

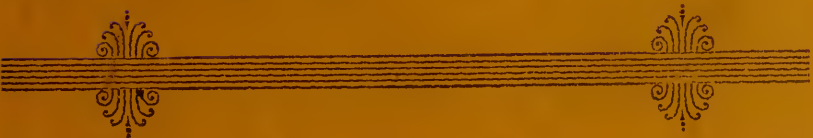


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A GEOGRAPHY
OF
NEW YORK STATE
PHYSICAL AND DESCRIPTIVE

BY
JACQUES W. REDWAY

AUTHOR OF A SERIES OF GEOGRAPHIES, PHYSICAL AND DESCRIPTIVE, "A TEACHER'S
MANUAL OF GEOGRAPHY," "A MANUAL OF SAND- AND CLAY-MODELLING, AND
MAP-DRAWING," "STUDIES IN PHYSICAL GEOGRAPHY," "A GEOGRAPHY
OF PENNSYLVANIA," "THE PHYSICAL GEOGRAPHY OF THE
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FOREWORDS.

BEYOND a division of the subject into topics, I have not attempted to present any improved methods of teaching it. I might have exploited some of my own pedagogical fads, but from my experience with the teachers of the state, I take it they have enough good judgment to properly use this manual, without any worry on my part as to the orthodoxy of the methods employed. It has been my chief endeavor to gather and present geographical information, and the only suggestion I make is, that, so far as possible, the fact and the reason therefor shall go hand-in-hand.

I know of no other region whose physiography is so interesting as that embraced in New York and the New England States, and I have therefore dwelt much on its physical geography, past and present. Inasmuch as the state owes its commercial supremacy mainly to certain of these physiographic features, I think it well to impress their importance upon the attention of the student.

J. W. R.

NEW YORK, *November 1*, 1890.

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PART I.—PHYSICAL.

I. INTRODUCTORY.

THE surface of the state is diversified by hills and dales, mountains and valleys, lakes, rivers, heaths, and forests. From Montauk Point to Niagara Falls—from Rouse's Point to the Pennsylvania Triangle—there are scarcely two successive miles in which the scenery is not an ever-shifting panorama. As time goes, it was only a few generations since the state was a forest-covered wilderness. Yet, during past ages, it has been more than once covered by the sea, and it has been lifted above the sea a thousand feet or more higher than it is to-day; it has been covered many hundred feet deep under a shroud of ice and snow, and it has been swept over by the waters of lakes and rivers of enormous size. Who shall tell when the benignant winds that now bear the refreshing rains shall be turned hence, and the fertile hills and valleys, now flushed with flowers, shall become a sere, parched desert?

In the following pages we shall learn how the forces of nature have operated to make the surface of the state what it now is,—how it has been wrinkled and cockled by gradual contraction,—how the lake-basins have been scoured out,—the mountain-folds worn off,—and the valleys filled with

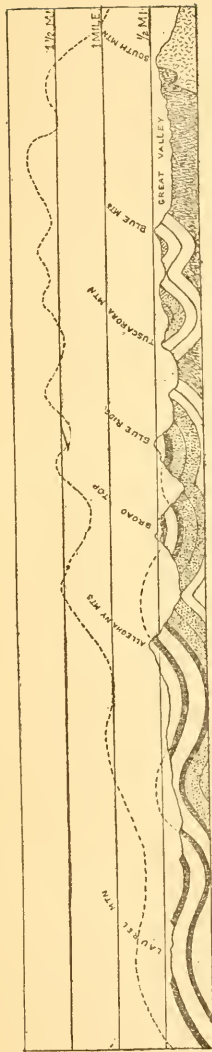
nutritious soil. We may find why New York is the first state in agriculture, in manufacture, in commerce, and in prosperity. All these things are governed by physical laws, and until we know something about their operation, we cannot intelligently study the geography of our state.

2. MOUNTAINS.

SOMETIMES one may notice an apple that has become wrinkled and shrivelled. When it was first picked from the tree, it was large and plump, and the skin fitted tightly about the fruit. In the course of time much of the juice disappeared, and the spongy pulp contracted in size. But the skin of the apple, in trying to fit itself about a smaller fruit, could do so only by wrinkling and cockling. It is the same way with the hand of an old man. Some of the fatty tissue has been absorbed, and the skin, in trying to fit itself around a somewhat smaller hand, must therefore be drawn into wrinkles and folds.

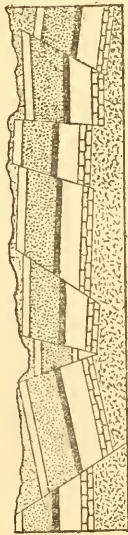
Mountains are earth-wrinkles. Because the hot interior of the earth shrinks in bulk as it parts with its heat, the outer layers of rock, fitting themselves upon a shrinking interior, are wrinkled in much the same manner as in the case of the apple. In some instances, as in the Uinta Mountains, the range is a single fold; in others, like the Jura and the Appalachian mountains, there are several parallel folds; in other examples, like the Alps, there are many folds extending in almost every direction; and in still others, like the Adirondacks, they are crumpled into a complex, knotted cluster.

A single fold, or wrinkle, constitutes the mountain-range,



The upper cut represents a section across the Appalachian Mountains in Pennsylvania. In the eastern part the folds are so worn that in several places the stratified rock has wholly disappeared.

and granite or other igneous rock is freely exposed at the surface. In the western part the folding of the strata has been much gentler, and



the folds themselves are not nearly so much worn. In the lower section there has been no bending of strata whatever; on the contrary, they have been broken and wedged together by the same kind of force which, in other places merely folded them. Instances of this character are not unknown in the Appalachian Mountains; they are very common in the Rocky Mountain region.

and all the ranges together form the mountain-system. The highest part of a range is called its **crest**, and any part of the crest noticeably higher than the rest is a **peak**. We must remember, then, that a peak is not a cone-shaped mountain rising from a plain, nor a range, a number of peaks in line. We must also bear in mind that the range rarely extends the whole length of the system; on the contrary, a range may extend a hundred miles or more, and then disappear, another rising to the right or to the left, or perhaps in line, takes its place.

But we must not consider the range an unbroken fold; on the contrary, all that remains of any range, chain, or system is but a very small part of its original mass, for the erosive forces of nature—the various forms of water—are constantly at work levelling the summits. If the foldings of the Appalachian Mountains could have been preserved unworn, their crests would now be higher than the highest summits of the Himalayas, and South Mountain, a low, insignificant ridge, which, under various names, extends from Virginia to Canada, would be higher than the loftiest peaks of the Rocky Mountains. But ever since the crests of these ranges were lifted out of the sea, the waters have been sculpturing their slopes, carving deep ravines in their sides, and scattering the products of disintegration over the valleys below, or else carrying them in the flood of turbulent streams to the sea.

Sometimes a stratum, bent and broken, will be worn so that its edges will extend longitudinally along the range. In many instances, half a dozen or more strata will thus protrude, forming a series of parallel ridges. When these up-

turned edges are cleared of the material that collects about them, they constitute the **ridges** of a range. Some of the so-called ranges of Pennsylvania are only ridges, and, in a manner, the same is true of certain of the ranges of the Adirondack, the Catskill, and the Taghanic mountains.

Although so much of the mountain-mass has been worn away by the action of water, it is hardly safe to say that the ranges of the Appalachian System were ever very much higher than they are at the present time. Because the earth parts with its heat very slowly, it is evident that the folding of the strata into mountain-ranges must have taken place very slowly, also. Moreover, any sudden movement of the strata of rock would break, rather than bend them; while, if the strain were very gentle, even the most brittle rocks would be bent after long and continued pressure. A sudden blow will break a piece of ice, but by gentle and continuous effort a slab of ice may be doubled up as completely as though it were soft putty. Sometimes, however, the strain becomes a little too great, and one or more strata will be ruptured and broken. Whenever this occurs, there is a quick, sharp trembling, that is usually called an earthquake. Perhaps,—and it is almost always the case,—the strata on one side of the break will settle down several feet lower than on the other side. Instances of this kind are very frequent in the Appalachian Mountains. They may have occurred many ages ago, but wherever such a break is observed, one may be sure there was an earthquake at that time.

In the water-gaps of Susquehanna, Delaware, Green, and Columbia rivers one may also find evidence of the slow up-

lift of mountains. All these rivers traverse ranges of mountains, having cut channels directly through their folds. Now one could not suppose for a moment that any one of these rivers flowed against the range and gradually sapped and tunnelled its way through it. On the contrary, the range would have turned the river to the right or the left. But, in some cases, the river is older than the range, and it flowed in the same channel it now holds long before the range existed; and when the uplift of the latter began, it progressed so slowly that the river cut its channel downward just as rapidly as the range was thrust upward,—in just the same manner, in fact, as a log is moved against the saw. In other instances, the head-waters of the river cut its channel backwards, little by little, until it had severed the range, or ridge, quite in twain. It is possible that Susquehanna River crossed the Appalachian Mountains in this way.

3. WATERS OF THE ATMOSPHERE.

OF the various substances, or elements, which go to make up the atmosphere, all except the vapor of water, remain about the same, so far as the proportion in which they occur is concerned. That is, in 1000 parts of atmosphere there are always about 790 of nitrogen, 200 of oxygen, and 3 or 4 of carbon dioxide (or carbonic acid gas). The amount of water-vapor is constantly changing,—sometimes more, sometimes less. When it is very warm, there may be as many as 25 grains of vapor mixed with every cubic foot of the atmosphere, but if it is freezing weather, there will be less than 2 grains.

In the following table we may see at a glance just how much vapor may be present in every cubic foot :

Temp.	Wt. of vapor in grains.	Temp.	Wt. of vapor in grains.	Temp.	Wt. of vapor in grains.
0°	.6	60°	5.8	96°	17.7
10°	.9	65°	6.8	97°	18.1
20°	1.3	70°	8.0	98°	18.6
32°	2.2	75°	9.4	99°	19.3
40°	2.9	80°	11.0	100°	19.8
45°	3.3	85°	12.8	102°	21.0
50°	4.1	90°	14.9	103°	21.6
55°	4.9	95°	17.3	105°	22.8

Sometimes we say that all the vapor is held by the air. This, however, is not quite correct. The vapor would exist above the surface of the land and the water whether there were any air or not. If the weather were warm, there would be a great deal of water-vapor present ; and, if it were cool, there would be much less, for the vapor has nothing to do with the other constituents of the atmosphere ; the amount in the air depends on temperature alone.

Now, let us suppose, during a very warm day when everything seems moist and sticky, that a cold, chilling wind sets in from the north. Before the cold wind began to blow there might have been, if the temperature were 95°, nearly 17.3 grains of vapor in every cubic foot of air—there might have been less, but there could not have been more. The wind quickly lowers the temperature to 70°. Let us see what must take place. By looking at the table we find that,

when the temperature is 70° , there cannot be more than 8 grains of vapor in a cubic foot of air. Therefore, all in excess of this will be changed to water, and appear in the form of cloud, mist, and rain.

This is just what occurs in every rain storm. All through the day the sun's rays, beating hot upon the surface of the ocean, change some of the water to invisible vapor, and great volumes of this warm vapor flow inland along with the wind. When the vapor reaches land, it is chilled by the high mountain-tops, or by cold land-winds, and the greater part again changes back to the form of water, falling on the land in the form of rain, or snow.

When all the moisture that can exist in the air at a particular temperature is present, the air is said to be **saturated**, or at the **dew-point**. Cool the moisture-laden atmosphere ever so little, and the vapor will be condensed, or changed to water; warm the atmosphere above the dew-point, and the water immediately begins to evaporate.

Usually, dew forms early in the evening, about the time of sunset. As soon as the sun disappears, the grass and the leaves begin to chill at once. They part with their heat much more quickly than does the air, and the moment the air next them cools below the point of saturation, the dew begins to form in minute silvery drops. If the temperature falls below 32° , then the droplets freeze, and become **frost**.

Sometimes, however, dew will form one night, and not on another equally cold. Possibly there may be so little moisture in the air, that even the lowest temperature of the night is not quite to the point of saturation. Or possibly, there

may be a brisk wind all through the night, and then no dew will form because none of the moisture is left long enough in contact with the earth to be chilled to the dew-point.

A slight condensation of moisture taking place high in the air forms clouds. If the condensation continues until the moisture in the lower part of the cloud gathers into drops, then a **shower** of rain falls on the earth. In many instances, however, the condensation does not continue to the point where rain begins to fall, and only clouds appear in the air. They may be the light, fleecy **cirrus**, or cat-tail clouds, which are so high that they are icy—a sort of frost, five or ten miles in the air; they may take the form of the great heaps we call **cumulus**, or summer clouds; or they may settle about the horizon in the long, sombre bands that form the **stratus** cloud.

They are all composed of condensed moisture, however,—a sort of dew forming on the minute specs of matter floating in mid-air. Increase the temperature of the air and the cloud disappears, because the moisture evaporates; lower the temperature, and it increases in size until the moisture collects in drops and rain begins to fall.

A storm, however, is something more than a mere shower of rain. The latter is of short duration, and affects a locality of small area. The former not only covers a large area, but it may sweep along a path a thousand miles broad and eight or ten thousand miles long. The storm consists mainly of an uprising column of air, called an **area of low barometer**, and toward this uprising column, the wind is blowing spirally from all directions. The area of low barometer,

or uprising column, is called the **storm-centre**, and it travels usually from some point in the south-west to one in the north-east quadrant.

In the United States, east of the Rocky Mountains, there are two general tracks, one or the other of which most of the storms follow. These are the Great Lakes and St. Lawrence River, and the Atlantic Coast-plain. In many instances, however, the storm-centre may be several hundred miles, or more, to one side or the other of these lines. A storm of the former class begins, usually, somewhere near the base of the Rocky Mountains. It gathers strength as it advances, and not infrequently continues its course until it has crossed the entire breadth of the Atlantic.

A storm of the second class originates in the Caribbean Sea, or in the Gulf of Mexico, and advances in a path nearly parallel to the coast. Sometimes only the edge of the storm touches the land, but many times the storm-centre will sweep the entire Atlantic Plain from Florida to Nova Scotia. Not infrequently, two storms, one from the Gulf, the other from the Plains region, will meet at some point east of the Appalachian Mountains, and join their forces. The famous blizzard of March, 1887, was an instance of this kind.

A storm-centre may travel from twenty to fifty miles per hour. As the winds blow toward the uprising column, they acquire a rotatory motion, which in ordinary storms is gentle, but in cyclones of the sea is very violent. Most of the rain falls in front of the storm-centre—only a few “clearing showers” occur after the centre has passed a given point. A moment’s thought will show that at any place where the

storm-centre passes, a storm of the first class will be preceded by an easterly, and will clear with a westerly wind. One of the second class will be preceded by a wind having a general southerly direction, and will clear with one from the opposite quarter.

During winter, a storm is sometimes followed by a "cold-wave." Let us see how this may occur. A storm-centre in winter traverses the middle of Illinois, Indiana, Ohio, and the southern part of Pennsylvania. Everywhere north of the track the wind blows fiercely from the north, and in the course of forty-eight hours an enormous mass of cold air is pushed down from the icy north. This constitutes the **cold-wave**, and its intensity and area will vary according to the size and speed of the storm.

Knowing the laws of storms, it is not so very difficult to predict them; and for this, among other purposes, the United States Weather Bureau has been established. The object of the Bureau is practically to protect navigation, commerce, and agriculture. This it does by furnishing information concerning approaching storms, dangerous coast-winds, threatened floods, cold-waves, probable frosts, etc. Stationed in various parts of the United States are upwards of 400 observers, who, twice a day, at the same actual time,—not clock time,—report to the Bureau the temperature, barometric pressure, relative humidity, and direction of the air, each at the locality of his station. These results are entered on a map, and from the information obtained thereby the predictions are made.

General storms are not difficult of prediction, for, when

one forms, its direction is known beforehand, and the rate at which it moves can be soon ascertained. It is only when such a storm abruptly changes its direction, or velocity, that the predictions fail. Local showers, thunder-storms, etc., are more difficult to foretell, because the conditions under which they are formed are liable to sudden change, and are often of local nature. On the whole, about eighty-five per cent. of the predictions are at present fulfilled. With an increase in the number of observers, a maximum of ninety to ninety-five per cent. may hereafter be verified.

The flag-signals now ordinarily displayed require four flags. A blue flag denotes rain ; a white flag, clear weather. A triangular blue flag above the weather-flag signifies warmer ; below the weather-flag, colder weather ; its absence, stationary temperature. A white flag, with a black square, denotes the approach of a cold-wave, or a decrease of temperature amounting to fifteen degrees, or more, **which shall bring the temperature below 45°.**

4. GLACIERS.

OF the snow that falls on the steep slopes of high mountains, a part evaporates, some melts, and, collecting into gullies, flows off. Much, however, tumbles down the steep sides in the form of avalanches, or is blown by the fierce winds into the ravines that score the mountain-side. That it would entirely fill the ravine until the latter is buried out of sight, is a conclusion one might naturally reach,—but it does not. Why it does not we may easily find the reason.

If we examine the mass of snow and ice in the ravine, we

shall find that it is moving down the slope. Its motion is very slow, it is true.—hardly more than two or three feet a day, but its flow is none the less certain. In the upper part of the ravine the snow is as light and fleecy as when it fell from the clouds. A little farther down, its character is changed, and instead of the beautiful star-shaped crystals, we find small, rounded grains of ice, the *névé* of the glacier. Still farther down the *névé* is pressed into a dirty-white ice, and yet beyond, still the minute air-spaces are squeezed out, and the white ice becomes a deep blue in color.

And now we shall notice that the surface of the glacier, or river of ice, is seamed with cracks, or **crevasses**. These are widest and most numerous in the middle of the glacier. They form because, at the surface, the ice in the central part of the glacier moves more rapidly than at the sides, or at the lower part. Streams of muddy water are flowing at the bottom of the crevasses, and, little by little, are melting the ice. Near the lower end of the glacier the crevasses have become very irregular, or have almost disappeared. In their place, the surface of the ice is a series of hummocks, and the streams of water have become torrents. By and by, after the glacier has pushed its way down beyond the snow-line, perhaps into the region of cultivated fields, the last vestige of ice melts, and the end of the glacier becomes the source of a river.

All along the ravine fragments of rock have been tumbling down upon the surface of the glacier. Some of them fall into crevasses and make their way to the bottom, but most of them are pushed against the sides of the ravine, where, in the course of time, they form long walls. These

walls are called **moraines**, and if at the side of the glacier, they are **lateral moraines**. In some instances, when two glaciers join and flow in the same valley, the two lateral moraines are brought together and form a **medial moraine**. The central moraine, however, does not long remain an unbroken wall. Most of the rocks fall into crevasses, a few are pushed to the side of the stream, and the few remaining ones are borne upon the surface of the ice.

The latter often become objects of curiosity, as well as of interest. As the warm rays of the sun beat upon the ice, they quickly melt it away from all sides of the boulder, so that by and by the latter, perched two or three feet high, rides on a column of ice that is constantly growing more and more slender. Many a traveller among the glaciers of the Alps has seen boulders, three or four feet in diameter, supported each by a shaft of ice not more than a foot thick. Sooner or later, however, the boulder falls from its perch, and is quickly carried to the bottom. At the lower end, where the glacier disappears by the melting of the ice, one will always find large piles of these boulders. During the summer season, when the ice melts more rapidly, the end of the glacier retreats up the valley, leaving thousands of these boulders scattered along its bed. But with the coming of winter, the ice again advances, and, pushing the boulders ahead of it, piles them up in a thick, high wall. This constitutes the **terminal moraine**.

The boulders found in the moraines of glaciers differ considerably from ordinary stream-gravel. The latter are smooth and evenly rounded; the former are commonly more or less

angular. Frequently it happens that a boulder will be quite as rough on all but one side as when it first fell upon the glacier. The one side that is worn, however, bears the markings that tell the story of its origin. It is very smooth, often polished, and is scored with parallel scratches. These are so characteristic and sharply cut that, once noticed, they will not fail to impress their character on the observer.

The finding of these glacier-marked stones in various localities of the northern parts of Europe and North America led to a search for other marks of glaciation, with the result of finding abundant evidences. Nearly every part of the British Isles and the Scandinavian Peninsula is covered with the peculiar drift, or till, that is formed by glaciers. Not only the boulders, but the surface of the country rock as well, bears evidence that the whole area was once ploughed over by a flood of ice. If we examine a good map of Norway and the British Isles, we cannot but notice the frayed rock-bound coast. The indentations are nearly parallel, and all of them point to the south-west. They look just as though some giant hand had scoured them over until the entire coast was nothing but a fringe of ragged rock. Thus, by studying the character of surface-erosion in regions where glaciers are now at work, one may learn to point out areas of country which were scoured and rubbed down by glaciers of a former period. A study of the fjords of Alaska, Norway, and Chili, which are now being frayed and shredded by glaciers, will show us that they differ in no way from those of the Maine coast.

In the same manner, the long, narrow lake-beds of Switzer-

land, walled up with drift or scoured out with an almost polished surface, are identical in general features with those of New York and New England. All through these states, extending even into Pennsylvania, we may find the markings of the glaciers of a former period, and they constitute the most impressive of the various surface features. Not only the till and planed boulders, but the long walls of rock that formed the moraines of these glaciers, are observed. One of these stretches across the north east corner of Pennsylvania, and another forms a ridge across New Jersey. Long Island itself is nothing but an old moraine pushed into its present place during the glacial epoch.

But the glaciers that were so active in North America and Europe during the long, icy winter were not the narrow streams of ice such as one now sees in the Alps, on the flanks of Shasta and Tacoma, or in the fjords of the Alaskan coast. On the contrary, they consisted of an immense sheet of ice that, little by little, crept down from the polar regions until it reached into the central part of North America, and covered it to a depth of hundreds of feet. It was during this period that the northern ranges of the Appalachian Mountain-system were worn down, in places, almost level with the valleys, and the multitude of lake-basins were dug out.

When again the climate began to grow milder and the glacial sheet of ice began to disappear under the growing warmth, the rivers were swollen many times their present volume, and the terraces that mark the upper levels of the river-valleys were formed. At last the ice disappeared, and the Great Lakes, drained of their floods, had shrunk to half

their former size, then the rivers dwindled to their present volume, and the face of the country assumed much the aspect it bears to-day.

5. RIVERS.

OF the water poured upon the land in refreshing showers, a part sinks into the earth to again gush forth from hidden recesses, in the form of springs; some is licked up by the dry air, to be carried elsewhere; but a large part flows back to the sea, forming brooks, torrents, lakes, and rivers.

The water that is dropped from a cloud, or is let loose from a winter's drift of snow, forms little rills which trickle in furrows down the slope. The rills gather into rivulets, and the rivulets collect into brooks, which roll down the steep inclines through pebbled gullies, or tumble over cliffs in silver-streaked cascades. Still farther down, the brooks unite into mountain-torrents, and the latter in their tumultuous passage carve deep ravines into the hardest rock, tossing immense boulders aside, or rolling them down the steep beds, as if they were straws blown by the wind.

As they near the foot-hills, the torrents emerge from echo-resounding cañons, and join to form a still more formidable stream. Thenceforth the stream becomes a river, and its conduct is altogether different. As it reaches the plain, it flows with a much slower current, and drops all the coarser sediment its waters contained. No longer having the power to toss aside the larger obstacles, it flows around them. As its current is checked, little by little, on account of the decreasing slope of its flood-plain, the water drops more and

more of its sediment, and because the current cannot carry it, the river must build its bed and banks higher than the surrounding land, and spread its waters out into long, sinuous loops, such as one sees in the Lower Mississippi.

By and by, however, there is a period of unusually high water; the volume of the stream is swollen, and because it is swollen its velocity is increased. It no longer deposits sediment, but is able to pick up and carry it. So, at once the water goes to work, and as the banks are the only places from which it can take the sediment, without further ado, it begins to cut these away. In a little while, there is a commotion of waters. The river has, perhaps, cut the narrow neck of a long loop, or may be it has found a new channel on lower ground.

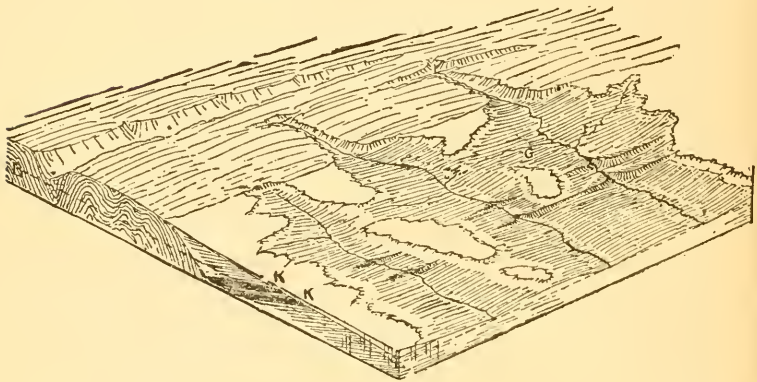
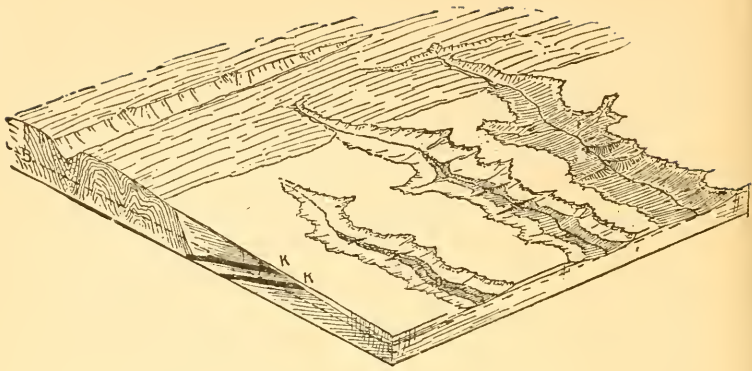
When the river reaches the sea, its waters are still laden with silt, and not until then does it drop the last of its burden. At the sea, not only is its current wholly checked, but twice a day its flood is pushed back a hundred miles, or more, by the tide. And here it is that the river shows its most wonderful work in continent-building. The Mississippi has built for itself banks between which it flows a distance of more than fifty miles into the Gulf of Mexico. With each ebbing and flowing of the tide a little more substance is added, and it is only a matter of years before it will have pushed them across the Gulf, leaving a salt lake between Mexico and Yucatan, and joining Florida to Cuba.

But in many instances rivers lengthen their courses not only at their mouths, but at their sources as well. A stream like the Alleghany, or the Susquehanna, may have its sources

on a slope, the soil of which is easily worn away by running water. With each succeeding rain, the rills cut their furrows deeper, and the latter, little by little, extend farther up the slope. In time, the gully will reach to the top of the divide, at some point where the latter forms a slight depression. But the stream does not stop here: it still continues its work of corrasion until it has traversed the ridge, and perhaps has tapped and diverted the head-waters of a stream flowing in an opposite direction.

A remarkable feature of many of the rivers of the North Atlantic States, is the succession of terraces into which their valleys have been sculptured. It is now thought that in former geological times, these rivers were streams of far greater volume than at the present time, and that the flood-plain of each occupied the whole breadth of the valley at the upper level of the terrace. When, in subsequent time, the river shrank in volume, owing to a diminution in the supply of water, the river was no longer able to spread over its old plain in time of flood, but could cover only a narrow strip in the middle of it. Moreover, it could spend its corrasive force on this strip only, and at this place the stream kept right on cutting into it deeper and deeper. By and by, it had carved a new channel in the old flood-plain, and all that was left of the latter were the terraces on each side of the valley.

In many instances, a stream of water descends abruptly from a higher to a lower level. Sometimes it passes to the lower level in a succession of dalles, sometimes in swift rapids, and sometimes it plunges over the vertical escarpment of a cliff in a magnificent cataract.



Two Stages in the History of a River.

In the upper cut the stream has just begun to sculpture the Quaternary plain; in the lower, it has removed the larger part, exposing the dykes at K K. thereby forming cascades and rapids.

In the rivers of New York one may readily observe in the two terraces, or ridges, that traverse the state a reason for the existence of rapids, but it is not quite so easy to discover the reason why there should be dalles in some places and cataracts in others. The character of the rock at Niagara Falls will aid us in studying the problem. The upper layer consists of the hard, calcareous rock, known as Niagara limestone. Below this are several strata, mainly of marl and other softer rock, and, at the bottom, a thick layer of Medina sandstone. On this upper stratum, because of its hardness, the water exerts but little corrasive action. On the lower strata, however, the case is different. The water not only has increased its velocity many fold, but it pounds away on the sandstone with an impact almost as powerful as though a multitude of pile-drivers were at work. Moreover, every grain of sand that is loosened becomes an active cutting-tool, and as the current sweeps away the débris, a fresh surface is always presented upon which the water strikes with a never-ceasing activity.

So, in time, a cataract like that of Niagara tends to increase rather than to diminish its height. In addition to this, the falls are slowly but surely receding. Since the falls were first formed (probably at the close of the Glacial epoch) they have receded about three and one-half miles. At present the recession of the Canadian, or Horseshoe Fall, amounts to about 24 feet per year, but in the centre of the channel it is nearly twice as much. At the point where the angle in the ledge is formed the recession since 1875 has been more than two hundred feet, but at the American Fall, since 1842, it has

been very slight.* It is a question of time only until the Canadian Fall shall have receded to a line between Dufferin and the Sister islands. When this shall have taken place the American Fall, which has been all the time decreasing in volume, will have nearly or quite disappeared.

Had the conditions of a hard stratum at the top, and a softer one at the bottom, been reversed, there would now be no cataract, even had there been one at the beginning of the Champlain period. The softer rock would have worn away at the edge until, little by little, the steep escarpment had become an inclined plane, extending to some point below Whirlpool Rapids; and, instead of the sublime cataract, there would now be a succession of rapids like those which mark the passage of St. Lawrence River.

6. LAKES.

LAKES are bodies of water resting in depressions in the land. A lake is the most ephemeral feature of the landscape; the river that flows into it is constantly carrying silt to its basin, thereby filling it, while the stream that emerges from its foot tends constantly to cut the rim lower and lower, and finally to drain it. The depression in which a

* From the end of this (Goat) island it is that these two great falls of water, as also the third, but now mentioned, throw themselves after a surprising manner, down into a dreadful gulph six hundred foot and more in depth. I have already said that the waters which discharge themselves at the cascade to the east fall with lesser force; one moderate, the other violent and strong, which at last make a kind of crotchet or square figure, falling from south to north and from east to west.—*Hennepin*, 1673.

lake rests is called its basin, but not every depression in the earth's crust bears a lake upon its surface. In many such depressions, all the water that falls into the basin evaporates under the hot rays of the sun; in others, the amount of water lodging in the basin is so great that not even the fiercest heat of the sun can dissipate it, and it fills, little by little.

In many instances, especially in regions of abundant rain-fall, the water steadily increases in volume until it flows over the lowest part of the rim. In other regions, chiefly those of limited rain-fall, the basin fills until just as much water is lost by evaporation as is gained by rains and the inflow of streams. Such lakes are said to have no outlets, and in many instances their waters are salt. It must not be assumed, however, that all lakes without outlets are salt; as a matter of fact, the majority of them are not. Salt lakes, it is true, have no outlets, but such lakes are salt only when the streams flowing into them percolate through soil containing much soluble mineral matter. If the lake has an outlet, both the water and the mineral matter will flow out of it, but if there be no overflow, the water is removed by evaporation, while the mineral salts remain. Thus in time the waters of such a lake become salt.

Many lakes are widened parts of river channels. This is especially true of the lakes of New York, New England, and, in fact, of all the group in the northern part of North America. These lakes are remarkable for their shape, being in every instance long, narrow, and deep. In New York, especially, their trend is as regular and as nearly parallel as that of the mountain ranges. The basins of these lakes, too,

are in nearly every instance gouged out of solid rock, and in some instances the edges of the basin have been built up with walls of boulders, almost as regularly laid as though some giant hand had fashioned and set them in place.

It is now thought that these lake-basins were formed by the action of the great ice-sheet which in former geological times covered the northern part of the continent. In all regions covered by this mighty glacial sheet lakes are abundant. In other regions they are rare, and where they occur they are shallow marshes rather than deep lakes.

In other instances, lakes have been formed by the action of rivers which flow through an alluvial soil. A river bearing much sediment in its current will deposit a large part of it if the current be checked ever so little. The river then begins to form the long loops which are so noticeable in the lower Mississippi River. In the course of years, however, the neck of the loop grows narrower and narrower, and, finally, in a time of high water, the river cuts its channel clear across it, and there remains, partly filled with water, a long crescent-shaped lake to mark the old channel. Such lakes are common in the Mississippi Valley, but are scarcely known in the Eastern United States.

Another manner of lake-formation has been described on pages 32 and 33. Lakes of this character are more properly called lagoons. They are closely connected with the wave-formed islands that mark the South Atlantic and Gulf coast of the United States. In New York they are exemplified along the south coast of Long Island.

The lakes of New York have contributed no little to the

prosperity of the state. All the larger ones are natural highways of commerce, free to the many vessels that ply upon them. They are, moreover, the only natural safe-guard standing between the people on the one hand, and rapacious railway corporations on the other. Aside from their value as open highways of commerce, lakes exert a wonderfully beneficent influence on the climate of the state. They modify, in no small degree, the severity of climate, and their shores are the resort of thousands who seek rest from the oppressive heat of summer and the restraints of crowded cities. Still more, they are immense storage reservoirs which, retaining the surplus waters at times of excessive rain, measure them out freely in times of dry weather, preventing, on the one hand, disastrous floods, and on the other, seasons of blighting drought.

7. ISLANDS.

A CASUAL inspection of any good map will show that, so far as their distribution is concerned, there are two well-defined classes of islands—those which are remote from continents, and those that are near to them.

The former are mainly “coral” islands. They are situated, for the greater part, in the broad expanse of the Pacific Ocean, and they are ranged in groups that have a general north-west and south-east trend. Most of the islands have the shape of irregular rings. Such islands are called **atolls**, and each atoll encloses a lake, called a **lagoon**. Nearly all coral islands are low and narrow,—rarely more than twelve or fifteen feet high, and seldom more than half a mile in

width. Some of them, however, are mountainous, but even these are encircled by a fringe of coral. These atolls, it is thought, mark the site of sunken mountain-peaks, each one of which is surmounted by a ring of limestone, deposited by the coral polyp, a form of marine animal that grows in shape and manner much like a tree, or thicket of brush.

Some geographers are of the opinion that atolls were at first reefs encircling volcanic islands, and that, while the island was slowly sinking, the coral polyp built its reef higher and higher. By and by, the island-mountain disappeared, and in its place there remained only the atoll, enclosing a lagoon of shallow water. Other students are of the opinion that because the region is one in which minute animal life is so profuse, the skeletons of their organisms in time have built the submarine plateau to such a height that the coral polyp could implant itself upon the higher summits, and then build to the surface. But to the geographer, the main features about these islands are that they show every evidence of having been formed on the higher surface of a vast plateau in the Pacific Ocean: that the plateau is traversed with nearly parallel ranges of mountains extending north-west and south-east; and that each atoll marks the site of a volcanic peak, the summit of the latter in some instances rising in the centre of the atoll. Besides the atolls of the Pacific, there are many island reefs off the shores of Southern Asia, a long barrier-reef off the east coast of Australia, and a number of island reefs in the Caribbean Sea and off the south coast of Florida.

The islands of greatest importance are those which lie

near the coasts of the continents, and are therefore called continental islands. In their structure and the forms of life found upon them, they do not differ materially from the continent near which they are situated, and as a part of which they are properly included. Usually such islands are long and comparatively narrow, and they are ranged in one or more lines parallel to the coast, or to one of the continental border mountain chains. In all such instances, the chain of islands consists of the higher summits of a partly sea-covered range of mountains.

Another example of island formation may be observed along the South Atlantic and Gulf coasts, and also along the southern shores of Long Island. No one who has examined a good map of these localities can have failed to notice the long and narrow spits that border these shores. They are very low,—seldom more than ten feet above the sea-level. They are rarely more than half a mile in breadth, while, not infrequently, one of them may be fifty miles, or more, in length. These islands are products of the waves and the rivers. The latter are constantly bringing down silt from the piedmont lands, and when the water reaches the sea, it drops its silt directly it comes in contact with salt water. But the action of the waves, instead of permitting the sediment to be carried seaward, pushes it shoreward. So, between the current of the river carrying it in one direction and the waves which force it in another, the sediment is piled up in long, narrow mud-spits.

The moment the island emerges above the surface of the water, the waves and the surf begin to pile sand upon it, and

build it still higher. Then the wind begins its part of the task. Seizing the loose grains of sand which the waves have thrown out of the water, it piles them up in dunes and ridges, making each island a miniature continent. It also brings the light seeds shed from maturing grasses, sedges, and shrubs. These soon grow, and, acting as a protecting cover, fasten the loose soil so firmly that even the winds themselves cannot remove it. The spits of Long Island, however, have been formed by wave-action alone. The southern shore, naturally much indented, has been hemmed in by the spit now named Fire Island. One of the lagoons thus enclosed, Great South Bay, is forty miles long and, in places, seven miles in width.

8. THE ORIGIN OF CERTAIN MINERALS.

Salt.—But little is known concerning the origin of rock-salt. In some instances, it is thought to have been deposited along old shores and sea-margins, and at the bottoms of former lake-beds, but many of the deposits are in positions which would be difficult to account for by any theory of the evaporation of sea-water.

The process now going on in that arm of the Caspian Lake, known as the Karaboghas, furnishes a clew as to the manner in which salt deposits may, at times, be formed. Among the many indentations of this lake, is the large bay mentioned. It is connected with the lake by a narrow strait about 450 feet wide. The strait is not more than six or eight feet deep, and the Karaboghas itself is scarcely more than ten or fifteen feet in depth. A current of three or four miles

an hour is always running into the inlet from the lake, but no current ever sets in an opposite direction. During hot, dry weather, the current is much more rapid, and it is also accelerated by westerly winds. After a series of careful measurements, M. de Baer estimated that 600,000,000 cubic feet of water entered the "black gulf" daily, of which not a drop flowed back into the lake.

Now, this vast amount of water represents the daily evaporation from the Karaboghas, and inasmuch as it contains about two per cent. of salt, 350,000 tons of the latter are daily deposited in this lagoon. No animal can live in its briny waters, and the shores are encased in a girdle of salt. In the course of time, it is evident that the entire lagoon will be filled with salt, and that the winds will cover it over with dust and detritus. Perhaps, in some future geological age, it may be discovered and recorded as a "Salina" epoch, such as that of Central New York.

In the Great Basin, similar instances have occurred. Humboldt and Carson sinks, Winnemucca, Pyramid, and a number of other lakes have passed through the same history. All these lakes have become dry at no greatly remote period in the past. At the bottom of each is a thick layer of salt, covered with a layer of sediment swept into their basins by the winds. And when, in after years, the climate again became more humid, the lake-basins again filled with water, the beginning of another period of salinification.

In at least one other locality, a vast bed of salt is accumulating. The region in question is not a lacustrine basin, but a low, flat portion of the delta of the Indus River, known as

the Runn of Kutch. This region, some 8000 square miles in area, is covered to a shallow depth by sea-water a part of the year, but is dry during the remainder, and already salt is depositing there in abundance.

Iron-ore.—In the manner of its occurrence, iron-ore bears some resemblance to coal. Like the latter, it is generally found in seams or layers, and the layers usually rest in basins. All soils contain more or less of the salts of iron, but the latter is rarely, if ever, found in a metallic state. The red and the reddish-brown colors observed in rocks and soils are nearly always due to the presence of iron, but it is rarely that iron-ore is found in rocks containing a large amount of coloring matter due to the presence of iron ; on the contrary, it is among white sandstones and rocks of light color that beds of iron-ore are most frequent. In nearly every instance, too, the bed of ore rests upon one of clay, slate, or other rock, through which water cannot pass.

In other words, geologists are of the opinion that the salts of iron have been leached, or dissolved, out of the rocks and soils through which it was sparsely but uniformly diffused, and deposited in basins.

The peroxide of iron, the mineral to which the red coloring-matter is due, will not itself dissolve in water, but when it comes in contact with decaying vegetable matter it undergoes chemical decomposition, and a salt of iron is formed which is soluble in water. But the latter, deposited in some basin of impervious rock, by exposure to the atmosphere, and by the action of other agents, is again changed to an oxide of iron, which constitutes the ore commonly known as *hematite*.

Another ore, *limonite*, occurring in New York, differs from the former, mainly in containing a certain amount of water of crystallization. Still another ore, *pyrites*, or fool's gold, occurs in the state. It is a combination of sulphur and iron.

The metal is obtained from the ore by smelting the latter with mineral coal, or with charcoal. The carbon of the coal unites with the oxygen of the ore to form carbon dioxide, setting free the iron as a metal. When the molten metal is drawn from the furnace, it is run into a long furrow of sand, with a great number of short furrows leading from the side. The central furrow is called the "sow," and the side furrows, "pigs," hence the term pig-iron. The latter is subsequently refined by again smelting.

Building Stones.—*Granite* is not a mineral, but a mixture of various minerals. That which forms the usual type is a mixture of mica, felspar, and quartz. If it has an appearance of stratification, or lamination, it is called *gneiss*; if the mica is replaced by hornblende, it forms *syenite*. Most of the granitic rocks of New York, especially in the southeastern part, are gneiss and syenitic gneiss. In some places they gradually change into a gritty schist of mica that contains little or no felspar. Garnets are generally abundant in granitic rocks.

Sandstone, as its name indicates, is composed of sand, the grains of the latter being cemented together by carbonate of lime, or by peroxide of iron. The former includes the white and the gray; the latter, the red and the brown stones.

Petroleum.—**Natural Gas.**—But little is known concerning the origin and formation of mineral oil, but it is

thought to be connected with the accumulations of sea-weed and coralloid limestones that grew and were deposited during the Palæozoic age. There is some evidence that the oil was formed by the decomposition of vegetable or of animal tissue—or possibly of both—at a high temperature in the presence of salt, and under great pressure. Professor S. F. Peckham is of the opinion that the oil of the Pennsylvania, New York, and West Virginia horizons is mainly of vegetable origin, while that of California is an animal formation. In the former group, the oil occurs in sandstone measures. There are three separate strata, separated by intervening beds of shale. The crude petroleum is obtained by driving artesian wells into the oil-bearing strata. Of late years, it has been necessary to pump the oil to the surface, but at the time of the discovery of the oil-fields most of the wells were spouters. After a well has been in operation for some time, the oil begins to flow less freely, owing probably to the fact that the porous sandstone through which the oil passes has become clogged. When this occurs, it is customary to explode a torpedo of dynamite at the bottom, in order to shatter the rock and thereby increase the flow.

Many useful products are derived from crude petroleum. Chief among these is the illuminating oil, kerosene or coal-oil. In distilling this, naphtha and benzine are separated and condensed in special receivers. Among other useful products are vaseline or cosmoline, paraffine, and asphaltum. From other waste materials there are prepared aniline (the base of a number of dyes), antipyrine, phenacetine, and carbolic acid—all useful medicines.

Natural gas is obtained in the same manner as mineral oil. The two are sometimes associated, but oftener they seem to have no connection. The gas has greater heating, but less illuminating power than that made from coal by destructive distillation. In some of the wells, the pressure of the gas was formerly in excess of three hundred pounds per square inch, and the temperature, when it escaped at the surface, several degrees below the freezing-point of water—a degree of cold probably due to the expansion of the gas when the pressure is relieved. It is certain that not only the natural gas, but also the supply of petroleum, is becoming gradually exhausted. Many of the oil-wells have ceased to yield, and in all the gas-wells the pressure is notably decreasing.

PART II.—DESCRIPTIVE.

I. POSITION AND EXTENT.

Suggestions.—To demonstrate the relative size and position of the state is not an easy matter. It is best done by marking off the outlines of the state in their proper place on a school globe, and then cutting a piece of paper to correspond in size. By putting the paper outline on different states and countries, the pupil may acquire a fair idea of the relative size of the state. If no globe is obtainable, sketch the outlines on a map of North America for comparison. It will also be a good plan for the pupil to write the names of a few large cities of the United States and foreign countries on that part of the margin of the map which will show their latitudes as compared with that of New York. Thus Marseilles, France, should be written opposite Niagara Falls, and Madrid, Spain, opposite New York City, etc. It is a good plan to memorize the political and natural divisions that are adjacent to one's own state; but it is not necessary to force every boundary to be exactly either north, south, east, or west. For instance, the Great Lakes and the Province of Ontario are north-west, rather than due north of New York.

Not all of the map-questions propounded in this and the following chapters can be answered either from the map or from the text. Indeed, it is the question that cannot be thus answered that will be likely to prove the most instructive. The true object of the question is, not so much to obtain a correct answer as to provoke a discussion that will inculcate original thought. Never mind an occasional error. The boy who never falls will never become a good wrestler, runner, or ball-player; and the pupil who is too timid to advance an opinion for fear of making an error will never have sufficient

strength of character to succeed in any undertaking he may attempt in after-life. Do not permit anything to be recited verbatim. Commend any answer or statement that shows thought on the part of the pupil. Where differences of opinion arise, or text-books clash, the teacher—or what is still better, the pupil—should write a brief letter to some authority on the subject in question. A letter addressed to the State, or to the United States Geological Survey, in reference to political boundaries or surface features, will always receive attention.

Map Exercises.*—Prove the statement that the northern boundary of New York is midway between the equator and the north pole. Name the states and Canadian provinces that border New York. Is any other state in the Union bordered by a greater number of states? Name the rivers that form boundary lines. Name the lakes and other waters that form boundaries. What boundaries are theoretically parallels? Why are they not actually parallels? Are any boundaries intended to be meridians? Can you explain the reason for the irregular jog in the boundary between New York and Connecticut? How does New York compare in size with Maine?—with the rest of the New England States? What other states on the Atlantic coast are larger? How does it compare in size with France?—with Switzerland?—with Iceland? Name the three largest islands belonging to New York. What strait or kill separates Long Island from Manhattan Island?—Manhattan Island from the mainland?—from New Jersey? What kills separate Staten Island from New Jersey? Give the location of Valcour Island,—Fisher's Island,—Coney Island,—Grand Island. Name another state noted for the number of islands included in its area. Can you explain how the long and narrow islands that border the south shore of Long Island are formed?

1. New York, the Empire State, is an irregular triangle in shape, bearing a fancied resemblance to a lion's head. Its

* Any county map of the state will be serviceable in accompanying these and the following questions. Outline maps of the state may be procured from the publishers of this manual.

northern boundary, lat. 45° , is midway between the equator and the north pole. The extreme southern limit is Ward's Point, on Staten Island, lat. $40^{\circ} 30'$. Montauk Point, lat. $71^{\circ} 51'$, on Long Island, is the eastern extremity. The meridian of $79^{\circ} 46'$ is the western limit.^{1*}

2. The land boundaries aggregate about 540 miles in length. The water boundaries are about 880 miles long, and, Delaware, Poughkeepsie, and a part of Niagara rivers excepted, their whole extent is navigable.

3. The greatest length of the state is about 412 miles; the maximum breadth, 323 miles. The area, including 1550 square miles of water surface along the shores of the Great Lakes, is 49,170 square miles. There are twenty-two states larger and nineteen smaller. It is about one-fifth the size of Texas, and nearly forty times as large as Rhode Island. In size it is about equal to England, and about half as large as Italy.

4. Included within the boundaries of the state are several hundred islands.² The largest of these, Long Island,³ comprises Kings, Queens, and Suffolk counties. Staten Island constitutes the county of Richmond; Grand Island, in Niagara River, is a part of Erie County. A large number of the Thousand Islands in the St. Lawrence River belong to the state. Most of the larger ones, however, belong to the Dominion of Canada, and a few are under the jurisdiction of the United States.

5. Manhattan Island is separated from the mainland by a

* The index figures refer to the notes on p. 91, and the following pages.

narrow kill⁴ which connects Hudson River and Long Island Sound. It forms the most densely populated part of New York City. Hart's, Ward's, Randall's, and Blackwell's islands, in East River, are a part of New York City.

6. All the islands of the Sound, excepting a few off the Connecticut shore, belong to the state. Fisher's Island, the largest of the off-shore islands, also belongs to the state. Coney Island lies at the south-western angle of Long Island, being separated from the latter by a narrow kill.

2. SURFACE FEATURES—MOUNTAINS.

Suggestions.—In studying the topography of the state, by far the best conceptions of its varied surface and physical features can be obtained from a relief-map or topographical model, provided it be a good one. Unfortunately, many relief-maps, because of their gross exaggeration of altitudes, and their failure to portray the character of relief-features, are worse than useless because they are untruthful. There are, however, several excellent topographical maps of the state, and one of these, with the aid of a moulding-board, will be much better than a poor model. In choosing a topographical map, select one as free from heavy lettering, political divisions, railway lines, etc., as possible. Recollect that in such a map topography, and not political features, is the salient point; for the study of political divisions a different map is required. In studying topography, bear in mind that there is an essential difference between a hill and a mountain. Study the range and not the peak as a unit. Bear in mind that the range is essentially a wrinkle, or fold, of the strata composing the earth's crust, and that a peak results from the unequal wearing of the crest of the range. Some of the ranges are more properly called *ridges*; that is, they are not folds, but long dikes that have been formed by the breaking and wearing away of the folds which constitute the ranges. The sectional views in Le Conte's and Dana's geologies will give excellent ideas concerning the character of mountain-ranges and valleys. Do not harbor the

idea that mountain-ranges are necessarily the divides between river-basins. Usually they are not. The passage of such rivers as the Susquehanna, the Delaware, the Columbia, and the Ganges through lofty ranges shows the absurdity of such an idea. It will be well, also, to bear in mind that the mountain-ranges of New York are of comparatively little importance in modifying either the industries or the climate of the state, while such features as the Mohawk and the Hudson valleys, and, more especially, the Mountain Ridge,—the former by opening natural commercial routes, and the latter, distributing an abundance of water-power over the state,—have been factors of the greatest importance in the prosperity of the commonwealth.

Exercises.—What parts of New York are mountainous? What parts are rugged? Is there any great extent of level land? Where is the land most nearly level? Name three mountain-groups in the state. In which direction do the ranges of the Adirondack Mountains extend? What is the general direction of the lakes of this region? How does the Adirondack region compare in productiveness with the belt of country along the 43d parallel? What reasons are there for the difference? What is the direction of the ranges and ridges composing the Highlands? What are the Shawangunk (*shōn' gum*) Mountains called in Pennsylvania? What are the highlands between the east and west branches of the Delaware called? (*Ans.* They are called the Delaware Mountains.) What knot of mountains between the Adirondacks and the Highlands? To what system do all the ranges of New York belong? What are they called in Pennsylvania?—in the New England States? Why are these ranges so much more worn and broken down in New York than in Pennsylvania? What is the highest peak in the state?—in the county in which you live?

What determines the direction in which rivers flow? With a fine-pointed lead pencil, on a map of New York, draw a light line that shall separate the sources of the rivers that flow into the Great Lakes and the St. Lawrence River, from all others. In a similar manner, draw a line that shall separate the streams flowing into the Atlantic, south of Long Island Sound. In the south-western part of the state,

separate in a like way the tributaries to the Alleghany River. Into how many principal drainage-basins do these divides separate the state? Which is the largest? Which is the most important commercially? Which contains the greatest number of rivers? Which has the largest population? In which drainage-basin do you live?

1. Probably no other state in the Union has a more diversified surface than New York.⁵ The eastern part is traversed by several ranges of the Appalachian System. The central part contains a plateau, reaching, in Otsego County, an altitude of 2300 feet. The southern part is high and rugged, and, in the south-east, mountainous. That part of the state sloping toward Lakes Erie and Ontario is less rugged than other portions, but it is by no means level.

2. There are three distinct groups of mountains in the state. The Adirondacks consist of several short ranges having a north-east and south-west trend. They culminate in Tahawas (*tah'wahs*) Peak (Mount Marcy), which has a height of 5334 feet, together with several associated peaks exceeding 5000 feet.

3. The Catskill (or Kaaterskill) Mountains are thought to be a continuation of the ranges which, in Pennsylvania, are named the Alleghany,⁶ Laurel Hill, and Broad Top mountains. They are apparently connected with these folds by the ridges commonly called the Delaware Mountains. The Shawangunk and Helderberg ranges form a part of the Catskill group. The former is a continuation of the Kittatinny and Blue mountains of Pennsylvania. Slide Mountain, the highest of the group, has an altitude of 4205 feet. There are a dozen or more summits exceeding 3500 feet in height.

4. The third group comprises the ranges known as the Highlands. It includes several low ranges, the principal one of which is cut in twain at West Point by the Hudson River. These ranges are continuations of the Taghanic (or Taconic) Mountains, and form a part of the Green Mountain folds.⁷ The crest of the highest range varies from 1200 to 1700 feet above mean tide.

5. As in Pennsylvania, so also in New York, the entire series of ranges has been traversed by water-gaps. The most noteworthy in this state is that through which the Mohawk River now flows, but through which the waters of what is now Lake Ontario were formerly emptied into Hudson River.

6. The Helderberg and Catskill mountains were once connected by a moderately high plateau. This, however, has been so sculptured by running streams that the elevated parts which remain have been improperly called a transverse range of mountains.

7. The average height of the state is probably not far from 1200 feet above the sea-level.⁸ The railways, which are built mainly along the river-valleys, have an average altitude of about 700 feet. Lake Erie is 573, and Lake Ontario 247 feet above the sea-level. There are thirty-five peaks in the state more than 4000 feet in height.

8. A noticeable feature of the topography is the existence of two well-defined terraces, or ridges, parallel to the shores of Lake Ontario. Roughly estimated, each is about 200 feet higher than the one below it. The lower terrace is from three to eight miles from the shore of the lake; the upper one, about thirty miles.⁹

9. Another noteworthy feature is the boulder-strewn surface of the state. The boulders, rounded and smoothed by attrition, were carried to their present resting-places and unloaded, when the ice sheet of the Glacial epoch covered these regions. There are but few parts of the state where such boulders are not conspicuous. They vary in weight from a few pounds to a hundred tons or more. In some instances they are loosely scattered; in others, they are piled in long, irregular walls.

10. There are several well-defined drainage-basins in the state, and though all the surplus drainage reaches the Atlantic, the waters are discharged into the ocean at places widely remote.

11. The northern and north-western half of the state lies on the slope of the St. Lawrence Basin. It is drained by a number of short streams, of which the Genesee, Oswego, and Black rivers are the most important. With one exception, this basin receives the overflow of all the larger lakes of New York.

12. The south-eastern part of the state includes the basins of the Hudson, Delaware, and Susquehanna basins, and the surplus waters are discharged respectively into New York, Delaware, and Chesapeake bays. The latter are tidal estuaries, situated at no great distance apart.

13. The south-western part of the state lies in the basin of the Mississippi and is drained by the head-waters of Alleghany River. This slope embraces scarcely 500 square miles of the state, its territory being confined to Chautauqua, Cattaraugus, and Allegany counties.

3. SURFACE FEATURES—RIVERS.

Suggestions.—It is well to bear in mind that the conduct of rivers flowing in deep channels and over rock bottoms is different from that of streams flowing in a bed, and confined by banks of alluvial soil. A river of the former class flows always in much the same channel, changing it only by gradually deepening it. One of the latter is constantly at work silting up its channel in one place, and cutting a new one in soil that it had already deposited at some previous time. The rivers of New York are mainly of the former type, and hence their channels are subject to but little change. It is well to call attention to the fact that the lakes of the state are, in most instances, widened parts of their respective river-channels. It will not be difficult to show how a river in descending to a lower level, if the upper stratum of rock be hard and the lower one soft, will, in time, create a cascade. If, however, the case be reversed, dalles or rapids will be formed. It is well to enlarge on the idea that navigable rivers are free highways of travel, and that they often contribute more than any one other feature to the prosperity of the people who live along their banks. A railway costs from \$30,000 to \$50,000 per mile; a river costs practically nothing. A river steamer costs but little more than a train of cars, and yet it has a much greater carrying capacity than the average freight train.

Exercises.—Which is the longest river wholly in New York? To what point is it navigable? What is the lower part of the river called? Why was it called North River? (*See Appendix, note 13.*) Name any other navigable rivers in the state. What prevents the navigation of the rivers flowing into Lake Ontario? How do vessels go from Lake Erie to Lake Ontario? Tell what you can of the features of Genesee River. What is East River? How would you go by water from Buffalo to Montreal? How would you return by water? Make a list of the rivers belonging to each drainage-basin; if navigable, give the navigable extent; locate the dalles, or falls, if any; and make a list of the ports and manufacturing towns on each. Study the list carefully, but do not attempt to memorize it. Why

has the St. Lawrence River so large a volume of water? Of what lakes is it the outlet?

1. The rivers of New York are short, but they are usually streams of considerable volume, and each of the larger ones expands into a lake in some part of its course. On account of the lake terraces, most of those belonging to the St. Lawrence basin are characterized by cascades and rapids.

2. The St. Lawrence,¹⁰ which forms a part of the northern boundary, is the outlet of the Great Lakes. It is a wide stream, and its course is studded with islands and interrupted by rapids. Descending vessels sometimes shoot the rapids; ascending vessels avoid them by passing through Rideau Canal.

3. Niagara River, which is practically a part of the St. Lawrence, receives the overflow of Lake Erie. In a course of about forty miles, it falls 226 feet. At Niagara, it plunges, in a divided stream, over a precipice 166 feet high.

4. Hudson River,¹¹ springing from a number of lakes in the Adirondacks, has a total length of about 300 miles. It is navigable to Troy, a distance of 151 miles. Below Albany, it is practically an arm of the sea, its level being only a few inches higher than New York Bay at high tide. At Peekskill, it expands into Tappan Sea, and at New York it widens out into Upper Bay.

5. South of Harlem River,—the kill¹² which separates Manhattan Island from the main-land,—the Hudson is commonly known as North River.¹³ Both sides of the river are lined with wharves, and it probably is traversed by a greater number of large vessels than any other river in the world.

6. East River¹⁴ is the name commonly given to the strait, or kill, connecting New York Upper Bay with Long Island Sound. It is the thoroughfare for vessels plying between New York City and New-England ports.

7. Mohawk River, about 135 miles in length, is the only river of importance in the state whose valley has an easterly and westerly trend. It flows through a region renowned for its fertility. The valley is generally broad, but in places it is contracted to a narrow gorge. At Cohoes and Little Falls, there are rapids and cascades, in all 70 feet high, which afford an abundance of water-power.

8. The valley of the Mohawk is one of the most important commercial thoroughfares in the world. For many years it was the only outlet of trade between New York City and the West, and it is to the topography of this valley, more than any other one feature, that the city owes its commercial supremacy.

9. Genesee River, about 200 miles long, is the most important stream of Western New York. At Portageville, twenty miles of its course lies in a gorge, in places 350 feet deep. Here its rapids and cascades aggregate 500 feet. At Rochester, in three cascades, it again falls more than 200 feet in cascades and rapids.

10. Oswego River is formed by the junction of Seneca and Oneida rivers. It receives the surplus waters of the lakes of the central part of the state, about fifteen in number; it, therefore, discharges a large volume of water.

11. Black and Raquette rivers drain most of the western slope of the Adirondack highlands. The former is navigable

as far as Carthage, and, like other rivers flowing into Lake Ontario, descends to the lower lake-terrace in cascades.

12. Delaware, Susquehanna, and Alleghany rivers, the most important streams of Pennsylvania, have their sources in New York.

4. SURFACE FEATURES—LAKES.

Suggestions.—In studying the physical geography of lakes, it will be well to keep in mind that lakes may be either marshes, whose waters rest in natural, but shallow, depressions, or they may fill basins that have been shaped by the action of glaciers. The former have usually borders that are nearly circular; the latter, in shape, are long, narrow, and deep. The lakes of New York belong to this class. Keep in mind also that, in many instances, the lake is only a widened part of the river. Be careful to study the manner in which the shore-lakes, or lagoons,—such, for instance, as occur along the southern shore of Long Island,—are formed. Find reasons why lakes, especially marsh (or playa) lakes, are the most transitory features of the landscape. Do not allow the absurd notion to obtain that lakes without outlets are necessarily salt. Do not memorize the area and depth of any lake except it be near the place in which you live.

Exercises.—In what direction do the lakes of the Adirondack group extend? Compare this direction with that of the mountain-ranges,—with that of the central group. What lake pours its surplus waters into Chesapeake Bay? What ones are tributary to the Gulf of St. Lawrence? What one is tributary to the Gulf of Mexico? Name the lakes that are navigable. What is the largest lake wholly within the state? Which state has the greater number of lakes, New York or Pennsylvania? Can you give a reason why? Can you name any lake in New York that has no outlet? Is it a fresh or a salt lake? In what part of the state are the lakes most numerous? Can you name the highest lake in the state? (*See par. 4, p. 51.*) What river in New York drains the greatest number of lakes? Why has the

St. Lawrence so great a volume of water? In note 8, Appendix, is a list of all the larger lakes arranged alphabetically. Make a table showing the drainage-basin in which each lies, and name its outlet. Arrange the lakes of the central group according to their altitude.

1. New York is remarkable for the number and the beauty of its lakes. Two of the Great Lakes¹⁵ form a part of its northern boundary, and another large one separates a portion of the state from Vermont. In all it is estimated that there are nearly one thousand lakes and ponds wholly within the state limits. These form two tolerably distinct groups.

2. The Adirondack group¹⁶ consists of a large number of lakes, generally small in size, lying within the valleys of the Adirondack folds. Because of their peculiar situation, they are long and narrow in shape, and their lines of greatest length extend parallel to the trend of the mountain folds.

3. Lake Champlain, the largest of the group, lies mainly in Vermont. At its upper end is Lake George, justly renowned for its beautiful landscapes and clear waters. During the summer season both lakes are part of a busy commercial highway between Montreal and New York City.

4. Saranac (Upper and Lower), Raquette, and Schroon lakes are noted summer resorts. A few of the lakes of this region find an outlet in Hudson River, but most of them discharge their overflow into the St. Lawrence. Moss and Tear-of-Cloud lakes are each more than 4300 feet above the sea.

5. The lakes of the central group¹⁷ are situated mainly on the upper lake terrace. Like those of the Adirondack region, they are long and narrow. A few small lakes at the western

end of the group overflow into the Genesee, but all the larger ones discharge their surplus waters into Oswego River.

6. Chautauqua Lake is the only body of water of considerable size whose final outlet is the Gulf of Mexico, and it probably has a greater altitude than any other navigable lake east of the Rocky Mountains. It is a noted educational summer resort.

7. It is a noticeable feature that nearly all the lakes of New York (and the New England States as well) are widened parts of the river channels that respectively drain them. It is now generally believed that the basins of these lakes were carved into their present shape during the Glacial epoch mainly by the action of ice.

8. All the large lakes of the central group are navigable, and in the summer season they are important commercial thoroughfares. Lake Seneca, the largest, is an open highway throughout the year.

9. Along the shores of Long Island are a few small lakes, or lagoons, that have been formed by the action of waves, which, throwing sand-bars across narrow estuaries, have finally enclosed them. All the lakes formed in this manner are transitory. Some have been entirely filled with sand, and others have been again drained by the same agents that formed them.

5. NATURAL RESOURCES—CLIMATE AND SOIL.

Suggestions.—In the study of climate there is a practical side, the discussion of which will well repay the student for any time devoted to it. Much may be learned from the study of the winds.

Observe closely the direction of the wind that precedes a storm, and also the direction at its clearing. Notice carefully the different kinds of clouds—cirrus or cat-tail, cumulus, stratus, and nimbus. Of these, the first named are the most important. Their appearance usually foretells an approaching storm, even ten or twelve hours before a general clouding of the sky occurs. A fair barometer may be constructed according to the manner prescribed in almost every textbook of physics, and the relation of the barometer to the atmosphere will prove an instructive study. It is an excellent plan to carry on a series of meteorological observations in connection with the school, and to display the same signals that are used by the United States Weather Bureau.

The study of the various kinds of soil occurring in the neighborhood where the pupil lives will be found not only interesting, but practical as well. The various soils, known as clay, loam, gravel, sand, etc., should be studied, not only as to their properties, but concerning their origin as well. It will be an excellent plan to have specimens of the different soils found in the neighborhood on exhibition. They are best kept in large glass jars, but for class examination a few ounces of each specimen may be exhibited in very shallow pasteboard boxes. It will be well to explain the reasons for artificially fertilizing the soil, for "fallowing," and also the part that the common angle- or earth-worm takes in its preparation.

Questions.—What conditions are included in the climate of a country? Can you tell what physical features and conditions modify climate? Which, as a whole, has the warmer climate, New York or Florida?—New York or the Province of Quebec? Give a reason for your opinion in both cases. In what part of the state is the climate affected by altitude? Are any parts affected by latitude?—by proximity to the sea? In what part of the state is the climate the most equable? In what part is the average rain-fall greatest? In what part is it the least? What direction has the wind that precedes most of the storms? What direction has the wind with which the storms clear? What is the highest and what the lowest temperature observed in the town in which you live? What is the heaviest rain-fall? Which is the warmest and which the coldest month?

What is the prevailing soil in the district or the township in which you live? For what kind of crops is it best adapted? How is gravel formed? What is the nature of clayey soil? Is it well adapted for crops? Can you explain how loam is formed? Can you tell what occurs when soil is turned up for summer-fallowing? Can you tell what is meant by the "wearing-out" of soil? What is meant by alluvial soil?—sedentary soil? How does the fertility of soil affect the prosperity of a country?

1. Owing to diversities in the height of the land, distance from the sea, and extent of latitude, the climate of the state is varied. In the highlands of the Adirondack and Catskill regions, the summers are cool and pleasant and the winters intensely cold.

2. Because of the proximity of the ocean, the southern and south-eastern parts of the state have a more equable climate than any other portion. Here the temperature rarely sinks to 0° , and very rarely exceeds 95° . In other parts of the state the winter's cold is so intense as to frequently sink to -25° . As a whole, the climate is warmer than that of Maine, and cooler than that of Pennsylvania.¹⁸

3. The rain-fall averages about forty-four inches annually in the south-eastern part, and thirty-four in the western part of the state. It is everywhere amply sufficient for all the needs of life.¹⁹

4. The winds are variable. Ordinarily, storms are preceded by east or north-east winds, and are followed by winds from the opposite direction. Storms may cross the state from some point in the west, or they may advance along the coast from the south-west. The latter are usually the edges of cyclonic storms from the Gulf of Mexico.

5. Tornadoes, or whirling storms, are of rare occurrence, and never so severe as in the Mississippi Valley. During the summer season, however, violent thunder-storms are by no means uncommon. Near the ocean and along the lake-coasts the air is moist, but in the interior it is remarkably dry. There are no extensive marshes and alluvial plains, and because of this, malarial diseases are rare.

6. Almost every variety of soil may be found within the boundaries of the state, and the cash value of the annual products of the land bears evidence of its wonderful food-producing qualities.²⁰

7. The flood-plains and terraces of the river-valleys are overlaid with a deep, loamy soil that is rich in the organic matter and mineral salts which constitutes the natural food of plants.

8. The hilly and piedmont lands are generally rocky, but their soil, although scant, is rich enough to produce an abundance of grass. In "breaking" new land for cultivation, the first crop is not infrequently one of glacial boulders or broken shale.

9. On Long Island the under soil is mainly of sand, but this in the course of time has been covered by a surface of fairly rich loam, and it is by no means sterile.

6. NATURAL RESOURCES—PRODUCTIONS.

Suggestions.—There is no part of the study of geography more practical than that which pertains to the natural resources of one's own state, county, or district. Physical features determine the distribution; natural resources, the density and the wealth of population.

It will be an excellent plan to learn about the habits of such animals as may be found in the neighborhood where one lives. It is not necessary to attempt any elaborate classification—to the average man there are but two classes—those beneficial, and those injurious to humanity. More especially is this true of birds and insects, and the student who applies himself to this aspect of the study of life-forms will find an abundance of work.

In the consideration of vegetation there may be much practical work done. The pupils of each school should provide it with an herbarium, including a specimen of every plant found in the district. If it be possible, grasses, herbs, and smaller shrubs should be gathered while flowering, taking care to have each specimen carefully mounted, labelled, and pressed. Where several varieties of a species occur, if not too large, they may be mounted on the same sheet of paper. Write the common name, or names, of the plant on each slip, and, if possible, the botanical name. It is well to have duplicate specimens, for exchange. Secure specimens of every kind of wood growing in the state. One specimen of each should show a small piece of the tree, or one of its branches, in its natural state; another should show a planed and polished longitudinal section. It is of the greatest importance that the pupil should become acquainted with plants that are enemies to the farmer, and also with those that have medicinal properties. Most of the plants commonly called "weeds" will be found to possess some economical or industrial properties. The manner in which plants are distributed by winds, by waves, and by the agency of animals, will, in conjunction with the peculiar forms of certain seeds, be fruitful subjects for discussion.

All that has been said in the foregoing paragraphs concerning the collection of plants will apply equally to the mineral resources of the district. The various specimens of soil and common kinds of rock alone will form a surprisingly large cabinet. The pupils should by all means collect specimens of the industrial ores and minerals. All specimens should be carefully arranged, each resting on a card bearing the common and the mineralogical name, and also the location to which it is native. In the case of ores, specimens of the manufactured product should be exhibited with the ore.

Questions.—Can you name any animals that were once abundant in the state that have since disappeared? How are animals exterminated by civilization? What is meant by carnivorous animals?—by rodent animals? Name several of each. Name any wild animals found in the county or the district in which you live. What is meant by reptiles? How does the rattlesnake defend himself against enemies? Why is this snake so named? In what way does it inflict its poison? Answer the same questions with reference to the copperhead. Make a list of the animals you know to be beneficial to the farmer,—of those that are injurious. Can you describe the transformations (as exemplified in the butterfly) through which most insects pass? Name the animals in the neighborhood in which you live that are hunted as game. Name the fish that are used as food.

Name, if any, the forest trees in the county in which you live that are converted into building timber,—those that furnish ornamental wood. Make a list of the plants cultivated in the neighborhood for food,—for other industrial purposes. Name or describe any that are used for medicines. Name, if you can, two garden vegetables and four flowers belonging to the night-shade family. Make a list of all the plants you know growing in the state that are injurious rather than beneficial to humanity, and give your reasons therefor. Can you tell how the Canada thistle, burr-clover, and dandelion are disseminated? In what manner are the oak and the hickory sometimes distributed? What and where is the Forest Preserve? For what purpose was it set aside? Name the wild fruits of which you have any knowledge that grow in the state.

What minerals are obtained in the county or the district in which you live? Which of them are valuable for industrial purposes? How is iron obtained from the ore of which it is a part? How is lime obtained? What is the difference between “slaked” and “unslaked” lime? Can you tell what minerals enter into granite? Can you tell any of the physical properties of slate? What are “flag-stones”? Of what minerals is “brownstone” composed? How is plaster-of-Paris prepared from gypsum? For what is it used? What are the properties of hydraulic cement? How is salt obtained? Name the counties in which you know it to be found. In what manner is petroleum mined? How is it mainly transshipped? How do min-

eral springs become impregnated with the minerals to which their properties are due? Give the location of any such springs in the county in which you live.

1. The range of animal life, and the number of species in New York, have been greatly changed by the advent of man and the unceasing march of civilization.²¹ This is due not only to the slaughter of the animals themselves, but also to the destruction of the forests, which were their native abiding-places.

2. The elk, caribou, and moose have been exterminated, but the deer is still found in the mountain fastnesses. The carnivorous animals are represented in the black bear, panther, wolf, lynx, otter, mink, marten, skunk, red fox, and grey fox. The wolf and the fur-bearing animals are well-nigh extinct. Among the rodent animals are the hare, white rabbit, beaver, squirrel, and various species of small animals.

3. In their customary season, all the birds common to the eastern part of North America may be found in this state. Of reptiles, there are more than a score of species. These embrace about a dozen species of snakes, including two varieties of rattlesnakes, and the equally poisonous copper-head.

4. There are many species of edible fish in the Great Lakes, and the mountain lakes and streams still abound in trout, bass, pickerel, and perch. The salmon, once common in the Hudson, has been exterminated. Recently, however, the U. S. Fish Commission²² has attempted to restock the streams with salmon and German carp. Oysters and other shell-fish are found along the Sound.

5. Aside from cultivated plants, the indigenous vegetation

is varied and abundant. Formerly, almost the entire surface of the state was covered with forests, but these have been largely cleared away, except in the northern part.²³

6. Among the kinds of timber having industrial uses are fifteen species of oak, five each of pine and maple, and several each of elm, spruce, ash, beech, and hickory. In addition to these are a number of ornamental woods, such as chestnut, black walnut, butternut, cherry, and others. The magnolia, acacia, lirodendron, and arbor vitæ are also found.

7. About two thousand species of flowering plants have been enumerated and described, exclusive of cultivated garden-plants. More than fifty species of ferns are found within the limits of the state—probably a greater number than occurs in any other state, California excepted.

8. In the main, the flora of New York does not differ materially from that of the rest of the North-eastern United States. In the Adirondack region, however, there occur a few species of Alpine plants which, it is thought, survived the Glacial epoch. These are found in a few summits of Vermont and New Hampshire also, but nowhere else in the United States.

9. The mineral wealth of the state, although surpassed by that of several other states, is perhaps as varied as that of any other state in the Union.²⁴

10. Iron ores are widely distributed, and, in the annual output, New York stands next to Michigan and Pennsylvania.

11. Building-stone of almost every conceivable character is distributed from nearly three hundred quarries. Granite, white marble, red marble, black marble, verde-antique, sand-

stone, limestone, flagstone, basalt, and hydraulic cement are among the chief kinds.

12. Salt is obtained from mines of rock-salt at Syracuse, and from several localities in the Genesee and Oatka valleys.³⁵ The salt-wells at Syracuse are controlled by the state; those of Western New York are operated by private firms and corporations. Natural gas is found in several localities, and for many years it has been used for lighting Fredonia and other villages. The Pennsylvania oil-horizon also extends into New York.

13. Mineral springs abound in various parts of the state, aside from the salt springs in Oneida and Onondaga counties. There are "medicinal"³⁶ springs at Ballston, New Lebanon, Richfield, Avon, and Saratoga, and all these places have become noted summer-resorts.

7. PEOPLE — SOCIAL AND POLITICAL FEATURES.

Suggestions.—A discussion of the characteristics of a people will always develop interesting topics of study, and it will be instructive to note the persistence with which social traits and customs handed down by successive generations, still linger among the people. The grave, stern, and dignified manner that marked the Puritan is still a noticeable trait in New England life, and it stands in strong contrast with the unmetaphysical but practical character of the New Yorker. The influence of the Dutch patroons still exists in a self-constituted aristocracy of New York City; and, in spite of the overwhelming element *not* of Anglo-Saxon descent, English laws and customs have ruled the state for more than two hundred years.

It is well to call attention to the fact that government, no matter how corrupt it may become, is still a power for right and protection. Any citizen whose liberty or whose property is imperilled, has prac-

tically the whole army and navy of the United States at his bidding to protect him. As Carlyle tersely puts it: "Whoso is possessed of a sixpence can command bread to feed him, philosophers to teach him, and queen to stand guard over him—to the extent of sixpence." Every pupil should be impressed with the fact that, on becoming of age, he or she is an integral part of the republic, and that respect for the law, honor for one's fellow-beings, and love for one's country, are duties that a republic has a right to demand. It is not only a proper thing, therefore, but an imperative necessity that every pupil should become acquainted with the principles of civil government, comprehending not only his rights, but his duties as a citizen of the state as well.

Every pupil should also understand that the state provides for the education of its youth solely that they may be trained to become intelligent, upright, and dutiful citizens. Except in a few technical schools that have been established, the avocation that a boy or a girl may choose to follow is a matter of indifference to the state. In the spirit of true democracy there is but one result to be sought in education, namely—citizenship of the noblest type. For the education of its youth the state pays more than twelve millions of dollars every year. In view of this, it is plain that the duties of citizenship begin, not when the child becomes of age, but from the very moment he reaches the age in which he may learn the first steps of knowledge. Truancy, negligence, and disobedience, although they may be not more than misdemeanors against the statutory law, are crimes against moral law, and the pupil who wilfully disregards the duties of the school, commits a misdemeanor against the state, and sows seeds which shall yield corrupt citizenship.

Questions.—What foreign nations are represented among the citizens in the city, village, or district in which you live? How does a person of foreign birth become a citizen of the United States? Why do so many people of foreign birth emigrate to the United States? Who were the patroons?

Why are not the three branches of government—executive, legislative, and judicial—vested in one set of officers? Which do you think the better for the people, a constitution or an absolute mon-

arch? Make a list of the offices of the district, the village (or city), and the county in which you live. Who are the State Senators and Assemblymen in the district in which you live? Who are the United States Senators for the state? Who is the Representative of your district? How does a bill proposed before the Legislature become a law? What is meant by the Governor's veto? What rights do the constitution guarantee every person? For what purposes are taxes levied? What persons may, and who may not, vote? What public offices may women in New York hold?

For what purposes are public schools established? What is a kindergarten?—a high school?—a normal school?—a college?—a university? How are public schools supported?—private schools? What are some of the duties of the Board of Regents? For what purposes are teacher's institutes held? For what misdemeanors may a pupil be expelled from a public school? What persons are eligible to teach in public schools? Is the United States flag hoisted over your school-building during the sessions of the school?

1. The first settlers of New York were emigrants from The Netherlands, and their descendants are still numerous in the eastern part of the state. The majority of the present population is descended from English and other European settlers. In addition to these, there is a large foreign-born population of Irish, German, and other European nationalities.

2. Differing materially from the New-England type in social customs, the people of New York have always been noted for breadth of character, intelligence, and energy, and it is largely because of these qualifications that New York has become the foremost state in the Union in wealth and prosperity.

3. Like that of the United States, the government of the state is vested in three branches—the legislative, which makes the laws; the judicial,²⁷ which interprets them, and decides

upon their constitutionality ; and the executive, which administers them. The officers of all these branches are sworn to support the Constitution, which is the supreme law of the state.

4. The principal officers of the executive department are the Governor, a Lieutenant-Governor, and Superintendent of Public Instruction, each elected for three years ; a Secretary of State, Comptroller, Treasurer, Attorney-General, State Engineer, and Surveyor, each elected for two years. There are also various special officers, such as Superintendent of Insurance, Bank Commissioners, etc., some of whom are elected, and some appointed by the Governor.

5. Every county has also certain executive officers. Of these, the sheriff, various clerks, auditors, registrars, and school commissioners are the principal. Township organization is neither so complete nor so far-reaching as in the New England States.

6. The Legislative Department consists of a Senate of thirty-two members, and an Assembly of one hundred and twenty-eight members. Senators are elected for two, assemblymen for one year. The Legislature assembles yearly, on the first Tuesday in January, or at such times as it may be convoked by the Governor.

7. The Judicial Department consists of a court of appeals, a supreme court, various county courts, and justices' courts. Connected with certain of these courts is an appointive Grand Jury, which inquires concerning the commission of crimes.

8. The Court of Appeals is the highest judicial state authority in all cases except that of impeachment.²⁸ It consists

of the Chief Justice and six other judges of the Supreme Court. They hold office for fourteen years.

9. The Supreme Court consists of forty-six justices, each elected for fourteen years. The state is divided into five judicial departments, and the justices are distributed among these. A branch of the court, presided over by one or more justices, sits in each county at stated times. In the trial of criminal cases, this court is styled the Court of Oyer and Terminer.

10. County courts are presided over by county judges, each of whom is elected for six years. In the trial of criminal cases, two associates, called Justices of Sessions, assist the judge. The court is then called the Court of Sessions.

11. Justices' courts are held in each town. They deal mainly with petty civil cases and misdemeanors. Justices of the peace are elected for four years. Police courts are provided for the trial of misdemeanors against municipal laws. In these courts, the prisoner's guilt or innocence is usually decided by the police justice ; in all others. by a jury.²⁹

12. The grant by the West India Company to the New Netherland Colony required the establishment of schools, and under the Dutch governor, Peter Stuyvesant, a number of academies were established, some of which attained a wide reputation

13. Early in the eighteenth century, a number of institutions were established, among them a free grammar school and King's (now Columbia) College. From this beginning, one of the best school-systems of the world has developed.

14. Exclusive of the cities, there are about 12,000 school

districts, and in the various grades and classes, about 1,200,000 children of the state are educated at an annual cost of \$12,000,000. So well graded is the school-system that it practically begins at the cradle and ends with the university.

15. For the professional training of teachers, eleven normal schools³⁰ have been established, and these are supplemented by institutes held annually in every county in the state.

16. The general policy of the schools is shaped by the State Superintendent and by the Board of Regents.³¹ In each county are one or more School Commissioners, who supervise the schools within their districts. The schools of each district are regulated by a local board of trustees.

17. In addition to these, there are several schools for manual training, seven for the instruction of deaf-mutes, and two for the instruction of the blind. There are also several reformatories for incorrigible youth, and one for weak-minded persons.³²

8. PEOPLE—INDUSTRIAL FEATURES.

Suggestions.—It is well to bear in mind that all great industries are the result of geographical environment. Agriculture is not profitable in mountain highlands. Stock-raising would never thrive in the heart of a great city; nor would extensive manufactures pay in a sparsely settled country remote from a harbor. Decrease the rainfall one-third, and New York's supremacy as an agricultural state would soon be transferred to some other locality. Level off the undulating surface to the features of a prairie, and her manufactures would dwindle to a fraction of their present value. Elevate the surface three hundred feet, and the commercial supremacy of New York City would vanish.

It will be a good plan to have, so far as possible, agricultural products displayed in the school museum. With respect to the

grains, seed-products, and certain fruits, this is not impractical. Even specimens of the perishable fruits may be kept long enough for pupils to learn the names and characteristics of the varieties. Some of them, wheat, for instance, can be shown in the various stages between production and manufactured state. Such topics as the fertilization of flowers,—especially that of the corn plant,—the effects of transplantation, the diseases of milk and butter, etc., will always prove interesting and instructive object-lessons.

The manufactured products of the locality are always of sufficient importance to study, and it is an excellent plan to have specimens in the various stages between crude material and completed article on exhibition. This is especially important in the case of ores and industrial minerals.

The study of routes of transportation is one of great practical value in geographical work, and it will be well for the pupil to prepare a railway map of the state. Any old map, or an outline map, will answer as a basis. The routes may then be entered by drawing fine lines with red ink. Canals may be drawn in blue ink. Do not enter the names of any but principal stations, junctions, etc. The material may be obtained from railway-folders. Steamship routes may be charted in dotted or dashed lines. Above all others, the pupil should know the exports, imports, and manufactured products of his own locality.

Exercises.—Would the industries of the state remain the same if the land of the state were perfectly level? Would they change if the state were to be suddenly transferred to the Basin Region of the Western Highlands? Give reasons for your conclusions.

What are the agricultural products of the county in which you live? Make a list of six or eight of the principal ones, and tell how each is grown or otherwise obtained. What processes are employed in making wheat, broom-corn, cherries, strawberries, tomatoes, peaches, apples, butter, and cheese ready for the market?

What products are manufactured in the district, village, or city in which you live? Is the motive-power water, coal, or electricity? Which of these is the more economical? To what parts of the country are the manufactured articles exported? Describe any piece of ma-

chinery, or any process of manufacture which you think unusually interesting. Are the products shipped by rail, by canal, or by steamer? Give a reason therefor. Are the raw materials, in general, produced in the neighborhood, or are they imported from a distance? In what locality are hops mainly cultivated?—tobacco?—broom-corn? How is maple sugar made? Where are grapes chiefly grown? In what localities are salt, building-stone, and iron-ore each obtained?

Name the railway lines that pass through the village or city in or near which you live. Name any canal or water route. Over what transportation routes would you pass in going from your home to New York City?—in going to Chicago?—in going to some summer resort with which you are acquainted?—in going to London? Can you name ten different kinds of railway coaches and cars? Can you tell the various lantern, flag, bell, and whistle signals used? What is the danger signal by flag?—by semaphore?—by lantern? What kinds of freight are carried by canal-boats? Are the ocean-steamers of which you know, side-wheelers or propellers?—the river- or lake-boats? What is meant by a tug?—a barge? Can you tell the fastest time made by an ocean-steamer between New York (Sandy Hook) and Liverpool (Queenstown)? What is meant by an accommodation train?—an express?—a limited express?

1. A rich soil, humid climate, and diversified surface, together with other natural resources, have contributed to make New York the empire state of the Union in commerce, population, manufacture, and wealth.

2. The state ranks among the first in the Union in the number and value of its farms. More than one-half the total area is under cultivation, and a still greater proportion is productive. About one-third of the products of the dairy and one-fourth of those of the orchard, consumed in the United States, are grown in New York. Oats and corn are the cereals most extensively cultivated.³³

3. In the highland region dairy farming and the raising of

thorough-bred stock³⁴ is the main industry. Hay, potatoes, and hops are among the most valuable products. Grape culture is carried on in the lake-valleys. Maple sugar, tobacco, and broom-corn are among the special products. In the vicinity of New York City garden and dairy products are the chief sources of wealth.

4. New York is also foremost in extent of manufacturing interests.³⁵ Nearly fifty thousand establishments, employing more than \$500,000,000 of capital and over five hundred thousand employees, produce an aggregate product of more than one billion dollars annually. Food-stuffs, machinery, clothing, leather and leather-goods, malt liquors, tobacco, metal-goods, books, and textile fabrics are the chief products of this industry. River-craft, canal-boats, and sailing vessels bear also an important place in the manufacturing interests.

5. The chief product of the fisheries is the oyster, and next to this, the menhaden haul,³⁶ the latter being used for purposes of fertilization. The aggregate yearly value of the fish product is about \$5,000,000. The Great Lakes yield the chief supplies of food-fish.

6. The chief mining enterprises are those connected with the salt-wells, the iron-ore³⁷ deposits, and the stone quarries. Most of the iron-ore is mined in Dutchess, Essex, Clinton, and Orange counties. The most extensive quarries are those of Ulster County. The yield of the oil wells, though declining yearly, is still an important product. Hydraulic cement and buhr- or mill-stone are also extensively mined.

7. The foreign commerce of New York centres mainly at New York City,³⁸ and represents the commerce of the United

States. About two-thirds of the imports of the United States pass through the Custom-house of New York City.³⁹ In 1889, the total value of the imports and exports aggregated nearly \$1,000,000,000.

8. The domestic commerce consists mainly in the exchange of manufactured articles for raw materials and food-stuffs. The lake-coast trade is also enormous. This centres mainly at Buffalo.

9. At the piers of North River may be found steamers and sailing-vessels from every part of the world. About fifty steel-built ocean greyhounds, with a tonnage each of from 4000 to 10,000, ply between New York City and European ports. There are also steamship or sailing-lines to various South American, Mexican, Gulf, and Pacific Coast ports.⁴⁰

10. The railways⁴¹ have an aggregate length of 7700 miles. Solid trains to Chicago, St. Louis, Cincinnati, Boston, Montreal, and Washington are conveyed over several routes, and with not more than one or two changes, passengers may disembark at New Orleans, Mexico, San Francisco, or Portland, Oregon.

11. The principal trunk lines⁴² are the Pennsylvania, Baltimore and Ohio, Lehigh Valley, New York Central, West Shore, and Erie railways. All these roads have termini either at Jersey City,⁴³ or New York City. Aside from these, there is a net-work of local and connecting lines.

12. For the transportation of freight, many of the railway companies have provided separate tracks, and, in some instances, have built separate roads.

13. There is also one of the most complete systems of

canals to be found in any part of the world. The Erie Canal, 363 miles in length, furnishes a direct water-route between Buffalo and the lake-ports on one hand, and New York City on the other.

14. In addition to these, the Delaware and Hudson Canal opens a direct route between Delaware and Chesapeake bays and Hudson River. The Champlain Canal connects Lake Champlain with the Hudson. Erie Canal is owned by the state; the others are private corporations.

15. For the transportation of crude petroleum, pipe-lines have been laid from the oil-fields of Pennsylvania to Buffalo and to Brooklyn. In several of the larger cities, elevated steam-railways, cable-railways, and electric-railways have been constructed for passenger traffic.

9. HISTORICAL.

Suggestions.—The general history of the state can be learned from many sources at the pupil's command; the history of the county, the city, or the village is usually not a matter of public record, and must be ascertained by personal effort. It is doubtful if there can be a more practical side to the study of history than that which pertains to one's own home and vicinity. In general, the study of the origin and history of place-names, social customs, the introduction of new industries, or the disappearance of old ones will be better topics for discussion than those of disgusting political intrigues.

Questions.—What was the object of Hudson's voyage to the New World?—of Champlain's? How came the English to lay claim to the territory? What is the meaning of the name "Netherlands"? Is it applicable to New York? After whom were the following names given; tell whether they are of English, French, Dutch, or Indian origin; Rensselaer, Hudson, Manhattan, Spuyten Duyvel,

Buffalo, Champlain, Seneca, Chateaugay, Canandaigua, Oswego, Niagara, Tonawanda, Yonkers, New Rochelle, Flushing, Peekskill, Albany, Westchester, Steuben, Delaware? Make a list of the counties named after distinguished men. Make a list of those bearing Indian names. In what part of the state are the remaining counties situated? Tell what you can about their names. Write the history of any town, sect, or settlement you may think interesting. Make a list of all the Indian names applied to places or natural features in the county in which you live. Can you tell the origin or the meaning of any of them? What historical associations are connected with Saratoga?—Ticonderoga?—Ft. Edward?—Crown Point?—West Point? What effect had the Erie Canal on the history of New York?—the Welland Canal?—the suspension bridge at Niagara Falls?

1. In 1609, Hendrick (or Henry) Hudson, an English sailor in the employ of the Dutch, while coasting about the New York Lower Bay,⁴³ discovered the river that now bears his name. He ascended the stream as far as the site of Albany with his ship, the *Half Moon*, and by smaller boats, some ten or twelve miles farther.

2. In the same year, a French explorer, Champlain, penetrated the northern part of this region, discovering Lake Champlain and Lake George. This territory was therefore claimed as part of New France.

3. Five years after the discovery of the Hudson River the Dutch made a settlement on Manhattan Island, to which, in honor of the capital of their fatherland, they gave the name New Amsterdam. They also called their thriving colony New Netherlands.⁴¹

4. A few years later, the English had made settlements in Massachusetts and the Swedes in Pennsylvania. In the course of time, however, as these colonies grew, and ex-

tended their settlements along the coast, frequent disputes arose, because both colonies claimed the same territory.

5. Because of Hudson's discovery of the Delaware, the Dutch asserted their right to all the land which the Swedes had formed into the colony of New Sweden. So in 1664, a fleet of Dutch vessels captured all the Swedish forts along the Delaware, and thus the colony of New Netherlands acquired still greater strength and importance.

6. In the meantime, the clash of ownership to the soil had begun to make trouble between the Dutch and their English neighbors in Connecticut. So the right to the territory by virtue of prior discovery was again called into question, and this time it did not result so happily for the Dutch.

7. More than one hundred years before Hudson's vessel entered New York Bay, Sebastian Cabot, an English sailor, had visited the north-east coast of North America. Based upon this right,⁴⁵ Charles II. of England sent his brother, the Duke of York, to whom he made a grant of the territory, with a fleet of vessels to take possession of it.

8. Rather singularly, the Dutch offered but little resistance. The reason was that they were heartily tired of the tyranny and incompetency of their colonial governors. So New Netherlands became an English possession, and New Amsterdam became New York City. A few years afterward (1673), the Dutch recaptured and held the province for a few months, but they soon lost it again, and the English held it until the Revolution.

9. During all these years, however, the English colonists were extending their settlements north and west, and again

they had to battle for possession of the soil. All along the St. Lawrence and the Great Lakes, the French, in their empire of New France, had been growing and extending their settlements, quite as energetically as the English.

10. By and by there arose the same question as to whom belonged the disputed soil that was claimed by both peoples. The question could be settled only by the force of arms, and by arms it was decided. From 1687 to 1754 there was a succession of conflicts which ended only when the French had given up about all the possessions they held, east of the Mississippi River.

11. During these struggles there were many exciting events. The country around Lake George and Lake Champlain bristled with hostile encampments, and fierce battles were fought at Crown Point, Ticonderoga, and Fort William Henry. Their close marked the beginning of a period of rapid growth, extended development, and great prosperity.

12. But during the next forty years a still more momentous question troubled the hearts, not only of the New York colonists, but of every American settlement under the English flag. This was the growth of the spirit of liberty. A few ill-advised acts of oppression by the mother country was followed by an uprising of all the colonies.

13. In the successful struggle for independence New York was a theatre of strategic events, and her soil was consecrated by the blood of her bravest men. Crown Point, Ticonderoga, Long Island, Stony Point, New York City, and Saratoga were the scenes of hard-fought battles.

14. After the close of the War of the Revolution, the

colony became one of the thirteen states that formed the United States, and the tide of prosperity again swept along. Albany was made the capital of the new state in 1797.

15. The peace, but not the prosperity, of the state was again interrupted in 1812 by another war between the United States and Great Britain. So far as New York was concerned, the principal events were Commodore M'Donough's victory on Lake Champlain and the battle of Lundy's Lane.

16. In the meantime, several important events had occurred which tended to increase the prosperity of the state. These were mainly the successful application of steam to navigation⁴⁶ and the construction of the Erie Canal. The former opened the heart of the country to domestic commerce; the latter was the beginning of a foreign commerce which even the most enthusiastic optimist could scarcely have dreamed of.

10. CENTRES OF POPULATION.

Suggestions.—It is not thought necessary to propound in these pages any questions concerning the location of towns and villages. The teacher's and pupil's judgment in such exercises would probably be superior to the author's. In general, it is more practical to locate a town or city on some trunk-line of railway than in an obscure county, or on some insignificant stream. If a town or city be an important sea-, lake-, or river-port, however, this should be mentioned. It goes without saying, also, that every pupil should be thoroughly acquainted with the boundaries, geography, drainage, and physical features of the county, and the city or village in which he lives.

1. The state is divided into sixty counties, one of which constitutes the City of New York. Each county, New York

excepted, is divided into townships. Included in the various county areas, but separate from their organizations, are twenty-seven cities. The capital of a county is called the county-seat, or county-town.

2. Cities are incorporated under a charter, or permit, granted by the state. They are usually controlled each by a Mayor and Board of Aldermen, elected by the people. Cities are divided into *wards*, and wards into *precincts*. A city can enact any laws for its own good which do not conflict with state laws. Nearly all the cities of New York are on navigable waters.

3. Villages are not incorporated under so broad a charter. Their laws are enacted by the state, or under certain general regulations which govern the rights and privileges of villages.

4. **New York City** is the largest city and chief commercial emporium in the Western Continent. Its population in 1890, estimated at 1,800,000, is surpassed by that of London and Paris only. With the City Hall as a centre, a circle, twenty miles in diameter, encloses a population of more than 3,500,000.

5. The city embraces an area of forty-one and a half square miles,⁴⁷ the greater part of which is included in Manhattan Island. Beyond the island, it extends to Westchester County on the north, and to Bronx River on the east. Including Harlem River, a kill connecting North and East rivers, the city has a water-front of twenty-five miles.

6. Four lines of elevated railway, extending nearly the whole length of the city, every day carry a quarter of a million people from their homes to their business places and

back. The largest suspension-bridge⁴⁸ in the world connects the city with Brooklyn, and ferry-routes bring the neighboring cities into still closer connection.

7. The foreign commerce extends to every part of the world, and more than half the foreign trade of the United States passes through the port of this city. Railways connect it with every important town in the United States, and through trunk-lines with all the larger cities.

8. It is also the chief centre of manufacture in the eastern part of the United States, and the value of the manufactured product surpasses that of any other city in the Union. Clothing, food-stuffs, furniture, machinery, and metal-ware are the principal items. About 40,000,000 books are yearly printed and distributed. The American Book Company is the largest corporation of the kind in the world.

9. Probably no other city in the world has so many hospitals, libraries, and institutions of learning. Among the latter are Cooper Institute, the Metropolitan Museum of Art, the American Museum of Natural History, and the National School of Design. Central Park, an important conservator of public health, situated in the heart of the city, contains an area of 875 acres.

10. **Brooklyn**, the second city in size, is situated on the western end of Long Island. Practically it is a part of New York City, with which its business interests and enterprises are identical. Its extensive water-front is crowded with piers and warehouses. These, with Atlantic Dock and Brooklyn and Erie basins,⁴⁹ give the city no small commercial standing.

11. The city is noted for its beautiful residences, and probably no other city in the Union has such well-paved and clean streets. Elevated railways leading from Brooklyn Bridge and the ferries traverse the whole length of the city.

12. The public school-system is one of the best in the United States, and there are many higher institutions of learning, among which are the Collegiate and Polytechnic Institute. The estimated population of Brooklyn is 800,000.

13. **Buffalo**, the metropolis of Western New York and the county-seat of Erie County, next to Chicago, is the chief port of the lake region. The city has an extensive waterfront on Lake Erie and Niagara River. Its harbor, protected by massive break-waters, is one of the best and most commodious on the lakes.

14. It is the western terminus of the Erie Canal and the centre of about a dozen lines of railway. Buffalo is one of the leading grain-markets in the United States, and its thirty elevators⁵⁰ are capable of handling 3,000,000 bushels of grain daily.

15. The city contains extensive flouring-mills and iron-manufactures. It is noted for its wide streets, fine parks, and beautiful residences. Among other noteworthy enterprises is one of the finest and largest engraving and art-printing establishments in the United States.

16. **Albany**, the capital of the state, is situated on the west bank of the Hudson River. It is the eastern terminus of the Erie Canal, and the centre for all transportation routes that pass through the Mohawk depression. The manufacturing interests of the city are extensive and varied.

17. Among the important institutions are the State Library, and the Museum of Agriculture, Geology, and Natural History, controlled by the State Geological and Agricultural Departments. A State Normal School and Dudley Observatory are located in this city. The Capitol, one of the most massive buildings in the United States, cost over fifteen million dollars.

18. **Rochester**, the county-seat of Monroe County, is situated at the falls of the Genesee River,⁵¹ a few miles from Lake Ontario. It is one of the largest cities in the United States not on navigable waters. Its growth and development are due mainly to the vast water-power at the falls.

19. The manufactures are extensive. They include some of the largest flouring-mills east of the Mississippi and the largest carriage factory in the United States. In the vicinity are probably the largest tree- and seed-nurseries on the continent. A university, a theological seminary, and the Western House of Refuge are located here.

20. **Troy**, the county-seat of Rensselaer County, is situated on an alluvial terrace, at the head of navigation of the Hudson River. It is the terminus of the Champlain Canal, and is an important railway and manufacturing centre. Ferries and local lines of railway place the city in close connection with Albany.

Shirts, collars and cuffs, hosiery, mathematical instruments, and terrestrial globes are among the articles of special manufacture. Rensselaer Polytechnic Institute is located here.

21. **Syracuse**, the county-seat of Onondaga County, is a railway and manufacturing centre, and an important grain

and lumber market. There are varied manufactures of iron and steel goods, but the chief industry is that connected with salt-making.⁵² Syracuse is the seat of a university and the State Asylum for Idiots.

22. **Utica**, one of the county-seats of Oneida County,⁵³ and an important railway centre, is also a station of the Erie Canal, and a terminus of a canal connecting the Susquehanna and Hudson rivers. Aside from its manufacturing interests, it is the centre of a rich agricultural district. It is the seat of a large dairy trade. A State Lunatic Asylum is located here.

23. **Auburn**,⁵⁴ the county-seat of Cayuga County, is situated at the foot of Owasco Lake. On account of the excellent water-power, its manufacturing interests, especially those of farming machinery and textile fabrics, are of considerable importance. A theological seminary and one of the state prisons are located here.

24. **Oswego**, one of the county-seats of Oswego, is a port of entry on Lake Ontario, and the commercial outlet of a large region with which it has canal and railway connection. Its harbor is protected by jetties and a sea-wall, which give the city several miles of wharfage. It is one of the largest grain markets in the Eastern States, and it is noted for its extensive flouring-mills and starch-factories. Iron manufacture and ship-building are also important industries. One of the state normal schools is located here.

25. **Kingston**, the county-seat of Ulster, an important river-port of the Hudson, is practically the northern terminus of the Delaware and Hudson Canal, and an important coal

market. Among the principal industries are ice-cutting, stone-cutting, and the manufacture of brick, cement, and malt liquors.

26. **Elmira**, the county-seat of Chemung County, is the largest city in the state on the Erie Railway, between New York and Buffalo. It is the seat of extensive iron manufactures, car-building establishments, and flouring-mills. Elmira Female College is located here. Because of its healthful situation and beautiful surroundings, the city is a favorite summer resort.

27. **Poughkeepsie**, the county-seat of Dutchess County, is an important centre of river trade. At this point Hudson River is spanned by a steel bridge, over which most of the through trains between Philadelphia and Boston now pass. The manufacturing interests include iron-furnaces and foundries. Vassar College, for women, is located here.

28. **Cohoes**, at the confluence of the Mohawk with the Hudson, is one of the chief manufacturing cities of the state. Its importance is due mainly to the falls of the Mohawk, which furnish an abundance of water-power, and to its situation at the junction of the Erie and Champlain canals. Cotton fabric, knit goods, hosiery, wrought iron, steam fire-engines, axes, and pins are among the principal manufactured goods.

29. **Yonkers**, a river-port of the Hudson, a few miles north of New York City, is noted chiefly as a place of residence for business-men of New York City. It contains manufactures of felt hats, carpets, textile goods of silk, and cotton goods.

30. **Newburgh**, one of the county-seats of Orange County, is a river-port of the Hudson, and the centre of an extensive trade in dairy products and lumber. During the Revolutionary War it was for a time the head-quarters of Washington's army.

31. **Binghamton**, the county-seat of Broome County, is the seat of considerable manufacturing interests. Its situation on the Chenango Canal, and at the junction of several railways, gives the city fine shipping facilities. Next to New York, it is the principal tobacco mart in the Middle States. Farming implements, boots and shoes are among the noteworthy manufactures.

32. **Jamestown**, Chautauqua County, situated at the lower end of Chautauqua Lake, is a favorite summer resort. The city is lighted, and, in part, heated by natural gas. Lake steamers connect the city with Mayville. Manufacture is the chief industry.

33. **Long Island City**, on East River, is a part of the overflow of New York City, with the interests of which it is identical. It is the terminus of the principal railways of Long Island. Most of the storage tanks and refineries connected with the coal-oil trade are located here.

34. **Schenectady**, the county-seat of Schenectady County, is noted mainly for its railway-locomotive building establishment. It is also the market for much of the broom corn grown in the Mohawk Valley, and is the seat of extensive broom-manufacture. Union College is located here.

35. **Lockport**, the county-seat of Niagara County, derives its name from the locks, ten in number, in the Erie Canal.

The latter descends sixty feet at this place. The canal also furnishes water to various manufacturing establishments, through a race three-quarters of a mile in length. Flour, lumber, cotton, and woollen fabrics are the chief items of manufacture. The famous Medina sandstone is quarried here. Lockport was probably the first city ever heated by steam supplied to the various buildings and residences by pipes from a central station.

36. **Rome**, a county-seat of Oneida County, is an important manufacturing city. The principal interests are connected with the manufacture of wrought iron, and the building of railway locomotives and coaches.

37. **Ogdensburgh**, a port of entry and river-port of the St. Lawrence, is the seat of considerable commerce with Lake Champlain and Canadian ports. Its industries are mainly connected with the marketing of grain and the manufacture of flour and lumber.

38. **Watertown**, the county-seat of Jefferson County, is situated on both banks of Black River, which affords unlimited water-power. The industries are mainly manufactures; and the products, sewing-machines, paper, lumber, leather and woollen goods.

39. **Hudson**, the county-seat of Columbia County, is at the head of deep-water navigation of the Hudson River. It is the centre of considerable river-trade and iron-manufacture.

40. **Dunkirk**, next to Buffalo the most important port on Lake Erie, is a port of entry, and one of the most rapidly-growing cities in the state. Aside from its lake-commerce, it

is the seat of extensive and varied manufactures ; among them, a railway-locomotive building-establishment.

41. **Amsterdam** is the largest centre of population of Montgomery County. Its most important industry is the manufacture of dairy products and knit-goods.

42. **Ithaca**, the county-seat of Tompkins County, is situated at the head of Cayuga Lake. Aside from its manufacturing industries, it is an important centre of commercial traffic. Cornell University is located here.

43. **Hornellsville**, Steuben County, is a rapidly-growing city, supported by varied and extensive manufactures.

VILLAGES.—The following are the principal villages of the state, arranged alphabetically. A few of them surpass some of the cities in population and importance.

44. **Albion** is the county-seat of Orleans County, and distributing point of a large agricultural region.

45. **Ballston**, the county-seat of Saratoga County, is a summer resort, and is noted for its mineral springs.

46. **Batavia**, the county-seat of Genesee County, is one of the largest and most beautiful villages in the state. Its extensive manufactures include those of reapers and mowers, and other farming machinery. Fruit-canning is an important industry. There is also a state school for the blind.

47. **Brockport**, Monroe County, is the seat of one of the state normal schools.

48. **Caldwell**, the county-seat of Warren County, is a noted summer resort, at the upper end of Lake George. It is also called Lake George.

49. **Canandaigua**, the county-seat of Ontario County, is a railway centre of considerable importance.

50. **Cape Vincent**, Jefferson County, is a port of entry on Lake Ontario, at the head of the St. Lawrence River.

51. **Catskill**, the county-seat of Greene County, is a river-port and summer resort.

52. **College Point**, on Long Island, near Flushing, is mainly a place of suburban residence for New York business-men.

53. **Cooperstown**, the county-seat of Otsego County, was named in honor of James Fenimore Cooper, the novelist, who lived here. The village is beautifully situated on the Susquehanna River, at the lower end of Otsego Lake.

54. **Cold Spring** is a summer resort opposite West Point. Here are extensive iron manufactures.

55. **Corning**, a county-seat of Steuben County, is a railway centre and a terminus of the Chemung Canal. Among its industries are car-building works and an establishment for the manufacture of cut-glass ware

56. **Cortland**, the county-seat of Cortland County, is the seat of extensive manufactures of wagons and wire-goods. A state normal school is located here.

57. **Dansville**, Livingston County, has an abundant water-power, and contains paper- and flouring-mills.

58. **Flushing**, Queens County, Long Island, is the home of many New York business-men. It is noted for its fine residences, excellent schools, and extensive tree-nurseries.

59. **Fort Edward**, Washington County, contains iron-manufacturing establishments and paper-mills. The village

is built on the site of old Fort Edward, a strategic-point during the French and Indian wars.

60. **Fulton**, Oswego County, has manufacturing interests of some importance. Its water-power is derived from Oswego River.

61. **Geneva**, Ontario County, is delightfully situated at the foot of Seneca Lake, and, during the summer season, is in the line of a heavy passenger-traffic for tourists *en route* between Niagara Falls and the East. There are extensive tree- and seed-nurseries, and a state experimental agricultural station here.

62. **Glen's Falls**, Warren County, is a famous summer resort and manufacturing village near Lake George. The dalles of the Hudson River, which here falls about fifty feet, furnish an abundance of water-power. Black marble of excellent quality is quarried here.

63. **Gloversville**, Fulton County, derives its name from the glove-making industry which centres here. It joins Johnstown, the county-seat, and is probably the largest village in the state.

64. **Green Island**, situated on an island in the Hudson, opposite Troy, is a part of the overgrowth of that city. It is a manufacturing village, and an important shipping-point for lumber and marble.

65. **Greenbush**, opposite Albany, is an outgrowth of the latter. It has extensive manufacturing enterprises.

66. **Hoosic Falls**, Rensselaer County, derives its industrial importance from the falls of the Hoosic River.

67. **Hempstead**, Queens County, Long Island, is a village

consisting mainly of the residences of New York and Brooklyn business-men.

68. **Hornellsville**, Steuben County, is a rapidly-growing village, supported by varied and extensive manufactures.

69. **Ilion**, Herkimer County, is mainly a manufacturing village. Among the products of its industries are farming implements, fire-arms, and sewing-machines.

70. **Jamaica**, the county-seat of Queens County, Long Island, is the residence of New York and Brooklyn business-men.

71. **Johnstown**, the county-seat of Fulton County, is the seat of very large skin- and leather-dressing industries. It is near Gloversville, with which its interests are identical.

72. **Lansingburgh**, Rensselaer County, is opposite the mouth of the Mohawk River. Among its special manufactures are brushes and oil-cloth.

73. **Little Falls**, Herkimer County, is built on both sides of the gorge which constitutes the water-gap of the Mohawk River. The Erie Canal and two trunk-lines of railway pass through this narrow gap. The fall of the river, forty-two feet, affords ample water-power for the extensive manufactures. It is one of the largest cheese markets in the country.

74. **Lyons**, the county-seat of Wayne County, is situated in a rich farming region. It is the centre of an extensive trade in grain and tobacco, and has probably the most extensive manufacture of oil of peppermint in the Western Continent.

75. **Malone**, the county-seat of Franklin County, is chiefly a manufacturing village. Woollen goods, paper, and flour are the principal items of manufacture.

76. **Matteawan**, Dutchess County, derives its industries from the falls of Fishkill Creek, which supplies water-power to its factories.

77. **Medina**, Orleans County, has given a name to the geological formation known as "Medina" sandstone, which occurs here in great abundance. The quarrying and shipment of this stone is the principal industry of the locality.

78. **Middletown**, Orange County, is a shipping-point for the dairy products of one of the richest agricultural regions in the state. The village has also varied manufactures. One of the insane asylums is located here.

79. **New Brighton**, Richmond County, Staten Island, is a thriving suburban village, containing the homes of New York business-men.

80. **New Rochelle**, Westchester County, is delightfully situated on Long Island Sound. It is also a village of suburban residences.

81. **Niagara Falls**, Niagara County, is a famous summer resort for tourists who visit the falls of Niagara River.

82. **Norwich**, the county-seat of Chenango County, is the seat of extensive manufactures. It is situated in a rich farming region, and is the centre of several lines of railway.

83. **Nyack**, Rockland County, overlooks the expansion of Hudson River called Tappan Sea. There are important manufactures, and a heavy shipment of dairy- and garden-products to New York City.

84. **Olean**, Cattaraugus County, is the seat of a very extensive petroleum trade, where several of the largest oil-refineries in the world have been erected. The storage tanks

have a capacity of about 3,000,000 gallons, and one of the pumping-stations of the pipe-line extending from the oil-regions of Pennsylvania to New York City, is located here.

85. **Oneida**, Madison County, is in the centre of a rich agricultural region. Hop-raising and dairy-farming form the leading industry. There is also considerable manufacture.

86. **Owego**, the county-seat of Tioga County, is the centre of both a farming and a manufacturing region. Flour, leather, marble, and carriages are the principal products of its industries.

87. **Peekskill** is an important river-port and shipping-point on the Hudson. Stove- and other iron-manufactures are the leading industries.

88. **Penn Yan**, the county-seat of Yates County, is situated at the foot of Keuka Lake. It is in the line of summer travel, and lake-steamers connect it with Hammondsport. An abundance of water-power gives the village considerable importance as a manufacturing place. A large malt-house and a barrel factory are among the special items of manufacture.

89. **Plattsburgh**, a port of entry, and the county-seat of Clinton County, is situated on Lake Champlain, in the vicinity of the iron-mines. It is a shipping-point for iron-ore and lumber.

90. **Port Chester**, Westchester County, is a suburban village of New York City.

91. **Port Jervis**, Orange County, at the meeting of the boundaries of New York, Pennsylvania, and New Jersey, is a popular summer resort, and is noted for its beautiful scenery.

Here are railroad shops, numerous manufacturing establishments, and a canal basin.

92. **Richburg**, Allegany County, is situated in the upper part of the Genesee Valley. It is the centre of varied manufactures and agricultural interests.

93. **Salamanca**, Cattaraugus County, is the shipping-point of a large lumber region. Railway machine- and car-shops are the only important manufacturing establishments.

94. **Sag Harbor**, Suffolk County, Long Island, is a port of entry, and the seat of considerable coasting trade. It is a popular sea-side resort.

95. **Saratoga Springs**, Saratoga County, is one of the most famous summer resorts on the Western Continent. Its popularity is due to the many mineral springs which are alleged to have curative properties. Near the village is the town of Stillwater, made famous by victories over the British troops during the War of the Revolution.

96. **Saugerties**, Ulster County, is mainly important for its foundries and factories.

97. **Seneca Falls**, at the lower end of Seneca Lake, has an abundance of water-power. Among its manufactures is that of steam fire-engines.

98. **Sing Sing**, Westchester County, has extensive manufacturing establishments. Among its special products are files and lawn-mowers. A state prison is located here.

99. **Stapleton**, Richmond County, Staten Island, is the residence of many New York business-men.

100. **Suspension Bridge** is a port of entry, a short distance below the village of Niagara Falls. It receives its

name from the railway suspension-bridge connecting the opposite shores of Niagara River.

101. **Tarrytown**, Westchester County, near New York City, is mainly a village of suburban residence.

102. **Wappinger's Falls**, Dutchess County, owes its prosperity to the ample water-power furnished by Wappinger Creek.

103. **Waterloo**, a county-seat of Seneca County, is situated at the outlet of Seneca Lake. Its interests are chiefly manufacturing, and among the special products are shawls.

104. **Watkins**, the county-seat of Schuyler County, is situated at the head of Seneca Lake. Near Watkins is the famous glen, to which the village is mainly indebted for its prosperity.

105. **West Point**, Orange County, is built on a terrace of the Hudson River. Aside from its importance as the seat of the United States Military Academy, it is possessed of interesting historical associations.

106. **West Troy**, Albany County, opposite Troy, is an overgrowth of that city. Its interests are mainly manufacturing, and include a United States (Watervliet) Arsenal.

107. **White Hall**, Washington County, is situated at the head of Lake Champlain, at the northern terminus of the Champlain Canal. The chief interests are the manufacture and shipment of lumber.

108. **White Plains**, Westchester County, is mainly noted for the battle fought here during the Revolutionary War.

APPENDIX.

NOTES.

1. The northern boundary of the state is a line first definitely surveyed by Valentine and Collins, in 1774. It is an extension of the northern boundary of Vermont, and was intended to coincide with the 45th parallel. As a matter of fact, however, it varies in places several hundred feet from a true parallel. The north-eastern corner of the state is about thirty feet north of the 45th parallel. The boundary separating the greater part of Pennsylvania from New York is theoretically the 42d parallel, but practically it is an irregular line, varying from 760 feet north to 350 feet south of the true parallel. The western boundary was fixed by treaty to be a "meridian-line drawn through the westerly bent or inclination of Lake Ontario." At the extreme western part of Lake Ontario is the small estuary, Burlington Bay. This estuary was not considered a part of Lake Ontario, and so most maps show the western boundary apparently two or three miles too far to the eastward. This explanation, however, clears the apparent discrepancy. The irregularity in the boundary between New York and Connecticut was the result of a compromise between the two states. Connecticut, desiring an increase of coast on Long Island Sound, purchased from the Duke of York a strip 96 square miles in area lying on the Sound, giving in exchange therefor a narrow strip of equal area from her western border. This left an angle of Massachusetts, known as Boston Corners, projecting into New York. The greater part of this triangle was ceded to New York in 1853, in order that the latter state might "correct certain irregularities in the sale of intoxicating liquors." In 1834, an Act of Congress gave New York jurisdiction over the entire

width of that part of the Hudson River lying south of Spuyten Duyvel Creek, providing, however, that all vessels lying at the wharves or docks on the Jersey side should be under the jurisdiction of New Jersey, excepting in the application of quarantine laws.

2. The following list embraces the principal islands belonging to the State :

<i>In New York Bay and Long Island Sound.</i>	Staten.	<i>In St. Lawrence River.</i>
Bedlow's (U. S.).	Ward's (City).	Carlton.
Blackwell's (City).	<i>In Niagara River.</i>	Fox.
Ellis (U. S.).	Beaver.	Gallup.
Fisher's.	Buckthorn.	Grenadier.
Gardiner's.	Cayuga.	Grindstone.
Governor's (U. S.).	Goat.	Many of the "Thousand Islands."
Hart's.	Grand.	<i>In Lake Champlain.</i>
Long.	Rattlesnake.	Crab.
Manhattan (City).	Sisters.	Dundas.
Plum.	Squaw.	Schuyler.
Randall's (City).	Strawberry.	Valcour.
Shelter.	Tonawanda.	

Not included in the foregoing are several islands in the St. Lawrence belonging to the United States.

3. Long Island is the largest of a chain of islands extending parallel to the Connecticut shore. It is a portion of a partly-submerged ridge, whose summit varies from 380 feet above to about 100 feet below the sea-level. Its surface has an average height of about 70 feet above mean tide, and is covered with strata of sand, gravel, and till. Deeper down, the surface drift gives way to bowlders of granitic rock, greenstone, and sandstone. One of these is about fifty feet long and forty feet in its shortest diameter. A range of hills extends along the island for about sixty miles, its highest summits being about 300 feet high. The surface is dotted here and there with lakes and ponds. One of them, Lake Ronkonkoma, near Lakeland, is subject to periods of increase and decrease in volume, the interval between high and low water being about seven years. At high water the area of the lake is about one-third greater than at the season of low stage. Long Island consists almost wholly of an immense deposit of glacial drift—in fact, the terminal moraine of a vast sheet of glacial ice.

4. For the explanation of this word, see note 12, p. 97.

5. Several causes have combined to give the state its varied surface, but the ones most potent were the plication of the strata into mountain-ranges, and their subsequent degradation by glaciers. So extensive was the degradation of the mountain-ranges, that, in many places, they have been almost wholly obliterated. In a few instances only can the individual ranges be traced throughout their entire extent, and, in many places, character and age of the rocks, and not continuity of elevation, furnishes the distinguishing clews. Since the time of the Glacial epoch, the surface has been alternately depressed and raised, and this has added to the confusion and obliteration of surface features. If it were not for their subsequent degradation, the whole amplitude of the fold of these mountains would aggregate upward of four or five miles. South of the Pennsylvania border, the folds, although about as greatly worn, are remarkable for their continuity; but in New York and the New England States, the degradation has been far less uniform. This is owing mainly to glaciation, for the great ice sheet which covered almost every part of New York and the New England States reached south of the Pennsylvania border in two or three places only, mainly in the north-eastern and south-western corners of the state.

6. Several different forms of this word appear, as will be noticed in the text. On Adlum & Walter's map of Pennsylvania, 1790, the form *Allegany* only appears. On Reading McDowell's map of the state, two forms, *Allegheny* Mountains and *Allegany* River, are found. *Alleghany* is a still later form, and is a monstrosity for which there is no authority whatever. In the Engineer Department of the Pennsylvania Railway but one form, *Allegheny*, is used; the State Geological Survey, however, recognize *Alleghany*, though admitting its inaccuracy.

7. There is a low, but not well-defined ridge along the eastern border, sometimes called the Skinnemunk Range. It is generally considered a part of the Taghanic folds. On Manhattan Island, where it is known as Washington Heights, it separates the Hudson and Harlem (or Haarlem) rivers. The ridge between the east and the west branch of the Delaware River is commonly called Delaware Mountain.

8. The following are a few of the principal altitudes:

<i>Adirondack Mountains.</i>			Feet.
	Feet.	Slide Mountain.....	4205
Colden Mountain.....	4708	Table Mountain.....	3865
Dix's Peak.....	4916		
Dix's Peak.....	*5200	<i>Lakes.</i>	
Gothic Mountain.....	4744	Avalanche.....	2856
Gray Peak.....	4984	Beaver.....	1409
McIntyre Mountain.....	5403	Catskill.....	2130
McIntyre Mountain.....	*5334	Cayuga.....	388
McMartin Mountain.....	5000	Cedar.....	2530
Skylight Mountain.....	4978	Champlain.....	91
S. McIntyre Mountain.....	4938	Chautauqua.....	1291
Whiteface Mountain.....	4955	Colden.....	2748
Whiteface Mountain.....	*4900	Crooked.....	2022
		Erie.....	573
<i>Catskill Mountains.</i>		George.....	324
Balsam Mountain.....	3601	Henderson.....	1833
Cornell Mountain.....	3681	Long.....	1584
Deep Hollow Mountain.....	3500	Lower Saranac.....	1527
Doubletop.....	3875	Moss.....	4312
Eagle Mountain.....	3560	Oncida.....	360
High Peak.....	3664	Ontario.....	247
Hunter Mountain.....	4038	Otsego.....	1054
Kimball Mountain.....	3960	Rich.....	1547
Mink Mountain.....	3807	Seneca.....	370
Pantherkill Mountain.....	3828	Skaneateles.....	932
Peak-o'-Moose.....	3875	Tear of Clouds.....	4327
Round Top.....	3500	Upper Saranac.....	1567
Rusk Mountain.....	3626	Woodhull.....	2019
<i>Cities, etc.</i>			
Albany (N. Y. C. Ry. Sta.)....	30	Fort Edwards.....	141
Albany (Mean tide, Hudson R.)..	6	Geneva.....	459
Albion.....	547	Herkimer.....	507
Attica.....	998	Hornellsville.....	1161
Auburn.....	674	Ithaca.....	392
Batavia.....	895	Kingston.....	186
Binghamton.....	868	Little Falls.....	376
Buffalo.....	584	Lockport.....	600
Canandaigua.....	740	Newburgh.....	25
Carthage.....	740	New York (Canal St.).....	12
Cortland.....	1116	New York (42d St.).....	50
Corning.....	942	New York (155th St. & 10th Ave.)	164
Dunkirk.....	598	Niagara Falls (Erie Ry. Sta.)...	574
Elmira.....	863	Ogdensburg.....	248
Fredonia.....	765	Oncida.....	440

* Appalachian Club.

Cities, etc.—Continued.

	Feet.		Feet.
Owego.....	301	Saranac.....	1488
Peekskill.....	7	Saratoga.....	265
Pinehill.....	1889	Schenectady.....	246
Plattsburgh.....	119	Syracuse.....	403
Poughkeepsie (N.Y.C. Ry. Sta.)..	139	Troy.....	16
Rochester (N.Y.C. Ry. Sta.)....	508	Utica.....	410
Rome.....	445	Watertown.....	455
Salamanca..	1384	Waverly.....	836

The foregoing elevations are mainly on the authority of the Adirondack Survey and the Appalachian Club. Those of the cities are in nearly every case the altitudes of the railway stations, and have been taken from the various railway surveys. The altitude of Tahawas is variously given. Two different determinations by the Adirondack Survey give 5403 and 5334 feet; that of Professor Guyot was 5379 feet.

9. The lower of these terraces is called the Lake Ridge, and from Sodus Point nearly to Niagara River it is distinct and but little broken. It may be traced even beyond Niagara River, quite to the head of Lake Ontario, but beyond the river its continuity is greatly interrupted. Throughout its extent in New York, the ridge or terrace is a remarkable feature, being interrupted only by the channels of the streams that flow into the lake. "It bears all the marks of having been the boundary of a large lake, and of having been produced in the same manner as the beaches of the ocean. Its distance varies from three to eight miles from the lake." (HALL: *Geol. Survey.*) The terrace is by no means absolutely level; but its inequalities, except where broken by stream-beds, do not vary more than a few feet—an amount readily accounted for by surface erosion. Its width varies from a few feet to several rods. The top soil is mainly sand and coarse gravel; the lower layers are composed of silt and various kinds of shore-drift. The upper terrace is commonly known as the Mountain Ridge, and it is thought to be due to the unequal erosion or wearing of the rock where the edges of two up-turned strata—the upper being the harder—join. Falls, cascades, and dalles mark the passage of the rivers where they descend from the upper to the lower level.

10. The St. Lawrence has a varied course. Beginning in Minnesota as the St. Louis River, it flows into and fills the basin of Lake Superior. At the eastern end of this lake it overflows into the narrow channel known as the Sault de Ste. Marie, falling twenty-two feet in its course to Lake Huron. At the lower end of Lake Huron it becomes the St. Clair, and below Lake St. Clair, Detroit River. Between Lakes Huron and Erie it falls five feet. In flowing from Lake Erie to Lake Ontario it is known as Niagara River, and by the time the waters have reached the latter lake, they are 226 feet nearer the sea-level, 156 of which constitute the Falls of Niagara. From Kingston to a point fifty miles below, the river is thickly studded with islands. The archipelago is collectively called the Thousand Islands, but the number exceeds this by five hundred or more. A few of these are Canadian possessions, but most of them are included in the State of New York. Beyond the Thousand Islands the river flows with a swift current, sometimes spreading out in broad lacustrine sheets, sometimes pouring its flood through narrow passages, and again shooting down steep inclines with torrential velocity. One of these rapids, La Chine, is almost a cascade, yet so deep are the waters that passenger steamers daily pass over it without unusual danger. Freight vessels and ascending craft avoid the rapids by going through Rideau Canal. By means of this canal, and another (Welland) between Lakes Erie and Ontario, vessels from Liverpool may unload at Chicago or Duluth—commercial centres nearly fifteen hundred miles within the heart of the continent.

11. The lower part of the Hudson is bordered on its west bank by a dike of trap rock in places nearly 200 feet high. This rock, it is thought, was extended in a molten state through a vast fissure that may be traced from Rockland into northern Pennsylvania. During the Glacial epoch the surface of eastern New York was much higher than at present. The old bed of the Hudson River may be still traced a distance of more than seventy-five miles south-east of Sandy Hook. Although the Hudson has probably always flowed in the present lower channel, it seems probable that the latter was not due to surface erosion and corrasion,—which was the case in its upper course,—but was formed rather by a bending and fracture of the surface strata. During the Glacial epoch it is likely that the depres-

sion now known as the Mohawk Valley was made—arising chiefly from the erosion due to glaciers, but, in part, possibly due to a slight pre-existing depression. When in the Champlain period the land subsided below its present level, a part, at least, of the waters of Lake Ontario were discharged through the Mohawk depression into the lower Hudson.

12. A *kill* is a narrow tidal channel extending for a considerable distance into, or cutting off part of the mainland. The word is of Dutch origin, and was frequently employed in the early settlement of New York. Kill Van Kull and Arthur Kill (formerly Achtyr, *i. e.* after Kill) separate Staten Island from the mainland. Coney Island is separated from Long Island by a kill. Spuyten Duyvel is a creek flowing into the kill that separates Manhattan Island from the mainland. Along the New England coast a kill was generally called a *creek*, and the latter word is still occasionally used in this sense along the estuaries of the Maine shores.

13. North River is a wide body of water everywhere with depth sufficient to float the largest steamers. It is very rarely frozen over below Spuyten Duyvel Creek.

14. East River, on the contrary, is narrow, tortuous, and swept by swift tidal currents. At a passage which is perhaps not the narrowest, but certainly the most crooked part, it is known as the Hell-gate (a corruption of *horll gat*, or whirling strait), and has been an exceedingly dangerous passage for vessels. Some years ago, however, all of the more dangerous rocks were removed by blasting, and the channel, though narrow, is comparatively safe. A part of the waters of the rising tide entering New York Bay advance through East River; another part enters at the opposite end, from the Sound. In both instances the advancing wave acquires a swifter velocity because of the gradual narrowing of the channel, and the two waves, meeting between Blackwell's Island and Throg's Neck, result in tumultuous, swirling currents that few vessels could stem.

15. The Great Lakes, four of which are practically continuous, form the largest inland body of fresh-water in the world. Their combined area is about three times that of Aral Lake, and three-fifths that of Caspian Lake. With the possible exception of Victoria Lake, either of the three largest lakes is unsurpassed in size. Lakes

Erie and Ontario together are about the size of Lake Baikal. The following table shows the principal elements of the Great Lakes :

<i>Name.</i>	<i>Area.</i>	<i>Depth.</i>	<i>Altitude.</i>
Superior	31,500 Sq. m.	1008 ft.	600 ft.
Huron	23,100 "	702 "	578 "
Michigan	23,150 "	810 "	578 "
Erie.....	7800 "	120 "	573 "
Ontario	6900 "	734 "	247 "

—Their drainage-basin is hardly greater than twice the area of the lakes themselves, and the annual rain-fall of the basin (about thirty-six inches), less the amount lost by evaporation, represents the quantity of water discharged by the St. Lawrence River. The rim of the basin is, in most places, a low one. At Chicago, the divide between Lake Michigan and Des Plaines River, whose waters finally are poured into the Gulf of Mexico, is less than a quarter of a mile from the lake shore. It is so low that water lifted four feet from the lake runs into Des Plaines River. In Minnesota, the head-waters of Arrow River, a tributary to Lake Superior, is separated from the Arctic basin by a divide about half a mile across. During previous geological times, the basin of these lakes, and the amount of water it held, was much larger than at the present time. The five lakes were then one vast sheet of water that discharged its overflow through the St. Lawrence, the Mohawk depression, and Des Plaines River of Illinois. With the subsiding of the floods of the Champlain period, the waters, in part, disappeared. The great inland lake became the five Great Lakes, leaving a number of small basins near their margin wholly or partly filled. Calumet, Kankakee, and Horicon marshes, along the borders of Lake Michigan, are among the larger of these obliterated lake-basins.

16. Among the lakes of the Adirondack group are a few which have no outlet except at times of unusual rains. Because of the absence of soluble mineral matter in the rocks which compose their drainage-basins, their waters are fresh. In one or two of these lakes, the overflow of the basin rarely, if ever, occurs.

17. Of the lakes of the central group, Seneca is the largest and most important. Owing to its great depth, 530 feet, it never freezes, al-

though an ice-foot sometimes forms around the shores. At the upper end is Watkins Glen, a water-worn gorge, in some places about three hundred feet deep. Through this miniature Colorado cañon, the water pours in a succession of cascades and rapids. Au Sable Chasm, in the Adirondack region, is a similar example of earth-sculpture.

18. The climate of the Adirondack region is modified both by latitude and altitude, and the winters in the Northern highlands are arctic in their severity. Along the St. Lawrence, they are also very severe, for not only is the cold intense, but the region of the Great Lakes and the valley of the St. Lawrence is a very common track for storms originating in the west. The following table shows the local variation within the limits of the state :

	<i>Lat.</i>	<i>Long.</i>	<i>Eleva- tion.</i>	<i>Av. Summer Temp.</i>	<i>Av. Winter Temp.</i>	<i>Rainfall.</i>
Moriches, L. I.	40° 49'	72° 36'	0	70	34	54.7
New York City.	40° 42'	74°	100	70	31	44.6
Albany	42° 40'	74° 45'	150	68	24	41.
Rochester	43° 08'	77° 51'	525	66	24	32.6
Plattsburgh.	44° 41'	73° 25'	186	64	18	33.4
Buffalo	42° 53'	78° 55'	660	66	24	34.8

19. River floods of disastrous character are less frequent in New York than in many of the other Middle Atlantic States. The reason for this lies mainly in the fact that less of the timber and shrubbery about the head-waters of the streams, especially those heading in the Adirondack and Catskill mountains, has been cut away. By clearing away the timber and shrubbery, the water falling on the steeper slopes of a basin gathers all the more quickly into the stream-bed, and thus a flood may result after a continuous, heavy rain. A dense growth of vegetation greatly retards the accumulation of water in the stream-bed, and hence the State of New York has wisely set off much of the Adirondack region as a forest preserve, forbidding the removal of any of the timber. The disastrous floods of the Ohio River, during which the water at one time rose seventy-one feet above low-water mark, is a direct result of clearing every available stick of timber from the slopes of a river-basin. The floods

in the Susquehanna and its tributaries, and in many other rivers of Pennsylvania and Ohio, equally destructive to life and property, have arisen from the same cause.

20. Soil is formed by the disintegration of rock. The latter, by the action of moisture, air, vegetation, and chemical decay, falls to pieces and becomes pulverized. Moisture may act in several ways. When water sinks into the pores of the rock and freezes, the expansion of the water at the moment of freezing causes small pieces of rock to be chipped off the surface. Running water, carrying these along, scours off still more material. By combining with the elements of the rock, as in quicklime, water may act chemically as well, and thus break it up; or by giving off the water it holds in chemical combination, the rock may in consequence crumble. In this manner certain hard, dark-grey rocks are changed to friable, red loams. Growing vegetation, by means of its rootlets which find their way into the crevices of rock, also wedge and break off even large pieces. Soil that has never been moved from the place where it has formed is said to be *sedentary*. That which has been carried down the slopes and spread over the flood-plains of valleys by running water, is called *alluvial* (*ad*, to; *luere*, to wash), or *fluvial* (*fluvius*, a river) soil. Growing vegetation contains among its constituents phosphoric acid, potash, lime, silica (of which sand is an example), nitrogen compounds (ammonia, etc.), and water. Therefore, if the soil does not contain all these elements it is not fertile. If there be no phosphoric acid compounds, the seed will not mature and reproduce. If the potash be absent, neither the stalk nor the seed will be plump. If there be insufficient nitrogenous matter, the plant will be small and sickly; and if the silica is absent, the stalk may not be stiff enough to stand upright. But water, the blood of the plant, is the most essential element, and every plant contains from three-fourths to nine-tenths of it.

21. The extermination of animals is brought about in several ways. By cutting down the forests, animals whose natural habitat, or dwelling-place, is in forests will migrate to regions where the forests have not been removed. Animals which prey upon the property of the farmer are systematically destroyed, in order to protect the more helpless domestic kinds. But by far the most potent agent

is the army of hunters, who commit the most wanton destruction merely for the pleasure of killing.

22. The United States Fish Commission was established for the purpose of restocking rivers, lakes, and certain littoral waters in which food-fish had been exterminated, and also for stocking the waters with foreign varieties. Hatcheries have been constructed at various localities, where the spawn is hatched and the young fry reared until they are able to take care of themselves. There is an extensive hatchery at Wood's Holl, Massachusetts. Several valuable species of food-fish have been recently acclimated in the waters of the state.

23. For the better preservation of the forests of the state, all the state lands in the counties of Clinton (excepting certain lands in Altona and Dannemora), Essex, Franklin, Fulton, Greene, Hamilton, Herkimer, Lewis, St. Lawrence, Saratoga, Sullivan, Ulster, Warren, and Washington are reserved from sale. These lands constitute the "Forest Preserve" of the state, and the cutting of timber within their limits is forbidden.

24. "Granite is found in the Adirondack region and along the Hudson; white marble, in Westchester and St. Lawrence counties; roofing-slate, in Washington County; red marble, in Orange County; black marble, at Glen's Falls; verde-antique, at Moriah and Thurman. Sandstone occurs at Potsdam and at Medina; shell-limestone, at Lockport-on-the-Hudson; excellent flagging, from Kingston; and paving-stone, from the trap-rock of the Palisades. Hydraulic cement occurs at Rondout, Manlius, and Akron; and gypsum is found in Onondaga County."—*Newberry*.

25. In some instances the salt is obtained from natural brines, but in most cases an artesian well is driven, the latter being piped from the surface to the salt-beds, which vary from a few hundred to nearly two thousand feet in depth. A pipe of smaller dimensions is then introduced into the well, leaving an annular space between the latter and the casing of the well. Water is forced into the well through the annular space, and allowed to remain in contact with the salt until it is saturated. It is then brought to the surface through the inner pipe. The magnesium salts are first precipitated by adding a small amount of quick-lime, and the water is then evaporated, leaving the salt in coarse crystals. In York, Livingston County, how-

ever, the salt is mined, a shaft having been sunk upon the beds. In 1890, the estimated yield of salt was 20,000,000 bushels.

26. The medicinal properties of these springs are due to the salts of the "alkaline" metals,—sodium, magnesium, calcium, and lithium,—which their waters hold in solution. In many of them is an abundance of carbon dioxide (carbonic acid gas), to which the palatable qualities of the waters are owing. The Sharon springs are "sulphur" springs. Mineral springs obtain their characteristic properties by dissolving the salts from the rocks through which the water percolates. All natural waters contain more or less of mineral salts, but when the salts are in such proportion as to impart a perceptible taste to the water, the latter is called "mineral water."

27. Of the various departments, the judiciary ranks the highest. It can declare inoperative any law not in accord with the Constitution, and it can release from confinement any prisoner who has not had a legal trial. It can also prevent the Governor, or any other executive officer, from doing an illegal act. The Constitution is the supreme law of the state, and all statutory laws and executive acts must be in accordance with its provisions, otherwise they are null and void. The powers of the different branches, however, are not very strictly drawn. The Governor of the state can pardon a criminal—a judicial function; a judge can order the arrest of a citizen—an executive function; the Legislature may decide upon the legality of the election of its own members—a judicial act.

28. When the Governor, or certain other officers, is charged with misdemeanor in office, he is tried before the Court of Impeachment. This tribunal consists of the Senators and Justices of the Court of Appeals. The penalty inflicted by this court cannot extend beyond removal from office, but the offending officer may be tried before the proper court for any misdemeanor or crime against the law.

29. It is well to bear in mind that it is the jury and not the judge which tries a prisoner charged with crime. The Constitution of the United States guarantees every prisoner the right to a trial before a jury of his peers, and no state nor statutory law can deprive him of this right. In municipal police-courts, however, the prisoner usually waives the right to jury trial.

30. The State Normal Schools are located at Albany, Brockport,

Buffalo, Cortland, Fredonia, Geneseo, New Paltz, Oswego, Onconta, Plattsburgh, and Potsdam. There is a Normal College for Women at New York City, and schools for deaf-mutes at Buffalo, Malone, Rochester, and New York City, three being in the latter place.

31. The Board of Regents of the University of the State of New York consists of nineteen members, chosen by the Legislature and the Governor, Lieutenant-Governor, Secretary of State, and Superintendent of Public Instruction, *ex-officio*. All, except the last four, are elected for life. The Board charters all colleges and institutions that confer degrees upon their graduates, and exercises supervision over all educational institutions supported wholly or in part by the state. It also carries on a system of examinations in secondary and higher studies, awarding diplomas of proficiency and certificates of fitness to enter college.

32. The following are the principal institutions for higher and professional education :

Alfred University.....	Alfred.
American Museum of Natural History.....	New York.
Bellevue Medical College.....	"
Brooklyn Collegiate and Polytechnic Institute.....	Brooklyn.
Canisius College.....	Buffalo.
College of the City of New York.....	New York.
College of Dentistry.....	"
College of St. Francis Xavier.....	"
Columbia College.....	"
Cooper Institute.....	"
Cornell University (for men and women).....	Ithaca.
Drew Seminary and Female College.....	Carmel.
Elmira Female College.....	Elmira.
Hamilton College.....	Clinton.
Hobart College.....	Geneva.
Ingham University.....	Leroy.
Manhattan College.....	New York.
National Academy of Design.....	"
St. John's College.....	"
St. Joseph's College.....	Buffalo.
St. Lawrence University.....	Canton
St. Stephen's College.....	Anandale.
Syracuse University.....	Syracuse.
Union College.....	Schenectady.
University of City of New York.....	New York.
University of Rochester.....	Rochester.
Vassar College (for women).....	Poughkeepsie.
Wells College.....	Aurora.

33. The surface of the state is too rugged and the land too valuable for grain-farming on an extensive scale. In grain-farming, the cost of harvesting the crop is one of the chief items of expense; and where the land is not level, it is materially greater, because it is difficult, or perhaps impossible, to move the heavy grain-cutting machinery over hilly land. On the level prairie land of Illinois, and in the Sacramento Valley, the headers for cutting the grain in some instances clear a swath from twenty to thirty feet in width. The use of such machinery would be impossible on rugged land. Besides, in New York the land is more valuable per acre than in the Mississippi Valley, and must therefore be made to produce an increased value of product; and this can only be accomplished by a more careful cultivation than is needed in grain-growing regions. This, together with a dense population, has resulted in small farms and variety of product.

34. In no other state in the Union is so much attention paid to improved breeds of cattle. As a result, New York not only surpasses every other state in the value of dairy products, but the quality is not excelled in any other part of the world.

35. The character of the manufactured product differs materially from that of the New England States. In the latter, light machinery, jewelry, fancy articles, and textile fabrics are the principal articles. In New York, clothing, food-stuffs, heavy machinery, etc., are the main items. Among the special industries for which New York is noted are book-publishing, piano-making, diamond-cutting, map-, steel-, and wood-engraving, and art-printing.

36. The menhaden is an oily fish, having a rank taste that renders it unpalatable as a food. On account of the nitrogenous matter (ammonium compounds), and phosphate of lime it contains, it makes the very best fertilizer for worn-out land. The oyster-beds are confined mainly to Long Island Sound; the fisheries for whitefish at the eastern end of Lake Ontario, and the shad-fisheries to the lower part of Hudson River.

37. In 1885, the iron-ore product of New York was surpassed by that of Michigan and Pennsylvania, and possibly by that of Alabama.

38. The commercial prosperity of New York is due partly to its protected harbors,—New York Upper Bay, North River, and East

River,—but quite as much to the existence of the depression known as the Mohawk Valley. Up to the time of the Revolution, its population was only 22,000, and it ranked below Philadelphia and Boston. The completion of the Erie Canal was the beginning of an era of prosperity. Prior to that time, ships bringing cargoes to American ports usually returned in ballast. After the completion of the canal, instead of returning in ballast they could reload with cargoes. Thus, New York became a port of export as well as import. But the canal would not have been constructed except for the low pass of the Mohawk Valley. This shows what a wonderful effect an apparently trivial physiographic condition may exert upon human history. The commerce of Boston, owing to the energy of her business-men, has not fallen below second or third place in rank of value; that of Philadelphia has declined to fifth or sixth place, and is still falling away.

39. Custom-houses have been established at or near Buffalo, Cape Vincent, Plattsburgh, Dunkirk, Rochester, New York City, Suspension Bridge, Ogdensburgh, Oswego, and Sag Harbor.

40. The following are some of the principal lines of ocean steamers:

Cunard.....	New York and Liverpool.
Inman.....	“ “ “
White Star.....	“ “ “
Guion.....	“ “ “
National.....	“ “ “ and London.
Anchor.....	“ “ Glasgow.
Red Star.....	“ “ Antwerp.
Nord Deutsches Lloyd.....	“ “ Southampton and Bremen.
Compagnie General Transatlantique..	“ “ Havre.
Hamburg American.....	“ “ Southampton and Hamburg.
Thingvalla.....	“ “ Copenhagen.
Pacific Mail.....	“ “ San Francisco.
Red “ D ”.....	“ “ South American Ports.
Mallory	“ “ New Orleans.

There are also lines to Philadelphia, Boston, Portland, Baltimore, Savannah, Galveston, and various ports in the West Indies.

41. Excepting the New York Central, the Erie, and the Delaware, Lackawanna and Western, the trunk lines have scarcely a mile of track in the state. Their termini are practically at Jersey City, and their New York connections are made by ferry across North River.

The same is true of the Philadelphia and Reading, the Central of New Jersey, and the various railways between New York City and the New England States.

42. The following list includes other important railways having their terminal stations in New York or at Jersey City :

Adirondack.	New York, Ontario and Western.
Albany and Susquehanna.	New York and Sea Beach.
Boston, Hoosac Tunnel, and Western.	New York City and Northern.
Brooklyn, Bath, and Coney Island.	New York, Woodhaven and Rockaway.
Buffalo and South-western.	Ogdensburgh and Lake Champlain.
Buffalo, New York, and Philadelphia.	Poughkeepsie, Hartford, and Boston.
Delaware, Lackawanna, and Western.	Rensselaer and Saratoga.
Delaware and Hudson Canal Co.	Rochester and Pittsburgh.
Lake Ontario Southern.	Rhinebeck and Connecticut.
Long Island.	Rome, Watertown, and Ogdensburgh.
Newburgh, Dutchess, and Connecticut.	Southern Central.
New York Elevated.	Syracuse, Chenango, and New York.
New York and New England.	Troy and Boston.
New York and Canada.	Ulster and Delaware.
New York, New Haven, and Hartford.	Utica and Black River.
New York and Brighton Beach.	West Shore.
New York and Harlem.	

43. It is by no means certain by whom or at what time New York Bay was *discovered*. Among others, it is asserted that Verrazano entered it in the ship *Dauphine*, in 1524. It is not improbable that Lief Eriksen may have visited it five hundred years previous to that time. There is no question of doubt, however, concerning Hudson's voyage and discovery of the river. The latter he named North River, to distinguish it from the Delaware, which he called South River. This river was afterward called Mauritius by the Dutch; by the Indians it bore the name of Mahiccannic, the "Stream from the Mountains." East River, it is thought, was discovered by Adrian Block, a Dutch sailor. His vessel was probably the first to force the passage of the Hellgate.

44. The Dutch were prosperous colonists, and their policy was a wise one. In order to encourage permanent settlements, the Dutch West India Company offered a grant of land of indefinite width sixteen miles along the shore of any navigable stream, or four miles along both shores, to any one who should establish a colony of fifty or more persons within four years. Such grantees were called

Patroons. The Patroon was to be absolute "lord of the manor," and his colony was to serve him for ten years. Every manorial servant was exempt from taxation during the period of his service. The colonists were permitted almost every privilege they wished, but they were forbidden to manufacture cloth, this being the perquisite of the company. The Patroons soon became a troublesome landed aristocracy, and their obstinacy and overbearing conduct added no little to the desire of the people to shake off Dutch rule. Traces of their customs exist among their descendants in New York City even to the present day.

45. The claim to the right of soil by virtue of Cabot's discoveries was a flimsy pretext to obtain the control of the Dutch possessions. The immediate excuse was a charge of smuggling; the real animus was the loss to English merchants of trade which had accrued to the more thrifty Dutch traders. A treaty with the Dutch, ten years before English occupation, had recognized their right and title to the region. The charter given by Henry VII. permitted "John and his sons to explore any seas with five ships, at their own expense, and occupy any isles or countries of the heathen or infidel before unknown to Christians, accounting to the king for a fifth part of the profits." There is no evidence that the Cabots ever availed themselves of this charter, or, in fact, that the elder Cabot ever made a voyage to the New World. Sebastian Cabot made his first voyage after the death of his father. He discovered the island to which, on his return from a voyage along the Labrador coast, he named New Found Land. It seems certain, too, that he coasted along the shores of Maine.

46. Robert Fulton, the owner and builder of the *Clermont*, the first steamboat that plied upon the Hudson, was not the originator of steam navigation. In 1784 James Rumsey built a steamboat that was successfully tried on the Potomac River. A few years later John Fitch, a citizen of Connecticut, received a patent for a boat to be propelled by steam. A company was formed, and a steam packet-boat built, which made regular trips until the failure of the company in 1790. About that time, John Stevens built a boat, which derived its power from a tubular boiler and a screw propeller. In 1803 a steam vessel was used in one of the estuaries of Scotland. The

Clermont was built in 1809, and was a better and more successful boat than any of her predecessors. In 1817, while the possibilities of steam navigation of the ocean were discussed, a learned savant wrote a pamphlet to prove that such an undertaking was impossible of success. During that year a package of these pamphlets was taken to England by the *Savannah*, the first steamship that ever crossed the ocean.

47. Because of its geographical environments, New York can grow practically in one direction only—up in the air. The long and narrow island has, therefore, become the most densely populated area in the world. For this reason, business blocks in the “down-town” part of the city are frequently built eight, ten, and twelve stories high, and the “up-town” residences are too often flats, apartment, and tenement houses, where perhaps a hundred or more people may dwell under one roof. Notwithstanding the elevated and the numerous street-railways, the task of carrying the people between their homes and business-places, in a reasonable length of time, has become almost a physical impossibility. Broadway, the principal street of the city, is about twelve miles long. Fourth, Fifth, Madison, and Lexington avenues, and the cross-town streets from Fourteenth to Central Park, are the principal residence streets. Wall and Pine streets are the financial heart of the city. Washington Heights, a beautiful suburb, contains some of the finest residences. It is a high ridge overlooking the Hudson River.

48. Brooklyn Bridge, one of the most wonderful illustrations of engineering skill in the world, is about 6000 feet long. It is suspended from two massive towers, each 278 feet high, the whole structure hanging in mid-air from four huge cables, each sixteen inches in diameter, and each made up of nineteen smaller cables. The ends of the cables are anchored in the solid masonry approaches leading to the suspended part of the bridge. The cables excepted, the suspended portion of the bridge is in two sections, which meet in the centre. The ends of the sections are not joined solidly, but slip upon a number of huge bolts. The reason for this is the great amount of expansion and contraction of the iron-work with the varying temperature between summer and winter. This ordinarily amounts to about eleven inches. The bridge affords passage-way

for a double-track cable-railway, and also a double passage-way for carriages. Over the railway track is a broad promenade for foot-passengers. At the spring of the arch, the bridge is 135 feet above the surface of the water, so that the largest vessels can pass under it. The traffic between the two cities has grown to such proportions that the bridge is insufficient for the wants of travel, and another one is in contemplation. A tunnel is in progress under North River, to connect New York with Jersey City.

49. These basins are artificial harbors, constructed for the convenience of shipping. Most of the boats belonging to the extensive system of canals are brought to these basins, where their cargoes are transferred to sea-going vessels. Among other enterprises belonging to Brooklyn is the Simpson Dry-dock, recently completed. This dry-dock is one of the largest in the world, and is designed for the mammoth ocean steamships which are now used between New York and European ports. The dry-dock is intended to facilitate the repair of damages to the hulls of vessels. The vessel is floated into the dock, and the water is then pumped out of the latter, thereby leaving free access to any part of the vessel's outer hull.

50. Brooklyn is largely a place of residence for business-men of New York, and the completion of the bridge and the elevated roads have greatly added to this class of population. Within the past few years considerable additional territory has been annexed to the municipality, so that now its area includes about one-half of Kings County.

50. The elevator consists of a storehouse and the necessary machinery for transferring grain. The latter is essentially a wide belt, armed with large scoops, stretched upon rapidly-revolving wheels, the whole being enclosed in a chute. The latter is attached to the warehouse building in such a manner that one end can be lowered into the hold of the vessel. The machinery is then set in motion, and the scoops quickly transfer the grain from the vessel to the bins of the warehouse.

51. The Genesee River is navigable for small craft to the northern end of the city, below the falls, but the difficulties of navigation are so great as to preclude any commercial advantages therefrom. Among the other large cities not on navigable waters are Minne-

apolis, Minn. (pop. 200,000), above the Falls of St. Anthony ; Los Angeles, Cal. (pop. 95,000) ; and Indianapolis, Ind. (pop. 90,000). The river at Rochester makes three vertical falls of 96, 24, and 84 feet.

52. The salt springs were first brought to notice by Jesuit missionaries in 1654, and for more than fifty years afterward salt was manufactured under their direction, by Indians. The wells are now partly under control of the state. Syracuse was first named Bogardus Corners. Its name was subsequently changed several times ; in 1824, to the present name. Since that time, the city has absorbed several suburban villages.

53. For many years Utica was the residence of the late Roscoe Conkling.

54. Auburn was the residence of William H. Seward, statesman, and Secretary of State under President Lincoln.





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