c=.175$. The structure consists of rather isolated strings of



extending indefinitely in the direction of the *c* axis. The structure accounts well for the perfect cleavages in the prismatic zone.

A Tabulation of Crystal Forms and Discussion of Form-Names, by Austin F. Rogers.

The Fedorov method of naming forms according to the number and shape of faces rather than by their position with respect to axes of reference is advocated.

A convenient tabulation of the 48 possible forms is presented in which open and closed, variable and invariable, and general and limit, forms are distinguished.

There are supplementary tables in which the derivation of general and limit forms is indicated.

This occasion offers an opportunity of discussing the various form-names.

The Accessory Minerals of the Wolf Mountain Granite, by R. E. McAdams.

This paper is a report of an investigation of the accessory minerals of the Wolf Mountain phacolith and other intrusive masses of central Texas. The Wolf Mountain granite and a nearby granite (Lone Grove) are characterized by apatite, zircon, titanite and monazite. Other intrusives thought to be younger contain fluorite as a prominent accessory.

The distribution of zircon and apatite in the Wolf Mountain intrusive suggests that the mass is of phacolithic habit rather than batholithic as suggested by some investigators.

With no further business to come before the Society, President Clarence S. Ross declared the meeting adjourned at 12 noon.

At various times during the sessions of the Society, the following persons registered their attendance. In addition there were many others who visited sessions whose names were not recorded.

H. R. Aldrich
F. I. Allen
H. L. Alling
O. Andersen
G. H. Anderson
R. J. Anderson
E. J. Armstrong

R. Balk
Mrs. R. Balk
H. M. Bannerman
J. D. Barksdale
T. Barth
F. Bascom
B. F. Buie
L. H. Bauer
W. S. Bayley
C. H. Behre, Jr.
J. F. Bell
H. Berman
F. Betz, Jr.
M. Billings
P. H. Bird
R. G. Bispham
R. G. Bogue
V. H. Booth
M. N. Bramlette
D. Brauneck
L. S. Brown
R. M. Brown
E. L. Bruce
A. F. Buddington
P. B. Bunton
W. S. Burbank
J. D. Burfoot, Jr.
B. T. Butler
J. W. Butler

C. K. Cabeen
E. Callaghan
W. H. Callahan
E. N. Cameron

G. M. Carhart
L. V. Case
C. A. Chapman
R. W. Chapman
H. D. Chase
D. B. Chisholm
W. B. Colburn
C. S. Corbett
A. Creagh
G. W. Crickman
L. W. Currier

R. Daly
D. W. Davis
A. L. Day
P. F. Dickson
J. D. H. Donnay
L. Dorschel

M. L. Ehrmann
J. D. Eisler

E. E. Fairbanks
F. W. Farwell
G. T. Faust
C. N. Fenner
H. G. Ferguson
C. R. Fettke
S. Fields
G. I. Finlay
L. W. Fisher
T. W. Fluhr
F. C. Foley
M. E. Forde
W. F. Foshag
K. Fowler-Lunn
E. J. Foyles
D. M. Fraser
A. H. Fretz
C. Frondel

A. Gabriel
R. B. Gage
D. L. Gamble
J. L. Gillson
J. Gilluly
J. J. Glass
E. N. Goddard
F. A. Gonyer
S. G. Gordon
L. C. Graton
J. W. Greig
R. E. Grim
F. F. Grout
E. M. Gunnell

J. B. Hadley
J. C. Haff
C. H. Hale, Jr.
Mrs. C. H. Hale, Jr.
G. M. Hall
B. Hamilton
J. B. Hanley
W. C. Hatfield
A. C. Hawkins
F. L. Hess
H. H. Hess
D. F. Hewett
G. R. Heyl
T. M. Hills
R. J. Holmes
A. P. Honess
M. Hooker
A. D. Howard
W. V. Howard
S. G. Hower
A. L. Howland
W. F. Hunt
Mrs. W. F. Hunt
C. S. Hurlbut

F. E. Ingerson
W. H. Irwin

E. C. Jacobs
C. P. Jenney
J. H. Johnson
J. R. Jones
M. L. Jones

P. F. Kerr
Mrs. P. F. Kerr
J. Kessler
A. Knopf
Mrs. A. Knopf
R. B. Koehler
E. H. Kraus
P. Krieger

A. C. Lane
E. S. Larsen
Mrs. E. S. Larsen
E. Larson, III
O. I. Lee
G. D. Louderback
G. F. Loughlin
T. S. Lovering
J. Lowe

H. E. McKinstry
J. P. Marble
E. B. Mathews
J. E. Maynard
E. B. Mayo
E. Mencher
A. Messina
B. L. Miller
C. Milton
A. Minkofsky
A. Montgomery
E. S. Moore
G. W. Morey
F. K. Morris
J. F. Morton
R. E. Myers

P. J. Nekrasoff
D. A. Nichols
F. B. Notestein

D. T. O'Connell
I. Ogilvie

C. Palache
M. A. Peacock
J. W. Peoples
E. L. Perry
S. S. Philbrick
A. H. Phillips
A. W. Pinger
M. B. Pollack
F. H. Pough

D. Randolph
H. L. Rickard
H. Ries
A. F. Rogers
J. L. Rosenholtz
R. R. Rosenkrans
C. S. Ross

Mrs. C. S. Ross
J. T. Rouse
C. Roy
O. N. Rove
M. Runne

E. S. Salmon
E. Sampson
J. F. Schairer
W. T. Schaller
Mrs. W. T. Schaller
R. J. Segal
B. M. Shaub
H. A. Sherman
M. N. Short
Q. D. Singewald
C. B. Slawson
D. T. Smith
I. F. Smith
A. K. Snelgrove
R. B. Sosman
L. E. Spock
Mrs. L. E. Spock
G. Stanton
R. Stoiber
M. H. Stow
B. Stringham
J. L. Stuckey
M. N. Sutherland, Jr.

S. Taber
E. Thomson
Mrs. E. Thomson
J. F. Tillson
C. Tolman
C. R. Toothaker
D. W. Trainer, Jr.
G. Tunell

R. C. Vance
S. Varni
A. W. Waldo
T. L. Walker
H. Wallace
C. R. Warren
C. H. Warren
A. C. Waters
E. Weidhaas
A. M. Wellnitz
C. D. West
A. W. Weston
E. T. Wherry
B. White
G. W. White
H. P. Whitlock
K. P. Wilson
A. N. Winchell
Mrs. A. N. Winchell
A. E. Woods
F. E. Wright

P. Zodac

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.

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
1933	Herbert P. Whitlock
1934	John E. Wolff
1935	Clarence S. Ross

VICE-PRESIDENTS

1920	Thomas L. Walker
1921	Waldemar T. Schaller
1922	Frederick A. Canfield
1923	George F. Kunz
1924	Washington A. Roebling
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
1933	Frank N. Guild
1934	W. A. Tarr
1935	Ellis Thomson

SECRETARIES

1920–1922	Herbert P. Whitlock
1923–1933	Frank R. Van Horn
1933–1934	Albert B. Peck
1934–	Paul F. Kerr

TREASURERS

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