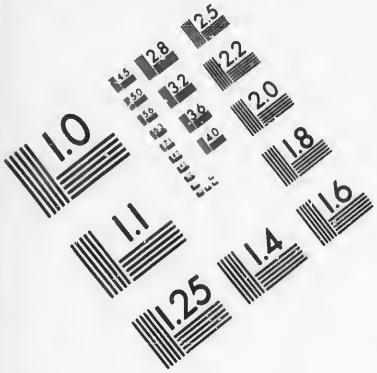

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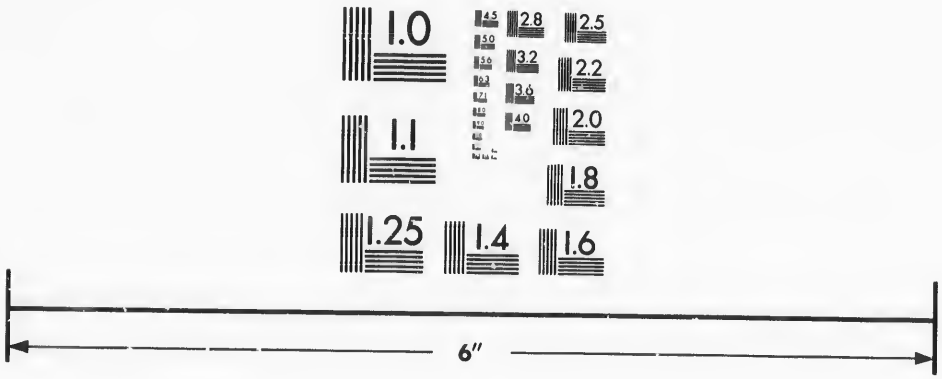

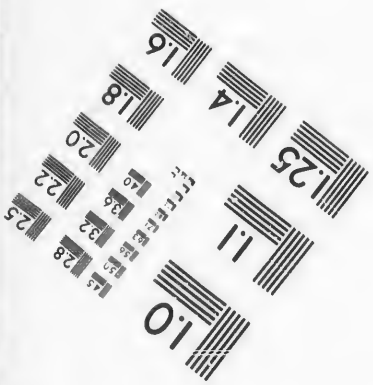

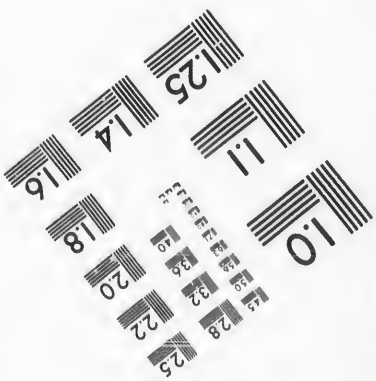

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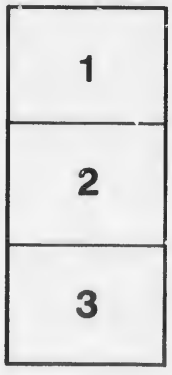

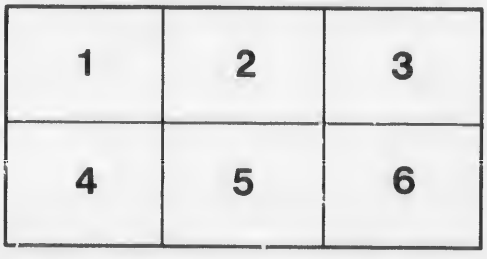

PROVINCE HOUSE

LECTURE

ON

Mineralogy.

DELIVERED BY MR. TITUS SMITH, ON MARCH 5, 1834.

BEFORE THE

Halifax Mechanics' Institute.

DEL

LECTURE

ON

MINERALOGY.

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PRINTED BY ORDER OF THE INSTITUTE.

Halifax:
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LECTURE

ON

Mineralogy.

In forming a collection of Fossils designed rather to throw some light upon the Mineralogy of this country, than as a cabinet of curiosities, I have thought it best to commence with our most common rocks. They are undoubtedly the most ancient, and probably form the basis upon which the others rest: In learning something of their relative situations, and of the materials which compose their external parts, we shall necessarily acquire some geological knowledge, and may also learn some things that will be of use to us. In giving the reasons for which these specimens have been collected, I have found it necessary to state, not only what I have seen, but also what I have thought.—To state the consequences that seemed to me to follow from the facts I had observed. I am sensible that some of these opinions will appear strange to many persons, who being in the habit of employing their minds in more profitable speculations have paid little attention to this subject. I have adduced several facts to shew the probability of these opinions, but do not expect they will strike the minds of others with the same degree of evidence that they do my own; for a multitude of slight proofs derived from facts observed during many years' attention to a favorite study, will leave an impression on the mind which is not easily conveyed to others.

In a society like the Mechanics' Institute, designed

for diffusing useful knowledge, our stores must necessarily, and ought to, be drawn principally from the treasures already accumulated in Europe; but if there is any subject upon which we can add something to the common stock, and repay a little for the much we receive, it is perhaps Natural History, for we here possess the advantage of viewing a part of the earth more in its natural state than any country which has been long possessed by a civilized race.

Geologists generally appear to be divided into two parties, one of which supposes that the large masses of rock were formed by the agency of fire, while their oppenents maintain that they were crystalized from a fluid which held them in solution. That there are in this Province rocks which have been formed in both these ways, there is no doubt, but it appears to me that the greater part of the large masses which compose the basis of this province, have acquired their present form in a somewhat different manner. He that dares to believe the evidence of his own senses, in opposition to such authority as can be adduced in support of the common theories, has no right to expect that his opinions shall be regarded any farther than he supports them with sufficient evidence. It is certain that in the great volume of nature there are records not written by the hands of man which throw some light upon the geological history of remote periods, and give us some knowledge of the operations of the Former of all things. If these records are obscure, their authority is undoubted. To decypher them has afforded the writer much pleasure in many a lonely and wearisome walk, for it is only by attending to the work that we can learn the design of the workman, and it is with a view of throwing some light on this subject, that a part of these specimens have been collected. Nova Scotia may be considered as a low portion of a mountain range, a large proportion of it being a solid rock covered with a shallow soil mixed with broken stone. Of this rock the greater part is granite. It composes most of the high-

est, steepest, and most abrupt and irregular hills in the province. It is divided into three distinct masses. One of which forms the basis of the greater part of the township of Halifax, commencing near the mouth of the NorthwestArm and passing about two miles west of the Dutch Village, continues upon an average within five miles of the Windsor road on the southwest side, and swelling into lofty hills on the south of the townships of Windsor, Falmouth, and Horton, extends under the name of the South Mountain, beyond Annapolis; then crossing Sissiboo River, and in some places approaching the sea, in others at eight or ten miles distance from it, bends to the left round the great barren plain of whinstone, which forms the centre of the south west part of the province, and ends a considerable distance on this side of Shelburne. The second, the least, but the most naked and mountainous, commencing near the north end of Lake Major in Preston, passes by the head of Chizzetcook harbour, and crossing the Musquodoboit ends a few miles beyond it upon the elevated plain of broken whinstone, which skirting the granite ridge on the north side nearly its whole length, extends beyond it between Musquodoboit and the sea shore almost to St. Marys. The third commencing a little east of Parrsboro' stretches across to within five miles of the Gulf shore at Tatmagouche, and forming the high land between Cobiquid and Pictou extends as far as Antigonish river, from whence, though the hills continue the rocks change to greywacke and coarse limestone.

Besides these three large masses, there are some other small portions of granite, but they are of inconsiderable extent. In some parts of the province very good land covers a rock of this kind, but a large proportion of the hills are nearly or quite naked. Upon these lie scattered innumerable blocks of granite, varying from five to forty feet in diameter, and resting frequently upon a few small rolled stones. They are also always found in abundance upon hills of other kinds of rock which are near to and south of masses of granite.

And a few, some of which are large, are found at a great distance, but always rounded, or in the form called rolled stones. The granite hills always shew abundance of irregular fissures, nor is it easy to find a place where a line could be stretched a hundred feet without crossing a crack. Besides these open fissures there are many seams which appear like fissures united, the small ones with quartz, those that are three or four inches broad with fels spar. Rarely a fine grained variety will be found extending for a mile or two, which separates where it is exposed to the air into pieces of a good form and size for building stones. Within ten or fifteen miles of Shelburne, there are some ledges composed of layers 6 or 8 inches thick, which stand vertically, and are separated from each other by clefts about two inches broad filled with scales of mica. Granite varies very much in the size of its grains and in the colour and quantity of mica it contains. There are also large masses which have their fels spar stained with red or yellow oxyde of iron. This variety is not fit for building stone, as it is subject to decay when exposed to the air.

Whinstone (Trap) is, next to granite, the most abundant rock. As it generally alternates with slate, except upon the great elevated plains above mentioned, it is necessary in describing its locality also to give that of slate. Some idea of the proportion which these rocks bear to each other, may be obtained from the following extract from the journal of a walk of 580 miles in that part of the province, which is southwest of the road from Halifax to Windsor. In travelling this distance I passed 350 miles of granite, 173 whinstone, eleven whinstone and greywacke, and forty seven slate. As the slate always runs in a direction a little north of east, and south of west, and I travelled in every direction, this although the best approximation that I can give, will be an imperfect representation of the proportions of slate and whin. To this it should be added that I travelled little within ten miles of the sea

shore, where slate would have been found in a greater proportion. The whinstone is generally of a light blue within, and of a greyish white on the surface: its fracture *invariably* splintery. It is deprived of its iron and partially decomposed by lying under peat earth or the turf of woods, and forms those beds of light dusty sand which are frequent on the shores of lakes. This sand shews no particles of quartz, is easily rubbed into fine powder, and fuses at a heat little exceeding that required to melt brass. In a few places the whinstone is cleft into layers, which have a vertical position and east and west direction like slate. Many portions of it have separated in straight lines, leaving pieces with one, two, or more plain surfaces; and in a few instances, all the surfaces are plain, and the pieces have six faces, which are sometimes nearly square, but far more frequently trapezoidal. It may be observed that the stones which have one plain surface, can frequently be broken by the hammer at right angles with, but never in a line parallel to the plain surface, although they sometimes break in that direction when exposed to fire. Consequently a stone which has the form of a cube or parallelopipedon is spoiled for a building stone by attempting to break it in the middle, as it is sure to separate in a diagonal direction. It is not easy to find a block of whinstone three feet in diameter which does not contain a number of fragments, (for the most part of an angular form) which are distinguishable by a different shade of blue, a coarser or finer grain, and a different direction of their fracture. In many instances these fragments compose the greater part of the stone. As every variety of our whinstone shivers to pieces when exposed to fire, and the blocks which are exposed to the air all show a disposition to separate, sometimes in straight lines, but far more frequently into irregular fragments, I conceive that the greater part of the masses of this rock were at some former period broken pieces thrown together without order, with their interstices filled by the sand which it forms as it de-

cays, (a state in which it may be found in many places under peat and turf,) and that by a recrystalization of the sand, they became again solid rocks, which being composed, (with the exception of the part newly formed) of fragments, whose natural lines of fracture were in many different directions, would be incapable of breaking in any uniform manner, either under the hammer or when exposed to fire or frost. Although the fact is well known to those who are constantly employed in quarrying stone, it may be useful to some persons to know, that building stone can be most easily procured from whinstone, in those situations where the greatest proportion of stones with, what are called, smooth faces are found. Whinstone, that which has a regular fracture not excepted, frequently contains rolled pieces of blue limestone, which when first broken, cannot be distinguished from the whin in which it is imbedded, except by its fracture, which is rather cubicogranular than splintery: but after a few days' exposure to the atmosphere, it becomes brown, and finally changes to a black rotten stone, that soon crumbles into sand, leaving as it decays, those semi-oval and hemispherical cavities which may be often observed on the surface of our trap rocks. Rolled and worn pieces of soft slate are also sometimes found imbedded in whinstone, which also sometimes holds a very small quantity of Pyrites, almost always crystalized in those regular forms to which the term of Marcasites has been applied.

Where hills of whinstone are nearly bare, perpendicular ledges may often be observed running in an easterly and westerly direction, and facing the south. Upon ascending the ledge there is either a level or a gentle descent extending northerly for perhaps a hundred yards, when we meet with another, and in this manner they continue often for a quarter of a mile or farther. In describing the situation of the whin which alternates with slate, it is necessary to observe, that there is a tract of land on the shore of the Bay of Fundy, commencing near St. Mary's Bay and extending to Cobi-

quid, varying from five to twenty miles in breadth, which has a deep soil with but little stone on the surface, and which generally rests upon rocks that I have not yet mentioned. With the exception of this strip of ground, and the granite and whinstone districts already noticed, nearly the whole of the land southwest of a line from the middle of the Township of Rawdon, to the middle of the great Shubenaccadie lake, and from thence to Lawrence Town, and the greater part of the land within ten miles of the shore from Lawrence Town, to Manchester, rests upon a rock which is alternately slate and whinstone. The surface of ground that rests upon slate is usually covered with broken whinstone for half a mile southward from the line of junction of a band of it with whinstone. Where either of these kinds of rock lie south of a Mass of Granite, the surface stones for a considerable distance are granite. When the soil is removed from these rocks, the slate frequently, and the whinstone in some places, appear to have a smooth surface marked with lines which seem to have been formed by the attrition of some hard substance moving in a north and south direction; some of these lines are near an inch in depth, others only slight scratches. Mr. Whiteman, whose business has given him many opportunities of observing them, informs me, that he has sometimes observed them upon granite, and that he has always found them to bear nearly a north and south direction in every part of the Province.

That curiosity which the Author of our being has implanted in the mind of man, undoubtedly with a view of stimulating him to the acquisition of knowledge which must ultimately be beneficial to him, will not permit him to rest when he observes that great and extraordinary changes have taken place in the world which he inhabits, without attempting to learn how these changes have been effected. When he has discovered a considerable number of facts which bear upon the subject, and has so familiarised his mind to them, that he can take them all in view at once, he will per-

ceive that there are other facts which are necessarily implied by those he has discovered, and a greater number which he will think are rendered probable by those which he knows to be certain, and in this manner before he is well aware that he has such a design, he will have framed a theory of the whole subject. These observations are introduced as some apology for the following Hypothesis which I should almost believe, did I know that the rocky parts of the earth generally resembled the little that I have seen.

The tradition of a "Golden Age," of a period in which there was no change of seasons, so generally spread through all ancient nations, is in some degree supported by the fossil remains of antediluvian animals and vegetables, which give no indication of a difference of climates. The Mosiac account of the creation and deluge favours the same opinion. "The Lord had not caused it to rain on the earth," "A mist went up and watered the ground"--Vegetables alone were given to man for food.—"Fourteen cubits of water" were sufficient to cover all the hills.--"It rained for forty days and forty nights." "The Fountains of the great deep were broken up." After the deluge the rainbow is mentioned as a new thing,—a proof that it had never rained before. Permission is given to man to eat animal food, without which he could not inhabit the polar regions. Summer and Winter, cold and heat, are now first mentioned.--The life of man is remarkably shortened.

The tremendous showers of rain that attend the eruptions of Vesuvius are stated to exceed in violence, and in the immense quantity of water which falls, any thing observed upon any other occasion, and the floods which they have produced appear on some occasions to have done more damage than all the other accidents attending the eruption. Undoubted volcanic remains prove that at some period prior to the date of history, subterranean fires must have prevailed in a greater degree than they have been known to do since. If these erup-

tions were simultaneous with the deluge, and what is meant by the "breaking up of the fountains of the great deep," they would be sufficient to account for the shock given to the earth by which the parallelism of its poles with those of the equator was destroyed, and a rotation of seasons necessarily introduced. Such a shock must have caused all the water of the ocean to roll over the earth with a force sufficient to have produced our present mountains by removing the soil that covered them, and for a time presented an appearance resembling the allusion of the prophet to this event. "The windows from on high are open, and the foundations of the earth do shake. The earth is utterly broken down. The earth is clean dissolved. The earth is moved exceedingly. The earth shall reel to and fro like a drunkard, and shall be removed like a cottage."

I have seen a piece of shallow plowland resting on a sloping rock which had the earth partly washed off in a heavy shower. The most elevated parts of the rock were naked, with a few large stones upon them, often resting on pebbles. The hollows of the rock filled with loose stones which covered a portion of the gravel. Here and there where a whirling eddy had been formed, by the position of the stones, small hillocks of the earth formed. The earth which had been carried off disposed in layers, varying in fineness and in the proportion of small stones which they contained.——Such is the general appearance of our mountainous districts upon a larger scale. The rounded form of the stratified gravel every where, indicates that these fragments of stone have been subjected to a violent motion. Thousands of boulders of granite* lying on hills of naked rock rest

*As the supposition that these blocks of granite have lasted for so long a time in their present position, may seem to border too much upon the marvellous; it should be observed that they can not have been completely exposed to the open air for any considerable time. Naked rocks are soon covered with the crustaceous Lichens. The minute leafy kinds are attached thickly to this crust, and soon followed by the larger kinds commonly called paper mosses. As they are bad conductors of heat, they preserve them in some degree from the effects of sudden changes of the temperature of the air, as well as from the mechanical action of rain and wind. They answer the same useful purposes upon the stems of trees,

upon rounded pebbles. The vallies between these hills covered with broken stones. The gravel where deep, lies near the lower parts of the hills. The whole suggests the idea that an immense volume of water rolling over these rocky districts has carried off the soil which once covered them. The charcoal so frequently to be found in the sand-stone proves that it was once on the surface of the earth, and stems of trees in a position at right angles with the layers, and sometimes passing through many of them, indicate that the layers were deposited nearly at the same time, and probably prevented from adhering together by slight depositions of vegetable matter not susceptible of petrifaction.

None of our rocks can be called "primitive" if this term designate such as have lasted from "the beginning," for they all contain rolled and angular fragments of other stones. The township of Halifax rests chiefly upon granite, and is the only place that I have seen in the province where a considerable plain can be found upon this kind of Rock. Near Dover and Prospect the granite contains a very large proportion of rolled stones, of iron stone slate, and whinstone, varying in size from four feet to two inches in diameter. The proportion of these imbedded fragments increases as we approach the sea shore, where they are so abundant as to impress the idea that this mass was originally a portion of disintegrated granite mixed with rolled stones which was deposited in its present situation at the time when the innumerable boulders of granite which rest

most of which are known by the colour of the crustaceous Lichens which cover them, and not by that of the bark, which in many trees, of which the Beach is one, is entirely covered with them.

Among the abundance of Lichens which are found on our hills of rock there are some which will be found useful when this becomes a manufacturing country, and which may now perhaps pay for exportation. The Lichen with which the piece of flannel attached to this paper is dyed, would it is conceived, if brought into common use, save half the indigo used by our country-women in dying blue, as it is not liable to fade like logwood colours, nor does the operation of dying with it injure the cloth. A brighter colour might have been given, but the cheapest materials, (Urine and a little lime) were purposely used to extract the colour.

on our hills of naked rock were fixed in their present position. The time when the surface stones of every kind were thrown southward of the mass from which they were broken. The time when so many large portions of the surface of the solid hills of slate and whinstone were ground smooth and marked with north and south lines by the attrition of the stones which the current of the deluge rolled over them. From the granite of this plain having its fels-spar very frequently stained with yellow oxyde of iron, as well as from its forming a plain, so very uncommon in a granite district, I have been led to believe that it is but of inconsiderable depth, and that it rests upon slate. It should be observed that this imbedded stone differs much from the masses of iron stone slate which are at a distance from granite, but very little from that which is contiguous to it. It contains a larger proportion of mica, and sometimes a few grains of fels-spar. I have often observed that a piece of ironstone slate of ten pounds weight has communicated a yellow stain to the fels-spar of the rock in which it is imbedded for the distance of half a yard. Wherever granite is much broken, rounded and angular pieces of a finer-grained granite may be observed, holding a greater than common proportion of mica. I conceive that these imbedded fragments were not originally granite, but that by means of an internal motion in the rock the material which forms mica and fels-spar has been introduced from the adjoining granite, and that the period may arrive when they will be no longer perceptible.

I am aware that this supposition must appear absurd to many, as the growth and changes of rocks are so slow that we have not the same kind of evidence of their certainty that we have of those in the vegetable kingdom. But all our large masses of rock are in some degree pervious to water, and must be more so to ærial fluids, and that the elements of rocks can readily assume an ærial state, any person may convince himself by rubbing two pieces of quartz, hornblende, or fœtid

limestone smartly together for a few seconds, when he will not only perceive a strong smell, but also that he can distinguish the different kinds by their peculiar smell.

We all know that the external parts of stones are liable to decay and change from an exposure to the weather, but have generally, it is believed, an idea that the internal part is a dead inert substance in which there is no motion, being at present in exactly the same state that it will be at a future period. Closer observation will convince us that this idea is not always correct. Blocks of whinstone are often met with containing veins of quartz, varying from two inches in thickness to an eighth of an inch and less : they have the appearance of having been cleft and again united by the seam of quartz. It appears to be necessary to the formation of the quartz that the external air should be partially excluded. In the woods when the mossy turf is removed from a cloven whinstone rock, if the fissure should not be more than two inches broad, the opposite faces of the rock will often be found covered with quartz. Sometimes with very small, glittering, sharp-pointed crystals often with larger, more opaque, and less perfectly formed crystals, often both faces are covered with solid quartz, and in some places united by it, while in others a small space remains, and points of crystals cover the opposite faces of the quartz. The first crystals that are formed are nearly at right angles with the face of the rock, but before the fissure is entirely filled up, some are often found in other directions. This circumstance may be caused by the fires which occasionally destroy the turf with which the rocks are covered. When the fissures being exposed, the crystals become opaque and sometimes shivered ; and being on their surfaces in a state of decay, are not continued when a new coat of turf is formed, but new crystals grow from their surface, some of which being attached to the bevelling es of the points, they form a mass of prisms which lot parallel to each other.

These veins of quartz occur also in granite and slate. When the veins are six inches or more in width in this latter rock they usually contain imbedded broken pieces of slate. There are several other minerals which occasionally fill up veins and cavities in rocks: but it should be observed that these minerals are always component parts of the rock in which they are formed. Thus common slate has its fissures united by pyrites. Broad veins of fels-spar are found in granite. Calcareous spar forms veins in lime stone, sometimes so numerous as to give the idea that it has formerly been cleft into minute pieces like half-slacked lime. There is a pebble approaching to jasper, rarely met with, composed of concentric layers of alternate yellow and brown which has the same appearance being very thickly veined with quartz. Near akin to this pebble are those rounded depressed lumps of yellowish claystone sometimes found imbedded in sand stone, which always contain a blackish nucleus in the centre, at times so much resembling a piece of iron rust as almost to give the impression that we may be surveying the remains of an antediluvian implement which changing to rust had petrified the surrounding clay, in the same manner that I have seen a somewhat similar stone formed about the head of an old axe which had been long buried in the ground.

The black lime stone on the Cape-Breton side of the Gut of Canso contains veins of beautiful violet purple spar.

The precipitous ledge of Cap dore' which contains native copper has some of its fissures united by veins of Jasper and Charcedony. The amygdaloid of which some fragments are found imbedded in the ground near Halifax, and large blocks on the bason of Mines, appear to the eye to be the same stone as the lava of Teneriffe, but this last contains empty vesicles like blacksmiths' cinders, while in our amygdaloid the vesicles are filled either with earthly chlorite (painter's mountain green) or with balls of opaque lime spar (steatites) composed of crystalizations which radiate from a com-

mon centre, and generally coated slightly with mountain green.

This amygdaloid appears to be very ancient lava, the vesicles of which have been filled up by the cyrstalization of a portion of its material.

There are in this Province masses of coarse gritty calcareous rock, which contain abundance of cockle shells in their natural situation. Upon breaking this rock most of the pairs will be found to have the space which was formerly occupied by the animal, partly filled with transparent glittering crystals of lime-spar. A very small number are empty, and a small number filled completely with an opaque stone, finer-grained and lighter coloured than the external rock. The shell itself having changed its appearance and become more like the rock in which it is enclosed. The appearance of the whole indicates that these shells will finally disappear, and the rock appear, and be a homogeneous stone. On the barren part of the southern coast of the province, masses of conglomerate rock occur composed of the common slatey gravel cemented by yellow oxyde of iron derived from the slate. In other places may be seen similar conglomerates, but the yellow oxyde has become red. The whinstone gravel and smallest pieces of slate are also red. The large pieces of slate still retain their colour. Another stone is all red, the form of a few large pieces of slate are visible, the small pieces are no longer to be seen, but a few very transparent specks of quartz appear, occupying interstices between some of the fragments of stone contained in the original mass.

In the eastern part of the Province large masses of pudding stone are frequently met with. They are composed of rounded pebbles of white, red, and blue stone, mostly siliceous, cemented generally by quartz which fill the interstices [in a few instances the cement is sand stone.] As these pebbles are the same in appearance as those in the beds of many rivers, it is probable that they were rolled by the action of water into their pre-

sent situation, where the external air being excluded by a covering of earth, they were united by the crystalization of a portion of the siliceous earth they contained.

A large collection of conglomerates, that is to say, of stones composed of earth and broken stone cemented by quartz, lime, oxydes or carbonate of iron, &c. would go far towards proving that many masses of rock were at some former period collections of the *debris* of various kinds of stone thrown together promiscuously, which, petrified either by oxyde of iron from some contiguous mass of pyrites, or by the crystalization of a small portion of the silica or lime contained in the mass, had since gone through certain changes (by means of an internal motion in the mass) which had made most of their peculiar distinguishing marks disappear, and changed a considerable portion of the mass into a homogenous stone. Fragments of fels-spar appear to be never affected by these combinations any farther than taking the colour of oxydes of iron, and mica usually retains its natural appearance. The cavities which abound in conglomerates at first, are by degrees occupied by a growth of transparent crystals which are either siliceous or calcareous in proportion as these earths predominate in the mass. It is most probable that the matter which forms these crystals is dissolved in an ærial fluid. For it is proved by the appearance of those which are of several colours, that they increase like trees by additional layers formed upon their surfaces, and it is inconceivable that the small quantity of watery fluid borne by capillary attraction to the cavities could be distributed over their surface in such a regular manner in any other than a gaseous state. Many appearances in stones render it probable that a part of these transparent crystalizations finally become opaque and by degrees acquire the nature of the rock in which they are imbedded. Among the fragments of Porphyries and Porphyroids which are generally spread over the province, some specimens occur containing small

spherical nodules of reddish brown jasper, or a stone approaching to jasper; which are generally solid, but there are some which have a cavity in the centre lined with pellucid spar. Nodules containing similar cavities are sometimes found in the common fœtid limestone, which are liable to produce dangerous explosions when thrown into the fire.

During the decomposition of pyrites, a portion of the rock in which it is imbedded is frequently decomposed, when this rock holds a considerable proportion of silica, crystals appear to form with great rapidity. I have seen in the front of a perpendicular rock a cavity, equal perhaps to six cubic feet, which appeared to have been exposed to the air for several years, by the falling off of a part of the rock which had covered it. This cavity appeared to have been not long before occupied by a mass of pyrites. The greater part was decomposed, and lay at the bottom, a blackish grey powder strongly impregnated with vitriol. Mixed with this powder there were several pieces of the weight of a pound or two, of the common granular pyrites, which is generelly completely decomposed by an exposure of twenty years to the air: yet the roof of this cavern, and the sides as far down as the pyrites had fallen off, were completely covered with crystals some of which were half an inch long. Collections of crystals generally seem to be connected with stones in a state of decay. In the granite district of the township of Halifax, there is a tract where specimens of crystalized quartz are frequently found, part of which is of a light purple colour. It is generally attached either to a kind of conglomerate formed of granite partially decomposed, cemented by quartz, or to a mixture of quartz with fels-spar in a state of decay, containing small cavities filled with China clay.

The appearance of the large masses of rock seems to indicate that the veins of every kind found in them were e fissures, and have since been filled by metallic or some other mineral substance which formed a

part of the general mass, and which dissolved in a fluid, or in a gaseous state, and impelled by that kind of attraction which causes the union of particles of matter which are all of one kind, have filled up these vacant spaces; thus forming collections of many substances useful to man by drawing their materials from a mixed mass.

In referring to "attraction" for the explanation of certain combinations, I wish it to be understood that the term is used not to cover, but to avow my ignorance. It might be defined to be a law which governs certain physicial actions of which we do not know the causes. All kinds of attraction are doubtless effects as well as causes, but they are mostly the effects of causes which man has not discovered. Thus a ley made from the ashes of wood which grows near Halifax or on any other vitriolic soil, will be found to contain potash and another salt now called sulphate of potash. This last cannot be dissolved in less than sixteen times its weight of cold water; the potash will dissolve in less than its weight of water. Consequently by evaporating the ley the sulphate of potash may be crystalized and separated, while the potash remains dissolved. This might be explained by saying, "That when this salt formed the seventeenth part of a solution the attraction of its particles for each other was stronger than their attraction for water," but this would convey no more information than saying in plain words: "We know that this salt will crystalize when it forms a seventeenth part of a solution, but we do not know the cause any more than we do why potash will *not* crystalize until it forms more than half of a solution."—Thus it is in every scientific pursuit, we presently come to bounds which prove that our mental powers are very much limited. We *may* learn that there is a necessary connection between the mineral, vegetable, and animal kingdoms, that many things which we had viewed as nuisances, were in their proper place, and answered useful purposes, and that the care and wisdom displayed in

preserving and continuing what are accounted the most insignificant plants and animals are so manifest, that we shall not be disturbed by dreams of the soil of our continents being washed into the ocean, or our planet displaced by the shock of a comet. But we shall learn at the same time that the number of things of which we have little or no knowledge is much greater than we were aware when we commenced our studies.

In traversing the dreary barren shore which extends from the mouth of the northwest Arm nearly to Margaret's Bay, some persons of good sense who have thought little upon the subject, are tempted to exclaim, "Why were those barren wastes created?" This question will be answered by referring them to the quantities of fish caught on the barren shores of Newfoundland and Labrador; while on the shores of the ocean no place is found where fish are caught in abundance, upon the coast of a very fertile district; and the inhabitants of Halifax would be poorly compensated for the loss of their fish market by having their townships covered with a fertile soil.

During the season of vegetation, a very fertile soil, whether in a state of nature or of cultivation strikes every eye as a beautiful object: but a rusty slate soil where the spaces between the stunted spruces and hacmetacs are occupied by trailing Juniper, Kalmia, Mayflower, and a little starved grass, is so associated in our minds with the ideas of sterility and poverty, that the first sensation it produces is far from pleasing, yet the naturalist whose thirst for knowledge compels him to search a little deeper will even here find sources of information and amusement. He will learn that this despised soil contains stores which may be useful to future generations, and that it must have been as valuable to the aboriginal inhabitants as the more fertile districts, during that unknown number of ages which preceded, the (to them) fatal period, when, "their times g fulfilled," that power was guided to the Amerishores, which "devoureth, breaketh in pieces, and peth the residue with its feet."

Upon turning our attention to the slates, we shall with the little knowledge we possess, be able to perceive that they are useful to man and that they have not been "created in vain."

To render the purpose for which the specimens of this stone are collected intelligible to those who have paid no attention to chemistry, it is necessary to observe, that all slate which is covered with a coating of rust, (technically called brown or yellow oxyde of iron) either contains, or has contained pyrites, a mineral which has a metallic lustre, and which varies in colour from white to yellow. That the pyrites in the common slate is principally composed of sulphur and iron. That, (with the exception of the species called marcasites which is crystalized in regular figures,) it is always decomposed by exposing it to the action of the air for a few years. The sulphur by attracting oxygen from the atmospheric air becoming sulphuric acid, dissolving the iron, and forming the salt called sulphate of iron, (the common green copperas of commerce). The pyrites during this process losing its lustre, and either falling to a powder, or becoming a soft blackish stone.

This salt dissolved by the water absorbed by the rock, sometimes forms chalybeate springs, but more frequently rises in small fissures to the surface of the rock by the power of capillary attraction, where it forms those white lines which may always be observed upon slate rocks after a few fair days in summer.

When a solution of copperas is exposed to the air it is soon decomposed by new combinations. This decomposition is accelerated by its coming in contact with vegetable mould or peat earth. The oxyde of iron separates in a light bulky state giving the water a thick oily appearance and ochery colour, a state in which it may often be observed in ditches on the peninsula. This substance on poor soils soon hardens, encrusting the stones, and often cementing the gravel and forming large masses of conglomerate rock, such as composes the bank on the south side of the Governor's farm, and in

several places on the shore of Dartmouth. Even on fertile soils fragments of slate may be found, which have doubled their bulk by petrifying a portion of the contiguous soil.

Slate stones therefore which have a strong brown crust, make an excellent material for roads, as the copperas they form, is slowly changing a portion of the soft soil to stone.

The vitriolic slate which lies under peat earth, is never encrusted with oxyde of iron, or petrified earth. On the contrary, the stones frequently have a worm-eaten appearance, the spaces near the surface which were once occupied by pyrites being empty.

Whinstone in the same situation appears to be in a state of slow decomposition, the surface resembling a soft white sand stone. The same effect is produced upon these stones by remaining for a considerable time under heaps of stable manure, and also in some degree by a covering of the turf of old woods. This proves the absurdity of the practice, still too frequent near Halifax, of repairing roads occasionally with soil from the ditches; as a material is introduced in the rich mould formed from the manure washed from the road, which not only serves to make dust in summer, and mud in the spring and autumn, but also to dissolve a portion of the stoney part of the road.

It appears therefore, that peat earth must be useful to the agriculturist upon vitriolic soils, which are too gravelly, as it will change a part of the stone to earth, although it will not, like carbonates of lime, change it to a fertile soil. The beds of bog ore found under peat swamps, have probably originated from the vitriol of the slate. Small beds of this ore, in a quantity too inconsiderable to be worth working, may now be found near Halifax, but as it appears to be necessary to its rapid formation that the ground should be exposed to the sun, I conceive that it will be more abundant here-

ere a barren slatey soil is covered by a growth of

firs two or three hundred years old, the surface is usually overspread with a layer of turf from six to twelve inches in thickness. Beneath this turf which excludes the external air, the slate appears more free from rust, more solid, and holding more bright pyrites near its surface, than that which has been for a considerable time exposed to the air. Yet there is always at the bottom of the turf a considerable quantity of charcoal, which together with an abundance of raspberry seeds, proves that the ground was open previous to the growth of the firs. It seems therefore, that the pyrites is reproduced after the turf becomes so thick as to exclude the external air in a considerable degree.

The oxygen of the oxyde of iron, and sulphate of potash probably unites with the charcoal, while the iron and sulphur again form pyrites in the cavities where it formerly existed. It would follow from this supposition, that while a country is inhabited by a race of savages who carefully preserve the forest, the formation of iron ores (useless to them) is retarded. But that when they are replaced by a civilized race, whose habits lead them to destroy the forest, the ores of this, (to them) most useful of metals, are rapidly accumulated. As many of our hills of common conglomerate contain a very considerable proportion of iron, some of them might be worth the trouble of an assay imitating the manner in which they must be smelted in large furnaces. It is to be observed that iron ore is valuable rather for the good quality than the large quantity of metal which it gives. For as iron is a combustible metal, it is always found necessary to add to *rich* ores a large quantity of some kind of stone or sand, partly for the purpose of forming a covering of glassy cinders to protect it from burning by excluding the air. The late Mr. Pernette shewed me a piece of cast iron which he had melted from the common conglomerate. By his assay it had yielded a fourth part, or twenty five per cent.

Slate usually stands vertically, and runs in a direc-

tion a little north of east and south of west. It is almost always rent with fissures, for a considerable depth, most of which cut obliquely across the natural line of cleavage of the slate. Some of these fissures are united by veins of pyrites, others open with the opposite faces coated with oxyde of iron. The varieties to be found in the common slate are numerous, although in general the difference between them is not great. When the rock is naked and smooth upon the surface, the layers which mark these varieties are very visible. A few of them are siliceous and nearly as coarse as whinstone. Very rarely a thin layer occurs which will split like roofing slate. The greater part of the slate in which the pyrites is mostly decomposed, splits easily, though not with regularity. There are some layers, which shew no disposition to cleave like slate: The most remarkable of these are, a kind of limestone in very thin layers, which usually are of small extent. It is extremely hard and heavy; strikes fire with steel;—is of a slate colour; generally contains pyrites, and sometimes garnets of the colour of rosin. Like many other kinds of limestone, it decays when exposed to the air, forming a black rotten stone. It burns to a dark sandy lime. I conceive that a portion of the material which forms slate has been introduced into this stone since it has been in its present situation, and that it was originally a common limestone, for I have in a single instance observed a rolled piece of this limestone in common slate, and think it very probable that it was originally of the same kind with that of which many rolled pieces (with the figure of paving stones) are found in whinstone, now scarcely distinguishable from the whin, but which have probably had a portion of hornblende and silex introduced into them since they were imbedded in their present position, which is the cause of their giving a dark sandy lime.

Another kind which will not cleave often forms layers of considerable size. It is as hard and fine grained as the limestone, contains a larger proportion of pyrites,

but will not burn to lime, and is usually encrusted with rust. Upon working a few feet into the rock, this variety sometimes changes into a stone resembling the Norway rag with an undulating grain like that of wood, and coated on one side with a thin layer of fine allum slate. I have seen a single instance in which a cylinder of this slate composed of concentric layers of grit about as thick as the grains of Ash, and surrounded with a thin bark of allum-slate, formed such an exact representation of a log of wood that it might have been mistaken for a petrifaction, had no more of the same variety in a different form been seen. The specimen marked allum-slate is taken from the cylindrical block above described. Although fine grained allum-slate like this specimen is very common in Halifax, I have not seen a vein more than an inch in thickness. When first broken from the rock it will mark paper like black lead, but it soon becomes hard by exposing it to the air. But there are other varieties in very broad veins which will yield allum. One rule may be given to distinguish them all. "Every slate which gives a blue mark when rubbed upon a piece of the same kind, will by skilful management yield considerable allum. The property of marking blue seems to originate from a partial decomposition of the slate itself that occurs during the decomposition of the pyrites. In most situations where peat bogs rest upon slate, shallow beds of blue clay occur, apparently formed from slate decomposed by the peat. This is a very tenacious clay, dries hard in the sun, but crumbles to dust if burnt or long exposed to the air. From this clay, allum can be made with less expence than it can from slate. Should any one be disposed to try the experiment, it would be necessary to observe that the substances which yield allum will also generally yield Copperas. That Copperas is composed of iron, dissolved in sulphuric acid.—That allum is composed of pure clay or alumine dissolved in sulphuric acid mixed with a portion of fixed or volatile Alkali. (in most specimens of allum, with both) That if alkaline

salt should be added to a solution of iron in sulphuric acid, a portion of the iron would be instantly separated, but that the acid dissolves clay most readily when mixed with a certain proportion of alkali. Were allum-slate from uncultivated ground or clay from the common to be exposed to the air for a year under a shed which protected it from the rain, and frequently turned, it would upon lixiviation yield copperas, but clay from the side of a cellar wall or allum-slate from the streets of Halifax in the same situation would form allum, because it would have imbibed a portion of alkali from the wash of the yards. As these clays differ in quality, being formed from different varieties of slate, it is customary previous to establishing allum works, to ascertain by experiments the kind, and the exact quantity of alkali, that will make the clay most productive. Some clays are mixed with peat, dried, and burnt: Others are placed under sheds and frequently turned, sprinkling them with urine till the proper quantity has been added.—Both wood ashes and urine are found necessary for some. It is also necessary to pay attention to the season in which the clay is lixiviated, for allum forms most readily in the hottest season, while other salts are formed from the same materials in the cooler part of the summer.

Some of the clay near Halifax that I have tried, has become so highly impregnated with allum as to present a glittering appearance by candle light, or in the sun, the surface being half covered with crystals of allum. As our barren soils contain the materials in abundance, it is probable that at a future period there will be extensive allum works in this province.

Besides the Slates there are other Matrices of Allum in the Province. I have observed allum formed from the soil of some of the meadows on the Souiac which contain salt springs, and lie contiguous to gypsum. It is formed also in the decayed portions of the fine grained, hard, grey rock which alternates with the sandstone at the Joggins, near the Cumberland coal mines. The

band of slate upon which the town of Halifax is built after running westward five or six miles, meets a mass of granite where it ends. Eastward it may be traced as far as Petpiswick, varying from one to two miles in breadth. Upon the north side of this band there is a [illegible]dth of about a hundred yards of pale siliceous slate, part of which is harder and heavier than whinstone. South of the Halifax slate the band of whinstone extends in breadth southward five or six miles: part of a band of slate appearing again near the point on the west side of the entrance of Cole Harbour. Northward the band of whin extends from the three mile house at the Basin, where it commences, to the sixteenth mile on the Windsor road, where a considerable band of slate occurs. Where these bands of slate join the granite on the west, they become ironstone slate, a singular variety, of which the distinguishing marks are, That it is heavier than any other stone in the province. That it is harder than common slate, and some portions of it harder than granite, and that it generally contains a large proportion of small oval grains, so exactly resembling the gravel formed from the debris of coral rock in figure and size, that I have conceived it to have been originally a shell gravel like that of Bermuda, Florida, &c. which had since it was imbedded in its present position by the introduction of a portion of the iron and hornblende of the rock changed its colour, and in some degree its nature without losing its original figure. Although from its resemblence to the stone in which it is imbedded, it is scarcely perceptible in some specimens when first broken, yet it is often perfectly visible upon the surfaces of the same specimens, for as it frequently decays when exposed to the air, either with greater or less rapidity than the stone in which it is contained, the surfaces will sometimes appear eroded with small oval cavities, while in other specimens they are overspread with the gravel in the form of the roe of fishes.

The hardest and heaviest ironstone is frequently separated into flags which shew no disposition to separate

again. It rings like metal when struck, and contains abundance of small crystals of hornblende, extremely hard, branching through it in every direction. It is very dark coloured, and has the smell of hornblende.—Perhaps it ought to be called a hornblende slate. I have observed that where the west end of the whinstone joins the granite, it differs little from the iron stone, becoming heavier than common whin and containing coral gravel. In the few places where I have seen the rock naked at the line of junction, the ironstone appears to dip under the granite, and although I have seen hundreds of fragments of ironstone imbedded in granite, I have not as yet met with a piece of granite in ironstone.

These imbedded fragments form so large a proportion of the rocks near the shore, that the sand between Sambro and Margaret's Bay has a grey colour, and the persons who supply Halifax with white sand find it necessary to go farther westward. The islands opposite the southern shore of the township are granite rocks. Their southern sides, exposed to the open sea, are worn away and shew layers of fine grained stone (apparently formed from fine granite gravel,) mixed with common black shorl. These layers are usually about a foot in thickness, and like those of stratified gravel form curves somewhat analogous to those of the hill above them.

Is it not probable that this rock is of later formation than most of our granite hills? That it was a mass of the debris of granite mixed with rolled stones, which since it was deposited in its present situation has been cemented by a portion of its material which had, probably, assumed a gaseous or ærial state? If this were certainly demonstrated it would appear very probable that our granite generally had at an earlier period been in a similar state upon the surface, and that the imbedded pieces had been stones of another kind which have since become granite. I have seen so many facts which render it probable that quartz, fels-spar, and mica are in some cases rapidly formed, that I think it by no means proved that granite never contained any organic substance, because they are not now found in it.

On slatey soils the magnetic needle is very frequently turned from its proper direction. The error does not often exceed two or three degrees, but has been sometimes observed to amount to ten. This magnetism is probably caused by iron lately precipitated from a solution of vitriol in the state of an imperfect oxyde, for the bright pyrites is not magnetic, nor are those ores in which the iron is in the state of a perfect oxyde, but the iron in vitriol is in the state of an imperfect oxyde like the scales from the blacksmith's anvil.

As peat earth decompose vitriol depositing the iron in the state of a perfect oxyde, the true direction of the needle may generally be found by setting the compass in the middle of a swamp, but this rule is not without exception, for I have seen a swamp, more than twenty rods wide in which the needle is considerable affected. Small springs of chalybeate water are always running into this swamp upon one side, and on the lower part of the hill on the opposite side are large masses of allum-slate, upon which the compass has been observed to change its direction four degrees upon removing it twenty feet. In winter the true course may often be taken from a frozen lake. This magnetism is sometimes observed on soils which rest on whinstone, but I have never observed it upon granite. I have however observed a remarkable affection of the needle where the surface stones were all granite, there being a mass of that rock half a mile to the northward. The bands of slate more frequently swell into lofty hills than those of Whinstone, and are therefore the worst situation for roads, except the road runs in the direction of the hills. The road through Preston to Chezzetcook follows the band of slate upon which Halifax stands most of this distance. It crosses so many high and steep hills that it can never be made a good road; but had it been bent a little southward at Lake Loon at the distance of three miles from the ferry, and following that direction as far as necessary, continued to the other side of Lawrence town river about a mile farther south than the present track, it

would have been an easy road.---Where Slate rises in lofty hills it frequently appears of a pale colour near their summits, and containing but a very small proportion of pyrites seldom acquires a rusty coat by exposure. Most of the best hills in Preston rest upon a rock of this kind. But upon the lower part of the same hills the rock contains a full proportion of pyrites and the soil is of course of inferior quality. The basis of some hardwood hills is a slate rock containing a mixture of limestone and no vitriolic mineral. As the soil on these hills is fertile, it is useful to be able to distinguish this variety of slate. It is always of a light bluish colour without rust. The limestone which is fine grained and nearly of the colour of the slate, forms serpentine veins which give it the appearance of having been cracked into irregular fragments and cemented by the limestone. When blocks of this slate are exposed to the air the limestone is easily distinguished as it decays and forms a brown rotten stone.

When we become rich enough to indulge in the luxury of dry roads at those times of the year in which they are now muddy, and of smooth roads at all times, our level roads will be covered with broken Slate of those kinds which readily shiver into thin pieces. The thin flat shingles of slate, always incline to rise to the surface if near it, rounded and angular pieces of stone have a tendency to sink.

These observations are not founded upon theory. I have seen some small-specimens of such road. McAdam, I think, recommends worn out hoops and similar useless pieces of iron for making roads firm in moist situations. Nature has furnished us with a similar material in abundance. The common conglomerate with a mixture of rusty slate gravel, will in moist situations make a very firm road. I have seen a road made across a small swamp, by first covering the remains of the old pickets with a layer of ten or twelve inches of stone which was again covered about ten inches in depth with a rusty slate-gravelly earth, mixed with about a third part

of fragments of common conglomerate. For ten years this road though considerably travelled, scarcely shewed the impression of a wheel, and it is still a tolerable road though it has not been repaired for twenty years.

Besides the slates already noticed, there is another kind always connected with the whinstone, of which it seems to be a variety. It is of a pale colour, never contains pyrites, and is consequently never of a rusty colour, it may be cleft like slate but not easily. It has formerly been used in Halifax for hearthstones and tombstones. Small veins of it are almost invariably attached to those masses of whinstone, which are of a good quality for building stone.

The reddish-brown Porphyries and Porphyroids, which in small fragments are generally scattered over nearly the whole province, most plentifully in clayey soils, were probably originally all conglomerates, formed from fragments of stones of various kinds thrown promiscuously together, which have by means of an internal motion so mingled the materials of which they were composed that they have now become a homogeneous mass, with the exception of the fels-spar and quartz. The sandstones appear generally to differ little from the sandy soil which covers them. If the one contains rolled stones, they are found of the same kind, and in the same proportion in the other, and they always alternate with about an equal proportion of a hard fine-grained stone, as sand upon digging deeply into it is found to do with clay. The three components of granite never shew any tendency to unite as a homogeneous mass. It is therefore probable that our granite resembles that of former periods. Yet is there good reason to believe that it has been, on the surface at least, in a state of disintegration, and also that it has a tendency to penetrate and change to granite some portion of those rocks, which are in contact with it. Mica during this process always preceding the quartz and fels-spar.

The common slate has clefts which admit some air for many feet in depth, and it appears to have suffered con-

siderable changes caused by the decomposition and growth of pyrites, and also of a portion of the stone, for in breaking some kinds of slate small cavities are found containing an earth differing little from Magnesia, and many fissures filled with the same earth united with a little oxyde of iron, and assuming a degree of hardness approaching to stoney, and in calcareous vitriolic slate, which is in a state of decay, thin veins of selenite may be found, so soft that it may be ground with the teeth when first taken from the stone: indications that during the decomposition of pyrites a portion of the stone in which it is enclosed is also decomposed.

The Whinstone also bears strong marks of having once been in a broken decayed state, and of having again become a solid rock. While these changes have been going on near the surface, it is probable that metallic ores and other homogeneous minerals have by degrees been collected in the deeper cavities and fissures of rocks which contained a small proportion of them diffused through their mass. Sulphur so generally contained in most rocks appears to be the principal agent in many of these operations, and particularly in the formation of veins of minerals. It often renders the oxydes of metals soluble in water, and as it very frequently assumes an aerial state; it undoubtedly, like other volatile substances renders a portion of the earth[illegible]d metals volatile also; as lead is rendered volatile by a mixture of oil of turpentine. There are many springs near to gypsum from which sulphurated hydrogen is always rising, (they also generally contain [illegible]nuriate of lime) and the general trouble experienced in almost all mines from firedamp, proves that there are always processes going on in the bowels of the earth by which water is decomposed, and hydrogen, the lightest known aerial fluid set free. Carbonic acid also exists in the earth in great quantities as a component of limestone, this always assumes an aerial state when it comes in contact with other acids. As there are therefore su[illegible] considerable quantities of elastic fluids contained in the earth, and as it is a known property of volatile sub-

stances to bear with them, when they assume a gaseous form, a certain portion of any fixed substance with which they were combined; it cannot appear improbable that mineral substances may in an aerial state change their situations in masses of rock, and that crystalization particularly, have been formed from the materials dissolved in an elastic fluid.

From all I have observed, I am compelled to believe that we have no proof that any mass of rocks in this province has existed in its present state from the creation. I believe that we have fertile lands formed from materials which once were rock—that we have masses of rock which once were earth. That there have been changes within the rocks as well as on the surface.—And that these changes will continue till they are brought to a conclusion by the last great Change.

SPECIMENS.

In describing these specimens the term "*rolled*" is applied to worn fragments of which there is no mass near to the place in which they are found, and there are several of which I have seen no mass in the province.

Those specimens whose locality is not named, from the township of Halifax

Slate 1. Mica Slate, rolled piece, not common.
Slate 2. Ironstone Slate, with oolite (supposed coral gravel) projecting.
Slate 3. The same with the oolite decayed.
Slate 4. Allum Slate.
Slate 5. Ironstone with crystals of hornblende.
Slate 6. Ironstone containing pyrites.
Slate 7. Hard calcareous slate containing pyrites. Not burning to lime.
Slate 8. Calcareous slate containing pyrites. Burning to lime.
Slate 9. Slate without pyrites, containing veins of limestone. Preston.
Slate 10. Calcareous slate, containing garnets. Burning to lime.
Slate 11. Siliceous slate.
Slate 12. From under peat, shewing the cavities where pyrites had been.

Slate 13. Ironstone slate contiguous to the common slate.
Slate 14. Siliceous, with herborizations.
Hornblende 1. Shubenacadie, rolled piece.
Hornblende 2. Approaching to Whinstone, Preston, large rolled pieces
Hornblende 3. In granular Quartz, large rolled piece, Preston.
Hornblende 4. Mixed with Quartz, large rolled stone, Preston.
Quartz 1. Greasy Quartz.
Quartz 2. Crystalized Quartz.
Quartz 3. Quartz passing into Jasper.
Quartz 4. Quartz with iron ore.
Quartz 5. Amethystine and crystalized Quartz. From the granite district.
Quartz 6. Quartz and slate.
Quartz 7. Whinstone veined with quartz.
Iron 1. Ore formed mostly within thirty years, from decomposed vitriol dropping from a slate rock, near the head of the North-west Arm.
Iron 2. Red iron stone, partly crystalized, rolled piece. Hummond Plains.
Iron 3. Magnetic iron ore, rolled piece. Shubenacadie.
Iron 4 Herborizations of red oxyde of iron, in the same kind of sand stone with Iron 2, rolled piece. Shubenacadie.
Fels-spar 1. Common.
Fels-spar 2. Semitransparent and opaque Fels-spar mixed.
Fels-spar 3. A Fragment of pellucid Fels-spar containing shorl.
Shorl 1. From the line where the iron stone and granite unite.
Shorl 2. From south side of a granite island worn by the sea.
Co. Conglomerates cemented by quartz, lime, or a mixture of one or both with oxyde or carbonate of iron. Masses of most kinds in the province.
Co. 1. Conglomerate passing into jasper porphyry.
Co. 2. Common Conglomerate composed of slatey soil cemented by iron ore, little differing from bog ore, and formed from the vitriol of the slate. This is called common because large masses of it occur in such abundance in slatey districts. Properly speaking this is not a conglomerate, but as most of the others have been formed by the petrifaction of large masses of heterogeneous materials literally rolled together, this could not properly be classed apart from similar rocks because its materials were not brought together in the same way.
Co. 3. Composed of grains of quartz in concentric layers.
Basalt. From its glittering fracture it is probable that it has been formerly in a state of fusion—Very rare—Always in rolled pieces of small size. A good stone for touch-stones.
Po. Porphyries and porphyroids. Scattered all over the province in small fragments. Most plentifully in clayey soils.
Po. 1. Porphyry containing spheroideal pebbles.
Po. 2. Porphyry with basis of siliceous slate. Shubenacadie.
Transition stones.
Tr. 1. Ironstone slate near the line of granite.
Tr. 2. Fragment of a rolled piece of ironstone imbedded in granite.
Tr. 3. Whinstone porphyroid adjoining granite.
Tr. 4. Fine grained granite, abounding with mica, imbedded in common granite in rounded and angular pieces.
Tr. 5. Granite stained with oxyde of iron, resting on Ironstone.
Limestone 1. Fœtid. North end of great Shubenacadie lake, in loose pieces, but there is probably a large mass near; as it is near to Gypsum, but the soil being deep the rocks are not visible.
Lime 2. Porous limestone, rolled stone. The nearest mass that I have

seen of this species is on the west side of Margaret's Bay, in granite. It appears to be about one hundred yards in breadth, and is the only instance that I have met with of a large mass or vein of any other stone in granite. On the eastern shore of the Bay some limestone appears opposite to this, and a few fragments are thrown by the sea on Lawrence town beach. Limestone resembling this may be found beyond Ardoise hill, but the fœtid limestone is most common there.

Lime 3. A fragment of marble, susceptible of a fine polish. North end of great Shubenacadie Lake.

Lime 4. Granular limestone, composed of oolite resembling that in ironstone slate. By heating it the cementing part assumes a different colour and shews the oval grains.

Carbonate of iron. Where small brooks run from swamps of peat earth over a soil that contains any vitriol, they usually deposit this substance for a distance of thirty or forty yards below the swamp, and sometimes much farther. Many persons have mistaken it for coal or iron ore. It appears to be a part of the carbonaceous and extractive matter of the peat dissolved in water, which uniting with the oxyde of iron in the vitriol that it meets with, precipitates with it, and also generally gives a similar coat to the stones it passes. It contains very variable proportions of iron; for some specimens when dried will float, and burn without flame. Others are heavier and incombustible till red hot. There are some fertile soils half covered with broken whinstone which has a worm-eaten appearance. This stone contains limestone gravel diffused through it, which is decomposed where it is exposed to the air. A brook running from a swamp with water of a brown colour will upon passing this whinstone, deposit a considerable quantity of this carbonate, and become perfectly clear.

It appears that a certain portion of vitriol is useful in freeing water from the peat, as *that* is in separating the vitriol, for on granite barrens where there is generally no vitriolic mineral, the water is invariably brown, and upon the granite islands where there is very little soil except turf, it is nearly black, and seems to be poisonous to cows and sheep. So far below where a brook issues from a swamp, as this substance is deposited, the water has a fertilizing quality, producing fiorin grass and crow-foot. But when it has deposited all the carbonaccous matter, the herbage changes to the common plants of moist barren soils. As whinstone soils generally hold but a small quantity of vitriol, the water from swamps retains a portion of this substance for a greater distance in running upon them, and may be often profitably employed as a manure for grass, by turning the brook along the side of a hill. On a rusty slate soil the vitriol will so quickly change it to a stoney substance, and precipitate it, that it is there of little value.

This substance has been used as a paint. It is a very dark brown. To prepare it for a paint it ought to be heated red hot in a covered crucible, or other vessel that will bear the fire; then ground, and mixed with water, which should be allowed to stand for a few seconds that the sand may fall, from which it should be poured off into another vessel, and when it has all subsided, the water may be carefully drained off. It will then, when dried, be in a proper state to grind with oil. [The box which contains the Specimens is stained with it.] Agate. Lawrence town beach.

Flints. Fl. 1. A fragment of a piece of transparent quartz encrusted with flint, from Mr. G. White, Cornwallis.

Fl. 2. Flint and Chalcedony from Mr. Scot's farm, Ballynan river, being part of a stone of more than 100 weight.

Fl. 3. Clements farm, Ballynan, about nine miles north of Shubenacadie. In both places found near fœtid limestone.

Fl. 4. Rolled piece, Twenty miles up Windsor Road. Properly Jasper.

Crystal. Fragment of ; Granite hills north of Preston.

Marle. Clements farm, Ballynan river. It is a mixture of decayed fresh water snail shells, and the white earth commonly found at the bottom of peat earth, that is under cold spring water. It appears to be a valuable manure.

Garnets, separated from a portion of Slate 10, that had fallen to dust by exposure to the air.

L. W. The two specimens with this mark are pieces of a West India limestone. One of them is manifestly the soil of the sea shore petrified by water dripping from lime stone. The condition of the shells proves that they were inhabited by living animals at no very remote period, and the petrifaction is of recent formation. The other, (a fragment of the same stone,) differs little from the Steatites which by cementing together fragments of quartz forms the Burr millstone. Could not these millstones be made by arranging fragments of Quartz within hoops in situations where they would be exposed to the drip of water which strains from the fissures of shivered limestone, and partially excluding the air? For water usually dissolves a portion of most kinds of limestone that contain but a small portion of other earths, and this water generally forms petrifactions when it falls into Caverns from which the external air is partly excluded.

Lapis ollaris. A rolled stone containing specks of soap-stone.

Fragments of Selenite from slate.

Micaceous and semi-crystalized iron ore from Cobequid. This last approaches to plumbago, and would probably make pencils.

FINIS.