the underlying cause of the acceleration in the rate of advance of natural knowledge. Is it to be found in the increase in power of the human intellect, or the diversion into one particular channel of activities previously otherwise employed? It is possible that the human intellect has, by the processes of evolution, become more powerful, and that man's ability to decipher the secrets of nature has thereby increased. I think, however, that it would require a bold advocate to support this thesis. If any such mental evolution has taken place, it is strange that it should be restricted to one particular sphere of activity. Are our poets and authors of to-day greater than Homer, our statesmen than Pericles? Or, passing into the domain of science, can we say with confidence that, in pure power of reasoning, Maxwell was undoubtedly the superior of Archimedes?

I have elsewhere indicated what appears to me to explain the mystery of this acceleration, namely, *the extension of our senses* by mechanical appliances. When we supplement our eyes by the bolometer and the electric coherer, the range of our vision is augmented a thousandfold. By the use of the electroscope and the galvanometer we have extended our senses of sight and touch until we can detect the presence of an electron.

Having realized the imperfection of our faculties, we have called upon nature in all departments of science to supply our deficiencies, and are thus enabled to walk with confidence where previously all seemed dark.

From the time of Archimedes to that of Bacon we despised natural knowledge while we deified intellect and authority; hence for nearly 2,000 years our record was one of retreat rather than advance. When the philosopher left his study and applied his powers of observation to the phenomena of the universe, progress became a reality, and thenceforward the march of discovery has known no backward step. We have, therefore, every reason to believe that when the association again visits this ancient city our president will be able to chronicle an increase in natural knowledge even greater than that which has been one of the distinguishing characteristics of the last quarter of a century.

E. H. GRIFFITHS.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SPECIAL MEETING, ITHACA, NEW YORK, JUNE 28–JULY 3, 1906.

SECTION E—GEOLOGY AND GEOGRAPHY.

THE section organized at 11 A.M., Friday, June 29, directly after the adjournment of the first general session of the association, in the geological lecture room, McGraw Hall, with Vice-president and Chairman A. C. Lane in the chair and thirteen members and seven visitors present. Before proceeding with the program of papers the following preamble and resolution were offered by Mr. George H. Chadwick, of Albany, New York:

WHEREAS in the decease of Professor Israel C. Russell Section E has lost an efficient officer and one of its foremost workers and best loved members.

Resolved, That the section express its deep sorrow and its sense of the great loss to geologic science through the event.

Remarks to the motion were made by Messrs. A. C. Lane, H. S. Williams, D. S. Martin and E. O. Hovey.

The following papers were then read in accordance with the printed program:

Revision of the Geological Section passing through Ithaca, N. Y.: Professor H. S. WILLIAMS, Cornell University. (By permission of the Director of the U. S. Geological Survey).

The author explained that the revision

of classification and nomenclature proposed was the result of a resurvey of the formations examined in preparation of the map and folio of the Watkins and Catatonk Quadrangles now in preparation. The section is the standard section of the New York Devonian as originally defined and described by Vanuxem and Hall in 1842–1843. The revision of the classification and nomenclature is based upon a critical study of the composition, sequence and range of the fossil faunas of the Watkins and Catatonk Quadrangles. The thicknesses are estimated as for a generalized section passing through the rocks at Ithaca, N. Y.

The taxonomic classification into series, formations, members and lentils, is in accordance with the rules of the U. S. Geological Survey published in the 24th Annual Report for 1902–1903.

The following chart expresses in brief the classifications and nomenclature presented, the new names having been accepted by the committee on geologic names of the U. S. Geological Survey.

The principal changes affecting nomenclature are the following: viz., the *Nunda shale and flagstone formation* is the stratigraphic equivalent of Hall's Portage or Nunda group, the standard section of which is found in the Genesee Valley. The term Portage was used by Hall for the sandstone member at the top of his Portage or Nunda Group as well as in the name of the other group. Of the two synonyms the first (Portage) is left to be applied in its specific sense to the Portage sandstone member, and Nunda is retained for the formation name.

The lithologically discriminated members of the Nunda characteristic of the Genesee Valley section (*i. e.,* Cachaqua, Gardeau and Portage) are not distinguishable in the Ithaca section. The subdivisions in the latter section are the *Sherburne flagstone,* the *Ithaca shale* and the *Enfield shale members.* The first of these is the equivalent of the Sherburne flagstone of Vanuxem; the second is the typical Ithaca group of Hall and later writers; the third is the

SCHEME OF CLASSIFICATION AND NOMENCLATURE OF THE GEOLOGICAL SECTION PASSING THROUGH ITHACA, N. Y.

	Formations.	Members and Lentils.	Section.	Thickness.
Erie (division or) series of Vanuxem.	*Chemung.* Shale and sandstone formation.	*Fall Creek* conglomerate lentil. *Wellsburg* sandstone member.		0–10 ft. 600–650 ft.
		Cayuta shale member.		600 "
	Nunda. Shale and flagstone formation.	*Enfield* shale member.		550–800 ft.
		Ithaca shale member.		80–300 "
		Sherburne flagstone member.		188–260 "
	Genesee. Shale formation.			125 ft.
	Tully. Limestone formation.			10–30 ft.
	Hamilton. Shale formation.			1,035 ft.
	Marcellus. Shale formation.			125 ft.
	Onondaga. Limestone formation.			125 ft.
	Oriskany. Sandstone formation.			0–4 ft.

'upper part of the Portage' of the classification proposed by Williams in 1884; and the name *Enfield* is applied for the name of the town of Enfield where the member is typically exposed.

The boundary between the Nunda and Chemung formations is established on the basis of change in the generic composition of the faunas occurring at the horizon indicated. The two genera *Dalmanella* and *Douvillina,* and the species *Spirifer disjunctus* are among the more characteristic of the forms marking this change. The *Cayuta shale member* contains the typical Chemung fauna of the Chemung Narrows section; it is paleontologically limited by the Nunda fauna below, and by the fourth of the known zones of *Tropidoleptus* appearing above the Hamilton formation, to which the name *Swartwood Tropidoleptus zone* has been applied by the author for the outcrop southwest of Swartwood at an altitude of about 1,600 feet A. T., containing the fauna.

The name *Cayuta* is applied for the Cayuta Creek, along the sides of which from Cayuta Lake to its discharge into the Susquehanna River typical exposures of the Cayuta member may be seen.

The second member of the Chemung is named *Wellsburg sandstone member* for its outcrop at Wellsburg and above in the hills of Ashland. It is paleontologically discriminated by absence of many common Chemung species and lithologically by the more sandy nature of the rocks; and the thin-bedded slabs characteristic of the higher 'Catskill' rocks are conspicuous in the upper portion.

The Wellsburg member is terminated above by the *Fall Creek conglomerate lentil,* a thin band of conglomerate discovered in place at the top of the Ashland Hills and frequently visible in detached pieces on tops of other hills along the southern townships of the state.

The Fall Creek conglomerate lentil is interpreted to be the equivalent of the conglomerate of that name in Bradford and Tioga Counties, Pennsylvania. In the beds immediately under the conglomerate, and terminating the Wellsburg member, occur in great abundance the shells of *Leptostrophia nervosa* and *Orthothetes chemungensis.* To distinguish this particular horizon the name *Ashland Leptostrophia zone* has been applied to the zone by the author. The author stated that other evidence obtained by comparison of this section with others indicates that the highest stratigraphic extension of the Chemung fauna is not reached at the top of the Wellsburg member, but that to the west and south of this section rocks stratigraphically still higher may bear many of the species of the Chemung formations.

Professor Williams's paper was discussed by Messrs. J. C. Branner, C. A. Hartnagel and D. S. Martin.

Abyssal Igneous Injection as a Causal Condition and as an Effect of Mountain Building: Dr. R. A. DALY, International Boundary Commission, Ottawa, Canada. (Illustrated with a diagram.)

The contraction theory of mountain-building is hypothetically extended to cover the explanation of igneous intrusion, geosynclinal down-warps, the location of mountain-ranges, and the common association of intense mountain-building with the batholithic intrusion of magma. Among the chief postulates are: (1) an earth-crust about twenty-five miles thick, overlying a substratum which, on account of its high temperature, acts as a viscous liquid; (2) the division of the crust into a shell of compression about five miles thick, overlying a shell characterized by cooling tension. The shell of tension extends from the bottom of the shell of compression down to the substratum.

One effect of cooling tension is to produce cracks in the lower shell; these are only partly closed by the shearing of masses against masses. Because of the solid continuity between the two shells, some of the tension remains unrelieved.

Tension in the lower shell permits of the abyssal (dike) injection of the substratum fluid into the crust. This injection is especially facilitated in earth-zones established by cosmical stresses. The hydrostatic and expansional pressures normal to the walls of such an abyssal dike cause lateral creep and special condensation of matter in the shell of tension. This movement induces a down-warp of the earth's surface overlying the zone of injection. When the down-warp is of large size it is a geosynclinal. Its sedimentary filling is accomplished through the shearing of the shell of compression over the shell of tension. This breaking of the solid continuity between the two shells releases all the accumulated tension. As a result, extraordinarily large bodies of magma are injected from the substratum into the shell of tension beneath the mountain-range. The assimilation of the folded rocks of the range leads to the formation of granitic batholiths.

Dr. Daly's paper was discussed by Messrs. A. C. Lane, J. C. Branner and D. S. Martin.

Brewsters Neck, Connecticut: Dr. F. P. Gulliver, Norwich Town, Conn. (Abstract read by E. O. Hovey.)

Brewsters Neck, Conn., is a deposit of water-laid sand and gravel lying between the preglacial valley of the Thames River, and the preglacial tributary which may be called the Poquetanock River.

The surface of this deposit rises from 70 to 85 feet above the level of the tide water as it exists to-day. It lies from 100 to 150 feet above the level of the bed of the preglacial Thames River.

On the east and west sides of this deposit there is a steep slope. On the north side the surface of the deposit comes directly against the bed rock, which at this point is covered with a thin deposit of till not completely masking the ledges which appear at various places.

On the northwest corner of this deposit there are distinct lobes projecting toward the northwest and between these lobes and the bed-rock slope to the north, which is very steep at this point, there is a deep hollow which is popularly called a 'valley.' The form of this 'valley' shows conclusively that it was not formed by degradation, but by aggradation.

On the southeast corner of this deposit the surface merges gradually into the gentle slope of a low hill, which is bed-rock covered with till. West of this hill is a confused mass of kames and kettle-holes which are beneath sea-level, and since these are now filled with water they are used for floating lumber for the Dawley Lumber Yard at Fort Point.

Perhaps the most interesting point along the margins of these deposits lies just above these two salt-water ponds, which fill these kettle-holes. The surface of this deposit, which the author would name a *delta-terrace,* slopes from the northeast, where the highest point is 85 feet above the level of the sea, toward the southwest, where the surface is about 70 feet. The deposit is undoubtedly a glacial delta. Its distinct lobes and structure are typically that found in deposits laid by a stream emptying into standing water. It is very similar to the structure reported by the author of this paper as occurring at the Navy Yard, above New London.[1]

[1] 'Thames River Terraces in Connecticut,' *Bull. Geol. Soc. Am.,* Vol. 10, 1898, pp. 492–494.

A new point in regard to the theory of the formation of water-laid glacial deposits is believed to be as follows: When the margin of the ice-sheet was retreating by the annual summer melting faster than ice was supplied, the ice remained longest in the valleys. Masses of ice would thus be left in the deeper valleys which would rise many feet above the surrounding hills. Between these ice masses standing water would occur either as arms of the ocean or as ice-dammed glacial lakes between these ice-blocks. In these bodies of standing water the streams from the melting ice would deposit their sand and gravel, and at the point where the streams issued from the ice there would be eskers and ice-contact slopes. These latter deposits would contain the larger materials, and the fine sand would be found farthest from the point where the streams issued from the ice. Where the supply of rock waste was sufficient to fill up the space lying between these ice-blocks, a flat topped delta-terrace would be formed; where the supply was not sufficient to fill up the water body, lobes would occur. These lobes would project into the water body, and from the axis of the arched layers as shown in sections, the direction of flow taken by a given glacial distributary may be discovered.

In this deposit, therefore, the lobes at the northwest corner show that the sand of which they are built was coming from the southeast. The arched layers shown in the sections at the southwest corner of this deposit indicate that the material there found came from the northeast. Other sections of this delta-terrace at Brewsters Neck, as revealed by the excavations made for the State Hospital, show that in the center of the deposit there were alternating currents coming from both the east and the west.

The author believes from the facts shown by these recent cuttings and from the facts which have long been recognized from the surface form, that this deposit was built by streams issuing from two blocks of ice, one of these blocks occupying the valley of the glacial Thames, the other occupying the valley of the tributary of the Thames River which flowed through the Poquetanock Valley. The slope of the surface of this delta-terrace indicates that the last source of the material was from the Poquetanock ice-block on the east.

Notes on the Geology of the Guaynopita, Chihuahua, Mexico, Mining District: Dr. E. O. Hovey, American Museum of Natural History, New York. (Illustrated with lantern slides.)

The Guaynopita district lies in the heart of the Western Sierra Madre in northern Mexico. It shows a series of Cretaceous limestone and schist and gneiss overlain by volcanic rocks (andesites) and invaded by granite intrusions. Later volcanics (basalt, andesites and rhyolites) have supervened, basins have been filled with sandstones and conglomerates, and the whole region has been deeply dissected by the Aros and its tributaries.

Dr. Hovey's paper was discussed by Messrs. A. C. Lane and C. R. Dryer.

The Relations of the Drainage of the Santa Clara Valley, California, to that of the Pajaro River: Professor J. C. Branner, Stanford University.

Several years ago Dr. Joseph Le Conte advanced the theory that the drainage of the Sacramento Valley of California formerly entered the Pacific Ocean through the Bay of Monterey instead of through the Golden Gate as it does at present. This theory was based chiefly upon the absence of a submerged channel outside of the Golden Gate and the presence of such a channel in the Bay of Monterey. Later the study of the fish faunas of the streams of California by Professor C. H. Gilbert and his colleagues showed that there had formerly been some connection between the Sacramento, the Coyote, the Pajaro, the Salinas and various other streams that are now separate. These faunal relations seemed to give strong support to the theory of the newness of the Golden Gate channel.

Later study shows that the mingling of these faunas may be explained otherwise. During the glacial epoch the region in question stood from 2,000 to 3,000 feet higher than it does at present. The Bay of San Francisco did not then exist, but the Sacramento and Coyote drainage flowed through it. Coyote Creek rising on the western slope of the Mt. Hamilton range flowed into the Santa Clara Valley at the top of the watershed between the present Coyote Creek and the Pajaro drainage. An alluvial cone was built up on the flat valley-floor where the Coyote emerged on the plain of the Santa Clara Valley. As this cone grew the Coyote swung from side to side, emptying its waters now into the Bay of San Francisco and now into the Bay of Monterey. Fishes ascending from the Sacramento into the Mt. Hamilton range, could later descend into the Pajaro drainage. The elevation of the coast at that period carried the mouth of the Pajaro farther toward the west, so that fishes could pass from the Pajaro into the San Lorenzo and into the Salinas without entering the sea.

The depression following the glacial epoch submerged the mouth of the Sacramento forming the Bay of San Francisco, and separated the San Lorenzo from the Pajaro and the Salinas Rivers. The decreased precipitation diminished the volume of Coyote Creek and it ceased to build the cone near Madrone Station, and since then it has flowed toward the Bay of San Francisco and has been cutting into its alluvial cone.

Professor Branner's paper was discussed by Messrs. T. C. Hopkins, C. R. Dryer, A. C. Lane, George H. Chadwick and E. O. Hovey.

The Geology of Coon Butte, Arizona: Messrs. D. M. Barringer and B. C. Tilghman, Coon Butte, Arizona. (Illustrated with diagrams and specimens and presented by J. C. Branner.)

Coon Butte, Ariz., is a low crater-like hill six miles south of Sunshine Station on the Santa Fe Railway, and about twenty-five miles southeast of Flagstaff. The general geology of the surrounding country is very simple, consisting of horizontal beds of red sandstone, silicious limestone, white sandstone and light brown sandstone, each bed being clearly distinguished from the others. In this plain is a pit about 600 feet deep and three quarters of a mile across. The edges of the beds exposed in the pit are all turned sharply upwards. The slopes of the ridge around the pit are covered with blocks and fragments of rocks like those exposed within the pit. Several years ago Mr. G. K. Gilbert made a study of Coon Butte. He appears to have supposed at first that it was formed by a meteor striking the earth. His final conclusion was, however, that it was caused by a steam explosion.

Some years ago a mining company acting upon the theory that the Coon Butte pit was made by a meteor, began a systematic search for the mass in the bottom of the crater-like depression. Their explorations show that the region has yielded several tons of meteoric iron, and that a large number of pieces of this iron have been found interbedded with the débris thrown from the pit. The distribution of the irons on the surrounding plain also lends strong support to the idea that the depression was made by a meteor striking the earth. The bottom of the pit is filled with fossiliferous fresh-water deposits to a depth of about eighty feet.

Messrs. Barringer's and Tilghman's paper was discussed by Messrs. J. C. Branner, A. C. Lane and E. O. Hovey.

Recess was taken from 12:45 to 3:45 on account of lunch and the dedication of Rockefeller Hall.

Saturday, June 30. Excursion to Union Springs under the leadership of Professor G. D. Harris, of Cornell University. This was participated in by thirteen members of the section. The stratigraphy, paleontology and physiography of the region were studied.

Monday, July 2. An excursion by boat to various points of interest at the southern end of Cayuga Lake under the leadership of Professor G. D. Harris, which was participated in by eighteen members of the section and association. The succession of Devonian beds along the lake shores was noted; peculiarities of shore-line and delta formations observed and the erosion of the strata as exemplified in the Taughannock Falls studied. The Glenwood intrusive dike was visited.

Tuesday, July 3. An excursion to Enfield Glen under the leadership of R. H. Whitbeck of the State Normal School, Trenton, N. J., which was participated in by fifteen members of the section and association. The glacial phenomena of Cayuga Valley, the geology of the lateral valleys, the jointed structure of the rocks and the Enfield Falls, were the natural features of particular interest.

After lunch at the Enfield Glen Professor C. R. Dryer, of the State Normal School, Terra Haute, Ind., gave, by invitation, a carefully prepared paper upon 'The Geologic Features of the Finger Lake Region, New York.'

Western New York may be divided into four physiographic regions: (1) the Iroquois plain, (2) the drumlin belt, (3) the Finger Lake belt, (4) the Allegheny Plateau. The Finger Lake belt lies on the northward slope of the plateau and is trenched by numerous north-south valleys, many of which contain lakes. The valleys are long, narrow, straight or but slightly curved, flat-bottomed, from 1,500 to 2,500 deep and partly filled with sediment. The rock floor of the Cayuga Valley is 55 feet below the sea level and that of the Seneca Valley at least 556 feet. The slopes of the valley walls are smooth, symmetrical, devoid of spurs, and below the 900-foot level are sharply oversteepened. The wide, open, mature valleys of the tributary streams are, with a few exceptions, 'hung up' at the edge of the steepened slope and the streams drop by rapids and falls through narrow rock gorges, to the lake level. Enfield Creek has in its upper course a fall of about 30 feet to the mile, then it makes a nearly vertical fall of 210 feet and descends 450 feet in one mile and a half to the level of Cayuga Inlet. If the slope of the upper part be extended out into the air it would pass 500 feet above the present mouth of the stream. Within sight on the southern horizon is a notch or gap 600 feet deep and one fourth of a mile wide which leads from the head of this stream through to the Chemung drainage without any definite divide.

The physiographic problems of this region are many; but the features just enumerated can have but one meaning. Main valleys oversteepened, overdeepened and too straight and smooth to be the work of streams alone, tributary valleys hanging hundreds of feet above their immediate baselevel, a main divide notched by through-going gaps—these are as characteristic of glaciated and ice-shaped regions as the features of Alaska, the Alps, Norway or New Zealand. In face of the fact that such peculiar, strongly marked and abnormal features always occur concordantly in regions known to have been extensively glaciated, any other hypothesis than that they are due directly or immediately to ice action of some kind seems gratuitous and impertinent. To set up such trifles as a patch of residual soil, an island in the lake, a shore cliff, etc., as competent to negative the evidences of glacial erosion is to swallow gnats and strain out a camel. A gnat may be as difficult to explain as a camel, but it is of relatively little consequence whether he is explained or not. As a means of progress across the desert of hypothesis to the oasis of conclusion, the camel may be relied on and the gnats that annoy him disregarded. The various sessions and excursions of the section were attended by thirty different members of the association.

The section finally adjourned at about 4 P.M., Tuesday, July 3.

EDMUND OTIS HOVEY,
Secretary.

SCIENTIFIC BOOKS.

Zur Erkenntnis der Kolloide. By RICHARD ZSIGMONDY. Jena, Gustav Fischer. 1905. Pp. vi + 185. 4 Marks.

The names of Siedentopf and Zsigmondy have become familiar to the whole scientific world through the brilliant researches which resulted in the development of the 'ultra apparatus'; their device for observing particles so small as almost to reach the hypothetical molecular dimensions.[1]

In this monograph, 'Zur Erkenntnis der Kolloide,' Zsigmondy has given a careful account of his own and Siedentopf's methods and results, a brief historical review of many other noteworthy researches and a short discussion of the bearing of the 'ultra' methods upon certain theoretical issues.

He states that the main purpose of his researches on colloids has been to determine whether or not the polarization and dispersion of light in Tyndall's experiment is an essential characteristic of all hydrosols or colloidal solutions. He has answered this question in the affirmative in numerous cases, having demonstrated that the dispersion of light is due to the presence of the same particles to which are to be ascribed the other remarkable properties of the liquids containing them.

It may not be amiss to state briefly the principle of Tyndall's experiment and of the 'ultra apparatus,' and to recount some of the interesting facts described in the book. A beam of light is sent through the space under observation, and the observer looks at the space in a direction perpendicular to the course of the beam. If dust, or other fine particles, are present in that space, they polarize, disperse and reflect the light, and the beam is seen. If no such particles are present, the beam is not seen, and the space is said to be optically empty.

With all the resources of the famous firm of Carl Zeiss at Jena at their command, Siedentopf and Zsigmondy constructed their apparatus to send a beam of great intensity, a minute image of the sun, into the medium under investigation, and observed through the best of microscopes. Under these conditions, the particles of metallic gold in a colloidal gold solution appear as brilliant sources of light, but their shape can not be determined.

Siedentopf and Zsigmondy counted the number of these bright spots in a space of known dimensions, they knew the concentration of the gold solution (the weight of gold per unit volume); they assumed that all the gold present was visible, that it had the same specific gravity in this finely divided state as when massive, and that the particles were cubes. From these values they easily calculated the linear dimensions of the individual particles. It will be seen at once that these dimensions can not be regarded as ascertained, because of the assumptions, but

[1] The original articles appeared in the *Zeitschrift für Elektrochemie,* Vol. VIII., pp. 684–687 (1902) and in Drude's Annalen, Vol. X., pp. 1–39 (1903).