reasons are given (based on the study of the faunas themselves) for thinking the Chouteau was later than the Chemung. From a similar study, the author concludes that there is not at hand sufficient evidence of the composite origin of the fauna in question.

North American Graptolites: By R. R. Gurley.

The present paper is a continuation of one in the January-February number of the *Journal.* The vertical range of graptolites is quite fully discussed and tables are given showing the horizon and geological range of each species so far as the facts are known. The value of these tables is much enhanced by references to the original sources of information in a large number of cases. The author finds that graptolites may be clearly traced to the beginning of the Carboniferous period, and he thinks it likely that allied genera lived through the Paleozoic.

Deformation of Rocks, II., An Analysis of Folds: By C. R. Van Hise.

Folds are divided into simple, composite and complex. The author compares a rock fold to a wave of the sea, each large wave having superposed on it waves of the second order, these having waves of the third order, etc. Thus while the forces producing them are different, the complexity of the two are comparable. Various forms of folds are figured, and the relation between them clearly stated. Simple folds may be united to produce a great variety of composite structures, anticlinoria and synclinoria. These may be normal or abnormal and upright, inclined or overturned. As to abnormal composite folds, several factors modify the result. (1) Readjustment between the beds; (2) the great strength of the older rocks; (3) decreasing lateral stress with depth; (4) the position of the fold in the group of rocks folded. Complex folds are folds considered in three dimensions. This complexity may be due to differences in thickness and strength of beds in different places, unequal thrust on different parts of the border of an area, and to the fact that thrust may be in two or more directions. A number of practical directions are given for discovering and interpreting in the field the structure of complex folds.

C. R. Van Hise continues the 'Summary of Current Pre-Cambrian North American Literature.' S. Weller contributes a review of Williams' 'Geological Biology.' A long list of the publications recently received closes the number.

D. P. N.

SOCIETIES AND ACADEMIES.

GEOLOGICAL CONFERENCE OF HARVARD UNIVERSITY, APRIL 28, 1896.

(1) *April recess excursion to the Middle Susquehanna, Pa:* By W. M. Davis.

The special object of this excursion was to study on the ground the deflected tributaries of the Susquehanna in Union and Snyder counties, Pa., and to determine their bearing on the hypothesis that the Susquehanna was superposed by flood plaining on the two synclines of Pocono sandstone in Dauphin county at a late stage in the Cretaceous cycle of denudation. (See Rivers and Valleys of Penna., Nat. Geogr. Mag., I, 1889, 241.) Spruce run and Buffalo creek, Penn's creek and Middle creek were examined; Penn's creek being the most significent, as it abandons a well-defined limestone and shale valley and turns south through ridges that surmount by a moderate measure the Tertiary peneplain of the region. These various streams cannot be regarded as antecedent to the time of mountain folding, for they are systematically placed with respect to the Susquehanna; they cannot be regarded as adjusted to the structures of the region, for they stand in most diverse relation to resistant and weak strata and to anticlines and synclines; their systematic southward deflection suggests the influence of an ancient flood plain of the Susquehanna that was formed on a peneplain of the past, of just the same kind as the influence exerted by the growing flood plain of to-day at Selin's Grove, where Penn's creek, after approaching within half a mile of the main river, has to flow four miles southward along the inner border of the plain before mouthing. Admitting that the deflection of the several streams was caused by flood plaining, this is shown to have been ancient, not only by the relation of Penn's creek to the low ridges that surmount the dissected Tertiary peneplain, but also by the imminent readjustment of some of the deflected streams by longitudinal subsequent streams that are growing along weak

strata from the main river; thus Penn's creek is almost captured by a longitudinal subsequent stream that enters the Susquehanna at Winfield; North Mahantango creek is likewise nearly diverted by a longitudinal subsequent branch of Middle creek that flows by Freeburg; and perhaps the direct longitudinal course of White Deer creek, further north, may be explained as a return to its normal attitude; its former southward deflection being suggested by the occurrence of a large number of Medina boulders on the col by which it is now divided from a south-flowing, transverse branch of Buffalo creek.

Among numerous points of interest noted during the trip may be mentioned: The superb view of the Delaware watergap, deep cut in level-crested Kittatinny mountain, as seen from the edge of Pocono plateau; the monotonous surface of this plateau, over 2,000 feet above tide, nearly stripped of its timber, almost uninhabited, and yielding little more than the winter ice crop of its numerous ponds; the alluvial fans, locally known as 'bulges,' formed on the low valley floors beneath various notches in the Medina ridges of the Seven mountains, one fan at Glen Iron having a radius of half a mile and a height of about three hundred feet, now somewhat trenched by its stream; the Pocono synclinal coves west of the Susquehanna, opposite Millersburg and Dauphin; the long straight boulder-strewn valley floor of Stony creek, east of the Susquehanna between Second and Third mountain, the boulders having crept down from the crests of Pocono and Pottsville sandstone and conglomerate, producing an irredeemable veneer over the otherwise fertile Mauch Chunk red shales; and the immediate transition from this uninhabitable valley to fertile fields on passing through Fishing creek gap to the more open country between First (Blue) and Second mountain.

(2) *April recess excursion to Gay Head, Martha's Vineyard:* By J. B. WOODWARD.

T. A. JAGGAR, JR.,
Recording Secretary.

NEW YORK ACADEMY OF SCIENCES.

AT the meeting of the Section of Astronomy and Physics on May 4th Prof. A. M. Mayer presented a paper on a heliostat with small mirrors, giving an intense beam of light and forming an image at its focus. It consists in mounting a convex lens so as to concentrate the beam of sunlight upon one surface of a total reflection prism, the lens being mounted to rotate upon a polar axis so as to keep the sunbeam continually upon the mirror. A negative lens near the prism renders the beam parallel again. A second total reflection prism sends the beam in any desired direction. The advantages of this heliostat are a very powerful beam of light which can be made to emanate practically from a point, and from which the heat rays have been almost entirely absorbed by its passage through the various pieces of glass. It is especially adapted to work with the solar microscope and experiments on the interference of light. The paper was discussed by Prof. R. S. Woodward.

The following notes were presented by Mr. Wallace Goold Levison. (1) On photographs of Geissler and Crookes' radiant matter tubes.

Mr. Levison presented a very interesting series of photographs of Geissler and Crookes' tubes taken by their own light. Many of these showed very beautifully the stratification in the Geissler tubes and the difference between the phenomena at the anode and at the cathode. He also showed a series illustrating the disturbances in the stratification produced by plunging the cathode to various depths in water. The photographs of the Crookes' tubes showed not only the fluorescent spot opposite the cathode, but also very distinctly the pale bundle of cathode rays which are almost invisible to the unaided eye. (2) In this connection Mr. Levison pointed out the resemblance between the succession of colors with varying pressure in Geissler tubes and the color variation in the aurora, and suggested that the experiments described bore out the idea that the aurora is an electric discharge through the atmosphere at various heights and pressures. A possible connection between these phenomena and the solar corona and comets was also pointed out.

The third note was the description of simple apparatus for obtaining X-ray photographs by long exposure with small (6-inch) induction coil and four Bunsen cells. The fourth note

was descriptive of certain plates which were exhibited appearing to indicate a magnetic action on photographic plates. These are called magnetographs and were made by placing various objects directly on the photographic film and suspending a magnet in front of them. No satisfactory explanation or theory of the results has been given. Fifth note: In conclusion, Mr. Leviston pointed out certain causes which, in his opinion, might account for the deterioration of photographic plates, suggesting among other things X-rays from unexpected sources, terrestrial magnetism, plant or fungus organisms, and gases, such as sulphuretted hydrogen, penetrating the boxes and injuring the plates. He suggested that the test should be made by enclosing the plates in soldered metal boxes. These notes were discussed by Profs. Mayer, Hallock, Van Nardroff, and others.

By permission of the Section Mr. C. C. Trowbridge read a paper entitled 'The Use of the Hair Hygrometer,' which will be published in this JOURNAL.

W. HALLOCK,
Secretary of Section.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, APRIL 14.

IN connection with the presentation of a collection of recent and fossil Strombidæ Mr. H. A. Pilsbry discussed the ancestry of Strombus Costata and Melongena subcoronata, their relations, fossil species being illustrated by large suites of intermediate forms.

Mr. Jos. Willcox commented on the influence of environment on the species as illustrated by specimens presented. It was apparent that those from the southern coasts of Florida swept by the Gulf Stream were all of a dwarfed type.

Mr. Benj. Sharp related the plentiful occurrence of a tetenophore, Mneopsis Ludyi in a fresh water pond near Nantucket. The embryos had been swept in by an accession of salt water and had accustomed themselves to their new environment. The species did not, however, persist in the pond in consequence probably of the severity of the winter. Specimens of the species referred to were beautifully preserved in a two per cent. solution of formaline.

Mr. Pilsbry announced the finding, by Mr. Chas. Johnson, for the first time, in the Eocene of Texas, of a representative of the genus scalpillum. It is a new species for which the name Chamberlaini was proposed, in recognition of the services of the Rev. Dr. L. T. Chamberlain to paleontological science.

EDW. J. NOLAN,
Recording Secretary.

NORTHWESTERN UNIVERSITY SCIENCE CLUB, APRIL 3.

DR. MARCY in chair. Prof. G. W. Hough presented the topic, 'Instruments for Recording the Time of Astronomical Observations.' He described various steps in the use of electric clock signals and the methods of mechanical record of such signals. After explaining a number of contrivances for securing uniform circular motion he described his printing chronograph, which prints with type the minutes, seconds, and hundredths of seconds of the time of the observation. The instrument has been in use since 1871, is easily kept in order, and has a great advantage over the recording chronograph in saving labor in meridian observations.

In the discussion Prof. Crew described devices used in securing uniform circular motion for chronographs at Johns Hopkins and at Lick Observatory.

A. R. CROOK,
Secretary.

EVANSTON, ILL.

NEW BOOKS.

Electric Lighting. Volume I. *The Generating Plant*: FRANCIS B. CROCKER. New York, D. Van Nostrand Co.; London, E. and F. N. Spon. 1896. Pp. viii+444.

Mathematical Papers read at the International Mathematical Congress. Edited by E. HASTINGS MOORE, OSKAR BOLZA, HEINRICH MASCHKE, HENRY S. WHITE. New York, Macmillan & Co., for the American Mathematical Society. 1896. Pp. xvi+411. $4.00.

Wages and Capital. F. W. TAUSSIG. New York, D. Appleton & Co. 1896. Pp. xviii +325.

Ruhmkorff Induction-Coils. H. S. MORRIE. New York, Spon and Chamberlain. 1896. Pp. xviii+183.