

SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE
OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE

FRIDAY, MAY 17, 1907

CONTENTS

<i>The Geological Society of America:</i> DR. EDMUND OTIS HOVEY	761
<i>Zoology at the New York Meeting, II.:</i> PROFESSOR C. JUDSON HERRICK	775
<i>Scientific Books:—</i>	
<i>Pillsbury on Attention:</i> PROFESSOR JOSEPH JASTROW. <i>Whipple on the Value of Pure Water:</i> PROFESSOR W. P. MASON. <i>Starke on Alcohol:</i> DR. GRAHAM LUSK	785
<i>Scientific Journals and Articles.....</i>	787
<i>Societies and Academies:—</i>	
<i>The American Mathematical Society:</i> PROFESSOR F. N. COLE. <i>Northeastern Section of the American Chemical Society:</i> PROFESSOR FRANK H. THORP	789
<i>Discussion and Correspondence:—</i>	
<i>The First Reviser of Species:</i> PROFESSOR S. W. WILLISTON. <i>Types of Genera by First Species:</i> DR. HARRISON G. DYAR. <i>A Sheep-goat Hybrid:</i> DR. W. J. SPILLMAN	790
<i>Special Articles:—</i>	
<i>The Significance of Latent Characters:</i> DR. GEORGE HARRISON SHULL	792
<i>Current Notes on Meteorology and Climatology:—</i>	
<i>The Lop-Nor Desert; Franklin, the Kite and the Lightning-rod:</i> PROFESSOR R. DEC. WARD	794
<i>A Monument to Lamarck</i>	795
<i>The Seventh International Zoological Congress</i>	795
<i>Scientific Notes and News</i>	797
<i>University and Educational News.....</i>	800

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE GEOLOGICAL SOCIETY OF AMERICA¹

THE New York meeting was the largest in the history of the society, the number of fellows and fellows-elect in attendance being 133. The sessions began Thursday afternoon at Columbia University with the business meeting and the reading of memorials and were continued through Friday and Saturday at the American Museum of Natural History. Six titles were added to the printed list, making eighty-six papers in all on the program as offered. On account of the long list of communications, the sessions were held in two sections on Friday and Saturday, but even with this arrangement twenty-nine papers were read by title only, and most of the remainder were read in abbreviated form.

The council accepted the invitation of the University of New Mexico to hold the annual meeting of 1907 at Albuquerque, New Mexico, beginning December 30, 1907. It was felt that a meeting in the west would be of interest and advantage to the society at large, since it would give an opportunity for a general convention of the whole society, the Cordilleran section having intimated its willingness to meet in Albuquerque, if the general society were to meet there.

The society will hold no summer meeting this year, but the fellows have been invited to join with Section E of the American Association for the Advancement of Science in a field meeting near Plattsburgh, N. Y.

¹ Meeting in New York, December 27-29, 1906.

The following is the list of nominations for officers for 1908:

President—Samuel Calvin, Iowa City, Iowa.

First Vice-president—George F. Becker, Washington, D. C.

Second Vice-president—A. C. Lawson, Berkeley, California.

Secretary—Edmund Otis Hovey, New York City.

Treasurer—William Bullock Clark, Baltimore, Md.

Editor—Joseph Stanley-Brown, Cold Spring Harbor, N. Y.

Librarian—H. P. Cushing, Cleveland, Ohio.

Councilors (until 1911)—H. P. Cushing, Cleveland, Ohio, and H. B. Patton, Golden, Colorado.

The following resolutions were adopted in the general session of December 28 at the American Museum of Natural History:

After sixteen years of service as secretary of the Geological Society of America, Professor H. L. Fairchild meets with us at this session for the last time in his official capacity.

These years of his service have witnessed the robust and vigorous growth of this society. To his fidelity, enthusiasm, patience, conservatism and lofty ideals we must ascribe in very large part the virile and promising condition of this society to-day.

The fellows of the Geological Society of America desire to enter on its permanent records this expression of appreciation of such devoted service and this acknowledgment of, and gratitude for, so willing a sacrifice on behalf of the progress of geological science in America.

Since 1891 Dr. I. C. White, now retiring from office, has served as treasurer of this society. For these sixteen years he has given to the management of its finances the benefit of his clear, practical judgment and his experience, and he has so carefully nursed its slender incomes that to-day the treasury of the society presents a most substantial and very gratifying showing.

The fellows of the society desire to record an expression of their appreciation of this watchful, faithful and profitable service.

The program as read was as follows:

Memorial of W. B. Dwight, by F. J. H. Merrill.

Memorial of S. L. Penfield, by J. P. Iddings.

Memorial of I. C. Russell, by Bailey Willis.

Memorial of N. S. Shaler, by J. E. Wolff.

Cutting of the Mississippi and Missouri River Gorges: N. M. FENNEMAN. Read by title.

Lateral Erosion on some Michigan Rivers: MARK S. W. JEFFERSON. Read by title.

Graded Surfaces: F. P. GULLIVER.

The author discussed the processes of aggradation and degradation, and the forms of surfaces produced. Various terms for different forms were considered. Examples of graded surfaces were given from Pennsylvania, New York and New England which show the necessity for greater precision in the use of certain terms, such as terrace, grade-level, base-level, etc.

The New Madrid Earthquake: M. L. FULLER and E. M. SHEPARD. Read by title.

Physiography of the Lower Hudson Valley: J. F. KEMP.

Series of borings across the bottom of the Hudson River in and above the Highlands have recently shown that the bed-rock is unexpectedly deep. Other borings across its tributaries lead to the same conclusion. From these and observations in the field the writer showed a quite profound canyon for the Hudson, which coincides fairly well with the one already known to exist, opposite its mouth and in the continental shelf. The records are used through the courtesy of J. Waldo Smith, C.E., chief engineer of the Board of Water Supply of New York City.

Professor Kemp's paper was discussed by Professors Willis and Davis.

Relations of Physiography to Structure at Manhattan Island and Vicinity: ALEXIS A. JULIEN.

The paper discussed: (1) Palisades of the Hudson; latent minute foliation or flow structure; development of horizontal seams; facility of ice plucking; zone of decay; undercutting of columns; measure

of depth of ice plucking and of age of decayed sheet. (2) Faults at Manhattan; ordinary effects and evidences; system of probable faults in this region; fault blocks on each side of the Hudson gorge. (3) Causes of early divergence of Hudson River into Hackensack Valley, two obstacles; early drainage system over Mesozoic terrane, Manhattan River; later drainage system over the Manhattan region, creeks in fault valleys; successive advances of the Hudson into series of preglacial channel gorges through and around Manhattan Island.

Professor Julien's paper was discussed by Professors Hobbs and Davis.

Geologic Map of North America: BAILEY WILLIS.

Exhibition and description of the map compiled in 1906 for the tenth International Geological Congress.

Professor Willis's paper was discussed by Professors Davis and F. D. Adams.

The Geologic Folio: WILLIAM HERBERT HOBBS.

A discussion of the advantages and disadvantages of the geologic folio as a medium for publication of geologic data.

Professor Hobbs's paper was discussed by Dr. Walcott.

Geological Map of Massachusetts and Rhode Island: B. K. EMERSON.

The map is on the scale of four inches to the mile, presenting with considerable detail the latest results reached in the study of the geology of these states. The author has had access to most of the material gathered by others in the parts of the territory not covered by his own special studies.

Professor Emerson's paper was read by title only, but the map was displayed in the Academy of Science exhibition in the museum.

The Cobalt, Ont., Silver Area: WILLET G. MILLER.

At the Philadelphia meeting of this society two years ago, the writer presented a short paper on the geology of the Temiskaming cobalt-silver area. Since that time the ore deposits of the area have attracted wide attention, not only from the unique character, on this continent, of the ores, but also from their great richness. The present paper contains further details concerning the character and relationship of the veins, and of the rocks. It was illustrated by lantern views, by a model of the more productive part of the area, and by a recently completed map on the scale of 400 feet to an inch with contour intervals of ten feet.

Professor Miller's paper was discussed by Professors Emmons, Bell and Buckley.

Virginia Barite Deposits: THOMAS LEONARD WATSON. Read by title.

Geology of Santa Barbara and Summerland Oil Field, California: RALPH ARNOLD. No abstract received.

Professor Arnold's paper was discussed by Professors Bell and Martin.

Personal Reminiscences of Sir William E. Logan: ROBERT BELL. Read by title.

Memorial of A. R. C. Selwyn: H. M. AMI.

Selwyn was a geologist who attained distinction for his work in Great Britain, Australia and British America. In 1845 he began his researches in England and Wales, in 1853 was appointed director of the Geological Survey of Victoria, Australia, and in 1869 succeeded Sir William E. Logan as director of the Geological Survey of Canada. Volcanic rocks and their relations to the earlier sedimentary formations formed the principal object of his energies in these three portions of the empire, whilst he did much to emphasize the economic relations of these groups to pure geological investi-

gations. In America Selwyn wrought from December, 1869, to January, 1895, a period of twenty-five years. He traversed the continent before the transcontinental lines of railways were built and directed the efforts of his staff to many of the portions of Canada whose resources to-day prove of such remarkable value. He received many distinctions at home and abroad.

Cave-Sandstone Deposits of the Southern Ozarks: A. H. PURDUE.

The rocks exposed within the area treated of in this paper are of Ordovician, Devonian and Carboniferous ages. Near the top of the Ordovician of the area is an unconformity upon which the Upper St. Peter sandstone is put down. Those portions of the sandstone that are put down in basins and cistern-like depressions are frequently preserved from erosion and stand up as conspicuous sandstone masses. Below this horizon, and at different levels in the Ordovician limestone, standing up on the sides of the ravines, are numerous large sandstone masses, similar to those already mentioned. These sometimes occur singly and sometimes collectively, one above the other. For several reasons, which are stated, these are considered to be cave deposits. The sandstone is of the same general character as that constituting the St. Peter, and is supposed to be of the same age. The manner of introduction of the sand and the age of the caverns was considered.

Professor Purdue's paper was discussed by Professors Grabau, Jaggar, Willis, H. C. Hovey, Fuller, Hopkins and Davis.

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

The principal object of presenting the paper was to show the society some photographs of these three volcanoes which were taken upon excursions made in connection

with the meeting of the tenth International Geological Congress in the City of Mexico, in September, 1906.

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. The volcano of Popocatepetl shows its composite character as a strato-volcano with great clearness 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 earlier eruptions and has led some observers to the erroneous conclusion that flows of lava have not occurred at the volcano of Colima.

Current Methods of Observing Volcanic Eruptions: T. A. JAGGAR, JR.

Dana's 'Characteristics of Volcanoes,' based on the Hawaiian Islands, and books with a Vesuvian bias have given undue importance to lava in volcanology. As a result, active volcanoes have recently been interpreted almost invariably as being actuated by a rising lava column as first cause of their explosions. Such interpretation may be correct, but the evidence needs careful sifting in every case, with the alternative possibility in view, namely: (1) That tectonic causes precede magmatic phenomena, (2) that release of superheated steam may be the first cause, (3) that new lava may be a secondary product, and may not appear at all.

Another criticism deserved by all current volcanologic research is that the investigations always follow the event, and are wholly unsystematized. Even the Vesuvian observatory publishes nothing in systematic, tabulated form, and no instrumental records that may lead, eventually, to prediction. Reviewing Pelé, Soufrière, Bandaisan, Tarawera and Krakatoa, all had scientific commissions, and in no case did the commission observe the first eruption or its forerunning phenomena. The writer would point out the exceptional opportunity now possessed by the United States for seismo-volcanologic research.

Professor Jaggar's paper was discussed by Professors Reid and Willis.

Experiments Illustrating Erosion and Sedimentation: T. A. JAGGAR, JR.

The first experiments illustrating rill erosion were made in 1899, and described by Dr. E. Howe and the author (21st Annual Report U. S. G. S.). A coarse spray was used, and the miniature streams of water were an inch or more in breadth, eroding models made of sand, marble dust and coal dust. In 1901 a finer spray was used, produced by a direct jet of water deflected from an inclined and embossed surface. An experiment in 'grand canyon' topography was executed with this apparatus by R. W. Stone. Lateral planation and delta sedimentation were well shown. The latest apparatus consists of a series of atomizers operated by compressed air. Digitate drainage of some delicacy of pattern is etched by the rills on a model made of modeling clay or mill slimes. These rivulets apparently reproduce the mechanism of 'bad land' drainage, or that of a newly uplifted coastal plain. The models made hitherto throw new light on the angle of intersection of streams, on piracy, on parallelism of tributaries and on the general principles which govern the migration

of divides. H. G. Ferguson has assisted in the last experiments.

Characteristics of Various Types of Conglomerates: G. R. MANSFIELD. (Introduced by W. M. Davis.)

The paper gave the results of a critical review undertaken in connection with the study of the Roxbury (Boston) conglomerate; examining the descriptions of conglomerates of many ages and countries as to the conditions of their formation.

Mr. Mansfield's paper was discussed by Professors Grabau, Barrell, Miller, C. W. Brown and Davis.

Dome Structure in Conglomerate: RALPH ARNOLD. Abstract not received.

River Sediment as a Factor in Applied Geology: W J MCGEE.

Various recent events and movements render it clear that the sediments transported by rivers require consideration, not merely as a factor in geologic process, but as an industrial factor of much moment. In systematic geology it commonly suffices to deal simply with the stream as a vehicle transporting load in solution, in suspension, and rolled or pushed along the bottom; while in most industrial problems the stream itself is regarded as the primary agency, and the load is commonly neglected, save merely as a disturbing factor. Yet in that constantly increasing control of streams (as sources of power, as supplies of water for irrigation and other purposes, as canals for transportation, etc.) which must eventually result in the complete artificialization of river systems, the load either immediately or remotely governs the character and behavior and ultimate utility of the stream. The bearing of these considerations on such engineering works as those of the lower Mississippi region and on such projects as that of the proposed Lakes-to-Gulf Waterway, is particularly worthy of discussion.

Relations between Climate and River Deposits: JOSEPH BARRELL.

The nature of subaerial river deposits is controlled by the geographic and climatic conditions of origin. The importance of the climatic factor is appreciated by contrasting the nature of deposits accumulating under similar geographic but dissimilar climatic conditions. As a result, where an ancient sedimentary deposit can be shown to be of subaerial origin, if the geographic conditions existing at the time can be allowed for, the climatic conditions of origin may be determinable. To that end, the geographic and climatic influences upon river sediments are examined under three headings: (1) relation of sediments to regions of erosion, (2) effects of transportation, (3) relation of sediments to regions of deposition. Under the latter heading the character of the surface of deposition is considered, and finally the relations of the deposits to four kinds of climates, namely, constantly rainy, intermittently rainy, subarid and arid. The effects of climatic changes upon sedimentation are also considered, and it is concluded that climatic as well as tectonic hypotheses must be considered in interpreting the cause of sedimentary variations.

Continental Origin of the Mauch Chunk Shale: JOSEPH BARRELL.

The discussion of the previous paper allows the presentation of the facts and conclusions of the present one. The Mauch Chunk Shale and the Pocono Sandstone represent the Mississippian, or sub-Carboniferous, in Pennsylvania. The former, consisting of red shales and sandstones, is considered in detail. After a statement of the relations to the underlying and overlying formations the lithologic and structural characters and the nature of the life record are stated. The problem of origin is then discussed, and it is concluded that

within the limits of the anthracite coal fields the entire formation originated as flood-plain deposits on the subaerial surface of a large delta. The climate under which the formation accumulated is next considered, and it is inferred that it was of a subarid character. The long continuance of similar conditions through the Upper Devonian is then indicated, and emphasized by contrast with the opposite character of the coal measures. In this connection, the possible importance of subarid climates upon the evolution of amphibians is suggested.

Professor Barrell's two papers were discussed by Professors David White, Willis, Huntington, Grabau and Davis.

Origin of Ocean Basins in the Light of the New Seismology: WILLIAM HERBERT HOBBS.

A review of the arguments upon which the permanence of the ocean basins has been assumed, with the modifications in them which time has wrought; particularly, however, as a consequence of zoo-geographic, comparative geologic and structural studies. The 'distant' study of earthquakes has shown that they are fifteen to twenty-fold as numerous as formerly supposed, and that over ninety per cent. occur upon the floor of the seas, and appear to proceed from the scarps bordering the great ocean deeps. The data for elevation or depression available within the coral seas have been assembled, and differential vertical movement is thus shown to have been recently the greatest within the zones of earthquakes, as mapped by de Montessus.

Hypothesis of Continental Structure: BAILEY WILLIS. No abstract received.

Mr. Willis's paper was discussed by Professors Heilprin, Schuchert, Emerson and F. E. Wright.

The Limestone Ocean of pre-Cambrian Time: REGINALD A. DALY. Read by title.

Controlling Factors of Artesian Flow: M. L. FULLER.

The rapid extension of well-drilling in granites, schists, slates, etc., in the last few years, and the obtaining in them of true artesian flows at many points, together with the increasing development of wells from uniform unconfined horizontal sands, has made a revision of the commonly accepted 'requisites' of flowing wells desirable. The paper discusses the character of the reservoirs, the sources of water, the confining agents, and the source of pressure, and concludes that the requisites of artesian flows are only three in number: (1) an adequate source of water supply; (2) a retaining agent offering more resistance to the passage of water than the well or other outlet, and (3) an adequate source of pressure. The specific sources of water and head, and the specific character of confining agents are too variable to warrant inclusion in standard requisites.

Conditions of Circulation at the Sea Mills of Cephalonia: M. L. FULLER.

Near Argostoli, on the southern coast of the island of Cephalonia, in Greece, a number of streams have, for an unknown period of time, left the sea and, flowing inland with a volume sufficient to operate two sea mills, finally disappeared in a fissured limestone. To account for the continuous circulation under conditions which preclude any lower outlet, the action of interior heat on an unsymmetrical passage with a short 'inlet' and a long 'outlet' arm was postulated by F. W. and W. O. Crosby. In the longer arm, because of its greater exposure to heat, the water is supposed to be warmer and lighter than in the short arm, thus establishing the necessary conditions for

circulation. A difference of 20 degrees in the average temperature, which may be supposed to occur with a system reaching a depth of 2,000 feet, would give an excess of height amounting to 10.6 feet to the warmer over the colder arm. The writer believes a difference of density (independent of temperature) in the water of the two arms affords a simpler and more effective explanation of the circulation. If the water remained unchanged in composition it would rise in the outlet arm of the passage only to the level of its entrance; but if it became diluted by an admixture of fresh water, the column in the outlet would be higher than in the inlet arm, and the essentials for circulation would be established. The specific gravity of Mediterranean waters is 1.03, hence a column of the sea water 100 feet in length will support a column of fresh water 103 feet high, or of sea water diluted one half by fresh water, a column 101½ feet in height. A depth of 2,000 feet with 50 per cent. dilution would furnish a working head of thirty feet as compared with ten feet under the heat hypothesis, while a head of three fourths of a foot, or enough to establish circulation, would be produced under the same dilution at a depth of fifty feet, or entirely within the zone controlled by atmospheric temperatures.

Mr. Fuller's two papers were discussed by Professors Kemp and Davis.

Normal Pressure Faulting in the Allegheny Plateaus: GEORGE H. ASHLEY. Read by title.

Geological Structure of the Uinta Mountains: S. F. EMMONS.

The Uinta Mountains form a range unique in the Cordilleran system, in that its axis of uplift has an east-west direction, and that it has a typical anticlinal structure. The conditions under which the

range was studied by the fortieth parallel and the Powell surveys in 1869-74 were reviewed and the reasons given why those studies were necessarily incomplete. After referring to articles on separate parts of the range by J. D. Irving (1896) and Chas. P. Berkey (1905), the writer gave the conclusions he has been able to arrive at with regard to its structure, and the age of the older beds involved in the anticlinal fold; together with some remarks on a new type of topographic relief, as the result of field studies made by him in company with Mr. F. B. Weeks, during the summer of 1906.

Stratigraphy and Structure of the Uinta Mountains: F. B. WEEKS. Read by title.

Structure of the Franklin Mountains, Texas: G. B. RICHARDSON. (Introduced by C. W. Hayes.)

The Franklin Mountains are the southern extremity of the long narrow range, known locally by different names, that extends southward from the Rocky Mountains, east of the Rio Grande, as far as El Paso. They are composed of sedimentary and igneous rocks which range in age from pre-Cambrian to Cretaceous. The strata dip westward from 20 to 75 degrees, and the mountains as a whole have the appearance of a block of the Basin Range type. The distribution of the strata shows that the range is traversed by a complex system of faults. Detailed sections of this uncommon structure were given.

Probable Age of the Meguma (Gold-bearing) Series of Nova Scotia: J. E. WOODMAN. Read by title.

Artificial Production of Gneissic Structures by Crystallization under Stress: FRED. EUGENE WRIGHT.

The generally accepted theory of the formation of gneissic and schistose structures, as it has been developed, especially by Van Hise, F. Becke and others, postu-

lates stress as a fundamental factor controlling the direction of crystal growth. Experiments with silicate glasses of diopside, wollastonite and other prismatic or tabular minerals, carried out in the geophysical laboratory of the Carnegie Institute, have shown that crystallization can be made to proceed in the glasses at a temperature much below the melting point of the individual minerals, and while the glass is still in a highly viscous state and capable of sustaining a considerable amount of applied mechanical stress. Glasses of these minerals were thus crystallized under stresses acting either in one direction or in two directions normal to each other, and a parallel arrangement of the prismatic crystals along definite planes or lines produced similar to that which characterize gneisses and schists. More recent experiments have also been performed with a view of obtaining a more definite idea of the order of magnitude of pressure necessary to influence and control the direction of crystal growth in such aggregates, and will be described briefly.

Origin of Meteor Crater (Coon Butte), Arizona: H. L. FAIRCHILD.

Four years of exploration and deep boring in and about the famous crateriform basin in Arizona have revealed interesting facts tending to establish the 'meteor theory' of its origin.

The Afton Craters: W. T. LEE.

Two depressions, locally known as the Afton craters, occur in southern New Mexico, west of the Rio Grande, in the midst of a broad sand plain which represents the aggraded floor of the ancient Rio Grande. The craters are comparable in size and character with 'Coon Butte' and the crater of Zuñi Salt Lake. They differ notably from ordinary volcanic craters, but are situated in a region of recent volcanic ac-

tion and are closely associated with crater cones of the ordinary type.

The geology of the surrounding regions indicates that the craters may be underlain by beds of salt, gypsum and limestone, the removal of which, by solution, may in part account for the depressions. The crater rims, however, composed of the material of the plain commingled with volcanic cinders, yield unmistakable evidences of explosive action, from which the inference is drawn that the craters are probably best explained as due to explosions of steam or other volcanic gases.

Volcanic Necks of the Mt. Taylor Region, New Mexico: D. W. JOHNSON. (Introduced by W. M. Davis.)

Some doubt has been expressed as to the correctness of interpreting as volcanic necks certain buttes which show vertical columnar structure, and which are surrounded at lower levels by undisturbed sedimentary beds. The Devil's Tower, of Wyoming, has been referred to a laccolithic origin, in part at least, because it shows the features mentioned, and the interpretation of buttes of the Mt. Taylor region as necks has been questioned. The paper presents evidence to show that the buttes of the Mt. Taylor region are undoubted volcanic necks, surrounded by undisturbed sediments, and exhibiting vertical columnar structure in many cases. The general history of the vulcanism and erosion of the region is considered, and the structural details of the neck discussed.

Earth-flows at the Time of the San Francisco Earthquake: ROBERT ANDERSON. (Introduced by Ralph Arnold.)

This paper treats of a variety of landslides caused by the concentration of water at certain points near the surface of gentle or steep slopes. Earth-flows are defined as slides or flows of portions of the surface of

slopes where the surface material has been saturated, loosened and weighted down and caused to cave away and flow or creep as a semi-fluid mass. They are distinguished from *avalanches* or comparatively dry landslides of otherwise loosened material. A number of instances are described and emphasis is given to their importance as initial factors in the formation of drainage lines.

Radio-activity of the Thermal Waters of Yellowstone National Park: HERMAN SCHLUNDT and RICHARD B. MOORE. (Introduced by C. W. Hayes.) No abstract received.

A Lower Huronian Ice Age: A. P. COLEMAN.

Since the final proof of the Permian glacial period of India, Australia and South Africa, more attention is being paid to the evidences of still more ancient glaciations, *e. g.*, in Cambrian times. For years the writer has believed that the 'slate conglomerate' at the base of the Lower Huronian of Canada is glacial, since it contains angular and subangular boulders of all sizes up to cubic yards, enclosed in an unstratified matrix. These boulders are often miles from any possible source. Recently, striated stones have been broken out of their matrix in the Lower Huronian of the Cobalt silver region, giving still stronger proofs that the formation is an ancient boulder clay. The results of this investigation have an important bearing on the earth's early history, since the Lower Huronian has only one known formation before it, the Keewatin. The earth's internal heat was not sufficient at that time to prevent the formation of an ice sheet in latitude 46 degrees.

Professor Coleman's paper was discussed by Professors Miller, Salisbury, Lane, Bell and Clapp.

Glaciation of Manhattan Island, New York:
ALEXIS A. JULIEN. Read by title.

Glacial Erosion in the Northford: MARK
S. W. JEFFERSON. Read by title.

Recent Changes in the Glaciers of Glacier Bay, Alaska: F. E. and C. W. WRIGHT.

A general geologic reconnaissance of Glacier Bay, Alaska, was made by the writers, assisted by Mr. R. W. Pumpelly, during the past summer. In the course of their investigations the existing glaciers were remapped and studied with special reference to the changes which have taken place since 1891, when a careful topographical survey was made of them by Dr. H. Fielding Reid. It was found that, in general, recession and melting on a remarkable scale have prevailed, although local advance was observed at several points. Comparative photographs were presented showing these changes and the causes were discussed which have probably been active in producing such effects. Incidentally, several phases of glacial sculpture were briefly described, also a new photo-topographic method which was applied to this region and found well adapted to work of such character.

Professor Wright's paper was discussed by Professors Blake, Reid, Gulliver and G. F. Wright.

Recent Changes in the Malaspina and other Glaciers of the Yakutat Bay Region, Alaska: RALPH S. TARR.

In the interval between September, 1905, and June, 1906, the eastern (Marvine) lobe of the Malaspina glacier and several smaller glaciers in the Yakutat Bay region have advanced so rapidly as to break the ice into a sea of crevasses. Glaciers which were easily traversed in 1905 are now practically impassable. This paper describes these changes, shows comparative illustrations of the conditions in the two seasons, discusses

the phenomena associated with the change, proves that the forward movement is still in progress, and discusses the cause of this remarkable change, suggesting its relation to the vigorous earthquake action.

Professor Tarr's paper was discussed by Professors Jaggar, Reid and Brooks.

The Glacier of the Lebanon Mountains: G.
FREDERICK WRIGHT.

In the autumn of 1905, in company with Professor A. E. Day, of the Syrian Protestant College of Beirut, the author took a horseback excursion of several days, leading diagonally from Beirut to the cedars of Lebanon. The results of his observations were to demonstrate, from the lack of glacial phenomena, and from the character of eroded surface, that there had been no general glaciation of these mountains. But it was clearly evident that a single glacier had extended from the highest summit of the range (10,000 feet above the sea) five or six miles down the valley of the Kadisha River, and lingered long enough to build up a terminal moraine three miles wide and four miles long and one thousand feet in thickness. Upon the surface of the upper end of this moraine the famous grove of the cedars of Lebanon is now to be found. Many subsidiary observations were recorded in correction of erroneous views which have been entertained.

Professor Wright's paper was discussed by Dr. H. C. Hovey and Professor G. F. Wright.

Ice Present during the Formation of Glacial Terraces: F. P. GULLIVER.

This paper described with maps and lantern slides some glacial deposits along the Connecticut, Thames and Quinnebaug rivers, which have usually been classed with the terraces formed by the down-cutting of the rivers. An example of terraces which have surely been carved by river action is found on the Westfield river

west of Springfield, Mass. The deposits described along the Connecticut rivers were contrasted with those found at Westfield, and it was shown that they must have been formed before the ice had completely melted from the valleys. These deposits were therefore forms of aggradation and not forms produced by degradation. Typical eskers, deltas and kettle-holes are associated with these so-called terraces; and even where these deposits have the characteristic form of river-cut terraces, cross sections as revealed by railway or other cuts show delta structure rather than the structure of alluvial flood plains. The delta lobes point either down stream or into side valleys, and there are frequently found unfilled portions of the main pre-glacial valley and of its tributaries, below the level of the delta-terrace, between the delta-terrace and the rock walls of the older valley.

Dr. Gulliver's paper was discussed by Professors Clapp, Salisbury, Leverett and Alden.

Discovery of Cambrian Rocks in South-eastern California: N. H. DARTON. Read by title.

Limestones of Westchester and Putnam Counties, New York: CHARLES P. BERKEY.

In the course of detailed areal mapping of the Tarrytown and West Point quadrangles, opportunity has been offered for extensive study of the variations and comparisons of the relationships of the formations characteristic of the Highlands region of New York. Certain constants of relation and character together with the causes for occasional variability and abnormal occurrences were discussed in this paper, and their bearing upon further stratigraphic and structural work suggested.

The Galena Series: FREDERICK W. SARDESON.

The so-called Trenton and the Galena formations of the Galena series in Wisconsin, Illinois, Iowa and Minnesota were discussed in regard to their present and original wide extent and uniform thickness. The lithologic diversity and the faunally uniform condition of the parts of the series were briefly considered. The relation which the naming of these formations has borne to the formational uniformity was outlined. The value of the Beloit formation as a geologic unit was followed by a like discussion of the Platteville limestone, leading to the question of expediency in using lithologic, as against paleontologic, evidence, as the basis for geologic formational units, in regard to the Galena series in particular, and somewhat as to formations in general.

Age and Stratigraphic Relations of the Chattanooga Black Shale: AMADEUS W. GRABAU.

Recent studies made of the principal sections of the Black Shale in the southern Appalachians have convinced the author that the reported hiatus between the Black Shale and the overlying formations does not exist, and that hence the age of the shale needs to be reconsidered. The facts bearing on this problem, together with an outline of the corresponding paleogeographic conditions of eastern United States as interpreted by the author, were presented.

The Medina Sandstone Problem: AMADEUS W. GRABAU.

Following up the line of investigation which led the author, at the Philadelphia meeting of the society, to announce his conclusions that the Oneida conglomerate is of late Medina age, and the Shawangunk conglomerate is of Salina age (since confirmed by the finding by the New York Survey of a Salina fauna in this conglomerate), the present communication deals more especially with the mode of formation of these sandstones and conglomerates.

The structural and stratigraphic evidence, pointing to a continental origin (river and æolian) of portions of these sandstones were given, and further evidence presented which seems to indicate that part of the accumulation of these sands began in Ordovician time.

Paleogeography of the American Devonian:

CHARLES SCHUCHERT.

A series of lantern slides was shown, illustrating the relation of the seas and lands of Helderbergian, Oriskanian, Onondaga, Hamilton and Chemung times.

Carboniferous of the Appalachian Basin:

JOHN J. STEVENSON. Read by title.

Coal Measures and Higher Beds of South Brazil: I. C. WHITE.

The author showed that a great system of rocks (the Santa Catharina system) exists in South Brazil, covering large areas in the states of Rio Grande do Sul, Santa Catharina, Parana and S. Paulo, entirely comparable to the Karroo system of South Africa. Also that, like South Africa, Brazil had its Glacial epoch succeeding the deposition of the Coal Measures, the 'Dwyka' and 'Talchir' conglomerates of Africa and India being paralleled by the Orleans conglomerate of South Brazil; that the Brazilian Coal Measure flora, as described by Mr. David White, is the same as that of the Coal Measures in South Africa, India and other southern regions during Permian time, and also that the reptilian fauna, as described by Dr. J. H. McGregor and Dr. A. Smith Woodward, is the same as that characterizing the South African beds. In other words, that the 'Gondwanaland' of the Indian geologists not only extended into Africa, but crossing from the latter into South America, most probably encircled in a broad belt the entire southern hemisphere.

Permo-carboniferous Climatic Changes in Brazilian South America, as indicated by Fossil Plants: DAVID WHITE.

The paper presented the conclusions, drawn from a study of the fossil plants, respecting Permo-carboniferous glaciation in Brazil, subsequent Permian climatic changes, and probable geographic relations of the southern portion of the continent, both to the Indo-Africo-Australian 'Gondwana Land' and to the northern land masses.

Structure of the Deep River Triassic: COLLIER COBB. Read by title.

Red Beds of Oklahoma and Adjacent States: CHARLES NEWTON GOULD. Read by title.

Stratigraphic Relations in Central Wyoming: N. H. DARTON. Read by title.

Correlation of the Triassic Trap Rocks of New Jersey: J. VOLNEY LEWIS. Read by title.

Pleistocene Glacial Phenomena of the Bolivian Plateau: W. G. TIGHT.

The paper described the topography and glacial deposits in the vicinity of La Paz, and the Cordillera Real east of the Lake Titicaca basin, and established the fact that in Quaternary times the Bolivian plateau region was subjected to three distinct stages of glaciation with well-marked interglacial periods. The paper also described the characters of the great basin south of the lake Titicaca region which was the floor of a very extensive glacial lake. The old beaches occur in three sets which are correlated with the three stages of glaciation of the plateau.

Preglacial Drainage in the Mississippi Valley, A Working Hypothesis: W. G. TIGHT.

The hypothesis proposes that the present Mississippi, Ohio and Missouri drainage

systems are of early Quaternary origin. That prior to the first ice invasion of the Quaternary the whole upper Mississippi drainage was to the north into the Hudson Bay. The movement of the ice into this basin advanced upon a rising plane. The margin of the ice was generally uniform and attenuated. The impounding of the drainage waters resulted in extensive frontal lakes. Sluggish action of the ice and poorly developed moraines, extensive sheets of extra morainic drift, slow movement of the waters from the ice front with deposition of loess and with general aggradation along the stream courses, the modification of preglacial topography and profound changes in drainage were some of the resultants. A new outlet to the south along the line of the present Mississippi over a low col between the southern end of the Appalachians and the Ozarks, was established and the general plan of the present drainage lines of the Mississippi basin developed. The later ice invasion of the Quaternary into the basin followed the establishment of gradients and developed the general lobate form of the margin characteristic of these invasions and produced only local and minor frontal lake phenomena south of the continental divide which was later discovered by the recession of the ice. The development of strong lobate moraines, the distribution of but a small amount of extra morainic drift, and the vigorous action of the streams discharging from the later ice fronts, were characteristic phenomena. The paper recited some of the evidence in support of the hypothesis and asked for more careful observation of the phenomena upon which data must be collected to prove or disprove the hypothesis.

Professor Tight's paper was discussed by Messrs. Leverett and Carney.

Glacial Flowage over New England: J. B. WOODWORTH. Read by title.

Quaternary Changes of Level in New England: FREDERICK G. CLAPP. No abstract received.

Mr. Clapp's paper was discussed by Professors Leverett, Hitchcock, Alden and Ami.

Glacial Lake Memphremagog: C. H. HITCHCOCK.

The existence of this lake was pointed out at the meeting of the Geological Society of America in 1894 (*Bull. Geol. Soc. Am.*, Vol. 6). Recent studies show that it was tributary to Glacial Lake Champlain by way of both the La Moille and Winooki valleys. When the ice filled the Champlain valley to the depth of a thousand feet, the impounded water upon the east side could have reached the Connecticut valley by way of White River.

Professor Hitchcock's paper was discussed by Professors G. F. Wright and Richardson.

Pre-Wisconsin Drift in the Finger Lake Region of New York: FRANK CARNEY. No abstract received. (Introduced by H. L. Fairchild.)

Mr. Carney's paper was discussed by Professors Tarr, Clapp and Leverett.

Wave-cut Terraces in Keuka Valley Older than the Recession Stage of Wisconsin Ice: FRANK CARNEY. No abstract received. (Introduced by H. L. Fairchild.)

Mr. Carney's paper was discussed by Professor Clapp.

Deposits of Glacial Age in the Non-glaciated regions of Central Asia: ELLSWORTH HUNTINGTON.

Different rates of weathering, and consequently of erosion and deposition, during glacial as opposed to inter-glacial epochs in arid regions appear to cause the alternate deposition and erosion of gravel beds

in the bottoms of all the valleys, whether connected with glaciers or not. The process gives rise to a series of terraces, uniform over wide areas. Such terraces have often, and probably wrongly, been interpreted as evidence of earth movements. In the self-contained basins of Central Asia glacial epochs were characterized by enlarged lakes in which greenish clays were deposited; inter-glacial epochs by diminished lakes and by the deposition of reddish, subaerial strata upon the previous lacustrine clays. A study of such alternating lacustrine and subaerial deposits in three widely separated regions leads to the conclusion that the glacial period consisted of an *increasingly* severe series of climatic oscillations preceding the well-known *decreasingly* severe series. Coal and iron ore occur interbedded with lake deposits. This suggests that some of the coal beds of more ancient times may indicate rapid changes of climate such as those of the Pleistocene and Permian glacial periods.

Some Results from the Study of the Cambrian Brachiopoda: CHAS. D. WALCOTT. Read by title.

Cryptozoon: Genera, Species, Relationships: HENRY M. SEELY. Read by title.

Crustacean Fauna of the Shawangunk Grit in Eastern New York: JOHN M. CLARKE. Read by title.

Additional Footprints from the Carboniferous Shales of Massachusetts: J. B. WOODWORTH. Read by title.

Occurrence of Unusually Large Calcite Crystals in New York State: D. H. NEWLAND. Read by title.

Origin of the Lead and Zinc Ores in Missouri: E. R. BUCKLEY. No abstract received.

Professor Buckley's paper was discussed by Drs. H. C. Hovey and Ami.

Asymmetric Differentiation in a Syenite Batholith: H. P. CUSHING.

This syenite occurs in the mid-Adirondack region, occupying some 100 square miles of surface. The normal rock is a highly feldspathic one, with about sixty-three per cent. of silica. It is one of the great pre-Cambrian intrusives of the region, of later date than the Grenville sediments, and the Laurentian granite gneiss. It shows contacts against anorthosite and Grenville calcareous sediments on one side, when it becomes basic, with a high content of ferro-magnesian minerals; on another side it cuts Laurentian granite gneisses and becomes acidic, approaching a granite in character and composition. In this granite portion is a considerable anorthosite inclusion, surrounded by basic syenite, which grades into the normal acid variety. The relations seem to point to incorporation and assimilation of the adjacent rocks as the cause of the asymmetry of the batholith. Intermediate rocks, such as anorthosite soaked with syenite, are also found.

Professor Cushing's paper was discussed by Dr. Lane.

Formation of Leucite in Igneous Rocks: HENRY S. WASHINGTON. Read by title.

Genetic Connections of Some Granitic Dikes: ALFRED C. LANE.

Near Huron Mountain, Marquette County, the hornblende gneisses and schists are cut by series of red granitic dikes. The coarser pegmatitic ones cut the finer, and may be regarded as products of the same magma when the country rock had been heated up and the magma cooled.

Different Manifestations of the Ophitic Texture: ALFRED C. LANE.

The ophitic texture results when idiomorphic feldspar is embedded in augite crystals. These in their growth crowd before them corroded remnants of olivine,

etc. Specimens were shown illustrating the mottled effect which this texture gives to the rock under various conditions, from those of the 'luster-mottled melaphyre' to those of the 'varioid greenstone.' The origin of the mottling is partly the ready alteration of the olivine, partly the porosity between the augite crystals. This latter character may be rather characteristic of the effusives.

Occurrence of Diamonds in North America:
GEORGE F. KUNZ. Read by title.

*Silver-gold Ores at San Pedro de Guana-
cevi, Durango, Mex.:* FREDERICK B.
PECK. No abstract received.

*Perspective View of the Submarine Canyon
of the Hudson River:* J. W. SPENCER.
Read by title. (Read before Section E,
American Association for the Advance-
ment of Science, December 31.)

*Titaniferous Basalts of the Western Medi-
terranean.* H. S. WASHINGTON. Read
by title.

The Paleozoic Section of the Upper Yukon:
A. H. BROOKS and E. M. KINDLE. Read
by title.

*Stratigraphic Succession North of Cook In-
let, Alaska:* SIDNEY PAIGE and ADOLPH
KNOPP. (Introduced by A. H. Brooks.)
Read by title.

*Seismological Observations in the United
States:* H. F. REID. Read by title.

*Peale's Painting of the Exhuming of the
First American Mastodon:* ARTHUR BIB-
BINS. Read by title. (Read before Sec-
tion E, American Association for the
Advancement of Science, December 31.)

*Relations of the Ithaca and Chemung
Faunas of Western Maryland:* C. K.
SWARTZ. Read by title.

EDMUND OTIS HOVEY.

ZOOLOGY AT THE NEW YORK MEETING II.

*The Order of Appearance of the Ambu-
lacrall Appendages in Holothuria flori-
dana Pourtalès:*¹ CHARLES L. EDWARDS.

Tentacles.—During the fourth day the embryo has a primitive symmetry of four tentacles; one placed in the mid dorsal interradius arising from the left dorsal radial canal, one in the right dorsal interradius from the right ventral radial canal, one in the right ventral interradius from the mid ventral radial canal and one in the left dorsal interradius from the left ventral radial canal. During the fifth and last day within the vitelline membrane, the embryo buds a fifth tentacle into the left ventral interradius from the mid ventral radial canal. In this condition the Holothurid hatches during the sixth day but it is not until the eighth day that the fifth tentacle has grown to the size of the four primitive tentacles. On the fortieth day a sixth tentacle develops in the right ventral interradius from the right ventral radial canal. From the forty-second to the forty-fifth days the next three tentacles appear; the seventh, in the left ventral interradius, from the left ventral radial canal, the eighth, in the mid dorsal interradius from the right dorsal radial canal and the ninth, in either the right or left dorsal interradius, from the right or left dorsal radial canal, respectively. On the fifty-third day the tenth tentacle appears in the dorsal interradius opposite to that in which the ninth has developed. On the seventy-fifth day the eleventh tentacle appears in the mid dorsal interradius.

Pedicels and Papillæ.—The first pedicel has budded from the posterior end of the

¹ Formerly identified as *Mülleria agassizii* Sel. —Edwards, C. L., 'Notes on the Embryology of *Mülleria Agassizii* Sel., a Holothurian common at Green Turtle Cay, Bahamas,' Johns Hopkins Univ. Circ., 1889, Vol. VIII., p. 37.