spray-showered rock, on sandy plains, in well-drained alpine meadows and in saturated sphagnum bogs. . . . we are hardly justified in depending upon these (physical) factors to explain the distribution indicated in the preceding tabulation.

In other words, Fernald's observations show that in accordance with the ancient experience of mankind (although contrary to the officially promulgated doctrine), certain chemical soil-conditions are not only equally as potent as, but sometimes prepotent over, even extreme physical conditions, notably in the case of lime; so that without the accompanying study of chemical soil-composition, mere physical analysis gives no definite clew to soil-values, adaptations and peculiarities. It is to be ardently hoped that the broader method of ecological investigation, as exemplified by Fernald's work, will be more generally applied, and so render such work both theoretically and practically more fruitful than it has been in the past. For what is true of wild plants is of necessity true for cultivated ones also.

E. W. HILGARD

BERKELEY, CALIF.,
Oct. 10, 1907

SOCIETIES AND ACADEMIES

THE OHIO ACADEMY OF SCIENCE

THE seventeenth annual meeting of the academy was held at Miami University, Oxford, O., on November 28, 29 and 30, the president of the society, Mr. Charles Dury, of Cincinnati, presiding. On Thursday evening an informal reception took place in Hepburn Hall, where accommodations for members of the academy were generously provided by the university authorities. The sessions on Friday and Saturday were held in Brice Hall.

The address of the president on "Zoological Reminiscences of the Cincinnati 'Zoo,'" occurred at 1:30 P.M. Friday, while in the evening at 7:30 Professor G. W. Hoke discussed "The Nearer East—A Study in Social Geography." Other papers of interest were those by Professor Bruce Fink on "The Status of American Lichenology," Professor S. R. Williams, "A Peculiar Circulatory Modification of *Necturus maculosus*," E. F. McCampbell, "Report on a New Pathogenic Pirosome" (presented by Professor Herbert Osborn in the absence of the speaker).

The following is the complete program:

"A Study of the Origin and Growth of the Egg in *Syncoryne mirabilis*," by Mary D. Mackenzie.

"A Better Method of Preparing Herbarium Specimens," by W. A. Kellerman.

"Compensatory Growth in *Podarke obscura*," by Sergius Morgulis.

"Note on the Development of the Skull in Clupea," by Edward L. Rice.

"Factors determining Cave Habitation as illustrated by the Cave Isopod and its Nearest Outdoor Ally," by A. M. Banta.

"*Symbiotes duryi* n. sp., a New Endomychid from Ohio," by L. B. Walton.

"Notes on the Early Development of Enteropnuesta," by B. M. Davis.

"The Discomycetes of Oxford and Vicinity," by Freda M. Bachman.

"*Wolffia brasilensis* in Ohio," by Robert F. Griggs.

"The Psychology of Speaking," a Scientific Analysis of the Art of Speaking," by John S. Royer.

"The Flora of Cranberry Island, Buckeye Lake," by W. A. Kellerman.

"Reaction of Amphibian Embryos to Tactile Stimuli," by G. E. Coghill.

"The Epibranchial Placodes of Ameiurus," by F. L. Landacre.

"Periodicity of Spirogyra," by W. F. Copeland.

"The Dispersal and Planting of Seeds by Nature's Methods," by W. L. Lazenby.

"The Male Reproductive Organs of *Cimbex americanus* Leach," by H. H. Severin and H. C. Severin.

"A Peculiar Circulatory Modification in *Necturus maculosus*," by S. R. Williams.

"A Migration of *Anosia plexippus* in Ohio," by Herbert Osborn.

"The Variability of Zygospores in *Spirogyra quadrata* formed by Scalariform and by Lateral Conjugation, and its bearing on the Theory of Amphimixis," by L. B. Walton.

"Some Observations concerning the Effects of Freezing on Insect Larvæ," by J. S. Hine.

"The Status of American Lichenology," by Bruce Fink.

"Stains for Embryonic Skeletons," by E. L. Rice.

"A Note on the Occurrence of *Typhlopsylla octactenus* in Ohio," by Herbert Osborn.

"The Development of the Swimming Movement in Amphibian Embryos," by G. E. Coghill.

"Natural History Notes from Hamilton County, Ohio," by Charles Dury.

"Some Rare and Unnamed Mushrooms found in the Cuyahoga Valley" (lantern slides), by G. D. Smith.

"Report on a New Pathogenic Pirosome," by E. F. McCampbell.

"The Marine Biological Survey of the San Diego [California] Region," by B. M. Davis.

"The Development of a Kelp," by R. F. Griggs.

"Regeneration and Inheritance," by Sergius Morgulis.

"The Gold Fish—*Carassius auratus* L.—and its Color," by L. W. Sauer.

"A New Experiment in Ionization," by F. J. Hillig.

"The Lateral Line Organs of Ameiurus," by F. L. Landacre.

"Annual Report on the Ohio State Herbarium for 1907," by W. A. Kellerman and Freda Detmers.

"Notes on Philomycus," by V. Sterki.

"Observations on the Life History and Adaptation of a New Semi-aquatic Aphid, *Aphis aquaticus*," by C. J. Jackson.

"Variation in Temperature and Light Intensity when Growing Plants under Cloth of Different Colors," by W. A. Kellerman and G. W. Hood.

"One Hundred Species of Mushrooms of the Cuyahoga Valley" (lantern slides), by G. D. Smith.

"Some Homologies between the Mouth Parts and Walking Appendages in the Hexapoda," by L. B. Walton.

"Ancient Finger Lakes in Ohio," by G. D. Hubbard.

"A Deposit of Glass Sand at Toboso, Ohio" (lantern slides), by Frank Carney.

"The Origin of Spring Valley Gorge near Granville, Ohio" (lantern slides), by Earl R. Scheffel.

"Extra-morainic Drift in the Baraboo Area, Wisconsin" (lantern slides), by Kirtly F. Mather.

Stratigraphical Studies in Mary Ann Township, Licking County, Ohio:

"Distribution of Formations" (lantern slides), by Frank Carney.

"A Phase of the Sharon" (lantern slides), by William C. Morse.

"Two Notable Landslides," by Geo. D. Hubbard.

"Pleistocene Deposits at Clay Lick, Ohio" (lantern slides), by Kirtly F. Mather.

"A Group of Eskers South of Dayton, Ohio" (lantern slides), by Earl R. Scheffel.

"An Overflow Channel of a Glacial Lake in Yates County, N. Y." (lantern slides), by Frank Carney.

"High Level Terraces in Southeast Ohio," by G. H. Hubbard.

"An Ecological Classification of the Vegetation of Cedar Point," by O. E. Jennings.

The committee on the state natural history survey was enlarged and continued. A committee consisting of the incoming president, secretary and treasurer was appointed to confer with the Indiana Academy of Science relative to the holding of joint meetings periodically by the two societies. It seemed to be the opinion of members of the society that such meetings could profitably be held at intervals of approximately three years in some locality near the border line of the two states.

The society adopted a resolution expressing its sense of loss in the deaths of two members during the past year, Albert Taylor and William Curtis Whitney.

After adopting resolutions expressing the appreciation of the society for the courtesies extended by the faculty and others at Miami University and furthermore thanking Mr. Emerson McMillin, of New York, for his continued interest in the welfare of the academy, the society adjourned. The following officers were elected for the coming year:

President—Professor Frank Carney, Granville, Ohio.

Vice-presidents—Professor J. H. Schaffner, Columbus, Ohio, and Professor F. C. Waite, Cleveland, Ohio.

Secretary—Professor L. B. Walton, Gambier, Ohio.

Treasurer—Professor J. S. Hine, Columbus, Ohio.

Executive Committee—(*ex-officio*) Professor Frank Carney, Granville; Professor L. B. Walton, Gambier; Professor J. S. Hine, Columbus; (elective) Professor Bruce Fink, Oxford; Professor Lynds Jones, Oberlin.

Board of Trustees—Mr. Charles Dury, Cincinnati, Ohio (in place of retiring trustee).

Publication Committee—Professor E. L. Rice (in place of retiring member).

L. B. Walton,
Secretary

THE NEW YORK ACADEMY OF SCIENCES—SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY

AT a meeting of the section held on Monday, October 21, at the American Museum of Natural History, three papers were read.

The Selective Reflection Characteristic of Salts of Carbonic and Other Oxygen Acids: L. B. MORSE.

I. *The Selective Reflection of Carbonates as a Function of the Atomic Weight of the Base.*—Polished plane surfaces of (Mg, Ca, Fe, Mn, Zn, Sr, Ba and Pb) CO_3 were prepared and the ratio of the reflected to the incident radiation was measured at short wave-length intervals between 4 μ and 15 μ. The following are the principal conclusions reached:

1. The reflection curves for all the carbonates examined show between 4 μ and 15 μ three, and only three, bands of abnormal reflection. Abnormal reflection interpreted means a free resonance period of the molecule.

2. The bands fall into three separate and definite spectral regions, which are distinct from the regions where the salts of other acids, so far as known, show reflection maxima.

3. With few exceptions, an increase in the atomic weight of the base causes a shift of all three reflection maxima toward long waves by an amount roughly proportional to the change in atomic weight of the base.

This is shown for the first reflection band by curve *A*, Fig. 1, in which the atomic weights of the bases are plotted as ordinates, and the wave-lengths of the "first" reflection maxima as abscissæ.

II. *The Rôle Played by Oxygen in the Selective Reflection of Carbonates, Nitrates, Sulphates and Silicates.*—Combining with the data on carbonates the scattered observations of other observers on nitrates, sulphates and silicates, the tentative hypothesis has been made that the oxygen atom is the one chiefly responsible for the marked reflection observed.

The wave-lengths of the first reflection bands in $CaCO_3$, KNO_3,[1] $CaSO_4$ and $MgSiO_3$[2] are plotted as abscissæ, curve *b*, Fig. 1, and as ordinates the weights of the acid-forming elements combined with O_3 (C = 12, N = 14, $\frac{3}{4}$S = 24, and Si = 28).

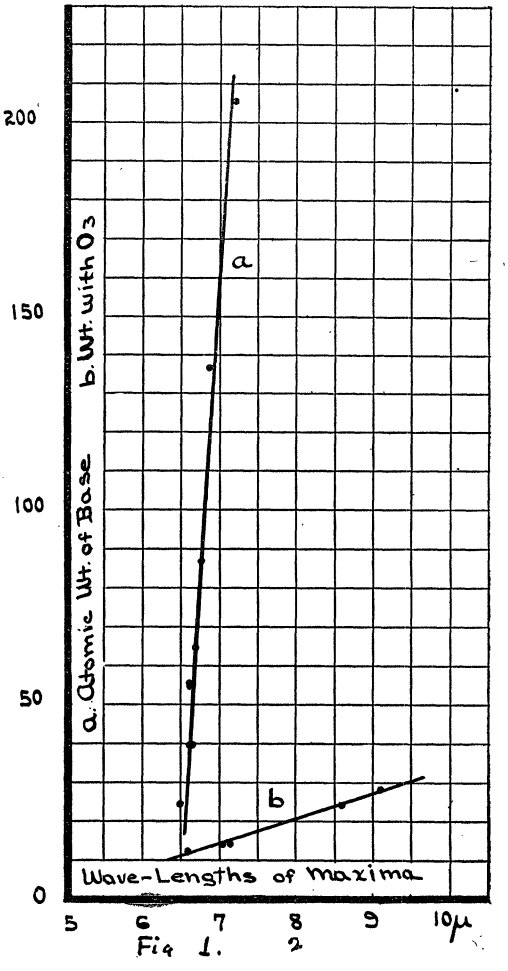

Fig. 1.

The lines drawn show clearly that a small increase in the weight of the acid-forming element produces a much greater displacement of the reflection band than does the same increase in the weight of the base, and this is in full agreement with the chemist's view of the relative strength of the bands existing between the *acid-forming element* and oxygen, and that between the *base* and oxygen.

The results suggest a new and far-reaching method by which it may some time be possible

[1] Two values are plotted for KNO_3 corresponding to the results obtained by two independent observers, Pfund and Coblentz.

[2] If a correction be applied to correct for Mg being lighter than Ca, this would bring the $MgSiO_3$ point even nearer the line drawn.

to express the dynamical relations existing between the separate atoms of a molecule, and thus the present conception of chemical bonds and linkages be given a broader significance.

The paper appears in full in the *Astrophysical Journal* for November, 1907. Addendum, October 30, 1907.

By reducing the results to zero weight of the base and extending the curve *b* to zero weight of the acid-forming element, the weight with O_3 both in base and as acid-forming element is zero. Thus a wave-length is found which is approximately that found by Ångström for the absorption of ozone.

Also a second absorption band in ozone corresponds to the second carbonate bands, found at a longer wave-length.

This is a very important confirmation of the assumption made viz., that, "the oxygen atom is the one chiefly responsible for the selective reflection observed."

The Decay of Phosphorescence of Gases: C. C. TROWBRIDGE.

The author described a new form of photometer designed for the purpose of measuring the rate of decay of luminosity of a phosphorescent gas. The photometer consists of a track 3.5 meters long, made of two brass rods under tension. On the track an electrically controlled carriage runs which carries the standard light. The standard light can be moved away from a screen placed close to a tube containing the phosphorescent gas to points *A, B, C,* etc. The illumination on the screen from the standard light is thus directly compared with the luminosity of the gas, and comparisons are made at *A, B, C,* etc., as the gas fades. Seven readings can be made within ten seconds, giving a variation of from 1/2 to 1/25 the original intensity of the phosphorescent gas. The entire apparatus is operated electrically, time being registered on a chromograph.

By means of this photometer the law of the rate of decay of phosphorescence for gases has been found. In this case, for air at about 0.1 millimeter gas pressure, the expression is the same as that for the decay of phosphorescent solids, or

$$I = \frac{1}{(a + bt)^2}.$$

Plotting the reciprocal of the square roots of the intensities, in the case of one decay of luminous gas, with the corresponding times gives a perfectly straight line. An application of the law to the grading of the light of a body of phosphorescent gas as great in size as a meteor train shows that the light of the self-luminous meteor train can be explained on the assumption that it is a gas phosphorescence, although the train may be visible for thirty minutes. A certain brightening of the sky around the radiant point at the time of meteor showers which has been called the "auroral light" is also explained by the application of the same law. In the latter case it is evident that the feeble phosphorescing of many trains has combined to give a pale glow in the regions of the heavens through which the shower was taking place.

Some Temperature Measurements taken in the Steel Works with the Wanner, Féry and Le Chatelier Pyrometers: W. CAMPBELL.

The author briefly described the instruments used, methods of standardization and application. The temperature readings obtained at the blast furnace were: Metal, 1375° to 1250° C.; slag, 1425° to 1375°. At the Bessemer converter, 1600° C., very hot blow; 1500° C. cool. Average blows 1550° C. The steel was cast at 1500° to 1460° C. At the Open Hearth the furnace temperatures varied from 1550° to 1705° C., the surface of the bath being 1705°. The steel was cast at 1540° to 1460° C. The temperatures of the gas producers varied greatly, one set averaging 650° C., another over 850° C. The most important readings were taken at the Rail Mill, on the finishing temperatures of steel rails. The readings with the Féry pyrometer varied from 1000° to 1070° C., whilst the Wanner averaged 1100° C.

At this meeting Professor D. W. Hering was nominated for vice-president and chairman of the section for 1908, and Professor W. Campbell for secretary.

At a meeting of the section held on Monday, November 18, three papers were presented.

Waves and Rays in Physics: DORIS W. HERING.

The author pointed out the extent to which waves or rays have dominated in explaining the transmission of a disturbance through space, as many as seven different kinds of waves having been employed, and no less than twenty-one different kinds of rays. The most fruitful generalization was Fourier's analysis of wave motion in his "Théorie Analytique de la Chaleur"; the boldest contention was that of Fresnel in advocating transverse vibration to produce waves of light; the most recent and comprehensive generalization was Maxwell's electromagnetic theory of light. The recent great increase in the number and variety of "rays" has been attended by a great deal of charlatanism.

Tool Steel-making in Styria: R. F. BÖHLER.

Reviewed the development of Styrian steel trade from prehistoric and Roman times up to our own days. The paper emphasized a number of special features characteristic of Styrian steel which are so many reasons for its superiority: (1) Crucibles used but once, (2) extreme purity of ores, (3) extensive or exclusive use of charcoal, (4) special skill of workmen in hammer- and heat-treatment.

The works, founded 1446, are now decidedly up-to-date; have pyrometric control; electric melting and hardening furnaces; latest physical testing methods, metallography.

As a consequence extensive use of Styrian steel in the five continents, for tools, rifles, shells, etc., also field guns, motor cars. Hundreds of tons of high-speed steel shipped to the United States yearly.

Electrolysis of Silico-Fluoride Solutions: Dr. E. F. KERN.

The author first of all took up the preparation of the electrolytes, current density, etc., and showed numerous specimens including metallic surfaces of lead, nickel, iron, copper and silver deposited from silico-fluoride and other solutions for comparison. The method on a commercial scale for the purification and desilverization of lead is employed at Trail, B. C., and elsewhere.

WILLIAM CAMPBELL,
Secretary

COLUMBIA UNIVERSITY

DISCUSSION AND CORRESPONDENCE

A BRITTLE-STAR NEW TO THE WOODS HOLE REGION

THROUGH the kindness of Mr. George M. Gray, the well-known collector of the Marine Biological Laboratory at Woods Hole, Mass., I am enabled to make an interesting addition to the list of echinoderms known from the Woods Hole region. A single specimen of a brittle-star was dug out of the mud between Ram and Devil's Foot Islands in August, 1907. It was taken to the laboratory alive and in good condition, but in the course of a few hours it shed its disk, leaving only the mouth parts attached to the arms. The disk, as well as the remainder of the animal, was preserved in formalin and the specimen was subsequently sent to me by Mr. Gray for identification. There is little doubt that it is an excellent example of *Amphioplus abdita* (Verrill), a species previously known only from Long Island Sound. It is recorded from near New Haven and from Thimble Islands, by Professor Verrill, and there are specimens in the Museum of Comparative Zoology from Noank, Conn. The Woods Hole specimen measures about 6.5 mm. across the disk, and the arms are between 80 and 90 mm. in length. It differs from Professor Verrill's very complete description, and also from the specimens in the Museum of Comparative Zoology, in three important particulars: (1) the arms are noticeably shorter in proportion to the diameter of the disk; (2) the scales of the disc are coarser and the six primary plates at the center are conspicuous; (3) the color is uniformly gray instead of variegated or yellowish-brown. It is greatly to be hoped that further search will bring to light more specimens at Woods Hole, of this mud-loving species, for it will be interesting to see whether the above-mentioned peculiarities are at all constant. It would also be of great interest to investigate the cause, method and consequence of disk-shedding, a habit known to be frequent in the family to which *Amphioplus* belongs, but concerning which we know almost nothing.

HUBERT LYMAN CLARK

MUSEUM OF COMPARATIVE ZOOLOGY,
November 14, 1907