Russell

THE Geological Formation

OF

LONG ISLAND, NEW YORK;

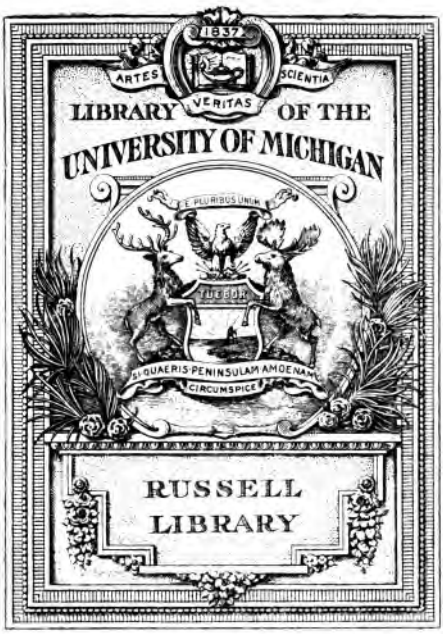
WITH A DESCRIPTION OF ITS

OLD WATER COURSES.

BY

JOHN BRYSON.

NEW YORK:
MACGOWAN & SLIPPER, PRINTERS, 30 BEEKMAN STREET.
1885.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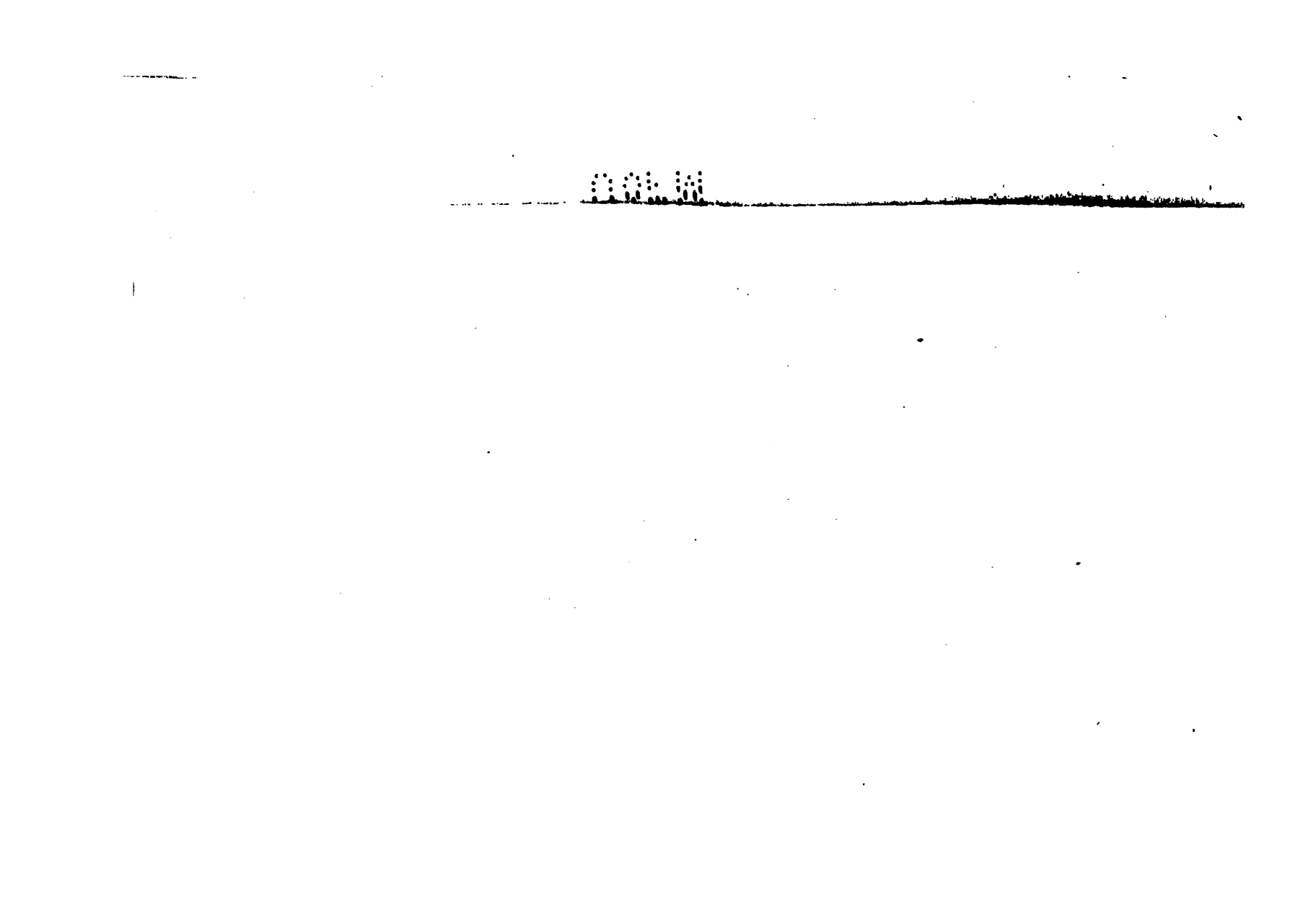

PREFACE.

THE study of the drift phenomena was taken up by the writer, while superintendent of the National Cemetery at Cypress Hills, Long Island. He makes no pretension to being a geologist, yet he hopes that his observations, very carefully made, will help somewhat in solving the perplexing problem—the formation of the Island.

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THE FORMATION OF LONG ISLAND, NEW YORK.

CHAPTER I.

THE formation of Long Island has been quite a puzzle to scientists, and even now the problem is far from being solved, for though all are nearly agreed as to its being the result of ice action, yet the manner in which it was laid down is still a subject of controversy. That is, there are some that hold that marine currents and floating ice, coming in from the sea, are sufficient to account for most of the phenomena, while others maintain that the formation is the result of glacial action.

Both schools, however, believe in an ice age, followed by a subsidence of part of the continent, when the waters of the sea washed over it. Then came a re-elevation of the submerged portions, leaving terraces and marine beaches along the former sea margins. This is known as the

CHAMPLAIN PERIOD.

Having lived for over seventeen years on what is known as the Backbone of Long Island, and having given considerable study to the subject, we are led to adopt the glacier theory as correct, while we differ with both schools as to the oscillation of the continent subsequent to the ice age. We are certain it is not true as far as Long Island is concerned.

At the close of the Tertiary, or what is known as the Quaternary age, through some cause not yet satisfactorily explained the most of the North American continent became frozen up. At this time, the rocks as they now exist were nearly all formed and all of the mountain ranges were completed, for the history of the glacier is everywhere written on their rocky crests.

Let us imagine, then, a great ice-sheet from five to ten thousand feet in thickness moving out from the region of the lakes. It seeks a pathway to the sea in a southeast direction, overflowing the highest mountains of New York and New England, for we find their summits abraded nearly to the top.

Before this moving mass of ice all signs of life disappear, and a

scene of utter desolation prevails, yet out of it is to come a new world of animation. "It is God's great ice plow," says one, "with which he is preparing the earth for the habitation of man;" for though it may be proved that man lived even before this, this fact would remain the same.

The glacier moves very slowly, perhaps not more than one hundred feet per year, or one mile in fifty years. After a journey occupying some 25,000 years it reaches the ocean, and a vast wall of ice stretches along the Atlantic border from New Jersey to the Arctic Sea. A huge mass of earth and rocky *debris*, known as a terminal moraine, is piled up in front of it; and as the ice begins to melt, the rivers behind it become dammed up and try to cut new channels to the sea, as their former ones have become greatly obstructed. As these streams play an important part in the formation of the island, we will describe them, as they appear to us after several years of careful investigation.

Before the glacial age, the site of Long Island was doubtless a shallow sea or bay, with sand banks and meadow lands running out from the original shore. This is evident from the marine and other deposits that are found under the drift and glacial detritus. At this time most of the rivers of New Jersey, New York, and Connecticut flowed directly into the ocean, or meandered through verdant plains that are now covered up with morainic *debris* or by the waters of the sea. As the glacier advanced into this shallow sea or plain, the streams continued to advance with it, and continued to flow from its terminal front after the ice sheet had reached its southern limit.

CONNECTION WITH MAINLAND.

In passing through the Sound or East River, it will be noticed that the so-called necks on the north side of the island have corresponding projections and depressions along the southern shore of the mainland. These, at one time, were doubtless connected. In fact, there was a tradition among the Indians that their forefathers crossed from the mainland to the island at a point known as "The Stepping Stones" or "Three Brothers," near Willets Point.

SUB-GLACIAL STREAMS.

From Little Neck to Gowanus, the main body of water was kept in rear of the terminal moraine or ridge. It is difficult now to trace out these old river courses in all of their ramifications, but in general they can be very well defined. It must be remembered that these streams were sub-glacial. The waters that came down from Bayside and Little Neck joined the stream that came in by

Flushing Bay, and from thence flowing down through Newtown and Winfield, they formed a junction with another stream coming in at Woodside.

Here the waters were divided, one stream branching off by Maspeth, the other going down by Dutch Kills in rear of Astoria, joining other currents that came in at this place, and forming a large basin at Hunter's Point. There were numerous other streams farther to the south sweeping the base of the ridge at Glendale and Middle Village, and in fact the whole north side of the island is indented by these sub-glacial currents. Basins were formed wherever a junction of these streams took place, as may be noticed at Hunter's Point and at the head of Newtown Creek. At this time the waters flowed around Hurl Gate, not through it.

The channel known as Newtown Creek swept up as far as the Cemetery of the Evergreens, but the main stream went off through Williamsburgh, and was joined by those coming in at Bushwick, Wallabout, and so on to Gowanus.

The whole lower part of this portion of the island seems to have been covered with water, as the whole lower part shows signs of stratification, and the material has a water-worn appearance. The upper part or unmodified drift must have been deposited when the ice sheet finally melted. The deposition of this upper stratum had considerable effect on these sub-glacial streams, partly, if not wholly, filling in many of the lesser channels. We find that the drift thins out as it nears the margin of these ancient rivers, showing that the currents must have prevailed until the close of the ice age. Of course, as the floods subsided, only the deeper part of the channels continued to flow, leaving the sand and gravel banks bare until covered over with accumulating drift, on the final melting and retreat of the glacier. The bottom till or bowlder clay was deposited first, then came the floods under the ice sheet, and lastly the deposition of the upper morainic drift as above stated.

Most geologists in accounting for these phenomena hold that there must have been two ice sheets, but we see no evidence of more than one.

The melting of the glacier, or rather floods resulting from it, is known as the Champlain period, when great oscillations of the continent are said to have taken place.

SOUTH SIDE.

So far we have been treating only of the north side of the island; we will now speak of the south side, that is, that portion of the island south of the main ridge. This ridge begins at the

Narrows, near Fort Hamilton, and runs in a northeast direction to Roslyn; in fact, it continues to the east end of the island, but in a more broken and modified form. The reason of this we will try to account for when we come to discuss the east end of the island.

KETTLE HOLES.

The ridge on the west end, though more entire, is nevertheless very much disjointed; for although the great body of the water was kept in rear of the terminal moraine, yet it will be found that most of the sub-glacial streams already described penetrated through it. Their channels only exist now in swampy peat beds or those peculiar, basin-shaped depressions known as "kettle holes."

If we follow up one of these sub-glacial streams on the north side of the island, as far as the main ridge, we will find it dividing into two branches, one running to the southeast, the other to the southwest. These continue to divide and subdivide very much the same as on the north. Whenever a meeting of the waters takes place, a basin-shaped depression is the result. These depressions correspond, of course, to the size of the streams, the smaller arms generally forming the kettle holes, the larger ones the swampy depressions. There is no other satisfactory way of accounting for these peculiar formations, and they conclusively prove that the streams that assisted in forming them were sub-glacial. Another singular feature about these streams is this: Each arm, as it penetrates the front of the ridge, divides again into two separate branches, which pursue the same ramifying course as heretofore described, and to their action is due the formation of the south side of the island, the lower part of which is composed of stratified sand and gravel. These stratified beds are covered with a clayey deposit, showing no signs of stratification, and is about four feet in thickness near the ridge, but thins out to a few inches as it nears the ocean. It is very difficult to account for this upper stratum, and we believe it has never been satisfactorily explained. It extends for miles along the whole southern front of the glacier region both in this country and in Europe. It seems as if a second ice sheet must have formed south of the terminal moraine, not glacial ice, but ice that formed over the flooded waters; for it must be remembered that the whole south side of the island was submerged during the final melting of the glacier. As the waters subsided the clay was deposited on the stratified beds, when the second mantle of ice disappeared. The winters must have been long and severe, even after the glacier had reached its southern limit, and it is

reasonable to suppose that the earth was encrusted with a sheet of ice far in advance of it. Yet there seems to be some difficulty in the way of such a theory, as it is generally rejected by geologists. We conjectured at first that the clay must have spread out over the plains at the final melting of the glacier, but it seems to be too uniformly deposited for that, and the clay is always thickest on the top of the hillocks, and thins out near the margin of the streams, showing that the deposit took place while the waters prevailed, to some extent, at least; and it is evident that the streams that penetrated the front of the glacier were almost, if not entirely, obliterated when the ice sheet finally melted. That the glacier did not advance beyond the main ridge is proved by the fact that no bowlders exist on the south side of the island; a few small ones are mixed up with the clay in places near the base of the ridge, and when plowed out they were called by the old Dutch farmers "stunraap," probably because they were about the size and quantity of turnips.

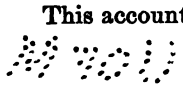
BOWLDER PHENOMENON.

The fact that no large stones were found south of the main ridge was noticed by the Indians, and gave rise to the legend that the stony character of the north side was due to some enraged demon over in Connecticut, who hurled the bowlders across the sound at the head of some offending spirit on the north side of the island. It is interesting to note that this bowlder legend has its counterpart in different parts of the world. Prof. Geikie, in his geological sketches, in speaking of the Baron's Stone of Killochan, says: "So conspicuous a feature in the scenery of the country could not very well escape notice, especially in early times, when a supernatural origin was easily found for what could not otherwise be readily accounted for.

"I have not been able," he continues, "to observe any of the traditional theories about bowlders in this part of Scotland (Ayrshire). They still exist, however, in other districts; and as a good example of the class, especially in the way of showing the dry humor which enters so largely into the Elfin legend north of the Tweed, I may quote one which came under my own notice some time ago at Clydesdale. An intelligent native of Carnwath, to whom I applied for information about the former number of bowlders, told me in his boyhood the ground between the river and the yelping craig, about two miles off, was literally strewn over with blocks of all sizes up to six feet and more in height. So abundant were they to the southwest of Carnwath, that the track was known as the 'Hell Stanes Gate,' *i. e.*, road, and another as the 'Hell Stane Loan.'

"My informant," he says, "after pointing out the graves of some of the largest bowlders, and the broken fragments of others, went on to tell me how in old times Michael Scott and the devil had entered into a contract with a band of witches to dam up the river Clyde. It was one of the conditions of the agreement that the name of the Supreme Being should never on any account be mentioned. All went well for a while, some of the stalwart spirits having brought burdens to within a few yards of the river, when one of the young members of the company, staggering under the weight of a huge block of greenstone, exclaimed: 'O! Lord, but I'm tired.' Instantly every bowlder tumbled to the ground, nor could either witch, warlock, or devil move a single stone a step thereafter." And so Mr. Geikie goes on to relate legends of like character. We laugh at the crudity of these early beliefs, yet we find many in our own day holding theories in regard to their origin equally if not more absurd. Ask many of the Long Islanders how they supposed those bowlders got there, and they will answer that they *grew*, and that the reason for their smallness on the south side was owing to the character of the soil. Others believe that they were made there when the world was created, like the old Scotch stonemason, when asked his idea of the endless blocks of granite that dot the fields and hillsides like flocks of sheep, gravely remarked that "when the Almichty flung the world oot, He mun hae put the stanes upon her to keep her steady."

There is little wonder that the primitive mind looked upon the bowlder phenomenon as something supernatural; for being ignorant of the forces applied in their removal, no other solution could very well be given, and even now, with all the knowledge we have on the subject, the mind is staggered and bewildered in its contemplation. The transportation of such massive bowlders as are found on the north side of the island almost exceeds belief, some of them weighing thousands of tons. Not long since, the writer saw one unearthed near Astoria measuring 132 feet in circumference and more than fifteen feet in thickness. It was a piece of trap rock, and must have been brought from New Jersey. Another one near Cow Bay, when blasted and broken up, made a wall eighty rods long, four feet high, and two feet in thickness; and then to think of the endless mass of smaller ones that go to make up the formation of the island. "Thousands of stone-breaking machines," says Robert Dick, "grinding for millions of years, could not have produced such a result." The bowlders were carried in and on the top of the glacier; and when the ice sheet melted, of course they were deposited on the surface of the land where the glacier rested. This accounts for no bowlders being found on the south side, as we



have seen that the glacier reached no further than the main ridge or terminal moraine.

SUBMERGENCE.

Mr. Elias Lewis, Jr., in an article published a few years ago in the American Journal of Science, "On the Old Water Courses of Long Island," in speaking of the south side, says: "It differs geologically from that of the north side, the former being composed of stratified sand and gravel, proving the presence of the ocean subsequent to the drift, and imply a submergence of 260 feet."

This statement implies that Mr. Lewis had not given the subject sufficient study. If he had, he would have seen that the waters of the sea had nothing to do with the stratification. In fact, it was not until after some years of study and careful investigation that we discovered that the formation of the south side of the island was due to the action of the streams issuing from the front of the glacier, or that they had any connection with the streams in the rear. At first their connection would never be suspected, but when carefully examined and followed out in all of their ramifications, their origin cannot be doubted. The sea has left no record of itself in the formation of the island, for no marine deposits are found except in the old sea bottom below the drift and along the present shore line.

This theory of oscillation is a very convenient one for geologists in explaining phenomena they cannot understand. If the waters of the sea had washed over the island to the depth of several hundred feet, as conjectured by most geologists, some evidence would have been left to attest the fact, but we have looked in vain for any such attestation. We have traveled up and down through and all over the island, looked into and examined every excavation we could find, and have failed to discover a single shell that properly belonged to the *drift* formation.

SHELLS AND OTHER MARINE DEPOSITS FOUND.

At New Utrecht the shells of clams and oysters were found at a depth of 67 feet, and a shell of a periwinkle was found at a depth of 250 feet. At Manhasset, or Cow Bay, on the north side of the island, at a depth of 34 feet, and a mile from the shore, a stratum of creek mud and shells was found in digging a well. The stench was so great that the opening had to be filled in. This black muck or old meadow land is often found below the sand and gravel, which goes to prove what we have already stated, that before the glacial age the site of Long Island was a shallow sea or bay, with

marsh lands running out from the original shore line. It may be that the land stood higher than now, and extended further to the south, but we think this is doubtful, although the coast line has doubtless undergone considerable changes since glacial times. Be this as it may, however, Long Island as it is, is unquestionably the product of the great continental glacier and the streams resulting from it.

ROCK *in situ*.

No rock in place comes to the surface except near Astoria; the rest lies buried several hundred feet below the drift and alluvial deposits. The *debris* north of the ridge was laid down by ice, and is called drift; the detritus south of it was laid down by water resulting from the melting of the ice sheet, and is known as loëss, or modified drift. The main ridge or so-called terminal moraine, from the Narrows to Roslyn, is generally unmodified, although there are stratified hummocks or kames connected with it. These will be more fully described in the following chapter under the head of "Southern Ridges."

CHAPTER II.

THE last chapter was devoted to a description of the west end of the island, yet what is said of one part applies to the whole, although there is seemingly a great difference between them.

Warren Upham, in speaking of the glacial phenomena of Long Island, says: "The drift appears without scarcely any modification from Fort Hamilton to Roslyn, and from thence a remarkable change takes place, the moraine of till being nearly everywhere buried by that of fluvial gravel and sand." To account for this phenomenon, Mr. Lewis, as already quoted, sinks this part of the island 260 feet and re-elevates it again, without disturbing the contour of the whole; we might as well try to sink part of a building so many feet, and raise it again, without disturbing a beam or breaking a rafter. Prof. Agassiz says: "Beware of an explanation made to suit a particular case."

HEMPSTEAD PLAINS.

Our study of the west end of the island led us to conjecture that the more fluviatile character of the east end, beginning with the Hempstead plains, was due to the breaking through of the glacial streams, and not to any action of the sea; and on the fourth of

July, 1882, we paid a visit to Roslyn for the purpose of investigating the phenomenon, the result of which was given in a letter to the *Brooklyn Eagle*, of date July 11, 1882.

We said: "Landing at Garden City by the Long Island train, we took the road to Roslyn, walking the whole of the way in order to examine more particularly the surrounding formations, and it was not long before we were convinced that our theory was correct. To the right and on the left the hills were visible, but in front it was easily seen that the ridge had been washed away, leaving an opening, clear through to the Sound. Through this gap, the waters must have plowed their way with terrible force, scattering the sand and gravel in every direction, the evidence of which is seen at every step. All the stones are waterworn, and differ from those in the drift. All the banks of sand and gravel seen along the road spoke of the mighty currents that must have at one time prevailed. That those stratified beds were not laid down by the ocean is evident from the manner in which they are arranged, and the abundance of conglomerate bespeaks their origin. The conglomerate is easily recognized, and can be traced to the highest point at Roslyn, 384 feet above the level of the sea, carried by the drift or swept by the currents that forced their way to the sea in spite of the rocky barriers that opposed them. This seems almost incredible; yet when we remember that the glacier was several thousand feet in thickness, the melting of such a mass of ice must have produced a mighty deluge under it, especially where the water was dammed up as it must have been behind the terminal moraine. We are inclined to believe that geologists are at fault in regard to the oscillation of the continent subsequent to the glacial age, and that the whole of the drift phenomena can be explained without it. The kames, river terraces, etc., can be explained without sinking portions of our continent.* We are aware that shells and other marine deposits found in places at great altitudes above the level of the sea argue in favor of a subsidence, but we are confident that in time their presence can be otherwise explained."

The views contained in the above extracts have been in the main confirmed by subsequent investigation; but we have discovered since that this part of the island differs very little from the west end, that is, the same conditions prevail along the whole extent of the island, the only difference being in the action of the floods and the assortment of the drift, that is, on the west end the *debris* was better able to withstand the force of the currents, therefore the terminal moraine remained more intact, while at Hempstead the

*This prediction has been verified. See Marginal Kames, page 161, Proc. of the Academy of Natural Science, Phil., 1885.

material was finer and less able to resist the press of the waters in the rear, and consequently became more spread out. If one will follow up the main ridge from Fort Hamilton to Creedmoor or Hinsdale, he will find it very much broken in places where these old sub-glacial streams prevailed. The old roads running through the hills generally followed the course of these ancient rivers. Martense Lane, near Greenwood, the old Port Road running through Prospect Park, the Clove Road near the penitentiary, and the Hunter's Fly Road at East New York, were all once the beds of sub-glacial streams. At Richmond Hill, near Jamaica, the ridge becomes broken again, as the water came through here from Flushing Bay, and so at a place called the Alley, at the head of the Little Neck depression. The Manhasset stream makes a larger break at Lakeville, and from here at the beginning of the Hempstead plains the ridge becomes lost in little hillocks and swampy depressions, and the front of the terminal moraine is not easily defined, as the morine of till, says Mr. Upham, "is nearly everywhere buried by fluviatile gravel and sand." It is wrong, however, to suppose that the main ridge or terminal moraine recedes as far back as Roslyn. It does not recede; it only disappears. The terminal front of the glacier may be determined by the slight elevations on a line a little north of Mineola, the height of the land at this point being 103 feet—only 35 feet lower than the main ridge at Richmond Hill, near Jamaica.

SOUTHERN RIDGES.

It will be noticed that as the material becomes spread out by the streams, the land portion to the south becomes more extended, and the so-called southern ridges become more prominent.

Mr. Upham, in speaking of the northern series of hills, says: "It appears that the ice sheet reached five miles south of this line, though perhaps only for a little while. This is shown by the Manetto and Pine hills, which extend in massive southern ridges from the west hills by Melville to Farmingdale. These have a height from 150 to 300 feet." Mr. Upham concludes that these southern ridge were deposited previous to those on the north. In these conjectures we think he is mistaken, and that they all belong to the same series; that is, the stratified part of both was formed by the streams under the glacier, the upper or unstratified part at the final melting of the ice sheet. As has been noticed, the streams had considerable to do in modifying the terminal front of the glacier, and we find that the moraine advances and recedes according to the flow of waters; for instance, at Fort Hamilton, where the flood of waters was great, the ridge is more broken, and extends in hillocks

to the south. At the Bay Ridge depression it will be seen that a line of hills runs away for some distance beyond what is called the main ridge ; they differ also from the latter in that they are stratified near the bottom. The top is always covered with till and bowlders, showing the glacier had advanced to this line. It will be seen that these southern or broken ridges are not alone peculiar to the east half of the island. The streams as they issued from the front of the glacier would naturally wear back that part of the ice sheet where they made their debouch, while the intervening portions extended further southward. Very often the unmodified and stratified sections mingle one with the other, making it difficult to define their limits. At East New York, when digging away the top of the ridge for the House of the Good Shepherd, clear sand and gravel were found below a few feet of clay on the southern side of the ridge, while on the north side the whole moraine was unmodified drift. On examination it was found to be due to the streams that had broken through just a little above and below this point, and gave the key to the solution of the whole problem. In crossing the plains, one cannot help but notice the little hillocks and numerous depressions that run through them; they all have their origin in the same way. The streams that came in from Oyster, Cold Spring, and Huntington bays all had their part in the formation of the Manetto and Pine hills referred to by Mr. Upham, and the same condition of things prevails to the extreme east end of the island. Block Island Sound, Gardiner's, Great and Little Peconic bays, were originally formed by sub-glacial streams that came from the mainland, and are merely the counterpart of the depressions or basins seen on the northwest end of the island. If these were flooded to the same extent as those referred to on the east, only a few islands would appear above the surface of the water north of the main ridge. A singular thing connected with some of these depressions is the fact that their bottom is below the present level of the ocean. The reason for this is that the old river channels had their beds near the *old* sea bottom, and retained their original depth, while the drift was being deposited around them. Of course, as the glacier advanced, the detritus washed out in front of it, as we have seen, had considerable effect in filling in the ocean in front of it. For a distance of eighty miles south of the Long Island coast, the descent is so gradual that, if the waters of the sea were dried up, it must look like a level plain.

OTHER PHENOMENA.

There are other strange phenomena connected with the drift, some of which it would be difficult to explain with our present