

learn, and inwardly digest it, that by *patience* and comfort of His holy Word, we may, instead of making shipwreck of our belief in inspiration, embrace and ever hold fast the blessed hope of everlasting life through the incarnation of our Lord. Amid the strife and turmoil of worldly cares, how good it is to withdraw our minds from such trifles, and enter the temple of Nature where—

“ In that great cloister’s stillness and seclusion,  
By guardian angels led,”

we may find the wisdom of the Apostle’s exhortation: “ Finally, brethren, whatsoever things are true, whatsoever things are honest, whatsoever things are just, whatsoever things are pure, whatsoever things are lovely, whatsoever things are of good report, if there be any virtue and if there be any praise, think of these things.”

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ART. VI. THE ROCKS IN THE VICINITY. BY WILLIAM GOSSIP.

[*Read February 1, 1864.*]

THE Rocks in this vicinity, and those on which Halifax is built, would seem to be an uninviting study, except for the practical purposes of the mason, or architect. They are unsightly in aspect, and nearly bare of vegetation. There is about them the wildness of desolation without much of its grandeur. Indurated beyond a common degree of hardness, they have so little disintegrated during the unknown ages in which their surfaces have been exposed to the atmosphere, that the soil which covers them is only now sufficient for the growth of ferns and mosses, shrubs and stunted trees, chiefly of the fir and spruce varieties. Wherever indeed there is a soil, it must be ascribed to other causes than the disintegration just noticed, and requires to be fostered by all the skill of the agriculturist, ere it make a due return toward the sustenance of man. Yet these rocks of so uninviting an aspect, and that soil so unprolific of itself, must have had a wonderful history in the past. The one carries us back, as nigh to that record of time when God created the heavens and the earth, as Geology has yet attained to; the other dates from a more recent period, yet probably so remote, that man had not *then* appeared upon the face of the earth, although creation was approaching his advent—when beasts of huge bulk, and birds of fabulous proportions dwelt upon it, which have

since become extinct : whose remains are only now and then developed to show us that such things were, and to teach us not to be incredulous to facts connected with the Earth's age and history, that the patient and laborious investigations of science may be able to demonstrate and prove.

The Rocks on which I purpose, ~~in the first place~~, to make a few observations, are those on the western side of the North West Arm, embraced within the limited space of the Government Quarries and the granite hills in their rear,—and those which cover the peninsula of Halifax. I begin with the former, as I believe the phenomena attending them (the lines of demarcation between the slate and granite,) are there more striking and better marked than elsewhere in the vicinity, although, doubtless there must be other places where they may be just as readily observed.

Professor Dawson, in his excellent work, "Acadian Geology," classes these Rocks as probably of a series older than the Silurian period, and, as ~~probably~~ <sup>possibly</sup> belonging to a still older, or Azoic series, which has been recognized in Canada. In a supplementary chapter to his latest edition, he somewhat modifies this opinion, but without educing any positive proof to sustain his new view. No fossils\* have been found in these Nova Scotia rocks, which is perhaps sufficiently accounted for by their metamorphism. He indicates their position, however, (by the evidence of the older slate series in Newfoundland, which has afforded trilobites of the genus *Paradoxides*,) to be in the lowest part of the Lower Silurian series; while further on, he states "that on a comparison of these rocks, with a series of altered deposits from eastern Canada, collected by the Canadian Survey, they appear more nearly to resemble those of the Hudson River group, than any other of the series—which

\* Subsequently to writing the above, I found the following paragraph in "The Citizen" newspaper of Halifax, which I also read, but have not had opportunity to corroborate its statement, which is not very clear upon the subject:— W. G.

"THE OLDEST INHABITANT.—Rev. D. Honeyman, whose geological eminence helped to increase the reputation of Nova Scotia at the Great Exhibition, has been the first to discover a trace of ancient life in the metamorphic clay slate strata on which Halifax is built. It is a minute reticulated zoophyte, noticeable enough to the unassisted eye. This important discovery, while it adds to the accessions with which Mr. Honeyman has enriched our Silurian geology—is valuable as settling the age of our gold fields, which are thus proved to be lower Silurian like those of Australia, where graptolites, the kindred of this little Haligonian fossil, are found. The discovery will make a sensation among geologists."

group belong to the upper formations of the Lower Silurian period.

But, although it is not easy to *class* the Metamorphic Rocks of this District, and there is some doubt as to their *true position* in the Geological scale, they must certainly be of an age long anterior to the granite which has broken through, partly absorbed, slightly lifted, and further hardened them. The belief may be reasonably entertained, also, that they had been subjected to a metamorphism long previous to the granitic eruption with which they are now in contact. Their strata, inclination and dip, in some places, and in some degree, go to shew, that the cooling granite had sluggishly overlaid and become cemented to them, without possessing heat enough to change their character. In other places the powerful leverage of the hot interior, has suddenly and cleanly fractured and tilted them up, affording sections which separated from the fracture, exhibit the strata and bedding dipping to the north, but running in a line with the granitic upheaval, east and west, doubtless meeting the granite at a low depth, but forming angles wide apart at the surface.

I have collected a few data in connection with my subject, from the Government Quarry on the western side of the North West Arm, called the Flag Quarry, nearly opposite to the Chain Battery on the eastern shore. It lies a short distance in a south-west direction from the wharf where the stone is shipped. At this place the rock is covered with loose slaty and granitic debris, interspersed with small weather worn granite boulders, to a depth of one to four feet. Upon the surface, lichens, ferns, and berry bushes, find a genial soil; atop, the rock is a good deal broken; at a depth of six to ten feet the Quarrymen begin to find excellent building material. The rock is here regularly stratified in a descending series of beds, from three to six feet thick, which may be called the main bedding. These exhibit, both in their upper and under faces, a curious appearance, which I can liken to nothing else than a line of gougings, running in the direction of the beds, east and west—the gougings of the lower deposit fitting accurately to the ridges of the upper, and *vice versa*. I may be allowed a little digression here, to state, that on one of our pleasant field excursions, last summer, I fell in with an old acquaintance opposite to the Three Mile House, a large stone, scooped after the fashion of these beds, the

markings on which had often been a puzzle to me. I imagined I had found a surface scratched and torn by the harrow teeth of a glacier or iceberg, and on this occasion showed the stone to a gentleman who was with us, who was evidently a good geologist. He thought it a very remarkable stone! Our esteemed associate, Mr. BELT, who was also with us on that occasion, thought it a very strange marking! On a closer inspection, however, and chipping it, he split off a piece which exactly fitted a scoop beneath it, and then it was pronounced to be, not a glacial phenomenon, but a conchoidal fracture. The rocks at the North West Arm, show, that it is the character of the true bedding of a peculiar class of metamorphic rock.

The rock at this quarry, and in the vicinity at the same level, is a bluish-gray quartzite, highly indurated. It partakes a good deal of the influence of the granitic upheaval—nor has the granite altogether escaped *its* influence. The quartzite here, has not been altered in composition, or changed into gneiss, and yet it is curiously laminated. There is, between many of the laminae, an exceedingly thin scaly film of silica, cementing them—in others, a thicker layer, more nearly resembling gneiss. All the laminae are in the direction of the main bedding. How, or by what process they were infused, or infiltrated, I am not geologist enough to pretend to conjecture. They have, however, a decided influence over the workable and merchantable character of the rock. The thinnest markings make the best cleavage, and are divisions of the best stones. When looking at this excellent material for pavement, and the little difficulty there is in quarrying it, and its apparent abundance in this vicinity, I could not but feel mortified at the spectacle exhibited in Halifax, of a large importation of Caithness flag, when an imperishable article, as good at least, if not much superior, may be found at our very doors.

There have been two depositions in this district, and at two different periods. One, and the earliest, the hard blue compact rock, which I call a quartzite, which is often highly micaceous, and has no doubt originally been a deposit from earlier formations, containing more or less of iron,—two, the dull leaden-blue clay slate, of various degrees of hardness, sometimes highly micaceous, also containing iron, and now much broken and disturbed—which may have

accumulated long after the quartz rock had been hardened, and both further metamorphosed. This idea, which is thrown out for the investigation of future commentators on these Rocks, to be either justified or disproved, as it deserves, seems to be corroborated by the geological sequence, and relative position of the rocks. The clay slate appears to have overlain the other formations to a great depth previous to the granitic upheaval, and being then broken and disturbed, has since suffered considerable erosion. Whenever gneiss is found in that vicinity, it may be considered a compound of the granite era, to which the quartzite, slate and granite have each contributed their portions; and, where the slate is more than usually hard, micaceous and crystalline, it will be found in close proximity to the granite, and flanking it at a higher level than the quartzite.

The junction of the slate and granite, follows the water line, at an elevation of forty or fifty feet, from the head of the N. W. Arm, along its western shore, to York Redoubt, stretching beyond these limits to a much greater distance in both directions. At that elevation the granite begins to predominate, and is found *in situ*, over a wide extent of country, east of Halifax harbour.

At more than half a mile back, ~~west~~wardly from the quarries, a distance occupied exclusively by the granite, a depression discloses the Coal Pit Lake, a pretty sheet of water which drains the surrounding hills, but has no apparent communication with any of the lakes in the neighbourhood. In this depression which falls to the level of the slate, at least, that rock is found, its surface, wherever smooth, covered with striæ; an evidence of glacial action, which may be deemed a sufficient apology for the sterility of an otherwise romantic picture.

There can, I think, be very little doubt, that, under similar circumstances, throughout the granitic district, the slate and quartzite will be found at nearly the same level as at the Coal Pit Lake, and that they underlie the granite with more or less of metamorphism from contact, to a considerable depth on this side of its true axis.

The denudation, however, has been complete. Whatever formations may have covered these rocks in previous geological eras, or whatever changes they may have undergone, the mighty currents, and the grinding action of the glacial period have swept all away;

and it is not improbable that both the early deposits, and the later drifts in this district, may have contributed to rear the Isle of Sable, or to raise a compensation to man for his agricultural loss, in the banks of the coast, that provide a rich piscatorial harvest to his active industry on the great waters.

The discovery of gold in the slate and quartzite of the Atlantic coast of Nova Scotia, in all directions, east, west, and northwardly of Halifax, makes it of importance that the rocks in its vicinity should be carefully inspected. Hitherto, however, while there are indications that imply a possibility of auriferous deposits, none, I believe, have been discovered. The slate is, in some places, penetrated by vein quartz, which may prove to be auriferous. The hard blue rock, lower than the slate, does not present any probability of gold. The granite is sometimes traversed by vein quartz; but so far as I know, gold has rarely, if ever, been found in quartz of the granitic formation. At the present, therefore, nothing positive can be said as to the existence of gold in the slate of this district; and being entirely of opinion, that it would be a waste of money and labour to institute a search for it, I shall turn to the granite, and conclude with it my observations upon the rocks on this side of the North West Arm.

There are two descriptions of granite, within a short distance, in this locality—one is much harder and finer grained than the other—and they are different in colour. The granite nearest to the blue rock and slate, has apparently partaken of the chemical action which has produced the colour of those rocks. It becomes somewhat porphyritic, and acquires a light greyish-blue tint, very observable as a means of contrast. Wherever also it approaches the lower rocks, it grows harder, and, although in some places of good quality is more difficult to work. It also seems to have imbibed some of the iron which weathers conspicuously upon the exposed quartzite and slate. There appears to be a well defined line of division between the two descriptions of granite. It is, as though the molten mass had, for some distance, overlapped and absorbed the lower material into its own composition, and had then cooled against the compact resistance offered to its further advance. It is during this mingling process, that the gneiss has been formed, and at its close, what we now term *the junction* of the granite with the

slate. A natural gully leading from the south Government wharf to the granite quarry on the hill beyond, has on one side this bluish hardened granite, and on the quarry side the purer description, untainted as it were by extraneous contact,—fresh from the interior abyss—a clear white quartz and feldspar, with black mica—of which it is but truth to say, that there is nothing superior, any where to be found, of granite rock. Blocks of the largest dimensions may be quarried here, and the supply at this height seems inexhaustible. Some very pretty cabinet specimens of porphyritic granite, *i. e.*, granite with crystalline feldspar and quartz in large pieces, and the mica interspersed in scales from one half inch to an inch in length and breadth—may be collected at a short distance from the quarry.

I would recommend the lover of Natural Science, who may visit this locality, intent on its pursuit, to ascend this region to a greater altitude; and then, mounting the conspicuous granite boulder on the top of the hill, which serves as a landmark to the pilot and fisherman, he will be amply compensated for the extra fatigue, by a panorama beautiful beyond description. I shall endeavour, however feebly, at the risk of being thought tedious, to give such an idea of this glorious scene, as I hope will tempt others to visit the spot, and enjoy it likewise:—

We look from our airy pedestal, and westward, as far as the eye can reach, the white granite prevails, intermingled with stunted vegetation rich in autumnal tints; while here and there its deep recesses disclose a pretty lake, stealing out upon the rocky solitude, and charming the eye and mind with its silver sheen. Southwardly, the eye takes in York Redoubt, its village and churches, and fifty miles of ocean, where the white sails of commerce move east and west, at the will of the mariner, to the several havens whither he would go. A long line of coast stretches eastwardly as far as Jedore, covered with dark green fir and spruce, which impart a sombre hue to the distant hills. Nigher, break on the view the verdant isles and verdant main of the Eastern Passage; and nigher still, the gem of the harbour, McNab's Island, with the dreaded Thrum Cap standing out from its shore, its picturesque beach and light-house, its green vistas and mingled forest and cultivation. The harbour is studded with

inward and outward bound; and from the deck of some tall admiral or royal steamer entering the port, floats upward the national anthem; while George's Island, or the citadel, salute them with the cannon's welcome.

We turn, and beneath us, for a long reach, stretches that scene of rural beauty—the North West Arm—only now beginning to be appreciated as a site for the villas and cottages of opulence. At our feet are the picturesque coves that grace its entrance. Across the Arm, the defences of the harbour fix the attention for an instant—further north the citadel rears its impregnable height and flies its flag of sovereignty,—and Halifax and Dartmouth mingled in the view, and toned and softened in the smoke of their own civilization and refinement, make up the splendid picture—which has its appropriate completion in a background of distant hills that encircle Bedford Basin.

This much beyond the Geology of our subject as an inducement to visit the boulder. Nor may it be unedifying, as we descend from this eminence, to contrast with the latest work of creation, which has man for its highest intelligence,—when the great Architect of the Universe, looking abroad, “saw everything that he had made, and behold it was very good,” those progressive geological eras which for millions of years may have preceded it—following them down with their varied formations, and changes of seasons and productions, their wonderful flora and fauna, their vast deposits of mineral and vegetable treasure, their grand upheavals and depressions, their disturbances, floods and erosions,—to that beginning, when “the earth was without form, and *void*, and darkness was upon the face of the deep,”—when, probably, the very rocks that have been our subject this evening, which now form the everlasting hills, were deposited in the depths of a heated ocean.

## PART II.

THE subject naturally resolves itself into two parts. I have treated the first very imperfectly, for there is a wide field of exploration open to the Geologist in that slaty-granitic area, which may yet lead to important mineral discoveries. The second part takes me to this side of the Arm, and to the rocks and deposits that cover the peninsula of Halifax. Professor Dawson, in the



excellent work to which I have before alluded, and to which I am again indebted, styles the whole Atlantic coast line—the Granitic Metamorphic District. There is, however, a great gap between the granite, as it comes down to the North West Arm, and the granite, as it again appears on the coast, eastwardly. On the peninsula of Halifax, there is not a particle of granite, *in situ*; the Dartmouth shore is also entirely bare of that rock; equally so is the coast to a considerable distance, and the interior also. The absence of granite therefore, over a wide range of country, is a plain indisputable fact. There may, however, be some reason for the application of the term. If the granitic disturbance beneath has been the cause of the shifting of strata, and the contortions and breakage and cleavage of the superimposed slate rock of the Peninsula, it should be deemed admissible. Dr. GESNER, in his first work on the Geology and Mineralogy of Nova Scotia, mentions the granite as appearing at the Grand Lake in an east and west direction; and the western side of Lake Thomas, I suppose, marks the nearest point east, where it again comes to the light, as part and portion of the granitic upheaval. It is just as likely, however, that the depressions and elevations which this extensive district must have undergone, subsequent to the granitic eruption, have been the cause of the disturbance which prevails amongst the slate and quartz rock, over all this wide tract of country.

The slate rocks of the Halifax Peninsula are evidently a continuation of the North West Arm formation. Near Point Pleasant, in some places, they alternate with the quartzite; the cleavage, however, is always more or less uneven, not continuous in one direction, and the strata often obscured. Where this last is observed, it varies considerably. In some places the east and west direction prevails, as at the Government quarries on the western side of the Arm, with a downward westerly inclination, and a northerly dip. At other places the dip is W. by S., and on the harbour side is S. by E. at some points, favouring the idea of an anticlinal. Large detached masses of rock are scattered over the surface, in the Point Pleasant woods. The face of the rock *in situ*, wherever denuded, is covered with striæ, and glacial erosion may be frequently detected. East of the road, at a short distance this

side of the tower at Point Pleasant, the contortions of the strata appear upon the smooth surface of the rock, in vari-colour undulations. These are all evidence of disturbance which this area has at several periods undergone. Very good sections of the slate may sometimes be observed in the excavations for drains made in the streets of Halifax. The rock will be found to alternate between the compact and slaty structure — large solid masses are succeeded by others exceedingly fissile, with a cleavage generally in one direction east and west, but very irregular — the joints of rock, or headers as they are termed by the workmen, go north and south across the cleavage, and nearly in the line of the street, affording facility for excavation which is of advantage in the formation of the trench. The slate is sometimes highly charged with iron pyrites, and quartz veins are frequently discovered running through it. Gold has, I am informed, been seen in some of these quartz veins,\* but if so it has never been indicative of any quantity of the precious metal worth a diligent search.

The highest range of the slate on the peninsula of Halifax, is probably 180 feet above the water level of the harbour, from which it rises in a sharp ascent to the Common, falling more gradually, but still at a steep decline, to the eastern shore of the North West Arm. Were the whole peninsula of Halifax denuded of the drift which forms its soil, and the boulders which are scattered over its surface, there can be no doubt that the face of the slate rock then exhibited, would be perfectly smooth, as seen at Point Pleasant. We should then have a tongue of land beautifully rounded and covered with striæ — the polish and scratching being the action of the icebergs and glaciers that have been borne upon it, which on one side may have scooped out the harbour, and on the other the North West Arm, on their onward march, driven by the mighty stream that then deluged this latitude of the northern hemisphere.

The evidences of glacial action are perhaps, nowhere more distinct than in the boulder clay and drift, which overlies the slate rock at many places on the Peninsula and along the shores of the

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\*I have seen one *sight* (as it is termed) of gold taken from quartz out of a trench in Barrack Street.—W. G.

harbour. The fact seems to be, that our harbour and the adjacent country (looking at their present conformation) have been the embouchure of one of the mighty streams that deluged the northern latitudes of this continent, and which discharged its ice-laden waters over our rocks into the ocean. Very thick deposits of clay are found at many places, less on the peninsula however, than along the eastern shores of the harbour. It is found at Veith's farm, a short distance from the city, on the old Three Mile road, and at other places in that direction. On the Dartmouth side and at the Eastern Passage, it occurs of considerable thickness, and is used for making bricks. In some places (as at the asylum for the insane) it is freer from stones than at others. There is very good brick clay also, at the head of Bedford Basin, and at some places along its shore. I have no doubt that McNab's Island has a substratum of clay resting on the clay slate. Over this boulder clay lies the unstratified gravelly drift. In it are found angular stones, quartz pebbles, boulders of the adjacent rocks, and sometimes pieces of red sandstone and trap rock, which show a foreign origin and remote descent. It forms some large mounds on and around the Peninsula and North West Arm. There is one of these on the approach to the town from the Three Mile House, by the Kempt Road. Fort Needham and the Jennings' Farm, form another of these conspicuous deposits. The most important, however, because it concerns the safety of Halifax, is the hill upon which the Citadel stands, which to a considerable depth is made up of the unstratified gravelly drift. We find hillocks also, of the same material, at the head of the North West Arm, along its shores, and at its entrance. At the head of the Arm it appears to partake a good deal of the nature of the substratum, and is highly coloured by the peroxide of iron. In some places it is exceedingly hard to excavate; but in no instance since its deposit, so far as I know, has it been formed into a solid compact rock. It is of itself a very unprolific soil.

It may be deemed strange, that neither in the slate, nor in the boulder clay and drift that cover the peninsula and the shores of the harbour, are there any traces of ancient or marine organisms. It is not improbable, however, that in the early period in which the slate was deposited, the water may have been so heated, or so

impregnated with chemical ingredients held in solution, as to be incapable of supporting animal life; and that the metamorphism of the slate took place ere the requisite conditions were attained. Subsequent denudation and erosion may have swept away all the accumulations, and fossil remains contained, of more recent periods. Coming down to the close of the Tertiary and Post Pliocene periods, we find thick mounds of unstratified drift and clay, which might reasonably have been expected to reveal facts of this nature connected with their history. They, however, tell no tale. Other drifts and deposits of the glacial period, contain marine shells, and remains—but those of Nova Scotia nothing of the kind. I do not know that this has ever been satisfactorily accounted for, or that it can be satisfactorily accounted for; but it is a fair subject of research, and any novel ideas started upon it, may be suggestive, and lead at one time or other, to a solution of the mystery.

If we examine a large map of North America, in the direction of the zone of depression, which during the glacial era was at its lowest point, we find all that immense system of lakes and rivers forming the great watershed of the country east of the Rocky Mountains, and approximately about half way between them and the Atlantic, discharging either into Hudson's Bay and the Arctic Sea, or finding an outlet by the Gulf of St. Lawrence. We see further, that another extended watershed existed, connecting the system of great lakes and rivers included in the latitudes of the drift, with the Gulf of Mexico, by other great lakes and rivers. Call it a stretch of fancy, or what you will, this conformation of land and water afforded strong evidence to my mind why our unstratified drifts and clays, differ from those of other countries, even from those of the Gulf of St. Lawrence, in possessing no marine fossils. It is not difficult to suppose, that the depression of the period collected all the fresh waters of the continent north, and many of those south of the latitudes of Lake Superior, into one vast area, and that from this centre an entirely *fresh water drift*, swept over the Nova Scotia peninsula, and the countries included, to the 42° N. latitude.\* Or, that another mighty stream diverging and mingling with the waters of Hudson's Bay, fresh and salt combined, may

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\* May it not have materially affected the Southern climate with cold at that period?

have swept over a portion of Labrador, and discharging itself by the Gulf of St. Lawrence, deposited in the drift boreal shells, and fossil capelan. If the present conformation discharges the waters of the great lakes and rivers, at a latitude much further north than their own latitudes—the *depression* that then existed may have poured them, irresistible in volume, and with all the icebergs from their glaciers, over that portion of Nova Scotia which was subjected to it; and over those parts of New Brunswick, Maine, New England, and New York, which have been proved to come under its influence. The gradual re-elevation of the land, diverting these mighty streams, may have been accompanied by an encroachment of the ocean in some places; and the still further and final elevation, circumscribing the waters, may have formed the St. Lawrence as it now exists—the Red River and others that fall into Hudson's Bay and the Arctic Sea—the Mississippi and its great tributaries—and the other great waters that now drain the continent.

However long the subsidence, or alternate rising and sinking, with its accompanying cold, may have continued, a change at last took place, and the gradual and final re-elevation of the land, left our rocks with their present outline denuded and bare, except where was deposited the legacy of the period—the boulders, the clay and the drift. We may with a fair approach to truth assert, that the land must have sunk during this great depression, at least six hundred feet,—for any evidence to the contrary that exists upon the seaboard, it may have been double that measure, and the present line of coast only a partial re-elevation. The high land of Aspotogaen, between St. Margaret's Bay and Chester, is 500 feet above the level of the sea, and at the summit Mr. POOLE found a travelled boulder, and striæ are there as plainly marked as on the rock at its base. We may therefore very safely conclude, that at that time Nova Scotia must have been nearly all overflowed.

I have slightly alluded to the glacial action which may on one side have scooped out the harbour, and on the other side of the peninsula the North West Arm. There are various grounds for supposing such action to have formed both of these channels. In both there is a parallelism that goes to prove a strong current sweeping over the land in one particular direction, and that in the

course of the striæ seen upon the surface of the rocks. If the mounds on the peninsula are conclusive proof of ice-borne drift, its character, I think, will oblige us to admit a landward voyage of the ice by which it was deposited. We must also claim a depression of the land at least 400 feet, to admit of the stranding of these drift laden bergs, or a current swollen to nearly that volume pouring over it to seaward. There may be some reason for both of these conditions. The depression undoubtedly existed. The country being clothed with thick-ribbed ice, glaciers came down to the head of the fiord, now represented by our Basin, and filled it. The Narrows, twelve fathoms deep now, may then have presented an obstruction to their passage; but the mighty force found and burst the weak barrier, ground and eroded their depths, and gave a passage to the ice masses, which piled themselves on the eastern shore, and did their part in depositing the boulder clay now found there in beds of considerable thickness, and in helping to form the shallows of the Eastern Passage. The principal force was no doubt exerted in that direction; but another glacier of less elevation and momentum, was pushing along in a lateral direction across the depression which is now our isthmus, and finding the ravine formed by the upheaval of the granite, further eroded its depth, and scooped the channel of the North West Arm. When this took place the land may have been sinking, or at its lowest depression. As the climate ameliorated and the land gradually rose again, many icebergs grounded on the heights of the peninsula, and melting deposited their burdens and formed the mounds which cover it. Channels were thus prepared for the ice laden currents that subsequently passed over the land, in the springs and summers of the warmer climate that accompanied the re-elevation, and found their way to the ocean. If we are prepared to admit the theory of glacial action as forming the various sections of our noble harbour, the relative depths of water in the Basin, the Arm, the Harbour and the Eastern Passage, become intelligible. At the Basin where the erosion commenced and was longest continued, the depth is in some places near the Narrows, 27 fathoms. The North West Arm, where the glaciation was less forcible and extensive, shows a depth of  $5\frac{1}{2}$  to 9 fathoms. The Narrows are 12 fathoms deep. While at the Eastern Passage, where are the

principal clay deposits, there is scarcely depth of water to float a small schooner. The depth of the harbour is pretty uniform with that of the basin, and varies from 9 to 17 fathoms. As the great landward current gradually ceased, from the natural causes of elevation, melted ice, and deflections owing to the reconstruction of the land, the ocean which must have been sensibly driven back by the overflow of this mighty river, resumed its ancient sway, and beat against a bare rocky coast, and covered depths completely eroded. It now fills the harbour, basin and arm with a placid stream, and a tide that has a rise and fall of not more than five feet. It has made deposits of sand and mud, but it offers no phenomena to prove that the clay and the drift were deposited from its bosom. Countless ages may have elapsed since it resumed its sway; but we are not warranted in believing that the depth of the sand or mud is very great. The most that can probably be said is, that there is good anchorage in any part of our noble harbour, perhaps an excavation of twelve to twenty feet would exhaust all their superficial contents. This much in favour of the glacial theory as accounting for some of the circumstances by which we are surrounded.

Geologists who engage in the study of soils will find a good field in this granitic and slaty district, in which to pursue their labours. Time has rounded the granite eminences, but has had little effect upon the rocks in general. In many places, although covered with trees, they have not been covered with decomposed matter. In others the decomposition barely nourishes mosses and lichens. The borders of our lakes sometimes exhibit a few feet in depth of peaty growth; but the debris of the rocks since their denudation, has never afforded a soil capable of itself of extensive cultivation, although it may have contributed, in many instances, to enrich the overlying deposits.

Could a human eye have looked abroad upon the land when Aspotogaen was regaining its five hundred feet of elevation, it would have been thought a hopeless scene. Yet now we know that it was a preparation for the advent of the human race—a grand operation of Divine Power, gradually forming the country for the habitation of living creatures. In process of time vegetation spread over the drift—the stunted spruce and fir—the alder

and birch—the flowering shrubs and evergreens—the ferns, mosses and lichens,—hid the deformities of nature. The bear, the moose and cariboo, the fox, the wild cat and the hare, tenanted the woods. The beaver dwelt undisturbed by his watery domain, and reared a numerous industrious progeny in plenty and security—fowl increased on the surface of the waters—and fish innumerable made the banks which the rushing inland flood and icebergs had formed scores of miles away, their habitual resort, and countless shoals filled our rivers, bays, and harbours. Lastly, a band of strangers from a distant land, allured by the plenty which a kind Providence had placed within their reach, and clad in the spoils of the brute pre-occupants of the forest, reared their wigwams on the shores of our noble sheet of water, and there acknowledged the goodness of the Great Spirit in silent adoration and worship. If the knowledge of the present era should ever pass away from the earth, and future intelligences should examine this region for evidence of the antiquity of man, they would not, as now in Europe, find a gradual sequence of improvement—or, as upon this continent, an age of barbarism succeeding traces and remains of civilization and refinement; but they would be puzzled by the fact connected with the ancient people,—that there were mingled in one strata, the stone weapons and implements of savage life, with those of finished manufacture, and other remains, which attested high cultivation in the arts and sciences.

The history of Nova Scotia is written on the modern page, and not far removed from the recollection of the immediate ancestors of the present generation. Columbus discovers a new world, and Anglo-Saxon energy is mainly instrumental in developing its vast resources. A century and a half has scarcely gone by, since the Briton reached these shores, and the civilization, refinement, intelligence and aptitude of progress of Europe, have taken root and flourished. Our barren rocks are beginning to be known abroad, and appreciated; and are already assisting to build up the great cities of this continent. They may yet prove a profitable staple of commerce; and time and scientific investigation may discover mineral treasure at our very doors. If these are but mere speculations, more unlikely things have come to pass. In the meantime there can be no mistaking our course. Let it be onward,—and our motto—“PERSEVERANCE.”