carry, the higher value of advanced over elementary work being kept in mind.

(*d*) To be eligible to the bachelor's degree a student must have completed the equivalent of three (preferably four) years of instruction in collegiate work. In this must be included the major work of some one department, with such minors as may be indicated by the head of such department, and also such electives as may be approved by the "major professor" at the time of registration.

(*e*) A student may change his "major department" on petition (and with the consent of the professors concerned). In this case the work done as major becomes a minor, and the back work of the new major must be made good.

(*f*) Departments should stand on a basis of academic equality, no student being obliged by the college to take one subject rather than another. Such prescription of studies should be the work of the major professor.

The colleges in New Zealand should devote themselves primarily to the actual needs of New Zealand. The professorship should carry greater power and greater responsibility than now, and much of the work of the council should be transferred to the four professorial boards.

6. Degrees should not be granted for extra-mural study, and in general not for attendance on night lectures or extension lectures.

To do work really worthy of university recognition, the student should enter the university atmosphere. He should make all possible use of teachers, laboratories and libraries.

7. Taxation of university students is the most oppressive form of state taxation.

8. In general, the professor as teacher has far too little initiative in the colleges of New Zealand. The students with their varied interests and varied talents should be the first consideration of the university. Honors may be granted on the judgment of the professorial body. It is impossible to arrange good students in linear series, as each one should be striving for a goal of his own.

DAVID STARR JORDAN
STANFORD UNIVERSITY

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. SUMMER MEETING, SECTION E—GEOLOGY AND GEOGRAPHY[1]

SECTION E of the American Association for the Advancement of Science held a summer field meeting at and near Plattsburg, N. Y., July 3–11, inclusive, to which all members of the Geological Society of America and the Association of American Geographers were invited. The number in attendance at the meeting was forty-four. The section was fortunate in having delightful weather for all of the excursions, there being no rain to interfere with the field trips until noon of the last day, when the party were assembled under the hospitable roof of Professor Kemp's house on Lake George.

The preliminary trip on July 3 was made to visit "The Gulf" at Covey hill. This drive of some thirty miles from Mooers, N. Y., across the Canadian boundary was exceedingly interesting to all students of glacial geography. The marine and glacial shorelines were visited on the route westward from Mooers, and the party stopped for lunch in "The Gulf," near the two lakes which show the location of the gorge that represents the ancestor of Niagara. The noon talk, given by J. B. Woodworth, who has worked out the glacial history of this region, was on

ABANDONED SHORELINES

At "The Gulf" Professor Woodworth spoke in substance as follows: "The Gulf"

[1] Plattsburg, New York, July 3–11.

and Covey hill north of it constitute a locality of critical importance in the study of water-levels in the Champlain and St. Lawrence valleys. "The Gulf" pertains to the closing stages of the great ice-dammed lakes which formed in front of the ice in its retreat from the territory of the United States. When "The Gulf" was being excavated by a powerful torrent of water, the ice-sheet still hugged the northern side of Covey hill, itself the northernmost spur of the Adirondacks.

The waters which entered "The Gulf" came from the west, the region of Lake Iroquois, whose waters would have taken this path after the ice retreat offered a lower outlet than that at Rome. The waters passed from "The Gulf" into Lake Vermont, the preglacial lake occupying the valley of the present Lake Champlain. Lake Vermont could not at this stage of its existence have risen above the surface of the water in the waterfall pools of "The Gulf." The lower lake is now 645 feet above sea-level. The sea could not at this latitude have stood higher than the bottom of "The Gulf."

With the further retreat of the ice from the northern slope of Covey hill the water, which had previously discharged through "The Gulf" on the south side of the hill, flowed around the northern slope of the hill and emptied into the sea. The salt water came in, and the history of the great glacial lake was completed.

Signs of wave action occur on the Champlain side of the Adirondacks as high as 720 feet, but these higher water levels do not continue about the northern side of Covey hill north of "The Gulf." A good beach is continuous from the Champlain valley about Covey hill into the upper St. Lawrence valley with an altitude of 450 feet at Covey hill. Higher signs of probable wave action occur up to 570 feet, merging into beaches evidently made by torrential waters confined between the hillside and the retreating ice-front.

"The Gulf" was properly understood by Ebenezer Emmons to have been made by a powerful torrent flowing where now no stream can flow. Gilbert, with the knowledge of the glacial theory, sought for a torrent spillway along the retreating ice-sheet, and considered "The Gulf" the outlet for the glacial waters. "The Gulf" therefore is an integral part of the wonderful story of the great glacial lakes, and the political chance which has drawn the boundary line between Canada and the United States across "The Gulf" serves doubly to remind us of its living type, the gorge of Niagara.

On Thursday, July 4, those who had taken the preliminary trip to Covey hill drove from Mooers southward to West Chazy along many abandoned shorelines, at elevations varying from 300 to 600 feet above the present sea-level. At West Chazy others joined the party from Plattsburg, and all met on Cobblestone hill, where a halt was made for an hour to study the remarkable beaches of cobbles showing pronounced bars, spits and hooks, at levels of 600 feet and over above sealevel.

These beaches of heavy glacial detritus were laid down in a fresh-water glacial lake, when the ice stood a short distance north of this point, by the waters discharging from the northwest over Flat Rock from the Altona spillway.

Thence the party drove across the bare Potsdam sandstone over the Altona spillway, where striking evidences were seen of the scouring action of torrential glacial waters. After lunch at a spring of water running from the Potsdam sandstone in the spillway the party listened to a talk by H. L. Fairchild on

IROQUOIS EXTINCTION

Lake Iroquois was the great glacial water

held in the Ontario basin while the Laurentian ice-mass occupied the St. Lawrence valley and forced the overflow by the Rome outlet to the Mohawk and Hudson valleys. This original Iroquois outlet was effective for several thousand years, and determined the water-level for nearly the whole existence of the glacial waters.

When the ice-body weakened, and the front receded on the salient which projects northeastward from the Adirondacks into Canada, a lower escape for the ice-dammed waters was opened across the Covey hill ridge, precisely at the international boundary.

"The Gulf," as it is locally known, is a great cut in Potsdam sandstone, long since noted by Emmons and Gilbert, and recently described by Woodworth. The present altitude of the head of the Covey outlet is over 900 feet, but at the time it was opened the locality was about 460 feet lower than to-day, and the initiation of the river flow must have been inferior to the Rome level, which is now 440 feet.

After at least many centuries of flow this predecessor of the St. Lawrence river, carrying the overflow of the second stage of Iroquois waters (or Hypo-Iroquois), was extinguished by the ice recession opening a yet lower pass, on the north slope of Covey hill. This third phase of the Iroquois waters was short lived and of rapidly falling levels, the river-flow past the ice-front only terracing the sandstone slope.

When the waters were lowered about 450 feet below the Gulf channel, they became confluent with the oceanic waters, and the Ontario basin was occupied by the Gilbert gulf, a branch of the Champlain or Hochelogan sea.

On Friday the parties from Mooers and Plattsburg met at Chazy where Professor Cushing and Dr. Ruedemann showed the visiting geologists many interesting features of the Chazy limestone, the local succession of beds, the characteristic fossils, the faults, and the dissection which have produced the present topography. After supper, while waiting for the train to Plattsburg, the party sat on the hotel porch and listened to a talk by R. Ruedemann on

THE LOWER SILURIC PALEOGEOGRAPHY OF THE CHAMPLAIN BASIN

The relations of the faunas of the Beekmantown, Fort Cassin, Chazy, Black River, Trenton, and Utica beds to those of the Atlantic and Pacific basins and the Mississippian sea were discussed, and by means of these relations the probable marine connections of the Chazy basin and the Levis channel with the oceanic basins traced. It was suggested that the Beekmantown sea, while extending as far as the Newfoundland embayment, held an American epicontinental fauna; that the Fort Cassin fauna did not reach Canada, but flourished in the Appalachian trough to the south of the Chazy basin, and also spread westward into the epicontinental sea. The typical Chazy fauna is thus far recorded only for the Chazy basin and the southern Appalachian trough. It extended as far as the Mingan islands, and came probably from the Atlantic basin. There is also evidence that it had some connection with the American epicontinental sea.

The Black River and Trenton faunas, while largely American in their aspects, contain European species as the first of the Lower Siluric; and the connection of the Trenton sea with the Atlantic ocean can not be doubted. In Utica time the channel became so wide that an oceanic current could enter the epicontinental sea from the northwest, bringing with it new faunal elements, and spreading mud shales over a large area of eastern North America.

The evidence of a deeper sea in the

Levis channel, furnished by the series of Lower Siluric graptolite shales, was also presented, and the relations of the graptolite shales to the mobile parts of the earth-crust, the geosynclines, briefly mentioned.

Friday evening the party went to Cliff Haven, three miles south of Plattsburg, where the authorities of the Champlain Assembly had placed at the disposal of Section E the New York cottage, in which the party were delightfully housed for five days. Excursions were made each day to various points, and in the evening all returned to the broad piazzas of the cottage, where they sat and discussed the various trips, within a few feet of one of the striking fault-line scarps of the region, looking out over the waters of Lake Champlain.

On Saturday morning, July 6, the party gathered on the steam launch kindly furnished by the state of New York, and under the guidance of Professor Cushing, Dr. Ruedemann and Professor Hudson took a charming sail on Lake Champlain. The party visited Crab and Valcour islands and studied the paleozoic sediments which are there so beautifully exposed with their many interesting structural features.

At noon the party enjoyed the delightful hospitality of Professor and Mrs. George H. Hudson of Plattsburg at their charming camp on Valcour island. After lunch a paper was given by John M. Clarke on

LAKE CHAMPLAIN

Dr. Clarke spoke of the origin of the Lake Champlain valley as the result of a series of downthrown fault blocks having the evident aspect of a Graben. He referred to the later evidence as confirmatory of Logan's conception of the Lake Champlain fault and indicated that this origin was borne out by the present attitude of the downthrown paleozoic against the abrupt eastern scarps of the Adirondack crystalline shield.

Reference was also made by the speaker to the possibility that the geographical name Trembleau, which designates the prominent headland and mountain ridge just south of Port Kent, embodies the record of an ancient seismic disturbance, and with this as a text fuller reference was made to the Canadian earthquake of 1663 which appears from the records preserved in contemporary documents to be the severest disturbance this continent has ever suffered from terrestrial dislocations. This earthquake was evidently a movement of the paleozoics against the crystalline shield along the course of the St. Lawrence river or the St. Lawrence fault, and its destructive effects from Montreal down to Tadousac were tremendous. It seemed to the speaker quite reasonable to infer that this displacement must have been continued along the contact line of the paleozoics and the crystallines in the direction of the Champlain fault, although the historic records for this region are very meager.

After lunch the party divided, one portion spending the afternoon on the shores of Valcour island studying stratigraphy and paleontology. The others sailed southward to the delta of Ausable river, where a landing was made and photographs taken showing some of the recent shoreline changes. Thence this party sailed across the lake between Stave and Providence islands, and then northward along the Vermont shore, returning to Cliff Haven.

In the evening in the auditorium of the Catholic Summer School the one formal gathering of the Plattsburg meeting took place. The Reverend John Talbot Smith, LL.D., president of the summer school, welcomed the members of Section E to Cliff Haven, and said that anything they could do to make our stay pleasant and profitable would be a great pleasure to the authorities of Champlain Assembly. Father Smith introduced the vice-president

of Section E, Dr. Alfred C. Lane, who gave his vice-presidential address on the "Early Surroundings of Life."[3]

Professor B. K. Emerson thanked the authorities of the Champlain Assembly for their hospitable reception of Section E.

On Sunday various features of the local geology were visited by members of the section. Others attended services at the Chapel on the grounds.

At noon the party were entertained most delightfully by the Honorable Smith M. Weed and his family at his summer home on the shores of Lake Champlain. In the afternoon another sail was taken in a steam launch on Lake Champlain.

In the evening Professor George H. Hudson, of the Plattsburg Normal School, showed the laboratories and some of the work of his students. The members then met in the science class-room, and listened to an informal talk by Professor Hudson on "Blastoidocrinus and its Type," illustrated by fifty lantern slides. The slides of Billings's type were from negatives possessing an amplification of ten diameters, and showed in a remarkable manner many points of structure not before noted in the specimen. The outer folds of the hydrospires were seen to extend under the interbrachials to the edges of the bibrachials. The position of the stem was shown to be not normal, as Billings supposed, but thrust up into the cœlomic cavity and separating the basals from the radials. There were no features to show a specific difference between the Canadian type and the more perfect Valcour island specimen, but the type served to corroborate in a clear manner much of the detail worked out from the latter and published in Bulletin 107 of the New York State Museum.

On Monday, July 8, the party went by train from Plattsburg to Lyon Mountain, and spent the day studying the magnetite mines under the guidance of Mr. Newland. After lunch the section listened to a paper by D. H. Newland on

THE IRON ORES OF THE ADIRONDACK REGION

Four varieties of iron ores are found within the limits of the Adirondack region, each constituting a more or less independent class of deposits as regards geological associations and mode of origin. The varieties are as follows: (1) Non-titaniferous magnetites, (2) titaniferous magnetites, (3) hematites, (4) limonites. In respect to the relative age or period of formation, it is probable that the magnetites of class 1 are the oldest, since they antedate the metamorphism and structural disturbances that affected the region during Precambric time. The titaniferous ores were formed before the oldest of the fossiliferous rocks of the region (the Potsdam sandstone) was deposited, and are generally regarded to be contemporaneous with the igneous inclusions in which they occur. The hematite ores are probably later than the Potsdam; while the limonites have the character of bog ores and are relatively recent surface concentrations.

The non-titaniferous magnetites are the most wide-spread of all the ores in their geographical distribution, and have been in the past and still are the main source of supply for the region. In a strict sense they are hardly deserving of the name that has been applied to them by geologists, since they nearly always carry titanium, though the amount is small, usually but a fraction of one per cent. These ores are found in all parts of the Adirondacks, except the central which is occupied by the great gabbro-anorthosite mass. They are associated with different members of the Precambric crystalline series, including gneisses of igneous derivation with the

[3] Published in SCIENCE for August 2, pp. 129–143.

mineralogy of granites and syenites, with gneisses of doubtful relationships, and with the schists and limestones of the sedimentary (Grenville) type. Their origin is obscure, a problem that has been fruitful in discussion and theorizing among geologists. It is doubtful if any one of the explanations that have been advanced is satisfactory as a general basis for the whole group; rather it would seem that the varying conditions surrounding the character and associations of the deposits indicate that they have been formed by a complexity of processes which may have differed materially in individual cases.

The titaniferous magnetites are distinguished from those of the preceding group by their higher percentage of titanium, which ranges from about 3 or 4 per cent. as a minimum up to a maximum of 10 or 15 per cent., and by the fact that they are always enclosed by basic igneous rocks of the gabbro family. They have been described by Professor J. F. Kemp as basic segregations formed during the cooling and consolidation of the wall rocks, an explanation that is generally regarded as correct. Some of the largest deposits of iron ores in the region belong to this class, those of Lake Sanford being specially extensive. After a long period of inactivity, due to the difficulties encountered in smelting the ores in the blast furnaces, attention is now being directed to the deposits with a view to their utilization. It has been found that the ores in some cases at least are not simply magnetite carrying titanium uniformly through its mass, but that they consist of a mixture of magnetite and ilmenite, the former having almost no titanium, a condition that is favorable to their commercial treatment.

The hematite ores are practically limited to the western Adirondack region of St. Lawrence and Jefferson counties. In this area the Grenville schists and limestones attain wide development, forming an interbedded series which has been upturned and sharply folded. Granite intrusions are numerous, but there is a noticeable lack of the basic igneous rocks that occur abundantly in the central and eastern Adirondacks. The ore bodies consist of lenticular, tabular, or irregular masses enclosed within belts of the schist and limestone, or lying along the contact of these rocks as at the Caledonia mine. Stringers and larger bands of ore often extend out from the main bodies for considerable distances into the foot and hanging walls. The deposits have originated, without much doubt, by a process of replacement. They grade at the borders into the wall rock and frequently inclusions may be found that show complete transition from the rock to the ore. Where the walls are schist, the ore often preserves the appearance of banding and cleavage, and not uncommonly carries a small percentage of graphite, the only mineral that seems to have successfully resisted the solvent action of the iron-bearing solutions.

As to the source from which the iron has come, the explanation advanced by C. H. Smyth, Jr., merits full acceptance since it meets the conditions surrounding the geology of the deposits. His theory is that the iron has been derived from pyrite and magnetite, which occur abundantly in the schist in the immediate vicinity of the ore bodies. By oxidation the pyrite would yield ferrous and ferric sulphates, which would be readily taken up by the underground circulations. Free sulphuric acid would also result and react upon the veins and disseminations of magnetite. By reaction with the limestone and the minerals of the schist, the solutions would decompose and the iron precipitate as carbonate and limonite. By subsequent alteration these minerals have been changed to hematite. Residual masses of carbonate are oc-

casionally found in the deposits. Whenever the Potsdam sandstone is found in contact with the ore, the lower layers show a deep iron stain, evidently the effect of impregnation by the iron-bearing solutions.

The fourth class of iron ores, the limonites, are not of much importance in the Adirondack region. The deposits are, as already stated, superficial accumulations due to the washing and leaching of the neighboring rocks and soils. They seldom, if ever, exist of sufficient size and richness to repay working, at least under present conditions.

On Tuesday an excursion to Keesville and the Ausable chasm was made by train and tally-ho. Professors Woodworth and Cushing showed the party the marine delta of the Ausable river, the former lake shorelines, the post-Hochelogan gorge of the Ausable river cut in Potsdam sandstone, the Potsdam conglomerate, the northern slope of Trembleau mountain, and the anorthosite.

In the evening at the Champlain Club Professor H. P. Cushing discussed the evidences of physical oscillations during the Cambro-silurian in northeastern New York as brought out by a general study of the stratigraphy of the region. There was a great Potsdam subsidence on the northeast, diminishing to zero westward. The succeeding Beekmantown depression encroached further on the land than did the Potsdam on the southern margin of the region, but like that was greatest on the northeast. During the Beekmantown occurred an uplift which caused cessation of deposition in all the region except the eastern border, confining the later Beekmantown and the Chazy deposits to that district. Oscillation then occurred between the Beekmantown and the Chazy, pinching out the Chazy to the south. Depression then ensued on the south and west, and the Lowville beds were deposited. The Black River limestone followed, this being the first formation found on all three sides of the region, which indicates connecting waters and similar conditions on these sides.

In the following Trenton time it seems likely that the waters nearly overspread the entire present Adirondack region, though shoreline conditions and small subsidence are characteristic of the Mohawk valley region.

Utica shale conditions came in from the east, and gradually encroached westward on the Trenton, so that the one thickens as the other thins, the Trenton thickest on the west, the Utica on the east. Following the Utica came the uplift which brought most of the region above sea-level.

On Wednesday, July 10, the party regretfully bade good-bye to the hospitable authorities of the Catholic Summer School, and took the delightful sail down Lake Champlain.

At Baldwins, the steamboat terminal at the northern end of Lake George, the party were met by Professor J. F. Kemp, by whom they were guided in the Lake George valley. The first stop was Hague, where the graphite bed at the Lakeside mine was studied. The bed is ten feet thick, and consists of a graphitic schist in which graphite supplies the micaceous mineral. Feldspar, quartz and a little pyrite constitute the associated minerals. In physical aspect the beds appear but slightly changed from a shaly sandstone. The floor and roof rocks are a garnet-feldspar gneiss with much sillimanite. The pegmatitic phases are frequent. The several methods of origin, organic; hydrocarbons akin to petroleum; the influence of eruptive rocks, etc., were passed in review. The forms of occurrence of graphite in the Adirondacks, in crystalline limestones, pegmatite veins, and schists or quartzites

were set forth. The invariable association even of the graphite-bearing pegmatites with Grenville sediments was emphasized, and the schists seemed most probably a metamorphosed carbonaceous sediment, or one which had been impregnated with a heavy oil.

The party next visited the potholes on Indian Kettles point, two miles north of Hague. These interesting relics of the glacial epoch are on a rocky point, and fifteen feet or more above the present lake.

In the evening a brief exposition of the local geology and physiography was given by J. F. Kemp, and illustrated by manuscript maps. The sediments of the Grenville series are the oldest rocks, now greatly metamorphosed. A syenitic series of eruptives, the most extensive of the local formations, succeeded the Grenville, and these are also greatly metamorphosed. There are also rocks intermediate between syenite and gabbro; true gabbros and granites. Lastly came a few basaltic dikes. There are no late Paleozoics in the reigon, but the Potsdam and Beekmantown are near or in the Lake George basin. The physiography was believed by the speaker to be chiefly due to block faulting, which was freshened up by the ice-sculpturing of the glacial epoch.

The next morning the party proceeded to Huletts, and visited an igneous contact on Tafts point. At Huletts dock interesting pegmatites and the effects of shearing and faulting were seen. Three sets of displacement could be detected. The party were kindly taken about the lake by Dr. Smith Ely Jelliffe in his launch, adding greatly to their pleasure and profit. After lunch in the charming summer home of Professor and Mrs. Kemp the members continued south through the lake and dispersed.

The following resolutions were passed by Section E:

Section E of the American Association for the Advancement of Science in summer session assembled desires to express its high appreciation and gratitude

To Dr. John M. Clarke and the members of the New York Survey for valued advice in the preparations for this meeting, and for guidance during its progress;

To Professor and Mrs. George H. Hudson, to the Honorable Smith M. Weed, and to Professor and Mrs. J. F. Kemp for most gracious hospitality; and

To the governing board of the Champlain Assembly for giving us an attractive and convenient home during our session, and the opportunity to become acquainted with a valuable and interesting educational institution.

The following members were chosen to represent the geologists and geographers of the American Association at the centenary celebration of the Geological Society of London, to be held in September, viz:

Professor J. P. Iddings, University of Chicago, Chicago, Ill. Vice-President Section E, Geology and Geography.

Dr. John M. Clarke, State Hill, Albany, N. Y. Director Science Division, N. Y. State Education Department.

Professor R. S. Tarr, Cornell University, Ithaca, N. Y. Acting President Association of American Geographers.

F. P. Gulliver
Secretary

SCIENTIFIC BOOKS

The Birds of North and Middle America: A descriptive catalogue of the higher groups, genera, species and subspecies of birds known to occur in North America, from the Arctic lands to the Isthmus of Panama, the West Indies and other islands of the Caribbean Sea, and the Galapagos Archipelago. By Robert Ridgway, Curator, Division of Birds. Part IV., Family Turdidæ—Thrushes. Family Zeledoniidæ—Wren-Thrushes. Family Mimidæ—Mockingbirds. Family Sturnidæ — Starlings.