SCIENCE

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CONTENTS:

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

MEETING OF SECTION E OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND OF THE GEOLOGICAL SOCIETY OF AMERICA.

PAPERS READ BEFORE SECTION E.

An American Geographers Union: WM. M. DAVIS.

There is to-day no geographical society in the United States of organization and rank similar to those of the Geological Society of America. It is believed that the advance of geographical science would be promoted by the organization of a professional society in which only those who have published papers based on original observation should be eligible to membership. A method of beginning the organization of such a society is suggested.

The Concentration of Geographical Publications: ISRAEL C. RUSSELL. (Read by title.)

The immediate welfare and future development of geographical science demand that there shall be a union or concentration of the several journals, proceedings, magazines, etc., now issued by geographical societies in North America, and one well-written, well-edited, well-illustrated and well-printed monthly magazine issued. Some of the advantages of such centralization are:

The convenience of reading or consulting one publication instead of many.

Less expense, as may be judged, of issuing one publication in place of several.

The much less expense to subscribers of one publication instead of ten or more as at present.

The larger audience to be secured by one centralized bureau of publication than by any one

and, as there seems no doubt, all of its component bureaus.

Greater promptness in the publication of results in a monthly magazine than in quarterly, annual or occasional journals, etc., as is now the case in several instances.

A larger and more important audience to be addressed on geographical themes, and hence greater inducement for careful preparation and greater care in writing.

Greater dignity and greater influence of one strong publication than of many, several of which are weak.

The employment of one instead of several editors, thus saving both time and money.

Greater revenues to be expected from advertisements from one widely circulated magazine than in the case of several local journals, etc., as at present, but few of which derive any assistance from this source.

The greater inducements which one widely circulated magazine would have in securing contributions from distinguished investigators, well-known explorers, etc., over a less widely distributed publication.

The probability that the proposed magazine, on account of its increased earning power over that of the several local publications now issued, would be able to pay for leading articles.

Important also is the fact that the concentration of geographical literature in one series of volumes, instead of several independent series as at present, would be conducive to the saving of time and energy on the part of all future generations of geographers who may wish to consult the writings of their predecessors. In order to gain these many and great advantages, geographical societies are asked to relinquish some of their purely local interests and look for compensation for such losses in the wider diffusion of geographical information and a more general awakening to an interest in geographical work.

Fossiliferous Sandstone Dikes in the Eocene of Tennessee and Kentucky: L. C. Glenn.

Fossiliferous sandstone dikes are found to occur in basal Eocene clays in Tennessee and Kentucky. The dikes have no definite orientation. They vary in width from mere stringers to masses several feet in width. The fossils are casts and are of Eocene aspect. The sands filling the fissures are micaceous and are regarded as derived from certain Eocene sands interbedded with the clays. There is no definite evidence as to their mode of origin, but as the region has recently suffered repeated earthquake shocks, it seems probable that it has similarly suffered in the past and that the fissures are of earthquake origin.

The Fauna of the Potter Creek Cave: W. J. Sinclair. Presented by J. C. Merriam. (Illustrated with lantern slides.)

The Potter Creek cave contains fossil remains representing a Quaternary fauna which has heretofore been very imperfectly known. Recent explorations in this and adjacent caves have brought to light over fifty species of mammals and birds. Of this number many forms are new. The paper treats of the occurrence of the remains and the general relationship of the fauna.

Evidence of Recent Differential Movement along the New England Coast: Geo. Carroll Curtis. (Read by title.)

Evidence of change of level of the land in respect to the sea in recent geologic time has been noted by Shaler, De Geer, Stone and Willis. Davis has described a coastal plain of recent origin in the vicinity of Portland. Tarr and Woodworth lately report shore lines on Cape Anne up to eighty feet. A range of earlier shore margins from a few feet above tide in Boston Bay to 1,300 feet or more on Mount Desert has thus been recorded. Detail study within this zone, however, indicates that these movements have not been continuous. On Monhegan Island, ten miles off the middle coast of Maine, there are strongly marked shore lines 160 feet above present sea level, with an amount of wave work in the hard

gabbro rock 40 feet above the present limits of waves, approximating that done at the sea margin of to-day. Glacial drift has apparently been largely removed through wave action. On the lower Matinicus Group, which lies some twenty miles to the eastward, banks of what seems to be glacial drift are now being rapidly cut away by the sea. Had these two groups of islands taken part in the same movements permitting the strong bench cutting in the hard rocks of Monhegan, the preservation of the yielding till has yet to be explained. A suggestion from this evidence is that the recent movements have not been continuous throughout the region.

The Two Classes of Topographic Relief: GEORGE CARROLL CURTIS. (Read by title.)

During the last few years there has been both in this country and in Europe discussion in regard to the 'proper method' for representing the surface of the earth in relief. Some of this discussion has been, it appears, over two distinct kinds of work under a single classification. These two classes, though not yet generally designated by separate terms, are labeled here as Classes I. and II.

CLASS I.

Requisites of Class I.
A miniature or replica of the earth's surface.
A characteristic reproduction of the topographic form.
As to scale; true.
Detail of form; in same proportion as general scale.
Color; consistent with natural laws.
Culture; indicated by the forms which characterize it.

CLASS II.

Attributes of Class II.
An expression of a map in relief.
An arbitrary representation of the topographic form.
As to scale; optional.
Detail of form; according to choice.
Color; any desired scheme or pattern.
Culture; indicated by any method or arbitrary sign which may seem desirable.

While these requirements and attributes cover but a portion of the subject, they may serve to illustrate the principles underlying it. Should Class I. be designated as topographic models and Class II. as relief maps (or by any more appropriate names) Class I. would include poor 'models' and Class II. good 'relief maps.' A poor 'model' would be one which, while attempting to follow the principles governing its class, does so in an unskillful and inexpressive manner. The requirements of a good 'relief map' are more difficult to state since, being of empirical character, based upon standards of choice, the style of relief maps may be subject to changes of fashion. It seems reasonable, however, to assume that the most satisfactory work in Class II. will eventually be based on a thorough understanding of the principles governing Class I.

PAPERS READ BEFORE THE GEOLOGICAL SOCIETY OF AMERICA.

Observations on the Geography and Geology of Western Mexico: OLIVER C. FARRINGTON. (Illustrated by lantern slides.)

This paper describes a journey from Durango westward to Ventanas across the plateau of the western Sierra Madre. The plateau exhibits a comparatively unbroken surface rising gradually from a height of 6,000 feet at Durango to about 9,000 feet farther west. It then slopes toward the Pacific and is deeply dissected by streams. Evidence is adduced to show a rather rapid eastward movement of the divide. The region is for the most part comparatively arid, although on the western edge of the plateau extensive forests occur. The rocks are largely eruptive. The Carro Mercado or 'Iron Mountain' is described in some detail and its origin discussed, as is also an area

of remarkable forms, produced by erosion, known as the 'City of Rocks.'

New Studies in the Ammonoosac District of New Hampshire: C. H. Hitchcock.

For several years the author has been investigating the geology of the only part of New Hampshire which yields fossils, hoping to be able to interpret the mutual relations of the several formations as revealed by paleontology and a better understanding of the petrography. The fossils have been renamed by Mr. Schuchert. (1) The rock masses in this district formerly referred to; porphyritic gneiss, lake gneiss, Bethlehem gneiss, protogene, diorite and hornblendites are now regarded as igneous instead of metamorphic stratified terranes. (2) The fossils belong to the middle upper Silurian. (3) The rocks of Blueberry Mountain exhibit the synclinal structure—consisting in the upward order of limestones, argillite, conglomerate and black argillites. Only the limestones contain fossils. (4) Different ranges of argillite having somewhat diverse petrographical character are now esteemed to be equivalent—the variations being supposed to have been occasioned by a greater or less metamorphic action. (5) Careful scrutiny of the slates reveals both a cleavage different from the stratification, and a structure analogous to stratification produced by a multitude of minute fractures. (6) The areal distribution and stratigraphy of the 'auriferous conglomerate' suggests its identity with the 'Coos quartzite'—a formation traceable southerly into Massachusetts down the Connecticut valley. (7) The numerous fractures in this conglomerate indicate that the whole region is but a mosaic of faulted fragments. (8) This better understanding of the Ammonoosac rocks can not fail to improve our interpretations of the ages of the adjacent crystalline groups in northern New England.

Studies in the Western Finger Lake Region: Charles R. Dryer. (Illustrated with lantern slides.)

The region discussed lies in western New York, between Canandaigua Lake and the Genesee River. The northward slope of the Allegheny plateau is here trenched by deep, narrow valleys, four of which contain small lakes, while a fifth is lakeless. These valleys are similar in general character to those of the larger Finger lakes, but bear peculiar relations to one another and to the east-west Cohocton valley. In several cases the head of a minor valley opens broadly into the side of a major valley but a few hundred feet above its floor, thus sustaining the relations of a headward hanging valley. These are thought to furnish criteria for estimating the amount of differential deepening by ice erosion. The main valley heads are blocked by massive terminal moraines and overwash plains. The steep valley slopes are broken by rock terraces which support well-developed marginal moraines. Pitted or morainal deltas indicate the existence of high-level marginal lakes. Transverse passes and high-level longitudinal valleys are choked for many miles with morainal deposits terminating in an overwash plain. Some of the principal ridges present drumlinoid profile, while their lateral slopes were greatly oversteepened. The phenomena indicate that during the late Wisconsin period the region was occupied by a complex system of distributary and intercepting ice streams, to which the present depths and sharpness of the valleys are chiefly due.

Note on the Geology of the Hellgate Valley between Missoula and Elliston, and Northward to Placid Lake, in Montana: N. H. Winchell. (Read by title.)

This paper gives an account of the general stratigraphy extending from the oldest sediments (Algonkian) to the Cretaceous

and an approximate estimate of the thickness of the various formations. The region is marked by many faults and close folds, the axes mainly running northwest and southeast. The author makes a provisional identification of the Algonkian formations described further north by Willis, viz., the Kintla argillite, the Sheppard quartzite and the Siyeh limestone. The great limestone formation of the region, usually regarded as including the Carboniferous, is believed to extend downward so as to embrace the Devonian and the Trenton of the Lower Silurian. The Jura-Trias, as identified, contains a coal bed that promises to be of economic importance. The igneous phenomena are numerous and diversified, consisting of surface lava sheets, volcanic craters and volcanic ash, as well as dikes of gabbro, diabase, quartz-porphyry and granite. The oldest rocks constitute the highest relief of the country, the Cretaceous strata having been less disturbed, though the Cretaceous is probably older than the epoch of the principal volcanic action. One of the most important statements of the paper is to the effect that there seems to have been a practically continuous sedimentation from the Algonkian to the close of the great (Carboniferous) limestone.

A Fossil Water Fungus in Petrified Wood from Egypt: ALEXIS A. JULIEN. (Read by title.)

A description is given of a specimen of silicified wood from a 'petrified forest' near Cairo, and the mode of distribution of the fungus throughout the ducts. An interesting association of crystals of hematite and of pseudomorphs after gypsum and halite occurs, which testifies to the earlier conditions of petrification. The organic forms have been preserved in remarkable perfection and abundance. These are successively described, comprising discoid spores, an articulated macromycelium, macrosporanges enclosing sporules, micromycelium bearing three forms of stalked cells, and large ovate capsules carrying the spores first described, a continuous series which apparently represents the life history of the new organism. Its generic relationships and genetic local history are then discussed, with a review of various theories of the process of silicification.

The Development and Relationships of the Rugosa (Tetracoralla): J. E. DUERDEN. (Illustrated by lantern slides. Read by title.)

The paper gives (1) a brief historical account of the various theories which have been held with regard to the nature and relationships of the extinct Rugosa or Tetracoralla; (2) the conclusions of the author from the examinations of a large number of species in the light of more recent results on living corals. The present investigation has been carried on mainly by the method of grinding down of individual coralla, each successive stage in the growth being drawn as it appeared. In this way the complete development and relationships of the septa have been established. In every instance where the perfect tip has been preserved a cycle of six septa is found to occur, thus demonstrating the primary hexameral relationships of the Rugosa as contrasted with the tetrameral usually assumed. The subsequent septa appear in only four of the six primary chambers and in a manner differing altogether from that in modern corals. The conclusions reached are that the Rugosa must remain a distinct group of corals, related in their early stage to modern corals and actinians, but later developing in an altogether characteristic manner. Of modern forms they are most closely allied to the zoanthid actinians, which are without any true skeleton; in these the addition of the mesenteries takes place in a manner

comparable with that of the septa in the extinct forms, though proceeding in only two of the six primary chambers.

The Sudbury Nickel-bearing Eruptive: A. P. Coleman.

Field work carried on for two summers for the Bureau of Mines of Ontario has proved that the eruptive rock accompanied by nickel ores in the Sudbury District has a continuous outcrop enclosing an oval area forty miles by sixteen in extent, and dipping inwards on all sides. It is in reality a sheet of rock from one to three miles thick forming a boat-shaped basin, but having an eruptive contact with the rocks both above and below. Its outer, lower edge consists of norite and is much more basic than the inner, upper edge, which is a micropegmatite consisting mainly of alkaline feldspars and quartz. The nickel ore bodies are found arranged along the basic, outer edge or on irregular dike-like extensions of the norite which may reach six miles from the main body of the eruptive. One mine contains several million tons of ore. Most of the ore appears to have separated by gravitation from the still molten eruptive, but part has been deposited by circulating waters.

The Widespread Occurrence of Fayalite in Certain Igneous Rocks of Wisconsin: Samuel Weidman.

In the central part of Wisconsin, within the area of pre-Cambrian rocks, is a large variety and abundance of igneous rock which intrudes a much older sedimentary series, and, in turn, lies beneath a later sedimentary series. These igneous rocks may be divided into three series; the oldest being rhyolite; the next, diorite, gabbro and peridotite; the latest, granite, quartz-syenite, nepheline, sodalite, and ægerite-syenites, and related rocks. In the last-mentioned series fayalite occurs as a persistent, though minor, constituent. Analysis of the fayalite is given. Also analyses of the rock varieties are given, showing a remarkably low content of magnesia, which does not increase as the content of silica in the series decreases. The alteration of the fayalite is to magnetic iron oxide. A brief account of the general occurrence of fayalite in other places is given. The various principal types of rock from Wisconsin, containing fayalite, with thin sections and photo-micrographs, are exhibited.

Structural Relations of the Granites of North Carolina: Thomas Leonard Watson. (Read by title.)

Describes the occurrence, distribution and petrography of the North Carolina granites, with special reference to their structural and age relations. The numerous dikes of basic igneous rocks penetrating the crystallines of the Carolina Piedmont Plateau region are discussed in their relations to the jointed structure of the enclosing rocks, especially the granites.

Field Work in the Wisconsin Lead and Zinc District: U. S. Grant.

During the summer of 1903 the Wisconsin Geological and Natural History Survey did some detailed mapping of selected areas in the southwestern portion of the state, which is part of the Upper Mississippi Valley lead and zinc district. In this field work the topographic and geologic mappings were carried on *pari passu* by the same individuals; the field sheets prepared were on the scale of eight inches to the mile, with ten-foot contour interval, and in publication the scale is to be reduced one half. While maps of this scale and detail will be valuable in themselves, it is hoped that they will give important results in working out the details of the relations of the ore bodies to the structure of the district.

Molybdenite at Crown Point, Wash.: A. R. CROOK. (Illustrated with lantern views.)

This locality furnishes the largest amount of molybdenite in the country. Twelve tons were produced in 1902. Mineral is found in fourteen different associations.

Recent Studies in the Physiography of the Ozark Region in Missouri: C. F. MARBUT. (Illustrated with lantern slides.)

Field work in the Ozark region during the past summer has demonstrated the existence of a peneplain lying at a lower level than that of the so-called Cretaceous peneplain of the same region. It is probably the same feature as the one described locally in Barry and Stone counties by Hershey in 1895. This paper describes its character in the south-central part of the Ozark region.

The Physiography and Glaciation of the Western Tian Shan Mountains, Turkestan: W. M. DAVIS and E. HUNTINGTON.

The existing ranges of the Tian Shan Mountains in central Turkestan result from the elevation and greater or less dissection of a more ancient mountain system that had been previously subdued or worn down to small relief over a large area. The elevation of the old-mountain region was accomplished in part with moderate deformation, in part with strong block-faulting. Local glaciation in several successive epochs is clearly recognized.

A System of Keeping the Records of a State Geological Survey: E. R. BUCKLEY.

Two classes of inquiries are received by a state geological survey, viz., (1) The mineral resources of a particular section of land and (2) the occurrence of a certain resource in a particular county. To answer these inquiries requires the collection and storing of a vast amount of information. The collecting of this information is gradually carried on by the usual field work of the survey and correspondence. The storing of this information in such a manner as to make it easily accessible is brought about by an adoption of the card catalogue system. A location case and a subject case are provided in which all data relating to the mineral resources of the state are recorded.

The Tectonic Geography of Southwestern New England and Southeastern New York: WILLIAM HERBERT HOBBS. (Illustrated with lantern slides.)

The paper discusses the important elements in the architecture of the earth's crust within the province designated, as a result of extensive surveys made for the U. S. Geological Survey. A number of 'key areas' were selected having regard both to the intricacy of their structure and to their distribution within the province, and studied with much detail. The structural elements characteristic of the individual areas were then compared and their relationship to the broader structural lines of the province as a whole considered. So far as possible the essential facts were set forth by means of maps projected upon the screen.

The Lineaments of the Eastern United States: WILLIAM HERBERT HOBBS. (Illustrated with lantern slides.)

This paper is an extension of the investigation upon the tectonic geography of portions of New England and vicinity, with a view to determining whether structures found to characterize that province are common to the larger regions as well. The materials of the study have been the topographic maps of this region and the published works of other geologists, the methods of examination and the point of view being, however, new.

A Pre-glacial Peneplain in the Driftless Area: U. S. Grant and H. F. Bain.

In southwestern Wisconsin and adjacent portions of Illinois and Iowa is a well-developed peneplain cutting across part of the Maquoketa shales, the whole of the Galena, Trenton, St. Peter and Lower Magnesian, and terminating to the north in a sharp scarp developed in the soft Potsdam sandstone. It rises gradually to the north. Above it are the so-called 'mounds' capped with Niagara limestone and forming monadnocks left in the dissection of an older peneplain. Below it the streams have cut valleys with sides of simple continuous slope. The valleys are arranged in normal dendritic fashion. Streams heading outside the area show terraces of glacial-derived material and their tributaries show commonly a low terrace developed by silting up of slack water. The peneplain represents the last great period of base-leveling before the oncoming of the glaciers. It was followed by one of sharp downward stream-cutting which continued apparently with but slight interruption through the Pleistocene to the present. Possible correlation of the peneplain with a similar one of Tertiary age in southern Illinois is discussed.

The New Cone of Mont Pelé and Other New Features of the Mountain: E. O. Hovey.

Some Striking Erosion Phenomena Observed on the Islands of St. Vincent and Martinique in 1903: E. O. Hovey.

The two papers announced in the above titles are essentially an exhibition of lantern slides illustrating facts brought out in recent publications.

The Grand Soufrière of Guadaloupe: E. O. Hovey.

This paper emphasizes by means of lantern views the idea that this cone has been formed in the same way as that of Mont Pelé.

Domes and Dome Structure in the High Sierra: G. K. Gilbert. (Illustrated with lantern views.)

In many dome-like granite hills the rock is divided into plates by curved joints approximately parallel to the surface. Some observers call the structure exfoliation, others regard it as an original structure of the granite. Under one view the surface forms determine the structure; under the other the structure determines the surface forms. A study of the High Sierra of California in the summer of 1903 has led the author to accept the former view, and to believe that the forms of the parting planes are conditioned by the forms of the topography. As to the cause of the phenomenon, the following hypothesis is advanced: Formed deep within crust, the granite was initially subject to compressive stress, which was balanced by internal expansive stress. As the unloading involved in subsequent denudation reduced the compressive stress, the unbalanced expansive stress caused strains which eventually resulted in exfoliation.

The Trent River System and the St. Lawrence Outlet: Alfred W. G. Wilson. (Read by title.)

The St. Lawrence River in the vicinity of the Thousand Islands crosses the Frontenac axis, a narrow neck of Archean rocks which connects the Adirondack region with the greater Archean areas of Canada. West of this axis, the country which lies to the north and east of Lake Ontario is underlain by flat-lying, Ordovician rocks, chiefly Trenton limestones. The drift cover of the area is very thin, averaging perhaps two feet in depth, while the relief has an average measure of at least one hundred and fifty feet. There are numerous areas where the bed-rock exposures are very ex-

tensive. In its present attitude the region is traversed by a number of southwest-flowing streams, running in broad, deep, rock-sided valleys. These valleys are older than the ice sheet which made the grooves on the bed-rock, and there is internal evidence to show that the amount of glacial erosion within the area has been very slight. The maturity of form, and the adjustments of these valleys, where they are not submerged beneath the waters of the present lake or obscured by morainic deposits, are regarded as indicating that they were eroded by the preglacial predecessors of the streams which flow in them. The form and adjustments of the valleys of the partly submerged portions of the limestone areas, particularly the Bay of Quinte and the present St. Lawrence outlet, suggest that these also are similar to those unsubmerged valleys which can be more readily and easily studied. It is concluded that these rock-sided valleys formed part of a now dismembered river system whose original general direction of flow was southwest; that the Trent River system occupies parts of no less than twenty of the tributary valleys of this system; and that the present St. Lawrence outlet from Lake Ontario, west of the Frontenac axis, consists of a complex of three of these ancient valleys in which the water is now flowing in a contrary direction to that in which it was flowing when the valleys were carved.

Postglacial Changes of Attitude in the Italian and Swiss Lakes: FRANK BURSLEY TAYLOR. (Read by title.)

In the summer of 1894 the writer spent two weeks in exploring the shores of the lakes of northern Italy for evidences of change in the relative attitude of the lakes and the land. On Lakes Maggiore and Como no certain evidence of wave action was found above present lake level. But a study of the old deltas of the numerous torrents which descend from the mountains shows that the lakes formerly stood in different attitudes, with reference to the land, from those in which they stand to-day; and Lake Maggiore stood at a slightly higher level. The old deltas are fragmentary, but their form and structure show the former lake level with approximate accuracy. Since the change of attitude the streams have cut down to the present level and some of the larger torrents have well-formed valley terraces connecting with their old deltas and standing high above their modern floods. In the northern part of Lake Maggiore fine examples may be seen at Macagno on the east side and at Conobbio on the west. The valley terrace back of Conobbio is a well-marked feature. At Arona and Meina near the south end, the old lake level was nearly 20 feet above the present level, and it rises gradually to 50 or 55 feet near Locarno at the extreme north. The Ticino River below Lake Maggiore seems to have cut down the morainic barrier nearly 20 feet since the change of attitude. On Lake Como the old lake level at Cernobbio on the west side near the south end appears to be about the same as the present level and rises northward to 30 or 35 feet at Gravedona. On Lake Garda, along the western side of the southern part, a small but well-defined wave-cut beach was found descending from the eastern end of the peninsula southeast of Salo, where it is about 15 feet above the present lake level, very nearly to the present level at Desenzano. It is also well shown on the outer end of the peninsula near Sermione and on Isola di S. Biagio and other small islands. The east side of the expanded portion of the lake was not explored. In the narrower northern part there are deltas near Riva like those of Lake Maggiore, and a few also along the eastern side. These seem to indicate a former lake level at the north end 30 or 35 feet higher than the

present. Thus, on each of the three lakes there are remains of an old lake surface which rises in a northerly direction about one foot per mile as compared with the modern surface. Lake Geneva in Switzerland was also studied for the same evidences. Sandy deposits apparently marking an old beach were found at Lausanne 12 to 14 feet above the present lake level. The paper then discusses briefly the significance of these facts and of similar facts in other parts of the world.

The Basin of the Po River: George L. Collie. (Read by title.)

The paper is the result of field work done on the Po plain in the spring of 1903. The basin of the Po was an arm of the sea during the Miocene; a portion of the time probably a strait connecting the Adriatic with the Mediterranean, through the present Col d'Altare. The sea was gradually crowded out by the encroachment of sediments, brought in from the Alps to the north and from the Apennines to the south. Sediments from Alpine sources are coarse; from Apennine sources, fine. The total area of the basin is 27,000 square miles, of which 16,000 square miles are mountainous and 11,000 square miles belongs to the plain of the Po. Borings in the plain show that it is composed of a series of approximately horizontal sands, clays and marsh deposits, the last including lignitiferous clays. The sands contain marine shells, the clays carry land shells. The whole succession indicates alternation of marine, fresh-water and land conditions. The thickness of the deposits ranges from 572 to 695 feet. There is little fine alluvium in the upper Po, the river flowing over coarse deposits; but below the Sisera River alluvium of a fine type is common. The upper Po is everywhere crowded close to the northern spur of the Apennines, forced over apparently by the large and heavily laden tributaries from the Alps. In times of flood the river carries an immense amount of debris, estimated to be one three-hundredth of its volume. In spite of this heavy load, the river is not aggrading its bed to an appreciable extent. This non-aggradation is due in large measure to the lake system of northern Italy, which drains into the Po and supplies it with four tenths of its water content. During periods of high water in the fall and spring, the sediment-laden streams from the Alps bring their load to the Po and deposit it. The lakes, however, being basins of reception, not only take out the sediments from the drainage, but also store the water and supply it more gradually than do the lakeless streams. Lago di Garda, in time of great rainfall, scarcely changes its level; the small lakes, such as Como or Maggiore, show great changes of level within a few hours, but, on the whole, they all tend to restrain the water. The result is that after the debris-laden streams have deposited their sediments in the Po and temporarily raised its bed, later there comes a volume of comparatively clear water which removes the previous accumulations, and an equilibrium is maintained on the whole. The Po is thoroughly diked from Cremona to the marshes of the delta. It is customary to place the froldo or main dikes at some distance from the river, thus allowing the river to overflow the intermediate flood plain or golene for some distance before reaching the dikes. The golene are frequently covered with willows and thick underbrush and the velocity of the current is greatly reduced thereby and there is little active erosion upon the dike itself. The dikes are continually being extended; the extension of dikes accounts in a measure for the rapid extension of the delta in modern times. Between 1200 and 1600 A. D. the delta advanced on the average about 70 feet annually; for the last few

decades, its advance has been at the rate of about 200 feet annually. The flood plain deposits of the upper Po are cross bedded and very irregular; the beds are chiefly cobbles, coarse gravel and pebbles; occasionally wedges of sand are thrust in, the latter of limited extent. The beds show great variations in size of materials; there are sudden changes from coarse to fine gravel, and *vice versa*. The beds are not continuous over wide areas; generally there is a change in composition and texture every few rods. Occasionally there are local deposits of silt and clay, stratified as a rule, which cover a few acres. One of these deposits in the environs of Turin covers forty acres. On the lower Po the flood plain deposits are much finer in texture and show more regular arrangement than those quoted above. Much of the material is silty clay and fine sand. Laminated structure is common, the thin laminæ extending for several hundred feet, but invariably replaced sooner or later by sediments of different texture or composition. When long sections are exposed so that they can be seen *ensemble*, it is noticeable that the beds undulate. Strictly speaking, there is no horizontality of beds, but rather a slow rise and fall. Long, flat augen of sand are the apparent cause of this arrangement. These flat lenses occur frequently, the finer sediments wrap them about, and the bedding of the latter is made to show corresponding undulations. The degree of undulation is determined by the thickness and length of the sand lenses.

Nantucket Shore Lines, II.: F. P. GULLIVER. (Illustrated with lantern views.)

During the past year the writer has continued his studies of the recent changes in the shore lines of the island of Nantucket, and the results of such study are given in this paper. Details of changes are presented in the following areas: Great Point, Coskata, Haulover Break, Surfside, Maddaket, Smith Point, Brant Point, Nantucket Harbor and Coatue. Original plane table surveys are given of Miacomet foreland, at Surfside, where sand has been built out some 1,500 feet in the last forty years in one of the most exposed portions of the island, while extensive cutting back has taken place both east and west of this foreland; and also of Smith Pond, where the shore line is rapidly moving to the north. Since the break was made in the tombolo at the head of the harbor connecting Coskata Island with the eastern end of Nantucket, in the winter of 1896–7, at the point where the fishermen formerly hauled their boats over the sand, there have been many changes in the shore lines. The facts in regard to these changes have been collected from government surveys and many private sources, and a series of outline maps prepared.

The New Geology under the New Hypothesis of Earth Origin: HERMAN L. FAIRCHILD.

A theoretical discussion of the geologic bearings of the planetessimal hypothesis. A brief comparison is made between the two conceptions of earth genesis, and it is shown how the nebular hypothesis has failed to explain phenomena and has been a hindrance to the progress of geologic science. Some of the topics discussed are, origin of the atmosphere, origin of the ocean, volcanic phenomena, source of hydrocarbons, geologic climates, diastrophic movements, life on the earth.

The Humboldt Region; a Study in Basin Range Structure: G. D. LOUDERBACK.

Glacial Erosion in the Finger Lake Region, New York: M. R. CAMPBELL. (Read by title.)

The Finger Lake region of New York is an ideal field for the study of the effect of glacial erosion, presenting as it does simple

geologic conditions free from complicated structure and possessing fairly well-marked topographic forms from which its physiographic history may be interpreted. The present paper is the result of an effort to make a systematic study of the physiographic features of this part of the state, and it is based largely upon a careful study of the contoured topographic maps that have been assembled and reproduced here for the first time. The author has approached the question free from any bias regarding the ability of glaciers to accomplish extensive erosion, and has dealt with the problem entirely from the physiographic standpoint; an effort was made first to account for the present topography largely through the simple process of subaerial erosion, but this failed to explain the peculiar features of the region. The conclusion arrived at is that ice was the principal agent in not only giving the finishing touches to the present topography, but in the extensive erosion which has reduced this portion of the state from an altitude of approximately 2,000 feet to that of 800 or 1,000 feet above sea level, and that has produced the great topographic embayment of the Finger Lake region.

Evidences of Slight Glacial Erosion in Western New York: H. L. Fairchild.

Waning of the Glaciers of the Alps: H. L. Fairchild.

Lantern views from photographs taken during the past summer illustrating the decrease of the Alpine glaciers within recent years.

The Carboniferous of the Appalachian Basin; Part II., the Pottsville: J. J. Stevenson. (Read by title.)

Notes on the Deposition of the Appalachian Pottsville: David White.

General view of the thickness and present distribution of the main divisions of the Pottsville sediments in the Appalachian trough. Extent and duration of the basal uniformity as indicated by fossil plants. Suggestions as to conditions of deposition of the several divisions.

The Benton Formation in Eastern South Dakota: J. E. Todd.

Further Studies of Ozark Stratigraphy: C. F. Marbut.

During the past summer the reconnoissance mapping of the formations of the Ozark Series was extended over the south-central counties of the state. The paper will describe the character and distribution of the various formations, and discuss briefly the evidence on which the correlation is based.

The Iroquois Beach in Ontario: A. P. Coleman.

The detailed mapping of the Iroquois Beach in Ontario was begun in 1898 and practically completed in 1902, but publication was delayed in hopes of extending the work northeast from Havelock, the last point at which the beach could be found. As it can be traced no farther, it is probable that the shore to the east and north consisted of ice. The highest point reached is 498 feet above Ontario or 744 feet above the sea. Northeast of Colborn it is split up into several beaches, in one case the highest being 80 feet above the lowest; but southwest to Hamilton the beach is practically a unit, and the same is true on the south shore to Niagara River. There is evidence of the splitting up of the water levels at Toronto and Hamilton in the form of old surfaces of erosion, soils with trees, and remains of mammoth, etc., at levels from 30 to 80 feet below the gravel bars representing the latest Iroquois lake levels. It is believed that the evidence obtained proves that the Iroquois water was a lake with an ice barrier to the northeast, and not an arm of the sea.

Evidence of the Agency of Water in the Distribution of the Loess in the Missouri Valley: GEORGE FREDERICK WRIGHT.

The paper is the result of field work conducted during the past year in the vicinity of the Missouri between St. Joseph and St. Louis. The direct evidence of the agency of water in distributing the loess is found: (1) in the relations of the loess to the main valleys of the Missouri and its larger tributaries; (2) the existence of distinct laminæ, at a height of 180 feet above the river at St. Joseph, which are very clearly of water origin; (3) the new light shed upon the glacial occupation of the region by the discovery of northern drift on the south side of the Missouri River forty miles beyond the boundary which has heretofore been assigned to it; (4) considerations which show the doubtful character of the conclusions drawn from the fossil shells found in the loess; (5) calculations showing the reasonableness of the supposition that at the close of the Iowan stage of the glacial period there were periodical floods each summer sufficient to cover the whole region occupied by the great body of the loess, and the presentation of a theory that would seem to harmonize all the facts.

The Loess at St. Joseph. (Illustrated by lantern slides.) Read by Professor G. Frederick Wright for Luella Agnes Owen.

Exposures of undisturbed loess in cuts at a variety of elevations are described. Several of the highest are distinctly stratified and the horizontal strata, in places, regularly banded with iron stain. Fossil snail shells of the two forms common to the loess are abundantly distributed throughout these high-level laminations. The iron bands can be accounted for by aqueous deposition, but the æolian theory does not so readily offer a solution of their presence and regularity. Objection to the glacial origin of loess has depended largely for support on the absence of an adequate barrier on the south and west to have retained a body of water of sufficient depth for the deposition of the higher portions of the bluffs. Such a barrier, however, can be shown to have existed and to still remain, by giving attention to the elevations of the tributary water-sheds in those directions and to the known conditions during the flood period in May of 1903. Authority is quoted to the effect that snails can not be identified by the shells alone, as the same kind may be common to forms of radically different organization; and the shell, therefore, is entirely subordinate to differences in structure of the animal. If this is true, the æolian theory suffers the loss of its best support.

Fresh-water Shells in the Loess: B. SHIMEK.

1. A review of the available literature in which reference is made to the occurrence of fresh-water shells in the American loess, with a discussion of the significance and weight of such testimony, showing that as yet no well-authenticated cases of the occurrence of fluviatile shells, at least in original loess, are known.

2. A statement of the author's own experience in the study of loess mollusks, which shows that land shells greatly predominate, and that only such fresh-water forms as inhabit temporary small ponds and streamlets occur in the loess, and these in relatively small numbers.

Comparison of the Stratigraphy of Black Hills, Big Horn Mountains, and Rocky Mountains, Front Range: N. H. DARTON. (Read by title.)

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