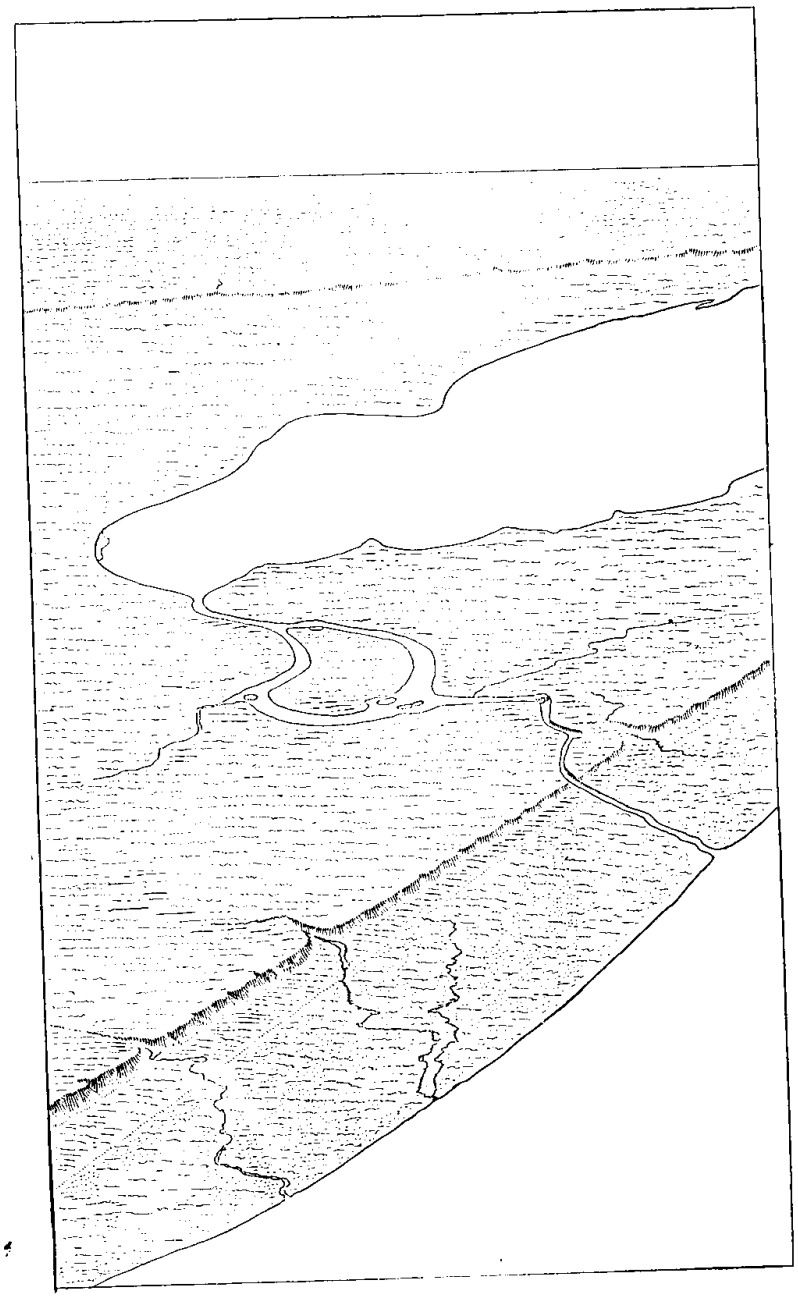

Bird's-eye view of Niagara River.

The Geology of Niagara Falls

BY

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THE effect of the more majestic spectacles of nature is to turn the mind of the observer away from the philosophy of the events which he is observing. This is a natural and wholesome action of all splendid things; he is indeed happy who flies at once to speculation as to the cause of that which he for the first time freely beholds. There is, however, a second stage in the service which the great spectacles of the earth can do for us. This is where we seek to understand the ways in which the offering is made to our souls. The well-trained naturalist, indeed any one who is attentive to the æsthetic as well as the rational opportunities of the world, learns in a manner to combine these impressions which may come to him by instinctive appreciation and by knowledge. To him the beautiful and the magnificent are none the less moving because he sees them in the perspective of history, or in the great assemblage of causations. It is the fairest province of science to afford these accessories of understanding so that the beauty of nature may make a deeper impression upon the mind of man.

Its work should in no wise diminish our perception or esteem of the beautiful; it should in fact unite these motives with our ordinary thought. Therefore it seems fit that we should consider the lessons which may be derived from a study of this great water-fall.

The first step towards the comprehension of any such feature as Niagara Falls should lead the student to an understanding of a general kind as to the range of the phenomena with which it is allied. We will therefore begin our inquiry by a brief consideration as to the various kinds of water-falls, and the conditions which produce them. It is easy to recognize the truth that all streams tend to form continuous and uninterrupted slopes down which their waters course from the highlands to the sea. It is to this principle, indeed, that we owe the fact that nearly all great rivers are freely navigable, and the most of the lesser are, for the greater part of their length, fit for small boats. Wherever we find a river in the tumult of a water-fall or of a cascade we readily note that it is steadfastly engaged in destroying the obstruction, and that given geologic time enough it will wear a channel down which its waters may glide quietly to the deep whence they came, and to which they inevitably return. If a new continent should be elevated, and rivers formed upon it, they would quickly develop a host of water-falls. If the continent were high, it would be a land of cascades. Gradually, as the land became older, these

barriers in the way of the descending water would be worn away. With the formation of each mountain system, however, or with the occurrence of other accidents, such as those which are brought about by a glacial period, the paths of the streams would be disturbed, and the rivers would once again have to contend with obstructions which they seek to remove. Philosophical geographers now recognize the fact that the presence of water-falls in a country means that the topography is, in a geological sense, new; that the region has either recently been uplifted from the sea, or has, not long ago, undergone considerable revolutions, which have changed the shape of its surface.

Among the many different conditions which produce cataracts, we may note the following groups, which include the greater part of these accidents: In mountain districts small streams gathered in the table-lands or upland valleys often encounter a precipice down which they find their way in successive leaps. The cliffs over which they tumble are not, as is the case at Niagara, the product of the stream's action, but have generally been formed by a fault or a break in the rocks, the strata on one side of the disruption having been lifted so that a wall-like escarpement is created. In other cases the valley has been deeply carved by a stream of fluid or of frozen water, a river or a glacier. Water-falls of this nature, though rarely of great volume, afford the most beautiful and highest cascades in

the world. Those of the Yosemite Valley, or of Lauterbrunnen, in Switzerland, are excellent examples of this kind.

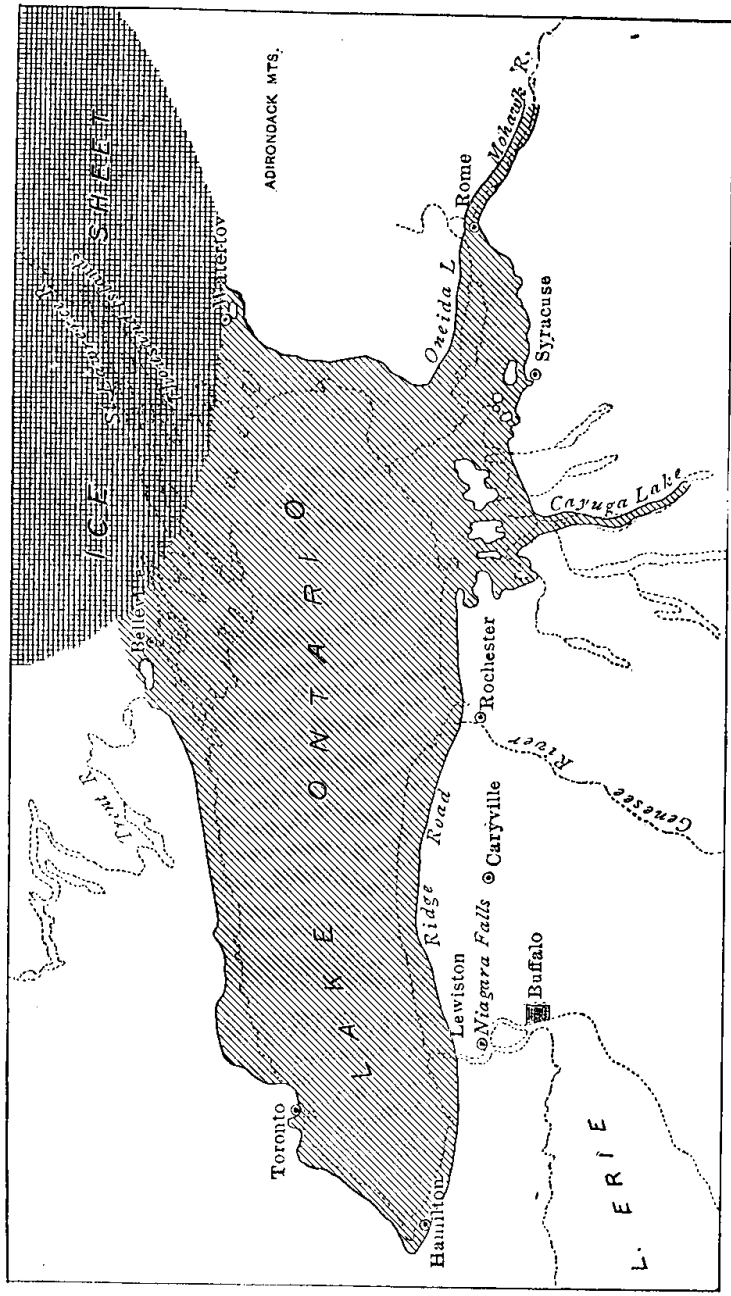
Wherever a stream, be it small or great, encounters in its course conditions in which it passes from a hard to a soft rock, or rather we should say from strata which it does not easily attack to other deposits which are readily worn away, the change is commonly marked by a rapid or water-fall. This alteration may be due to any one of many causes. Commonly it is brought about by a dike, or fissure filled with volcanic rock, which lies across the channel of the river. In our limestone rocks an ancient coral reef, buried in the strata, may produce a considerable cascade. The Falls of the Ohio at Louisville are due to the fact that such an ancient reef lies athwart the path of that river.

Along the seashore wherever the waves have carved, as they often do, an overhanging steep, the streams, which may originally have flowed down gently declining beds, tumble over precipices, sometimes falling, as on the north shore of the Island of Anticosti, directly into the ocean. In all such cases we may assume that the cliffs have been driven backward into the land by the effect of the surges.

By far the commonest origin of water-falls is to be found where horizontal stratified rocks arranged in alternating beds of hard and soft character are flowed over by a considerable stream. In these conditions

the bed of the river is apt to lie on one of the hard layers upon which it courses until it cuts the layer through; then encountering the underlying soft materials it quickly wears them away down to the level of the next resisting stratum, where the process is repeated, forming, it may be, a dozen steps of descent in the course of a few miles. Each of the "treads" of such a stairway is apt to be many times as wide as the fall is high; but where the river has a great volume the down rush of water is apt to break up the lower-lying harder layers so that one great fall is produced. The reader will do well to see the beautiful system of step cascades known as Trenton Falls, where West Canada Creek descends from the highland about its source through a beautiful gorge of its own carving in many successive leaps.

The foregoing brief story concerning the natural history of water-falls has led us to the point where we may begin our inquiries concerning the genesis of Niagara. This fall belongs to the last-mentioned group of cascades, that in which the course of the river is determined in a great measure by the diverse resistance which horizontically-bedded rocks opposed to the wearing action of the water. In order, however, to face the many interesting questions which this river and fall present to the naturalist, we must ask the reader at the outset to obtain a clear idea as to the conditions of the valley of the stream from the point where it leaves



Map of Lake Iroquois.

EXPLANATION.—Modern hydrography in dotted lines. Ancient lake area shaded. Ice sheet cross-shaded.

Lake Erie to that where it enters Lake Ontario. The ideal way to obtain this impression would be to view the country from the sumit of a tower having a height of five hundred feet or more, standing at a point near the present line of the falls. It is indeed most desirable from the point of view of the teacher, as well as others who love wide views, that such a "coin of vantage" should be constructed. In passing, we may remark that such an outlook would enable the observer to command the whole field of nearly level country from lake to lake. The student would thus be able to perceive directly what he can only otherwise infer from the maps and bird's eye views. Using, however, these last named means of illustration, we readily observe the following facts concerning the course of Niagara River. We follow the prevailing fashion in terming this stream a river. It is, in fact, a mere strait connecting two fresh water seas, the one lying about three hundred feet above the other.

Near its point of exit from Lake Erie the stream passes over a low uplift of the strata which somewhat interrupts its flow. A little way on in its path the tide is divided, enclosing a large island and some smaller isles. Its movement is slow, and in general the condition of the stream and its banks remind one of the lower parts of a great river where it is about to enter the sea. The striking feature is, that from Lake Erie to Goat Island the stream has no distinct valley. It

has evidently done none of that downward carving which is so conspicuous a feature in the work of all ordinary rivers where they flow at a considerable height above the ocean's level. In part this absence of a valley is to be accounted for by the absolute purity of the water. Ordinary rivers bear much sediment, the coarser parts of which are driven along the bottom continuously, though slightly wearing the bed-rock away as they rub over it; but in the Niagara all these sediments which the streams bring from the uplands are deposited in the chain of the great lakes.

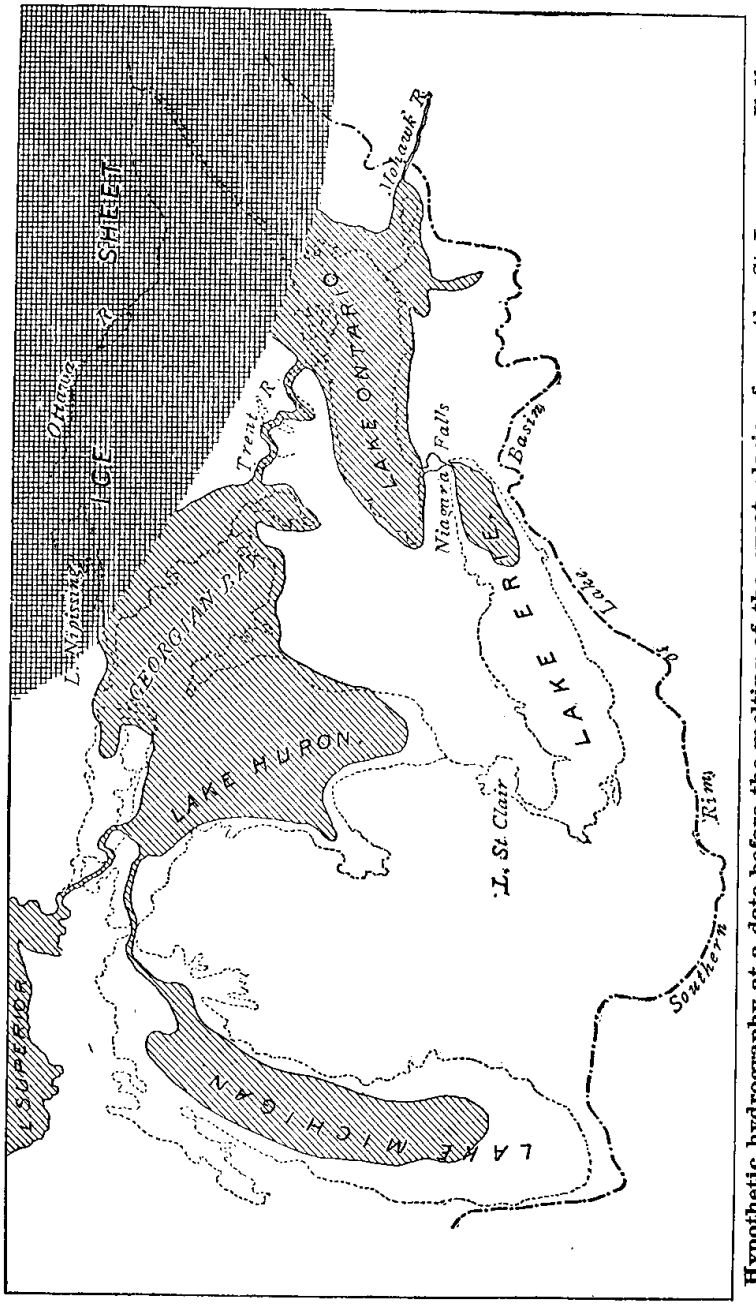
At Goat Island the conditions are suddenly changed. In the rapids and in the main falls the river descends about two hundred feet into a deep gorge, through which it flows as far as Lewiston in a more or less tumultuous manner. At this point the channel passes through the escarpement which borders the southern margin of Lake Ontario. Here it ceases to flow as rapidly as before, the tide of waters finding ample room in the deep channel for a leisurely journey to the lower lake.

The gorge of the Niagara, though deep, is very narrow: to the eye of the trained observer it appears almost as unlike an ordinary river valley as is the path of the stream above the cataract. Everywhere the walls are steep; there is no trace of the alluvial plain which normally borders great rivers; nor do we find the slope of country towards the edge of the cliff which is

so characteristic of ordinary valleys. This depression, indeed, is a true cañon, a trough carved by a main stream without any coincident work of erosion effected by the rain, frost and water-courses operating on either side of its path. These features have led geologists, as they well may lead any intelligent observer, to the conclusion that the Niagara River is from beginning to end a new-made stream; a watercourse which originated not as most of our American rivers have in remote ages, but in the geological yesterday. The reason for this sudden coming into existence of the Niagara, the steps which led to its invention, are now undergoing a very careful discussion through the labors of several able geologists.* Although there is much which is still doubtful concerning the history of this singular stream, a great deal of interest has been well ascertained. The outlines of this matter we will now endeavor to set before the reader.

In endeavoring to comprehend the history of Niagara, it is necessary to take account of the singular conditions presented by the great valley in which it lies. The St. Lawrence is on some accounts the most curious of all the great vales which geographers have had an opportunity to study. The most of the river-

*The literature concerning the problems of the Niagara River is abundant, but widely scattered. The ablest single contribution to the subject is by Mr. G. K. Gilbert, Geologist, U. S. Geological survey. It is contained in the sixth annual report of the Commissioners of the State reservation at Niagara, for the year 1889.—Albany, James B. Lyon, Printer, 1890. References to various other treatises on the subject may be found in the foot-note of that paper.



Hypothetic hydrography at a date before the melting of the great glacier from the St. Lawrence Valley.

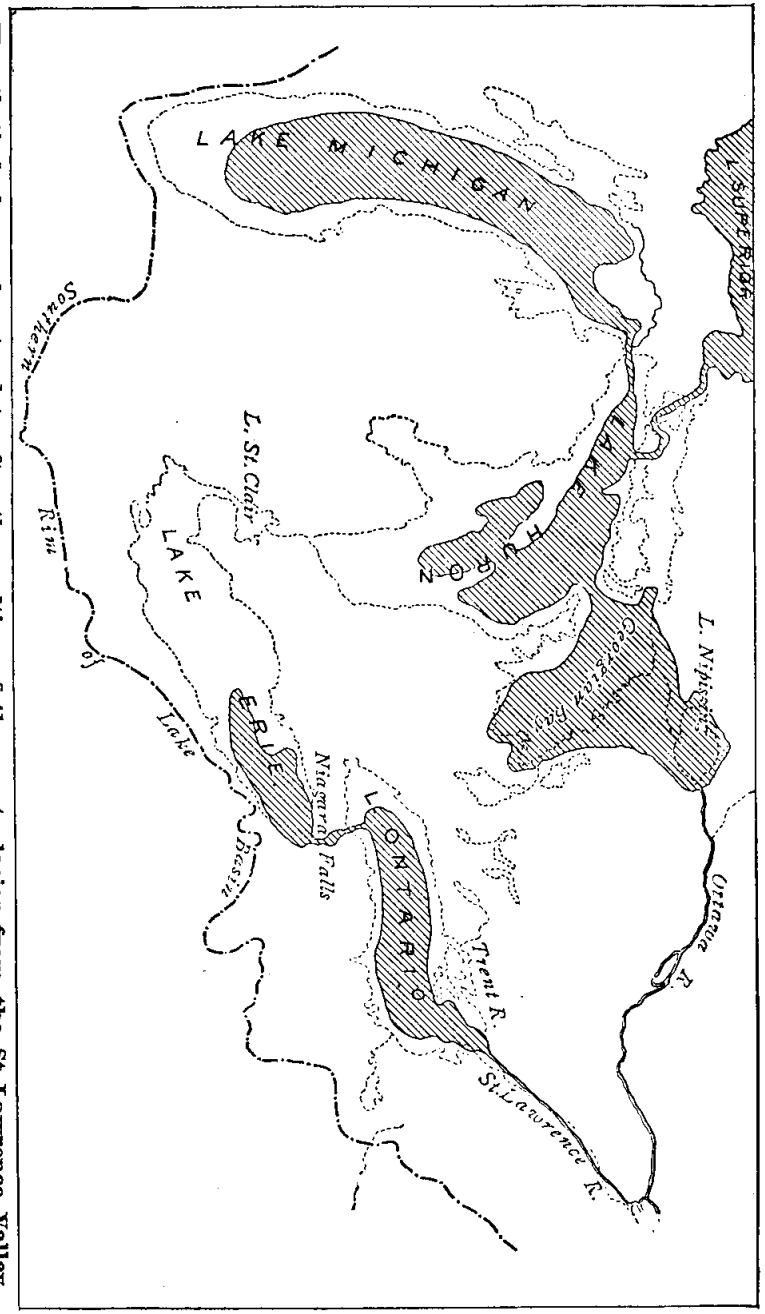
EXPLANATION.—Water-parting in heavy broken line. Modern hydrography in light broken lines. Ancient rivers in full lines. Ancient lakes shaded. Ice sheet cross-shaded.

basins in the world have their boundaries defined by a considerable elevation. If, here and there, they have a low side over which we may pass to a neighboring valley without traversing a decided water-shed, the partial breach of the boundaries is very limited in its length. In the St. Lawrence valley, however, from the lower end of Lake Ontario to the mouth of Lake Superior the basin is on its southern side but ill-defined.

The low, broad ridge which separates the drainage from that of the streams which flow into the Hudson, or into the Mississippi, is frequently breached by depressions through which the waters belonging to the Great Lakes system may readily be discharged whenever their elevation is considerably altered, or when by chance a barrier is interposed to their exit through the Gulf of St. Lawrence. Accidents of this description have been probably of frequent occurrence, so that from time to time the geographical relations of these waters have been greatly changed.

The Great Lakes of the St. Lawrence valley were probably in existence before the last glacial period, though they were doubtless extended and somewhat modified in form by the wearing of the rocks which occurred in that wonderful age. With the beginning of the glacial period the ice-sheet of eastern North America, which is now limited to Greenland, rapidly extended its bounds over the land to the northward of the Great Lakes. It soon filled their basins, and ex-

tended southward until its margin attained the Ohio River where Cincinnati now stands, and lay over the head-waters of all the valleys of the streams which pour from the South into the Great Lakes. It is easy to see that such an ice-sheet having the depth of a mile or more would profoundly disturb the drainage of these rivers. In its advance it would first create a dam across the waters of the St. Lawrence River, compelling the lakes to rise until they discharged through some of the low places on their southern boundary ; next it must have filled their basins with ice, and deepened the sheet until its surface lay thousands of feet above their floor. We cannot trace the history of these alterations which the advance of the glacial envelope brought upon this field of land and water. But the steps in the alterations may be inferred from what happened when the envelope retreated stage by stage until it vanished from the continent, or at least from the part of the field with which we are concerned. For a time the barrier lay in such a position that the waters of the Lakes below Superior were barred out from the passage of Niagara, flowing over into the valley of the Ohio through a channel passing by the site of the City of Fort Wayne, and thence into the Wabash River. This old waterway has been preserved with unmistakable clearness. With the further retreat of the ice-front to the northeastward, the line of the barrier was withdrawn to near the present mouth of Lake



Hypothetic hydrography at a date after the melting of the great glacier from the St. Lawrence Valley.

EXPLANATION.—Water-parting in heavy broken line. Modern hydrography in light broken lines. Ancient rivers in full lines. Ancient lakes shaded.

Ontario, where it flows into the St. Lawrence River. At this time the level of the Great Lakes was lowered by successive stages, though on the whole rather suddenly, to the amount of five hundred and fifty feet.

With the last mentioned condition of the ice barrier the exit of the Great Lakes changed to a path which led through Central New York, down the valley of the Mohawk River. The channel still shows the marks of the great tide of water, probably as great in its volume as that which now passes Niagara Falls. Those who journey by the New York Central Railway to and from Albany, may note at Little Falls the broad gorge of the sometime great river which is now occupied by a relatively small stream. It might be supposed that at this stage the observer would have found the Niagara river flowing in somewhere near its present position. But here comes in one of the extraordinary accidents of that period of geographic wonders, the great Ice Age. When the ice lay over the country to the north of the Great Lakes, the part of the continent which it occupied appears to have been borne down by the weight of the mass in such a manner that it sloped to the northward at the rate of two or three feet to the mile. The result was that the basin of Lake Erie was to a great extent dry, and that of Lake Huron did not connect across to the southward through Lake St. Clair, but through Georgian Bay, and thence by a channel occupying the site of the

Trent River to the northern part of Lake Ontario. At a yet later stage, when the ice barrier was still further withdrawn, so that the channel of the St. Lawrence was open, another channel was found by way of the Ottawa River, so that the upper lakes no longer emptied by way of Lake Ontario.

After the ice passed completely away from this part of the country, the land recovered from its southward down-tilting, Lake Erie regained its waters, and the tide from Lakes Michigan and Huron began to flow, as at present, by way of the Detroit River and Lake St. Clair. This was probably the age when the present Niagara River came into existence. We have already noted the fact that as a whole the valley of the Niagara, both above and below the falls, appears to be a piece of stream-carving done in very modern times. Although it doubtless antedates the earliest chapters of human history of which we have any written records, it almost certainly is newer than the records of man which we find written in certain ancient art remains, such as those which were found with the Calaveras skull in California. The stream may have begun its work not more than ten thousand years ago. It appears, however, that there was a pre-glacial Niagara.

If the reader will go to the cliff which borders the lowland along the lake, a precipice carved at some period when Lake Ontario was higher than at present, and walk westward from the river, he will observe that at

the town of St. David's, a few miles west of Queenston, the cliffs turn inland in a way which indicates that here of old was a valley through which a great river found its way to the lake. Going southward to the site of the whirlpool we find there a point where, and where alone, the steep rocky walls of the Niagara cañon fail, and their place is taken by heaps of drift material, evidently brought to its present site by the ice of the glacial time which here, as in many other regions, filled the pre-glacial valleys with detritus. In the opinion of those who have most attentively studied the problem, there was an old Niagara River extending a part of its channel from St. David's to the whirlpool, and probably from that point along much the same line as the present stream toward the existing falls. It is possible, however, that this old channel may have bent away to the west from the whirlpool, and attained Lake Erie at some unknown point. If the old channel entered the present Niagara gorge at the pool we have to assume that when the stream, long dispossessed by the glacier, was permitted again to flow, it found the channel to St. David's so completely filled that it was easier to plunge over the Queenston bluff at a new point, and thence in the retreat of the falls to carve the cañon back to its present site. It may be that a part of the channel above the enlargement at the whirlpool was also carved in the old pre-glacial days, filled in with glacial waste, and afterwards swept clear of the obstruction by the mighty stream.

To the reader who has paid no attention to the geographic changes which were produced in the last ice time, such alterations in the path of a river may seem most improbable. The geologist, however, knows that these have been among the commoner incidents in this chapter of the earth's history. Hardly any of the considerable streams which existed within the glaciated field before the advent of the ice escaped such perturbation. We could in an *a priore* way predict that a stream lying in the position of the Niagara River, where the amount of glacial waste deposited on the surface was very great, would be so far effaced by detritus that when the tide again began to flow, a portion at least of its channel would depart from its primitive position. In fact, among the many detailed inquiries which the geologist has a chance to make in the old glacial fields there are few which are more interesting and, indeed, more perplexing than these which concern the relation of the ancient and existing river valleys.

From this general and rather wide consideration of the Niagara problem, which has brought us in face of some of the majestic actions of the past, we may now profitably turn to the detailed phenomena exhibited in the Falls and in the gorge between them and Queenston. The student will do well to begin these inquiries by a journey to the Cave of the Winds, where, penetrating behind a thin strip of the falling water, he can see something of the condition of the steep over

which the cataract plunges. He should also observe the rocks in the faces of the cliffs below the Falls. He will readily note the fact that the top of the precipice is occupied by a somewhat massive limestone. This rock is, it is true, divided by joints into large blocks, but these are hard, and are not much worn by the clean water which at the margin of the escarpment shoots clear of their face in the manner shown by the diagram. Below this limestone, which is extensively developed in New York and in the adjacent parts of the continent, and which most properly bears the name of "Niagara Limestone," there is a less considerable thickness of thin-layered shaley beds known as the "Niagara Shale." Yet below lie beds of the Clinton Age, composed of somewhat coherent limestone shales sandstones. . At the base of the section of the Falls and steep, occupying more than half of its height, are the beds of the Medina formation, mostly made up of rather frail sandstones and thin reddish shaley layers. From what the reader can see in the Cave of the Winds, and what he can readily infer by observing the rocks bared in the cliffs near the Falls, he will readily understand that the Niagara Limestone is the rock which takes the brunt of the work required in maintaining the precipice, down which its river plunges. He will see also that this hard edge of the cliff projects beyond its base, thus giving free room for the fall to descend unbroken to the level of the stream

Bird's-eye view of the Niagara Gorge.

below, and thence downward in the tumult of waters to the river bed to a greater depth than the visible face of the Falls.

From time to time as abundant general observations and accurate surveys show, the Niagara cornice of the wall is so far left unsupported by the more rapid wearing of the lower-lying softer beds that it breaks down by its own weight and falls in ruins to the base of the submerged cliff at the foot of the cascade. In this position we cannot see what becomes of the debris, but from what we may readily observe at other points we can make some interesting and trustworthy inferences. Along many rivers the student of such phenomena can find places where ancient cataracts have left their bases bare by the shrinkage or diversion of the streams which produced them; thus at Little Falls on the Mohawk, which, as before noted, was once the path of exit of the Great Lake waters, there was in the olden day a great cataract, the most of which is now above the level of the shrunken river. Here we find the rocks once trodden by the fall excavated in great well-like "pot-holes," some of which are ten feet or more in diameter, and with more than that depth. Each of these cavities has evidently been carved out by the bits of hard rock which the stream brought into them, the fragments having been made to journey round and round in a circle, forming what is often a dome-shaped chamber, widening toward its

base. Such whirling movements of water may be observed in a miniature way where a stream from a hydrant falls into a basin. The base of the Niagara cliff is doubtless under-cut in the manner above described, the graving tools being the hard fragments which fall from its upper parts.

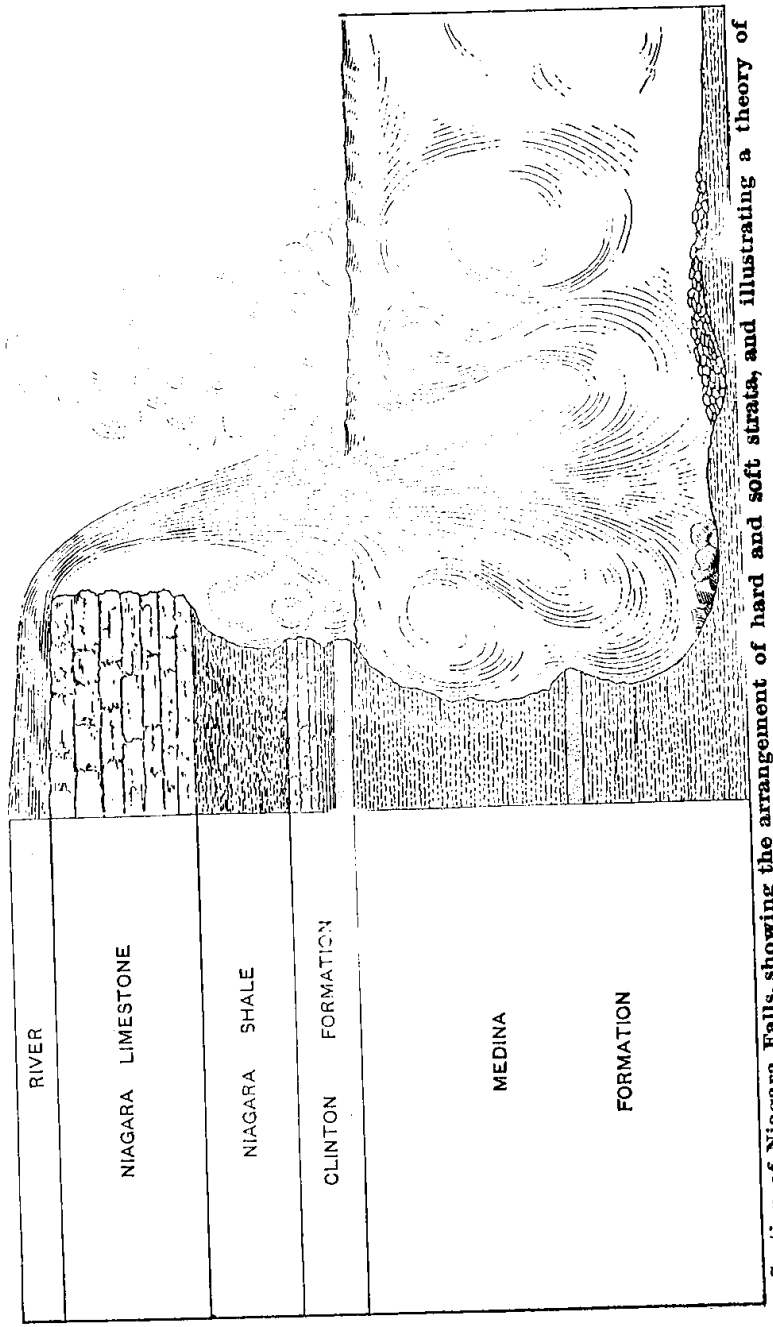
As we may behold in the Cave of the Winds, the whirlings of the water-laden air and jets of spray tend somewhat to soften and dissolve the layers of the shale, and thus to bring about that recession of the face which causes the limestone to jut beyond the base of the precipice. Beneath the level of the stream the violent swayings of the tormented water, beaten by the strokes of the Falls, doubtless serve yet more effectively to erode the soft rocks of the Medina formations. These actions co-operating with the pot-holing work keep the cliff ever retreating at its base at a little greater rate than at its summit, the limestone capstone falling only when the excavation beneath denies it effective support. In the above described features Niagara Falls are in no sense peculiar. There are probably within two hundred miles of their site over fifty cascades which have been engendered and maintained by the same simple conditions of an upper hard layer and lower-lying more easily worn strata. It should be remarked, however, that the greater the height down which the plunge of water takes place, and the larger its volume, the more vigorous is the

assault upon the base of the cliff through the development of pot-hole excavations and the lashing which the troubled waters apply to the rocks. But for the fact that the tide of Niagara, though of vast volume, is perfectly clean, the retreat of the Falls precipice towards Lake Erie would have been far more rapid than under the existing conditions. If, in place of the marvelously pure lake water the turbid stream of the Mississippi poured down this steep, the scouring action of the tumult beneath the fall would produce a vast increase of erosion. In these assumed conditions it might well be that the observer would find some sorry remnant of this great cascade far to the southward of its present position, perhaps within the limits of what is now Lake Erie. The difference in the effect of pure and turbid water, when forced against hard rocks may be judged by the fact that while a glass window may be washed with a hydrant stream for an indefinite period without mark of abrasion, a similar stream of very turbid water will in a short time bring about a noticeable scratching of the glass.

We are now in a position to understand how it is that the Falls have cut their way back through the great distance which separates them from the Queenston bluff over which the river flowed when it was first made free to follow its present course. It is a fine tour of the imagination to conceive how in some day after the ice age, when the country had assumed the

elevation and attitude which required the development of the second Niagara river, the waters broke over the barrier near Buffalo, sweeping across the gently sloping country to the Queenston cliffs, there plunging down in what was at first a broken cataract rather than a fall, into the lowlands about Ontario, or it may have been directly into the waters of the lake, then more elevated than now. Very quickly the undercutting process above described must have converted the cataract into a vertical fall. In a few score years the process of retreat of the steep over which the water fell must have begun the excavation of the great gorge. It may help the reader to conceive the advance of the process to imagine a great auger boring away upon some soft material, the tool while turning being drawn slowly across the surface. In the similitude, the whirling waters at the base of the cascade with their armament of stones, represents the auger, and the wide field of strata which have been carved the material which is bored by the moving tool.

For many years geologists, who are ever trying to measure the duration of the past, have endeavored to compute the time which has elapsed since the excavation of the gorge below Niagara Falls began. It seemed at first likely that the time occupied in this great work might be reckoned in a somewhat definite way. Long ago it became evident that the Falls were slowly advancing up the river through the undermin-



Section of Niagara Falls, showing the arrangement of hard and soft strata, and illustrating a theory of the process of erosion.

ing of their base and the consequent crumbling of the overhanging limestone at the foot of the precipice. In 1842, Dr. James Hall made a careful map showing the position of the different parts of the Falls, which were referred to monuments from which subsequent surveys could do work that would afford a basis for comparisons. A third of a century later another survey was made by officers of the U. S. Engineers. In 1886 Mr. R. S. Woodward made yet another careful map of the region. It now appears, however, according to Mr. G. K. Gilbert, that one or more of these delineations is somewhat in error, for at certain places the outline of the front projects beyond the position indicated by Hall's survey. After a careful consideration of these discrepancies, Mr. Gilbert says: "Nevertheless a critical study, not merely of the bare lines on the chart, but also of the fuller data in the surveyor's notes, leads to the belief that the rate of recession in the central part of the Horseshoe Fall is approximately determined, and that it is somewhere between four feet and six feet per annum. The amount of falling away at the sides of the Horseshoe is not well determined, but this is of less importance, for such falling away effects the width of the gorge rather than its length, and it is the length with which we are concerned."

If we could assume that all the cutting of the gorge from the Falls to Queenston had been done since the stage in the retreat of the ice sheet when the river, as

we now know it, began to flow, it would seem to be an easy matter to make an approximate computation as to the length of time which had been required to effect the task. As yet, however, we must hesitate to make an assertion, and, following the example of Mr. Gilbert, regard the problem as one which demands a far more careful study than it has as yet received before a judgment can properly be given. It is in a high degree improbable that the rate of retreat in the last forty years is anywhere near an average of the movement since the excavation of the cañon began. Between the Falls and Queenston the rocks which have been cut through, though of a tolerably uniform nature, have here and there local peculiarities which may have greatly accelerated the rate at which the Falls have worked upstream. The height of the Falls has altered in this movement, and it is very probable that the volume of water may have been subjected to considerable changes through the alterations of climate which have attended the passing away of the glacial sheet. In addition to these evident sources of error there are others connected with the irregular tilting movements of this part of the continent which, as before noticed, have perturbed the drainage since the close of the time when the ice sheet lay over the basin of the St. Lawrence.

At present it is tolerably safe to reckon the rate of retreat of Niagara Falls at about five hundred feet in a century. The reader may, if he pleases, assume that this

is a fair measure of the speed with which the cascade has worked back from the Queenston escarpment; but if he makes the computation he should regard it as amusing rather than instructive work. It is evident, however, that in the course of a thousand years the Fall is likely to be about a mile nearer Lake Erie than it is at present.

It is most probable that long before this planet has dispensed with the presence of man, and before any geological or geographical changes have effaced this land, the question will have to be met whether our successors shall permit the recession of the Falls to bring about the draining of Lake Erie and the adjacent waters. In the illumination of that time, indeed we may say in the light of our own, it will not appear difficult to arrest this natural development by which the recession of the cascade tends to drain away the lake from which its waters flow. New channels can be excavated which will divert the stream to some point on the line of the cañon where a fresh field of excavation can be provided for the cataract; or if it seems worth while, an excavation can be made beneath the stream at a point above the Falls, and a hard masonry support provided for the Niagara limestone, which, as we have noted, forms the cornice over which the water plunges.

If we may judge the motives of the future by those of the present, the decision as to the eventual fate of Niagara will rest upon economic considerations. Such

considerations, indeed, are likely in course of time, and that not long, to lead to the utilization of the vast amount of power which now goes to waste at this point. So long as the factory had to be placed near its water-wheel the demand for the energy of the Falls was not very insistent. If, however, as seems most likely, electricians devise means whereby the tide of force made available by this leap of waters can be carried, without too much loss, to points five hundred miles or more away, we may find New York and Chicago, and a hundred other places, asking for a share of the energy which here goes to waste. It is indeed most likely that the arrest in the southward march of Niagara will be brought about by the diversion of its waters to the turbines which drive dynamos.

The foregoing considerations may make it evident to the reader that Niagara Falls should not be viewed as a mere spectacle. They should be taken as majestic natural phenomena which throw light on many important chapters in the history of our continent. It is indeed doubtful if at any other place in the world the mind stimulated by a majestic scene is so naturally led to inquiries full of learned as well as of human interest.