berger, W. L. Elkin, S. P. Ferguson, R. A. Fessenden, Edward P. Fleming. Mrs. M. Fleming, Albert S. Flint, Edgar Frisby, R. H. Frost, Miss Caroline E. Furness, Miss E. F. Gill, H. M. Goodwin, Miss Ida Griffiths, J. G. Hagen, George E. Hale, J. F. Hayford, Miss Lillian Hodgdon, G. W. Hough, Harold Jacoby, E. S. King, Laurence La Forge, Miss E. F. Leland, F. H. Loud, C. Lundin, Alex. Macfarlane, Miss A. C. Maury, C. H. McLeod, D. C. Miller, Edward W. Morley, G. W. Myers, S. Newcomb, Henry M. Parkhurst, H. M. Paul, B. O. Peirce, Edward C. Pickering, Mrs. Edward C. Pickering, William H. Pickering, Charles Lane Poor, Miss Mary Proctor, Alden W. Quimby, F. G. Radelfinger, Wm. Maxwell Reed, Charles H. Rockwell, Jonathan T. Rorer, A. Lawrence Rotch, W. C. Sabine, F. E. Seagrave, Arthur Searle, Aaron N. Skinner, Frederick Slocum, M. B. Snyder, Charles E. St. John, John Stein, Miss M. C. Stevens, A. E. Sweetland, Winslow Upton, J. M. Van Vleck, Frank W. Very, Robert DeC. Ward, Charles F. Warner, W. R. Warner, A. G. Webster, Oliver C. Wendell, Miss Sarah F. Whiting, Frank P. Whitman, Miss Mary W. Whitney, Miss A. Winlock, Miss L. Winlock, Miss E. G. Wolffe, Miss I. E. Woods, R. S. Woodward, Paul S. Yendell.

At the close of the Conference Professor Comstock presented a motion recording the thanks of the Conference to Professor and Mrs. Pickering and the members of the Observatory staff for the generous hospitality of the Harvard College Observatory; to the President and Fellows of Harvard College for courtesies and hospitality extended; and to Professor Charles R. Cross for hospitality accorded by the Massachusetts Institute of Technology. With the unanimous adoption of this motion the Conference adjourned.

The undersigned begs to acknowledge his indebtedness to the members of the Conference for generous aid given in the preparation of the foregoing report.

M. B. Snyder.

GEOLOGY AND GEOGRAPHY AT THE AMERICAN ASSOCIATION MEETING.

I.

By the invitation of Section E (Geology and Geography) of the American Association, meetings of the Geological Society of America and of the National Geographic Society were held with this Section, the former in three sessions on Tuesday forenoon, afternoon and evening, August 23d, and the latter on Thursday afternoon, the 25th. These sessions, and those of Section E, were held in the lecture room of the Boston Society of Natural History, excepting the final session, on Friday forenoon, which was held in the geological lecture room of the Museum of Comparative Zoology, in Cambridge.

The address by the Vice-President of Section E, Professor Herman L. Fairchild, of Rochester, N. Y., on 'Glacial Geology in America,' was presented on Monday afternoon. It reviewed the history of the development of this branch of geology in the United States and Canada, concluding with the assertion that the origin of the North American drift through the action of a continental ice-sheet is now, after fifty years of exploration and discussion, as fully proved as any of the principles of geology. It is published in the September *American Geologist* and in the *Scientific American Supplement* for September 3d, 10th and 17th.

In the opening session of Section E, with the Geological Society, on Tuesday forenoon, short memorial addresses on the life and work of the late Professor James Hall were given by Professors Emerson, Fairchild and Niles, and by Dr. Horace C. Hovey, noting Hall's earnestness in boyhood and youth to acquire knowledge of geology and allied sciences, walking twenty

miles from his home in Hingham, Mass., to attend lectures by Benjamin Silliman before the Boston Society of Natural History, his distinguished services of more than sixty years on the Geological Survey of New York, and his recent illness and death, August 7th.

The papers presented before the Geological Society of America, with brief notes of their scope, mostly as stated in the Society's preliminary announcement, were as follows:

1. *Some Features of the Drift on Staten Island, N. Y.* By ARTHUR HOLLICK, Columbia University, New York City. The terminal moraine crosses Staten Island from Fort Wadsworth at the Narrows to Tottenville, opposite Perth Amboy, N. J. Its front rests partly on the serpentine ridge and partly on the plain region to the south. In the former locality it consists of true morainal material of the northern drift. In the latter it comprises a ridge or core of Cretaceous and Tertiary clays, sands and gravels, shoved forward and upward from their original position on the island, and on top of these disturbed beds are the morainal till and gravel. At two localities there are well defined indications of extra-morainic drift, south of the terminal moraine. The direction of glacial movement is indicated by the striæ on rock outcrops to be about S. 17° E.

The most abundantly represented boulders are those derived from the Triassic of New Jersey, although nearly all the outcrops between Staten Island and the Adirondacks have contributed. A list of about 120 Palæozoic fossils obtained from the transported boulders was appended to this paper, with another list of about 35 Cretaceous and Tertiary species, mostly fossil plants, derived from the disturbed Staten Island strata.

2. *Loess Deposits of Montana.* By PROFESSOR N. S. SHALER, Cambridge, Mass. (Read by title.)

3. *Glacial Waters in the Finger Lake Region of New York.* By PROFESSOR H. L. FAIRCHILD, Rochester, N. Y. This paper noted the stages of glacial retreat and consequent changes of drainage, by which the glacial Lake Newberry, outflowing southward to the Susquehanna, was succeeded by Lake Warren, about 100 feet lower; and this, when the ice was further melted back, by Lake Iroquois. For the most definite stage between Lakes Warren and Iroquois, represented by a large beach at Geneva, N. Y., and by an old channel of eastward outflow south of Syracuse, the name Lake Dana is proposed.

4. *The Stratification of Glaciers.* By PROFESSOR HARRY F. REID, Baltimore, Md. Lantern views of the glaciers of Switzerland and Alaska were displayed, attention being directed to the author's observations of the persistency of the original stratification occasioned by the snowfall of successive years on the névé. This structure was distinguished from the transverse blue banding, analogous to cleavage, which is occasioned by pressure of the moving ice, being especially developed in constricted or very steep parts of the glaciers.

5. *Evidences of Epeirogenic Movements Causing and Terminating the Ice Age.* By WARREN UPHAM, St. Paul, Minn. The vertical amount of the preglacial elevation of North America, during late Tertiary and early Quaternary time, is shown to have ranged from 3,000 to 5,000 feet, according to the soundings of fjords and submerged valleys on our Atlantic, Pacific and Arctic coasts, the deepest of these valleys, exceeding 5,200 feet, near Monterey, California, having been described by Davidson a year ago. Similarly it is also known that a general uplift of western Europe and western Africa took place near the same time, of varying amount, from a minimum of probably about 1,500 feet in the British Isles to maxima of about 4,000 feet in Scandinavia, nearly 9,000 feet in the country adjoining the

southeast part of the Bay of Biscay, and more than 6,000 feet at the mouth of the Congo. These great uplifts are thought to have given the cold and snowy climate under which the ice-sheets were amassed. But the lands were afterwards depressed, in the closing, or Champlain, epoch of the Glacial period, to levels mostly somewhat below their present heights, whereby a temperate climate, with warm and even hot summers, was restored on the borders of the ice-sheets, melting them gradually from the periphery inward. Steep frontal gradients and vigorous glacial currents were thus produced, heaping much of the drift in prominent recessional moraines.

6. *Clayey Bands of the Glacial Delta of the Cuyahoga River at Cleveland, O., compared with those in the Implement-bearing Deposits of the Glacial Delta at Trenton, N. J.* By PROFESSOR G. FREDERICK WRIGHT, Oberlin, O. A year ago Professors Wright, Hollick, Mercer and Libbey made excavations at Trenton in the field where Mr. Ernest Volk has been working under the direction of Professor Putnam. As a result of their work, they found several implements from three to four feet below the surface, and beneath certain red clayey bands which they supposed to be a part of the original delta deposited at Trenton during the close of the Glacial period. In the meetings of the American and British Associations, however, at Detroit and Toronto last year, vigorous efforts were made by others to prove that these clayey bands do not belong to the original water deposition, but may have been wind-blown surfaces or lines of oxidation in the sand. During the past year Professor Wright has made numerous observations upon excavations in a similar delta of Glacial age at Cleveland, where he finds a succession of reddish clayey bands in the sand precisely similar to those at Trenton; and at Cleveland they merge into cross-bedded sand and gravel strata on the same level, showing unequivocally that the whole is a water deposit, and that it has not been disturbed since the original deposition. This strongly confirms the inferences drawn a year ago concerning the age and undisturbed character of the deposits at Trenton from which Mr. Volk has derived so many implements for Professor Putnam, indicating that men were present, making, using and losing those implements at the time of departure of the ice-sheet.

7. *The Middle Coal Measures of the Western Interior Coal Field.* By H. FOSTER BAIN and A. T. LEONARD, Des Moines, Iowa. These coal measures are marked by non-persistence of strata. The upper measures are more regular. Between the two is a series partaking of the characteristics of each. This series includes the Raccoon River beds, the Appanoose formation and equivalents in Iowa, the Henrietta in Missouri, and the Oswego and Pawnee limestones of Kansas. No fitting general term for the whole has yet been proposed. The old term, middle coal measures, included the beds here referred to and the higher beds now quite generally known as the Pleasanton shales.

8. *The Principal Missourian Section.* By CHARLES R. KEYES, Des Moines, Iowa. The previous classifications of the Carboniferous formations of the region west of the Mississippi River were briefly outlined. The results of the recent work along the Missouri River were summarized and the inferences to be drawn were given. The Missourian series, as one of the four principal subdivisions of the Carboniferous of the continental interior, was described. Eleven well defined formations or stages are shown to have a wide distribution, the formations in five States being correlated.

9. *Tourmaline and Tourmaline Schists from Belcher Hill, Jefferson County, Colorado.* By HORACE B. PATTON, Golden, Colo. Black tourmaline, often in fine large crystals,

occurs very abundantly in pegmatite veins that cut the crystalline schists of the foothills of Jefferson county, west of Denver, Colorado. On the Belcher Hill road, near Golden, the tourmaline occurs: (*a*) in separate crystals; (*b*) in black masses (schorl) in quartz veins; (*c*) the same in pegmatite veins; and (*d*) in finely disseminated needles replacing biotite and even feldspar and quartz in biotite schists and gneisses at contact with veins of pegmatite and quartz. The beautiful banding and cross-banding produced by this replacement is unusual. The paper was illustrated by specimens and photographs.

10. *Magmatic Differentiation in the Rocks of the Copper-bearinq Series.* By ALFRED C. LANE, Houghton, Mich. In many of the effusive sheets a difference may be noted between the top and the bottom. At the top the feldspar is oligoclase, at the bottom labradorite. At the top olivine is more conspicuous, at the bottom augite. The oligoclase and olivine were evidently formed before the lava from which the sheet was formed came to rest, at least in part. The augite and labradorite were probably formed later. It is possible that the early formed oligoclase rose to the top, and that the sodiferous magma there formed had not such corrosive action on the olivine as the calcareous magma left below, the latter causing the olivine to be changed to augite. Comparing different flows, we find the same kind of relations that exist between the top and bottom of the same flow. This suggests that similar differentiation went on before eruption.

11. *The Volume Relations of Original and Secondary Minerals in Rocks.* By PROFESSOR CHARLES R. VAN HISE, Madison, Wis. This paper discusses the volume relations of secondary minerals as compared with original minerals, and considers this volume change in reference to the depth at which the alteration occurs.

12. *Note on a Method of Stream Capture.* By ALFRED C. LANE, Houghton, Mich. When the divide between two streams is porous, and the valley of one much deeper than that of the other, springs may arise on the side of this deeper valley, which drain the water from the higher valley and thus diminish the erosive capacity of the stream therein, until the higher valley has a stream only in times of rain and is soon eaten into by lateral tributaries of the deeper stream. Various illustrations of this action were given, and it was noted that the streams draining the ice-front during the Glacial period were especially liable to capture because they occupied channels heavily filled with porous gravel and sand.

13. *The Development of the Ohio River.* By PROFESSOR WILLIAM G. TIGHT, Granville, Ohio. A brief review of the literature shows that it has been generally accepted that the Ohio River is a very ancient stream, but recently the work of several geologists in New York and Pennsylvania indicate the Pleistocene origin of the Ohio above New Martinsville. In papers already published by the author the existence of a very ancient erosion basin extending in general from east to west through the central part of Ohio and Indiana is established by the restoration of many tributary drainage lines and by deep wells. Further evidence is presented in this paper to show that the Ohio in its present location has been established through the appropriation of sections of numerous northwardly and northwestwardly flowing streams by the cutting of the ancient cols and the broadening and deepening of the valleys. The explanation for these changes is found in the position and action of the ice-sheet in the various sections, thus determining the age of this part of the Ohio valley to be Glacial or Postglacial.

The theory is proposed that the development of the Ohio River almost entirely be-

yond the greatest extent of the ice-sheet, and of the Missouri River almost entirely within the limits of the ice, was due to the different angles which these streams made with the ice-front, and to their different gradients. In the Ohio basin the water was forced over distant cols; but in the Missouri basin it was drained southeastward along the ice-front, thus wearing back the ice at the time of final recession before the establishment of the channel by erosion.

14. *Classification of Coastal Forms.* By F. P. Gulliver, Southboro, Mass. A scheme is proposed in this paper for the classification of the various forms of the coast according to their stage of development. Two markedly different classes of initial forms are recognized, those following elevation of the land and those following depression. Each class is seen to have characteristic forms at various stages of its development, and the writer urges others to think of all the forms on the coast or along the shore as in a certain stage of their life-history. This will further suggest the form from which any given example has come and toward which it tends to develop.

15. *Dissection of the Ural Mountains.* By F. P. Gulliver. The Urals are seen to be pretty thoroughly planed, so that the summits of the many ridges rise to nearly the same elevation, except a few commanding peaks which are found to consist of quartzite or other rock more resistant than the surrounding beds. The summit-level plane descends gradually to the west until it merges into the upland levels of the great plain of Russia, while on the east in several places there is a rather steep fall-off to the Siberian plain, though in other places the plane of the summits merges into that of the great Tertiary deposits of northwestern Asia. The stages of dissection in various parts of the Ural Mountains, and the grade-planes of different streams, are compared, the result of such comparison being that there seem to be three epicycles or divisions of the present cycle of erosion.

16. *Note on Monadnock.* By F. P. Gulliver. The relation of Monadnock to the New England upland was considered, and the valleys in the vicinity of this mountain were described. The elevations of two former stream grades have recently been determined in this region.

17. *Spacing of Rivers with Reference to the Hypothesis of Baseleveling.* By Professor N. S. Shaler, Cambridge, Mass. (Read by title.)

18. *The Continental Divide in Nicaragua.* By C. Willard Hayes, Washington, D. C. The comparatively short streams, with steep gradients, descending to the Pacific, have in numerous instances increased their drainage basins by capture of the headwaters of streams flowing eastward to Lake Nicaragua and the Caribbean Sea. In this way the water divide on the surveyed line for the Nicaragua Canal has been removed a considerable distance eastward, being now at a much lower altitude than the original mountainous watershed.

The following papers were presented in the session of the National Geographic Society :*

1. *The Venezuela-British-Guiana Boundary Dispute.* By Dr. Marcus Baker, Washington, D. C.

2. *Considerations Governing Recent Movements of Population.* By John Hyde, Washington, D. C.

3. *Some new Lines of Work in Government Forestry.* By Gifford Pinchot, Washington, D. C.

4. *The Development of the United States.* By W J McGee, Washington, D. C.

5. *Atlantic Estuarine Tides.* By M. S. W. Jefferson.

6. *The Forestry Conditions of Washington State.* By Henry Gannett, Washington, D. C.

* See the account by W J M in the issue of Science for September 16th.

7. *The Five Civilized Tribes and the Topographic Survey of Indian Territory.* By CHARLES H. FITCH, Washington, D. C.

8. *Bitter Root Forest Reserve.* By RICHARD U. GOODE, Washington, D. C.

The papers of Section E of the Association were as follows:

1. *Outline Map of the Geology of Southern New England.* By PROFESSOR B. K. EMERSON, Amherst, Mass. This paper, with maps, gave a summary of the areal geology of Massachusetts, Rhode Island, Connecticut, and parts of New Hampshire, Vermont and New York.

2. *Basin in Glacial Lake Deltas.* By PROFESSOR H. L. FAIRCHILD, Rochester, N. Y. During the glacial recession the impounded high waters of the Canandaigua valley, in central New York, at one time escaped across the eastern border of the basin into the Flint creek valley, which was also occupied by a glacial lake at a lower level. The river thus formed cut a channel in drift and rock, and deposited the débris, as a delta, at its mouth in the lower lake. The delta now forms a conspicuous plateau of gravel 125 feet above the adjacent village of Potter. In this plateau is an irregular depression which reaches to the very base of the delta deposit, and occupies, perhaps, a fourth of the area of the plateau. The only satisfactory explanation of its origin is that an isolated block of ice was left there by the receding ice-front, and that the delta material was piled around it, the subsequent melting of the ice block producing the cavity. Elsewhere shallow basins occurring in deltas are in many cases attributable to deficient filling by capricious currents and wave action; but such bowls cannot be confounded with the Potter kettle-hole, which was illustrated by a map and photographs.

3. *An Exhibition of the Rare Gems and Minerals of Mt. Mica.* By DR. A. C. HAMLIN, of Bangor, Maine. (Read by title.)

4. *The Hudson River Lobe of the Laurentide Ice-sheet.* By PROFESSOR C. H. HITCHCOCK, Hanover, N. H. The glacial drift and striæ of Quebec, New England and New York prove the existence of a glacial lobe following the Champlain-Hudson valley. The movement was to the southeast over the summits of the White and Green Mountains and to the southwest over the Adirondacks, but due south along the medial valley. Last October the author climbed Orford Mountain, which rises northwest of Lake Memphremagog to an altitude of about 5,000 feet above the sea, and found it glaciated from bottom to top, wholly in a southeasterly course. All over the mountain were found boulders of Laurentian gneiss, which (according to their determination by Professor Frank D. Adams, of Montreal) must have come from the north side of the St. Lawrence River. It had before been shown that the highest mountains of New Hampshire and Vermont were glaciated from the northwest, but doubt had been lately expressed about Orford Mountain. These observations prove that the Laurentide ice-sheet overrode all these mountains, flowing from the region north of Montreal and Quebec southward and southeastward to the sea border.

5. *The Age of the Amboy Clay Series as indicated by its Flora.* By ARTHUR HOLLICK, Columbia University, New York City. Investigations in the paleobotany of the Amboy Clay series and the equivalents on Staten Island, Long Island, Block Island and Martha's Vineyard, conducted during the past twenty years by the late Dr. J. S. Newberry, Dr. Lester F. Ward, Mr. David White, the writer and others, have shown that the formation which includes them is very closely related to the Atane and Patoot beds of Greenland, the Dakota group of the West, the Albirupean series of the South and the Cenomanian of Europe, so that there was no hesitation in declaring them

all to be Middle Cretaceous in age. This conclusion seemed to be quite generally accepted and was apparently not questioned until about two years ago, when an announcement was made, with some show of authority, that the series is probably Jurassic in age. In regard to the correlation of the several formations mentioned there can be no question. The large amount of paleobotanical material available for comparison has given opportunity for the identification of so many species common to them all that this conclusion is not only justifiable, but inevitable, and the only question is whether the correlation also demonstrates that the several formations are Middle Cretaceous in age. If any one of them is, then they all are; if any one is not, then the others are not.

In paleobotany, as in paleozoology, the broad general facts are recognized that the biological sequence is coincident with the geologic sequence, and that the farther back in geologic time the simpler and lower in the scale of life were the organisms. Hence, if we divide our fossil flora into the three great classes of cryptophytes, gymnosperms and angiosperms, the sequence of their appearance and periods of maximum development would be in the same order. The percentages of these classes in any floras should, therefore, be a fair indication of the relative ages of the floras. A typical Jurassic flora, such as that of Siberia, contains, roughly, the following percentages: cryptophytes, 22; gymnosperms, 74; and angiosperms, 4. The Older Potomac flora, which is regarded as Lower Cretaceous, contains the same classes in the percentages of 39, 39 and 22; the Newer Potomac, regarded as Middle Cretaceous, 8, 13 and 79; the Amboy clays, 6, 13 and 81; the Dakota group, 1, 5 and 94. Similar examples of percentages are also calculated for other floras regarded as Cretaceous in age. The main fact, which is at once seen, is the manner in which the percentages of the gymnosperms and angiosperms are reversed. Few angiosperms, and only those of doubtful character, have been found in any formation recognized as Jurassic, so that when it was ascertained that in the Amboy Clay flora and its equivalents the angiosperms represent from 70 to 90 per cent. of the entire flora there was little hesitation in considering it as well advanced in the Cretaceous period. There would be nothing inconsistent in regarding the lowest of the Older Potomac strata as Jurassic, but even there it would require definite paleontologic evidence, while in regard to the Amboy Clay series it is safe to say that a Jurassic fauna will never be found in connection with its flora.

In face of the direct evidence of the fossil flora, therefore, it would seem a very hazardous undertaking, without ample evidence in rebuttal, to draw the line of separation between the Jurassic and Cretaceous so that in the West the base of the Cretaceous would be represented by the Dakota group and in the East by the clay marls of of the Matawan formation. (The paper was illustrated by tables of percentages and charts.)

6. *Some Feldspars in Serpentine, in Southeastern Pennsylvania.* By Professor T. C. Hopkins, State College, Pa. Feldspar occurs in this district as dikes or veinlike masses in serpentine, sometimes attaining a thickness of 20 to 25 feet. The most extensive area is in Chester county, extending also into Lancaster county; but there is another area in central Chester county, near the corundum mines. The feldspar is snow-white to pink in color, and seems to be wholly orthoclase. Some of the dikes have been exploited to a depth of 60 feet.

7. *The Region of the Causses, in Southern France.* By Rev. Horace C. Hovey, Newburyport, Mass. Lofty tablelands in the Departments of Lot and Lozére, along the

western declivity of the Cevennes Mountains, are known as the Region of the Causses. The term 'causse' is derived from the Latin word calx, meaning limestone. Some of the finest roads in Europe run along the plateaus, and occasionally descend into the valleys. But the author's exploration, here noted, led by E. A. Martel, of Paris, left all beaten paths at the village of St. Enimie, launched in canoes, and followed the winding gorges of the Tarn for 46 miles, and then, by mules or in carriages, explored the gorges of the Jonté and Durbais. The Causses vary in height from 1,000 to 5,000 feet above the sea, and these gorges are cut through them somewhat as the Grand Canyon of the Colorado cuts through the plateaus of Arizona. The cliffs of the river Tarn are often from 1,000 to 2,000 feet high, and occasionally still higher, and are brilliantly colored.

The caverns of the region are as remarkable as any in Europe. There are hundreds of them, and of all sizes. Among the large caverns explored by this party may be mentioned those of the Baumes Chaudes, three in number. From one of them the late Dr. Pruniéres exhumed 300 prehistoric skeletons, and in another are nine vertical pits from 40 to 127 feet deep. Another cave destined to become famous is that of Darjelan, with twenty halls from 65 to 600 feet long, the lowest of them being 420 feet deep. The author's party discovered and explored the Aven Armand, down whose chasm Louis Armand was the first to go. This vertical pit is 240 feet deep, beyond which is another 300 feet deep, the total vertical depth being 600 feet by actual measurement. The descent was made by a series of rope ladders, and was not without its dangers. The stalactitic decoration of these caves is remarkably fine.

The term 'aven' is applied to what we call a 'sinkhole,' except that the avens seem to pass more abruptly into pits or chasms. They pierce the Causses from the drainage level, and are death-traps for animals whose remains were found below in various stages of decomposition and whose bones lie imbedded in the dripstone. The theory is that every aven has a passageway to the rivers of the region. That this is often so is proved by the great springs at the base of the cliffs of the Tarn; but in some cases the subterranean passages trend away from the streams instead of toward them, and often they are dry, showing that the drainage must have been at some remotely ancient period.

Should it be asked why the wonderful Region of the Causses has so long escaped exploration amid a country of high antiquity, the answer is that these lofty plateaus are barren solitudes, except for the chalets of wandering shepherds. The gorges and avens have been objects of dread instead of places attracting visitors. The superstitions of the peasants have also operated to make them shun what a few tourists now delight to explore. Under the stimulus of the Société de Spéléologie, the region is being opened to the public, and it is destined to be resorted to by thousands of tourists when its interesting features become more widely known.

8. *The Washington Limestone in Vermont.* By C. H. RICHARDSON, Hanover, N. H. This name is proposed by the author for the more calcareous member of the Calciferous mica schist of Professor C. H. Hitchcock. It is for the most part a very dark silicious rock, the color of which is due to finely disseminated carbon. This formation, varying from 2,000 to 5,800 feet in thickness, extends from south to north through Vermont; but its most important development, economically, is in the townships of Washington and Topsham, Orange county, where, within the past five years, numerous valuable marble quarries have been opened in it. The chemical compo-

sition of specimens of this marble from a deep test pit at one of the quarries is very remarkable, no less than eighteen elements having been detected in its analysis.

9. *Fluctuations of North American Glaciation shown by Interglacial Soils and Fossiliferous Deposits.* By Warren Upham, St. Paul, Minn. From a comparison of our continental drift deposits with the present retreatal conditions of the piedmont Malaspina glacier in Alaska, it is concluded that the fauna and flora adjacent to the retiring ice-sheet were nearly like those of the same latitudes to-day, and that fluctuations of the ice border to the extent of a few miles, a few score, or a few hundred miles, more acceptably account for our interglacial beds, former surface soils and leached subsoils, than a general departure and renewal of the ice-sheet.

10. *Time of Erosion of the Upper Mississippi, Minnesota and St. Croix Valleys.* By Warren Upham. Until the Ozarkian epoch of great elevation of the northern part of this continent, inaugurating the Quaternary era, the upper part of the present Mississippi basin, above the vicinity of Dubuque, appears to have been drained northerly, according to recent studies by Hershey (*American Geologist*, Vol. XX., pp. 246–268, October, 1897). After the Cretaceous marine submergence of the State of Minnesota, its chief river system probably flowed through the Red River Valley to Hudson Bay during the Tertiary era, being reversed to take nearly the course of the Minnesota and Mississippi Rivers at the end of that era. The St. Croix River is thought by the author to have obtained its passage through the rock gorge of the Dalles at Taylor's Falls, Minn., so late as the Buchanan Interglacial epoch, preceding the Illinoian and Iowan glacial readvance; and the channel of the Mississippi from Minneapolis to Fort Snelling, eroded during the Postglacial period, has afforded to Professor N. H. Winchell his well-known estimate of that period as between 7,000 and 10,000 years.

11. *Supposed 'Corduroy Road' of Late Glacial Age, at Amboy, Ohio.* By Professor G. Frederick Wright, Oberlin, Ohio. This paper detailed the discovery of a series of logs lying side by side as in a corduroy road, and extending for a distance of 200 feet or more, which were covered by 30 feet of gravel, in which were found the tooth and tusk of a mammoth, the tusk being 10 feet long, 22 inches in circumference at the base, and weighing 155 pounds. The resemblance to a corduroy road was, indeed, very striking, but the appearance of the logs showed that they were driftwood, and had been buried by the accumulation of the gravel that took place along the old shore of Lake Erie, when, during the closing centuries of the Glacial period, the water was held up to a level 150 feet higher than now. The logs and base of the deposit are 140 feet above the lake and about 4 miles back from it, on the banks of Conneaut Creek, in the extreme northeastern corner of Ohio. The gravel was evidently brought down from the higher lands of the south, near the sources of the creek, and was deposited with the mammoth remains in a delta at the edge of this old glacial lake. In connection with this investigation it was ascertained that similar deltas of gravel characterize the margin of the old lake where other streams from the south met it at various places between this point and Cleveland. Altogether, these observations give a very vivid picture of the rapidity with which coniferous forests proceeded to cover northern Ohio as the ice melted back, and of the promptness with which the immense animals of the time reoccupied the territory. Important inferences are also derived, showing that the period of time during which the water remained at the high levels of the old ice-dammed lakes was short.

12. *Changes in the Drainage System in the Vicinity of Lake Ontario during the Glacial Period.* By DR. M. A. VEEDER, Lyons, N. Y. The paper noted sections of wells in buried river channels south of Lake Ontario, from the Niagara River eastward to the Mohawk Valley.

13. *Recent Severe Seismic Movements in Nicaragua.* By JOHN CRAWFORD, Managua, Nicaragua. Description of a series of earthquakes experienced in western Nicaragua from April 29th to May 12th of this year, as reported by the author in the *American Geologist* for July (Vol. XXII., pp. 56–58).

WARREN UPHAM,
Secretary of Section E, 1898.

(*To be Concluded.*)

THE BOTANICAL SOCIETY OF AMERICA.

THE fourth annual meeting was held at Boston, August 19 and 20, 1898, under the presidency of Dr. N. L. Britton.

In the absence of Professor C. R. Barnes, Secretary, Dr. B. L. Robinson was elected Secretary *pro tem.*

The following new members were elected: Robert A. Harper, University of Wisconsin, Madison; Edward A. Burt, Middlebury College, Middlebury, Vt.; Herbert J. Webber, Department of Agriculture, Washington, D. C.; L. H. Pammel, Iowa Agricultural College, Ames; Albert S. Hitchcock, Kansas Agricultural College, Manhattan; Herbert Maule Richards, Harvard University, Cambridge, Mass.; David G. Fairchild, Department of Agriculture, Washington, D. C.; David M. Mottier, University of Indiana, Bloomington.

In the absence of the retiring President, Professor John M. Coulter, his address, entitled 'The Origin of Gymnosperms and the Seed Habit,' was read by Dr. B. M. Davis. It has been published in this JOURNAL.

The following papers were presented:

1. On Sporogenesis in *Arisæma.* By Professor George F. Atkinson.

2. Symbiotic Saprophytism. By Professor D. T. MacDougal.

3. Sporogenesis in *Trillium.* By Professor George F. Atkinson.

4. The Structure and Development of the Centrosphere in *Corallina.* By Dr. B. M. Davis.

5. Relations Between the Forest Flora and Geological Formations in New Jersey. By Dr. Arthur Hollick.

6. Preliminary Notes on the Fertilization of the White Pine. By Miss M. C. Ferguson (by invitation of the Council).

7. Notes on a *Helianthus* from Long Island. By Dr. N. L. Britton.

8. Tetrad-formation in *Tsuga.* By W. A. Murrill. (Presented by Professor Atkinson.)

9. A Fossil Moss from the State of Washington. By Mrs. E. G. Britton and Dr. Arthur Hollick.

The following officers were elected for the ensuing year: President, Professor L. M. Underwood; Vice-President, Dr. B. L. Robinson; Treasurer, Dr. Arthur Hollick; Secretary, Professor Geo. F. Atkinson; Councillors, Professor C. E. Bessey and Dr. W. P. Wilson.

MEETING OF THE AMERICAN FORESTRY ASSOCIATION AT BOSTON.

THE meeting of the American Forestry Association, held in connection with the American Association for the Advancement of Science, was chiefly interesting for the reports of progress of the forestry movement. The sessions were held at Horticultural Hall, on Tuesday, August 23d, to Thursday, August 25th. The social features and excursions of interest, lavishly provided by a local committee and the Massachusetts State Forestry Association, formed a prominent part of the meeting. The opening session was mainly occupied by reports from delegates of various States as to the condition of the forestry movement. Forest Commissioner Rothrock, of Pennsylvania, reported progress in the establishment of State Forest Reserves. Mr. Austin Cary, of Maine, referred to his employment by a paper-pulp manufacturing company to direct the logging of their large forest