$$\Gamma(n+1) = n\,\Gamma(n) = n(n-1)(n-2) \ldots (n-r)\,\Gamma(n-r). \quad \text{(ii)}$$

It becomes an exceedingly tedious operation when n has a value of over, say, 20. In calling this the "exact" value in the table the intention is merely to convey the idea that the only approximation involved is that incident upon the use of 7-place logarithms, the process *per se* being an exact one. The fourth and fifth columns of the table give the results obtained by using the values of log n, their first second and third differences, in the usual advancing difference interpolation formula

$$u_{x+n} = u_x + n\,\Delta u_x + {}_nC_2\,\Delta^2 u_x + {}_nC_3\,\Delta^3 u_x \cdots. \quad \text{(iii)}$$

TABLE I

Values of log $\Gamma(n)$ *by Different Methods*

n	Exact Value	Forsyth's Approximation	Interpolation Using Δ^2	Interpolation Using Δ^3
5.123	1.4613860	1.4613679	1.4619138	1.4615009
15.123	11.0834931	11.0834916	11.0835559	11.0834985
25.123	23.9637108	23.9637096	23.9637336	23.9637119
35.123	38.6594135	38.6594126	38.6594251	38.6594138
75.133	107.7498704	107.7498692	107.7498727	107.7492870

From this table it is evident that the interpolation method, when third differences are used, gives values slightly better than those by Forsyth's method when $n \leqslant 25$. For $n = 75$ or more the interpolation method using only second differences gives an approximation sufficiently close for all practical statistical purposes. As to the labor involved, there is no great amount of choice between Forsyth's and the interpolation method, but on the whole there appears to be a distinct, if small, advantage in favor of the interpolation.

RAYMOND PEARL

THE GEOLOGICAL SOCIETY OF AMERICA

THE twenty-seventh annual meeting of the Geological Society of America was held at the Academy of Natural Sciences, Philadelphia, December 29–31, 1914, under the presidency of Dr. George F. Becker, of the United States Geological Survey, Washington, D. C. On account of Dr. Becker's enforced absence through illness, the sessions were presided over by Vice-presidents Waldemar Lindgren and Horace B. Patton. In attendance there were registered 117 Fellows of the Society and the number of students and others, including members of the American Association for the Advancement of Science who were present at the sessions, swelled the attendance to more than 200, making this one of the most largely attended meetings in the history of the society.

At the first general session of the society Dr. Samuel G. Dixon, president of the Academy of Natural Sciences, welcomed the visiting geologists and paleontologists, making them feel very much at home as the guests of the historic academy.

The report of the council, as submitted in print, showed that the present enrollment of the society is 363, aside from the 19 new fellows elected at the meeting but who had not yet qualified. During the year 1914 the society lost five fellows by death: Alfred E. Barlow, Albert S. Bickmore, Horace C. Hovey, A. B. Wilmott and Newton H. Winchell; and three correspondents: H. Rosenbusch, Eduard Suess and Th. Tschernyschew. The treasurer's report showed that the society was in a flourishing condition financially and the editor's report indicated an unusual activity in publication during the past year.

The papers presented in the three general sessions of the society were as follows:

Relation of Bacteria to Deposition of Calcium Carbonate: KARL F. KELLERMAN.

At the suggestion of Dr. T. Wayland Vaughan, bacterial studies of water and bottom mud from the Great Salt Lake, and sea water and bottom deposits from the vicinity of Florida and the Bahamas were undertaken in the hope of supplementing the work of Vaughan,[1] of Drew[2] and of Dole[3] in regard to the probable agencies concerned in the precipitation of calcium carbonate and the formation of oolites.

It has been possible to form calcium carbonate by the action of bacteria on various soluble salts of calcium both in natural waters and in synthetic mixtures. The most important natural precipita-

[1] T. Wayland Vaughan, *Bull. Geol. Soc. Am.*, Vol. 25, No. 1, p. 59, March, 1914. Also Publication No. 182, Carnegie Inst. of Washington, pp. 49–67.

[2] G. H. Drew, Publication No. 182, Carnegie Inst. of Washington, pp. 49–67.

[3] R. B. Dole, Publication No. 182, Carnegie Inst. of Washington, pp. 69–78.

tion is probably the transformation of calcium carbonate by the combined action of ammonia, produced by bacteria either by the denitrification of nitrates or by the fermentation of protein, together with carbon dioxide, produced either by the respiration of large organisms or the fermentation of carbohydrates by bacteria. Both ordinary crystals of calcium carbonate and oolites may be produced by the growth of mixed cultures of bacteria, either in salt or fresh water. The zonal structure of the oolites of bacterial origin and of those found in nature in oolitic deposits appears to be exactly the same; undoubtedly this shows the similarity of the processes of their origin.

Coral Reefs and Reef Corals of the Southeastern United States, Their Geologic History and Their Significance: Thomas Wayland Vaughan.

After briefly alluding to some of the more recent publications on coral reefs, the author stated what in his opinion were the necessary lines of investigation in order to understand the ecologic factors influencing coral reef development, the constructional rôle of corals and other agents, and the series of geologic events which preceded any particular coral reef development. The geologic history of the extensive coral reefs of the southeastern United States and nearby West Indian islands, which have been the subject of investigation for a number of years, was outlined and the bearing they have on the theory of coral reef formation was indicated.

The author stated his conclusions regarding the Florida coral reefs as follows: (1) Corals have played a subordinate part, usually a negligible part, in the building of the Floridian plateau; (2) every conspicuous development of coral reefs or reef corals took place during subsidence; (3) in every instance the coral reefs or reef corals have developed on platform basements which owe their origin to geologic agencies other than those dependent on the presence of corals.

The older Tertiary reefs and reef corals of St. Bartholomew, Antigua and Anguilla all grew on subsiding basements. The relatively small proportion of the contribution by corals to calcareous sediments in Florida, the Bahamas and the West Indies was shown.

It was shown that the Floridian plateau was similar in configuration to the Mosquito Bank off Nicaragua, to Campeche Bank off Yucatan and to Georges Bank off Massachusetts; the east side of the Floridian plateau is similar to the continental shelf off Cape Hatteras. The platform which supports the reef along the east coast of Florida extends beyond the reef limits northward of Fowey Rock. The reef platform of the Great Barrier Reef of Australia is similar to the continental shelf of eastern North and Central America, and it continues south of the reef limits. Rosalind Bank, Caribbean Sea, was compared with Rangiroa, Paumotus, which is similar in essential features. The complex history of the coral reef foundations in Florida, Antigua, St. Martin, Anguilla and Bermuda was described, and it was stated that the formation of the platforms could not be referred solely to Pleistocene time.

Attention was directed to the facts that around the Island of Saba, in which volcanic activity has so recently ceased that the crater is still preserved, there was scarcely any platform at all; that in the case of the young but slightly older volcanic island of St. Kitts, the platform was narrow, while the geologically much older islands standing above the Antigua-Barbuda bank, the St. Martin plateau, and the Virgin Bank, rise above platforms which are miles across and have an area many times greater than that of the present land surfaces. Width of platform is therefore indicative not of the amount of submergence, but of the stages attained by planation processes.

The conclusions were summarized as follows:

1. Critical investigations of corals as constructional geologic agents are bringing constantly increasing proof that they are not so important as was long believed, and that many of the phenomena formerly attributed to them must be accounted for by other agencies. Here it should be emphasized that the ecology of probably no other group of marine organisms is known nearly so thoroughly as that of corals.

2. All known modern off-shore reefs which have been investigated grow on platforms which have been submerged in recent geologic time.

3. No evidence has as yet been presented to show that any barrier reef began to form as a fringing reef on a sloping shore and was converted into a barrier by subsidence; but it is clear that many, if not all barrier reefs stand on marginal platforms which already existed previous to recent submergence and the formation of the modern reefs.

4. Study of the geologic history of coral reef platforms has established that there were platforms in early Tertiary time on the site of many of the present-day platforms, and evidence has not as yet been adduced to prove long-continued, uninterrupted subsidence in any coral reef area. There have been many oscillations of sea level and recent submergence is probably complicated in many

areas by differential crustal movement concomitant with increase in volume of oceanic water through deglaciation.

5. The width of a submerged platform bordering a land area is indicative not of the amount of submergence, but of the stage attained by planation processes. Other conditions being similar, the longer the period of activity of such processes the wider will be the platform.

6. The principal value of the coral reef investigation to geology consists not so much in what has been found out about corals as in the study of a complex of geologic phenomena, among which coral reefs are only a conspicuous incident.

Causes Producing Scratched, Impressed, Fractured and Recemented Pebbles in Ancient Conglomerates: JOHN M. CLARKE.

The Devonian conglomerate lying beneath the fish-beds of Migonasha, P. Q., is a characteristic "Nagelfluh" filled with scratched, fractured and deeply impressed pebbles. Specimens exhibited indicate that the explanation of the phenomena of impression by solution, as suggested by Sorby, Heim, Kayser and others, is inadequate and that the effects described are in large part actually due to forcible contact resulting from internal friction. Some of the pebbles show unqualified evidence of glacial scratching and the entire mass is regarded as an outwash from glacial moraine.

Revision of Pre-Cambrian Classification in Ontario: WILLET G. MILLER AND CYRIL W. KNIGHT.

During the past decade the authors have been engaged in detailed work on pre-Cambrian areas in various parts of the Province of Ontario. The results of this work, and that of other investigators, have made apparent the necessity for revising the age classification of the pre-Cambrian rocks, particularly in the use of the terms Huronian, Laurentian and others. The following classification and nomenclature have therefore been adopted by the Ontario Bureau of Mines.

KEWEENAWAN.
Unconformity.
ANIMIKEAN.
Under this heading the authors place not only the rocks that have heretofore been called Animikie, but the so-called Huronian rocks of the "classic" Lake Huron area, and the Cobalt and Ramsay Lake series. Minor unconformities occur within the Animikean.
Great Unconformity.
(ALGOMAN GRANITE AND GNEISS.)
Laurentian of some authors, and the Lorrain granite of Cobalt, and the Killarney granite of Lake Huron, etc.
Igneous Contact.
TIMISKAMIAN.
In this group the authors place sedimentary rocks of various localities that heretofore have been called Huronian, and the Sudbury series of Coleman.
Great Unconformity.
There is no evidence that this unconformity is of lesser magnitude than that beneath the Animikean.
(LAURENTIAN GRANITE AND GNEISS.)
Igneous Contact.
LOGANIAN.
Grenville (*Sedimentary*), Keewatin (*Igneous*).
The authors have found the Keewatin to occur in considerable volume in S. E. Ontario and have determined the relations of the Grenville to it.

Investigations by the junior author during 1914 have shown that certain rocks of the "classic" Huronian area of Lake Huron, the "Thessalon greenstones," that heretofore have been placed with the Keewatin, are of much later age, being in intrusive contact with the Animikean, as defined in the above table.

North American Continent in Upper Devonic Time: AMADEUS W. GRABAU.

The history of North America in the Upper Devonic has been worked out in some detail, on the basis of physical stratigraphy combined with paleontology.

At the opening of the Upper Devonic, marine waters were much restricted in North America, the greater part of the United States being exposed to active erosion of the previously deposited Hamilton or earlier formations, as indicated by disconformities. The Tully-Genesee sea was restricted to central New York, but extended northward over Canada. Appalachia, Atlantica (the Old Red Continent) and Mississippia were the chief continents. The evidence pointing to the gradual southward transgression of the sea over the eroded lands is clear. Three open marine water bodies existed throughout Upper Devonic time, each with its Urals, (2) the western or North Pacific, extending from central New York across Ellsmere land to the Urals, (2) the western or North Pacific extending across part of Alaska, (3) the eastern or Atlantic. The latter entered the interior by way of a narrow strait between Appalachia and Atlantica, permitting the periodic invasion of the Atlantic or Tropidoleptus fauna. There may have been a fourth South Pacific water body extending into Nevada, but this is less certain. Three principal river systems are recognized in the lowland of Mississippia. These have furnished the black mud for the black shales which were deposited in embayments of di-

minished salinity. The eastern or Genesee beds are restricted to New York and the states just south. The base of the black shale of Ohio, Michigan and Canada is younger than Genesee, as shown by stratigraphic and paleontologic evidence. The great fish fauna of these shales is shown by its occurrence and distribution to be primarily the fauna of these sluggish rivers projected at intervals into the brackish water of the embayments. The land flora of Mississippia is also preserved in these shales. The rivers of Appalachia and Atlantica also had their fish fauna, but these were of different types, their smaller size adapting them to these torrential streams. With them occurred the survivors of the Eurypterids, which also inhabited the rivers of the Paleozoic lands. The flora of Appalachia and Atlantica is likewise largely distinct from that of Mississippia. The deposits made by these rivers were partly preserved as sandy deltas and alluvial fans.

"Symposium on the Passage from the Jurassic to the Cretaceous."

(1) *The Morrison; An Initial Cretaceous Formation:* WILLIS T. LEE.

(2) *Origin and Distribution of the Morrison:* CHARLES C. MOOK.

(3) *Sauropoda and Stegosauria of the Morrison Compared with those of South America, England and Eastern Africa:* R. S. LULL.

(4) *The Paleobotanic Evidence:* E. W. BERRY.

(5) *The Invertebrate Fauna of the Morrison:* T. W. STANTON.

Present Condition of the Volcanoes of Southern Italy: H. S. WASHINGTON AND A. L. DAY.

A brief description of the general condition and state of activity at Vesuvius, Etna, Vulcano and Stromboli, as observed during the summer of 1914.

Recent Eruptions of Lassen Peak, California: J. S. DILLER.

Lassen Peak, in northeastern California, at the southern end of the Cascade Range, has long been considered an extinct volcano, but has recently shown signs of rejuvenescence. The first of the recent outbreaks occurred at 5 P.M., May 30, 1914, and since then many eruptions have occurred. The nature of this remarkable phenomenon was illustrated and discussed.

Physiographic Study of the Cretaceous-Eocene Period in the Rocky Mountain Front and Great Plain Provinces: GEORGE H. ASHLEY.

The study of the rocks, especially of the coal beds, the structure and the life in the provinces named, appears to indicate that Upper Cretaceous time in that region was occupied by a single movement of subsidence, somewhat irregular, but, on the whole, persistent: that this was followed by a period of general and differential uplift, to be followed in turn by renewed subsidence, interrupted locally, from time to time, by pronounced movements of differential uplift. Comparison is made between this interpretation and the assumed conditions in the eastern United States and certain deductions drawn as to the point in the time scale at which the first general uplift occurred.

Relation of Physiographic Changes to Ore Alterations: WALLACE W. ATWOOD.

While a land mass is being dissected, the groundwater table is slowly lowered through that mass, until, at the peneplain and base-level stages, the groundwater table remains almost stationary for long periods of time. During successive cycles of erosion the position of the base-level of erosion in the land mass being dissected must change, and, if climatic conditions remain constant, such changes are necessarily accompanied by changes in the position of the groundwater table. If the land mass is elevated, the base-level will be lowered through the land, and the groundwater table will be slowly lowered. When a land mass is depressed, the base-level of erosion and the groundwater table are elevated throughout that land mass. Moist climates will raise the groundwater table, and dry periods lower that table. As the groundwater table is raised or lowered, the zones in which the chemical changes associated with the secondary alteration of ore deposits take place are varied in thickness.

These facts indicate that physiographic studies may be profitably applied in the study of ore alterations, and conversely that the record of ore alterations may furnish important data bearing upon the physiographic evolution of the districts concerned.

The study of secondary ores by various investigators has called for intensive physiographic studies. During the past season field work was done in the vicinity of Butte, Montana, and Bingham Canyon, Utah, to determine the relationship of physiographic evolution to the secondary enrichment of ores in those regions. In this paper the problem of the application of physiography to the investigation of secondary ores was defined, and some of the results of the past season's field work were presented.

Graphic Projection of Pleistocene Climatic Oscillations: CHESTER A. REEDS.

Penck's curve, page 1168, "Die Alpen im Eiszeitalter," 1909, expresses graphically the climatic oscillations of the alpine district for Pleistocene and post-Pleistocene time. The key to the four glaciations and the three interglacial stages indicated in the curve was found in the four outwash deposits of glacio-fluvial streams on the northern foreland of the Alps in the vicinity of Ulm and Munich. Along the present stream valleys the glacio-fluvial deposits are arranged in terraces, the oldest occupying the highest position and the youngest the lowest level. When the key was carried in mind to the French and Italian Alps the remarkable association of these deposits on the northern foreland was found to be applicable throughout. Hence the names of four small tributaries of the Danube which cross the outwash deposits on the Bavarian plateau, Günz, Mindel, Riss and Würm, were applied by Penck and Brückner to the first, second, third and fourth glaciations. The deposits of the third or Riss glaciation in the Swiss and French Jura extend farther out on the foreland than the deposits of the other glacial advances, but in other districts the morainal deposits of the second or Mindel stage extend beyond that of any other, hence it is regarded as the most extensive of the four alpine glaciations. The morainal and outwash deposits of the first or Günz glaciation are least in evidence while those of the fourth or Würm glaciation, the last, are most in evidence.

That the temperature of the alpine region was considerably colder during the stages of glaciation than during the interglacial stages and the present which is at the close of the retreating hemicycle of the last glaciation, is shown conclusively by the depressed snow lines. Penck has determined their position in the Alps for all four glaciations. They have a distribution parallel to that of the present snow-line, but occupying lower levels, namely, Günz, 1,200 meters, Mindel, 1,350 meters, Riss, 1,300 meters, and Würm, 1,200 meters below the present snow-line. During the interglacial stages the snow-line was approximately 300 meters higher than the present one. From the Höttinger Breccia near Innsbruck Penck determined that there was a temperature variation of 1° C. for every 200-meter change in the altitude of the snow-line.

The unit of measurement which Penck used in estimating the duration of the Pleistocene period is the retreating hemicycle of glaciation of the fourth or Würm stage, better known as the post-glacial period. In the alpine district Penck and Brückner found that in this retreating hemicycle there were three minor advances called the Bühl, Gschnitz and Daun stadia. These advances were preceded by a prominent minor retreat of the Achen oscillation. From the lignite deposits of Dürnten, the deposits of the Muota deltas and the turf deposits in many of the glacial swamps it has been possible to estimate the duration of this hemicycle of glaciation in years, as follows:

Subdivisions of Post-Glacial Time

	Years
Achen oscillation	9,000
Bühl advance and retreat	5,000
Gschnitz advance and retreat	4,000
Daun advance and retreat	3,000
Age of copper	1,000
Post-copper time	3,000
Total	25,000

The estimate on the duration of post-glacial time in America is based chiefly on the recession of the waterfalls of Niagara and St. Anthony. Recently Coleman[4] made an estimate based on the rate of wave erosion on the shore of Lake Ontario and glacial Lake Iroquois. Twenty-five thousand years is a figure which falls within the estimates made by Coleman, Taylor, Lyell, Chamberlain and Salisbury. It is a bit under those of Fairchild, Sardeson and Spencer and above those of Gilbert and Upham. It is considered a conservative figure.

Penck states that it must have been 16,000 to 24,000 years from the Bühl stadium to the present, with 20,000 years as an average, and 25,000 to 40,000 years from the beginning of the Achen retreat to the present. In selecting a figure, however, which shall be used as a unit of measurement in calculating the duration of the entire Pleistocene period, he chooses 20,000 years as the length of post-Würm time.

The correlation of the mountain glaciations of the Alps with those of the Scandinavian continental ice fields of Pleistocene time has not been worked out in all regions, but there is sufficient information at hand to say that there were four advances of the continental ice over northern Europe which correspond to the periods of ice advance upon the alpine forelands. Geikie remapped in 1914 the second, third and fourth glaciation distribution in Europe. G. de Geer delimited the retreating stages of the fourth glaciation in the Scandinavian peninsula in 1912.

A correlation of American with European glacial deposits has been made by Leverett. By consid-

[4] Coleman, A. P., Proceedings, Twelfth Inter. Geol. Cong., Canada, 1913.

ering with Leverett[5] the so-called Iowan glaciation contemporaneous with the Illinoian it is possible to correlate the Günz glaciation with the Nebraskan, the Kansan with the Mindel, the Illinoian with the Riss and the Wisconsin, early and late, with the Würm. There are corresponding interglacial stages. With the time units of Chamberlain and Salisbury[6] 2, 4, 8, 16, in mind for the duration of the last three glaciations, based upon the degree of weathering of American glacial deposits, it is possible to construct a curve similar to Penck's, but differing in length and the number of units assigned to the interglacial stages. In tabular form the data appear thus:

Estimated Duration of Pleistocene Oscillations

	Reeds, 1914			Penck, 1909		
	Units	Years	Totals	Units	Years	Totals
Post-glacial	1	25,000	25,000	1	20,000	20,000
Fourth glacial..	1	25,000	50,000	1	20,000	40,000
Third interglacial.....	4	100,000	150,000	3	60,000	100,000
Third glacial...	1	25,000	175,000	1	20,000	120,000
Second interglacial.....	8	200,000	375,000	12	240,000	360,000
Second glacial..	1	25,000	400,000	1	20,000	380,000
First interglacial	3	75,000	475,000	5	100,000	480,000
First glacial....	1	25,000	500,000	1	20,000	500,000
Pre-transitional.	1	25,000	525,000	1	20,000	520,000

Geologic Deposits in Relation to Pleistocene Man: CHESTER A. REEDS.

The present known distribution of Pleistocene man through southern Europe, the Mediterranean border and Java, points to the conclusion that this early man lived along the river courses, on the adjacent uplands, in caves and grottoes which overlooked well-defined river valleys and on the seashore. Human remains have been found entombed in a few caves within the region of mountain glaciation—for example, Frendenthal, Kesslerlock and Schweizersbild in Switzerland—but most of the finds have been made in the southern non-glaciated portions of Europe. The vicissitudes and the ameliorations of climate during the glacial and interglacial stages no doubt caused southward or northward migrations of peoples or encouraged congestion in the limestone caverns of Belgium, France, Germany and northern Spain. With the repeated formation of continental ice sheets on the Scandinavian plateau during periods of glaciation and their movement outward in all directions across the adjacent basins and lowlands of northern Europe, together with the appearance of ice caps on the high mountains of southern Europe, the lowering of the snow line on the mountain slopes, the development of snow caps on plateaus of but moderate relief, the extension of the glaciers into aprons and tongues on the piedmont areas and the choking of the river valleys with ice and deposits, glacial man must have felt that Snow and Ice were the governing forces. The warmer interglacial epochs were more to his liking. In the present terrace and loess deposits along the river courses and in the cave and grotto fillings, eight human culture stages have been delimited within recent years. They have been called, beginning at the bottom, pre-Chellean, Chellean, Acheulean and Mousterian as Lower Paleolithic and Aurignacian, Solutrean, Magdalenian and Azylian-Tardenoisan as Upper Paleolithic. In the cavern and grotto deposits of the Dordogne, southern France, most of the culture stages appear in regular geologic sequence one above the other. Human remains and culture stations of glacial, interglacial or post-glacial age have been found in approximately three hundred different localities.

[5] Leverett, F., *Zeitschrift für Gletcherkunde*, Vol. IV., pp. 282–83, 1910.

[6] Chamberlain and Salisbury, "Text-Book of Geology," Vol. III., p. 414, 1906.

Physiographic Features of Western Europe as a Factor in the War: DOUGLAS W. JOHNSON.

Every military campaign is controlled to some extent by the surface features of the country over which the contending armies must move. The physiography of a region may therefore profoundly affect both the detailed movements of armies and the general plans of campaign. An examination of the physiographic features of western Europe in the light of recent events enables one to comprehend more fully the strategic importance of many places mentioned in war dispatches and throws valuable light upon the question as to why the neutrality of Belgium was violated.

John Boyd Thacher Park. The Helderberg Escarpment as a Geological Park: GEORGE F. KUNZ.

A most important benefaction to the state of New York is the beautiful John Boyd Thacher Park, opened with appropriate ceremonies September 14, 1914. During the winter of 1913–14 the American Scenic and Historic Preservation Society received word of the intention of Mrs. Thacher, widow of John Boyd Thacher, to realize her generous purpose of donating to the state a superb trust of 350 acres of land for a public park,

as a memorial of her husband, and in March, 1914, a bill was introduced and passed in the legislature accepting the gift and constituting the American Scenic and Historic Preservation Society the custodian. The park embraces the most picturesque and geologically interesting part of the Helderberg range in Albany County.

The remarkable geologic formations to be seen in this park include one of the finest exposures of the Upper Silurian and Devonian strata in the country, and offer classic types of several formations, as is shown by the designations "Helderberg limestone" and "Helderberg group"; the rocks contain a great number of characteristic fossils, especially of marine forms. On the slope appear Hudson shales, and flaggy sandstones of the Hamilton formation crown Countryman Hill. The deep amphitheater at Indian Ladder has been worn out by the water of a small stream.

There is now a small museum and library in the park, and the Geological Survey has set up a bench-mark. It is hoped that very soon the cottage-building for the reception of guests will be completed, so as to afford comfortable shelter for visiting geologists who wish to study this Mecca of geologists. The library would be glad to receive geological publications having any bearing on the local conditions; such mail should be addressed to the curator of John Boyd Thacher Park, East Berne, New York. (By title only.)

The Relief of our Pacific Coast: J. S. DILLER.

The continental feature bordering the Pacific coast of the United States is a mountain belt of surpassing grandeur and composed in general of two lines or ranges of mountain elevations with a depression between. For the most part the two lines of mountains appear to be parallel with each other and the coast, the Sierra Nevada and the Cascade Ranges on the east and the Coast Ranges, including the Klamath Mountains of California and Oregon and the Olympic Mountains of Washington on the west, from the Mexican line to that of British Columbia. Cross folds connect the side ranges and separate the great valley of California from the Willamette Valley of Oregon.

The Sierra Nevada is composed of folded sediments and igneous rocks of various ages from Silurian to Jurassic, and faulted and tilted as one great block with long gentle slope to the west and steep slope to the east.

The Cascade Range is essentially volcanic and due mainly to volcanic upbuilding, though partly to uplifting, from Mount Adams in Washington to Lassen Peak in California, but beyond these limits the older crystalline rocks rise to the surface.

The Klamath Mountains are in large measure like the Sierra Nevada in their rocks, although more fossiliferous, but differ in structure, being characterized by broadly curved thrust faults with the overthrust into the concave curve and thus toward the Pacific ocean.

The coast ranges of California and Oregon are composed almost wholly of Mesozoic and Tertiary rocks. In California the coast range rocks are greatly crushed and faulted, but in Oregon the compression has been much less intense.

At eight o'clock P.M., on December 29, the society convened in the lecture hall of the Academy of Natural Sciences and listened to the reading by Vice-president W. Lindgren of an abstract of the address of the retiring president, George F. Becker. The title of his address was "Isostasy and Radioactivity."

In addition to the papers which were read at the general sessions, the following papers were presented in the sectional meetings of the society:

"Origin of the Red Beds of Western Wyoming," by E. B. Branson.

"Some New Points on the Origin of Dolomites," by Francis M. Van Tuyl.

"Range and Rhythmic Action of Sand-Blast Erosion, from Studies in the Libyan Desert," by William H. Hobbs (by title).

"Corrasive Efficiency of Natural Sand-Blast," by Charles Keyes (by title).

"False Fault-Scarps of Desert Ranges," by Charles Keyes (by title).

"Stratigraphic Disturbance Through the Ohio Valley Running from the Appalachian Plateau in Pennsylvania to the Ozark Mountains in Missouri," by James H. Gardner (by title).

"Preliminary Paper on Recent Crustal Movements in the Lake Erie Region," by Charles E. Decker.

"Quaternary Deformation in Southern Illinois and Southeastern Missouri," by Eugene Wesley Shaw (by title).

"Old Shorelines of Mackinac Island and their Relations to the Lake History," by Frank B. Taylor.

"Some Peculiarities of Glacial Erosion Near the Margin of the Continental Glacier in Central Illinois," by John L. Rich.

"New Evidence for the Existence of Fixed Anticyclones above Continental Glaciers," by William Herbert Hobbs (by title).

"Can U-shaped Valleys be Produced by Removal of Talus?" by Alfred C. Lane (by title).

"On the Origin of Monk's Mound," by A. R. Crook.

"Physiographic Studies in the Driftless Area," by Arthur C. Trowbridge (by title).

"Hemicones at the Mouths of Hanging Valleys," by Charles E. Decker (by title).

"Block Diagrams of State Physiography," by A. K. Lobeck (by title).

"Pre-Cambrian Igneous Rocks of the Pennsylvania Piedmont," by F. Bascom (by title).

"Magmatic Assimilation," by F. Bascom (by title).

"Hypersthene Syenite (Akerite) of the Middle and Northern Blue Ridge Region, Virginia," by Thomas L. Watson and Justus H. Cline (by title).

"Pyrrhotite, Norite and Pyroxenite from Litchfield, Connecticut," by Ernest Howe.

"Some Effects of Pressure on Rocks and Minerals," by John Johnston.

"Primary Chalcocite in the Fluorspar Veins of Jefferson County, Colorado," by Horace B. Patton.

"Recent Remarkable Gold 'Strike' at the Cresson Mine, Cripple Creek, Colorado," by Horace B. Patton.

"Platinum-gold Lode Deposit in Southern Nevada," by Adolph Knopf.

"Organic Origin of Some Mineral Deposits in Unaltered Paleozoic Sediments," by Gilbert van Ingen.

"Type of Rifted Relict Mountain, or Rift-Mountain," by John M. Clarke.

"Evidence of Recent Subsidence on the Coast of Maine," by Charles A. Davis.

"Basic Rocks of Rhode Island: Their Correlation and Relationships," by A. C. Hawkins and C. W. Brown.

"Acadian Triassic," by Sidney Powers.

"Geological History of the Bay of Fundy," by Sidney Powers.

"Alexandrian Rocks of Northeastern Illinois and Eastern Wisconsin," by T. E. Savage.

"Olentangy Shale and Associated Deposits of Northern Ohio," by Clinton R. Stauffer (by title).

"Diastrophic Importance of the Unconformity at the base of the Berea Sandstone in Ohio," by H. P. Cushing.

"Kinderhookian Age of the Chattanoogan Series," by E. O. Ulrich.

"Origin of the Iron Ores at Kiruna, Sweden," by Reginald R. Daly (by title).

"Origin of the Rocky Mountain Phosphate Deposits—Preliminary Statement," by Eliot Blackwelder (by title).

"Regional Alteration of Oil Shales," by David White (by title).

"Oil Pools of Southern Oklahoma and Northern Texas," by James H. Gardner.

"Natural Gas at Cleveland, Ohio," by Frank R. Van Horn.

"Origin of Thick Salt and Gypsum Deposits," by E. B. Branson.

"Crystalline Marbles of Alabama," by Wm. F. Prouty (by title).

"Devonian of Central Missouri," by E. B. Branson and D. K. Greger.

"Olentangy Shale of Central Ohio and its Stratigraphic Significance," by Amadeus W. Grabau.

"Hamilton Group of Western New York," by Amadeus W. Grabau.

"Extension of Morrison Formation into New Mexico," by N. H. Darton (by title).

"Geological Reconnaissance of Porto Rico," by Charles P. Berkey.

"Relation of Cretaceous Formations to the Rocky Mountains in Colorado and New Mexico," by Willis T. Lee.

"Post-Ordovician Deformation in the St. Lawrence Valley, N. Y." by George H. Chadwick.

The annual dinner of the society was held on the evening of December 30 and was attended by 140 of the members of the society and their friends. E. O. Hovey acted as toastmaster and the speakers of the evening were Messrs. W. Lindgren, H. F. Osborn, C. D. Walcott, C. R. Van Hise, W. W. Atwood and F. R. Van Horn.

In addition to the hospitality offered by the Academy of Natural Sciences, the Fellows of the society resident in Philadelphia entertained the Geological and Paleontological Societies and their friends at luncheon each day of the meeting and at a smoker given on the evening of the first day, at the close of the reading of the presidential address.

The officers elected for the year 1915 were Arthur P. Coleman, president; L. V. Pirsson, first vice-president; H. P. Cushing, second vice-president; Edward O. Ulrich, third vice-president; Edmund Otis Hovey, secretary; Wm. Bullock Clark, treasurer; J. Stanley-Brown, editor, and Frank R. Van Horn, librarian.

The next meeting of the society will be held at Washington, D. C., December 28–30, 1915.

EDMUND OTIS HOVEY,
Secretary