Viele (E. L.)

THE

TOPOGRAPHY & PHYSICAL RESOURCES

OF THE

STATE OF NEW YORK.

SURGEON GEN'L'S OFFICE
263
LIBRARY

AN ADDRESS

Delivered by EGBERT L. VIELE, before the

AMERICAN GEOGRAPHICAL SOCIETY,

April 29, 1875.

E. S. Dodge & Co., Printers, 12 Warren Street. N. Y.

The regular monthly meeting of the American Geographical Society was held April 29th at Association Hall, at Twenty-third Street and Fourth Avenue. The chair was occupied by Chief Justice Daly, President of the Society. Col. F. A. Conkling, Vice-President, read the following names, which had been added to the list of members : Mayor Wickham, George Wilkes, Charles Francis Stone, Gen. Alfred H. Terry, United States Army ; Gen. James H. Ruger, United States Army ; Gen. John Pope, United States Army ; James P. Carson, District Attorney Phelps, John A. Davenport, E. M. Daniels, George M. Curtis, Justice Kasmire, Justice Otterbourg, Alderman Monheimer, Edward Oothout, P. Roessle, of Washington, and Lawrence D. Kiernan. The following were elected corresponding members : Rev. J. P. De Haas, United States Consul at Jerusalem, and E. Greenville, Murray, Paris.

Among those present were Rev. Dr. William Adams, Samuel B. Ruggles, Gen. George W. Cullum, United States Army ; William H. H. Moore, Francis A. Stout, Col. F. A. Conkling, William Remsen, Elial F. Hall, Alexander McL. Agnew, and Isaac Bernheimer.

The President, in a few remarks, referred to the remarkable features in the physical geography of the State of New York, and introduced to the Society, General Egbert L. Viele, who delivered the following

SURGEON GEN'L'S OFFICE
263,
LIBRARY

ADDRESS

ON THE

Topography and Physical Resources of the State of New York.

Mr. President and Members of the Geographical Society :

Several years have elapsed since the subject of a topographical survey of the State of New York was made a matter of special report by a committee of the American Geographical Society, consisting of Mr. John Jay, Mr. F. A. Conkling and myself, This report, which is found in the Bulletin of the Society for

1856, Vol. 2, presents a clear statement of the great value of such a survey, and was followed by a memorial to the State Legislature; but, as the object sought to be attained was more general than local in its character, it did not receive that individual attention which seems to be requisite to success in all legislative action. Hence, this important public measure was suffered to pass unnoticed, and has remained unacted upon to this day.

As a member of the committee referred to, the subject awakened in my mind a very deep interest, increased by a natural feeling of State pride, eventuating, through the coincidence of professional proclivities, in the accumulation of a large amount of data pertaining to it, and at length resulting in the preparation of a topographical map of the State, which, while making no claim to the accuracy of a Geodetic survey, has nevertheless, the merit of general truthfulness, and on the scale to which it is drawn, renders unappreciable many unavoidable errors of detail, while at the same time, it furnishes a clear exponent of those grand physical developments, which constitute the wealth of the State and excite the just pride of its citizens.

A complete description of the natural features of the State, and its vast mineral and industrial resources, would furnish material for many interesting volumes. In fact, a score of volumes upon this subject already exist, the results of careful and prolonged examinations, extending through a period of many years, and embracing nearly all the branches of natural History. These pages, while reflecting the highest degree of credit upon the scientific skill and assiduity of their authors, are deprived of much of their value by the absence of accurate topographical maps, upon which the information acquired could be graphically delineated.

While the map now executed may not entirely suffice for all the purposes of this delineation, it exhibits nevertheless, the physical characteristics of the State in their relative proportion, while the gradual changes of its natural features, through the successive stages of continental development, can be traced in no uncertain lines.

THE INDIVIDUALITY OF THE STATE.

No other one of the United States possesses such a marked individuality as the State of New York. Whether we regard the magnitude and extent of its rivers and lakes, the grandeur and beauty of its scenery, its broad and productive valleys, its lofty mountain chains, its successful plans of internal improvement,

or its teeming population and busy industry, we find it in its expanse of territory, its fertile soil and genial climate, in the general distribution of its enormous aggregate of water-power, and in all its vast accumulation of material resources, an "*imperium* in imperio," without an equal, and without a rival.

Possessing the natural highway to the populous and luxuriant West, and the gateway to the Canadas, it has acquired a prominent position in the confederacy of States, and its metropolis has become the commercial entrepôt and financial centre of the continent. Its position in the Past has been no less commanding than it is in the Present.

Its annals form a complete chapter in the history of American civilization. Its statesmen and soldiers have been pre-eminent in the council and the field; and the fires of patriotism have always burned brightly upon the altars of its people. While in the more remote past, those early days of conquest and settlement, when life was a daily and hourly struggle to subdue at once the wilderness and its savage inhabitants, the history of the State is but one long record of self-sacrifice and heroic deeds, worthy of any race and nation that has ever lived. No less remarkable is the history of the aboriginal tribes who occupied the State from the ocean to the Lakes, when the European landed on its shores. The Iroquois or Six Nations, ranked the first among the Red Men of America. They were far in advance of all their barbarian compeers. They had a confederation for offence and defence, and possessed the elements of a rude civilization. They welcomed the white man when he came, and shared with him their substance, while their rude industry became the first wealth of the colonists. By their skill and superior intelligence, and their bravery, they dominated over all the tribes east of the Alleghanies, and south to the Gulf of Mexico, and have been not inaptly termed the Romans of the Western world, for their orators were as eloquent as Cicero, and their warriors as brave as the legions of Cæsar. Yet this once powerful race, these chieftains "to the manner born," whose council fires were as numberless as the stars in Heaven, have passed from the face of the Earth, and left no monument to tell of why they lived, or how they died. Over their graves, powerful nations have disputed for the mastery of the soil, and in the progress of events, all vestiges of the aborigines have been obliterated. In a single century the race has disappeared from its borders, and in that short period of time, the homes and temples of a new civilization have filled all its lim-

its. The wilderness has been made to blossom as the rose; opulent and populous cities rise up on every hand, while nearly five millions of people, representing the arts and industries of every nation, have under the ægis of a free government and salutary laws, achieved a degree of general prosperity heretofore unknown among any people. That this prosperity is due in a large measure to the geographical position occupied by the State, and in a still greater degree to the topographical configuration of the surface, is clearly shown by an examination of those physical characteristics, the principal features of which it is the object of this paper to delineate.

THE GEOGRAPHICAL POSITION OF THE STATE.

The geographical limits of the State extend from 71° 50′ to 79° of longitude west from Greenwich—and from 40° 29′ 40″ to 45′ 0′ 42″ north latitude, embracing 8° of longitude, and 5° of latitude, being 320 miles long and 312 miles broad, and containing 47,156 square miles, or 30,179,840 acres. On the north is Lake Ontario, containing 6,900 square miles, and the St. Lawrence River and Canada. On the east are Vermont, Massachusetts and Connecticut. On the south are New Jersey and Pennsylvania. On the west Lake Erie, containing 7,800 square miles and a portion of Canada. The area included within these limits is in many respects the most remarkable portion of the American Continent. Geology tells us that of all the land now in existence, the first that rose above the waste of waters in the earliest periods of creation, lies within these borders; that long ere the crags of Jura, the heights of Chimborazo, or the lofty Cordilleras were created, the sun shone here upon the shore of a vast ocean, whose limits were the great globe itself. That while yet the sites of Babylon and of Tyre, of Carthage and of Rome, were hidden beneath the sea, created life moved along the old silurian beach, whose tidal lines across the State are as distinctly marked to-day as they were when the waves of the primitive ocean beat upon the shore. The successive geological evolutions which have been wrought out during the long ages that since then have come and gone are inscribed upon these mountains, hills and valleys as upon the pages of a book where science reads the history of the material world. On no other continent and in no other spot are the records of the past so clearly defined or so easily read. In seeking a key with which to analyze and describe the topographical characteristics which have thus been developed, we find that the

mountain system of the State is the extension and in part the termination of the great Appalachian chain which forms the easterly range of the continental system of mountains. This broad series of parallel ridges, with intervening valleys, which extends from near the Gulf of Mexico on the south, to the Gulf of St. Lawrence on the north, having a mean elevation of 2,500 feet (at one point rising as high as 6,000 feet), forms an almost insurmountable barrier between the Atlantic coast and the interior of the continent. As it enters the State of New York from the south, this mountain range, which in some places is 200 miles broad, becomes narrowed and depressed, and while a portion of it sinks beneath the later sedimentary formations which overlie the greater part of the State, another portion, passing to the east of the Hudson River and across the State of Massachusetts, forms in its continuation the Green Mountains of Vermont and the White Mountains of New Hampshire. At West Point on the Hudson, where this formation is developed in all its grandeur, the mountain chain is riven asunder, and the lordly river whose deep channel would float the navies of the world, passes on majestically to the ocean. No scenery on the continent can rival the Highlands of the Hudson at this point; and when we consider that this is the only spot where the thousand miles of rocky barrier is broken, giving to the State of New York the key with which commerce has opened the treasure house of the West, and brought from thence the willing tribute of its abundance to this great city of the sea; when we find a similar result although on a scale less grand and imposing, produced by the remarkable erosion of the valley of the Mohawk, thus extending the facilities of commerce to the great lakes—we no longer wonder at the events which one century has brought about. Eighty years ago there were more people living in Massachusetts than in New York, also in Pennsylvania and even in North Carolina, and Virginia had double the population of this State; while to-day New York has a million more inhabitants than the whole country had at that time.

To understand more fully the influence of these topographical lines of lowest level, we have only to compare the gradients of the railways which extend from the Atlantic to the West. All the railways south of this line extending from the sea coast to the lakes and Mississippi Valley, pass the mountain range at various elevations; the Erie Road at an elevation of 1,800 feet, with grades of 90 feet per mile; the Pennsylvania Road

at an elevation of 2,200 feet with grades of 125 feet to the mile; the Baltimore and Ohio at an elevation of 2,600 feet, with grades for 15 continuous miles of 116 feet; and the Chesapeake Road in Virginia at 2,000 feet, with corresponding grades; while from the Hudson at or near Catskill to the Mohawk a distance of 53 miles, the entire ascent is but 220 feet, which can be overcome by grades not exceeding 30 feet to the mile, and the highest summit thence to Lake Erie of 193 feet is overcome at grades not exceeding 20 feet to the mile, while the remainder of the line is characterized by a generally level grade. Now, as the cost of draught on a railway is nearly as the power employed, so that it costs twice as much to carry a load with an ascending grade of 24 feet as to carry it on a level route, and as this element of railway construction increases in importance with the increase of traffic, the value to the State of its low level line of transportation is apparent.

THE RIVER SYSTEM OF THE STATE.

The river system in its influence on the general prosperity of the State is even more remarkable than its mountains, whether we view it as a system of drainage, for this widely extended territory, or regard it as the local and concentrated source of a semi-continental river system, whose waters wash the borders of half the States of the Union; or whether we contemplate its wonderful adaptability in nearly all its wide-spread ramifications to the industrial interests of the inhabitants of every section of the State, and the transportation facilities it affords for internal commerce. It may almost be said, that every drop of water that falls upon the surface is conserved for a useful purpose. Wherever a stream ceases to be navigable it becomes a mill-power, and the great value of those inequalities which at first glance give a rugged aspect to the surface, becomes apparent. The estimated number of interior lakes is 648, and the area of lake surface 466,550 acres. The average height of these natural reservoirs, above the level of the sea, is 1,000 feet; one of the fine lakes in the Adirondack, is 3,000 feet above the sea, and in that region the average height is over 1,500 feet, while the rivers and streams that emanate from them, fall with great rapidity of descent towards the sea level. The amount of water-power which is thus developed, is simply enormous. If all the motive-power of this kind existing in the State, were properly utilized, it would be greater than that of all the rest of the United States,

excluding the State of Maine. The principal rivers of the State are the Hudson, the Mohawk, the Delaware, the Susquehanna, the Chenango, the Chemung, the Genesee, and the Alleghany, each having distinct valleys of drainage, while the Adirondack region is drained by the Black, the Rackette, the Grass, the St. Regis, the Au Sable, the Saranac, and the Sacondaga. The Hudson drains all of the Appalachian region of the State, and with the Sacondaga drains the south-easterly portion of the Adirondack region. The Mohawk, although lying along the southerly base of the Adirondack and having a very broad natural valley, has a limited area of drainage. Its principal affluent being the Schoharie, which drains the southerly and westerly slope of the Catskill Mountains. The Delaware drains the counties of Delaware and Sullivan, and a large portion of New Jersey and Pennsylvania. The Susquehanna which takes its rise in Otsego Lake, in Otsego County, drains, together with its branches, the Chenango and Chemung, most of the southern tier of counties. While the Genesee, the only river flowing directly north, drains a comparatively limited area beyond its own immediate valley. The Alleghany with its branches, drains the south-western portion of the State.

THE DIVIDING VALLEYS.

The area of the State is trisected by the valleys of the Hudson and the Mohawk, which intersect each other at right angles, and constitute the key to its topography.

These valleys were the hunting trails and the war-paths of the aboriginies; the strategic lines of contending armies of Europeans; and are now the broad avenues of a peaceful commerce, the bond of a perpetual unity, and the exponent of the increasing prosperity of the nation.

The three divisions which are thus formed, are each peculiarly distinct, both in their topography and their geology. Each seems to have separate epochs of existence, each is a separate volume of the earth's great legends of antiquity.

THE FIRST DIVISION.

The first division is that portion of the State which lies east of the Hudson river. Although constituting but seven of the sixty counties into which the commonwealth is politically divided, its population is larger than any of the States of the Union with the exception of five, and there are two States whose combined

area does not equal it in extent, while one other is but a little larger. Geologically, this district is almost entirely composed of the remnant of a continent which is no longer in existence. Itself the crystallized and metamorphosed sediments of wasted mountains, it became in turn the rocky shore of a vast sea in which the present continent had its origin. The rocks, minerals and metallic deposits of this region, have been the study and puzzle of geologists for years, while even now it periodically vibrates and trembles with the earthquake-shock that tells of dormant life or slumbering fires beneath it. The topographical descriptions of this district begin with the island of Manhattan which forms the lower portion of the city of New York. This island is twelve miles long and from one-half a mile to two miles and a quarter broad. The basic rock is Gneiss, with the exception of a deposit of limestone at the northern extremity. The strata have been turned up to a vertical position, and an elevated ridge extends nearly the whole length of the island, varying in height from seventy to one hundred and twenty-five feet. The ridge is broken at the northern end of the Island, admitting the passage of the waters of the Hudson river, but rises again in Westchester County, and continues northward at an increasing elevation. At the northeast point of the island are extensive alluvial flats, a portion of which are overflowed by the tide. Formerly a number of running streams of water existed on the island, the general course of which was north and south, emptying into the adjacent waters, where breaks in the rocky formation would admit. These streams have nearly all been filled up and their flow obstructed to the manifest detriment of health.

No metalliferous deposits have been found, but excellent building stone of granite and limestone have been quarried in several localities.

The original topography is rapidly disappearing in the grading of avenues and construction of buildings.

Passing northward to the main land we find the same basic rock. The single elevated ridge of the island gives place to a succession of nearly parallel ridges with intervening valleys. A section across Westchester County at Hastings, twenty miles from the City Hall, shows six of these ridges. There are, however, two predominant lines of elevation in this county attaining an elevation of 1,500 ft., one along the Hudson, and the other on the easterly border. They all become merged into the high lands of Putnam County. These Highlands consist of several steep rocky

ranges extending in a northeast and southwest direction, separated by deep narrow valleys. Numerous lofty peaks tower above the surrounding mountains, from which are views of great extent and picturesque beauty. As far as the eye can reach a continuous series of rocky summits extend to the farthest horizon. Interspersed between the ridges and sometimes attaining very great elevations are many fine lakes, some of them very extensive sheets of water, a large number being often visible from a single point of view, sparkling in the sunlight like jewels in a diadem of mountains with which nature has crowned a glorious landscape. The deep shadows of the narrow valleys serve to heighten the beauty of the scene by increasing the relief of the mountains, while the rivers, which meander at their base, appear like tortuous threads of silver. The low intervening hills of gravel and sand, formed in the whirling torrents of an early period, are clothed in emerald verdure or covered with luxuriant forests. Geologically, the Highlands of Putnam County as well as those of Orange County on the opposite side of the Hudson river, are the continuation of the primitive rocks of the Appalachian chain. In Dutchess County the Mattewan mountains form the northern limit of "the Highlands" in this State. Its highest summits attain the elevation of 1,700 feet. Next to these mountains on the east, and separated from them by a broad valley, are the Taghanick mountains, which extend along the east border of Dutchess County and northerly through Columbia, Rensselaer and Washington Counties into Vermont, forming the foot hills or easterly slope of the Green Mountains. This formation is entirely distinct from that of the Highlands, being composed of Metamorphic limestone and slate. Parallel to this range in the west are the Petersburgh mountains, which, commencing in an elevated plateau in the northern part of Columbia County, extends through Rensselaer and Washington Counties. These mountains belong geologically to what is known as the Hudson river group, composed of shale, slate and limestone. In some places they rise as high as 2,000 feet above the sea. The declivities are usually steep. Nearly parallel to this and still farther to the west, there is in Washington County a range known as the Palmerstown mountains which forms a portion of the Adirondack system. They consist principally of gneiss, granite sandstone and impure limestone. Their sides are very precipitous and broken, and their summits are wild, irregular masses of naked barren rocks. The valleys between them are

narrow and rocky, often bordered by precipices many hundred feet high. These, in brief, constitute the chief topographical features of this division of the State.

Hydrographically, the Hudson River forms the entire eastern border, and between all the ranges and lines of elevations even down to the lesser ridges, there are drainage streams of greater or less extent ; some are rivers of no inconsiderable volume, supplying with their numerous branches a large aggregate of water-power, which is made available for the use of innumerable mills and factories. The general course of the streams is southerly, and nearly all of them empty into the Hudson. The principal of these are the Bronx, the Nepperhan, and the Croton, which, rising in Dutchess County and passing through Putnam and the northern part of Westchester, constitutes with its branches the chief source of water supply for the City of New York. Three large storage reservoirs constructed in Westchester and Putnam Counties, holding many millions of gallons, retain these waters for distribution and use when the ordinary flow of the River fails to meet the demand. The Sawkill, Fishkill, and Wappinger's Creeks, the Claverack and Kinderhook, the Hoosick and Baten Kill, are all noted streams which drain the principal valleys. Besides these, are numerous and beautiful lakes throughout the entire division, the resort of many thousands of people in the summer months. The economic resources of all this region are varied and valuable, embracing many varieties and extensive deposits of granite, marble, serpentine steatite, slate and iron ore.

GRANITE.

Granite occurs abundantly in New York, Westchester, Putnam and Dutchess Counties. It presents all varieties of texture, from a very coarse grained rock to one almost perfectly compact. In color it varies as much as in texture. It is white, red, gray, yellowish, and bluish gray, according to the color of the minerals forming it. The color of the feldspar usually determines that of the mass. It occurs in beds, in veins, in interstratified masses, and in knobs, knots and protruding masses, in which no connection with beds or veins have been traced. The more common mode of its occurrence is in beds ten to one hundred feet thick, interstratified with gneiss.

The materials are of the best quality, easily quarried in large blocks suitable for columns, cornices, etc., easily dressed, enduring as time, which the naked crags themselves will testify.

MARBLE.

The granular limestone or marble of this region, especially that found in Dutchess, Columbia and Westchester Counties, is very extensive, and does not yield to any other mineral deposit in those counties in prospective value. Marble quarries are extensively worked in many portions of this limestone range. It extends through the greater part of the length of these counties and crops out with a variable breadth from a few hundred yards to several miles. The marble business is one that will always employ much labor and capital, and as this valuable material is inexhaustible in any definite period of time, it will always be an unfailing source of wealth.

SERPENTINE.

The Serpentine quarries of Putnam County, are sufficient to supply the market, not only of our own country but the world, with this kind of ornamental marble for a long period of time. It is a beautiful material when polished, is exceedingly rare in Europe. In ancient times it was used in some of the Spanish palaces with fine architectural effect.

STEATITE.

Steatite, commonly known as soapstone, is very abundant in Putnam and Dutchess Counties. It is quarried in large blocks, beautifully spotted and colored. Good quarries of this rock are very valuable, and the use of the material is steadily increasing.

IRON ORE.

The iron ore of Westchester, Putnam, Dutchess and Columbia Counties is very abundant and of the best quality. It exists in extensive beds in the form of Hematite, and also in immense deposits as Magnetic Oxide. Many mines are in active operation, and numerous furnaces have been constructed along the Hudson river and in the interior. The quantity of pig-iron manufactured is increasing every year, employing many men and a large capital.

SILVER AND LEAD.

Deposits of silver and lead have been found in Dutchess County, and have been worked with more or less success. Recent explorations and analysis indicate extensive and valuable veins of silver, and arrangements for deep mining are now being projected.

INTERIOR COMMUNICATION.

Extensive lines of railway both longitudinal and transverse with numerous lateral branches, have been constructed throughout the whole of this region. Along the east bank of the Hudson, and through the valleys of the Nepperhan, the Bronx, the Croton, the Hoosick, and Baten Kill, railways have been built connecting this section with all the New England States. In the north, through Washington County, the Champlain Canal connects the waters of Lake Champlain with those of the Hudson. Large and populous cities, prosperous towns and villages, an active, intelligent and enterprising population engaged in the industrial pursuits of commerce, agriculture, mines and manufactures, exhibit throughout the length and breadth of this area unrivaled evidences of energy and thrift.

Properly speaking, Long Island and Staten Island, with the smaller insular territory in the Harbor of New York, as well as the Harbor itself, belong topographically to this Division.

Long Island, 120 miles long by 10 broad, is of drift alluvial origin.

Staten Island, 14 miles long by 8 broad, is a granitic formation interspersed with serpentine steatite. There are valuable deposits of hematite iron ore and fire-clay on this island. The quality of the iron ore and the advantages of its proximity to tide water are attracting the attention of ironmasters, and it is stated that iron can be manufactured here at an expense much less than at any other locality.

HARBOR OF NEW YORK.

The Harbor of New York consists of the harbor proper and an outer roadstead, called the Lower Bay. The latter being partially protected from the sea by the island of Sandy Hook (almost a peninsula), which stretches out from the coast of New Jersey in a northerly direction, about six miles in length and three-quarters of a mile broad. The main channel into the bay passes near the extremity of Sandy Hook, between which and the coast of Long Island, a distance of seven miles, is an immense shoal, through which pass three lesser channels into the harbor. The bar to the entrance lies three miles off Sandy Hook. On it there is a depth of water of from 21 to 23 feet. The Lower Bay contains one hundred square miles of water surface, receiving from the West the waters of the Raritan river, which is 74 miles in length, passing through the red sandstone formation of New Jersey. The outer bay connects with the harbor proper at the

Narrows, a strait formed by the approximation of the shores of Long Island and Staten Island. There is also another connection formed around the western shore of Staten Island, by the Staten Island Sound, as it is called, which meets at Newark Bay the united waters of the Passaic and Hackensack rivers. The former is 70 miles in length, passing through the New Red sandstone formation, and having at one point a fall of 70 feet. The latter is 40 miles in length, passing through red sandstone and conglomerate. Newark Bay is also connected with the Harbor by the Kill von Kull, a narrow strait.

The principal affluent of the harbor is the Hudson River, which rises in the mountains of Hamilton and Essex counties, New York, is 350 miles long, passing through granite and calcareous formations ; the principal tributary being the Mohawk, 155 miles long, with a fall of 75 feet, two miles from the junction. The Hudson is navigable for large ships a distance of 118 miles. It is connected with the Great Lakes by the canal at Albany, and with Lake Champlain and the St. Lawrence river by the Northern Canal. The river divides at the northern extremity of Manhattan Island, forming what is called the Harlem River, which empties into the East River, an arm of the sea connecting the harbor with Long Island Sound—thus forming a second opening to the ocean. The harbor contains 24 miles of water surface. The harbor thus formed is the finest on the continent, if not in the world. The navies of all nations can ride in safety within its limits, and the largest vessels ever constructed can enter without difficulty, and yet it is but one of the many lavish gifts bestowed by Nature on this favored State.

THE SECOND DIVISION.

The second division comprises that section of the State lying south of Lake Ontario and the Mohawk river and west of the Hudson. It contains forty-one counties. With the exception of a small portion occupying the south-eastern corner, this division belongs to the great paleozoic basin, which extends from the Appalachian range to the Rocky Mountains, constituting the great part of North America. Formed in the ocean's bed from the ruins of a wasted continent, and of a succession of vast deposits during alternate periods of elevation and subsidence, the whole series of stratified rocks that underlie this portion of the State, from the magnesian base of the lower silurian to the storm-worn cliffs of red sandstone that crown the highest

peaks of the Catskill Mountains, tell in unmistakable language, the history of the material world through unnumbered ages of time. The several formations have a general geological designation as the Lower and Upper Silurian and Devonian systems, while the more detailed divisions, embracing many successive and distinct epochs of creation, have received a nomenclature in accordance with the localities where they are most clearly shown. There are twelve of these divisions, having an entire thickness in this State of 13,000 feet, but which it is not necessary for the purposes of this paper to enumerate. They are characterized by the circumstances of alternate elevation and depression under which they were formed. Sometimes in the bed of an open sea, and again in a land-locked basin of fresh water, while at other times the waters were limited to the area of a salt lake or great dead sea, whose bitter and saline waters were destitute of animal life, leaving, however, for future ages a deposit which is now one of the most productive sources of industry in the State. The salts of the rocks formed at this period are found in solution in waters issuing from the strata. The salt wells at Salina, in the county of Onondaga, are from 150 to 300 feet in depth, and at Syracuse, in the same county, they are between 250 and 350 feet deep. Thirty-five to forty-five gallons of this water afford, on evaporation, a bushel of salt ; while it takes 350 gallons of sea-water to produce the same result. The salt-works of this section are on a large scale and of great importance.

In consequence of the deep erosion of the river valleys, all of the geological formations are exposed to view in one place or another ; while the two uppermost, that are known as the Chemung group and the Catskill group, predominate over all the surface of that portion of the State now under consideration. Through the central part of this division stretches, from east to west, an extensive plateau, rising to the west and south, but broken through by many transverse valleys, and descending by a series of terraces to Lake Ontario. In those transverse valleys lie embedded that wonderful chain of lakes which make the topography of this part of the State so remarkable.

THE LINES OF ELEVATION.

The first and most easterly line of elevation in the second division is the extension into the easterly part of Rockland County of the Palisades or basaltic ridge from New Jersey

along the west bank of the Hudson. This is a volcanic intrusion of trap rock through the red sandstone formation. The Highland range which is parallel to this, is composed of a great number of mountain ridges, occupying a belt of country 20 miles in width, extending through Rockland and Orange Counties in a north-easterly direction to the Hudson, being the continuation of the Appalachian range. These are not long unbroken lines of elevation, but a succession of ridges, which are not really in line with each other. The scenery in this region is grand and imposing. Numerous lakes are nestled in the hollows of the mountains. Vast deposits of iron ore are found throughout this range, as well as quarries of excellent granite.

Along the northwest portion of Orange County, the Blue mountains extend in a high unbroken range, known as the Shawangunk mountains, to the height of 2,000 feet. Its long unbroken crest is clothed with forests, and which with the highly cultivated slopes form a pleasing and beautiful landscape. Between the Blue mountains and the Highlands lies the broad undulating valley which is a part of the great valley of the United States, extending from Canada to Tennessee, known in New York as the valley of Lake Champlain and the Hudson River, in New Jersey as the Kittany Valley, in Pennsylvania and Maryland as the Cumberland Valley, in Virginia as the Shenandoah and Great Valleys, and in Tennessee as the Valley of East Tennessee. It is everywhere noted for its rural beauty and agricultural wealth.

This is in fact the true extension of the valley of the Hudson. Through it vast, deep, and rapid torrents of water coming from the Champlain valley, have more than once passed southward to the sea, bearing in their currents much of the original surface which now forms the rich alluvial lands of the Atlantic border.

The next line of elevation to the west of the Blue ridge is composed of the sedimentary deposits which form the Catskill and Helderberg range of mountains. Unlike the Appalachian Chain to which it is contiguous, which originated in the violent and convulsive throes of nature, and are upturned in wild confusion, the Catskills were formed in calm, untroubled waters, and with the exception of a gradual and gentle elevation of wide extent, these rocks have remained comparatively undisturbed, save by the erosive action of water, since their first creation. The area covered by this old red sandstone formation was very much

greater than it is now, probably extending over a large portion of the lower half of the State, but by glacial and aqueous action it has been removed, leaving for the uppermost rocks the shales and sandstones of the Chemung group.

THE GREAT PLATEAU.

The rocks of the Chemung group overlie the principal portion of the plateau of the southern tier of counties. In this wide region there is a total absence of those rich mineral deposits, which characterize the Archean rocks of the eastern portion of the State. The scenery of its lakes and its long river channels is varied and beautiful. Its valleys and its hill tops are fertile, and their sides are clothed with verdure which tells of a wealth in the soil, greater, perhaps, than the mines and the marbles of the eastern side. This is the granary of the State ; the quiet peaceful homes of her yeomanry, where smiling fields and sequestered woodlands tell of cheerful toil, of domestic comfort, and of industry rewarded. Let us look for one moment at the results accomplished in this agricultural district.

New England and New York.

New England, the synonym of thrift and prosperity, contains 13,000,000 more acres of land than New York. The last census gives us the following figures. The six New England States have an area of 43,742,323 acres, New York has 30,080,000 acres.

	New England.	*New York.*
Acres of Improved Ground	11,997,540	15,627,206
Value of Farms	585,169,472	1,272,359,966
Farm Implements and Machinery	22,553,059	45,997,612
Value of Live Stock	100,521,907	175,881,712
Value of Farm Products	154,026,300	253,526,153
Bushels Wheat	1,000,693	12,178,462
" Corn	7,347,666	16,462,825
" Oats	9,169,504	35,293,625
" Rye	703,379	2,478,225
" Buckwheat	1,189,413	3,904,030
" Barley	1,075,059	7,434,621
" Grain ground	20,918,415	45,663,123
Value of Products	26,474,435	60,237,220
Orchard Products	3,819,206	8,247,417
Value of Leather Tanned	18,452,970	26,988,320
Lbs. Butter	49,662,275	107,147,526
Gals. Milk sold	21,044,175	1,135,771,919
Lbs. Hops	987,409	17,558,681
" Wool	6,643,863	10,599,225
" Flax	19,741	3,670,818

These statistics are given not for the purpose of drawing an invidious comparison, but because it is only by such a comparison that the true extent of the resources of the State can be cor-

rectly understood or appreciated, and to enable us to see what the great Western plateau of our State can produce, and no one will say that more than a fraction of our true resources have yet been developed.

THE LAKE REGION.

The Lake chain which occupies the centre of the plateau, has always been a source of wonder and admiration to the student of natural history as well as to the lover of the beautiful in nature—the remarkable manner in which their united waters seek the same outlet into Lake Ontario ; the part these waters are made to play in the grand system of internal communication ; the strange freak of nature which has strung them together like a necklace of gems ; the historical associations which surround them ; the euphonious titles which recall the memories of the once powerful races of men who, vanishing forever from the earth, left nothing behind them save only their tribal appellations, inscribed upon the beautiful sheets of water they loved so well and around whose shores their lives were passed. Truly it is fitting that Lakes Seneca, Cayuga, Oneida and Onondaga should be united in a natural chain which shall forever symbolize the links of friendship that bound those gallant clans whose names they bear in bonds of amity that death alone could sever.

From the shores of these lakes the land slopes beautifully and evenly upward to the summit of the ridges which form their water sheds. The waters are clear and sparkling, and the whole lake region presents some of the finest landscapes in the country—Cayuga Lake is 38 miles long, Seneca Lake 35, Oneida 20, Canandaigua 18, Chautauqua 18, Crooked Lake 14, Owasco 11, and Skaneateles 13. The origin of these lakes has been ascribed to glacial action. Naturalists, however, disagree as to the manner in which this action took place. On the supposition that the land was elevated previous to the ice period, when a large portion of the continent was covered with an immense ice cap, it has been suggested that the valleys of the lakes were groves worn out by the abrasion of the advancing glacier. Again it is surmised that the valleys were formed under water by the movements of immense icebergs over a plastic surface. Agassiz infers that they are the result of cracks or fissures made in the contraction of the surface, by exposure to the heat of the atmosphere, on the elevation of the land from beneath the waters which at one time covered it. But the topographical position which they occupy with relation to

each other, would seem to indicate an uniformity in the cause which has produced them that cannot be accounted for on any of the suppositions named. Assuming as established that the glacial movement was from the northwest to the southeast, the receding of the glacier would take the opposite direction. In its dissolution an immense volume of water would be discharged from the melting ice and would naturally descend in channels to the foot of the glacier, where being impinged with great force upon the earth, it would wear a deep channel which would be prolonged as the mass of ice receded.

Looking at the location of the lake valleys we can readily conceive the torrents of water discharging themselves from the receding glacier at the head of Cayuga and Seneca lakes, and a smaller one at the head of Crooked Lake. This last lake is only 14 miles long, but simultaneously with its termination, the size of Seneca Lake is materially increased, as if the stream that formed it had been enlarged by having added to it the one that was forming Crooked Lake. Cayuga Lake is also increased in volume. And the heads of a number of smaller lakes appear on the same line, indicating a great increase of temperature and a consequent increase in the number of torrents discharged from the melting and receding ice-field. All of these lakes, large and small, terminate on nearly the same line, where the erosion of the Mohawk Valley begins, as if the glacier having reached that line, the volume of water, caused by its rapid dissolution was discharged through that valley. In connection with this lake system, there is one feature which, although less striking than any other, and affording to the casual observer nothing to impress or interest, is nevertheless an object of deep concern to every citizen, not only in its economical aspects, but also in its influence upon the general welfare. I refer to the enormous area of saturated soil caused by the level character of the upper lake terrace. From Buffalo to Utica there is very little of this terrace, ten miles wide and more than a hundred miles long, that is entirely free from the blighting influence of the immense swamp district that is there formed by the want of a sufficient outlet for the waters that accumulate on the surface. In times of excessive rain, all the lakes in consequence of their connection with each other, are under the influence of this excess of water. So that the cities of Auburn, Ithaca, Syracuse and Utica, as well as the smaller towns and villages, and all the inhabitants of this otherwise beautiful and highly favored region, are sufferers to a degree that is almost

incredible. And all this for the want of an outlet for the superabundant waters, which can be readily and economically constructed.

THE THIRD DIVISION.

The third division of the State, or that part lying north of the Mohawk, and east of the Champlain valley, is comprised almost entirely of the Adirondack region. This wild and picturesque mountain elevation is composed of rocks of the Archean or primitive period. It was an island while all the rest of the State was under the sea. Its magnificent and picturesque scenery makes it one of the most inviting spots in the world. Vast stores of mineral wealth and geological wonders abound on every side. The beauty and grandeur of the mountains, lakes and forests, have given it the name of the American Switzerland. Volumes could easily be written in the detailed description of this section. It embraces twelve of the largest counties, and occupies one-third of the area of the entire State. Although a large portion of it is totally unfit for cultivation, yet it is a region of great value. Its stores of iron are enormous. In one spot a large river has poured its torrents for ages over a dam of native iron.

What is known as the Adirondack Mountains,consists of several distinct and nearly parallel ranges, although the spans which are thrown off from the different ridges, interlock each other to such an extent as to give the whole the appearance of a confused and irregular upheavel. The highest summits are attained in the county of Essex, which lies in the eastern part, bordering on Lake Champlain, the wildest portion of this wild region. Lofty peaks, immense mountain masses, broken crags and high precipices, deep gorges and narrow ravines, characterize the entire landscape. The several ranges have received so many different local names that it is difficult to describe them. Dix's Peak, the highest point of which is called the Bouquet Range, is 5,200 feet above tide, Mount Marcy, the highest point in the Clinton range, is 5,467 feet above tide, and the point of greatest elevation.

Mounts McMartin, McIntyre and San-da-no-na, belonging to the same range, are all upwards of 5,000 feet high ; Mount Seward of the Au Salle range, is 5,100 feet above tide. In the valleys between the mountain ranges, are several remarkable chains of lakes, generally long and narrow and bordered by the steep mountain sides. Indian Lake, Lake Pleasant, Schrone Lake, St Regis

Lake and others to the number of several hundred, form most interesting features in the landscape. The centre of the region forms an irregular mountain plateau, filled with innumerable lakes and swamps, from which many of the rivers take their rise. Of late years the lakes and forest of the Adirondacks have become a popular resort for tourists and pleasure seekers, so that much that was previously unknown is becoming familiar ; a railway penetrates to the heart of the iron district, and numerous summer hotels have been erected in different sections.

The chief value of this area to the people of the State consists in the vast natural reservoirs of water which the large and numerous lakes of this region constitute. The necessity for storing and husbanding the water supply of the Adirondacks as a means for increasing the volume of the Hudson river in times of drouth, have become so apparent, that the State has taken active steps to carry out the plans requisite to secure this object. The destruction of the forest along the watershed of that river, has naturally injured its navigation, and the remedy proposed for this evil cannot be too soon or too fully accomplished.

It is impossible in a brief paper to give anything more than a mere outline of the remarkable resources of the State. To the early recognition of their importance and value is due the preeminent position it now occupies.

INTERNAL IMPROVEMENTS.

In the last century, at the close of the war of the revolution, General Washington's anxious solicitude for the welfare of the country led him to a thoughtful consideration of the means by which its newly formed bonds could be more firmly secured. He saw the necessity of uniting the east and west by artificial means of communication and by the improvement of the natural channels. To this end he made a personal and careful examination of the topography of the State of New York. Having been an engineer, he was competent to understand the relations which topography bore to transportation. And, in a letter to the Marquis of Chastellux, written at the time, he says : "I have lately made a tour through the Lakes, George and Champlain, as far as Crown Point—then returning to Schenectady, I proceeded up the Mohawk river to Fort Schuyler, crossed over to Wood Creek, which empties into the Oneida Lake, and affords the water connection with Ontario. I then traversed the country to the eastern banks of the Susquehanna, and viewed the Lake

Otsego and the portage between that Lake and the Mohawk river at Canajoharie. Prompted by these actual observations I could not help taking a more contemplative and extensive view of the vast inland navigation of the United States, and could not but be struck with the immense diffusion and importance of it, and with the goodness of that Providence who has dealt His favors to us with so profuse a hand. Would to God we may have wisdom enough to improve them."

The natural advantages thus graphically outlined by General Washington, became a subject of careful investigation under the authority of the State, resulting in the successful execution of those plans of internal improvement, which are at once the pride and glory of the State. These public works have, in their ultimate results, exceeded the most sanguine anticipations of those statesmen, to whose wisdom and foresight their conception is due, and to them, the City of New York is chiefly indebted for its pre-eminence as a commercial City. The Erie Canal is a monument of skill and enterprise, of which the citizens of the State may be justly proud. Its construction was authorized in 1817, and it was completed in 1825, at a cost of $7,143,789.86. Its completion was an era not only in the history of the State, but also an era in the history of the country, for by it, a commercial highway was opened to the Great West, along which has moved the silent but resistless tide of immigration, which has spread itself through the valley of the Mississippi, creating States, erecting cities, and developing the wonderful resources of a vast country, which but yesterday was a wilderness in the undisputed possession of savages and wild beasts. Every five years adds more than a million recruits to the great industrial armies, which, while creating homes for themselves, return here the product of their labor, and thus pay constant tribute to the commercial emporium. Thus the wonderful growth of the City of New York has become the exponent of the rise and progress of the Republic, while its prosperity dates from the completion of the Erie Canal. There are many yet living who heard the exulting shouts that went up from the Atlantic to the Lakes, when on the 26th day of October, 1825, the signal guns, placed at intervals for five hundred and thirteen miles from Buffalo to New York, announced to listening thousands, that the first boat from Lake Erie, had entered the western canal, to be conveyed to the ocean ; and who saw also that triumphal procession as it moved through the streets of the city,

in which all the trades and industries vied with each other in testifying in the most appropriate manner their joy at the completion of a work, to them the dawn of a new prosperity.

It was a coronation day! for Industry was that day crowned King in the Metropolis of free America. Not Westminster, nor Rheims, nor pagan Rome, ever witnessed so grand a scene. There were no gilded Chariots, nor purple robes, but simply a long line of artisans working at their trades, exhibiting their joy by asserting in their pride of manhood the dignity of labor. None who were present can ever forget the simple grandeur of the occasion. Just half a century has passed since that day of exultation, and the solemn questions have been asked of the citizens of the State and city—Have we been true to the high trust which was that day imposed upon us? Has the gift that day bequeathed to posterity been kept untarnished, to be handed down in its purity to future generations? If official corruption and private greed have impaired the value of this great public boon and blessing, let us see to it, that such a stain be thoroughly erased from the otherwise fair escutcheon of our State.

Besides the Erie Canal there are twelve so called Lateral Canals, some of which were constructed to supply the main Canal with water. The total cost of all the canals was $64,710,836.94. Most of the lateral canals were built to open up the forest lands of the State, and as the forests have been in a great measure removed these canals have ceased to be a source of revenue, on the contrary, are a tax upon the State. It is proposed to dispose of them, or discontinue them as State works, and to concentrate the resources and energies of the government upon the maintenance and improvement of the Main Line. This is a measure of such clear and just policy that there should be no delay or hesitation in adopting it. For so long as the revenues of the trunk line are diverted to the useless maintenance of the lateral lines, so long will the commerce of the State be taxed by high rates of transportation. The effects upon the grain trade are too apparent to need discussion, and the permanent diversion of this trade to other channels will be the inevitable consequence of a persistence in the present course.

Time will not permit me to dwell further upon the interesting subject of the resources of the State of New York. This brief review is a mere indication of what they are.

I am sure, however, that no citizen can contemplate its wonder-

ful advantages and its great prosperity without a feeling of deep pride in the Present—a profound respect and veneration for those who guided its councils in the Past—and a strong hope and fervent faith in the Future.

At the close of the address, which commanded the close attention of the large audience to the end, the Rev. William Adams, D.D., moved that the thanks of the Society be tendered to General Viele, and that a copy of the paper be requested for publication. Dr. Adams stated that the subject was one of great interest to every citizen, and that he had felt deeply impressed by the exhibit which had been presented of the resources of the State. And referring to the suggestion which had been made by a member of the Society, that the Governments of Europe were more liberal to science than the United States, he expressed the belief, that through the graduates of the Military Academy at West Point, of which the speaker of the evening was one, the United States had conferred more benefit on the cause of science than any appropriation of money could accomplish.