

the fundamental region of a discontinuous group of linear transformations.'

E. B. WILSON: 'Oblique reflections and uni-modular strains.'

C. N. MOORE: 'On the introduction of convergence factors into summable series and summable integrals.'

The May number (volume 13, number 8) of the *Bulletin of the American Mathematical Society* contains: Report of the February meeting of the San Francisco Section, by W. A. Manning; Report of the Fifty-seventh Meeting of the American Association for the Advancement of Science, by L. G. Weld; 'On a Final Form of the Theorem of Uniform Continuity,' by E. R. Hedrick; 'The Groups Generated by Three Operators Each of which is the Product of the Other Two,' by G. A. Miller; 'A Table of Multiply Perfect Numbers,' by R. D. Carmichael; 'The Symmetric Group on Eight Letters and the Senary First Hypoabelian Group,' by L. E. Dickson; 'Double Points of Unicursal Curves,' by J. E. Wright; 'The Mathematical Tablets of Nippur,' by D. E. Smith; 'Osgood's Theory of Functions' (Notice of Professor W. F. Osgood's *Lehrbuch der Funktionentheorie*), by H. S. White; Shorter Notices (Arnoux's *Introduction a l'Etude des Fonctions Arithmétiques*, by W. H. Bussey; Neumann's *Studien über die Methoden von C. Neumann und G. Robin zur Lösung der beiden Randwertaufgaben der Potentialtheorie*, by O. D. Kellogg; Biermann's *Vorlesungen über mathematische Näherungsmethoden*, by J. W. Young; Ariès's *La Statique Chimique Basée sur les deux Principes Fondamentaux de la Thermodynamique*, by E. B. Wilson); Notes; New Publications.

#### SOCIETIES AND ACADEMIES

##### THE IOWA ACADEMY OF SCIENCES

THE twenty-first annual session of the Iowa Academy of Science was held at Drake University, Des Moines, Iowa, on April 26 and 27. The meeting was well attended and much interest was manifested in the papers presented. In addition to the regular program, illustrated lectures were given on the evening of the twenty-sixth by Professor H. L. Russell, of

the University of Wisconsin, on 'Recent Discoveries with Reference to Insect-borne Diseases,' and by Professor W. W. Campbell, director of the Lick Observatory, on 'The Solar Eclipse in Spain.'

The officers elected for the ensuing year are:

*President*—John L. Tilton, Simpson College.

*First Vice-President*—C. L. Von Ende, State University.

*Second Vice-President*—Nicholas Knight, Cornell College.

*Secretary*—L. S. Ross, Drake University.

*Treasurer*—H. E. Summers, Iowa State College.

The following program was presented:

*The Influence of Science in Forming Ideals.*

President's Address: C. O. BATES.

*Exposures of Iowan and Kansan (?) Drift, East of the Usually Accepted Boundary Line of the Driftless Area:* ELLISON ORR.

(a) *Volcanic Phenomena around Citlaltepetl and Popocatepetl, Mexico;* (b) *Physiographic significance of the Mesa de Maya;* (c) *Tertiary Terranes of New Mexico:* CHARLES R. KEYES.

*A Visit to the Panama Canal* (illustrated): GRANT E. FINCH.

An account of three weeks of observations on the Canal Zone during the summer of 1906. Impressions of climatic conditions and of problems and progress in the canal enterprise.

(a) *The Channel of the Mississippi between Lansing and Dubuque* (illustrated); (b) *The Unconformity at the Base of the Saint Louis Limestone* (illustrated): S. CALVIN.

(a) *Recent Alluvial Changes in Southwest Iowa;* (b) *Effect of Certain Characteristics of Formations upon Rate of Their Erosion:* J. E. TODD.

(a) *The Loess of the Missouri River* (illustrated).

In large part a rejoinder to Professor Todd's late paper on the same subject, especial attention being given to his attempted explanation of the manner in which the shells of molluscs found their way into the deposit.

(b) *The Loess of the Paha* (illustrated).

The formation of loess on the Paha by wind is explained largely on the basis of plant ecology.

(c) *The Loess and the Nebraska Man* (illustrated): B. SHIMEK.

A brief discussion of the weakness of the evidence that the human remains found near Florence, Nebr., are in undisturbed loess.

*The Orbit of the Asteroid, 1906 W. E.*: E. B. STOUTER.

*A Catalogue of the Poisonous Plants of Iowa*: L. H. PAMMEL and ESTELLE D. FOGEL.

The purpose of the catalogue is to enumerate the plants that are poisonous to live stock.

*A Study of the Variation in the Number of Ray Flowers in Certain Compositæ*: W. S. DUDGEON. (Presented by L. H. Pammel.)

A study was made of the ray flowers of the following plants: *Rudbeckia triloba*, *R. hirta* and *Helianthus grosseserratus*. The constant was worked out according to Professor Davenport's formula. The ray flowers of *R. hirta* vary from 2 to 28 out of 3,847 counted; 1,327 had 13 rays. The ray flowers of *R. triloba* vary from 5 to 18. The ray flowers of the sunflower vary from 7 to 25. In *R. hirta* there appear to be two well-marked forms.

*Iowa Erysiphaceæ*: J. P. ANDERSON.

*Notes on Iowa Algæ*: R. E. BUCHANAN.

Keys to groups and species of algæ and their reported distribution in the state.

*The Homologies of Tissues in Ferns*: H. S. CONARD.

*Studies in Karyokinesis*: J. E. GOW.

An account is here presented of some observations on the process of cell division in the pollen mother cells of *Trillium sessile*, in the vegetative cells of the nucellus of *Arisæma*, and in the young root tips of *Zea mays*. Attention is called to the latter as contradicting, apparently, certain accepted theories of vegetative cell divisions.

(a) *The Estimation of Silica*; (b) *The Analysis of Some Iowa Waters*: NICHOLAS KNIGHT.

*The Recent Investigation of Iowa Ground Waters*: W. S. HENDRICKSON.

*Some Problems in Municipal Sanitation*: L. H. PAMMEL.

The question of the water supply for cities and villages is a very important one. With the density of population increasing, the problem becomes more complex. All of our Iowa streams are more or less polluted. The paper discusses some of these and the supposed case of pollution when a railroad passes over water. Such pollution will not occur if proper precautions are taken.

*The Physical Science Laboratory of the State Normal School* (illustrated): A. C. PAGE.

Description of new laboratory presented because of possible interest to any contemplating building.

*The Lateral Line System of Amphiuma*: H. W. NORRIS.

*Securing a Stand of Clover on the Southern Iowa Loess—A Biological Study*: E. B. WATSON.

L. S. ROSS,  
Secretary

#### THE AMERICAN PHYSIOLOGICAL SOCIETY

THE seventh special meeting was held at Washington, May 7 and 9, in conjunction with the Congress of American Physicians and Surgeons.

The sessions of the society were held in the Physiological Laboratory of the George Washington University.

The scientific program was as follows:

#### TUESDAY, MAY 7

YANDELL HENDERSON: 'Production of Shock by Loss of Carbon Dioxide and Relief by Partial Asphyxiation.'

J. A. E. EYSTER: 'Vagus Inhibition from Rise of Pressure in the Aorta.'

DONALD R. HOOKER: 'May Reflex Cardiac Acceleration occur Independently of the Cardio-inhibitory Center?'

WILLIAM H. HOWELL: 'The Calcium and Potassium Metabolism of the Heart during Inhibition and Acceleration or Augmentation.'

T. SÖLLMANN: 'The Acute Effects of Gastric and Peritoneal Cauterization and Irritation on the Blood Pressure and Respiration.'

T. SÖLLMANN: 'Perfusion Experiments on Excised Kidneys: Solutions of Electrolytes.'

VELYIEN E. HENDERSON: 'The Teaching of

Physiology in the Laboratory.' (A discussion of this paper is especially invited.)

C. C. GUTHRIE: 'Results of Removal and Transplantation of Ovaries in Chickens.'

R. S. LILLIE: 'The Influence of Electrolytes on the Osmotic Pressure of Colloidal Solutions.'

#### THURSDAY, MAY 9

Joint session with the American Society of Biological Chemists.

REID HUNT: 'Notes on the Thyroid.'

WALTER JONES: 'On the Occurrence of Ferments in Embryos.'

C. G. L. WOLF and PHILIP A. SHAFFER: 'Metabolism in Cystinuria.'

C. G. L. WOLF: 'Protein Metabolism in the Dog.'

A. B. MACALLUM and C. C. BENSON: 'The Composition and Character of the Hourly Excretions of Urine.'

S. P. BEEBE: 'The Parathyroid Gland.'

V. C. VAUGHAN: 'Proteid Susceptibility and Immunity.'

WALDEMAR KOCH: 'The Distribution of Sulphur and Phosphorus in the Human Brain.'

A. D. EMMETT and WILLIAM J. GIES: 'On the Composition of Collagen and the Chemical Relation of Collagen to Gelatin.'

LAFAYETTE B. MENDEL: 'Embryo-chemical Studies.'

Joint session with the Association of American Physicians.

Symposium upon acidosis. The discussion was introduced by Dr. E. P. Joslin, representing the Association of American Physicians, and Dr. Otto Folin, representing the American Physiological Society; and followed by a discussion, in which Dr. Graham Lusk, Dr. Lafayette B. Mendel, Dr. A. E. Taylor, Dr. L. F. Barker, Dr. W. S. Thayer and others took part.

The following resolutions were adopted by the society, in association with the American Society of Biological Chemists at the joint session: "This society approves of the movement represented by the Committee of One Hundred of the American Association for the Advancement of Science to increase and coordinate the present activities of the federal government in matters pertaining to public health. This society therefore urges upon the President of the United States and members of Congress the favorable consideration of such legislative measures as are best adapted to secure this result."

The society decided to hold the next annual meeting in Chicago during Convocation week, December, 1907.

LAFAYETTE B. MENDEL,  
*Secretary*

#### THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 429th meeting was held April 6, 1907, with President Stejneger in the chair.

Under short notes Dr. Hopkins called attention to the influence of the recent abnormal warm weather on the opening of the buds of certain forest trees, stating that certain early varieties of American linden trees on B Street, southwest, were fourteen days earlier this spring than last, but that the buds on the late varieties of the same species were not influenced, thus indicating a method of locating varieties of forest trees and the determination of the range of a given periodical phenomenon within a species as influenced by normal and abnormal seasonal conditions. Phenological data collected during the past ten years show quite conclusively that the average time of the beginning of seasonal activity of certain species and varieties of indigenous plants and animals, that remain dormant during the winter, may be utilized as an index or guide to the dates each season when, at different latitudes and altitudes, the conditions are most favorable for action against certain insect pests, plant diseases, etc. The same records show that there is a normal variation in a given phenological phenomenon of about four days for a difference of four hundred feet of altitude and four days for a difference of one degree of latitude, thus it has been shown that within a state like West Virginia there may be a variation of thirty days on the same degree of latitude, due to a difference of 3,000 feet altitude, which is equivalent to a difference of about seven degrees of latitude at the same altitude. Thus, the normal variation between two localities may be calculated approximately, but the response of life activity in certain index forms of plants and animals, to general and local climatic and other influences, will not only give quite positive evidence of the actual variation between localities, but will

serve as most reliable guides to the solving of certain economic problems, as, for instance, the control of certain insect enemies of forests which require remedial action within a short period in their seasonal history.

The practical application of the principle outlined in these remarks has been referred to by Dr. Hopkins in Bulletin 50, West Virginia Agricultural Experiment Station, 1898, pp. 17-18, Bulletin 67; *ibid.*, 1900, pp. 241-248; and Bulletin No. 58, Part III., Bureau of Entomology, U. S. Department of Agriculture, 1907, p. 32.

Dr. Gill, apropos of his recent Smithsonian article on 'Parental Care among Fresh-water Fishes' and the numerous cases of oral gestation and harboring the young in the mouth, called attention to an article in a Swiss journal (*Bibliothèque universelle*, Geneva, 1905) by Dr. Fuhrmann, announcing that an osteoglossoid fish of Borneo (*Scleropages formosus*) also took the young into the mouth after hatching; the data given, however, were scanty and it was not stated whether the egg-carrier was the female or male.

The regular program consisted of an address by Dr. George A. Soper, of New York, on 'A Chronic Typhoid Fever Producer,' and discussion following.

The speaker, after introduction by Dr. L. O. Howard, gave a detailed account of his investigation covering several months into the source of a household epidemic of typhoid fever occurring in Oyster Bay, N. Y., during the summer of 1906. Of eleven persons six developed positive cases of typhoid between August 27 and September 3. Several suspected sources—water, milk, vegetables, fruit and soft clams—were excluded by careful study and examination. Repeated sanitary analysis of the water supply and failure to detect subsoil pollution by fluorescein tests of the drainage showed the infection was not water borne. Typhoid was unusual in Oyster Bay and there were no cases immediately preceding or following those under consideration. The milk and food supply of the infected household was common to others of the village without the occurrence of other cases. None of the patients had been absent for several

weeks prior to the outbreak and they therefore had acquired it on the premises. The house and surroundings were in an entirely hygienic condition. The investigator inferred the occurrence of some unusual event prior to August 20, and found it in a change of cooks August 4. The new cook's term of service with this family covered a period three weeks prior to and three weeks subsequent to the outbreak. She refused to give any information tending to connect her with the cases, but an independent investigation of her previous service disclosed a startling and significant history of typhoid. Despite the fact that her record for nearly two of the past five years is yet unknown, twenty-six cases of typhoid fever, including one death, were associated with her service in seven families during this time. The cases were almost entirely among the servants and the initial case frequently occurred soon after the arrival of the cook. She did not directly admit having herself suffered from typhoid, but to three persons she is said to have previously testified to a mild attack.

The evidence indicating the cook to be a competent cause of typhoid, she was taken into custody by the New York City Department of Health, March 11, 1907, and at the detention hospital a bacteriological examination was made. She was a large healthy Irishwoman, single, forty years of age. The urine was free of typhoid bacilli, but the stools showed great numbers nearly every day for the several weeks of observation. The blood gave a positive Widal reaction. Thus a healthy and vigorous subject was shown to be a chronic typhoid-fever producer. As the typhoid organism is known to persist for years in the gall bladder, this is the presumed source of the infection, removal of which requires the consent of the subject.

The speaker called attention to recent papers by Dr. Robert Koch and others on the important investigations in western Germany of typhoid outbreaks by the aid of portable or 'flying' laboratories. To the Germans the dangers of bacillus-carriers were well known. Stress was laid on the importance of contact in transmission and on the analogy in this

respect between typhoid and diphtheria and tuberculosis. A careful campaign is necessary to discover bacilli-carriers once they escape the physician's care. The rigorous measures of isolation and disinfection adopted in Germany are perhaps impracticable here at the present time, except during epidemics.

In the discussion which followed, Dr. W. C. Woodward, health officer of the District of Columbia, commended the accuracy and the scientific spirit of Dr. Soper's work and spoke of the desirability and the difficulty of procuring such accuracy in the routine work of a health department and in obtaining for such routine work men imbued with the same scientific interest as that displayed by Dr. Soper. The extreme difficulty of detecting bacillus carriers and of enforcing upon them proper isolation would constitute a serious obstacle in the way of preventing the spread of disease through them. The public should guard, however, against forming exaggerated ideas of the danger from this source. Among the many hundreds of patients suffering from typhoid fever who have come to the knowledge of the Health Department during recent years, many were housewives and other persons who, upon convalescence, necessarily took an active part in the ordinary affairs of the household. And although many of such cases must have been what are now termed bacillus carriers for longer or shorter periods after convalescence, the Health Department had yet to find a case in which there was an outbreak of typhoid fever, or even a second case, in the household after the convalescence of the first case.

Dr. Woodward asked why it was that in the families in which the bacillus carrier which formed the subject of Dr. Soper's investigation, had been employed, the number of the members of the families affected by the disease was apparently relatively so small as compared with the number of persons affected among the persons employed about the household and about the premises.

Dr. M. J. Rosenau said that the typhoid problem is now magnified and the difficulty of dealing with it increased. Though complex and intricate, the situation is not hopeless. It is not necessary to imprison the bacillus

carrier; it is sufficient to restrict the activities of such an individual. As for typhoid in Washington, if largely transmitted by bacillus carriers and contacts a different epidemiological picture might be expected; the disease should increase progressively, whereas it is epidemic in the summer, declining rapidly in the fall; there is little typhoid fever here in the winter and spring. Dr. Rosenau believes that when large quantities of virulent cultures are ingested the disease is frequently induced within the usual period of incubation. Ordinarily, however, persons become infected with dilute cultures or attenuated bacteria which remain in the intestinal tract awaiting lowered resistance before the disease manifests itself. This lowered resistance is largely brought about by the enervating effects of the hot weather. This explains the seasonal prevalence of typhoid fever and why it is a summer disease in Washington and many other places.

Dr. L. O. Howard, while appreciating that a charge of professional bias might lie, felt it necessary to emphasize the rôle of the housefly as a carrier. Whether its importance is secondary, tertiary, or further removed in degree, it is certainly known to transmit typhoid even under city conditions. The housefly is abundant in low quarters and near waste lots in cities like Washington. To do away with it is a simple matter. It is but necessary to oblige stable keepers to dispose of horse manure, since 99 per cent. of the houseflies in cities are bred in it. Dr. Soper's paper has emphasized the importance of this measure by showing the possibilities of healthy human subjects as carriers. Such persons of unclean habits increase the opportunities of the housefly as a transmitter of infection.

Dr. C. W. Stiles, referring to the question why bacillus carriers did not infect more widely, drew an analogy from parasitic worms. *Oxyuris (Oxyurias) vermicularis* is transmitted by the hands. As with typhoid distributors it might be expected to infect a large number of persons. This is not the case. For instance, in an orphan asylum of several hundred, perhaps only eight or ten may be infected, though the worm is transmissible

from hand to mouth. The dwarf tape worm, *Hymenolepis nana*, is another case in point. Personal cleanliness has an important bearing.

Mr. K. F. Kellerman said that Doctor Soper's typhoid investigations have shown weighty reasons for the sterilization of sewage. Chemical sterilization is practicable at low cost, by nascent chlorine or one of the heavy metals, and should be resorted to when sewage is discharged into streams which in a short time are used as the sources of drinking water. He seconded Doctor Howard with respect to the importance of flies. At Panama typhoid is rare, and the few cases are confined to the lowest classes of negro laborers who eat in the open where flies are abundant instead of in screened dining-rooms such as are used by the Americans.

Dr. J. Goldberger gave some figures on the frequency of bacillus carriers. One thousand seven hundred cases examined at three of the laboratory stations in Germany showed 3 per cent. to be chronic carriers. It is possible to calculate the number of carriers for a given district and the probable danger to non-immunes.

Dr. G. Lloyd Magruder recalled the early typhoid investigations in Washington and the surrounding country which cited the water supply, cesspools, manure piles and milk as carriers. The city wells and water supply of many dairy farms were found contaminated. It is difficult to enforce sanitary precautions in the city and almost impossible in the country. The farm is an important source of city typhoid and the fly an important carrier on the farm.

Dr. Soper in closing replied to questions and amplified certain points. With respect to the cost of his investigation he preferred to give no figures. It had cost him personally more than he had agreed to charge at its beginning. The investigation would hardly have been undertaken in this particular instance, save for its scientific interest. His typhoid work was generally done for cities, as at Ithaca and Watertown. As to why more persons other than the servants were not attacked in the families served by the cook, he believed

the members of the family were protected in large measure by the sterilizing effect of cooking, the food being chiefly handled after cooking by butlers and waitresses or servants other than the cook. The cook never handled fruit, salads and other things eaten raw by the family. Servants newly attached to the household were more apt to take the disease than those long associated with the cook. Possibly an acquired immunity explains this. Hand infection is important and the hands should receive more attention than they do. It would be well if cooks could be selected only after careful assurance concerning their histories and personal habits. In general, scrupulous cleanliness is an important safeguard against typhoid. Increase in knowledge of bacillus carriers should be looked upon as encouraging rather than otherwise, since it is only by a knowledge of the facts that preventive measures can be accurately applied and transmission can be prevented. As to the situation at Washington, the speaker preferred to say nothing until the official report of the exhaustive investigations of the Public Health Service had been made public.

At the conclusion of the meeting the chair tendered the society's thanks to the speaker for his address.

M. C. MARSH,

*Recording Secretary*

#### THE GEOLOGICAL SOCIETY OF WASHINGTON

At the 190th meeting of the society, held at the Cosmos Club, on Wednesday evening, March 27, 1907, under informal communications, Mr. F. E. Wright showed a new double screw micrometer ocular by the use of which the optic axial angle of a bi-axial mineral can be determined on any section showing in convergent polarized light an optic axis within the field of vision.

The regular program consisted of an exhibition of the geologic relief map of the Southern Appalachian Province prepared for the Jamestown Exposition. The following description of the territory covered by the map was given:

*The Appalachian Mountains and Valleys: Mr.*

ARTHUR KEITH.

The four main geographic divisions of the Appalachians are typically shown in this area.

These are the Piedmont Plateau on the east, the Appalachian Mountains, including the Blue Ridge and joining the Appalachian Valley northwest of the mountains, and, still farther northwest, the Appalachian Plateau, including the Cumberland and Allegheny plateaus.

Southeastward from the Blue Ridge the streams flow directly to the Atlantic in most of the area, northwestward from it they flow into the Appalachian Valley, and southwestward along the valley into Alabama. Most of the drainage of the Appalachian Plateau is dendritic and flows northwestward into the Ohio River from the eastern margin of the plateau.

The characteristic topography of the Piedmont Plateau is a smooth, even-topped upland into which the stream channels are rather deeply dissected. The Appalachian Mountains, from maximum heights of 6,600 and 6,700 feet in western North Carolina, become gradually lower toward Alabama and Virginia. Around their southern end the Piedmont Plateau merges with the Appalachian Valley. The same is true in less degree in Virginia. The Mountains are rugged and deeply dissected, especially where they rise abruptly from the Appalachian Valley. The great Appalachian Valley is a composite of many small valleys, separated by sharp linear ridges and mountains. The valleys follow the beds of soft rock and the ridges the hard sandstones. The height of the valley is greatest (about 2,000 feet) in southern Virginia and descends in either direction to about 500 feet in Alabama and northern Virginia. The Appalachian Plateau in Tennessee and Alabama are typically flat, table-topped mountains, more or less dissected by stream gorges and narrow valleys. They are preserved from erosion by beds of hard sandstone. In Kentucky and farther north the sandstones are less prominent and the region is extensively dissected into a network of hills and knobs. The summits of these, however, fall in general into planes.

Only the larger rock divisions were shown in color on the model. These corresponded in the main with the great time divisions—Cam-

brian, Ordovician, etc. The Carboniferous was shown in two divisions, the Pennsylvanian and Mississippian, and the Cambrian was divided into a lower siliceous and upper calcareous group. The Archean was divided into gneisses and igneous rocks. These greater divisions correspond closely with the great geographic divisions, the topographic features, in fact, being very largely determined by the progress of erosion on the different formations, according to their solubility. Thus, the Appalachian Plateau is formed mainly of Pennsylvania sandstones and shales with bordering zones of the Mississippian limestone. The Appalachian Valley is underlain in the main by narrow bands of the Devonian, Silurian, Ordovician and the calcareous division of the Cambrian rocks, while along its southeast border lie the siliceous Cambrian rocks. These also form the northwestern part of the mountains in a comparatively narrow band extending throughout the Appalachian system, with a few outliers farther southeast.

The main mass of the mountains is composed of gneisses through which have been injected igneous rocks of various descriptions—mainly granites. These rocks are, for the most part, Archean, but include also some of Algonkian age. They extend southeastward over the Piedmont Plateau in broad areas. Over the plateau there are also found large masses of later igneous rocks of approximately Carboniferous age. In this respect the Piedmont Plateau resembles the eastern part of the Appalachian province in New England. Other resemblances are seen in central Virginia and North Carolina, where sediments of Silurian age are found. Knowledge of these parts of the Appalachians is at present very limited. Over the Piedmont also are isolated basins of Triassic red sandstones and shales.

The Appalachian structures also fall into main groups similar to the geographic and geologic features. The Appalachian Plateau is underlain by rocks which are nearly flat. In the valley all of the formations are steeply folded, overturned, and, in places, faulted. The local changes in the extent and type of deformation express the differences in the character of the rocks. Open folding at the

north progresses into steeper folding southwestward, then into faulted folds and overthrusts, until in southern Tennessee and northern Georgia faults are much more prominent than folds. Huge overthrusts of many miles throw extend from lower Virginia into Georgia. These have been folded and faulted by later deformation. In the mountains similar structures prevail and metamorphism is added thereto. This increases rapidly toward the southeast and in large areas has destroyed the original aspect of the formations.

These structures were produced by tremendous force which thrust the pre-Cambrian masses northwestward against the sediments. According as these masses were unequally advanced the sediments were deformed and the great bends of the Appalachian Valley produced. Most of the structures run for great distances in parallel lines, but there are many cross folds extending across the valley and mountains.

Deformation was active in pre-Cambrian time, appeared in less degree at several times during the Paleozoic, and culminated in the post-Carboniferous Appalachian revolution. The Piedmont Plateau shared to some extent in the deformation of Triassic time, but the rest of the region appears to have escaped. Still later uplifts have appeared at various times up to the Quaternary and can be traced through the topographic forms. The land was uplifted and warped in broad levels or domes.

*The Plateau Region:* Mr. M. R. CAMPBELL.

*The Appalachian Revolution:* Mr. BAILEY WILLIS.

Assuming that the geologic structure of the Appalachian zone is too well known to require any descriptive statement, Mr. Willis proceeded to discuss the larger problems of the nature and origin of the movement involved in Appalachian folding. He referred to the hypothesis which he had once entertained of a movement of the interior continental region from northwest to southeast, a movement supposed to be of such a character that the mass of ancient crystallines in North Carolina formed the buttress against which Paleozoic strata were folded. He gave reasons for

abandoning this view and accepting that which is more generally entertained, of a movement from the southeast toward the northwest. Tracing this northwestward movement, he showed that all of the known mass of the continent southeast of the Appalachian zone had been involved in it; that we must suppose a belt a thousand miles long and several hundred miles wide to have moved northwestward between thirty and forty miles. With reference to such displacement of the continental margin, he stated his belief that it involved the expansion of a sub-oceanic sector. Developing this idea by illustration of continental compression in North America and Asia, he stated a general theory that since an early geologic date, continents have from time to time been compressed in consequence of the expansion of the material beneath the oceanic basins, and he attributed this expansion to the plastic flow of rocks considered as rigid solids, which are nevertheless not sufficiently firm to maintain their form as masses of oceanic extent and one hundred miles or more deep. This property of plastic movement would apply equally to sub-continental as to sub-oceanic masses, but in view of the greater density of the latter, the motion has been from the oceanic toward the continental areas.

*Economic Conquest of the Southern Appalachian Coal Field:* Mr. GEO. H. ASHLEY.

Mr. Ashley traced briefly the movements resulting in the populating of the district, pointing out some of the factors affecting that movement, the routes by which it took place and the relation of those routes to the physiography. He then reviewed briefly the early efforts in marketing the coal by the use of the rivers reaching from the Ohio up into the coal fields, pointing out the difficulties encountered and how these were overcome by building dams and locks. Then came a study of the gradual incoming of railroads in which he pointed out the relation of the routes chosen to the physiography, some of the difficulties encountered, and the territory opened up to export as a result.

RALPH ARNOLD,  
Secretary



## THE NEW YORK ACADEMY OF SCIENCES

At the meeting of the Section of Geology and Mineralogy, January 7, the following paper was presented:

*Volcanoes of Colima, Toluca and Popocatepetl*: EDMUND OTIS HOVEY.

Toluca is the oldest of the three volcanoes. A feature of greatest interest in the crater is the dome of vitreous andesite which welled up in the crater as the latest phase of the activity of the volcano and shows a certain resemblance to the cone of Mt. Pelé, with regard to origin. The volcano of Popocatepetl shows its composite character as a strato-volcano in the walls of the crater, and streams of lava have been among the features of the most recent eruptions. The volcano of Colima is still sending up a vigorous column of steam from its central summit crater. From this summit crater there poured out, in the latest eruption (1903), streams of very frothy lava which present a strange appearance on account of the porous character of the surface blocks. The same feature characterizes the streams of the earlier eruptions and has led some observers to the erroneous conclusion that flows of lava have not occurred at the volcano of Colima.

The major portion of the evening was then devoted to an examination of the exhibits of geology, paleontology and mineralogy in the New York Academy of Sciences Exhibition, under the guidance of the committeemen in charge of those exhibits.

At the meeting, April 1, Mr. Robert T. Hill gave a discussion of the tectonic structure of the northern part of the Mexican Plateau, which was published in *SCIENCE* for May 3.

Dr. Alexis A. Julien then spoke on the 'Evidence of the Stability of the Rock Foundations of New York City.' The general facts were reviewed which might justify the confidence of builders in the operations of extensive construction now in progress. Two former periods of enormous seismic activity in this region were considered, as recorded by the violent faulting produced at each time. The one, connected with the foldings, slips and shattering during the great Appalachian up-

lift, and now revealed by the numerous pegmatite intrusions cutting irregularly across the stratum of crystalline schists, probably effected during Cambrian time. The other, after the close of the Mesozoic, during the thrust of lava sheets between the sandstones and shales of the Newark series of New Jersey, now indicated by many faults across Manhattan Island and the adjacent Palisade Ridge. The long period of cessation of uplift, of ensuing subsidence and extensive surface erosion, offers the conditions in this region which promise long stability, notwithstanding the slight tremors noted at intervals of thirty or forty years. In the absence of disturbance of the glacial striæ, everywhere abundant, which serve as natural benchmarks to record changes of level or faulting, we obtain therefore direct testimony to the established absence of tremor during the long and approximately definite period which has elapsed since the passage and withdrawal of the continental glacier. In other parts of the Hudson River valley, however, some evidences of post-glacial faulting have been observed.

ALEXIS A. JULIEN,  
*Secretary of Section*

THE ELISHA MITCHELL SCIENTIFIC SOCIETY OF  
THE UNIVERSITY OF NORTH CAROLINA

THE 172d meeting was held in the main lecture room of Chemistry Hall, Tuesday, April 16, 7:30 P.M., with the following program:

PROFESSOR ARCHIBALD HENDERSON: 'The Foundations of Geometry.'

PROFESSOR CHAS. H. HERTY: 'The Optical Rotation of Turpentine.'

ALVIN S. WHEELER,  
*Recording Secretary*

DISCUSSION AND CORRESPONDENCE

THE CLOCKS OF THE GREENWICH AND U. S.  
NAVAL OBSERVATORIES

TO THE EDITOR OF *SCIENCE*: In Professor Eichelberger's paper, published in your issue of March 22, 1907, he gives a comparison of the performance of six clocks, at various periods from the time of Bradley in 1750.

This table is primarily intended to show the