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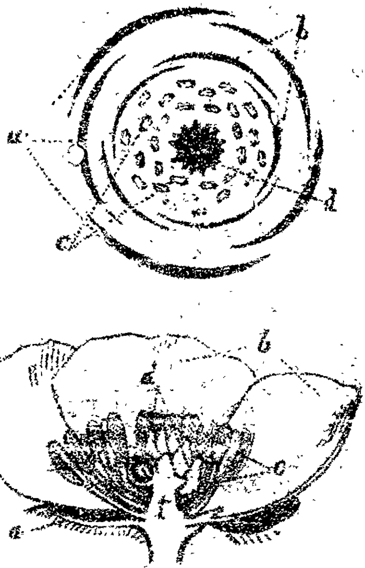

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This Magazine will appear bi-monthly, and be conducted by the following Committee, appointed by the Natural History Society of Montreal:—

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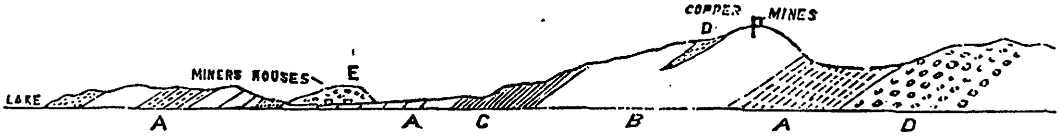

(A) Amygdaloid and Tufa.

(B) Compact Trap and Amygdaloid.

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THE

CANADIAN

NATURALIST AND GEOLOGIST.

VOLUME II. MARCH, 1857. NUMBER 1.

ARTICLE I.—*On the Geological Structure and Mineral Deposits of the Promontory of Maimanse, Lake Superior.*

BY J. W. DAWSON, A. M., F. G. S.

(READ BEFORE THE NATURAL HISTORY SOCIETY OF MONTREAL, FEB. 10, 1857.)

The Copper Districts of Lake Superior have been so frequently explored and described, that little interest may attach in the minds of many to the subject of this paper. I have selected it, because the locality referred to, though shortly noticed in the Reports of the Canadian Survey, has not hitherto attracted any very large share of attention, and in the hope that to a new observer even the features common to this and the better known copper districts of the region, may have presented themselves in some new aspects.

On the North Shore of Lake Superior, the geologist observes between Sault St. Marie and Maimanse, portions of the three oldest formations in America or in the world.

1st. Those beautiful red and spotted sandstones so well seen in the excavations of the Sault St. Marie Canal, and regarded by most geologists as the equivalent of the Potsdam sandstone of New York and Lower Canada, the base of the Silurian Series in America.

2nd. An enormously, thick formation of Conglomerate, Sandstone, Slate, and Trap, evidently lying at the base of the red Sandstone, and constituting the Huronian Series of Sir W. E. Logan.

3rd. The still older Laurentian Series, represented here principally by Syenitic rocks, which have afforded the materials of the Huronian Conglomerates.

The two latter groups of rocks are first seen at Gros Cap. The nucleus of this lofty promontory consists of reddish Syenite, here projecting to the South West of the ordinary limit of the formation to which it belongs, and running down in abrupt precipices into the lake, while around its Western side are wreathed sheets of trappean rock, similar to the cupriferous traps of other parts of this coast, but here containing only veins of calc spar and sulphate of barytes.

Gros Cap is a place to be remembered by a tourist from the eastward. Its bold front, against which the waves break like a sea swell, the picturesque coves cut into the trap of its western side, the singular and rich flora, depending in part, no doubt, on the peculiar climatal conditions of the region, and in part on the character of the rocks,—all contribute to make it the beau ideal of a voyageur's camping ground, and a fitting introduction to the bold scenery of the north shore of this great inland sea.

Crossing Goulais Bay, which cuts deeply into the land, immediately west of Gros Cap, we pass a low shore, presenting no rock sections, but exhibiting in the bottom of the lake, red and white sandstones, like those of Sault St. Marie. At the head of Goulais Bay, Sir W. E. Logan has observed these to rest on the continuation of the trap of Gros Cap.

The next indentation is Batcheewanung Bay, beyond which, after passing a low gravel point, we find on the west side of the small inlet, called Anse aux Crepes, a series of rocks, which, if not forming an underlying member of the Potsdam sandstones, must be of Huronian age.

They consist of imperfectly laminated red and mottled sandstone, a mottled argillo arenaceous rock, having a marly appearance, but not calcareous and possibly a mixture of sand and volcanic ash; conglomerate with syenitic pebbles; laminated tufaceous beds, made up of volcanic ashes and scoriae; and beds of amygdaloidal trap. They dip at high angles to the southward, but very irregularly; the dips observed along a small extent of shore varying from S 10° E to S 70° W. At one part, they are traversed by a thick dyke of trap, in contact with which the sandstones are changed into coarse banded jasper.

An observer approaching these rocks from the eastward, must at first sight, form the opinion that he has reached a lower member of the red sandstone series of the lake, modified by the proximity of rocky coasts and contemporaneous and subsequent igneous action. A geologist familiar with the red sandstones of other regions and periods, would be the more inclined to adopt this view, from the circumstance, that the coating of white sand with peroxide of iron to form red sandstones, has usually, if not always, been a secondary consequence of volcanic action; and hence, the association of red sandstone with trap and tufa is very frequent. For this reason, the appearance of the red rocks of Sault St. Marie would alone be sufficient to prompt the question—are there, in the continuation of these beds, any evidences of contemporaneous volcanic action?

On the other hand, the high inclination and disturbed condition of these rocks, render it not improbable that, as Sir W. E. Logan has shown to be the case with the somewhat similar rocks on the north side of Lake Huron, they uncomformably underlie the Potsdam sandstone, which in that case may be in part made up from their waste.

The promontory of Maimanse is high and rugged in its interior, and in approaching from the east, its outline presents a series of abrupt protuberances. This appearance is caused by the outcropping edges of thick beds of trap and conglomerate, which have, better than the associated tufa and sandstone, resisted the denuding agencies, which in this region appear to have most thoroughly swept all the elevated tracts, scooping out the soft beds and carrying off all the finer materials, as if the forces of breakers and strong currents had been combined in the operation, along with the drifting agency of ice.

In a point at the west side of Anse aux Crepes, the beds of sandstone and trap are seen in a less disturbed state than in the bay itself. Two very thick beds of amygdaloidal trap are here exposed, and between them are bands of brown ripple-marked sandstone and volcanic tufa. The whole dip west at an angle of 15°. The amygdaloids are evidently superficial lava currents, presenting in some places those pipe-like cavities described by Sir W. E. Logan in his account of this place, and which must have been caused by air bubbles rising through the superficial molten mass. The amygdaloid is much more vesicular above than below, and its cavities and veins are filled with agate, crystalline quartz, calc spar, and flesh-coloured laumonite.

The shore for some distance follows the strike of these beds, in which the waves, acting on the tufa and mineral veins, have excavated many small caverns and ravines. Some of these excavations are at a little higher level than that of the waters of the lake at present: and they are very instructive in the explanations which they afford of erosions observed even on the summits of the hills.

Five miles westward of Anse aux Crepes, the ledges of the coast are broken across, probably along the line of a transverse fracture of the beds, to form the little bay of Maimanse. On the east side of this bay, we find another section of trappean and sedimentary rocks, apparently a little lower in the series than those of Anse aux Crepes. The highest bed of trap is amygdaloidal above, and more compact below, where it rests upon a brown conglomerate with syenitic pebbles, and thin layers of brown sandstone. The latter consists of grains, often rounded, of quartz, felspar, and hard black slate, stained by peroxide of iron, and cemented by carbonate of lime, which also enters into the cement of the conglomerate. The conglomerate rests upon another bed of trap, which in its upper part is largely amygdaloidal, and contains small agates. It also holds syenitic fragments, probably mixed with the scoriaceous matter of its surface, at the time when the conglomerate was deposited above, so that, as is often seen in such cases, the upper part of the trap passes into the conglomerate. These rocks present no appearance of igneous alteration subsequent to their deposition, and dip S. 70° W. 35°.

At the head of the bay, and at its western side, the sections show alternations of compact and amygdaloidal trap and hardened volcanic ash, in very regular layers; and holding numerous veins of Calc Spar, Laumonite and Quartz, with small quantities of Epidote, Prehnite, Sulphurets and Carbonates of Copper, native Copper, native Silver, and Galena; the mode of occurrence of which will be noticed hereafter. The numerous alternations of thin sheets of trap and tufa that appear in the low ground around this bay, indicate a long continued series of submarine volcanic overflows, while the rounded pebbles in the conglomerate point to a rocky Laurentian shore at no great distance. Much remains to be done in this region in separating those igneous beds which have consisted of volcanic ash and scoriæ, from those which are properly trappean; but this is rendered very difficult by the consolidation of the fragmentary beds by zeolitic matter, and by the resemblance which hardened volcanic mud and beds of vesicular scoriæ bear to true overflows of amygdaloidal trap, as well as by the changes induced in true igneous rocks by the percolation of water.

At the head of the bay, the ground rises rapidly to a height of 300 feet, in a succession of steep ridges, representing the outcrops of the beds which succeed each other in descending order. The section from the N. W. extremity of the bay inland is as follows, the measurements being taken from a plan prepared by Mr. Coatsworth of the Bruce Mines, for the Montreal Mining Company, who are now carrying on works of exploration at this place. The dips are to the westward, the general strike being N. 10° to 20° W., and the angle of dip varying from 25° to 35°. The rocks are, as usual with such materials, very unevenly bedded. (See section.)

1. Alternations of trap and tufa, with a bed of conglomerate, which appears to run out a little to the westward of the line of section, in which it does not appear. Large veins of calc spar, quartz, and laumonite occur in the trap, and some of them contain small quantities of native copper, native silver, and galena. Native copper also occurs in the vesicles of one of the amygdaloids, and one thin bed has its vesicles filled with a steatitic mineral. These rocks occupy a breadth of 500 yards.

2. Argillo-arenaceous beds, in places baked into a compact jaspery rock of a fawn colour, with red dendritic stains, in other parts a mottled argillaceous sandstone, similar to that of Anse aux Crepes. Breadth 220 yards.

3. Crystalline and Amygdaloidal Trap, with a bed of conglomerate. These rocks occupy a breadth of 440 yards, and rise to an elevation of 300 feet. The old Indian workings and the excavations of the present mine are on the summit of this ridge. The lowest rocks of this band are probably tufacous, and have been excavated into the ravine of a small brook.

4. Very coarse syenitic conglomerate, forming a second ridge. Some masses of stone two feet in diameter, were observed in this bed. It occupies a breadth of 160 yards.

The thickness represented by these measurements may be about 2,000 feet; but this by no means includes the whole thickness of similar rocks developed at Maimanse, and which extend both above and below the beds above described. The total thickness seen at Maimanse, is estimated by Sir W. E. Logan at 10,000 feet.

The beds included in No. 3 of the above section, are those in which the principal indications of copper have been observed. On the summit of the ridge, the hard semi-crystalline trap is traversed by a narrow fissure, running nearly with the strike of the beds, or north and south. Its greatest thickness is about 6 inches, but in some places this has been found to be nearly filled with native copper. One mass weighing 600 lbs. has been extracted, and the whole yield of a shaft 27 feet deep and without galleries, has been about three tons. The veinstones here are principally calc spar and quartz.

At a short distance westward of the shaft, the vein is divided into two branches. The course of this vein, as well as of most others in these hills, is marked by surface trenches, usually called "Indian diggings," though they are evidently erosions similar to those which run along the veins seen on the present beach, and excavated when the surface was undergoing denudation under water. These trenches, however, afford excellent guides in tracing the veins, and they have served this purpose to the ancient Indian miners, in whose time it is likely that plates of metallic copper, exposed by the removal of less resisting materials, may in places have projected from the bottom of these furrows. The real Indian diggings are shallow holes, sunk at intervals along the courses of the veins, and surrounded by broken pieces of veinstone, along with which are occasionally found stone hammers. These hammers are merely beach pebbles, usually of trap, and having shallow grooves worked around them, to receive withes or thongs used as handles. Most of them are 5 or 6 inches in their longest diameter, but one, now in the collection of the Geological Survey, is about a foot in length.

About one hundred yards northward of the shaft just mentioned, excavations have been made at the intersection of two veins, one running NW. and SE., the other N. and S. The former is unproductive; but the latter, which is six inches in width, contains small bunches of purple copper, in a veinstone of quartz and calc spar. A few small crystals of copper pyrites have also been observed in it. About 30 yards eastward from the second opening, is another vein, running E., 20° N., and wider than either of the others. Its principal mineral contents are green carbonate of copper with a little vitreous copper and copper pyrites. A few minute specks only of native copper have been observed in it. It appears to be very irregular in its width, and at the place where it has been opened, the wall on one side consists of amygdaloid, and that on the other, of compact trap, probably in consequence of a fault.

It would appear that this ridge is traversed by a multitude of fissures, containing copper and copper ores, and as is generally the case with such veins in trap, very irregular in course and dimensions. Those above described, are the most considerable yet discovered. Their value as deposits of copper, is not yet determined; but the indications are of sufficient promise to warrant works of exploration. The quality of the veins will, no doubt, change as they penetrate the underlying tufa and conglomerate, though, whether in the direction of greater or less value, is uncertain.

As the mode of deposition of native copper has been a subject of much controversy, I examined with care, with the aid of Mr. Borron, of the Bruce Mine, the veins exposed at Maimanse; and shall state the results at which I have arrived for that locality, with the facts on which they are based, without meaning to assert that the mode of occurrence and formation of native copper must, in all cases, have been of similar character. The veins traversing the trap of Maimanse have been filled with successive deposits of mineral matter on their sides, in the manner of ordinary mineral veins. In the larger veins, these are alternate layers of quartz and calc spar, the latter often moulded on the crystalline surfaces of the former, and *vice versâ*. In several cases, the first deposit of quartz is of an agatiform character and stained by peroxide of iron, but the greater part both of the quartz and calc spar is crystalline and colourless.

The deposition of the native copper has evidently been contemporaneous with or subsequent to that of the quartz and calc spar. The larger masses are imbedded in calc spar, occupying the cavities left in the wider parts of the vein, after its sides had been coated by that mineral. Smaller masses occur in a similar relation to the quartz. In one of the beds of amygdaloid, are kernels of copper impressed by crystals of zeolite, which had lined the vesicles previously to the deposition of the metal. In one small vein, plates of copper cut across the veinstone of quartz. Such examples indicate deposition of copper after that of the veinstone. In other specimens, delicate arborescent crystals of copper penetrate calc spar crystals in such a manner as to give them a general red color, indicating contemporaneous deposition.

Fig. 2 exhibits a magnified view of a thin slice of this cupriferous calc-spar, in which the crystalline laminæ of copper remind one of the quartz plates in graphic granite, and have evidently in part conformed themselves to the structure of the calc spar.

Fig. 2. *Slice of cupriferous calc spar from Lake Superior; magnified 20 diameters. The fine straight lines indicate the cleavage; the dark lines the laminae and fibres of copper.*

Native silver occurs on the shore in small quantity, in similar dendritic forms, in a vein containing calc spar, zeolites, and fragments of trap. The sulphurets of copper occur in precisely the same relations with the native metal. The carbonate is probably a product of oxidation of vitreous copper and native copper near the surface of the rock.

The whole of the appearances indicate that the deposition of copper belongs to the period of aqueous infiltration, by which the veins and vesicles were filled after the consolidation of the trap; and the copper, like the calc spar and zeolites, occurs both in true veins and in the cavities of beds of vesicular trap and tufa. Its deposition must, therefore, be explained, not by igneous causes, but by electro-chemical agencies, decomposing some soluble salt, most probably the sulphate, of copper. Such changes may have been aided by the remaining heat of portions of the volcanic masses, by the presence in them of large quantities of iron in low states of oxidation, and by the further oxidation of that metal evidenced in the red jasper and red laumonite of the veins, and the red conglomerate and sandstone associated with the trap.

One great difficulty in supposing the electro-chemical deposition of copper in these veins, is the want of a conducting surface, and one not likely to be acted on by copper salts, for the commencement of the process. Much of the copper, however, even when not exposed to atmospheric action, is coated with suboxide of the metal; and I have, in several instances, observed the crystals of calc spar in these veins varnished with a thin coat of peroxide of iron, or of suboxide of copper, which has been precipitated on their surfaces, and might have formed a better basis for copper deposition than the naked surface of the calc spar. In the delicate dendritic forms, the crystallization has evidently commenced from minute points; and this may have been the case also with some of the larger masses, which often have thin plates or fibres connecting them with the wall of the vein. Such connecting threads, if first deposited, may have served as conductors.

Such attempts at explanation must, however, in the meantime, be regarded as merely conjectural; and it must be confessed, that we can have little accurate conception of the processes that may go on in fissures extending from the bottom of the sea far downward into volcanic masses, and in which a great variety of substances are subjected in different degrees to the combined influences of heat, pressure, and aqueous solution. The main fact in relation to the origin of the metallic copper, is that it is a product, not of the fusion of the trap, but of subsequent processes, by which the fissures of that rock were filled by materials regarded as of aqueous origin.

In some specimens collected by Mr. Pilgrim, of Sault St. Marie for the Montreal Mining Company, in other locations on the north shore of Lake Superior, and with which I have been favoured by the officers of the Company, I find the following modes of occurrence, which farther illustrate the above views.

One of the specimens (17 of the Company's collection) is a portion of a vein of calc spar and agate with dendritic copper, traversing both minerals. The wall of the vein appears to be a reddish tufa, with fragments of green trap. Another (12) has a nugget of native copper, imbedded among calc spar crystals, coating a cavity in partially decomposed greenish trap. Another has a thin plate of native copper, running through the centre of a narrow vein of red laumonite. Another (22) is a vein of calc spar and datholite in a reddish tufaceous rock. The datholite occupies the interior of the vein, with calc spar on both sides, and contains crystalline granules of copper, with a little green carbonate of the metal. Another (19) has plates of native copper, moulded into the crevices between crystals of quartz and calc spar, in the cavities of a peculiar pseudo-porphyritic rock, which may have been a mechanical aggregate of felspathic fragments and volcanic ash. Another has small grains of copper attached to crystals of green prehnite, and moulded into cavities left by botryoidal concretions of that mineral In many specimens accompanying the above, vitreous and purple sulphurets of copper and galena occur in associations precisely similar to those of the native copper.

The age of the cupriferous rocks of Lake Superior has been a subject of much discussion; and my observations do not bear on this subject any farther than to convince me that the rocks seen at Maimanse underlie the red sandstone of Goulais Point and Sault St. Marie. From the observations of Logan, Owen, Foster, and other geologists, I have, however, little doubt that these last are really the equivalents of the Potsdam or Calciferous sandstones; and on this view I have proceeded throughout this paper.

The Maimanse rocks are assigned by Sir W. E. Logan to the geological horizon of the beds of the Bruce Mine and other places on the north shore of Georgian Bay, as a portion of his ante-silurian Huronian system, which, in the last mentioned locality underlies uncomformably the lowest Silurian rocks. This unconformability has not, so far as I am aware, been observed in Lake Superior; but I should not be disposed, in the case of formations without fossils, and similar in their sedimentary beds, to attach much importance to it; unless indeed it can be proved, that the red sandstone of Sault St. Marie is of much later date, and has been formed out of the waste of the older Maimanse rocks. The appearances rather indicate a great continuous series of sedimentary and volcanic rocks, in some places presenting only fragmentary debris, in others intermixed with volcanic ejections; and perhaps locally broken up by volcanic action, before the close of the process of deposition.

Whatever their precise age, it cannot be doubted that the cupriferous rocks of Maimanse occupy the same position, in relation to the older Laurentian and newer Silurian series, with the Huronian beds of Georgian Bay, and that they also bear a certain general resemblance to them in mineral character.

The red sandstone of Maimanse is represented at the Bruce Mines by quartzite; the conglomerate by a rock with similar pebbles, but much more indurated; the calcareous sandstone by arenaceous limestone. Veins of copper occur at both places; but at Maimanse, native copper prevails, while at the Bruce Mines, the sulphurets alone occur; at Maimanse, the veinstone is mainly calcareous, while at the Bruce, it is mainly silicious. The trap and tufa of Maimanse are at the Bruce represented by greenstone. While the Bruce sedimentary rocks may thus have originally been similar to those of Maimanse, they have been far more altered, and are associated with the deep-seated crystalline products of volcanic agency, instead of with those that are superficial. Differences of this kind imply, however, no difference in age.

These Huronian rocks, including under that name both those of Maimanse and Georgian Bay, mark a long continued period of igneous action and mechanical degradation, proceeding along the coasts of that old azoic land, which formed the nucleus of the American continent. This great series of physical operations constituted the preparation for the Silurian period, and no doubt formed the sea bottoms on which its sea-weeds and shell-fish began to live. In Lake Superior, we have the deposits of the shore margin only of these old seas; what may have been proceeding in their profound depths, we know not, nor have we any information as to the occurrence in their more tranquil waters, or on the neighbouring land, of any form of animal or vegetable life; and the rocks themselves are not of a character to warrant any very sanguine hopes of the discovery in them of organic remains. In a geological point of view, they merely inform us, that at the dawn of the Silurian period, and immediately before the deposition of the oldest rocks in which we find animal life, there occurred along the sea margin of this most ancient part of the American continent, enormous volcanic outbursts; and that these very closely resembled in their character the volcanic phenomena of every succeeding geological period, and even of modern times; and were associated with the extensive deposition of beds of red sandstone and conglomerate, similar to those which, at various succeeding epochs, have accompanied great volcanic outbursts and physical changes of the earth's crust. In an economical point of view, the great extension of these rocks, and their penetration by veins of copper, give them an importance which must constantly increase as they become more accessible, and are more fully explored.

ARTICLE II.—*Remarks upon the Geographical Distribution of the Order Ranunculaceæ, throughout the British Possessions of North America.* By GEORGE BARNSTON, ESQ., of the Honorable Hudson's Bay Company.

(Communicated to the Botanical Society of Montreal, Dec. 5th 1856.)

The Ranunculaceæ,* form a somewhat extensive order and make a good deal of show among the herbaceous vegetation of North America, although Europe can boast of possessing a greater number of species, the proportion being nearly as 7 to 5 in its favor. These generally hardy, and often beautiful floral inhabitants of the country, frequent the edges of our forests, our river and lake banks, and the rich natural prairies or lawns, that are scattered in such abundance over some portions of the continent. They climb to the mountain tops, and descend to the deepest dells. One species of Anemone is found like a primrose or crocus courting the snows on the great western ranges, and the Hepatica triloba may be spied out in Canada, concealed in the hollows of the most secluded glens. The order also maintains great freedom, in its choice of diversity of soil. We have the Aquilegia Canadensis on the warm slopes of rock and gravel, declining to the southward, while the Ranunculus Sceleratus, Abortivus &c., seek the damp and spongy meadow. The Ranunculus Aquatilis, still more thirsty in its propensities, will be pleased with nothing less than several feet of pure water.

In commencing my observations more particularly upon the distribution of the genera, I may state that I adopt the sequence in which these occur in Torrey's work on North American Botany, it being better to assume some method, however destitute of exact relation to my subject, than no method at all. For it will perhaps be the opinion of the most able in Botanical Science, that Flora, in the distribution of her Ranunculaceous

* For the information of the general reader, it may be remarked that, under the modern systems of classification, the *Ranunculaceæ* form the first Natural order of Flowering Plants. They constitute a very numerous family, characterise a cold damp climate, occupy an extensive range

favors, has attended very little to system or plan, rather seeming to have tripped about with this order in the most discursive and sportive manner. We may imagine her to have been in her

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of country in Europe and North America, and, when met with in the tropics, are found chiefly on the sides and summits of mountains. They vary much in form, and even in the structure of the flower, but they possess certain important characters in common, which admit of their being readily classified under one order. They are herbs or rarely shrubs, possessing an acrid watery juice, and having leaves generally much divided and with thin stalks more or less dilated and sheathing. The flower is variable in form and size, and, in many of the plants, its parts are very anomalous. These anomalies, however, may be generally looked upon as mere modifications, occurring during the progress of development, and in no way diminish that important anatomical resemblance in structure, which may be traced throughout the whole order.

The two following figures illustrate the general characters of the flower, as exhibited in the Ranunculus.

Fig. 1.

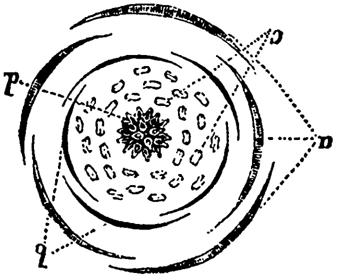

FIG. 1. Diagram of flower of Ranunculus, showing *a.* an outer whorl of 5 floral leaves, called *Sepals; b.* an inner whorl of 5 floral leaves, called *Petals; c.* an indefinite number of *Stamens; d.* numerous *carpels* in the centre, each containing a single seed.

Fig. 2.

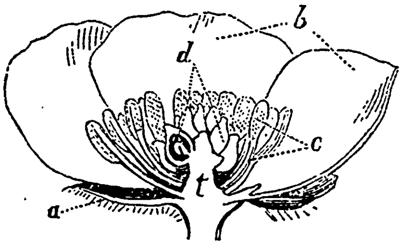

FIG. 2. Section of same flower, showing the position of the parts. *a. Sepals; b. Petals; c.* numerous *Stamens* attached to the elongated receptacle or torus (*t*), and situated below *d.*, the *carpels* or fruit, containing the seeds.

more girlish years, when this portion of her pleasing task of decking our earth was imposed upon her. Mayhap also, she may have breathed into the ears of her admirers of the present day, to lead off with Clematis, and thus constitute the Ranunculaceous order, the foremost of the great class of Exogens.

Of the above genus CLEMATIS, the *C. Virginiana* and *C. Verticillaris* are the two most northern species. After leaving Canada for the North West they seldom occur, although they are to be met with south of 54,° where the soil is rich and shrubs are numerous. According to Hooker, the latter is found as far west as the Rocky Mountain, and plentifully at Cape Mendocino on the Pacific, but the C. Virginiana does not appear to pass the longitude of Red River, or Lake Winipeg.

Among the ANEMONES, the two, which I have seen display themselves most conspicuously in Canada, are the *Anemone Pensylvanica* (the "Aconitifolia" of Michaux,) and the *A. Virginiana*. The former keeps its ground throughout the extent of the British territory, eastward of the Rocky Mountain and even westward, though less plentifully. The latter is less extended, scarcely reaches the Mountain, and is much more rare. Coppices of aspen, alder and young birch, not far removed from river banks, are the situations selected by these Anemones. They are of strongest growth in Canada in old garden ground, which may have been allowed to run waste. That slender little Anemone, the *A. Nemorosa*, so elegant in form and delicate in flower, is common to the westward of Lake Superior, along the frontier line of the United States. Choosing rich alluvial soil, it appears with the early violets, in woods where the sun is not entirely excluded by foliage or the growth of the shady fir tribes. It is a very interesting plant, prized by those who love the lightest carmine tint upon pure white. Besides these three Anemones, so well known in Canada, two or three species of low growth, and bearing flowers of various shades of blue, are to be met with by one travelling the continent from east to west. Like the Crocuses of British gardens, they appear to gladden the eye, as soon as the ground is clear of its winter covering, striving, as it were, by their early yet modest forwardness, to satisfy the longings of the impatient naturalist. The *A. Richardsoniana*, not a very showy Anemone, is a stranger to the two provinces, but in the north it sends up its yellow cup, where its more stately sisters decline to reside. In the moss of pine barrens, it stretches along its slender rhizoma, enjoying its soft bed and loving to associate with the Rubus Arcticus, whose habits it seems to imitate. Estranged from its relations, it chooses friends of congenial tastes. According to Torrey, it is found throughout Siberia, and possibly may have advanced like the mongrel, from west to east. I have had the plant from McKenzie River, and it has location in various parts of the Hudson's Bay territories, decreasing as it approaches Norway house or the north end of Lake Winipeg.

By the illustrious Linnæus and earlier systematists, the *Hepatica Triloba*, or Liverwort, was classed with the Anemones, to some of which it bears a strong affinity. As far as I have learnt, it is not to be had in the Hudson's Bay Territories, out of the ranges of the Rocky Mountains. In the vallies of these, it was found by Drummond, that unfortunate wandering collector, and as far north as latitude 55°. Here an interesting enquiry forces itself upon us. If this plant really do not exist in the great extent of country lying between Western Canada and the Rocky Mountains, how has it taken the mighty leap? Can it have made a circuit by the waters of the Missouri? Nature, we know, is not discrepant with herself. Will any theory of Appetencies or Okenian system of development account for these huge strides of vegetable species over numerous parallels of longitude? Is it not much easier and more rational at once to suppose, that there is an Almighty Creator and wise Distributor, exercising his unfettered power and will, in all things pertaining to man's terrestrial abode?

Coming now to the grand denominator, if not type, of the order, the genus Ranunculus, we have a mass of plants whose occurrence and distribution are so general and varied, that it would defy the efforts of the most accurate and extended observation to particularize or define them. Each species has more or less its own lines of extension and march and its own choice of favorite localities, so that the limits of range and abundance or scarcity in growth, cannot be easily or shortly specified. Such minute detail also would in a paper like this be tiresome and devoid of interest. Yet, something must be said on the subject.—The *R. Cymbularium* and *R. Reptans*, with undivided leaves, and the *R. Affinis*. *R. Ovalis*, *R. Abortivus* and *R. Sceleratus*, with foliage more or less cut and lobed, are the common species about Lake Winipeg, and probably throughout the Hudson's Bay country. The *R. Aquatilis*, or River Crowfoot, so remarkable for its numerous white little flowers on the surface of pools and of the still waters of very sluggish rivers, is as often met with by the voyageur in the wilds, as by the sportsman in Canada, who in his search for wild-fowl frequenting water, will stumble upon it often. It may be considered the lily of the frogs; for where it is, frogs delight to dwell. Its range is most extensive east of the Rocky Mountains, stretching, as it does, from the Arctic circle to South Carolina. It is confined on the east and west only by the Atlantic and Pacific oceans, although less abundant on the western side of the continent. Of that strong and rough species, the *R. Hispidus*, I have specimens from McKenzie River. It is found elsewhere throughout Rupert's Land.

The very general and extensive distribution of some of the most acrid species of this genus has no doubt, like everything else in the constitution of nature, its own wise purposes. The natives are aware of the properties of these plants, and the Doctors or Medicine Men make use of the *R. Aquatilis* and *R. Sceleratus* and others in their practice, but probably without any precise idea as to their peculiar action in the cure of the patient, their knowledge being strictly experimental. It must be admitted, however, that considerable skill is shown by them at times in the healing of wounds and cure of sores.

The *Caltha Palustris*, or Marsh Marigold, as it is called in some parts of England, may be said to cross the Continent, but I am not aware of its having a high northern latitude. 56° may possibly be the line which it does not pass, that is to say, on the eastern side of the Continent.

In certain parts of Lower Canada, the *Coptis Trifolia*, or Golden Thread, is very plentiful; but I have not observed it to be so abundant further in the interior, certainly not about Lake Winipeg. According to Sir John Richardson, it runs north to the parallel of 58°, and Torrey has it from the bogs of Greenland and Labrador. The same able Botanist quotes North West America, (Sitcha, Unalashka,) also as its habitats, from which we see at a glance the wide range of this pleasing little plant, with its small staminate looking petals, and its bright yellow, creeping and useful roots. Two other species, not existing in Canada or Hudson's Bay Territory, are found to the westward,—one, the discovery of the celebrated Menzies on the north west coast, named by Salisbury *C. Asplenifolia*; the other, of late introduction to the knowledge of botanists, the *Coptis Occidentalis* of

Nuttall, discovered, I believe, by Mr. Wyeth, in the Rocky Mountains. Science is indebted to this gentleman for several additions made to the herbarea of North American plants, although it was mercantile enterprise and views of trade alone that led him to cross the continent to the Columbia.

Of the AQUILEGIAS or Columbines, one species of which is so highly graceful and ornamental to Canada, I have not been able to collect more than two kinds, viz.: the *Aquilegia Canadensis* of known celebrity, and the *A. Brevistyla* of Hooker. By this botanist, the former is said to be very abundant at the mouth of the Columbia or Oregon River, and also in the Rocky Mountains between latitudes 52° and 55°. I am not aware of its existence to the northward of 56°, and would therefore say it preferred a domicile within a zone, bounded by a line of 40° on the south, and 56° on the north, making choice of dry situations and warm exposures, where the soil is suitable. It may be noticed here, that Torrey does not seem to admit the Columbia or Pacific Coast as a locality for this plant, which renders it probable that the *Aquilegia formosa* of Fischer, which resembles closely the *A. Canadensis*, was the species which Hooker took for a variety of the other.

In all my walks I have never yet had the pleasure of meeting with the *A. Brevistyla*, but it has been sent to me from Mackenzie River. I conclude that it is very rare to the southward of Lake Winipeg, although, according to some, it is a native of Western Canada.

Following naturally the Aquilegias, come the Larkspurs, or genus DELPHINIUM of Linnæus. Several species, not known in Canada or on British Territory, grow in the southern and western States of the Union, being natives there, and others also in California and the Oregon. The *Delphinium Exaltatum*, found in Canada, attains to a high latitude, as it passes the barrier or ridge of high land that separates the waters running eastwards into Hudson's Bay from those that fall by another course into the Arctic ocean. In these northern latitudes, it is probably confined to the limestone strata and the warmest exposures. I have dried specimens of some size from friends in the north, who gathered them on the banks of Clear Water River. I must own, I have not met with it myself between Lake Winipeg and Canada. To me, therefore, this fine plant, like the Hepatica, appears to have taken an immense leap of nearly 2,000 miles. If there be connecting links along this great distance, where the *D. exaltatum* shews itself, the chain must run to the southward of Lake Superior, crossing westward to Red River, and from that by the west side of Lake Winipeg and the northern tributaries of the Saskatchewan to the waters of Peace River.

The two species of ACTÆA, or Baneberry, common enough in Canada and the northern States, and so conspicuous in autumn by their cylindrical bunches of red and white berries, occur sometimes in woods where there is depth and richness of soil; but while the *A. Rubra*, according to Hooker, travels as far north as 60°, the *A. Alba*, I imagine, does not pass the latitude of 53° or 54°. This seems surprising, the "Alba" being so near akin to the "Rubra" in every respect, excepting the color of the fruit and the thickness of the pedicels, that by Pursh they were taken as varieties merely of the same species.

THALICTRUM closes the number of the genera of the order, which have come under my observation within the temperate climate of British North America. The *T. Dioicum*, called in the United States "Early Meadow Rue," although possessing no affinities with Rutaceæ, and little in common with the Rue plant, except a sort of resemblance in the leaf, is a hardy subject of our northern climes. Sir John Richardson states it to be in latitude 67°, on the grassy banks of the McKenzie, and American botanists give South Carolina as its southern bounds. It spans therefore nearly the whole breadth of the Temperate Zone. It enjoys a very short summer in its close look at the Arctic circle, and on the other hand can have very little winter, as a neighbour to the Magnolias and Agaves, and such tropical plants as stray a few degrees north, out of the torrid zone. Like the *Thalictrum Cornuti*, it springs up among the rich herbage along the banks of rivers, and seems to prefer limestone districts. In Lower Canada I have found the *T. Cornuti* frequently; and it is, I dare say, the most common species in that Province, and countries of the same parallel of latitude westward to the Pacific. It comes up north as far as 56°. If Hooker be correct, it takes a bound across the prairies of Central America, clears the Rocky Mountains, and seats itself again in the woods of the Columbia and the western portion of our continent.

Before finishing this paper, I may mention that of the 39 full genera of the order, noted by Lindley, Torrey has 21, as existing natives of North America, some of these genera displaying many species, such as the Ranunculus, Clematis, Anemone, and Delphinium, while others can sport only one. Among the latter is Hydrastis, taking its specific name from Canada. It is more abundant, however, to the southward, and it may be remarked of this plant, that it is not found to the westward of the Mississipi, nor any where, I believe, within the British Territories beyond Canada. It seems to have a liking to the Alleghany range and the streams running from it. It is found generally on the slopes of hills, where the growth of timber can afford it shade, and the soil sufficient moisture.

One or two species of Pœonia have been found westward of the Rocky Mountains, but not as yet to the eastward. Indeed they appear to have been dainty in adopting situations for their residence. The *Pœonia Brownii*, called after him who was styled by Humboldt the prince of botanists, has been found in the Blue Mountains and their vicinity, (from which locality I procured seeds for the unfortunate Douglas), and on the great volcanic range from which start up the snowy peaks of Rainier, St. Helens—Mts. Hood and Jefferson. Its discoverer Douglas has enriched British gardens with this and numerous other beautiful North West American and Californian plants. The other species which we owe to Mr. Nuttall appears only to be obtained from the neighbourhood of Ste. Barbara, Upper California, and has been named *P. Californica.*

The Genera which I have not touched upon, are—Myosurus, Cyrtoryncha, Trollius, Enemion, Aconitum, Cimicifuga, Trautvetteria, and Zanthorhiza, as they have not come under my observation. They have few species in North America. Torrey describes 4 in Aconitum, 4 in Cimicifuga, 2 in Trautvetteria, and 1 in each of the others. With the exception of *Cimicifuga racemosa*, he places none in Canada. They are to be found in the central and southern States of the Union, California, and the Oregon.

We thus see a pleasing variety in all that concerns this order of herbaceous plants. In the inflorescence as well as the fruit, the differences are very remarkable. The genera Clematis, Anemone, Thalictrum, and Hydrastis, cannot be said to have petals, although the sepals are coloured or petaloid; the Ranunculus and Pœonia have from 5 to 10. While the 5 petals of the Aquilegia have spurs at their base, the Delphinium has the upper sepal spurred, and in Aconitum it takes the form of a helmet, or is vaulted. In the fruit, we find also a sportiveness with all that might be considered regular. The Ranunculus has its Torus with the dry, hard implanted Akenia, the Hydrastis its juicy berry, while the Aquilegia is contented with nothing fewer than five erect follicles. Seeing so great diversity of form pervading the genera of this order in the most important parts of their structure, the flower and fruit, in all which however there is a connecting law, traceable by the philosophical and scientific botanist, let us not be surprised at perceiving, that Ranunculaceæ love change and variety likewise in their habits, their extension, residence, quantitative growth, numerous or rare distribution, &c. Although the ablest minds will never be able to account for these matters, these apparent whimsies and caprices of Flora, yet we may be sure that a regulating law directs them also, and we may be well content that it is so, since the study of such intricacies and diversified subjects in nature serves so remarkably to the employment of man's best faculties, and the mental powers, while the contemplations arising out of these studies are calculated to impress us with so much delight. The Creator and Distributor of the whole has thus magnified and multiplied our sources of pleasure, and therefore to Him are all the praise and honor due.

ARTICLE III.—*On the iron ores of Canada and the cost at which they may be worked.*

The iron ores of this Province are chiefly confined to the Laurentian system of rocks, in which they occur in such prodigious quantities that this may be styled pre-eminently the iron formation. The origin of those ores we know not. It is only certain that during the period when the Laurentian rocks were in process of being formed, iron was abundantly elaborated, while in the age of the Huronian deposits copper was principally produced and iron not at all in any great quantity. The following section is intended to give an idea of the order in which these formations repose upon each other.

Fig. 1. *An ideal section from the iron mine in Hull across the valleys of the Ottawa and St.Lawrence to the iron mines in the Adirondack mountains in the State of New York.*

Fig. 1.

H.—*Iron mine in Hull.*
A.—*Ditto Adirondack.*
O.—*Channel of the Ottawa.*
L.—*Ditto of the St. Lawrence.*

In the above section, the dark mass in which the beds of the two rivers are excavated is Silurian, consisting of sandstones, limestones and shales full of organic remains. The base of the figure represents the Laurentian formation composed of various kinds of hard rocks, such as gneiss (commonly called granite in this country) and white crystalline limestone. From the hills on the north shore of the Ottawa where they hold iron in great masses, these rocks dip under the Silurian sandstones and limestones, and come out again to the surface in the State of New York at the point A, where they also contain many large beds of valuable ore. It is evident that the valley between these hills H and A was, during the Silurian age, occupied by the ocean, because the greater portion of the deposit represented by the dark part of the figure is full of petrified marine animals. The floor of that ocean was formed of the Laurentian rocks, but when these are closely examined, they are clearly seen to have been also of aqueous origin although they do not contain fossils. They are stratified, and some of the beds have been ascertained by Sir W. E. Logan and Mr. Murray to consist of conglomerates or rocks made up in part of rounded pebbles, which no doubt had been worn by the action of water. These facts are sufficient to prove that they were formed under water, but then other circumstances show that they were not the product of the same ocean which accumulated the Silurian strata now lying upon them. In the first place, they are bent twisted, and tilted up at all angles, while the Silurian rocks are in general nearly horizontal, and lie in broad sheets across their upturned edges ; and in the second place, in Western Canada, another formation lies between the Laurentian and Silurian. This fact is illustrated by the following figure which represents a section from the county of Renfrew westerly to Lake Huron.

Fig. 2.

I.—*Laurentian or iron formation.*
C.—*Huronian or copper formation.*
S.—*Silurian.*

The above figure gives the order in which our mineral wealth is laid up in the crust of the earth. The Laurentian contains iron in great abundance, but, only insignificant traces of copper. The Huronian is full of copper veins, but with very little iron, while the Silurian holds neither iron nor copper. Again, as the Huronian lies between the Silurian and the Laurentian, the Silurian does not belong to the age immediately succeeding the period during which the latter was deposited ; and further, as the Huronian rocks rest upon the upturned edges of the Laurentian and the Silurian upon the upturned edges of the Huronian, great intervals of time must have elapsed between the period of any two of the three. The Laurentian epoch was the age of iron, and long after its termination came the Huronian epoch when copper was produced. In the valley of the Ottawa below Lake Temiscamangue Huronian rocks were never deposited, consequently as we find the Silurian in this part of the country where the line of contact can be seen always resting upon the Laurentian rocks, our chances therefore of finding great quantities of copper in this part of the country are exceedingly small.

The above remarks are intended to give an idea of the geological position of our iron ores, and we shall now proceed to the discussion of their extent and cost of working. It must be borne in mind that the Laurentian rocks constitute the surface of Canada throughout an area of 150,000 square miles, that a vast proportion even is still a wilderness, and that therefore the beds of ore as yet discovered in all probability constitute but a small part of the whole mineral wealth of this important formation. The best known mines are the following :

1st. *The Hull mine*, situated five miles from the city of Ottawa, 100 feet in thickness, and containing according to the analyses of Mr. Hunt, Chemist to the geological survey 69.65 per cent, or in round numbers 70 per cent of pure iron. When this bed of ore was supposed to be only 20 feet in thickness, Sir W. E. Logan estimated that it would yield for every fathom forward and downward from fifty to sixty tons of pure metal. Report of 1845-6, page 76. But this bed is now ascertained to be 100 feet, (more of it being at present exposed by the process of mining) and consequently the yield will be five times as great, or from 250 to 300 tons per fathom. The distance to which it may be worked cannot be ascertained. As a general thing, veins of ore have never been traced to their termination, no doubt this bed underlies the country for many miles in one continuous sheet. It is not a vein filling up a perpendicular fissure in the earth's crust but a bed lying between the strata of the formation. Where it is exposed, it forms a dome and dips aways in all direction. How for it extends cannot be ascertained, but granting that 500 fathoms is its limit each way, then, it would contain 250,000,000 of tons of pure iron.

2nd. *The Crosby Mine.*—This bed is said to be nearly 200 feet thick, and should its yield be as great in proportion as that of the Hull mine, it would contain in a superficial area of 1,000 fathoms, 500,000,000 of tons of pure iron. This enormous bulk of metal can scarcely be comprehended. Were the whole iron mining force of Great Britain and the United States at work for one hundred years upon such a deposit, they would not, at their present rate of production, exhaust it.

3rd. *South Sherbrooke.*—There is in this Township a bed 60 feet in thickness, and its probable contents, according to the above estimates, are 100,000,000 of tons of pure iron.

4th. *McNab.*—This mine consists of the specular oxyde of iron. The bed is 25 feet thick, and contains perhaps 50,000,000 of tons to the 1,000 fathoms square. It is situated about one mile from the village of Arnprior, 30 miles from the City of Ottawa, and in the midst of an abundance of water-power.

5th. The beds from which the *Marmora Iron Works* are supplied, may be estimated as containing 100,000,000 of tons.

We have, therefore, in the above five beds, in round numbers, 1,000,000,000 of tons—a quantity sufficient to yield 1,000 tons of iron a day for 3,000 years, could furnaces be erected and kept in operation capable of smelting that quantity. And as the deposits above mentioned are only a part of the known iron wealth of the Province, and, in all probability, but a small proportion of that which is at present unknown, but must be brought to light as the Laurentian region becomes settled, it is clear that we may safely consider the stores of this metal inexhaustible.

It must be recollected that these ores are generally of a very superior quality, that they make the best kinds of iron, and that some of them are so situated that, for a great length of time, they can be quarried in the open air. In Europe, veins of iron, two or three feet in thickness, are followed deep down into the earth; but in this country, a superior material for smelting can be turned out in huge blocks upon the surface, with as little labour as is required to take building stone from an ordinary quarry.

When the enormous quantity of our iron ores is taken into consideration, it cannot but be seen, that to reclaim them is most important for the advancement of the national wealth of the country. What boots it to us that nature has literally floored one half of the Province with mineral wealth, if we do not reach forth our hands, and convert it into a material having commercial value?

The principal difficulty which appears to stand in the way of the manufacture of iron in this country, is the want of coal. There can now be but little doubt but that the coal formation does not occur in Canada; but then we have wood in abundance, and the best of iron can be made with charcoal. It is supposed, however, that the manufacture of iron by charcoal would be an unprofitable undertaking. But in the United States great quantities of the metal are produced from the same ores we have in Canada, with no other fuel, and it appears to us, with a profitable return upon the capital invested. The following quotation from an excellent Lecture, delivered before the Mechanics Institute of Toronto lately by Professor Hind, of Trinity College, shows the extent of the manufacture both in Britain and the United States:

"No one disputes that the iron industry is of immense importance, and supplies the means of living, directly and indirectly, to many millions of our fellow men,—in 1855, Great Britain alone manufacturing 3,585,906 tons of iron, valued at £23,000,000 currency. This vast production employed 238,000 men, representing a population of 1,190,000 persons, or nearly as many people as there are now in Upper Canada. 2120 steam-engines, of an aggregate power, represented by 242,000 horses, were also instrumental in this production of iron in Great Britain.

"The growth of the iron trade and manufacture of the United States, during the last forty years, has been very great. In 1816, there were 153 furnaces, producing 54,000 tons of pig iron; in 1855, there were 540 blast furnaces, averaging 900 tons each annually, yielding 486,000 tons; and 950 bloomeries, forges, rolling and splitting mills, yielding of bar hoops, &c., 291,000 tons, and of blooms, castings, machinery, and stove plates, 151,500 tons; making, that year, an aggregate of 929,100 tons, at the value of $33,940,500. In 1853, the rapid increase in this class of manufacture was such as to yield more than a million tons of pig iron.

"The United States producing in 1855, more than 1,000,000 tons, shows that the iron industry has already become very extensive in the neighbouring Union. How far the want of coal as fuel for smelting may interfere with future Canadian production, remains to be tested. There can be little doubt that when the railway is constructed from Peterborough to the Marmora iron region, the demand for coal so universally springing up in the basin of Lake Ontario, will enable it soon to be laid down at the mines at as cheap a rate as it is now furnished at Lake Ports."

Now, of the iron made in the United States, no doubt a large proportion is smelted with mineral coal, but a great deal is also made with charcoal, especially in the State of New York, where the Laurentian formation appears in the region near Lake Champlain and the Adirondack mountains. The following particulars relating to these works, have been gleaned from a series of articles, which appeared in the *Railroad Journal* for 1849. Speaking of the furnaces in Clinton county, he says: "The works are generally small, scattered over the country in the neighbourhood of the various mines. The principal portion of the inhabitants are directly dependant upon it, the only employment not closely connected with it being lumbering, for which the fine forests of this region afford abundant materials. In the long winters, when nothing can be done in farming, the farmers find a busy occupation for themselves and their teams, in drawing in the supplies of charcoal, wood, and of ore. At this time, the roads covered with deep snow, are in the best order for hauling heavy loads, and new ones are easily opened through the woods and over the roughest ground by merely clearing out the brush. The works, in general, involving little capital, are put up by men of moderate means, and in remote places; while the iron made in them, being a refined article, can pay a rate of transportation to market, that would be ruinous to those making the cheaper pig metal." It will be seen by the above, that these furnaces in the forest are principally employed in the manufacture of bar iron instead of pig iron. The price of the article from these localities is from £17 10s. to £25 per ton in New York.

At one of the principal furnaces, called the SISCOE, the cost of making a ton of pig iron is thus stated by the writer of the articles in question:

Ores	$4 12
Charcoal	8 40
Flux and labour	2 70
Repairs, Interest, &c.,	3 00
	$18 22

Thus, for about £4 10s., a ton of pig iron, worth £8, can be made, yielding a profit of £3 10s. The cost of this furnace was $54,903 78. The wood costs $2 per cord. The manufacturers purchase the wood, and make the charcoal in kilns prepared for the purpose. One cord of wood makes 56 bushels of charcoal; and 160 bushels of charcoal make 1 ton of iron.

At the East Moriah furnace, the cost of making a ton of pig iron is	$19 53
At the Crown Point furnace	$17 58
At the Mount Hope furnace	$21 00
At the Brasher furnace	$22 50
At the Constantia	$17 50
At the Clinton	$12 81

In all these places, wood costs about $2 per cord, a price which would be very acceptable to our farmers in the vicinity of our mines, where they cannot sell the wood at all, but are obliged to burn it to clear the land. The absence of mineral coal is actually no objection to the manufacture of iron in Canada. What we want, is information how to construct the proper works. It must be recollected, that it was long before the Americans found out how to make their furnaces pay; and there can be no doubt that, with the benefit of their experience, works could be erected in Canada that would be profitable. We can see no reason to the contrary. Wood is cheaper, our ores quite as abundant, and the demand for iron as great. With the same advantages then, why cannot we do as well as the Americans?

Two or three years since, the bed of iron ore in Hull was sold to a Company, who quarry the material, and carry it all the way to Pittsburg, in the State of Pennsylvania, where they convert it into iron. If it pay to manufacture this ore, after a transportation of several hundred miles, surely it might be worked on the spot. At the City of Ottawa, you may see, at the same wharf, a barge laden with our ore on its way to the United States, and along side of it, another barge load of sheets and bars, imported from Europe. This looks like carrying coals to Newcastle.

In the United States, they have a method of making malleable iron from the ores by one fusion. This is not a new process, because we saw it in operation thirteen years ago, at a small forge in the County of St. Lawrence. The operation is thus described in the excellent report of Messrs. Foster & Whitney on the Geology of the Lake Superior region.

"The ore is introduced into the top of the forge, in alternating charges with charcoal, in a state of great mechanical subdivision, resembling coarse sand, having been previously calcined, stamped and washed, if it contain much earthy matter. The supply of fuel is maintained in the first stages of the process so as to keep the space full, and prevent the ore from collecting together. Water is occasionally sprinkled over the surface, which prevents the fine siftings from being blown away, and gives increased fusibility to the scoriæ. The ore falls down, and the melted iron collects in a mass at the bottom of the hearth, while the thin slags run off by an upper overflow The mass is removed about every hour, in a pasty condition, by means of a powerful pair of tongs—working by an iron wheel on a railway suspended from the beams above—which seizes it firmly, and conveys it to an anvil, where an iron lever, called a "squeezer," working up and down; kneads the particles of iron together, forcing out the semi-fluid cinders, and fashioning the loup for the rollers, to which it is transferred.

"The substitution of drawing cylinders in the place of trip-hammers, has greatly facilitated the manufacture of iron. It accomplishes in a few minutes the condensation of the particles and the distribution of the fibres, which formerly was attained only after repeated heats and hammerings.

"In cylinder drawing one workman holds the loup in a pair of tongs, and passes it into the first of the grooves; another workman, on the other side, receives it, and passes it back to the first, who passes it into a second and smaller set, and so on, until it is reduced to a bar, three or four inches broad, and two in thickness. This is then cut by powerful shears into short lengths, called "blooms," which are afterwards subjected to a refining process.

"So great is the dexterity displayed in these various processes, and so admirable the adaptation of the machinery, that the rude ball, as it comes from the forge, is converted into mill bar iron before it has had time to cool. The whole operation is accomplished in a little more than a minute.

"The bars are next subjected to the refining process, which consists in heating them in the oven above described, and bringing to a welding heat, which is accomplished in the course of one-half or three-quarters of an hour. Where great tenacity is required, they are re-heated and rolled. From the oven they are passed to the extension rollers, where they are fashioned into the required form, whether round, square, oval, or rectangular."*

The iron made in this way, will resist a pressure of over 70,000 lbs. to the square inch.

The above facts were collected from various sources, with the view of showing that iron can be manufactured in this country, although we are destitute of mineral coal. It would be well for the Province were this branch of industry introduced and encouraged to the utmost. The vast forests in the neighbourhood of the mines, are fast disappearing before the axe of the sturdy settler, and the only fuel we have to convert our rich stores of metal into the elements of national wealth, is being thus destroyed, without being made serviceable to man to the full amount of its capabilities.

E. B.

ARTICLE IV.—*On Serpentine, and some of its uses.*

This mineral species was known to antiquity, and received from the Greeks the name of *ophitès*, in allusion to its variegated greenish colors and peculiar lustre, which were supposed to

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* *Foster & Whitney's Report on the Geology of the Lake Superior Region. Page 79.*

resemble those of the skin of a serpent (*ophis*). It is, however, probable that some of the early writers confounded under the same name with the true serpentines the harder green porphyries, which are very distinct. Linnæus, who regarded serpentine as a species of talc, described it under the name of *talcum serpentinum*, and the name of serpentine, synonymous with the Greek *ophitès*, and corresponding to the *serpentino* of the Italians, is now universally employed.

Serpentine is a soft mineral, easily scratched with the point of a knife, and gives a white powder somewhat unctuous to the touch, a property which it has in common with talc and several other minerals. Its colors are generally some shade of green, varying from oil or leek green to olive or blackish green; they are seldom bright; yellow and red serpentines are sometimes met with; the colour of the latter is due to mechanically intermixed red oxyd of iron. The finer varieties are very often translucent, constituting what is sometimes called *noble serpentine*, but more frequently the mineral is opaque, or only translucent in thin fragments. Serpentine is generally massive and without any visible structure; it is tough and breaks with a conchoidal fracture. Occasionally, however, it is met with foliated or fibrous, forming splintery masses like wood, the fibres being brittle and elastic; this variety has been named *picrolite*. The fibres sometimes become exceedingly fine, and are thin, soft and flexible, with a silky lustre, constituting a variety of asbestus, differing chemically however from the true asbestus, which is a variety of hornblende. This asbestiform serpentine has been called *chrysotile*.

The lustre of the massive varieties of serpentine is feeble, and somewhat waxy or resinous; they are capable of receiving a fine polish. Serpentine is comparatively tender and easily wrought when first taken from the quarry and yet moist, but becomes hardened when exposed to the air. When moistened by breathing upon or otherwise, serpentine gives a peculiar odour, like that of clay; hence called the argillaceous odour. The specific gravity of serpentine is from 2.4 to 2.6, water being 1.0.

As to its chemical composition, serpentine is essentially a silicate of magnesia combined with water; when pure it should contain: silica 43.60, magnesia 43.40, water 13.00=100.00; but a portion of protoxyd of iron, amounting sometimes to 7 per cent., generally replaces a part of the magnesia, and minute quantities of oxyd of nickel, chrome and alumina, are very often present. When heated to redness, serpentine loses all its water, and turns reddish from a change in the oxydation of the iron; it also becomes much harder. When heated in powder with strong sulphuric acid, it is completely decomposed; the silica separates as a white powder, and sulphates of magnesia and iron are formed.

Besides employing it as an ornamental stone, the ancients attributed great medicinal and magical powers to serpentine. It was prescribed with wine for calculus, recommended as a certain cure for the bites of serpents, and was regarded as a talisman against small-pox, poisoning, lethargy and madness. It was also, as an old writer informs us, used for mortars, as "from its natural benignity, it seemed peculiarly fitted for the pounding of medicines." Boetius de Boot assures us that serpentine has such a repulsion for poisons of all kinds, that so soon as a poisoned liquid is poured into a vase of the mineral it begins to foam, and is expelled from it. And another old author, Laet, tells us that he had received from Crusius a specimen, upon which was written, "A fragment of the cup of Edward IV., King of England, formed of the stone called ophites, useful against poison; the gift of H. Morgan, 1581." But all these virtues are now forgotten, and serpentine no longer finds a place in the modern materia medica, nor is there any good reason to believe in its medicinal powers. Some calcareous serpentines effervesce powerfully with an acid liquid, and such may have given origin to the statement of de Boot.

Serpentine is found in many parts of the world; it forms mountains in the Alps, is abundant in the Apennines, in many parts of Germany, in Cornwall, forming the Lizard Point, and in Scotland, particularly at Portsoy in Banffshire. It is a very abundant mineral in Canada. The limestones of the old Laurentian rocks very often contain it in small soft, greenish or yellowish grains, disseminated through the rock. The green and white serpentine marble of Grenville is an example, and Dr. Wilson has found serpentine in this formation in the township of Burgess, in large masses, which have often a reddish colour. Polished slabs of this serpentine may be seen in the Museum of the Geological Survey.

The most important deposites of serpentine in Canada, however, occur in the hills of the Green Mountain range. Sir William Logan has traced a continuous formation of serpentine from the line of Vermont to beyond the Chaudière river on the north-east. In this region the serpentine is no longer a subordinate mineral as in the limestone beds of the Laurentian system, but forms great rock masses which are interstratified with the slates and quartz rocks of the country. It often rises into hills, and sometimes covers areas of many miles, generally covered with a growth of pines and firs. The same range of serpentines has been followed southward through New England, and along the Alleghany mountains, of which the Green Mountains are but the north-eastern extremity.

This serpentine rock is somewhat variable in its characters. Its weathered surface is either whitish or of a rusty red; it is very tough, and when broken, exhibits the usual colours of serpentine, generally however the darker tints. Sometimes it is foliated, and then is for the most part pale green; it is often intersected by veins of picrolite or by thin seams of chrysotile, the fibres being perpendicular to the sides of the seams. Sometimes the rock exhibits the character of a conglomerate, consisting of rounded masses of serpentine of various sizes, cemented by a paste which is a dolomite or carbonate of lime and magnesia with a little carbonate of iron; at other times, we meet with a fine grained and intimate mixture of serpentine with dolomite, and the powdered mass then effervesces with nitric acid, which expels the carbonic acid from the dolomite; in other cases, pure carbonate of lime is intermingled with the serpentine, and this mixture may be distinguished by effervescing with acetic acid. Carbonate of magnesia, which also occurs in beds near the serpentine, is sometimes intermingled with it; but in the greater number of cases, the rock is nearly pure serpentine. Chromic iron, which is the only source of the oxyd of chrome and the chromates of potash, lead, and zinc, so much used in dyeing and painting, is chiefly found in serpentines, and is almost always present in those of Eastern Canada, generally in small grains, but occasionally in beds of considerable size, as in Bolton and Ham.

The economical uses of serpentine are important. From the beauty and variety of its colour and the ease with which it is wrought, it is much employed as an ornamental stone. Thus, at Portsoy in Scotland, Baireuth in Franconia, and Zoblitz in Saxony, it is extensively manufactured into vases, ornaments, and articles of furniture. At Zoblitz, it is said, that some hundreds of persons are employed in quarrying, cutting, turning, and polishing the serpentines of that vicinity, which are sent all over the world.

In Limoges, in France, quarries of serpentine have within a few years been re-opened, which were explored by the Romans, who held this stone in great esteem. Near Grenada, in Spain, also there are quarries of serpentine, which form the ornament of the palaces and churches of Madrid. The famous *vert antique* marble is no other than a serpentine intermingled with a portion of white or gray dolomite or carbonate of lime; and many other varieties of serpentine rock, not less beautiful, are known in France and Italy, as marbles *vert de mer*, *vert d'Egypte*, *&c.* The serpentines of the Vosges, in France, are very extensively wrought and employed for tables and chimney pieces, and for the decoration of churches and palaces. There are extensive mills at Epinal (Vosges) where the serpentine of Goujot, which is much esteemed, is sold when polished, for 54 francs the square metre, or about 45 shillings the square yard. The serpentine marbles of Galway and Mayo, in Ireland, are also much esteemed, and those of the New England States are beginning to attract attention. That of Roxbury, Vermont, is now coming into extensive use for furniture and interior decoration.

The serpentine rocks of Canada afford varieties which will not yield in beauty to any foreign specimens. The whole range of the Eastern townships abounds in localities which offer great diversities of hues and combinations. The colours are green of every shade, sometimes nearly black, and occasionally intermingled with white and gray. These are sometimes veined or bended, at others arranged in clouds, or in spots like a pudding stone. The only explorations as yet attempted among these beds, are those of the Geological Commission. Sir William Logan has caused trials to be made of several blocks taken from different exposures of serpentine in Brompton and Oxford, and not one of these, when cut and polished, but has afforded a beautiful variety of marble.* These specimens may be seen at the Geological Museum. It is greatly to be desired that native industry should be turned to the working of our marbles, in a region where water-power is abundant, and where, in addition to these beautiful serpentines, there is to be found a variety of other marbles rivalling

* The name of marble is strictly applied only to such stones as are composed wholly or in part of carbonate of lime; but as the marbles which are mixed with serpentine pass by insensible degrees into pure serpentine, it is not easy to distinguish between the latter and the serpentine marbles, properly so called.

those of any other country. The demand for such materials among us is already considerable, and will rapidly increase with wealth and taste. May we not hope to see the new cathedrals which are soon to adorn our city, decorated with Canadian marbles?

There is another economical application of serpentine which has now become of some importance. That of Newburyport, in Massachusetts, is ground to powder, and by a peculiar process impregnated with different vegetable and mineral colors, forming thus cheap and valuable paints, which are extensively used in the United States. We are informed, that the serpentine is partially decomposed by sulphuric acid, and that the colours seem to unite with the liberated silica, which plays a part analagous to that of alumina and oxyd of tin in the lakes.

In France, serpentine is also turned to account as a source of magnesia and magnesian salts. We have already seen that sulphuric acid decomposes serpentine with the formation of sulphate of magnesia. As a preliminary operation, the mineral is calcined at a strong red heat for forty-eight hours in a reverberatory furnace, which holds about two and a half tons. This calcination has for its object to render the iron almost insoluble. The calcined serpentine is then ground to powder, and mixed with a quantity of sulphuric acid, not quite sufficient to combine with all the magnesia. The mass becomes hot, and is converted into a paste of sulphate of magnesia, which is leached in large vats, as in the preparation of potash; the silica and oxyd of iron remain behind. A little milk of lime is added to the liquid to get rid of a small portion of iron and some other impurities in the solution, which, when then boiled down and crystallized, yields pure sulphate of magnesia—the *Epsom salt* of the apothecaries. There is an establishment of this kind at Ramiremont, in the Vosges, which has been in operation for nearly twenty years, and produces annually 80,000 or 90,000 pounds of sulphate of magnesia, which is sold at about eighteen shillings the hundred pounds, which is said to be only one-third the price of that imported.

Serpentine contains on an average 40 per cent. of magnesia, and crystallized sulphate of magnesia consists of 16.25, sulphuric acid 32.50, water 51.25, = 100.00, or one equivalent of magnesia 20, one of sulphuric acid 40, and seven of water 63, = 126. It will be seen then, that 100 pounds of serpentine, containing 40 of magnesia will require 80 pounds of dry sulphuric acid, or about 100 of oil of vitriol, and will yield 246 pounds of crystallized Epsom salt. The carbonate of magnesia or *magnesia alba* of the shops is made by decomposing a solution of the sulphate with a boiling solution of carbonate of potash or soda. The carbonate of magnesia separates as a white powder, which is washed with water, pressed into cubes and dried. It contains about 40 per cent. of magnesia combined with variable proportions of carbonic acid and water. These are dried off, when the *magnesia alba* is heated to redness, and caustic or calcined magnesia remains. Serpentine will thus yield about its own weight of the carbonate and 40 per cent. of calcined magnesia.

There are other sources of magnesia in the dolomites and magnesites of the country, but a description of these and of some of the uses of magnesia in the arts, we shall reserve for another number of the *Canadian Naturalist.*

T. S. H.

ARTICLE V.—*General Remarks on the Study of Nature, with special reference to Botany.*

It will be acknowledged by every student of nature, that much pleasure and gratification are experienced in the general contemplation of the works of Creation. However cursory his observations may be, they exercise a wholesome influence upon the mind, excite admiration within the breast and encircle the imagination with a halo of pleasurable feelings. It is within the compass of every mind, however crudely educated, to receive such general impressions, and to benefit by the display of those objects of nature which ever prove sources of recreation. A recognition of this has led to the adoption, more especially in large towns, of extensive Parks and Botanic Gardens, which, as places of general resort, tend materially to the physical and mental improvement of populous communities. It must be remembered, however, that the mere general contemplation of the works of the Creator is not all that is required of man, to whom was given *power*, to have command over "things possessing life," and *intelligence*, to study with advantage to himself the numerous and varied objects placed before him. Nor must we be satisfied with a mere cursory glance of the eye or a temporary excitation of the mind, and take cognizance of nothing but what is excited by striking contrast or the sudden stimulus of grand and sublime scenes. If the mind be not educated to receive the delicate impressions of nature, it has no hold, and only remembers enough to shed a ray of delight upon the imagination. In order to realize truly her beauties and harmony, we must ensure our acquaintance with her objects in detail, with the laws that govern them and the phenomena they exhibit; and what is essentially necessary to this end, is the education of the youthful mind, by which we mean, its thorough training in the exercise of minute observation, systematic comparison, and correct generalization. Nor can this be better and more easily effected than through the study of one or more of the Natural History Sciences themselves, for which the requirements are few and simple. An ardent desire to attain not a mere sprinkling of knowledge, but a thorough and intimate acquaintance with the characters and features of the objects of nature, the phenomena they exhibit, the relations they bear to each other, and the laws which govern them individually and collectively—this, coupled with an honest spirit of caution and a resolute determination to persevere, constitutes what might be called the elements for entering upon the study of Science. It is no severe and arduous task for the diligent student to pursue a successful course of study, and it is within the range of every one possessing ordinary capabilities. We observed that it is during the period of youth, that is, when the mind is expanding and the intelligence growing, when the buds of intellect are flowering into luxuriant forms and shapes—it is at this time that the mind should be infused with a relish and taste for scientific pursuits, and the foundation laid of that framework, which, when ultimately viewed, will faithfully represent the elements of the structure of an accomplished Naturalist. There is an elasticity of the mind in youth that makes it easily susceptible to impressions, and admits of its being moulded into tastes eminently scientific. There is a vigour and energy, too, that surmounts all the little difficulties and drawbacks incident to the study. But why thus, it may be asked, spend the powers and energies of youth, which should be directed solely to the study of those branches of education that more materially affect individual interests and welfare in after life? Why this perversion of the mind, as some call it? It would be almost unnecessary to reply to this question, were it not very frequently put forward in the form of a serious objection.

Nothing can be more erroneous than the supposition, so generally entertained, that Science is a superfluity, that its study is an idle occupation, and its knowledge of little or no value.

Apart from the more apparent advantages accruing from its acquaintance, its study possesses the intrinsic value of being the powerful instrument whereby the mind is exercised in habits of careful and accurate observation, of systematic comparisons, and of philosophical generalizations. In the study of the objects and phenomena of nature there is a continued process of mental labor and activity. Before the mind is perfectly adapted to the pursuit, we can easily analyze the elements of this mental process—for, though complicated, it is slow, and consists of successive steps. There is first brought into play the all-important element of *Observation.* It will be allowed that this should be minute, clear and correct; but in order to this, it must be exercised and reduced to methodical training. The untutored mind, whose powers of observation are not developed, is ever subject to aberrations and distortions, ignores plain facts or falsifies their nature, and is quite incapable of drawing correct deductions or abstracting generalizations. There can be in such a mind nothing more than a chaos of visionary ideas. Let nature then be the instrument by which we educate our powers of observation, and we will possess, in all its force and beauty, one of the rarest accomplishments.

This leads to the second important element in the mental process, viz. that of *Comparison*, which, in all its phases, observes system at its basis, and involves the due exercise of our reason. To compare well, requires a constant train of thought and reasoning, and in systematically exercising these latent powers of the mind, we are only preparing to reduce the knowledge we possess into tangible shape and form. This constitutes the last step in the series, and may be designated *Philosophical Generalization.* This brings our judgment into active operation, and entails the necessity of weighing evidences, in drawing deductions and forming our ideas and opinions. Having thus passed through a process of special training, and acquired systematic habits of observation, thought and judgment, what are the advantages derived therefrom? We believe many; but, above all, is their *reactionary influence* upon the character of man, by which we mean, the adaptation, to the ordinary business and duties of life, of the same habits and principles as those acquired while treading the paths of Science. It is impossible for one well trained by system to deviate from the principles by and in which he was educated, nor is it reasonable to believe that he will omit to exercise the same method of observation and pursue the same process of reasoning in all circumstances requiring the play of these powers and qualities. It can, therefore, be readily understood how the youthful votary of Science, who has somewhat matured the powers of his mind, is well qualified to enter upon the public duties of life, to bear its strifes and battle its storms, and steadily and successfully gain that position which is beyond the reach of his less favored companions and competitors.

The observations just made, though applicable to the Natural History Sciences generally, are intended to have special reference to the study of botany. Without miscalculating the difficulties encountered, as well as the advantages gained in the study of other departments, we believe we can say of Botany, that in no science are the qualifications above enumerated more requisite for entering upon its study, or the same methods of thought and reasoning more fully exercised, or the same habits of diligence and application more securely acquired. To be a thorough botanist—one not merely versed in the nomenclature of plants, but intimately acquainted with their structure and functions, and with their natural classification and alliances—demands the most intense application and unwearied labour, even in the highest order of minds. The vegetable kingdom includes within itself such a vast multitude of objects and such a wide range of phenomena, that it is difficult, nay almost impossible, for the most ardent and persevering to attain a perfect knowledge of so extended a subject; and even though the facilities for becoming acquainted with the botany of foreign climes are many and various, it is only within the reach of the few favored, who dwell in the great centres of literature and science, and who devote both their time and their money in botanical study and research. Let it be clearly understood, however, that *Science never demands of any one more than his time can afford or his capabilities master.* What indeed would be the sensations created in the mind of the most profound of Botanists, were circumstances to require his possessing an intimate knowledge of the myriads of plants known to flourish on our globe, whose record numbers at the present day more than 100,000 species? No! Nature is never exorbitant in her demands. She speaks, and her voice proclaims her many beauties and charms, administers pleasures and happiness, and teaches lessons as various and beautiful as can be found within the pages of any book. She invites us to fill up our leisure hours in studying these beauties, and in drawing thoughts of pleasure and delight from her pure and refreshing fountain. In preparing our minds, then, to commence the study of Botany, we do not bind ourselves to a laborious task in order to the acquirement of a complete and perfect knowledge of it. While we are following out our own special avocations in order to our advancement and welfare in life, we merely take up this study as a recreation for the mind in times of leisure and idleness. It is universally acknowledged that no branch of Natural History furnishes better opportunities of improvement and contributes more to the health of the body, while it is supplying wholesome food to the mind. It may be affirmed that it is the science pre-eminently popular—we say, *pre-eminently popular;* for where will we find another special science with so many votaries in every rank and station of life—not merely confined to the physician, but finding its way into the precincts of the noble palace and the sacred studio of the clergyman and the man of literature. Nor does it rest here; its influence ranges further, and glides stealthily but happily within the walls of that Institution, where are educated the fair and amiable of our society; nor will it ever cease here to be considered an accomplishment of the highest order.

In prosecuting the study of botanical science, we should not fall into the false idea that the naming of plants is all that is required. Although it is undoubtedly one of our leading objects as practical botanists, it should ever be borne in mind, that such knowledge is merely superficial and tends to no intellectual or practical good. Our great aim should be a thorough acquaintance with the science. We should study it in all its bearings. We should possess a knowledge of the anatomy and structure of plants, in order to prepare our minds for understanding the functions of their different parts, such as the roots, stem, leaves, and flowers, and for judging of their importance in the economy of nature. We should study also the relations they bear to each other, their specific differences and general alliances; and lastly, we should investigate their properties, in order to ascertain the special uses to which they may be applied in the economy of man. Having done this, it remains within our choice in what way we are to follow up our knowledge *practically,*—whether, as agriculturists, to contribute to the improvement of land in districts or countries; or as horticulturists, to beautify our private residences with gardens, orchards, and nurseries or, what may occur now and again, to rear up a public Botanic Garden; or, should the inclinations of the botanist tend to the scientific pursuit of the subject, nothing can prove a greater source of pleasure than the forming of an *Herbarium*, or repository of plants, either of the district in which he lives or the country or continent. In order to this, he allots a few spare hours occasionally to the field. He is now seen perambulating the valley or the plain, picking here and there a plant of ordinary form and appearance; a little beyond, he gathers of the sweet and lovely flowers of the little stream or the winding river. At another time, he winds his way along its shaded banks or the rocky sides of a distant hill, adding plentifully to his stock of plants rich in gay colours, as well as shrubs of verdant green, which contrast strongly with the slender grasses, carices and ferns of the swamp beneath; while a third excursion will find him upon the ridges and summit of some lofty mountain, adorned with alpine plants of great variety, and remarkable for the fineness and softness of their texture and the rich beauty of their gay colours, and enhanced greatly by their modesty of size. These rambles, whether on the wide plain or through the extensive forest—whether along the winding river or upon the mountain top, each and all afford endless sources of pleasure and gratification. While they contribute to the health and strength of the body, they exhilirate the mind and impart to it tone and vigour. Not the least of their advantages are the wholesome impressions made upon the mind, as well as the many associations hereafter connected with such rambles. He who has united himself with his companions and formed a botanical party, and with whom he has oft visited nature's spots of beauty and gathered of its treasures, he alone it is, who can know the feelings of delight that spring within the breast, "feelings," says Dr. Balfour, "by no means of an evanescent nature, but lasting during life, and at once recalled by the sight of the specimens which were collected." An occasional glance at an herbarium will call forth many a pleasing recollection and bring to mind many a circumstance otherwise forgotten. One little alpine plant will often tell a tale of adventure and call up many a delightful association of persons, places and incidents. This is not the least of its pleasures. It appears to us, that it is only after the lapse of time, and especially when far removed from the scenes of botanical study, that we can appreciate its value; for then it brings up many reminiscences of past kindness, friendship and pleasures, and forms a happy bond of union and sympathy between friends and acquaintances of the past. Should not this, then, be a strong incentive to the study of the Science of Nature, that in the prosecution thereof, we form the acquaintance of those who are treading the same paths, and likewise establish among them friendships always delightful and ever permanent? Can it be said so of this world? Can the man who has satiated his desires with its enjoyments say, that its pleasures are sweet, or its friendships enduring? Has he not already discovered that these pleasures are vain emptiness, and these friendships but of a day? and did he look back and take a lesson from the past, he would know that those who have gone before him, have sunk within the grave to be remembered no more—to be forgotten even by those who have been the constant recipients of his kindness and favors. On the other hand, the man of Science feels himself knit with the souls and minds of his fellow-laborers, who can appreciate his talents and his tastes —whose delight is to extend to him the warm hands of fellowship in life, and after death to cherish his name in fond remembrance.

Botany has still a higher claim upon our study and attention than those already indicated. It forms no small portion of that great Volume of Nature which, when studied in the true spirit of wisdom, forms the handbook to the Volume of Inspiration. It is the echo of the voice of the Creator "of the heavens and of the earth and all that therein is." The knowledge of the one will never be found at variance with the truths of the other. Nay, the more deeply we study each—the more minutely we compare the facts and phenomena of the one with the revelations of the other, the more evident shall we see the harmony that subsists between them, and the more beautiful the light they reciprocally shed upon each other.

J. B.

ARTICLE VI.—*Notes on the Distribution of Insects, &c.*,

By William Couper, Toronto,

Cor. Mem. of Lit. & His. Soc., Quebec, & Nat. His. Soc., Montreal.

If a keen-eyed Coleopterist confine his researches to any given district or locality he may, in one summer, attain a tolerably correct knowledge of the forms existing therein; this is only ascertained by profound attention to the natural habits of species of the numerous genera which constitute the order. Should he find the remains of a coleopteron,* he can determine whether it is local, or of rare or common occurrence; he may occasionally capture a species that had been introduced through accident, and the representative of which may be local in another district. This applies more particularly to some genera of predaceous ground beetles, or the great family of *Carabidæ*. In this country, the banks of rivers and shores of lakes are at all times preferable to any other place for collecting this family; and intermediate soils such as deep black loam, particularly where woods can be found, are also productive.

Any one who has acquired a knowledge of their instincts and habits, and of the many curious incidents connected with their distribution, would not be surprised were he to discover on the shores of our Canadian Lakes, the representatives of species that are known to occur in other quarters of the globe. Insects and plants are liable to be disseminated by the force of wind and water, and therefore subject to an extensive and wider geographical distribution than animals of the higher orders. Examples of this nature have been noticed on the island opposite Toronto, where insects that are local to the opposite side of the lake are occasionally brought thither by floating timber containing the *larvæ* or *pupæ*, from the southern and western shores. The drift wood being covered by sand, the *larvæ*, &c., go through their metamorphoses in a perfect degree—the timber thus embedded, is well adapted for the proper development of the genera *Elateridæ*, *Buprestidæ*, *Cerambycidæ*, &c. The total removal of a plant from one locality to another, has in many cases caused its insect parasite to follow, instinct having taught it to distingnish in the plant thus removed, the original and only food of its progeny. On the western side of the Rocky Mountains, a number of plants and insects are found that are of Asiatic type. Among several beetles taken by Sir John Richardson in his travels

* Up to this time, there has been but one species of *Scarites* taken in the vicinity of Toronto. A lady, whose husband is a profound entomologist, picked up a mutilated specimen on the islands opposite this City; he instantly recognized the form, and a short time afterwards communicated the fact to me. I made a search, and discovered that this species was confined within the space of half a mile; and up to this time, it has not been captured in any other locality on the north side of the lake.

through Rupert's Land, there is one in particular, the *Carabus Vietinghovii*, which Kirby says is synonymous with Dr. Fischer's figure in his Russian Entomology.

"The close and accurate observation of nature most forcibly induces that frame of mind so beautifully described by Shakespeare, in which we are disposed to find

"Books in the running brooks,
Sermons in stones, and good in everything."

To those who take no interest in science it would be difficult to explain the feeling with which the geologist regards a rock, a Botanist a flower, or an Entomologist an insect; it is something quite peculiar, and can only be understood and appreciated by those who have passed from ignorance to knowledge, and have felt how *immeasurably* their enjoyment of life has been heightened, as they have become better able to appreciate the wonderful works of God.

The connexion between different sciences is always very interesting, and that between Zoology, Physical Geography and Geology, is no exception to the rule. Lists of species have long been used as excellent tests of the age of deposits found in different parts of the world, and the labours of Professor Edward Forbes have made known to us that interesting evidence on the Geography of ancient times may be obtained in the same way from a careful examination of the lists of species. In his paper on the *Geological relations of the existing Fauna and Flora of the British Isles*, he shows that out of sixty-five species of testaceous molluscs which are common to the coasts of the United States and of Europe, fifty-one are known as glacial fossils, of the remaining fourteen, two are pelagic wandering mollusca, one Teredo Navalis is carried about in floating wood, two are small species living in stony ground, near high-water mark, and therefore not likely to be found fossil; three are Chitons, which fall to pieces soon after death, two are doubtful, and the other four may very probably yet be found fossil. The inference which Professor Forbes draws from these facts is, that "not a single littoral or coast, inhabiting Mollusc has found its way across the Atlantic, in either direction, since that ancient time, anterior to all human records, and probably long anterior to the appearance of man on our earth, when an Arctic sea, inhabited by a limited and uniform fauna, extended from the then western coast of Siberia into the heart of North America, and southwards in

Europe to the parallel of the Severn, and in America to near that of the Ohio............ There could not have been such a separating abyss between Northern Europe and Boreal America as now divides them ; the sea, through a great part, must have been a shallow sea, and somewhere, probably far to the north, there must have been either a connexion or such a proximity of land as would account for the transmission of a non-migratory terrestrial and a littoral marine fauna.

Mr. Wollaston says that, out of 482 species of Coleoptera occurring in the Islands of Madeira, 201 are also found in Europe. To account for this we must suppose one of two things, either that the latter number of species have been introduced by accident as by man or by winds, or some similar cause ; or else that these species have been in existence ever since the time when Madeira formed part of the great continent. The latter supposition will certainly be preferred by all who have studied the great changes which have taken place in the distribution of sea and land even in the most recent Geological period.—*Lubbock.*

In the family *Cicindelidæ*, the species taken in this vicinity evidently belong to a single genus. No species which can be classed under *Megacephala*, *Omus*, *Amblycheila*, or *Dromochorus*, have been discovered north of Lake Ontario ; of the last genus, but one species occurs north of Mexico. We have eight species of the genus *Cicindela*, but they so closely resemble each other in elytral characters, that the student encounters much difficulty in determining a true form from a variety.

With regard to our great family of *Carabidæ* those that have been collected must remain for the present untouched, until one of our museums procure a foreign collection, containing true generic forms.

Dr. LeConte of Philadelphia, has published an excellent classification of those occurring in the United States. We are indebted to this gentleman's skill and energy for the present advanced state of this branch of the Natural Sciences in America. Many species of *Dyticidæ* inhabiting our waters, are described by him in "Agassiz's Lake Superior."

Silphidæ—Five species of the genus *Necrophorus* are now known to occur north of Lake Ontario ; and of the three following genera—viz : *Necrodes*, *Oiceoptoma*, *Thanatophilus*, but one species of each, whilst of the genus *Necrophila* we have four species which are purely northern types.

DERMESTIDÆ, PYRRHIDÆ, and HISTERIDÆ are equally represented in the north. They are of the same habits, destroying furs, and other animal substances; species of the three families are frequently taken together. Importing furs, &c., from America to Europe may have been a source by which some of the American forms effected so extensive a distribution. Of HISTERIDÆ, the representatives of four English species are now known to occur in North America.

LAMELLICORNIA—Thirty-seven species of the following genera inhabiting the United States, have been taken in Canada: *Canthon*, 1; *Copris*, 2; *Onthophagus*, 2; *Aphodius*, 3; *Trox*, 3; *Geotrupes*, 2; * *Bolbocerus*, 1; *Lucanus*, 3; *Dorcus*, 1, probably 2; † *Platycerus*, 2; *Passalus*, 1; *Xyloryctes*, 1; *Pelidnota*, 1; *Areoda*, 1; *Phyllophaga*, 2; *Omaloplia*, 1; *Serica*, 1; *Dichelonycha*, 1, probably 2; *Macrodactylus*, 1; ? *Valgus*, 1; *Osmoderma*, 2; *Trichius*, 2; *Cetonia*, 2.

CERAMBYCIDÆ—The number as yet found in the United States, north of Mexico, is 270, while in France 180 has been found, and in England 64. The six following species—*Criocephalus rusticus*, *Hylotrupes bajulus*, *Phymatodes variabilis*, *Clytus Gazella*, *Callidium sanguineum* ? *Monohammus sutor* (?) *Pachyta sexmaculata* appear to be identical with European species. The North American forms of Longicorns seem to have a nearer relation to those of Europe than to those of South America; the same genera being mostly found in both regions, to which some of the northern forms are almost entirely confined, as *Oberea*, *Rhagium*, *Pachyta*, *Strangulia*, and *Leptura*. The PRIONIDÆ are almost fully represented in the western hemisphere; the genus *Elaphidion*, *Desmocerus*, *Tetraopes*, *Dorcaschema*, and others are strictly

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* I believe this is the only species of the genus taken in Canada:— Color ferrugineous; Clypeus margined, granulate, and rounded in front with two minute tubercles between the eyes; thorax margined, densely and minutely punctured, transversly elevated in front, with a longitudinal furrow in the disc, and lateral black spot; scutellum bell-shaped, smooth, and very distinct; elytra densely punctured in rows, about 16 in each clytron; body pilose; tibiæ toothed. Length 5 lines. Not determined.

† Of this genus two North American species, are already known. Mr. Ibbetson, late Assistant. Commissary General of Montreal says—that a third one has been taken by him in Canada which differs in size and color from *quercus* or *depressus*, and that probably it is new.

North American forms, while the extensive European apterous genus *Dorcadion* is perhaps entirely unknown here. Amongst the genera common to North and South America may be mentioned *Mallodon*, *Callichroma*. *Eburia*, *Amniscus*, *Oncidcrus*, *Hippopsis*, *Amphionycha* and *Distenia*—Haldeman.

The genera collected in Western Canada are *Orthosoma*, *Tragosoma*, *Criocephalus*, *Arhopalus*, *Callidium*, *Phymatodes*, *Physocnemum*, *Clytus*, *Euderces*, *Helliomanes*, *Grophisurus*, *Monohammus*, *Plectrodera*, *Tetraopes* *Compsidca*, *Saperda*, *Obcrea*, *Desmocerus*, *Rhagium*, *Toxotus*, *Evodinus*, *Acmaeops*, *Strangalia*, *Leptura*, *Trigonarthris*.

Two of the species mentioned by Haldeman, viz.:—*C. sanguineum*, and *M. sutor* are European species, but there is a doubt regarding their occurrence in America. *M. resutor* Kirb. and *M. scutellum* Say, are synonymous. Kirby describes *M. resutor* as resembling the European *M. sutor*, "in many particulars," he says, "that it is not without considerable hesitation I describe it as distinct; it exhibits, however, some characters that seem to indicate more than a casual variety, produced by a difference of climate." He also says, that *resutor* is intermediate between *M. sutor* and *M. sartor*.

Calosoma scrutator occurs on the western frontier of Texas, and in Canada; it has been taken on the northern shores of Lake Ontario. *Chlœnius seriseus* occurs at Tampico, and is common throughout the Canadas. *Staphylinus villosus* occurs in Mexico and Cuba, and is also common throughout the United States and Canada. *Necrophorus obscurus* found in the valley of the Great Salt Lake of Utah, occurs in Canada. *Aphodius strigatus* found at Jalapa, occurs as far north as Lake Superior; also the European *Aphodius fimitarius* has its representative in America, and is found on the shores of Lake Superior. *Hister bimaculatus* is naturalized, but of rare occurrence in this vicinity. *Byrrhus varius* inhabits France and England; in North America it is common. *Byr. clyclophorus* occurs in Eastern Canada. *Pelidnota tripunctata* occurs at Fort Gates, Texas; its range has been traced northward to Niagara Falls, where it is found on grape-vines *Arcoda lanigera* occurs at Santa Fé; is rarely found in Canada West, and probably its northern range terminates about the 44th parallel. *Clytus flexuosus* occurs at Fort Gates; its northern limit is confined to a species of Locust tree, on which it is a parasite in its *larva* stage. Mr. Harris places *Pyrophorus noctilicus*, a West Indian insect, in the American fauna. The authors of "Melcheimer's Catalogue" reject it for want of proof as to its naturalization, probably attributing its introduction to accident. If Mr. H. really captured a living specimen in the U. States, his authority is quite sufficient.

A distribution of insects is also effected by means of importing cattle from one country to another. By this means, a few species of the Dipterous order of insects have been introduced into this country; one of these is the *Œstrus ovis.* Our sheep owners may be ignorant of the fact that this insect parasite is prolific in Canada, being a pest to sheep in winter as well as summer. Entomologists, by strict attention to the habits of this fly, have discovered the manner in which the species is propagated in the nostrils of the sheep. While the animal is grazing, the female fly watches an opportunity to alight on its nostrils deposit its eggs, which are placed in the frontal sinus, in the midst of the mucus which they contain. Each *larva* is provided with a pair of hooks to assist it in motion, and with which it inflicts wounds, and then feeds upon the matter generated therein. When the *larvæ* are full grown, they fall through the nostrils and change to *pupæ* on the surface of the earth. In March, 1856, five of the *larvæ* of this fly were taken from a sheep's head, obtained from the Toronto market. The party who purchased the head, did not know how "the worms," as he called them, got there, and made no use of it, being under the impression that the animal had died from disease. Sometimes the irritation produced by the *larvæ* is so excruciating that the animal runs about continually, rubbing its nose on the ground, and it frequently loses the power of its feet. There have been several instances in England which proved fatal. The disease is called "Staggers" by persons who are ignorant of the cause. The *larvæ* can be destroyed by injecting tobacco juice into the nostrils.

It is indeed probable that the Dipterous wheat parasite which is now propagating to an alarming extent in this country, and where it has done so much damage to the staff of life, may be traced to some European country in which it is attached to another species of cereal, and that naturalists take no more notice of it than that it does exist. Many species of all the orders of insects, while in the *larva* state, derive nourishment from more than a single vegetable substance; and any person who has studied Insect life, can see that every parent insect is provided with instincts for the production of its species. If the insect is a parasite on two plants, it is not at a loss to discover one of them; but deprive it of one of these plants, and the result is that the remaining one suffers doubly. It is astonishing to witness the manœuvres of these minute animals to sustain nature. Every type of creation is destined to pass through its course of life; and we find, as one species becomes extinct, another hitherto unknown to us, springs up, as if by magic, in some other part of the globe, to fill up the vacancy. Of this wheat parasite I shall make some further remarks. It is not known at present; and until we do enquire into its origin and habits, much cannot be said of it.

ARTICLE VII.—*On the Natural History of the Rosignol or Song Sparrow, Fringilla melodia.*

This interesting little bird is one of the first to proclaim with his song the return of spring, with its wood-music, flowers and soft southern breezes. His note is no sooner heard than all nature seems to arouse itself from the torpor of winter and burst forth into an universal revivification. No Canadian can listen to the sweet ditty of the rosignol, at the same time recalling the incidents of his school-boy days, without feeling his heart warm towards the happy little creature. It is remarkable that with respect to so very common a bird, there should yet be a doubt as to its correct specific description. Audubon figures it with a black spot near the centre of the breast, but does not mention this spot in his summary of the characters of the species. He, however, quotes Dr. Brewer, who says that he has reason to believe that there are two birds included under the same appellation. One of these has the breast spotted nearly all over, while the other has the black star in the centre. He says, the latter builds its nest in bushes or young trees at least two feet from the ground, and the other always upon the ground. He says, the most common resort for nesting is a young cedar tree where the branches are very thick, and where he has twice found an arched entrance leading to it, and a cover to the nest, made by weaving straw and hay among the thick foliage of the tree. The eggs have a ground colour of green, which is perceptible all over the surface, not even excepting the large end, where the spots of lilac brown with which the egg is spangled over, are the thickest. The egg of the other species or that which builds upon the ground, has a ground colour which appears to be white as far as can be seen, but the whole is so thickly spotted with blotches of a rusty brown as to appear almost wholly of that colour.

Both of these birds spend the summer in Canada, and their nests may be found in almost every meadow, both on the bushes and on the ground. We hope that some of our youthful readers may endeavour to solve the problem of "two species or one," during the approaching season.

The Rosignol, after leaving us in the autumn, passes into the Southern States, where these birds actually swarm during our winter months. This abundance, Audubon says, is easily "accounted for by the circumstance, that it rears three broods in the year; six in the first, five in the second, and three in the third brood, making fourteen per annum from a single pair. Supposing a couple to live in health and enjoy the comforts necessary for the bringing up of their young families, for a period of only ten years, which is a moderate estimate for birds of this class, you will readily conceive that a whole flock of sparrows may in a very short time be produced by them."

This bird, although it leaves the nest clean and perfect after the first brood, does not rear a second in the same domicile, but constructs a new one. It is made of fine grass, and nicely lined with hair, principally horse hair. Both birds assist in the process of incubation, and while one is in the nest, the other affectionately brings it food. While the female is sitting, the male sings to her from some neighbouring twig or fence rail. The flight of the song sparrow is short, and much undulated when the bird is high in the air, but swifter and more level when it is near the ground. They migrate by night, singly or in scattered troops. They feed on grass seeds, berries, insects, especially grass-hoppers, and now and then pursue flies on the wing. On the ground their motions are lively. They continue running about with great nimbleness and activity, and sometimes cross shallow waters leg deep. They often frequent orchards and gardens, where they love to breed if a secure corner can be found.

This bird sings the whole summer long, and until it takes its departure in the autumn. The notes or chant are short, but very sweet, resembling the beginning of the canary's song, and frequently repeated, generally from the branches of a bush or a small tree, where it sits chanting for an hour together.

The song sparrow is usually called in Upper Canada the "grass bird" or "grey bird," a name that is also applied to another little fellow, who is frequently found building upon a tree close to the walls of some inhabited house. This, however, is the "chipping sparrow," a bird which, although it belongs to the family, has its place in another genus. It is the *Emberiza socialis* of Swainson, and may be recognised by its song "*sip-sip-sip-sip*, resembling, as Audubon says, "the sounds produced by smartly striking two pebbles together, each succeeding note rising in strength, although the song altogether is scarcely louder than the chirping of a cricket."

Of the genus to which the song sparrow belongs, four species only, visit Canada, and of these *Fringilla melodia* is the most common.

The following are the generic and specific characters:

CANADIAN SPARROWS.

[CLASS AVES, ORDER INSESSORES, GENUS FRINGILLA, (LINN.)]

Bill short, stout, conical, somewhat compressed, pointed; upper mandible of the same breadth as the lower, with its dorsal line straight, the ridge indistinct, the sides rounded, the edges ascending at the base, the notches obsolete, the tip scarcely deflected; lower mandible with the angle very short and rounded, the dorsal line straight, the sides convex, the edges inflected, the tip acute Nostrils basal, roundish, concealed by the feathers. Head rather large, ovate; neck short; body compact. Legs of moderate length; tarsus rather short, compressed, with seven scutella; toes moderate; hind toe stout, lateral equal. Claws rather long, arched, compressed, acute. Plumage rather compact, but blended. Wings of moderate length, with the second, third, and fourth quills longest. Tail of moderate length, slightly emarginate. Roof of upper mandible moderately concave, with three longitudinal ridges; tongue compressed, channelled above, horny, rather obtuse and concave at the end; œsophagus dilated about the middle; stomach roundish, muscular; intestine rather short; cœca small.

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1. *Fringilla iliaca*, MERREM. Fox-coloured Finch.

Upper parts light red, claws long, hind toe and its claws of equal length, tail lighter, the head and neck intermixed with light bluish-grey; inner webs of quills brown, secondary coverts slightly tipped with whitish; lower parts white, and, except the abdomen, spotted with light red, the spots on the breast smaller and inclining to black; a patch of dusky on its fore part, produced by the inner webs of several of the feathers.

Male, 7½, 10½. *Female*, 7½.

Dispersed in winter throughout the Southern and Western Districts. Breeds from Nova Scotia to Labrador and the Fur Countries. Rather common.

Fox-coloured Sparrow, Fringilla rufa, Wils. Amer. Orn. v. iii. p. 53.
Fringilla iliaca, Bonap. Syn. p. 112.
Fringilla (Zonotrichia) iliaca, Swains. & Rich F. Bor. Amer. v. ii. p. 257.
Ferruginous Finch, Fringilla iliaca, Nutt, Man. v. i. p. 614.
Fox-coloured Sparrow, Fringilla iliaca, Aud. Orn. Biog. v. ii. p. 58; v. v. p. 512.

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2. *Fringilla melodia*, Wils. Song Finch.

Hind toe and claw of equal length; upper parts yellowish-grey, streaked with brownish-black and brownish red; on the head three greyish-blue longitudinal bands; quills dusky brown, margined with brownish red, tail-feathers dull light brown, edged with lighter; sides of the head yellowish-grey, with two bands of dusky brown; throat white, with a broad band of dusky brown on each side; lower parts white, the fore neck and sides tinged with reddish, and streaked with dusky brown. Bill stouter than in the preceding species.

Male, 6, 8½.

Breeds from Texas to Nova Scotia. Not observed in Kentucky. Winter resident in the Southern States. Very abundant.

Fringilla melodia, Wils. Amer. Orn. v. ii. p. 125.
Fringilla melodia, Bonap. Syn. p. 108.
Common Song Sparrow, Fringilla melodia, Nutt. Man. v. i. p. 486.
Song Sparrow, Fringilla melodia, Aud. Orn. Biog. v. i. p. 226; v. v. p. 507.

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3. *Fringilla Pennsylvanica*, Lath. White-throated Finch.

Male with the bill dusky; the upper part of the head black, with a central white band; a bright yellow band from the nostril to the eye, continued into a white band passing over and behind it, and margined beneath with black; fore part of back bright bay, streaked with dusky and reddish-yellow; rump yellowish-grey; edge of wing light yellow; quills brownish-black, primaries edged with yellowish-grey, secondaries and their coverts with light red; two narrow bands of white on the wings, formed by the tips of the secondary coverts, and first row of small coverts; tail-feathers brown, edged with rufous; throat white; cheeks, sides, and fore part of neck, and a portion of breast, ash-grey; the rest of the lower parts greyish-white, the sides tinged with yellowish-grey. Female similar, but with the colours duller.

Male, 6¾, 9. *Female*, 6¼, 8½.

Winter resident from Louisiana to Maryland, and inland as far as Kentucky. Breeds from Maine to the Fur Countries. Abundant.

White-throated Sparrow, Fringilla albicollis, Wils. Amer. Orn. v. iii. p. 51.

Fringilla Pennsylvanica, Bonap. Syn. p. 108.

Fringilla (Zonotrichia) Pennsylvanica, White-throated Finch, Swains. & Rich. F. Bor. Amer. v. ii. p. 256.

White-throated Sparrow, Fringilla Pennsylvanica, Nutt. Man. v. i. p. 481.

White-throated Sparrow, Fringilla Pennsylvanica, Aud. Orn. Biog. v. 1. p. 42; v. v. p. 497.

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4. *Fringilla leucophrys*, Gmel. White-crowned Finch.

—White-crowned Sparrow.

Male with the bill yellowish-red tipped with brown; upper part of the head with four longitudinal black, and three white bands; fore part of the back streaked with reddish-brown and yellowish-grey; rump light yellowish-brown; quills dark brown, primaries edged with yellowish-grey, secondaries and their coverts with yellowish red; edge of wing whitish; two bands of white on the wing, formed by the tips of the secondary coverts and first row of small coverts; tail-feathers brown, edged with yellowish-brown; throat greyish-white; cheeks, sides, and fore part of the neck, and a portion of the breast, ash-grey; abdomen white, sides, and lower tail-coverts, yellowish-brown. Female similar to the male. Young in first plumage with the back, wings, and tail as in the adult, but duller, and the bands inconspicuous; on the head three greyish-white bands, streaked with dusky, and four dull greyish-brown bands similarly streaked; cheeks, sides, and fore part of the neck, with a portion of the breast, dull greyish-white, streaked with dusky, the rest of the lower parts dull yellowish-white. At the second moult the colours approximate to those of the old bird; but the central band on the head is dull yellowish-brown, the lateral bands brownish-red; while the lower parts are of much duller tints.

Male, 7½, 10¼.

Breeds from Newfoundland and Labrador northward. Abundant. Migratory. Passes southward in autumn beyond the Texas.

White-crowned Bunting, Emberiza leucophrys, WILS. Amer. Orn. v. iv. p. 49.

Fringilla leucophrys, BONAP. Syn. p. 479.

Fringilla (Zonotrichia) leucophrys, White-crowned Finch, SWAINS. & RICH. F. Bor. Amer. v. ii. p. 255.

White-crowned Bunting or Finch, NUTT. Man. v. i. p. 479.

White-crowned Sparrow, Fringilla leucophrys, AUD. Orn. Biog. v. ii. p. 88; v. v. p. 515.

The above descriptions are from Audubon's Synopsis.

ARTICLE VIII.—*On the Minerals of Canada. A Lecture by* PROFESSOR HIND, TRINITY COLLEGE, *Toronto.**

MINERALS OF CANADA.

PROFESSOR HIND'S SECOND LECTURE.

The vast areas occupied by the rocks yielding Gypsum with brine springs in Western Canada have for many years been regarded as sources of great national wealth. Gypsum, or Sulphate of Lime, is used in the Arts for numerous purposes. Our gypsiferous and brine-yielding rocks extend from the Niagara to the Saugeen, and have a breadth varying from five to fifteen, and even twenty miles. Gypsum has been quarried in the Townships of Dumfries, Brantford, Oneida, Cayuga and others in the valley of the Grand River. It will, probably, be found in great abundance

* Extracted from the Toronto *Daily Colonist* of 21st February, 1857.

in the valley of the Saugeen when that fertile tract of country becomes better known. "Apart from domestic consumption, the Townships of Oneida and Cayuga, furnished in 1854, 7,000 tons of gypsum for exportation to the United States. These gypsums are of recent origin; they occur in the form of mounds, which penetrate the palœzoic strata, and the overlying clays of recent date. The beds of lime-stone which surround them are upraised, broken, and in great part absorbed. Mr. S. Hunt, of the Geological Commission has shown that these phenomena are due to certain springs containing free sulphuric acid, which acting upon the carbonate of lime, has changed it into gypsum."

In the arts gypsum is employed by potters for procuring moulds with its calcined powder, moistened with a proper quantity of water. The finer kinds are selected for the manufacture of the alabaster ornaments so much admired. When properly calcined and ground to a fine powder, it is largely employed for stucco work, statues and statuettes; when mixed with glue or gelatine, coloured stuccoes of great hardness and beauty are made from it. It is admirably adapted for taking casts of objects, and is frequently employed for that purpose. Gypsum is commonly known under the name of Plaster of Paris; vast quantities of this substance being found in the neighborhood of the French Capital, and a large quantity of the material is prepared there for home consumption and exportation. Gypsum is the basis of Keen's, Martin's Parian cement; the material is thrown into a saturated solution of Alum, Sulphate of Potash or Borax; after soaking, it is air-dried, and rebaked at a low red heat. When Borax is used, plaster is called Parian; when Sulphate of Potash is employed, it is styled Keene's cement; and when made with Pearl-ash and Alum together, and baked at a higher temperature it is designated Martin's cement. In England, the Gypsum for these purposes is obtained from Nottinghamshire, Derbyshire, and Cumberland. An immense number and variety of articles manufactured from Gypsum, with small additions of the substances before mentioned, were exhibited at the London and Paris exhibitions. The subject is one of general interest, and the vast deposits of Gypsum in Canada will, no doubt, become considerable sources of national wealth, when the proper times arrives.

For Agricultural purposes, the value of Gypsum is too well known to require much notice here; a growing appreciation of its worth is shewn in the yearly increasing demand, and it is now found for sale in large quantities in most Canadian towns. It is a fact ascertained by the experience of very many years in France and Germany, and more lately America, that Gypsum judiciously applied, sometimes doubles, and even trebles the quantity of certain plants usually grown upon an acre; a study of the mode and time of applying it, and of the plants most benefited by it ought not to be lost sight of in Canada, where it so largely abounds in the District between Niagara river and the Indian Peninsula of Lake Huron. The value of the exports from Canada of ground plaster and lime show a steady and important increase. In 1853, the total value was only £1340 Cy., in 1854 £2017, and in 1855 £19,112.

BRINE SPRINGS.

In describing the great extent of the Gypsum and Brine bearing rocks of Canada, it is possible to speak only with comparative certainty of their economic value with respect to Gypsum. Although Brine springs may be common and apparently sufficiently strong to warrant the commencement of working operations, yet failure and disappointment have so often resulted from unfortunate attempts in New York, and even in Canada, that actual experience resulting from trial is the only sure indication of success. In this group of rocks, brine springs occur abundantly in the region between the valley of the Grand River and the Indian Peninsula, and in the eastern prolongation of the same rocks enormous quantities of salt have been made at Salina.

The vast extent of country not hitherto thoroughly examined but occupied by the salt-bearing rocks, leaves it extremely probable, but only extremely probable, that brine springs sufficiently strong for manufacturing purposes will be found and worked west and north-west of Hamilton. The question is one of much commercial interest, and is represented in our annual expenditure by the sum of £51,320, which we pay to the United States, and £13,977 to Great Britain, making, with other small importations of the same material, the total amount of £69,209, representing 1,687,926 bushels of salt in 1855.

MARBLES.

Statuary marble is a material employed in an art which no one can expect to find exercised to a large extent in Canada in the infancy of the country; it is evident, therefore, that the finer kinds we possess, may derive value from the creation of a demand for them as raw material abroad, where mechanical labour is less proportionately valuable, and where cultivated taste in execution may succeed in imparting to them a value which their natural beauty serves only to heighten. The coarser kinds of marble will acquire continually increasing value with us, as the wealth of the country increases, and facilities for carriage extend into the regions where Canadian marbles are to be found.

In the Eastern townships there are very extensive ranges of serpentines, affording beautiful varieties of marbles, specimens of which attracted considerable attention in England, in 1851. Sir W. Logan thus notices this important and extensive range:—

"Several considerable blocks of limestone and serpentine, fit for the purposes of marble, carried across the Atlantic in the rough, were sawed and polished in London. They were all from the eastern townships, and though selected hastily and without previous trial of the stone, most of them gave very fair results, and one of the serpentines from Brompton Lake, shewing a dark green ground with black spots, was of a peculiar beautiful character. I was informed by the marble manufacturer, a highly respectable one, who cut the stone, that large blocks of such a description would command a ready sale in the metropolis, and when we consider the great extent to which the serpentine ranges through the townships, 145 miles, the results of these trails give hopes that much stone of a valuable description may be obtained from that region.

Among the localities where marbles have been found and examined by the members of the Geological Commission—are for white marble—Lake Mazinaw and Philipsburg; black, Cornwall and Philipsburg; red, St. Lin; brown, Packenham; yellow, and black, Dudswell; grey and variegated, Macnab, Philipsburg, St. Dominique, Montreal; green, Grenville and along a serpentine range before mentioned extending for 150 miles in the eastern townships. In the "Sketch of the Geology of Canada," these green marbles are mentioned in the following terms:—The serpentines throughout their whole extent, furnish very beautiful dark green marble often resembling the *vert-antique ;* green serpentines of various shades are mingled with white and grayish limestones; giving rise to many varieties of these marbles, the finest of which are from Broughton and Oxford. Near Philipsburg, the Trenton limestone afford a fine white marble; in their southern prolongation, these limestones become more crystalline, and form the white marbles of Vermont, which are now celebrated. The upper silurian limestone of Dudswell are greyish and yellowish, with veins and spots of black, they still exhibit on their polished surfaces, the traces of fossils, and often form marbles of great beauty.

The specimens upon the table were from Madoc; a considerable abundance of coarsely crystalline marble occurs in those back townships, and as the country becomes cleared and known, more of better quality will probably be found.

The process of turning and polishing marbles by means of a common lathe is not generally known, and may therefore be briefly noticed. A piece of marble of the size required is selected free from veins and cracks. The first operation is to chisel it roughly to a cylinder form. It is then fastened by resinous cement to the lathe and subjected to a slow revolving motion. The tool used is a bar of iron about 30 inches long and pointed, this is forcibly applied to the revolving cylinder of marble, which it gradually reduces to its required form. A coarse sandstone with plenty of water is next applied; the cylinder of marble being made to revolve much more quickly. The tool marks disappear under this process. A finer piece of sandstone is then employed to remove the scratches of the preceding one, and so on with still finer stones, until all scratches are quite obliterated. In polishing, a piece of of cotton cloth rubbed with flour emery is used; and, finally, a similiar piece of cloth rubbed over with tin putty gives a very high polish, and completes the process.

SLATE.

Slate is a material daily becoming more valuable on account of the vast variety of useful purposes to which it is applied. One of its most important characteristics is its strengh, it is computed to be about four times as strong as ordinary stone, and slabs 8 feet long and upwards can be safely used of thicknesses not exceeding half an inch. It is a non-absorbent of moisture and thus adapted as a admirable lining for wells and for roofing houses. The slates which were taken to the London Exhibition from Canada were not good representations of the material since found to exist in this country. The economical importance of slates has attacted attention to their distribution in Lower Canada, and already large quarries are worked which furnish slate of superior quality. Some of the quarries are wrought on rocks of the same geological epoch as those which underlie the clay on which Toronto is built, altered however by heat. The numerous applications of this entirely useful material have been alluded at some length by Sir W. Logan in his Geological Report:

"Not only is it applied as a covering for houses, but it is employed as walls for cisterns to hold water, slabs of fifteen feet by eight feet being sometimes used for the purpose: in smaller dimensions, it is used for wine coolers, dairy dressers, kitchen and hall flooring, tables, chimney mantles, and a multitude of other purposes where surface is required. In its application as tables and chimney pieces, it is capable of receiving a great degree of decoration; the tables after being dressed to the smoothest possible surface, are embellished with gilding or with paintings in colors resisting fire, showing landscapes, or imitations of stone, and a silicious varnish being applied, the stone subjected to a heat which melts the varnish into an enamel, and produces a brilliant result. Chimney pieces in the same way are enamelled over the natural colour of the stone, or over a fancy colour given to it. When the colour is black, it is difficult to distinguish the slate from a brilliantly polished and valuable black marble, while the cost is comparatively small. The great number of purposes to which good slate is applicable, render the rock of great economic importance, and well worthy of research."

HYDRAULIC LIMESTONES.

The term hydraulic limestone is very frequently met with in accounts of the construction of reservoirs, canals, water-tanks, cellars, and a host of other artifices of public utility and domestic comfort. Often, indeed, these fail to secure the object for which they are designed, as many of the public works in the United States testify. This arises from a misconception of the nature of an hydraulic limestone, and of the effect which time and exposure are capable of producing upon different varieties. This subject has been much studied in Europe by the ablest chemists, but not with those clear and satisfactory results which so frequently distinguish the progress of modern science. Mortars and hydraulic cements may be thus distinguished:—

1. Common limestone, such as the limestone from Kingston, or the quarries on the western extension of the Grand Trunk, is exposed to a heat sufficient to drive off the carbonic acid it contains; it

then acquires the power of absorbing water in the proportion of 9 pounds of water to 28 pounds of lime, with the evolution of much heat. If this lime is mixed with sand to the extent of two or three times the weight of the lime, and water added, a mortar is formed which possesses the property of hardening in dry air or between dry bricks, imperfectly hardening in damp air, and refusing altogether to become consolidated under the surface of water.

2. Water Limes or Hydraulic Limes, or Cement, are those which possess the property, after they have been properly burned, of hardening under water without admixture with any other substance.

The simplest form of an hydraulic lime, is common lime mixed with 10, 15 or 20 per cent. of clay, or clay and magnesia, or a little clay, sand and magnesia. With such a compound, when calcination or burning is not carried too far, a good and durable cement is obtained, setting under water in periods varying from a few hours to a week or more, and at the end of some months becoming harder than many common limestones.

Many calcareous clays or argillaceous limestones exist in nature possessing these properties, these are called hydraulic limestones, because when they are partially burned they possess the property of setting under water. Many limestones which are used for hydraulic purposes, possess the very detrimental quality of containing portions of lime after they are burned, which slake at a period subsequent to their use. The mortar or cement then falls to pieces and becomes not only useless, but absolutely injurious.

Limestone, containing the proper admixture of the materials enumerated, exists in many parts of Canada; at Paris, Cayuga, Thorold, Kingston, Loughboro', Hull, Quebec and elsewhere. In some of these localities the beds have been worked; those of Hull are of excellent quality and highly esteemed. This bed is characterized by the proximity of a layer filled with a particular shell, and has been traced chiefly by means of this shell over a large area, and it is the continuation of the same bed which furnishes the hydraulic lime of Kingston and Loughboro'.

In the United States the preparation of hydraulic cement of different qualities, is already a manufacture of considerable importance.

So far back as 1840, there were 60 kilns for the manufacture of cement, in the vicinity of Kingston, Rosendale, Lawrenceville, and High Falls, in the State of New York. In that year it was estimated that 600,000 barrels were sent to market from those kilns. It is shipped to all American Atlantic ports and the West Indies. From that period it is almost needless to say that the production of hydraulic cement, in the United States, has immensely increased.

Many of the Canadian beds of water lime appear to be of excellent quality; they are generally distributed through the country, from the valley of the Grand River to the Saugeen. Trials have been made by Mr. Hunt, on a specimen from near Brantford, which, in five minutes, set under water.

OCHRES.

Ochre used as a paint, is of growing importance on this continent. So many of our structures are built of wood, that their preservation from the air, and a desire to give them a suitable and agreeable appearance, naturally leads to their being covered with some material possessing the required properties. Ochres of different tints are largely used for this purpose. Canada imports a very considerable quantity of ochre in a manufactured state, and yet possesses within her borders, very extensive and valuable deposists of this mineral. The exhibition of ochres at Montreal in 1850 attracted the attention of a stranger, who enquired of Sir W. Logan, where they came from; he was informed of the position, and of the means of obtaining access to them. The stranger, knowing the value of the deposit, immediately secured the property on which it was found. In 1852-53 Sir W. Logan relates the subsequent history of this ochre bed, which affords one instance out of hundreds, which have occurred in Canada, of foreigners familiar with the value of some of our natural products, and acquiring knowledge of their extent and distribution appropriating, and with perfect justice, the gain to themselves.

"A very large ochre bed is situated on the St. Nicholas range of Pointe-du-Lac, on the property of Mr. Piere Chaillon and his brother. It is crossed by the range road, running north westward, over a mile from the point where starts from the water-side road; the deposit extend on each side of the road, about ten acres to the south-west, and forty acres to the north-east; the breadth is irregular, and varies from one to twenty acres, and the whole area may be about 400 acres; the thickness of the deposit ranges from six inches to four feet, and may have an average of about eighteen inches. The prevailing colors of the ochres are red and yellow, but there occurs also in some parts a beautiful purple tinge, and in others a blackish-brown. At the Industrial Exhibition which took place in Montreal, in October 1850, some of the ochres of this locality presented to the public view by Mr. D. G. Labarre, attracted the attention of persons acquainted with the commercial value of such products, and arrangements were subsequently made with the proprietors of the land, by Messrs. H. A. Munroe & Co., of New York, for the purpose of entering upon such a preparation of the crude material as should fit it for sale. With this view, a couple of furnaces have been erected in the vicinity of the ochre bed, and an agent established to carry out the details of the manufacture, and attend to the forwarding of the article to New York, where the sale of it is effected. I was given to understand by the agent, that 400 barrels of the ochre had been disposed of at five dollars each, and that as many as twelve barrels had occasionally been prepared in a day. From the few natural colors that have been mentioned, eight tints are said to be prepared. The deposit being but little mixed with sand, the chief impurity to be got rid of consists of the roots of those plants which have been growing on the surface, some of which penetrate to a considerable depth. Two modes are resorted to for this purpose; one is by dry sifting, which is used where the natural colors of the ochres are to be preserved, as in the case of the yellow variety, of the purple, and of the blackish brown. The yellow is a hydrated peroxyd of iron, the purple also is probably in some peculiar state of hydration, but the red is the anhydrous peroxyd. By exposure to a sufficient heat in the furnace, the water of combination is driven off from the yellow and purple, and both becoming anhydrous peroxyd, assume the tint of the natural red ochre, from which, as from the other two, the vegetable matter in this operation is burnt out. The blackish-brown variety is scarcer than the others, and affords colors of a more valuable description; purified from roots without fire, it is sold under the name of raw sienna; it is admirably adapted for graining, and brings in retail, I am informed, so much as a shilling the pound. When subjected to fire, it assumes brown of less intensity, and it is sold as burnt sienna. As it does not turn red from burning, it is probable that there may be in this ochre, an admixture of manganese."

In the St. Malo range of the Seigneury of Cap-de-la-Madeleine a great deposit of ochre occurs. The area occupies upwards of

600 acres. It is underlaid by peat, the fuel sufficiently well adapted to prepare it for the market. This and many other localities in Lower Canada, as well as in Upper Canada, contain inexhaustible quantities of ochre, some of excellent quality and of a great variety of colours.

STEATITE.

Steatite or soap stone, composed of flint and magnesia, possesses many singular properties which are gradually introducing the material into notice and use. It is generally soft to the touch, scarcely affected by acids, and little changed by exposure to intense heat.—In Maryland a steatite or soap-stone company exists, and manufactures a surprising number of articles for económical purposes. In addition to the properties before enumerated, the remarkable ease with which steatite is worked by common carpenters' tools, render it an object admirably adapted for may operations to which other materials are not applicable. A substance almost indestructible by fire and many strong acids, and so soft as to admit of being turned, bored, screwed together and planed, is well worthy of attention.

In Canada it is found and used as a refractory stone in the township of Vaudreuil, Beauce, Wotton and Ireland; it exists also in Sutton, Bolton and Melbourne; it also exists in the township of Leeds and Stanstead, where it is ground and employed as a paint.

The brief and necessarily imperfect sketch I have now given of the most important minerals hitherto found in Canadian rocks may serve to convey a tolerable impression of what our country offers to mining enterprise and industry. We must, however, in justice to that large extent of territory which constitutes our main mineral region, bear in mind that it is, in great part, still an uncultivated and but partially explored wilderness.

It was said by one, far above his fellowmen in acquirements, and in the additions he had made to human knowledge, that when at the close of a long life, he contemplated the work he had done, "he seemed like a child to have been gathering pebbles on the sea shore, with the vast ocean of truth lying unexplored before him." We may, with some semblance of propriety, apply this beautiful simile to our present acquaintance with the stores of inert wealth which lie hidden in the rocks of the unsettled parts of our country. Although the information which has been given to the world by the geological commission is of the highest national value, and in amount, far greater than was ever expected to be acquired in so short a period, over a country so extensive and little known, and with means so inadequate to the end, yet it is not to be understood that discoveries equal in importance to those already made may not year by year inform us of fresh treasures before unthought of. It is only the other day that a band of rock was discovered, so admirably adapted to the milling purposes for which Burrstones are employed, that we may not only become independent of foreigners for that important article, but enabled to export them to other countries.

The discovery of hydraulic lime in some of the strata on which the city of Quebec stands tells, by means of a geological knowledge of the country, of the existence of hydraulic lime for hundreds of miles. The ascertained southern limits of the Huronian copper bearing rocks on lake Huron and Superior indicate a copper yielding country in which a search for that metal may be prosecuted over many thousand square miles with every prospect of success.

The influence indeed of a single discovery of an economic material in any strata acquires importance which cannot easily be estimated, when the known extent of the rock which holds it occupies wide areas. It is for this purpose that a general study of geological outlines of the country is so useful, and in our time even necessary. Think of the advantage to the settlers in the Ottawa region to know of the existence of Crystalline Limestones beneath their feet, over which they have been many years journeying 15 and 20 miles for the same indispensable material to the great River Ottawa itself, where it is exposed in a form to which they have been accustomed. But expand the ideas conveyed in this simple announcement to the whole region in Canada where it may apply, and we find that a knowledge of the structure of the Laurentian Rocks, which extend from Labrador to Lake Huron, and thence on towards the Mackenzie River, tells us of the existence of Crystalline Limestone throughout the whole of the vast country and limestone is an indispensable necessity of civilized life. But we may amplify still further and point to the iron ores generally associated with these limestones. I have spoken in a former lecture of the vast magnetic beds, of Marmora, Madoc, Belmont and Hull; these are generally found in juxta-position with beds of crystalline limestone. When this great fact becomes generally known among future settlers in the Laurentine Country, and they are made aware of its applicability to the extensive areas between the Ottawa and Lake Huron and elsewhere, it becomes almost a matter of certainty that the large rivers traversing this region may thus be made accessible and of commercial value. Consider again the lime and soda felspar rocks which throughout the Laurentine Country are associated with the crystalline limestone, and remembering the words of Sir William Logan, we shall not despair of, but rather hope well for, this vast uninhabited region. The vallies underlaid by these lime and soda felspars guarantee a fertile soil and agricultural capability, wherever they are to be found, and the discovery of important ranges in the Laurentine Country establishes this capability over wide areas. It is of the highest importance to give due prominence to this part, for an impression has prevailed almost universally that the Laurentine Country, now comprising the unsurveyed part of Canada, is hopelessly sterile, and consequently incapable of supporting agricultural people so necessary in the proximity of a great mining district. Whereas the real facts of the case, when fully known, show conclusively that not only in the river vallies but over extensive ranges occupied by particular rocks, all the elements of fertility exist in singular abundance, and that it requires only the industrious hand of man to convert wide areas in those unoccupied solitudes into cultivated and fruitful farms.

ARTICLE IX.—*Quarterly Journal of Microscopical Science.*

No. 18, January, 1857, p.p. 114, with six plates. London: John Churchill, 4s.

CONTENTS.

On Striated Muscular Fibres in the Skin of the Human Lip; by Dr. Woodham Webb, London.

Translations, Notes and Correspondence, and Proceedings of the Microscopical Society.

This is an average number. From the notes we select the following communication addressed to the editors, which may prove interesting to microscopists among ourselves.

"Allow me to call your attention, and that of your readers, to a little contrivance of mine, which may be found useful."

"It is a simple apparatus for illuminating objects under the microscope, and will be found particularly of use when examining Diatomaceæ. Knowing that there are many microscopical observers like myself, not able to expend large sums in accessory apparatus to the microscope, I particularly recommend it to their notice."

It consists of a plate of glass, (fig. 1) (an ordinary slider,) three inches by one; to one side of which, in the centre, is attached, by

Fig. 1.

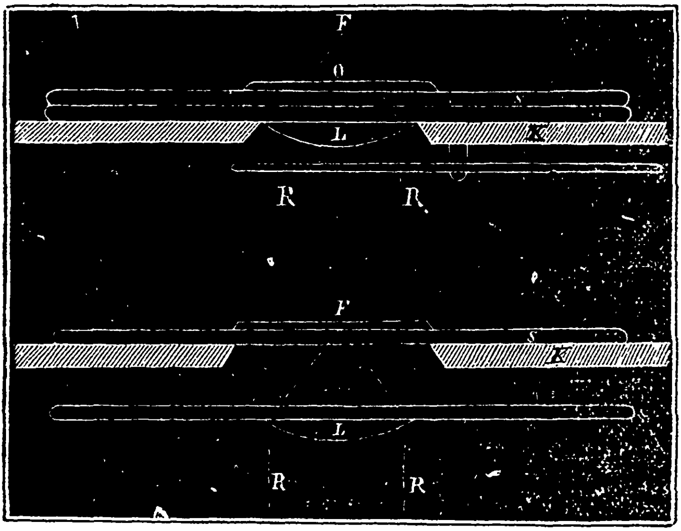
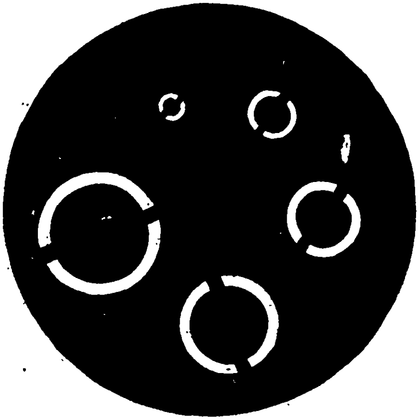


Fig. 2

Canada balsam, a *plano convex* lens (L) and this may be of about one quarter-inch focus. Lenses of different powers can be used although I have found one of half-inch, and one of a quarter-inch focus to be the most useful. The way in which this is used is seen in the first figure. The rays of light (R) fall on the lens (L) placed on the microscope stage (K), so that the flat side is uppermost, upon which is placed the object to be examined. The rays are brought to a focus (F), at some distance above the object (O), thus giving an even white light over the whole field of vision, and this I have found particularly advantageous when using low powers for viewing objects. We can modify this arrangement by placing the lens below the stage, (as in fig. 2), and at a point where it can be adjusted by a rack and pinion, so that the rays from it are focussed on the object. However, the first arrangement I have found the most generally useful. To this can be added a diaphragm (fig. 3), which any one can make for himself, to fit the microscope, of blackened card-board. The general utility and cheapness of this simple contrivance will, I think, recommend it to the consideration of all whose purses are not as large as their desire for knowledge.

Fig. 3.



I should also mention that I have found this illuminator particularly useful on dull days, when, by the mirror alone, only a gray light could be obtained, while with the addition of my condensing lens a clear white light is obtained, and from the reason of most of the rays falling obliquely on the object, the markings of certain of the Diatomaceæ can be easily resolved with it. When the diaphragm (fig. 3) is added, with its numerous apertures, and which can be varied to suit the fancy, we get an apparatus which, on important occasions, will be found to fill the place of the more expensive achromatic condenser.

E ARTHUR M. EDWARDS, *New York.*

Miscellanies.

THE LATE MR. HUGH MILLER.

"Hugh Miller," (writes the accomplished Editor of Silliman's Journal,) "one of the best known and most honored of Scotland's sons died at Shrub Mount, Portobello near Edinburgh, on Wednesday the 24th December. In consequence of excessive mental labor, his mind had become disordered, and under derangement, he died by his own hand. He had just finished a new work, one of a series that has done *more than all else published in the world* to popularize and christianize science; and he leaves this "Testimony of the Rocks" as a testimony to his own greatness and goodness of soul, as well as to the treasures of wisdom in the volume of creation which he so delightingly read."

The italics are our own. We cull from recent Scotch papers the following accounts of this sad event: * * * * * *

(From the Scotsman.)

"Rarely are we called upon to perform a duty so painful, alike in itself, and in the sudden circumstances of its occurrence, as to record the death of Hugh Miller. His name, as editor of the *Witness*, as a man of science, and as a genial and admirable writer on social and literary topics, is known wherever our recent literature itself is known; and in Edinbugh, the city of his adoption, and nursery of his talents and reputation, his death is felt and mourned as a public loss. However sadly the narrative of his death may touch Mr. Miller's immediate friends, is will be to them less startling than to others unaware of his peculiar temperament, and of his recent state of health as a sufferer from nervous depression and irritation."

"Mr. Miller has fallen a victim to overwork of the brain, the peculiar malady of these days, and of men of his class. Such, we know, was and had long been his own conviction. Years ago, and again within these two or three days, he was pleased in the goodness of his heart, to warn the writer of these few hasty and halting words against what he thought dangers of that class, pointing to his own case as an example deterring from continous efforts and anxieties.

In this respect, however, Mr Miller suffered, we suspect, from a somewhat peculiar temperament—he did not work *easy*, but with laborious special preparation, and then with throes that tortured him during the process, and left him exhausted afterwards. In saying this, however, we speak only of the more recent years; and it is at least six or seven years since we heard him complain that hard work had left him only *half a man*, and that he could do only half work with double toil."

"Although apparently a man of physical as well as moral courage, he had a curious tendency to keep fire-arms about his house and person. When he lived at Sylvan Place, to the south of the Meadows, he was accustomed, when going home after nightfall, to carry a loaded pistol, and from some allusions in his work—"First Impressions of England"—it appears that he followed the same practice when travelling, or at least when on his pedestrian excursions.

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To that habit, we have apparently in great part to ascribe the event we to-day deplore, and which a large proportion of the Scottish people will hear with startling and grief."

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"Beginning his literary career as a correspondent of the *Inverness Courier*—whose accomplished editor will be among his sincerest lamenters—he asserted his claims as a delightful sketcher of manners and of natural scenery and objects, and next as a powerful writer on ecclesiastical politics. It was only when the comparative ease and leisure he enjoyed as editor of the *Witness* enabled him to follow the natural bent of his inclinations and genius, that he developed that power of observation and research which he had cultivated, almost furtively, throughout his whole career, that he became known as a discoverer in science, and as one of the most felicitous of its popular illustrators. He was born in October 1802, as he himself tells us in the fascinating narrative of his life already alluded to. He has thus been cut off at the early age of fifty-four, while engaged on works to which he had devoted years of toil and research, and from which the geological world expected a rich harvest of new ideas and valuable results. His "Scenes and Legends of the North of Scotland," published about twenty years ago, (which was intended for a narrow circle,) revealed his poetical imagination and his extraordinary power of writing. The "Old Red Sandstone," published in 1841, while it placed him in the first class of geologists, and made his name known over Europe as a man of science, charmed even ordinary readers by the fascination of its style. In 1849 he published "Footprints of the Creator, or the Asterolepis of Stromness," one object of which was to expose the flimsy sophistry,—and what he deemed the atheistical tendency—of the "Vestiges of the Natural History of Creation." It is ably reasoned, and—like his other works—beautifully written. Besides these, (and passing over his articles in the *Witness,*) he published a small volume—"First Impressions of England"—we think about eight or nine years ago. Many of his geological papers, scattered through the columns of the *Witness*, and no doubt others still existing in manuscript, he intended to publish in a more accessible form; and deep will be the disappointment caused by his death among the wide circle of his admirers, who yet expected many works, to instruct and delight, from his pen. His wonderful command of the English language, and the charms of his style, drew a glowing tribute to his eloquence from Dr. Buckland (himself a first-rate writer), which has often been quoted, 'I would give my left hand to possess such powers of description as this man; and if it please Providence to spare his useful life, he, if any one, will certainly render the science attractive and popular, and do equal service to Theology and Geology.'

"Bred a mason, with only common education, he raised himself by his native talent, from a humble rank of life to a distinguished place among the best writers and most scientific thinkers of the age. His country will long honour him as a noble example of a self-educated Scotsman."

From the Edinburgh News.

* * * * "His published works contain but a fraction of the labours of his lifetime. For many years past he has been one of the most energetic members of the Royal Physical Society, at whose meetings he from time to time made known the progress of his researches. Were these papers collected, they would form several goodly volumes. But their author studiously refrained from publishing them, save occasionally in the columns of the *Witness* newspaper. It was his intention that they should each form a part of the great work of his life, to which for many years his leisure moments had been devoted. His design was to combine the results of all his labours among the different rock formations of Scotland into one grand picture of the geological history of our country. For this end he had explored a large part of the Scottish

counties, anxious that his statements should rest as far as possible upon the authority of his own personal investigation. His knowledge of the geology of the country was thus far more extensive than was generally supposed. We may refer particularly to that branch of it on which he bestowed the unremitted attention of his closing years—the palæontological history of the glacial beds—that strange and as yet almost unknown period that ushered in the existing creation. He studied it minutely along the shores of the Moray Firth, on the east coast of Scotland, along the shores of Fife and the Lothians, and on the coast of Ayrshire and the Firth of Clyde. This last summer he made a tour through the centre of the island, and obtained boreal shells at Buchlyvie in Stirlingshire—the *omphalos* of Scotland. The importance of this discovery, in connection with those he had previously made in following the same chain of evidence can only be appreciated by those who have paid some attention to geology. We may state briefly that it proves the central area of Scotland to have been submerged beneath an icy sea, and icebergs to have grated along over what is now the busy valley of the Forth and Clyde, while the waters were tenanted by shells at present found only in the Northern Ocean. A large part of his work is written, though it is to be feared that much knowledge, amassed in the course of its preparation, has perished with him. In particular, there were whole sections of his museum understood only by himself. Every little fragment had its story, and contributed its quota of evidence to the truth of his descriptions. There is perhaps but another mind in Britain,—that of Sir Philip Egerton,—that can catch up the thread, and read off, though with difficulty, the meaning of those carefully arranged fragments. Yet, even with such aid, much must long, if not for ever, remain dark and obscure. The work on which he was more immediately engaged at the time of his death was partly theological, partly scientific. It was to embrace the substance of some lectures lately delivered, and a paper read last year before the British Association at Glasgow, on the fossil plants collected by himself from the Olite and Old Red Sandstone of Scotland. It was likewise to contain the figures of some thirty or forty hitherto undescribed species of vegetables. We hope that, as it was all but ready for publication, it may yet be given to the world."

(From the Scottish Guardian.)

* * * * * * * "To Mr Miller, more than to any other geologist, undoubtedly belongs the honour of having demonstrated, what previous observers had begun to suspect, that the Old Red Sandstone was entitled to rank as an independent formation, by its distinctive fossils, many of which he was the first to discover and describe. Mr Miller had projected and had advanced far in the preparation of, a work on the general geology of Scotland; but it is with the Old Red Sandstone that his name as a geologist will be permanently connected. The work in which he traces the progress of his observations, has been probably perused more for its moral interest and its literary excellences than even for its geogolical descriptions. It is such a book as Oliver Goldsmith might have written, had he been a naturalist, which he was not; but still when Goldsmith wrote on natural history, he threw the natural historians into the shade by his marvellous powers of description; and of all the writers of the golden age of British literature, it has always appeared to us that Mr Miller's style came nearest to the exquisite English of Goldsmith. To Mr Miller's versatile talents, and the varied contributions of his pen to criticism, art, philosophy, and science, is applicable also more than to any other writer of the day, the panegyric pronounced upon Goldsmith, that there was no branch of knowledge which he did not touch, and which, touching, he did not adorn. His most profound work, the "Footprints of the Creator or the Asterolepis of Stromness," is a contribution to natural theology of inestimable importance. It has been adopted as a text book by some of the most eminent teachers of geology in the Universities; and it has done more to expose the atheistical fallacies and sophistries of the "Vestiges of the Natural History of Creation" than even the elaborate essays of Sedgwick and Brewster."

"But to other and abler pens must be assigned the task of estimating the genius, the character, and the services to religion, science, literature, and social progress of this marvellous man. We must content ourselves with these brief and hasty recollections of his life and labours, in recording the unexpected and sorrowful intelligence of his death. Thousands here and in other lands will join with us in the tribute of an honest tear to the memory of a man of true heart and noble powers of intellect, devoted to the loftiest purposes. Little did we think, when we met Mr.

Miller last year, in the genial and kindly intercourse of the British Association, that we were to see his face no more; and that at the early age of fifty-four, he would be lost to the Church which he loved, and to the cause of Christian science, which owes so much to his example and labours. Death has made sad inroads of late years upon the ranks of the cultivators of natural science. Dr. Landsborough, Professor Edward Forbes, Dr. Johnston of Berwick, Mr. Yarrell, and now Mr. Hugh Miller, have passed away in rapid succession,—and Forbes and Miller have left behind them no equals."

We conclude our extracts with the following from the pen of the Rev. Dr. Hanna, in "The Witness," Mr. Miller's newspaper. "But Mr Miller was far more than a Free Churchman, and did for the Christianity of his country and the world, a far higher service than any which in that simple character and office was rendered by him. There was nothing in him of the spirit and temper of the sectarian. He breathed too broad an atmosphere to live and move within such narrow bounds. In the heat of the conflict there may have been too much occasionally of the partizan; and in the pleasure that the sweep and stroke of his intellectual tomahawk gave to him who wielded it, he may have forgotten at times the pain inflicted where it fell; but let his writings before and after the Disruption be now consulted, and it will be found that it was mainly because of his firm belief, whether right or wrong, that the interests of vital godliness were wrapped up in it, that he took his stand, and played his conspicuous part, in the ecclesiastical conflict. It is well known that for some time past,—for reasons to which it would be altogether unseasonable to allude,—he has ceased to take any active part in ecclesiastical affairs. He had retired even, in a great measure, from the field of general literature, to devote himself to the study of Geology. His past labours in this department,—enough to give him a high and honoured place among its most distinguished cultivators, — he looked upon but as his training for the great life-work he had marked out for himself,—the full investigation and illustration of the Geology of Scotland. He had large materials already collected for this work; and it was his intention, after completing that volume which has happily been left in so finished a state, to set himself to their arrangement. The friends of science in many lands will mourn over the incompleted project which, however ably it may hereafter be accomplished by another, it were vain to hope shall ever be so accomplished as it should have been by one, who united in himself the power of accurate observation, of logical deduction, of broad-generalization, and of pictorial and poetic representation. But the friends of Christianity cannot regret, that since it was the mysterious decree of Heaven that he should prematurely fall,— his work as a pure Geologist not half done,—he should have been led aside by the publication of the Vestiges of Creation to that track of semi-theological, semi-scientific research to which his later studies and later writings have been devoted. That, as it now seems to us, was the great work which it was given him on earth to do,—to illustrate the perfect harmony of all that science tells us of the physical structure and history of our globe, with all that the Bible tells of the creation and government of this earth by and through Christ Jesus our Lord. The establishment and exhibition of that harmony was a task for which, is it too much to say, that there was no man living so competent as he? We leave it to the future to declare how much he has done by his writings to fulfil that task; but mourning, as we now can only do, over his sad and melancholy death,—to that very death, with all the tragic circumstances that surround it, we would point as the closing sacrifice offered on the altar of our faith. His very intellect, his reason,—God's most precious gift,—a gift dearer than life,—perished in the great endeavour to harmonize the works and word of the Eternal. A most inscrutable event, that such an intellect should have been suffered to go to wreck through too eager a prosecution of such work. But amid the mystery, which we cannot penetrate, our love, and our veneration, and our gratitude, toward that so highly gifted and truly Christian man shall only grow the deeper because of the cloud and the whirlwind in which he has been borne off from our side."

The Late Dr. Kane.—At a late special meeting of the American Geographical Society in New York, the President, the Revd. Francis L. Hawks, D. D., paid the following beautiful tribute to the memory of the late much lamented Dr. Kane.

Gentlemen of the Society: It becomes my sad duty, as your presiding officer, to bring to your notice the removal, by death, of one of our most distinguished associates. Our friend, Dr. Kane, is no more. I knew him intimately, and the strong bond of our personal friendship, while he lived, prompts me to solicit your indulgence if I depart from the formality of a more official announcement on this occasion, and render my brief and humble tribute to the worth of a man whom I greatly loved. In my observation of human nature it has seldom fallen to my lot to meet a fellow-being possessed of more striking excellences, or in whom there was a combination more rare of seemingly opposite qualities; in him, however, they were all harmoniously blended, and it was precisely this fact which made him to me an object of deep and affectionate interest. To a fine mind, inquiring and analytical, he added great industry; and what he deemed worthy of study at all he studied thoroughly. The range of his attainments, too, was varied, and he had roamed largely over the wide-spread field of physical science. Both varied and accurate as were his attainments, there was a beautiful simplicity and modesty so blended with them, that no one ever could suspect him of feeling his superiority in learning, over those with whom he mingled. He had not studied for ostentatious display, but for usefulness in his station. The strong trait in his character was his indomitable energy. In his small and feeble frame there was combined an iron will, a giant power of resolute purpose. Impulsive, ardent as he was by nature, one might have expected that his would be just the disposition to leap prematurely to conclusions; but a very slight acquaintance soon proved that such was not his habit of mind. Rarely have I seen so much of impulsive warmth blended with the soberness of patient, laborious inquiry, and sound practical judgment, as in him. Thus for instance, the strong conviction he had of the open Polar sea, which he lived long enough to discover, was founded on no hasty or happy guess. In conversations which he held with me on the probabilities of its existence, when our discussion turned entirely on scientific considerations, I found that he had reasoned out his conclusions by a chain of induction almost as strictly severe as mathematical demonstration; indeed, part of his process was mathematical. Before he sailed, he told me he was sure there was open water around the pole, and that if he lived to return he hoped to be able to tell me he had seen it. He no more proceeded on conjecture merely than did Columbus in his assertion of the existence of our hemisphere. But with these intellectual traits, and with great personal intrepidity, he had a gentleness of heart as tender as a woman's. There was an over-flowing kindliness in his soul which stirred up his benevolence to its lowest depths when he encountered human misery, whether of body or mind. He spared not time, nor toil, nor money, to relieve it. I may not violate the sacred confidence of private friendship under any circumstances, and least of all when the grave has for a time sundered the ties which bound us as earthly friends together; but were it lawful to speak all I know on this point, both as his almoner and adviser, I could move your generous sensibilities even to tears, by stories of as pure, disinterested, liberal, self-sacrificing efforts for others, as any it has been my lot to meet with in the records of human benevolence. Alas! my countrymen, what is his early grave but a noble testimonial to his humanity? He is dead himself, because he would snatch others from death.

Another remarkable trait in his character, was the power he had of commanding and exercising an irresistable influence over men. You, Sir (Mr. H. Grinnell), can bear witness with me to this. You have seen him when, with gentle firmness, when love and resolution were both unmistakablypresent, and both marvellously blended—you have seen him encounter the unequivocal purpose of insubordination and rebellion in the person of the enraged, reckless and desperate seaman who refuses obedience, and who possessed a physical power that could have killed him with a blow. You have seen that light, frail frame, that, alas, now sleeps in death, approach with quick, firm step, and with no weapons but such as nature gives, he but fixes his keen eye on the offender, and the clear sound of his voice rings upon the ears, in no tone of passion or anger. He but talks, and there is some strange magic in his manner and his words; for presently the tears begin to roll down the rugged, sunburnt cheeks of the hardy seaman; he has humanized him by some mysterious power made up of love and reason mixed. Rebellion dies, and in its place is born a reverence and affection so deep, so devoted, that to the end of our dead friend's life, none love him better than the vanquished rebel.

These were some of his qualities as a man. Of what he has done in the cause of science, and of our chosen department in particular, there is but little need that I should speak. In a short career of but 35 years, he has left upon the times in which he lived his impress so indelibly stamped, that science numbers him with her martyrs, and will not let his memory die. He has told, too, so beautifully and modestly the story of his last suffering pilgrimage in her cause, and that of benevolence, that his remembrance will be kept green in the land of our fathers as well as in our own; for the English language is our common property, and that which is registered in the literature of that tongue, I love to think, is destined to a long existence and wide diffusion on our globe. Had he done less in *science*, England would not forget him, for his benevolent heart led him to seek the relief of Englishmen, undismayed by the horrors and perils of an Arctic voyage; but what he accomplished in science secured to him the generous tribute of acknowledgment and admiration from England's scientific men. He received there the medal of our sister institution, the Royal Geographical Society, her highest tribute to eminent service in geographical discovery.

And as for ourselves, there is little danger that we shall forget him. He was a noble specimen of man, and he was our countryman. Letters may yield a graceful tribute to his worth in language fitted to her mournful theme; science may rear his monument, and tell the world she weeps over one of her most gifted sons, and this all right; but there is a more touching tribute to his memory than either of these:

> "*Affection* shall tenderly cherish his worth,
> And *memory* deeply engrave it,
> Not upon tablets of brass or stone.
> But *in those fond hearts where best 'twas known.*"

Mr. F. A. Concklin then offered the following preamble and resolutions;

This Society having been informed of the death of Elisha Kent Kane, and deeming it due alike to the memory of our deceased associate and to the Society, that his daring in the cause of humanity, and his achievements in science should be fitly commemorated, therefore, be it

Resolved, That in the death of Dr. Kane this Society mourns the loss of a member whose name is illustrious before the nation and throughout the civilized world; and whose fame, we would fain believe, will be as enduring as it is deserved, of one whose deeds enoble our race and shed the highest honor upon the land which gave him birth.

Resolved, That while we lament the to us untimely loss of our illustrious associate, we find consolation in the thought that his life was sufficiently prolonged to enable him to fill up the measure of his renown; and that his very youth but renders his great example the more eloquent to us and the more inspiring to posterity.

Resolved, That the Council be requested to make arrangements for the delivery, at some future day, of a suitable eulogy upon the life and character of Dr. Kane.

Resolved, That a copy of these resolutions, with the preamble, signed by the President and Recording Secretary, be transmitted to the family of the deceas [illegible], and that they be published.

These resolutions were ably seconded by Dr. King, Columbia College, and after other appropriate remarks by Dr. J. W. Francis and the Revd. J. P. Thompson, they were unanimously adopted.

FRANCOIS ARAGO.—I saw Arago, for the first time, in the winter of 1852 and '53, within the walls of the *Institut de France.* Shortly after my entrance, a paper was read by a member, on the Physical Geography of a portion of the interior of Africa; which, to me appeared to be a production possessing an unusual degree of merit. When concluded, an old man, seated at an elevated bench, arose, put a few questions to the writer and sat down. The answers given, were evidently not satisfactory, for the old man again rose, and so dissected the paper, bit by bit, dwelling, with emphasis, on what he considered to be objectionable, and hurrying rapidly over other portions, that I doubt not, the writer hardly recognized his own production when again pretented to him, for he sat down with sullenness, without attempting to reply. Another (on Organic Chemistry I believe) followed, when the same old man had some remarks to offer. A third paper was then read on Physical Astronomy, and a discussion ensued, attended with more heat and anger than would have graced, even a less dignified assemblage. The old man had laid down postulates which he now saw were interfered with, and the essayist supported *his* views with marked ability and no less warmth; but gradually the tide of opinion turned in favor of the critic. At a loss to know the name of one who thus "bestrode that little world like a Colossus," I turned to a gentleman seated near me, and asked him if he could tell me the name of the old man with gray hair, shaggy eye-brows and husky voice, who seemed to play with the other Academicians as anglers do with trout. Monsieur, replied he, with more astonishment in his looks than was quite consistent with Parisian *politesse, c'est* NAPOLEON DE L'ACADEMIE, the well known *sobriquet* revealed to me, Arago. Had I left Paris without again visiting the "*Institut*," my recollections of the Astronomer would have been different from what they are,—I would have thought of him as a surly, ill natured old man, who had spent so much of his time among other and colder planets, that all his humanity had been frozen out of him, leaving him the most pitiful of all beings—Un esprit sans cœur.

But I subsequently paid another visit, when Arago was then in his place of perpetual Secretary. The *Academie* had assembled to hear an *eloge* on his friend and co-laborer in Science, the Astronomer Leopold de Buch of Berlin, recently deceased. The old man's countenance presented a pleasing contrast to what it did on a former occasion, it was now calm and even sorrowful,—he arose and alluded, in truly eloquent and feeling terms, to the sad event which had deprived the scientific world of one of its brightest ornaments, and had thinned the ranks of their associates. No one present seemed to feel the force of his words more fully than Arago himself. His voice trembled, and his hand shook so as to agitate violently the paper which it held. I left the halls of the *Academie* that evening, with feelings of admiration and esteem, far higher than could have been produced by the display of talents however exalted.

W. H. H.

Proceedings of the Botanical Society of Montreal.

At a Meeting of the above Society, held on the 22nd day of February last, the following Circular (which has been published for transmission to Botanists and Botanical Societies) was read and approved of, its object being to enlist the sympathy and aid of Scientific men in the obtaining of a sum of money sufficient to raise a suitable monument to the memory of the late Frederick Pursh, the celebrated Botanist.

Montreal, Canada East, *January*, 1857.

" In the course of last Spring, the attention of the Botanical Society of Montreal was directed to the fact that Baron Pursh' the celebrated botanist, who died in this City in 1820, was interred in the Old Burying Ground on Papineau Road, without any Monument. The Society immediately felt its obligation to render tribute to so illustrious a name, and accordingly appointed a Committee to transfer the remains to a new lot in Mount

Royal Cemetery, purchased for that purpose, and to take steps to raise an adequate sum of money for the erection of a Monument to his memory.

The remains of Pursh now rest in the Mount Royal Cemetery, and the Committee take the liberty of soliciting the favor of your assistance in the efforts the Society is now making, to raise a suitable Monument over his grave.

The following are a few particulars which the Society is enabled to furnish, regarding his life and labours:—

Frederick Pursh was a German by bi th and education. He pursued a successful course of study in Dresden, and acquired, at an early age, a taste for Science, and a peculiar fondness for Botanical and Horticultural pursuits. He contemplated with pleasure and admiration, the many beautiful and singular flowers—the fine shrubs and ornamental trees, that adorned the gardens and pleasure-grounds, and which were natural productions of North America. This excited in his mind a strong desire to visit the new Continent—to observe in their natural soil and climate these same plants, the study of which had already afforded him so much gratification, and to make such discoveries as circumstances might throw in his way. Accordingly in 1799, he embarked for the United States, where he at once commenced his researches as a scientific and practical Botanist. He devoted his time to the field, the forest and the glen, and enriched his own extensive collections by valuable additions from the Herbaria of the United States' Botanists, with whom he became acquainted. His labours, however, were not confined simply to the formation of an Herbarium. He rendered his researches of great value by introducing into the garden many beautiful herbs and shrubs, whose cultivation has since been greatly extended. Having thus laboured assiduously for a lengthened period of 12 years—during which time he discovered many new and rare plants, and ascertained the soil, situation and range of country in which each species was found—he proceeded to England with the intention of publishing his researches. The materials he now possessed, together with the information obtained from collections he consulted in England, formed the basis of his "FLORA AMERICÆ SEPTENTRIONALIS," in 2 vol.—a work which immediately gave him a high position among men of science and learning, and secured to his name an authority on North American Botany, that will be always recognised.

The success of this publication, and the interest excited by his discoveries, induced him, under favorable auspices, further to prosecute his researches in the Canadas—a country possessing a wide field for Botanical investigations. He accordingly arrived in the Lower Province with the view of forming a complete Herbarium of Canadian plants, of ascertaining the natural resources of the soil, and improving the system of Horticulture. His labours, however, were not of long duration, and not without many drawbacks. After having Botanized a large portion of Eastern Canada, and made a considerable collection of Plants, (which were subsequently destroyed by fire) he died in Montreal, in July, 1820—so destitute of means, that the expenses of his burial, and other outlays, were defrayed by his friends.

Pursh possessed a happy temperment—a kind and generous disposition, and was a universal favorite among gardeners, whose interests he served by every means in his power.

The following is the inscription which was clearly preserved on the Tin Plate, attached to the Coffin containing his remains:—
"*FREDERICK PURSH, DIED* 11*th JULY*, 1820, *AGED* 46 *YEARS.*"

JAMES BARNSTON, M. D. }
GEORGE SHEPHERD. } *Committee.*

James Barnston, Esq., M.D., and George Shepherd, Esq., have been appointed a Committee to receive Subscriptions for the above object, and communications on the subject may be addressed to either of the above gentlemen: or to J. G. Barnston, Esq., Secy. of the Society, No. 40, Little St. James Street, Montreal.

J. W. DAWSON, PRESIDENT,
Botanical Society of Montreal."

After the ordinary business had been transacted, Principal Dawson, the President of the Society, read an interesting paper "On the Botanical affinities of the Fossils known as *Sternbergiæ*," of which the following is a short *résumé.*

The fossils of the genus *Sternbergiæ* present the appearance of stems of plants, marked by transverse wrinkles, and sometimes showing internal partitions or *septa*, corresponding to the external wrinkles. They are found in the Coal Formation on both sides of the Atlantic, and quite plentifully in the Upper Coal Measures of Nova Scotia. The author noticed the views published by Brogniart, Lindley, Dawes, Williamson and himself on these singular vegetable remains, and stated that Prof. Williamson has satisfactorily proved that some at least of the species are casts of the pith of tr of the pine family,—the *Coniferous* trees of the coal period having differed from our modern pines in possessing large medullary cylinders. He then described some interesting specimens from Nova Scotia, shewing the structure not only of the wood, but of the transverse septa, and remains of the external bark of the tree. He compared these specimens with recent woods shewing a similar modification of the pith, and stated some facts indicating that pith casts of this kind may have been furnished by other plants as well as conifers. He concluded by drawing attention to the circumstance, that in very many cases the only remains of large trees are these casts of the medullary cavities. Professor Dawson is preparing for publication his recent observations on this subject.

At a subsequent monthly meeting of the Society, held March 6th, a very interesting paper was read by the Rev. A. F. Kemp upon the "*Algæ* of the Bermudas," which was illustrated by numerous very beautiful and well-preserved specimens. This paper will appear in the next number of the journal.

(Signed,) J. G. BARNSTON,
Secretary.

MONTHLY METEOROLOGICAL REGISTER, SAINT MARTIN'S, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF JANUARY, 1857.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

	Barometer corrected and reduced to 32° F. (English inches.)			Temperature of the Air. F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Mean Velocity in Miles per hour.			Amo'nt of Rain in inches.	Amo'nt of Snow in inches.	Weather, Clouds, Remarks, &c., &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. .	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	....	....	6 a. m.	2 p. m.	10 p. m.
1	30.142	29.963	30.199	18°9	26°2	21°3	·091	·135	·089	·80	·83	·73	N. E. by E.	E. N. E.	N. E. by E.	2.05	2.21	3.80	....	....	Cum. Str. 10.	Cum. Str. 10.	Cirr. C. Str. 10.
2	177	30.095	003	18°2	24°2	18°5	·088	·091	·088	·72	·63	·72	N. E. by E.	E. N. E.	E. by S.	0.60	1.02	7.12	....	....	Cirr. C. Str. 6.	" " 8.	Cum. Str. 10.
3	29.913	29.527	29.585	18°1	25°0	21°0	·088	·125	·086	·73	·80	·64	S. by E.	N. E. by E.	N. E.	11.95	7.03	14.26	....	4.10	Snow.	Snow.	" " 10.
4	734	863	921	18°6	20°3	11°2	·110	·101	·077	·85	·77	·83	W. N. W.	W. N. W.	N. W.	11.86	9.62	15.30	....	Inapp.	Cum. Str. 2.	Cum. Str. 10.	" " 2.
5	923	923	30.064	— 3°5	2°6	— 7°1	·033	·046	·028	·83	·84	·82	W. N. W.	W. by N.	W. by N.	22.60	11.63	10.37	....	....	Clear.	Clear.	Clear.
6	30.052	913	29.991	— 13.9	— 3.0	— 6.5	·023	·036	·029	·98	·85	·86	W. N. W.	W. N. W.	W. by N.	19.05	13.52	14.01	....	....	Clear.	Clear.	Cirr. 2.
7	29.961	840	942	— 15.1	— 1.7	— 9.7	·019	·038	·029	·83	·81	·86	W. by N.	W.	W. N. W.	17.85	13.47	25.08	....	Inapp.	Cum. Str. 4.	Cirr. Cum. Str. 4.	Cirr. C. Str. 6. Lunar Halo.
8	30.052	30.053	30.108	— 14.0	— 3.5	— 13.0	·016	·032	·021	·63	·70	·74	W. S. W.	W. S. W.	W.	26.71	3.83	9.06	....	....	Clear.	Clear.	Clear.
9	29.800	29.607	29.604	— 13.5	5.0	10.6	·023	·053	·064	·81	·80	·80	S. W.	N. W. by W.	W. S. W.	10.96	2.15	3.70	....	Inapp.	Cum. Str. 10.	Slight Snow.	Cum. Str. 10.
10	538	506	591	10.4	25.0	11.6	·064	·127	·075	·84	·83	·94	W. by S.	S. S. E.	N. E. by E.	1.61	0.11	6.77	....	Inapp.	" " 10,	Cirr. Str. 10.	Snow.
11	712	683	752	2.7	6.8	— 4.8	·047	·059	·036	·84	·92	·84	N. E.	N. W.	W. by N.	24.25	6.00	12.40	....	....	" " 10.	Cum. Str. 6.	Cirr. C. Str. 4.
12	907	844	927	— 4.2	8.5	11.0	·033	·058	·075	·84	·81	·91	W.	W.	W. by S.	6.53	19.07	12.42	....	....	Str. 8.	Clear.	Cum. Str. 10.
13	718	684	663	11.5	21.4	18.5	·075	·115	·101	·94	·94	·91	W. S. W.	S. W.	S. W.	14.30	9.60	2.15	....	Inapp.	Cum. Str. 10.	C. Str. 10.	" " 10.
14	666	794	854	14.0	17.4	7.0	·083	·096	·054	·86	·84	·79	N. W. by N.	N. E.	N. E.	7.81	4.91	3.05	....	....	" " 10.	Cir. C. Str. 6.	" " 10.
15	906	954	30.163	— 2.0	1.5	— 6.4	·046	·044	·034	·84	·85	·89	N.	W. by N.	W. S. W.	5.12	5.41	8.37	....	....	" " 9.	Clear.	Clear Zodiacal Light.
16	30.140	926	29.756	— 8.9	15.9	11.2	·032	·081	·075	·88	·84	·90	W.	S. W. by W.	S. S. W.	9.10	4.83	0.15	....	....	" " 10.	Cum. Str. 10.	Snow.
17	29.533	810	30.171	— 15.5	— 1.2	— 18.5	·081	·038	·016	·86	·83	·80	W. by S.	N. by E.	N. by E.	8.75	18.07	12.92	....	0.70	Snow.	Clear.	Clear Zodiacal Light.
18	30.431	30.400	195	— 31.8	— 5.6	— 17.5	010	·027	·017	·81	·77	·81	N. W.	S. W. by W.	N. E.	3.50	1.15	0.03	....	....	Clear.	Clear.	Cirr. Str. 10.
19	29.984	29.591	29.534	— 15.2	10.3	8.5	·019	·071	·065	·85	·90	·93	N. E. by E.	N. E. by E.	W. S. W.	18.16	15.05	13.63	....	1.60	Cum. Str. 6.	Snow.	Snow.
20	722	736	741	— 5.1	6.5	5.3	·031	·059	·059	·82	·79	·81	W. N. W.	N. W.	N. E.	14.92	3.87	4.80	....	....	Clear.	Cirr. Str. 10.	Cum. Str. 10.
21	556	634	651	3.0	29.7	16.1	·049	·155	·084	·82	·90	·84	N. N. W.	W.	W.	6.90	8.35	4.66	....	0.70	Cum. Str. 10.	" " 10.	Clear Zodiacal Light.
22	677	577	817	— 3.5	— 9.0	— 23.5	·036	·024	·012	·82	·78	·75	W. N. W.	W. N. W.	W. N. W.	13.63	12.43	23.22	....	....	Cirr. 4.	Light Cirr.	" " "
23	829	898	913	— 29.6	— 21.1	— 25.3	·008	·014	·011	·68	·65	·73	W. N. W.	W. N. W.	W. S. W.	26.29	13.03	10.55	....	....	Cum. Str. 10.	" " 2.	" " "
24	976	982	944	— 29.6	— 3.3	— 9.4	·008	·029	·024	·70	·68	·69	W. S. W.	S. E. by S.	N. E. by N.	1.75	4.60	1.83	....	....	" " 4,	Cum. Str. 10.	Cirr. Str. 10.
25	30.054	30.144	30.329	— 21.2	8.3	— 5.4	·013	·063	·051	·77	·90	·82	E. by N.	W. S. W.	S. S. E.	1.40	2.17	0.62	....	....	Clear.	" "	Clear Zodiacal Light.
26	450	214	029	— 17.6	8.0	12.6	·019	·089	·078	·89	·87	·90	S.	S. E. by S.	S. S. E.	7.06	2.30	11.22	....	....	Clear.	" " ...	Cum. Str. 10.
27	29.850	874	163	12.6	27.9	20.1	·078	·147	·103	·91	·94	·89	S. W.	W.	W. S. W.	12.42	0.00	0.52	Inapp.	4.80	Snow.	Slight Rain.	Clear Zodiacal Light.
28	30.430	30.314	244	9.4	27.9	18.0	·063	·147	·094	·90	·89	·85	E. by N.	E. N. E.	E. N. E.	2.82	0.20	3.32	....	....	Clear.	Cum. Str. 2.	" " "
29	052	29.989	051	8.1	25.9	16.1	·065	·132	·084	·89	·87	·84	E. N. E.	S. W. by W.	W. by N.	6.32	1.08	3.12	....	....	Cum. Str. 10.	" " 10.	" " "
30	341	30.305	308	1.0	11.0	— 6.0	·044	·059	·029	·86	·70	·82	N. E. by E.	N. E. by E.	E. N. E.	5.53	3.77	3.80	....	....	Clear.	Clear.	" " "
31	131	29.624	29.597	— 7.1	11.4	9.0	·028	·069	·067	·85	·80	·89	N. E. by E.	N. E. by E.	N. E. by E.	20.21	20.10	18.10	....	7.20	Cum. Str. 10.	Snow.	Snow.

REMARKS FOR JANUARY, 1857.

Barometer.
- Highest, the 18th day, 30.431 inches.
- Lowest, the 10th day, 29.506 inches.
- Monthly Mean, 29.915 inches.
- Monthly Range, 0.925 inches.

Thermometer.
- Highest, the 28th day, 27°9.
- Lowest, the 18th day, 31°8.
- Monthly Mean, 4°05.
- Monthly Range, 59°7.

Greatest intensity of the Sun's rays, 78°4.
Lowest point of Terrestrial Radiation, —32°4.
Mean of Humidity, ·849.
Rain fell on one day inappreciable in amount.
Snow fell on 11 days amounting to 19.10 inches. It was snowing 64 hours 50 minutes.
The Aurora Borealis was not visible at observation hour this month.
The Electrical state of the atmosphere has indicated a constant high tension. Ozone was in small quantity.