A. B. COBLE: 'Some applications of a theorem in the theory of forms.'

L. E. DICKSON: 'The group of a tactical configuration.'

T. S. FISKE: Presidential address, 'Mathematical progress in America.'

MAURICE FRÉCHET: 'Sur les opérations linéaires (deuxième note).'

F. MORLEY: 'On an inversive relation between five points of a plane.'

J. E. WRIGHT: 'Application of the theory of continuous groups to a certain differential equation.'

EDWARD KASNER: 'Geometry of point correspondences: osculating homographies.'

C. H. SISAM: 'On septic scrolls.'

E. V. HUNTINGTON: 'Note on definitions of groups, abelian groups, and fields.'

E. V. HUNTINGTON: 'A set of postulates for ordinary complex algebra.'

BURKE SMITH: 'On the deformation of surfaces of translation.'

L. E. DICKSON: 'A general theorem on algebraic numbers.'

A. B. COBLE: 'The similar projective groups of a cubic space curve and a quadric surface.'

E. H. MOORE: 'On a definition of abstract groups.'

The Chicago Section of the society met at Chicago, on December 30–31. The next meeting of the society will be held on February 25. The San Francisco Section will meet on the same date.

F. N. COLE,
Secretary.

THE GEOLOGICAL SOCIETY OF AMERICA.

THE seventeenth annual meeting of the Geological Society of America was held at the University of Pennsylvania, Philadelphia, December 29–31, 1904, under the presidency of Professor John C. Branner, of Stanford University. Sixty-one papers, divided among eight branches of the science, were presented for reading, and about one hundred members of the society were in attendance, making the convention one of the largest in its history. The report of the council for the year 1904 shows that in all respects the affairs of the society are in a highly satisfactory condition. The net active membership of the society was reported as being 259, and 15 new members were elected at the Philadelphia meeting. During the past year, five members have been removed by death, Professor C. E. Beecher, J. B. Hatcher, Henry McCalley, W. H. Pettee and Charles Schäffer. Memorials of these members were read at the first session of the Philadelphia meeting.

The report of the treasurer showed that the society had a balance in the treasury, December 1, 1904, of $1,973.68 and invested funds amounting to $8,300. The volume of the *Bulletin* of the society comprises 636 pages of text, with 75 illustrations, the articles being divided among nine branches of the science, of which stratigraphic geology occupies about one half. The library of the society, which is deposited with the Case School of Applied Science in Cleveland, now comprises some 2,600 numbers, of which 1,400 are bound volumes.

Professor Branner chose as the subject of his presidential address, 'Geological and Geographical Studies on the Northeast Coast of Brazil,' and illustrated his paper by means of numerous photographs and charts. The most peculiar feature of this coast is the series of hardened sandspits occurring at the mouths of most of the rivers. These spits consist of quartzose sand which has been cemented together into a hard solid rock by means of calcium carbonate brought down in solution by the rivers and precipitated by contact with the waters of the ocean, which here possess a high degree of salinity. This hardening extends to a depth of several feet and, in many instances, has been of great economic importance through the formation thereby of natural breakwaters, forming safe harbors, as at Pernambuco. The spits contain many fossils, all of which are of living species. A second coast feature of importance

is the series of coral reefs which alternate or which are associated with the sandspits in certain localities. These reefs seem to be comparatively thin, but many of them are wide. That the coast has remained stationary for a considerable time is indicated by the fact that these reefs reach to the upper limit of coral growth, where they show broad areas of dead coral within the fringe of living animals.

In the restricted space of a summary report like the present it will not be possible to do more than briefly outline the contents of the more important of the 43 papers which were actually read, leaving out of account those which were read only by title.

Dr. Robert Bell, director of the Geological Survey of Canada, read a somewhat detailed paper on the geology of the region in the vicinity of the Great Slave Lake, and illustrated his remarks by maps and sections made for the Canadian Survey.

Professor E. R. Cumings, of the Indiana State University, discussed the development and morphology of *Fenestella,* and showed that this Devonian bryozoa is related genetically to the cyclostomata. In a paper concerning new evidences of the geographical differences of fossil faunas of the same age, Professor H. S. Williams, of Cornell University, stated that extended study of the Devonian rocks of the eastern United States pointed to the conclusion that geological faunas once thoroughly established probably possessed a geological range far greater than is indicated by the actual range in any particular section.

The petrographic and economic papers were introduced by Professor James F. Kemp, of Columbia University, in a paper detailing observations made along the garnet contact zones and associated copper ores at San José, Tamaulipas, Mexico. These contact zones are the result of the action of an intruded bed of andesite upon the surrounding Cretaceous limestone. Geologically the formation of garnets has been the most important feature and has resulted from the rearrangement and recrystallization of the materials present in the limestone. The chalcopyrite, which is the important ore, is a later phase of the contact phenomena. In another communication Professor Kemp described his method of 'Geological Bookkeeping,' which is a system of taking notes in the field and of locating the observations upon the field map, based upon a series of definite and invariably subdividing squares. This leads to a compilation book in which the observations of scattered seasons are entered upon pages which correspond in their enumeration to the series of squares on the field map. It is believed that the system possesses advantages in affording permanency and intelligibility of records even though the latter be made at widely diverse times and by different individuals.

In a paper on the occurrence and distribution of celestite-bearing rocks, Professor E. H. Kraus, of Michigan State University, stated that the mineral occurs widely throughout central New York and southern California. The percolating waters have leached out the crystals to a considerable extent, forming the so-called 'vermicular' limestones of New York and the 'gashed' and 'acicular' dolomites of Michigan. Precipitation of the material from these waters is the source of the large deposits of celestite which occur at Put-In Bay, the Maybee Quarry, Monroe County, Mich., and elsewhere.

Professor T. C. Hopkins, of Syracuse University, described the closely crystalline, fine, fossiliferous, metamorphic limestones of central and southern California which contain the wonderful deposits of tourmaline and other gems which have been obtained within the past few years from

Eldorado County southward to the national boundary.

According to Dr. G. P. Merrill, of the National Museum, the so-called asbestos (fibrous serpentine) of the Thetford Mines, Canada, and elsewhere, fills cavities which were made by the shrinkage of the massive serpentine in which the fibrous material occurs, and he advances arguments to prove that the filling process is due to crystallization from the walls of the cavities inward.

Messrs. Ralph Arnold and A. M. Strong, of the California State University, described at length the crystalline rocks of the San Gabriel Mountains near Pasadena, Cal. The last of the petrographical papers was by Dr. G. M. Murgoci, of Bucharest, Roumania, and concerned the origin of the peculiar rock known as riebeckite granite, suggesting that the change from normal granite was due to heavy pressure combined with motion.

Five papers on physiographical geology were presented, three of which were read in full. Professor N. M. Fenneman, of the University of Wisconsin, in a paper on the control of the form of contact surfaces by marine denudation, laid down the principles that the nature of a surface of unconformable contact between strata is determined by two factors: (1) the topography of the early land surface, and (2) cliff erosion during submergence. The first element would preserve the former land-surfaces in the subsequent beds, while the dominance of the second element would make the contact surface in every case a plane.

Professor R. S. Tarr, of Cornell University, described some drainage features of southern central New York showing the relation of the pre-glacial valleys to the present surface. In many instances along the divide between the Susquehanna and St. Lawrence drainage system there is a condition of lowered divides, across some of which, as in the Tioughnioga valley, east of Cortland, and Cayuta Creek valley, west and south of Van Etten, the present drainage passes. Three theories may be adduced to account for these phenomena: glacial erosion, erosion by ice-fed stream and head-water erosion during rejuvenation. Evidence from valley form, glacial deposits and hanging tributary valleys is presented to prove that these drainage features are in many cases, if not in all, due to changes of earlier date than the advance of the Wisconsin ice sheet. While the influence of possible earlier ice advances, of which no evidence has been found in this region, is not eliminated, the facts so far discovered favor the hypothesis of rejuvenation rather than of glacial action during earlier ice advance.

The next paper pertained to hanging valleys and was by Professor Israel C. Russell, of the University of Michigan. He recognizes four classes of such valleys, each of which contains several varieties. The author considers that too much stress has been laid upon the existence of lateral glaciated hanging valleys on the sides of glaciated troughs and he advances evidence to show that in certain instances at least such valleys are not due in a conspicuous manner to differentiation of glacial erosion. The study of glaciated hanging valleys is intimately connected with a still greater problem, namely, the origin of the leading features in the relief of such mountains as the Sierra Nevada range and the Cascades. There is good reason for thinking that these two ranges were deeply stream-sculptured prior to the glacial epoch.

Under the head of physical and structural geology twelve papers were read. Professor C. K. Leith, of the University of Wisconsin, discussed in masterly fashion the present state of knowledge of the subject of rock cleavage, with special reference to recent publications by Dr. Becker and

himself. The author has devised a piece of apparatus which mechanically illustrates his theories in a remarkable manner. Professor E. H. Kraus, in a paper on the origin of the caves of the island of Put-In Bay, Lake Erie, stated that in all probability the folding of the Lower Helderberg limestone of the region was caused by hydration of anhydrite, since large deposits of gypsum have been encountered in sinking wells in the immediate vicinity. The increase in volume caused by such hydration may be as high as sixty per cent. and the energy developed in the process would be sufficient to account for the results observed. Subsequent leaching out of the gypsum by percolating waters would account for the existence of the caves, and the collapse of the roofs of the cavities would account for the step-like form of the ceiling.

Mountain growth and mountain structure was the subject of a communication from Mr. Bailey Willis, of the United States Geological Survey. The study of peneplains at various altitudes with reference to sea level, in North America and Eurasia, demonstrates that elevations of the earth's surface have resulted from deformation which produced warping of previously levelled-off surfaces. In general this process has been a recent one, post-Mesozoic in time, and it may be held that mountains are youthful features of the earth. The structures which have been discovered in mountain masses are such as are developed under a considerable load, and consequently at notable depths in the earth's mass. Study of the relation between structure and form leads to the conclusion that modern mountains are not the effects of the forces which produce the structure, a conclusion which cuts at the foundation of older systems of classification.

Professor Florence Bascom, of Bryn Mawr, brought out by means of detailed maps the nature of the formation and the structure of the Piedmont region of Pennsylvania, giving the results of extended field work carried on for the United States Geological Survey. Her paper was followed with one on the Piedmont of Maryland in correlation with that of Pennsylvania by Professor E. B. Mathews, of Johns Hopkins University. The latter author afterward read a paper on the Cockeysville marble, in which he gave the results of much very close field study by himself and W. J. Miller, of Baltimore, into the concrete problem in Piedmont structure, the area concerned occupying approximately 300 square miles and lying north of the city of Baltimore.

Mr. N. H. Darton, of the United States Geological Survey, in discussing overlap relations along the Rocky Mountain front range, described features which have been traced by him through Wyoming and Colorado into New Mexico, mainly for the purpose of correlating the different forms. He finds that the Paleozoic and Mesozoic rocks of the region present frequent variation in character, occurrence and varieties. In the course of his field work, Mr. Darton visited the Zuñi salt lake, forty miles north of the Indian pueblo of Zuñi. At this locality there is in the plain a circular depression about a mile in diameter, containing a salt lake and two cinder cones. The depth of the depression is about 200 feet and its walls are of Cretaceous sandstone, capped on one side by a lava flow. All around the rim there is a wide low ridge of volcanic ejecta which has been laid down in water. The history of this remarkable feature is not clear.

Professor Frank C. Adams, of McGill University, presented the results of an investigation made by himself and Mr. E. J. Coker into the cubic compressibility of rocks and certain phases of rock flow. The

apparatus employed was an improvement of that which had been used by Professor Adams in some remarkable experiments, the results of which were published five years ago. In the present experiments, nickel-steel tubes have been used and the compressibility of fourteen typical rocks determined, and the deformation of the rock-making minerals concerned were carefully studied by means of the microscope.

Mr. E. O. Hovey, of the American Museum of Natural History, presented three papers upon the Caribbean volcanic islands. He described the Soufrière of St. Lucia as being the result of waning volcanic activity manifested along ancient fissures, but not within any recognizable crater. The Boiling Lake of Dominica is considered to be within an ancient broken-down crater from the southern portion of which there was a superficial eruption of dust and fine lapilli in 1880. The third of these papers pertained to the present condition of Mont Pelé, which was stated to be in a condition of intermittent mild activity; the dome, which has formed as a feature of the eruptions which began in 1902, is still undergoing modifications, elevation and subsequent destruction by explosion being nearly balanced. The great spine was destroyed more than a year ago.

The six papers upon glacial geology which were read gave rise to much discussion. The first of the series was by Professor R. S. Tarr, upon the moraines of the Seneca and Cayuga Lake valleys. During the recession of the Wisconsin ice sheet a stand was made near the heads of the two lake valleys—Cayuga and Seneca. This major ice stand consisted of a series of minor halts in the receding ice which projected lobes up the two lake valleys, and minor lobes into the side valleys. By reason of the irregularity of topography and the several minor halts, a complex series of moraines was accumulated, both as lateral and terminal deposits, the latter being developed with especial intensity in the two major valleys south of the heads of the lakes.

The drumlins in the Grand Traverse region of the northwestern part of the southern peninsula of Michigan have been studied recently by Mr. Frank Leverett, of Ann Arbor, Mich., who contributed a paper on them which, in the absence of the author, was read by Professor Russell. Particular attention was devoted to modes of development, since more than one mode appears to have been operative; some drumlins have been sculptured from earlier deposits at the last ice advance, and some built up during that advance from material contained in the ice. Attention was called incidentally to heavy deposits of nearly pebbleless laminated clay, apparently laid down in interglacial lakes, for this clay has been molded to some extent into drumlin forms by a subsequent ice invasion. Large valleys excavated in this interglacial clay were briefly discussed and shown to antedate the production of the drumlins, the latter being in some cases built upon the valley bottom.

A second paper upon the drumlin areas of Michigan was delivered by Professor Russell. It described with some detail two regions in the northern peninsula of Michigan, in which drumlins form the most conspicuous features of the topography. One of these areas includes Les Cheneaux Islands and a part of the adjacent mainland, on the north shore of Lake Huron; and the other area is situated principally in Menominee County, to the west of Green Bay. The drumlins are for the most part smooth-surfaced, half-cigar-shaped hills of the normal type, but in a few instances instructive irregularities are present. Among these irregularities are: A flattening of a portion of the normally elliptical ground-plan, as if a marginal portion of a

well-shaped drumlin had been removed by erosion, leaving an abnormally steep slope; deep transverse trenches at right angles to their longer axes; straight or curved trenches extending from their summits down their sides; irregular pits in their normally smooth surfaces; and, in one instance, a terrace-like shelf with a convex longitudinal profile, parallel with the crest-line of the drumlin on the side of which it occurs. In the valleys between the drumlins there are several eskers. From the evidence the conclusion is drawn that the drumlins of the Menominee area were produced by ice erosion from a previously deposited till sheet.

The drumlins of central New York State were the subject of a brief paper by Professor H. L. Fairchild, of the University of Rochester, who also summarized the more important glacial problems in the state. A third paper by Professor Fairchild took up the thesis that the theory of erosion by ice is a fallacy, in amplification of a paper presented by him at the preceding annual meeting of the society. The author gave arguments for arriving at the conclusion that deep ice-erosion of living rock has never been proven, and that it is practically impossible of accomplishment. In New York State there seems to be positive proof that there has been no effective excavation by ice in the valleys of the Finger Lakes, the field study thus sustaining the theoretical consideration of the question.

The stratigraphical section of the program showed the largest number of titles of papers offered and read. Professor W. G. Miller, of Toronto University, discussed the pre-Cambrian rocks in the vicinity of Lake Temiskaming, Ontario, not only from a stratigraphical, but also from an economic, point of view. The region in question shows at the base a complex assemblage of igneous rocks, including granite. Erosion of this complex has given rise to conglomerate and finer-grained slate-like rocks. Afterwards ensued a second period of erosion during which arkose and quartzite were deposited on the surface of the older two series. Finally each of these three series is intersected by dykes of pre-Paleozoic age. The second group or series, the conglomerate and slate, is of economic interest on account of the occurrence therein of fissure veins carrying important amounts of silver and of cobalt and nickel ores and smaller quantities of other ores.

In a paper on the paleogeography of St. Peter time, Dr. C. P. Berkey, of Columbia University, showed by means of charts and sections the probable varying distribution of land and water during the formation of the St. Peter sandstone of Minnesota. The rock was interpreted as of marine origin where early deposited. The region then became a land area with the production of sand-dune phenomena, after which there occurred another period of submergence. In the discussion which followed the reading of the paper the fact was brought out by Professor Gilbert van Ingen that rounded sand grains are not necessarily an indication of arid conditions of deposition, since they are found in coastal sand-dunes today. Dr. Berkey's second paper was upon the stratigraphy of the Uinta Mountains and announced the discovery of an erosion interval in the section, which favored the reference of the great basal Weber quartzite to Cambric age, rather than to Carbonic, as held by King, or to Devonic, as contended by Powell.

Professor A. W. Grabau, of Columbia University, in a paper on the relative areas of the Oneida and Shawangunk conglomerates advanced the theory that these beds represent different portions of a basal conglomerate in the transgressing Siluric sea. In another paper, Professor Grabau discussed Helderberg seas and the interrela-

tionships of lower Devonic strata in the eastern United States. Charts were used in showing the long narrow Cumberland sea as this body of water is called. Mr. C. A. Hartnagel then, in some notes on the Ontaric (Siluric) section of eastern New York, traced the comparative sections to the west and to the east of the Helderberg Mountains and showed the continuous character of the Cobleskill beds. On the east the formation immediately beneath this is, probably, Salina in age, down to and through the Shawangunk conglomerate as the basal member of the Salina group.

The age of the Morrison formation of the Rocky Mountain region was the theme discussed by Mr. N. H. Darton, who has carried on extensive field work along the outcrops. It has been found that the Morrison formation is of wide extent in the Rocky Mountain region, from Montana to New Mexico, but evidence as to its age is meager. Abundant mammalian remains occur, but the paleontologists do not agree as to the horizon, some investigators regarding them as Jurassic and others as late Cretaceous. The meager fresh-water molluscan fauna is not definitive. Some time ago, Mr. Willis T. Lee found evidence that Morrison shales give place to Comanche deposits in western Oklahoma, and the author has found similar relations in the Two Butte uplift in southeastern Colorado, and concludes that the Morrison strata are of Comanche (Lower Cretaceous) and that sandstones occur representing both the Lakota and the Dakota sandstones of the Black Hills region.

In a paper on the classification of the Upper Cretaceous formations of New Jersey, Professor Stuart Weller, of Chicago University, reviewed the schemes proposed by the state survey at various times, and, by means of fossils, substantiated the subdivision which had been made by Knapp and Kümmel on lithologic grounds alone. Professor Weller then went on to discuss in detail in a second paper the fauna of the Cliffwood, N. J., clays, which form the most notable example of marine sedimentation in New Jersey during Raritan time.

The fossils of Cook's Inlet and the Alaska peninsula have been made the subject of careful study by Messrs. T. W. Stanton and G. C. Martin, of the United States Geological Survey. The section shows a great thickness of beds which are well provided with fossils. The beds seem to be closely related to the Jurassic strata of Russia. The scientific program was closed by Professor G. H. Perkins, of Vermont University, with a paper on the Tertiary lignite of Brandon, Vermont, and its fossil fruits. These historic beds were worked for fuel during the anthracite coal strike and as a result many specimens of fossil fruits were found, most of which are described now for the first time.

The following papers were read by title only: 'Occurrence of Gem Minerals in San Diego, Riverside and San Bernardino Counties, Cal.,' by George F. Kunz; 'Rocks from Mt. Desert Island, Maine,' by Persifor Frazer; 'Plumose Diabase and Palagonite from the Holyoke Trap Sheet,' by B. K. Emerson; 'Determination of Brucite as a Rock Constituent,' by Alexis A. Julien; 'Origin of Leached Phosphate,' by C. H. Hitchcock; 'Serpentine Deposits of Belvidere Mountain, Vermont,' by V. F. Marsters; 'The Shifting of the Continental Divide at Butte, Montana,' by Walter H. Weed; 'Nantucket Shorelines, III. Muskeget,' by F. P. Gulliver; 'The Dexter, Kansas, Nitrogen Gas Well,' by Erasmus Haworth; 'Relation of Lake Whittlesey to the Arkona Beaches,' by Frank B. Taylor; 'New Geological Formation in the Eo-Devonian of Annapolis County, Nova Scotia,' by H. M. Ami; 'Age of the Marine Limestones of West Bay, near Parrsborough, Cumberland County, Nova Scotia,'

by H. M. Ami; 'Upper Trias of the Lander Basin, Wyoming,' by S. W. Williston; 'The "Red Beds" of Southwestern Colorado,' by Whitman Cross and Ernest Howe; 'Pleistocene History of Fishers Island, N. Y.,' by Myron L. Fuller; 'Pleistocene of the Chesapeake and Delaware Basins,' by A. Bibbins; 'The Loess of the Lower Mississippi,' by G. Frederick Wright; and 'The Loess and Associated Interglacial (Post-glacial) Deposits,' by B. Shimek.

The following candidates were elected to fellowship in the society: Nevin M. Fenneman, University of Wisconsin; Charles N. Gould, University of Oklahoma; Mark S. W. Jefferson, Michigan State Normal College; Benjamin L. Miller, Bryn Mawr College; Cleophas C. O'Harra, South Dakota School of Mines; Albert H. Purdue, University of Arkansas; Solon Shedd, Washington Agricultural College; Bohumil Shimek, Iowa State University; Gilbert Van Ingen, Princeton University; Ralph Arnold, U. S. Geological Survey; John A. Bownocker, Ohio State University; Reginald W. Brock, Canadian Geological Survey Department; Hiram D. McCaskey, Chief of the Mining Bureau of Manila; Henry Montgomery, Trinity University, Toronto; Arthur E. Seaman, Michigan College of Mines.

The officers of the society for the ensuing year are:

President—Raphael Pumpelly, of Dublin, N. H.
First Vice-President—Samuel Calvin, of Iowa City, Ia.
Second Vice-President—W. M. Davis, of Cambridge, Mass.
Secretary—H. L. Fairchild, of Rochester, N. Y.
Treasurer—I. C. White, of Morgantown, W. Va.
Editor—J. Stanley-Brown, of New York City.
Librarian—H. P. Cushing, of Cleveland, O.

EDMUND OTIS HOVEY.

SCIENTIFIC JOURNALS AND ARTICLES.

The American Naturalist for November-December contains the following articles: 'The Embryological Development of the Skeleton of the Head of Blatta,' William A. Riley; 'The Arboreal Ancestry of the Mammalia,' W. D. Matthew; 'Localized Stages in Common Roadside Plants,' Joseph A. Cushman; 'An Arrangement of the Families and Higher Groups of Birds,' R. W. Shufeldt; 'Observations on Hearing and Smell in Spiders,' Annie H. Pritchett; 'Amitosis in the Embryo of Fasciolaria,' H. L. Osborn; 'The Transplanting of Trout in the Streams of the Sierra Nevada,' D. S. Jordan; 'A New Species of *Diaptomus* from Mexico,' A. S. Pearse; '*Hyla andersoni* and *Rana virgatipes* at Lakehurst, New Jersey,' W. T. Davis. There are also notes, reviews and lists of publications.

Annals of the Carnegie Museum, Vol. III., No. 1, contains the following papers: 'Minute (or Order) Book of the Virginia Court Held for Ohio County, Virginia, etc.,' edited by Boyd Crumrine; 'The Tropidoleptus Fauna at Canandaigua Lake, New York, with the Ontogeny of Twenty Species,' Percy E. Raymond; 'Two (new) Species of Turtles from the Judith River Beds of Montana,' O. P. Hay (*Baëna callosa* and *Aspideretes beecheri*), and 'A Preliminary List of the Hemiptera of Western Pennsylvania,' P. Modestus Wirtner.

The Zoological Society Bulletin, of New York, for January contains accounts of the newly erected ostrich house and small mammal house, a note on 'Wild Animal Photography,' a description of 'A Mosquito Object-Lesson at the Aquarium' and other interesting and valuable information regarding the work of this very active society.

The American Geologist for December contains as the leading article a paper by Charles S. Prosser assisted by Edgar R. Cumings, entitled 'The Waverly Formations of Central Ohio,' illustrated by three plates of half-tone views of the formations described. The region considered, which is near Columbus, had never been carefully described; but on investigation it affords the most satisfactory exposures of the Waverly formations to be found in central Ohio. Mr. N. Mistockles continues his serial on 'The Untenableness of the Nebular Theory' and Professor Hobbs