ing themselves. Hence, though it is certain that the most voluminous and, perhaps, the most comprehensive results, and those resulting from the performance of coherent experiments extending through a long series of years, will come from the great centers of research, there is no reason why qualitative results equal to the best may not continue to come, as they have in the past, from isolated workers, to the rounding out and completion of whose studies the facilities of the larger institutions will be more and more applicable as the problems of equipment are worked out.

William Trelease.

Botanical Garden of Missouri.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION E.—GEOLOGY AND GEOGRAPHY.

Section E of the American Association this year virtually included the Geological Society of America. The latter organization held only a short meeting for routine business on the Saturday evening previous to the meeting of the American Association, and referred all its papers to Section E of the A. A. A. S. The total number of papers offered in Section E was 42. The last day of the meeting the Section was divided into two subsections, one dealing with Pleistocene Geology, and the other taking the remainder of the field of the science. Even with this division, the time did not suffice for the full reading of all the papers, and a considerable number of papers whose authors were absent were read by title. While none of the papers recorded any discoveries of epoch-making significance, nearly all of them contained the results of solid and valuable work, contributing, in an important degree, to the advancement of science.

The following is a list of the papers presented:—

Notes on the Artesian Well sunk at Key West, Florida, in 1895. By Edmund Otis Hovey.

The Hydraulic Gradient of the Main Artesian Basin of the Northwest. By J. E. Todd.

The true Tuff-beds of the Trias, and the mud enclosures, the underrolling, and the basic pitchstone of the Triassic Traps. By B. K. Emerson.

Volcanic Ash from the North Shore of Lake Superior. By N. H. Winchell and U. S. Grant.

The "Augen-gneiss," Pegmatite Veins, and Diorite Dikes at Bedford, Westchester Co., N. Y. By Lea McI. Luquer and Heinrich Ries.

The Tyringham (Mass.) "Mortise Rock," and Pseudomorphs of Quartz after Albite. By B. K. Emerson.

The Succession of the Fossil Faunas in the Hamilton group at Eighteen Mile Creek, N. Y. By Amadeus W. Grabau.

Development of the Physiography of California; Synopsis of California Stratigraphy. By James Perrin Smith.

Ancient and Modern Sharks, and the Evolution of the Class. By E. W. Claypole.

Observations on the Dorsal Shields in the Dinichthyids. By Charles R. Eastman.

The Discovery of a new Fish Fauna, from the Devonian Rocks of Western New York. By F. K. Mixer.

Interglacial change of course, with gorge erosion, of the St. Croix River, in Minnesota and Wisconsin; The Cuyahoga Preglacial Gorge in Cleveland, Ohio. By Warren Upham.

A Revision of the Moraines of Minnesota. By J. E. Todd.

Notes on certain Fossil Plants from the Carboniferous of Iowa. By Thomas H. Macbride.

Origin of the High Terrace Deposits of the Monongahela River. By I. C. White.

The making of Mammoth Cave. By Horace C. Hovey.

The Colossal Cavern. By Horace C. Hovey.

James Hall, Founder of American Stratigraphic Geology. By W J McGee.

Professor Hall and the Survey of the Fourth District. By John M. Clarke.

Sheetflood Erosion. By W J McGee.

Glacial Flood Deposits in the Chenango Valley. By Albert P. Brigham.

Origin of Conglomerates. By T. C. Hopkins.

Origin of Topographic Features in North Carolina. By Collier Cobb.

The Cretaceous Clay Marl Exposure at Cliffwood, N. J. By Arthur Hollick.

Post-Cretaceous Grade-Plains in Southern New England. By F. P. Gulliver.

The Algonquin River. By G. K. Gilbert.

The Whirlpool-Saint David's Channel. By G. K. Gilbert.

Profile of the bed of the Niagara in its Gorge. By G. K. GILBERT.

The Niagara Falls Gorge. By GEORGE W. HOLLEY.

Origin and Age of the Laurentian Lakes and of Niagara Falls. By WARREN UPHAM.

Correlation of Warren Beaches with Moraines and Outlets in Southeastern Michigan. By F. B. TAYLOR.

Notes on the Glacial Succession in Eastern Michigan. By F. B. TAYLOR.

The Operations of the Geological Survey of the State of New York. By JAMES HALL.

The Eocene Stages of Georgia. By GILBERT D. HARRIS.

The Origin and Age of the Gypsum Deposits of Kansas. By G. P. GRIMSLEY.

Geomorphic Notes on Norway. By J. W. SPENCER.

The Slopes of the Drowned Antillean Valleys. By J. W. SPENCER.

Notes on Kansan Drift in Pennsylvania. By E. H. WILLIAMS.

Preliminary Notes on the Columbian Deposits of the Susquehanna. By H. B. BASHORE.

Pre-Cambrian Base-leveling in the Northwestern States. By C. W. HALL.

The address of the Vice-President, Prof. B. K. Emerson, has been published in full in this JOURNAL, and requires, therefore, only brief reference here. It was a remarkably bright and interesting address, and was listened to with delight by a large audience.

Two sessions of the Section were occasions of especial interest, dependent in one case upon the time, and in the other upon the place, of the meeting. The former of these sessions, occurring on Wednesday afternoon, was devoted chiefly to exercises in commemoration of the sixtieth anniversary of Prof. James Hall's work on the Geological Survey of the State of New York. It is, indeed, a fact well worthy of commemoration, that the great geologist who is now at the head of the New York Survey, has completed a period of sixty years of continuous service, and still possesses a physical and mental vigor which promises years of fruitful work in the future. In some respects, the survey of the State of New York has been of more importance in the history of American geology than that of any other part of the country. The remarkably complete exhibition of the Paleozoic strata in that state, the relatively early date of the commencement of their study, and the sagacity with which the true principles of stratigraphical classification were conceived by Prof. Hall and his associates, have made the State of New York the standard of comparison in the study of Paleozoic formations for the whole region of North America east of the Cordillera. The work of Prof. Hall holds, therefore, a relation to the stratigraphical geology of North America somewhat similar to that which the work of William Smith in England holds to the general stratigraphical geology of the world. The New York Survey has a special interest for the members of the American Association, by reason of the fact that the Association of American Geologists, first organized by the State Geologists of New York and a few other states, was the germ which developed into the American Association for the Advancement of Science. The exercises were introduced by Vice-President Emerson in a brief and appropriate address. Prof. Joseph Le Conte, President of the Geological Society of America, spoke in behalf of that Society with rare eloquence. Prof. Hall responded gratefully to the congratulations of his fellow geologists. The papers by W J McGee and John M. Clarke, in which was given an appreciative history of Prof. Hall's work, were worthy of their theme. A letter of congratulation was read from Dr. George M. Dawson, Director of the Geological Survey of Canada; and appropriate remarks were made by a number of gentlemen who, in various ways, had been associated with Prof. Hall and his work. The meeting, as a whole, was an appropriate and worthy commemoration of an epoch-making work.

The other occasion of especial interest

was the meeting of the sub-section of Pleistocene Geology on Friday afternoon, when the papers were read relating to the history of Niagara Falls. Mr. Gilbert's three papers were of extraordinary interest. In the paper on the Algonquin River, evidence was given of an outlet of Lake Algonquin, heading at Kirkfield, Ontario, and following the Trent River to Lake Ontario. This outlet for the drainage of the upper lakes belonged to an earlier date than the outlet through Lake Nipissing and the Ottawa River. There is, therefore, evidence of two epochs, after the birth of the Niagara River, in which it lost the waters of the upper lakes, and was reduced to the condition of an outlet merely for the Erie basin. In the paper on the Profile of the Bed of Niagara in its Gorge, evidence was given to show the correlation between these epochs of low water and the excavation of particular parts of the gorge. In the swifter and more turbulent parts of the Niagara, a determination of the depth by sounding is, of course, impracticable; but an approximate estimate of the depth has been reached indirectly by determining the velocity of the water, since obviously the same volume of water must pass in a unit of time through every cross section of the gorge. The Niagara gorge shows two stretches of narrow and shallow channel, in which the current is swift and tumultuous, one extending from the railroad bridges to the Whirlpool, the other extending for some distance below Foster Flats. The latter was apparently excavated during the low-water epoch in which the drainage of the upper lakes was through the Algonquin River, while the former is correlated with the later epoch in which the upper lakes discharged their waters by way of Lake Nipissing and the Ottawa River. In the discussion of Mr. Gilbert's papers, Mr. F. B. Taylor gave important confirmation of the views advanced in regard to the history of Niagara, derived from his investigations upon the history of the lakes.

In his paper on the Whirlpool-St. David's Channel, Mr. Gilbert presented evidence for the belief that that channel was excavated in preglacial times to a depth below the present level of the Niagara River. The outcrops of rock in Bowman's Creek were explained as due to the fact that Bowman's Creek is not in the middle, but at one side, of the ancient preglacial channel. The evidence of a deep, continuous channel between the Whirlpool and St. David's is acknowledged to be incomplete, since none of the wells in that region are in the line of the middle of the channel, and none of them, therefore, reveal its full depth.

In the discussion of this paper, Prof. I. C. White suggested that at moderate expense an experimental boring could be made in the direct line between the Whirlpool and St. David's, and the question of the existence of a deep channel in that vicinity conclusively settled. The suggestion was favorably received, and a committee, consisting of Prof. White and Messrs. Gilbert and Spencer, was appointed to carry out the proposed investigation. Subscriptions of twenty-five dollars each towards the expense of the investigation were made by Prof. White, Prof. H. S. Williams, and Mr. F. B. Taylor.

Besides the papers relating to Niagara, a number of other interesting papers relating to Pleistocene Geology were presented. Mr. F. B. Taylor, in his paper on the Glacial Succession in Eastern Michigan, described a series of fifteen terminal moraines between Cincinnati and the Straits of Mackinaw, and pointed out interesting correlations between the Quaternary history of Michigan and that of western New York.

Mr. Warren Upham, in his paper on the St. Croix River, gave evidence that in preglacial times the upper St. Croix River left

the present St. Croix valley near the mouth of the Sunrise River, and emptied into the Mississippi between Anoka and Minneapolis, while the lower St. Croix Valley was occupied only by the waters of the Apple River. The intermediate portion of the present St. Croix River, including the picturesque gorges called the Dalles, is attributed to the Aftonian and Wisconsin stages of the Glacial period. In his paper on the Cuyahoga Preglacial Gorge, Mr. Upham presented evidence that that valley was deeper than had been indicated by facts previously known, new reports of wells giving a depth of 350 to 470 feet below the surface of Lake Erie.

Prof. J. E. Todd gave an interesting review of the Moraines in Minnesota. These moraines were mapped by Mr. Upham as extending east and west in nearly straight lines without regard to the topography of the country. Such a position seems *a priori* improbable; and, according to Prof. Todd's observations, the morainic accumulations may be considered as forming a series of concentric curves around lobes of the ice sheet.

Prof. I. C. White, in his paper on the High Terrace Deposits of the Monongahela River, attributed them to a Monongahela Lake, made by the ice sheet damming up the Monongahela River, whose outlet in preglacial time was northward into the Erie basin. In the discussion of this paper, Mr. Gilbert called attention to the remarkable fact that the two main tributaries of the Mississippi, the Ohio on the east and the Missouri on the west, are both in large part streams of postglacial origin.

While the subject of Pleistocene Geology occupied a large part of the attention of the Section, other departments of geology were by no means neglected. Dr. E. O. Hovey gave an interesting account of an artesian boring at Key West, Fla., reaching a depth of 2000 feet. The boring was in limestone for the whole distance, although the rock exhibited considerable variation in texture. By the evidence of characteristic fossils, the summit of the Vicksburg formation was recognized 700 feet below the surface.

Prof. I. E. Todd presented interesting data from the numerous artesian wells in Dakota and the adjacent regions, whose abundant water supply is derived from the Dakota formation. In general, the water pressure in these wells is found to diminish eastward, but with local variations which it is by no means easy to explain.

Rev. H. C. Hovey, D. D., presented a paper on the Making of Mammoth Cave, which he attributed purely to the solvent action of water upon the limestone. Neither seismic disturbance, nor a supposed pot-hole action in the deep pits or depressions of the cave, can be considered to have had any considerable effect. Many measurements were given of different parts of the cave, which Dr. Hovey and his associates have most thoroughly explored. Dr. Hovey also described a newly discovered cave called the Colossal Cave.

Mr. W J McGee's paper on Sheet-flood Erosion called attention to the remarkable conditions existing in Papagueria, a district lying in southwestern Arizona and western Sonora, where an extensive area between mountain ranges has been planed off by the erosive action of water, and veneered with a thin sedimentary deposit. The erosion and deposition are due, not to streams concentrated in definite channels, but to the flowing of waters in broad sheets over the region after violent rains.

Prof. B. K. Emerson, in his paper on the Tuff Beds and other features of the Connecticut Valley Trias, called attention to some very remarkable phenomena. In some localities the broken surface of the extrusive trap sheets, with the calcareous or arenaceous deposits mingled with the trap, has been rolled under in the

onward flow of the trap, so that the same phenomena appear both at the top and bottom of the trap sheet. In certain localities the wet mud of the estuary bottom, over which the trap sheet flowed, has risen up into the trap, presenting an appearance very similar to that of true tuff beds. In these cases portions of the mud have been metamorphosed into a quartzite, and portions of the molten material of the trap, chilled by the ascending currents of mud and water, have solidified into a pitchstone or tachylite.

Prof. N. H. Winchell reported the discovery of fragmental volcanic deposits near Duluth, although no remains of craters had been recognized. It is remarkable that, amid the abundant interbedded igneous rocks of the Lake Superior region, only one find of fragmental volcanic deposits had hitherto been reported.

Prof. J. Perrin Smith gave a lucid account of the Physiography of California, illustrating it by a photograph of a relief map, which was projected on a screen. In discussing the causes of the present physiography, he dwelt especially upon the Tertiary and post-Tertiary uplifts and consequent erosion.

A number of interesting papers were presented in the department of Paleontology. Prof. E. W. Claypole's paper on Ancient and Modern Sharks gave an interesting account of the peculiarities of ancient sharks, as revealed by the recent discoveries of Dr. Clark and others in the Cleveland shale of northern Ohio. The remains referred to are remarkably well preserved, and throw much light upon the evolution of the Elasmobranchs.

Dr. C. R. Eastman gave a very interesting paper on the Dorsal Shields of the Dinichthyids. The median dorsal plate in these fishes bears a keel, which is comparatively slightly developed in Coccosteus, but attains a greater development in other genera of the group, reaching its maximum in Dinichthys and closely related genera, in which it is produced backward far beyond the margin of the plate. This keel is believed to serve for the attachment of muscles for swimming. Dinichthys livonicus, from Russia, first described by Pander as a species of Coccosteus, is the smallest and earliest species of Dinichthys, and the one most resembling Coccocteus. A comparison of the different species of Dinichthys shows that, as the genus moved westward from its starting point in eastern Europe, the species increased in size and in differentiation.

Mr. F. K. Mixer gave an account of recent discoveries of fossil fishes in the Hamilton and Portage formations of western New York. The discoveries indicate in the Portage of that region an abundant and varied fish fauna, including groups so diverse as those represented by Dinichthys, Holoptychius and Palæoniscus.

Mr. A. W. Grabau gave a detailed account of the succession of fossil faunas in the Hamilton group at Eighteen Mile Creek, near Buffalo. The comparison of the succession of faunas at Eighteen Mile Creek with that shown in the salt shaft at Livonia reveals a very interesting instance of migration, since the shale beneath the Encrinal Limestone at Eighteen Mile Creek contains essentially the same fauna found in a shale above the Encrinal Limestone at Livonia.

Prof. A. Hollick gave an account of the exposure of Cretaceous clay marl at Cliffwood, N. J. The fossils from this locality are poorly preserved, but are of great interest as marking a transition from the estuarine conditions of the Amboy clays to the marine conditions of the overlying marls. The deposit is considered to represent the Mattawan formation of Prof. W. B. Clark.

Prof. T. H. McBride exhibited microscopic sections of remains of Sigillarids and Conifers from the Carboniferous of Iowa.

The remains are so exquisitely preserved as to throw much light upon the nature of the Carboniferous flora.

In recent years a very important part of the work connected with the meeting of Section E and the summer meeting of the Geological Society has been in the line of excursions, under expert guidance, to interesting geological localities in the vicinity of the meeting. The geological excursions connected with the present meeting have been on a more extensive scale than ever before. For the week preceding the meeting of the Associotion, four excursions in different parts of the State of New York were proposed, but only two of them were carried out.

An excursion for the study of Pleistocene Geology commenced on Monday, August 17th, at Rochester, N. Y., under the direction of Prof. H. L. Fairchild. Monday was spent in the study of the phenomena of Lake Iroquois, in the vicinity of Rochester, and the kame moraine of the Pinnacle Hills. On Tuesday the party visited the high beaches lying east of the Genesee valley, arriving at Mount Morris for the night. On Wednesday the party visited the "High Banks" of the Genesee, near Mount Morris, and the Portage Falls, with the terraces above them, and the water-leveled drift which blocked the old valley. The night was spent at Portage. Thursday was spent in studying the beaches and moraines between Alden and Crittenden. Mr. Frank Leverett had intended to conduct the party the latter half of the week, but on account of sickness was unable to do so. The party accepted the invitation of Mr. B. W. Law to visit his home in the Cattaraugus valley; and Friday was spent in the study of the preglacial and postglacial channels of Cattaraugus Creek, the Warren glacial lake fillings, and the beaches at Eden Valley and Hamburg.

Another excursion, devoted especially to the study of Petrographic Geology, commenced on Monday, August 17th, at Port Henry, on Lake Champlain, under the direction of Prof. J. F. Kemp. Monday was spent in the study of the crystalline limestones, and the gabbros with their remarkable gneissoid modifications, in the immediate vicinity of Port Henry, and the great mines of magnetite at Mineville. Tuesday the party went by steamboat to Plattsburgh, studying on the way the titaniferous magnetites at Split Rock Mine and some of the numerous dikes along the shore. On Wednesday the party went by rail to Ausable Forks, and thence by stage through the Adirondacks to Lake Placid, passing through the magnificent fault valley of Wilmington Notch, and along the eastern foot of Whiteface Mountain. Thursday and Friday was spent at Gouverneur, under the direction of Prof. C. H. Smyth, Jr. The party studied the gneisses which form the prevalent rocks in the region, some of which seem to be granite dynamically metamorphosed, while others appear to have more the character of metamorphosed sediments. The crystalline limestones with their remarkable enclosures, the talc mines, the danburite locality in the town of Russell, and a remarkable instance of dynamic metamorphism in gabbro, were also studied.

During the meeting of the Association, the afternoon of Thursday was occupied by an excursion to Eighteen Mile Creek, and a study of the fossiliferous rocks, under the direction of Mr. Grabau, whose paper on the subject has been already mentioned.

Monday and Tuesday of the week following the meetings were occupied by an excursion for the study of the problems of Niagara, under the direction of Mr. G. K. Gilbert. The first day the party visited the Whirlpool, recognized the drift on the bank of the stream at that point as unmistakably in situ, climbed up through the ravine of Bowman's Creek, visited the remarkable

precipice at Wintergreen Flats (where a small branch of the river seems once to have made a cascade like the present American Fall) and recognized in the gorge the alternation between the broad and deep stretches of quiet water, corresponding to the high-water epochs during the erosion of the gorge, and the narrow and shallow stretches with swift and tumultuous current, corresponding to the low-water epochs. On Tuesday the route led over the supposed buried channel to St. David's ; and the party proceeded thence along the edge of the escarpment to Queenstown, returning, at the close of the day, from Lewiston to Niagara Falls by the railway in the gorge.

William North Rice,
Wesleyan University. *Secretary.*

SECTION H.—ANTHROPOLOGY.

The Section of Anthropology at the Buffalo meeting, American Association for the Advancement of Science, August 23d–28th, met on Monday morning for the transaction of the usual business, in addition to which it was this year necessary to elect a Secretary, because of the death of Capt. J. G. Bourke, who was chosen at the Springfield meeting. The place was filled by the election of G. H. Perkins, of the University of Vermont. In the afternoon the address of Miss A. C. Fletcher, Vice-President of the Section, was read, a most interesting, suggestive and valuable contribution to our knowledge of the religious ideas of the Dakotan peoples. Its subject was 'The Emblematic Use of the Tree in the Dakotan Group.' This address will be published in full in Science.

On Tuesday morning Section H, as was the case with all the Sections, settled down to the regular reading of papers. The programme of this and the following days was made far more orderly and helpful than it has been heretofore by reason of certain preliminary arrangements. A provisional programme had been arranged before the opening of the session, which was possible because, through the energy of the Vice-President, notice of the meeting and request for early sending of abstracts of papers which members intended to present had been sent to all those especially connected with the Section. The response to this request had been so hearty that the provisional programme required very little change as it was used from day to day. Another and convenient change was the arrangement of all papers, the titles of which had been received, under various headings, as Archæology, Ethnology, Somatology, and assigning one or more sessions to each heading. In this way, although absolute order could not be brought about because of the late arrival of authors and for other reasons, a reasonable degree of unity in the papers presented at each session was secured, very greatly to the advantage of both hearers and readers.

A large number of papers were offered to the Section, most of which were read, occupying all the time up to the last day of meeting. The quality of the papers was fully equal to that at previous meetings, and at adjournment the members of Section H agreed that a very profitable and enjoyable session had been held. The courtesy and good humor which prevailed during all the numerous discussions was noticeable. Many of the papers presented opinions with which all could not agree, but differences of opinion were always expressed in a most kindly manner. It is to be remembered that space allows no account of these discussions and that the papers are reported simply as presented by the authors and give only their views of the question treated.

It is also to the credit of the Section of Anthropology that it is the only Section which has recognized the justice of giving equal honor for equal work to woman as to man, and that a woman who has done good work in the department which the Section