

The discussion for the meeting, Quartz and mineral inclusions in quartz, was then introduced by the Chair, who called upon members to show specimens of interest illustrating this topic. Mr. Ashby exhibited specimens of capped quartz from a number of localities including one with 4 caps, one of them removable, from Schlaggenwald, Bohemia; specimens illustrating Babel quartz and unusual terminations, as well as some examples of inclusions.

Capt. Miller discussed the physical properties of quartz, dwelling particularly on the origin of the colored varieties, blue, violet and pink quartz and cited recent authorities to the effect that some of these colors are due to small percentages of manganese oxide. He also discussed pyro-electric phenomena, etching-figures, and the effects obtained by ultra-violet light.

Mr. Whitlock exhibited a diagram explaining the twinning laws of quartz, and models illustrating right and left crystals and twinning habits. He also showed characteristic examples of twinned intergrowths, parallel position intergrowths with a marked tendency toward skeleton crystals, and a remarkable example of multiple phantoms.

Mr. Wintringham explained by means of blackboard diagrams right and left handed crystals of quartz, and showed a curiously distorted crystal. Mr. Manchester spoke of quartz including pyrrhotite crystals from King's Bridge. Dr. Kunz exhibited a particularly fine quartz phantom from Madagascar, and discussed quartz inclusions. Miss Luther showed a handsome suite of cut quartz illustrating the applications to jewelry.

HERBERT P. WHITLOCK, *Recording Secretary*

NOTES AND NEWS

Dr. Waldemar T. Schaller has resigned from the U. S. Geological Survey and Mr. Harry F. Gardner from the New York State Museum, both to enter industrial work.

ABSTRACTS—CRYSTALLOGRAPHY

THE ARRANGEMENT OF ELECTRONS IN ATOMS AND MOLECULES. IRVING LANGMUIR. *Gen. Elec. Co. J. Am. Chem. Soc.*, **41** (6), 868-934, 1919.

Chemical evidence indicates that the electrons in the atom (at least the outermost ones) are essentially stationary. In some simple atoms, such as those of the inert gases, the electrons are arranged in pairs symmetrically placed about the equatorial plane, so that the symmetry is holohedral tetragonal. By considering the properties and behaviors of atoms of various elements, it is possible to work out probable electron arrangements for a number of them. The tendency for electrons to form groups of 8, or octets, is marked, and the valence of many elements can be accounted for in this way. The constitution of organic, simple inorganic, and complex inorganic compounds can be worked out on this basis. [The original contains a vast amount of additional data.]

E.T.W.

ISOMORPHISM, ISOSTERISM, AND COVALENCE. IRVING LANGMUIR. *J. Am. Chem. Soc.*, **41** (10), 1543-1559, 1919.

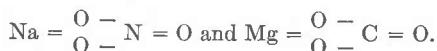
That the valence of the chemical elements is related to the electrons in their atoms has been demonstrated by many recent investigations; and

Langmuir has elaborated an "octet theory of valence," according to which the atoms are bound together by pairs of electrons held in common, arranged in definite positions in the atoms. [See preceding abstract.] He proposes the term *covalence* for the number of electron pairs and *isosteric* to describe molecules in which the number and arrangement of the electrons are alike.

The conception isomorphism has been applied by different authors in a variety of ways. In the strictest sense it is limited to substances closely related in both chemical composition and crystal form. The magnesite (or calcite) group of minerals is a typical example of strict isomorphism; the crystal class is trigonal-rhombohedral (scalenohehdral) with the axial ratios ranging from 1:0.80 to 1:0.85, the compounds included being $MgCO_3$, $CaCO_3$, $MnCO_3$, $FeCO_3$, $CoCO_3$ and $ZnCO_3$. It has long been known that sodium nitrate, $NaNO_3$, is closely related in form to the magnesite group, its class being the same, its axial ratio 1:0.83; and, when it is allowed to crystallize on a cleavage surface, it forms parallel growths with the mineral. Nevertheless many crystallographers have denied that sodium nitrate is isomorphous with magnesite, calcite, etc., since according to the usual valence theory, their chemical structures are unlike, being respectively:



But Langmuir finds that on the basis of his theory sodium is isosteric with magnesium and the nitrate ion is isosteric with the carbonate ion, the structures of the compounds being if the abstract or interprets this correctly:



Sodium nitrate is accordingly isomorphous with magnesite not only as to crystal form but also as to chemical structure.

Other similar cases, where the crystal forms of compounds are alike, but their structures, according to the usual interpretations, are not, can be readily explained by the octet theory. In addition to many instances among artificial compounds, Langmuir points out two among minerals, the tetragonal group including cassiterite, Sn_2O_4 , zircon, $ZrSiO_4$, and xenotime, YPO_4 ; and the triclinic plagioclase feldspars, albite, $NaAlSi_3O_8$ and anorthite, $CaAl_2Si_2O_8$. [The abstractor can not refrain from calling attention to several additional cases, in which similarity in crystal form has been pointed out by crystallographers, although true isomorphism might well be questioned by chemists because of unlike structures; isosterism probably exists in these cases:

Fluorite, CaF_2 , is isomorphous with yttrifluorite, YF_3 , (though not with sellaite, MgF_2); fergusonite, $YCbO_4$, is isomorphous with scheelite, $CaWO_4$, etc.; danburite, $CaO \cdot B_2O_3 \cdot 2SiO_2$ is isomorphous with andalusite, $2Al_2O_3 \cdot 2SiO_2$; in the rutile group, Ti_2O_4 is isomorphous with tapiolite, $FeTa_2O_6$ and other similar compounds. Indeed, titanates seem to be isomorphous with columbates in many rare-earth minerals; and finally, in the alunite-beudantite group, sulfates are isomorphous with phosphates and arsenates in a striking way, and recognition of this has made possible the establishment of the correct formulas of some very complex minerals.]

E.T.W.

THE NATURE OF THE FORCES BETWEEN ATOMS IN SOLIDS.

RALPH W. G. WYCKOFF. Geophysical Lab. *J. Wash. Acad. Sci.*, 9 (19), 565-592, 1919.

It seems possible to arrange all crystalline solids in a number of groups according to the nature of the forces between their atoms. All recent studies of atoms have indicated that they are built up of electrons; and there is evidence that the outer electrons tend to form clusters of 8, occupying the positions of the corners of a cube. The phenomenon known as valence is explainable in many cases as the result of this tendency. [See preceding abstracts.] All chemical compounds may be considered as included within the following extremes, having the atoms electrically: (1) charged; and (2), neutral. In case 1, the compound is called polar, in case 2, non-polar. In the former the outside electrons of the electropositive atom are drawn toward the electronegative one, to form a cluster of 8. In the latter there is no transfer of electrons, but the fields of electrical force of the atoms interact. Each unit of valence represents two electron bonds. All gradations between these extremes probably occur.

In non-polar compounds, of which organic compounds are typical examples, the electrons are rather firmly united to the atoms, and the molecules are well-defined, in solid and liquid as well as gaseous states. In polar compounds, however, of which sodium chloride may be taken as an example, electrons go over from one atom to another. A crystal of such a substance consists of a group of electrically charged atoms, or ions, held together mainly by the electrostatic forces of attraction between positive and negative charges. The "molecule" disappears completely in the solid, being present only in the gaseous state. Bragg's X-ray studies led to the above structure of the sodium chloride crystal. In sodium nitrate, calcium carbonate, etc., the nitrate and the carbonate ions act as single units. Three factors are of importance in determining the crystal form of such substances: (1) The stable arrangement of points in space which correspond in number and in charge with the ions of the substance. (2) The number and arrangement of the atoms making up these ions. (3) The volumes of the ions. The NaCl grouping is the simplest possible for an equal number of positive and negative ions of about equal volume. NaNO_3 and CaCO_3 are essentially the same, with the NO_3 and CO_3 ions instead of Cl.

There is also another type of compound, which may be called the valency compound, of which diamond, magnetite, carborundum, many oxides, sulfides, etc., are examples. No electron transfer takes place, and each valence unit corresponds to two electron bonds. The atoms are held together by valency but the chemical molecule does not appear, the entire crystal being a single chemical individual. Three limiting types of crystalline solids thus exist: (1) Molecule-forming compounds; (2) polar compounds, and (3) valency compounds. Combinations and transitions between these are frequent; thus in NaNO_3 the Na and the NO_3 ion are mutually polar, but the atoms in the latter are held together by valence. Silver halides are midway between 1 and 2, in that the electrons lie midway between the atoms. (For many details see original.)

E.T.W.

THE BUILDING OF ATOMS AND THE NEW PERIODIC SYSTEM.
 WILLIAM D. HARKINS. University Chicago. *Science*, 50, 577-582, Dec. 26, 1919.

The arrangement of the elements usually known as the Mendeléeff periodic system is now recognized to express the arrangement of the outer electrons in the various kinds of atoms. Professor Harkins has developed a new periodic system (the periods being two atoms in length, instead of 2, 8, 18, and 32), connected with the structures of the nuclei of the atoms. It is based on the atomic numbers of the elements, the atoms of those of even atomic number being built up of helium nuclei alone, while odd ones contain hydrogen nuclei in addition. The even-numbered atoms should be, theoretically, much more stable than the odd ones. This can best be tested out by studies of the occurrence of the elements in nature; and it has been fully confirmed, as shown by these data: In iron meteorites the even numbered atoms are 127 times more abundant than the odd ones; in stone meteorites 47 times more abundant. In the earth's crust the even numbered atoms are 10 times more abundant than the odd ones. All of the seven most abundant elements in meteorites are even numbered, and these 7 make up 98.6% of the material of meteorites. The most stable nuclei seem to be those of oxygen, magnesium, silicon, and iron, all even numbered elements of low atomic number. (Additional details as to the inferred atomic structures, etc., are given in the original.) E.T.W.

THE ABSOLUTE CALCULATION OF CRYSTAL PROPERTIES WITH THE AID OF THE BOHR ATOMIC MODEL. M. BORN AND A. LANDÉ. *Sitzb. preuss. Akad.*, 1918, 1048-1068.

CRYSTAL SPACE-LATTICES AND THE BOHR ATOMIC MODEL. M. BORN AND A. LANDÉ. *Ber. physik. Ges.*, 20, 202-209, 1918.

THE CALCULATION OF THE COMPRESSIBILITY OF CUBIC CRYSTALS FROM THE SPACE LATTICE THEORY. M. BORN AND A. LANDÉ. *Ber. physik. Ges.*, 20, 210-216, 1918.

THE ELECTROSTATIC POTENTIAL OF THE FLUORITE LATTICE. A. LANDÉ. *Ber. physik. Ges.*, 20, 217-223, 1918.

THE CALCULATION OF ABSOLUTE CRYSTAL DIMENSIONS. M. BORN. *Ber. physik. Ges.*, 20, 224-229, 1918.

FOUNDATIONS OF THE OPTICS OF CRYSTALS. III. THE CRYSTAL OPTICS OF X-RAYS. P. P. EWALD. *Ann. Physik.*, 54, 519-546, 557-595, 1918.

ROENTGEN-RAY INTERFERENCE AND MIXED CRYSTALS. M. VON LAUE. *Ann. Physik.*, 56, 497-506, 1918.

DETERMINATION OF THE CRYSTAL STRUCTURE OF COMPLEX COMPOUNDS. P. NIGGLI. *Physik. Z.*, 19, 225-234, 1918.

Abstracts of the above series of 8 mathematical and theoretical papers will be found in *Chem. Abstr.*, 13 (14), 1556-1558, 1919. E.T.W.

ARTIFICIAL GLIDING AND TRANSLATIONS IN MINERALS, ACCORDING TO THE STUDIES OF K. VEIT. A. JOHNSEN. *Kiel. Centr. Min. Geol.*, 1918, 265-266.

When the minerals were embedded in sulfur and exposed to high pressures, translations were obtained with fluorite, sphalerite, rhodochrosite, smithsonite, barite, anhydrite, and aragonite; gliding was shown by hematite, corundum, and anhydrite. E.T.W.

TOURMALINE FROM THE BROCKEN GRANITE AT SCHIERKE, HARZ. KARL SCHULZ. Berlin. *Centr. Min. Geol.*, 1918, 266-268.

A description, with figures, of two small crystals is given. They are well developed and show marked hemimorphism, but no rare or new forms. E.T.W.

CRYSTALS OF QUARTZ FROM MONTE CALANNA, ETNA. SALVATORE DI FRANCO. *Atti accad. Lincei*, 27, I, 203-208, 1918.

An ancient lava of Etna found on this mountain is interesting in containing a number of crystallized minerals; a petrographic description of the rock is given. In geodes in the lava occur quartz crystals up to 7 mm. long, showing now and then unusual development. The forms observed were:

r (10 $\bar{1}1$), M (30 $\bar{3}1$), f (40 $\bar{4}1$); z (10 $\bar{1}1$), π (10 $\bar{1}2$); m (1010); s (11 $\bar{2}1$); x (51 $\bar{6}1$) and y (41 $\bar{5}1$). There are also rough faces in the basal position, (0001). Details of combinations and of measurements by which these forms were established are given. E.T.W.

MANGANOUS TARTRATE AND POTASSIUM MANGANOUS TARTRATE. LEONARD DOBBIN; crystallography by MARY W. PORTER. *J. Am. Chem. Soc.*, 41 (6), 934-940, 1919.

The method of preparation of manganous tartrate is described. Its crystals are monoclinic, with a prism, base, and side-dome, axial ratios $a:b:c = 0.816:1:0.699$, angle $\beta = 100^{\circ}14'$. The faces are curved and striated, making measurements only approximate. The angle table is given in the following form:

Face	Azimuth (φ)		Polar Distance (ρ)	
	Observed	Calculated	Observed	Calculated
m {110}	*51° 13'	—	90° 00'	90° 00'
c {001}	87 23	90° 00'	11 15	10 14
q {011}	*14 28	—	*35 50	—

[The placing of observed and calculated values of each angular coordinate side by side emphasizes the degree of accuracy attained; although it is usually preferable to group all observations together. Abstr.] E.T.W.

CRYSTALS WITH OPTICAL ROTATORY POWER. T. LIEBISCH. *Sitzb. preuss. Akad.*, 1918, 821-839.

The phenomena obtained by superposing plates of optically active crystals are discussed mathematically, and some fine photographs of the effects obtained with right and left handed quartz are given. E.T.W.

ABSTRACTS—MINERALOGY

THE LIMITS OF MIX-CRYSTAL FORMATION BETWEEN POTASSIUM CHLORIDE AND SODIUM CHLORIDE. R. NACKEN. *Tübingen. Sitzb. preuss. Akad.*, 1918, 192-200.

There being some uncertainty as to the exact relation between these salts, a new series of observations was made, using the determination of the refractive index by the immersion method for obtaining the composition of the mixtures. The concentration-temperature diagram was found to show a maximum at slightly less than 500° and 65 molecular per cent. NaCl.

E.T.W.

THE TELLURIDES OF BISMUTH. M. AMADORI. *Gazz. chim. ital.*, 48, II, 42-53, 1918; *Atti accad. Lincei*, 27, I, 131-133, 1918.

Fusions of Bi_2S_3 with Bi_2Te_3 have been studied, but only one compound was found, containing equal molecular amounts of these. No substances corresponding to the minerals tetradymite, "joseite," "grünlingite," etc., were obtained.

E.T.W.

THE COMPOUNDS OF THE FLUORIDE AND THE CHLORIDE WITH THE PHOSPHATE OF LEAD. M. AMADORI. *Atti accad. Lincei*, 27, I, 143-148, 1918.

Fusions yielding pyromorphite and the corresponding fluo-pyromorphite, not known in nature, have been studied. Detailed thermal data are given.

E.T.W.

ANHYDROUS PHOSPHATES, ARSENATES, AND VANADATES OF LEAD. M. AMADORI. *Atti ist. Veneto*, 76, 419-433, 1917; thru *Chem. Abstr.*, 13 (14), 1568, 1919.

A description of thermal studies of the systems $\text{PbO-P}_2\text{O}_5$, $\text{PbO-As}_2\text{O}_5$ and $\text{PbO-V}_2\text{O}_5$. Several compounds were found to exist in each system.

E.T.W.

ALLOYS OF IRON AND NICKEL DEPOSITED ELECTROLYTICALLY. P. BENVENUTI. *Atti ist. Veneto*, 76, 453-477, 1916; thru *Chem. Abstr.* 13 (15), 1675, 1919.

In the course of the chemical studies alloys corresponding to the meteoritic varieties taenite and kamacite were obtained.

E.T.W.

THE PRESENCE OF BORON IN CERTAIN NATURAL BASIC SILICO-ALUMINATES. A. LACROIX AND A. DE GRAMONT. *Compt. rend.*, 168, 857-861, 1919.

Spectroscopic examination having shown the presence of boron in Madagascar occurrences of several basic aluminosilicate minerals in which it has not been heretofore recognized, analyses were made by Dr. Raoult, giving: sapphirine, 0.75, grandidiérite 2.81 and kornerupine, 3.59, per cent. of B_2O_3 . It is suggested that the B occurs as an isomorphous replacement of aluminium and ferric iron. B was also found in variable amounts in dumortierite and vesuvianite.

E.T.W.

MINERALS FROM RHODESIA. IMPERIAL INSTITUTE. *Bull. Imp. Inst.*, 16 (4), 456-476, 1918.

While this paper is chiefly devoted to statistics of production and occurrence of various ores, it includes also a report of the discovery of a sand composed largely of what appeared to be the rare mineral microlite, [identity not adequately established, however. Abstr.] analysis of which gave: Ta_2O_5 63.41, Ch_2O_5 16.80, $Fe_2O_3 + FeO$ 0.27, U_3O_8 0.10, TiO_2 , As_2O_5 none, MnO , SnO_2 trace, Ce_2O_3 0.50, CaO 12.75, MgO 0.70, K_2O 0.50, Na_2O 3.52, SO_3 0.06, SiO_2 0.50, ign. 0.50, sum 99.61 per cent. [Unfortunately fluorine was not determined; the analysis leads approximately to the formula $2CaO \cdot Ta_2O_5$, theory CaO 12.8, Ta_2O_5 87.2%, but there is an excess of bases. Abstr.]

E.T.W.

A HYDROMAGNOCALCITE FROM THE LOPUSNA VALLEY NEAR LUCSIVNA, SOUTHERN TATRA MOUNTAINS. EMANUEL GLATZEL. *Centr. Min. Geol.*, 1913, 307-311.

The composition of a chalky white amorphous mineral occurring in loose blocks was found on analysis to be $CaCO_3 \cdot Mg(OH)_2$. Its specific gravity is 2.412.

E.T.W.

THE SOLUBILITY OF THE LIME, MAGNESIA, AND POTASH IN SUCH MINERALS AS EPIDOTE, CHRYSOLITE, AND MUSCOVITE. R. F. GARDINER. Bur. Soils, U. S. Dept. Agr. *J. Agr. Research*, 16, 263-278, 1919.

Aqueous extracts of acid soils, on being mixed with these minerals and allowed to stand for two months, extracted up to nearly 2 per cent. of the bases.

E.T.W.

MARYLAND CHROME SAND ORE. JOSEPH T. SINGEWALD, JR. *Econ. Geol.*, 14, 189-197, 1919.

The origin and working of the deposits are described in detail. Analyses of fractions separated magnetically showed that if Cr_2O_3 is in excess over Al_2O_3 , it takes less than 30 per cent. of the magnetite molecule to make the resulting mineral highly magnetic. On the other hand, if Al_2O_3 exceeds Cr_2O_3 , the presence of even 26 per cent. of magnetite does not produce distinct magnetism. These relations should be taken into account in prospecting.

E.T.W.

MICROSCOPIC EXAMINATION OF CLAYS. R. E. SOMERS. Cornell Univ. *J. Wash. Acad. Sci.*, 9, 113-126, 1919.

An elaborate report on the results of study of over a hundred clays. Noteworthy minerals found to be present in some or in most of these are: kaolinite crystals, "hydromica," regarded as intermediate between sericite and kaolinite, rutile, zircon, tourmaline, epidote, titanite, diaspore, and halloysite. The disappearance of some of these on heating was also studied.

E.T.W.

MICRO METHODS FOR THE DETERMINATION OF CARBON DIOXIDE AND MOISTURE IN MINERALS. G. K. ALMSTRÖM. *Svensk Kem. Tidskrift*, 31, 71-74, 1919; thru *Chem. Abstr.* 13 (12), 1289, 1919.

The CO_2 content of minerals could be accurately determined by fusion with $K_2Cr_2O_7$ or with V_2O_5 , but both gave too high results for H_2O . A micro-Penfield apparatus gave good results for H_2O determination with minute amounts of minerals.

E. T. W.