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☞ Excursion to Butternut Grove, 31st May. ☜

June, 1890.

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NOTICE.—The Treasurer begs to call the attention of members to he advertisements.

ELEMENTARY LECTURE—PALÆONTOLOGY.

By Walter R. Billings.

(Read January 20th, 1890.)

A fossil (from *fossus* the Latin for "dug up") Lyell defines as "any body or *the traces of the existence of any body*, whether animal or vegetable, which has been buried in the earth by natural causes."

What these natural causes were is a question which has engaged the attention of thoughtful men from early historical times, and so far back as 5 centuries before Christ, Zenophanes of Colophon (500 B.C.), Herodotus, and Empedocles of Agrigentum (450 B.C.), followed somewhat later by Aristotle (384-322 B.C.), appreciated to some extent the true character of, and gave rational explanations concerning, the presence of these remains. They concluded that when the bottom of the sea had been in a soft condition that the remains were entombed, and that the sea, deserting some lands and invading others, had brought the earlier sea bottom within reach of easy inspection. Aristotle's opinions concerning the spontaneous generation of animals, which he believed could originate from moist earth or the slime of rivers was applied by his followers to fossils as well, for it seemed to them a much simpler way of accounting for the remains of animals in the rocks, than the marvellous changes of sea and land otherwise required to explain their presence, and this view later on obtained credence more readily, owing to its accordance with the Biblical theory of the creation of man out of the dust of the earth. The Romans merely repeated the ideas of the Greeks on this subject, some holding with the earlier writers, others with Theophrastus, the pupil of Aristotle, that they were produced by a certain plastic virtue latent in the earth until, near the close of the second century, we find Tertullian instancing the remains of sea animals on the mountains far from the sea as proof of the general deluge recorded by Moses.

During the thirteen or fourteen centuries onward from the close of the second century all departments of knowledge were enveloped in darkness, and no attention was paid to fossils excepting that occasional repetitions of the ideas of the ancients were made without appreciation or any special show of interest.

In the beginning of the sixteenth century the study of fossil remains may be said to have really begun. Leonardi da Vinci, the renowned artist and scientist, and Fracastro, of Verona, both maintained that the fossils were entombed in the sea mud instead of being sports of nature generated by fermentation through the influence of the stars or by spontaneous generation, theories which were thus for the first time seriously questioned, and which, in spite of all opposition, retained a dominant influence for two centuries later. Some claimed that the shells had been left by Noah's deluge, but, in opposition, Fracastro offered a mass of evidence which, although to us apparently conclusive, was not in accordance with the predominant theory of the time, and was in consequence fiercely assailed. He considered that inundation too recent and too transient; it consisted mainly of fresh water, and any organic remains resulting therefrom would necessarily be found in superficial deposits instead of in the interior of mountains.

And Fabia Colonna appears to have been the first to point out that some of the fossil shells found in Italy were marine and some terrestrial. However, these correct generalizations were the exception, not the rule, for during the sixteenth century fossils were usually considered as "sports of nature." The eminent botanists, Tournefort and Camerarius, believed in the dissemination of the seeds of minerals and fossils throughout the sea and the earth, and in the subsequent development into the characteristic forms by augmentation of atoms or particles as in crystals, stalactites, and stalagmites. Lhwyd, in his Lithophylacii Brittanici Ichnographia (Oxford, 1599), taught that the spawn of marine animals, after being raised with the vapors from the sea, conveyed inland by and precipitated from clouds, permeated into the interior of the earth where they produced the fossils. In addition to these there is the theory popular for many centuries, and now not entirely thrown aside although never a favourite with scientists, viz., that fossil animals and plants were formed by the Creator just as they are found in the rocks in pursuance of a design beyond our comprehension.

In the seventeenth century by means of collection, description and discussion of fossils the study was considerably advanced, and, although the "sports of nature" theory was still "on deck" up to the end of the century, clear ideas began to prevail and the study to advance rapidly. Steno, a Dane, to whom are owing many important views in regard to the origin of different kinds of strata, first recorded the fact that the oldest rocks are unfossiliferous. In spite of the advance in knowledge the general belief was that fossil remains were deposited by the Mosaic deluge, and this belief being opposed by courageous men and the conflict as to the nature of the fossils being fairly settled, the ground of discussion was transferred to Noah's flood, and until the close of the eighteenth century the theologians *had their own way—they pointed* out that Noah's deluge was universal, that all life, except what Noah saved, was destroyed, and that it followed that fossils were relics left by the flood. Several dissented, Voltaire and Buffon among the number, but the latter being politely invited by the College to recant and fearing the delicate attentions of his opponents, recanted accordingly.

The beginning of our century marked the commencement of the study of fossils as a science, and the advance since then—and for the first time in history—has been rapid and continuous. I regret we have not time to refer to its triumphs in detail.

This brings us back to Lyell's definition of a fossil as "any body or *the traces of the existence of any body*, whether animal or vegetable, which has been buried in the earth by natural causes." At first all objects dug up, whether organic or mineral, were called fossil, but when organic remains became generally understood the distinction was made. Palæontology is a modern term, which first came into use in 1830. Petrifactions form the most numerous class of fossils, being actual portions of animal or vegetable organisms, such as the shells of molluscs, the skeletons of corals, the crusts of crustaceans, the bones, teeth and scales of fish, the bones and teeth of reptiles and mammals, the bark, leaves or seeds of plants, "and these may be preserved very much in their original condition, or may be altered subsequent to their burial." But, in addition to these two principal kinds, there are the *traces* referred to in the definition quoted, among which traces are the moulds or casts of shells, and the footprints left by animals upon sand or mud. The "*alterations subsequent to their burial*" are usually replacements which either show intimate structure as well as in the original, or fail to do so, the failure or success being proportionate to the rapidity or slowness of decay. The soft or fleshy parts in all cases disappear.

There is a popular fallacy that the human body sometimes turns to stone after burial, and this error is owing to the fact that the fat and muscular tissues change after death to a waxlike substance called adipocere, which being tolerably firm, often preserves the form and features of the body in a more or less perfect condition for a few years after death, but this only retards, not prevents, the final and complete decomposition of the soft parts.

Moulds or casts may be either of the interior or of the exterior of the shell of the mollusc, the cup of a coral or crinoid, or the skeleton of any organism possessing such.

Taking as an example the shell of a mollusc which, after being filled with mud and buried in the ocean bed, was subjected to influence which dissolved out the shell—an interior and exterior cast, with an empty space between, would be the result. However, it is very rarely that a cavity is left, as in any porous matrix mineral particles would be deposited until a filling is formed. A familiar instance of a cavity or mould is that of a citizen of Pompeii found during the excavation of the streets of that city. The man had probably been suffocated in the showers of ashes from Vesuvius. A plaster cast was made of the cavity, and the form of the Pompeiian restored to human gaze after a lapse of 1,800 years.

Through careful oberservation of readily accessible rock masses in various countries as to their super-position, mineral characters, and included fossils, geologists have been enabled to break up the entire stratified series into a number of different divisions or formations, each characterized by general uniformity of mineral composition, by peculiarity of position with regard to the others and by a peculiar assemblage of fossils; and further, to break up each of the primary divisions into a series of smaller ones similarly characterized and distinguished. In no known locality can all these rock groups be seen surmounting one another in uninterrupted succession. There are localities where representatives of the Cambrian, Silurian, Old Red and Carboniferous are to be found following one another in regular succession. But, on the other hand, there are localities where the Carboniferous rests on the Silurian and the Old Red is absent, and this may have been owing either to the elevation of the Silurian beds above the sea immediately after their deposition and their remaining so until the Old Red period had passed ; or to the Old Red having been deposited on the Silurian, the whole elevated above the sea and subjected to denudation sufficient to remove the Old Red ; in either case when the land was again submerged the formation then in process of deposit would be laid down directly on the Silurian. One thing should be carefully noted, viz., that the rocks never occur in an inverted order, *i.e*, no one of the Cambrian beds is to be found resting on any of the Silurian, nor any of either of these on a representative of the Old Red.

As each superimposed stratum is older than that underlying it, so the fossils contained in an overlying bed are less ancient than those in the bed beneath, and thus the succession of organic remains are the evidences of the growth and development of living forms.

As aforesaid, each formation and each of its subdivisions is characterized by a peculiar assemblage of fossils, and, owing to this, when we find the peculiar assemblage repeated, we know that we have a repetition of the formation in which it was originally discovered ; and thus a knowledge of the fossils contained in any particular bed or group of beds, enables us to determine the relative age and position of the beds compared with other beds in the same region or other regions. How far this test may be applied with certainty to minor rock groups or sub-divisions, we have not time here to consider, but its value to determine formations has never been questioned. Further, although the combination or assemblage of fossils is peculiar to that formation or sub-division, each fossil of it is not, for it may go on upward through several formations before it disappears : one thing, remember, that when it once disappears it never reappears.

Let us suppose that in any one country we discover the order and relative succession of the rocks, and that we have examined and noted the mineral character of the beds as well as the fossils they contain. Now to identify any outlying beds throughout the neighbourhood, the mineral character alone would be a sufficient means of identification for most of the beds, while superposition would do for the remainder. But to determine the stratigraphical position of rocks in a far off region from mineral evidence obtained in this country would be vain—here a comparison of the fossils would be the only reliable test. For instance, the mineral character of our Trenton group of rocks at Ottawa is sufficiently constant to make it a good test almost anywhere within a radius of 200 miles, and where the least doubt arises, superposition would be another ready means; but the Trenton group of Missouri, for instance, is of a beautiful creamy-buff dolomite, very unlike our ugly sad-coloured limestone, and here we have to fall back on our fossils for light as to the age of the rock.

As a proof of the great value of fossils as evidence, I quote the evidence of Dr. Hall, New York State Geologist, given in 1854, before a select committee of the House of Commons of Canada, as follows:—"One of the great practical advantages resulting in New York I conceive to have been the proof that no valuable or workable coal exists within the State. This fact, although of a negative character, has for ever set at rest all explorations for coal, while it has been ascertained that during fifty years previous to the commencement of the survey not less than one million of dollars had been expended in abortive search for fossil-fuel, where a well-informed geologist would have at once pronounced the undertaking useless and certain to prove a failure." Through a study of the fossils it was established that in New York "both salt and gypsum are products of the * * * Silurian Period, while previously it had been believed they belonged to the New Red * * and consequently that coal would be found in these rocks as in Europe * * * The evidence from fossil character soon proved the futility of such an expectation. Thus, in this instance, *mineral evidence* set the public wrong and *fossil evidence* corrected the error. Again the occurrence of the rock known as the Oneida Conglomerate was, from its mechanical structure, believed to be identical with the Millstone Grit of England, which underlies the coal, and examinations for coal were * * to some extent made. From the fossils in the rocks above and below it has been proved to belong to the older Silurian beds. Thus, in this case also, mineral evidence misled the public, and fossil evidence corrected the error." * * * *

An instance in which a knowledge of the fossil remains of a formation was of still greater importance than a knowledge of its mineral character is the lead-bearing formation of the States of Wisconsin, Illinois and Iowa. For many years a serious misapprehension existed in regard to the true position of the lead-bearing rock, and only so lately as 1850 was it determined by a proper examination of its fossils that instead of being in the Niagara group, as formerly supposed * * * it belonged to the Lower Silurians." Since this discovery, miners search for lead in those rocks only where the characteristic fossils occur.

"Miners of coal and other products recognize the surrounding *strata, and determine their proximity to the productive by the presence* of certain fossils well known to them at sight."

The formation of the Geological Survey of Canada put a stop to much useless expenditure in the same way, and proofs of the non-existence of workable beds of coal throughout the old provinces of Upper and Lower Canada, due to the labours of the Survey, put a stop to many futile researches after that mineral and the consequent waste of money. At Gaspé and at Owen Sound in those early days parties were prevented from sinking shafts in bituminous shale by Mr. Logan, whose knowledge of the fossils told him there could be no coal there; although practical colliers had declared in favour of its occurrence. Such instances, however, could be multiplied but our time does not permit.

Besides enabling us to determine the relative age and position of each deposit in which we find them, they enable us to arrive at the mode of deposit and the condition of the district or region at the time of its formation. If it contains the remains of animals such as now inhabit rivers, we know that it must have formed part of a river bed or been deposited by the overflow of a stream; if it contains remains of molluscs, fish or crustaceans such as inhabit lakes, we know it was *deposited beneath a lake; and if it contains marine animals or seaweeds,* we know it was a sea bottom.

We may go more minutely into the matter than this, for if the fossils resemble those now inhabiting shallow seas, or if they are rolled and broken and accompanied by remains of land organisms, there can be little doubt they are a shore deposit or were laid down in a shallow sea in the vicinity of the coast; but if the remains are those of deep sea organisms mixed sparingly with extraneous forms, a deep sea origin may be decided upon. In some cases we find an ancient coral reef, in others a bed of social shells like the oyster, each case telling a tale not to be mistaken. Occasionally there are beds of dwarfed marine species telling of a brackish sea, and others related to those we find in estuaries at the present time. You will observe that the remains mentioned are aquatic organisms only, but all these deposits contain, in more or less degree, ærial and terrestrial animals and plants. Many of these frequented the seas and lakes, and their remains readily found place in the deposits pertaining thereto, while others have been drowned in lakes or rivers and have been carried out to sea by streams. Some remains of land animals occur in "sub-aerial" deposits, such as blown sand accumulations on the land.

And, further, we may form a fairly reliable opinion of the climate which obtained during the deposit of these, thus, *e.g.*, the Eocene deposits of Greenland, a country now buried under ice, contain the trees, shrubs and plants of the temperate regions—the Eocene of Western Europe contains remains of cowries, volutes and palms closely related to those found in combination with a mean temperature 30° warmer than at present.

As has been stated the various formations are characterized (1) by the association of certain fossils, (2) by the predominance of certain families or genera, or (3) by an assemblage of fossil remains representing the life of the period in which the formation was deposited. But the record of the life of the whole series from bottom to top is not an uninterrupted one, and this "imperfection of the Palæontological Record," as it is termed, is to be regretted, because our knowledge of prehistoric life is almost entirely limited to the palæontological evidence at our disposal. At the outset is what is known as "unrepresented time" or better, perhaps, as "the imperfection of the Geological Record," owing to the fact that many missing or undiscovered rock groups are buried beneath others or beneath the waters of the sea out of sight; that a large portion of the earth, including two great continents, is as yet unexplored; and also that denudation has played the same havoc with the deposits of bygone ages that it has played with those of to day.

No better example of "unrepresented time" can be had than that oft-quoted break in the strata of Great Britain between the secondary and tertiary epochs. In the upper cretaceous beds there are 500 species of described fossils, and of these only one brachiopod and a few foraminifera have yet been detected in the overlying eocene beds. The explanation of this is that the break in the life of these two periods represents an incalculable lapse of time. The cretaceous area was elevated and its fauna emigrated; when it was again depressed the lapse of time was so great that the life which immigrated then from neighbouring seas was composed of new forms. Indeed, the eroded character of the cretaceous rock upon which the tertiary was laid down would in itself prove the great lapse of time.

But "the imperfection of the Geological Record" accounts for only some of the causes of "imperfection of the Palæontological Record," for, if the series of sedimentary rocks had been preserved to us in its entirety and open to our inspection, there would yet be the deficiencies owing to (1) the facility with which different animals may be preserved as fossils, (2) the liability to be deposited where they may be preserved, and, finally, (3) the liability to be obliterated or destroyed after being deposited.

To the varied facility with which different animals may be preserved as fossils, enormous deficiencies in the palæontological record are due. In the polyzoa, cœlenterata, anneloida and annulosa a large proportion, comprising entire classes possess no hard parts, and consequently are unrepresented as fossils, and even in the mollusca and vertebrata some families are lost to us through the same cause. Birds, owing to their lightness, float after death on the water until devoured, and mammals, the majority of which live on land, have fewer opportunities of being buried in aqueous accumulations, consequently are not so often represented as those forms which are essentially marine.

In addition to these is the disappearance of fossils from rocks originally fossiliferous. Metamorphism or the subjection of the rock to a sufficient heat to cause rearrangement of the particles, and consequently an obliteration of the fossils, is the chief cause to which we have to look for the irreparable loss of an enormous mass of palæontological evidence. The life of the great Laurentian series of rocks comprising 30,000 feet (say 6 miles) in thickness of sediments, has been entirely blotted out by this cause. Another cause of obliteration is the percolation of water holding carbonic acid (rain water, for instance) through sand or loose rock.

Lack of time forbids my consideration of such interesting matters as "zones," "the doctrines of colonies," and other interesting divisions of this portion of the subject.

An important part in the formation of rock masses has been played by fossils, for although the sand and clay rocks have not been shown to be of organic origin, yet the greater part of the lime rocks, some of the flint rocks and all the coal and blacklead, with presumably the phosphates, were built up of the remains and through the agency of the animals and plants of the periods of their deposition.

The greater part of the limestones and chalks are compact masses of organic remains of corals, molluscs, echinoderms, foraminifera, calcareous algæ, and other organic forms which possessed lime skeletons. Many flinty deposits are due to polycystina, diatoms and sponges, and the coal, blacklead and other forms of carbon have undoubtedly been produced through the agency of plants.

It is not generally known that geology originated from a study of fossils, and that without palæontology there would have been no science of geology—that is to say, palæontology was the foundation, not a branch, of geology.

Zoology and botany also owe much to the study of fossils. The classification of both animals and plants has been rendered much more nearly complete, through the insertion of many intermediate orders, the blastids, the cystids, the cyclocystids, the peculiar palæozoic starfishes, the receptaculites, the trilobites, the eurypterids, the many orders of fishes from the old Red, the labyrinthodonts, the wonderful reptiles of the secondary, the odontoterms or toothed birds, including the archæopterix (a bird with a tale of a reptile), the strange Eocene mammals and ungulates, the extinct marsupials of Australia and edentata of South America, and the Pliocene hippopotami of Asia and Africa are some of the examples.

Vertebrate palæontology has furnished data for some fairly well proven genealogies of various existing animals, especially of the large mammals, which have been traced back through allied forms, in a closely connected series to early tertiary times. In several cases, notably in that of the horse, the series are so complete that there can be little doubt that the line of descent has been demonstrated.

Comparative anatomy and embryology owe much to the study of fossils, especially a greatly enlarged knowledge of the vertebrate skull, the limb arches and the limbs, together with the law of brain growth, found to exist among extinct mammals and other vertebrates, which law Marsh, its discoverer, states as follows:—"All tertiary mammals have small brains. There was also a gradual increase in the size of the brain during this period. The increase was confined mainly to the cerebral hemispheres, or higher portions of the brain. In some groups the convolutions of the brain have gradually become more complicated. In some the cerebellum and olfactory lobes have even diminished in size." Since this general statement further research has shown "that the same general law of brain growth holds good for the birds and reptiles from the Secondary epoch to the present time," and the facts so far gathered indicate that as a general law this will hold good for all extinct vertebrates.

To Archæology also, Palæontology has rendered great service in extending our knowledge of the antiquity of the human race. Evidences which after having long accumulated to be rejected merely because not in accord with accepted theories, have been during this century re-examined and added to, until now they are strong enough to make the conclusion inevitable that the occurrence of the remains of man in the Pliocene now fairly establishes the fact of the existence of man in that period.

———:o:———

REPORT OF THE CONCHOLOGICAL BRANCH.

(Read March 13, 1890.)

The leaders of the Conchological Branch have to report that they have personally been able to do little work in the field during the past season, and they are not aware that any other members of the club resident in Ottawa have taken up the study. This is greatly to be regretted for, as will be seen from the present report, much remains to be done before the list of Ottawa mollusca can be considered complete.

A very prolific locality (the wood between St. Louis dam and the Experimental Farm) was visited by the writers on one or two occasions, and in moss collected there many interesting though minute land shells were found—*Pupa contracta, Vertigo pentodon, V. curvidens, V. ovata, V. Gouldii* (very common), *V. simplex, V. Bollesiana, Zonites milium, Z. exiguus,* etc., etc.

In a little wood near the Canada Atlantic Railroad at Archville *Zonites minusculus* and *Binneyanus* were found, together with *Punctum pygmæum* in some numbers, and *Pupa contracta, Vertigo ovata, V. Bollesiana* and *V. pentodon.*

At the outlet to Leamy's Lake, a capital locality, were found, *Sphærium rhomboideum, S. partumeium* and other freshwater shells and a small *Pisidium* there taken is thought by Mr. Latchford to be *P. rotundatum,* new to our lists.

But though little field work has been done, the leaders have devoted considerable time to the study of the species in their collections, and they have reached the conclusion that some alterations are necessary in the Ottawa lists. This is specially the case in puzzling groups such as the Amnicolæ and Pupidæ, and papers on the local species of these groups are in preparation.

Up to the present time there have been recorded in the transactions of the club, 126 species of land and freshwater mollusca. Of these the writers are of opinion that 5 must be dropped :—

Amnicola Sayana, Anth. -Tr. I. iii, 57. These were *A. granum,*

A. decisa, Hald. —Tr. I. iii, 57. These were *A porata.*

Limnæa lanceata, Gould.—Tr. I. iii, 58. These were *L. stagnalis,* young.

Physa brevispira, Lea.—Tr. I. i. 39, 62. These were *P. Billingsii.*

Planorbis lentus, Say.—Tr. I. i. 39. These were *P. trivolvis.*

In place of these, 6 other species can now be added :—

Sphærium stamineum, Conrad. Rideau River at rifle range.

Pisidium rotundatum, Prime. Outlet to Leamy's Lake.

Amnicola Cincinnatiensis, Anth. Rideau Canal.

Amnicola pallida, Hald. Local specimens of this species are in the Geological and Natural History Survey Museum.

Vertigo curvidens, Gould. Woods near St. Louis dam.

Helix dentifera, Binney. The Ox-bow farm, Casselman.

The number of species on the list is now, therefore, 127, namely :— Freshwater bivalves, 41; freshwater univalves, 39; land shells, 47.

There are, however, some sp.cies about which the writers are very doubtful, and which may eventually have to be dropped.

Appended to this report is the Ottawa list of land and freshwater mollusca as it at present stands.

References are added to the pages in the Transactions on which the species are recorded or referred to, and a ? is prefixed to all names that are still in any way doubtful.

GEO. W. TAYLOR,
F. R. LATCHFORD.

NOTE.—The papers with reference to Ottawa Land and Freshwater Shells that have been published in the Transactions of the Club up to date are as follows:—

Heron, G. C.—On the Land and Freshwater Shells of the Ottawa. Trans. vol. I, pt. i, p. 36 and 62.

Latchford, F. R.—Notes on the Ottawa Unionidæ. Trans. vol. I, pt. iii, p. 48.

Latchford, F. R.—Observations on the Terrestrial Mollusca of Ottawa and vicinity. Trans. vol. II, p. 211.

Small, H. B., and Symes, P. B.—Report of Conchological Branch for 1881. Trans. vol. I, pt. iii, p. 57.

Poirier, P.—Report of Conchological Branch for 1882. Trans. vol. I, pt. iv., p. 74.

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List of the Land and Freshwater Mollusca of Ottawa as recorded in the Transactions of the OttawaField-Naturalists' Club, up to April 1st, 1890.

A.—FRESHWATER BIVALVES.

1.—Sphærium sulcatum, Lam. Trans. Ot. F. Nat. Club vol. I, pt. i, p. 40; II, 265-6.
2.— " striatinum, Lam. Tr. I, i, 40.
3.— " stamineum, Conr. Ot. Nat., vol. IV, p. 53.
4.— " rhomboideum, Say. Tr. I, i, 40.
5.— " occidentale, Prime. Tr. I, i, 40; Ot. Nat. I, 107.
6.— " partumeium, Say. Tr. I, i, 40.
7.— " secure, Prime. Tr. I, i, 40; II, 132, 264.
8.— " rosaceum, Prime. Tr. II, 351.
9.— " truncatum, Linsley. Tr. I, iii, 59.
10.—? Pisidium Adamsi, Prime. Tr. I, i, 40.
11.—? " compressum, Prime. Tr. I, i, 40.
12.— " abditum, Hald. Tr. I, i, 40; II, 264.
13.— " ventricosum, Prime. Tr. I, i, 40; II, 264.
14.—? " rotundatum, Prime. Ot. Nat. IV. 53.
15.—Unio complanatus, Sol. Tr. I, i, 40; iii, 49; II, 265, 266; Ot. Nat. I, 114; III, 65, 66.
16.— " gibbosus, Barnes. Tr. I, i, 40 (as dilatatus); iii, 50; Ot. Nat. I, 114; III, 66.
17.— " ellipsis, Lea. Tr. I, i, 40 (as U. olivarious); I, iii, 50; Ot. Nat. I. 114; III, 66.
18.— " rectus, Lam. Tr. I, i, 40; iii, 50; Ot. Nat. I, 114; III, 66.
19.—Unio radiatus, Lam. Tr. I, i, 40; iii, 50; II, 264.
20.— " luteolus, Lam. Tr. I, iii, 51; II, 265.
21.— " Canadensis, Lea. Tr. I, iii, 52.
22.— " borealis, A. F. Gray. Tr. I, iii, 52, pl. II, fig. 1, 2, 3; Ot. Nat. I, 114; III, 66.
23.— " cariosus, Lea. Tr. I, iii, 51.
24.— " occidens, Lea. Tr. I, iii, 51; Ot. Nat. I, 114; III, 65, 66.
25.— " subovatus, Lea. Tr. I, i, 40 (as cardium); I, iii, 51.
26.— " alatus, Say. Tr. I, i, 40; iii, 52; Ot. Nat. I, 114; III, 66.
27.— " gracilis, Barnes. Tr. I, iii, 52; Ot. Nat. I, 114; III. 66.
28.— " pressus. Lea. Tr. I, iii, 52; iv, 74.

29.—Margaritana marginata, Say. Tr. I, i, 40; iii, 54.
30.— " undulata, Say. Tr. I, i, 40; iii, 54; Ot. Nat. I, 114; III, 66.
31.— " rugosa, Barnes. Tr. I, i, 40 (as costata); iii, 54.
32.—Anodonta edentula, Say. Tr. I, iii, 55.
33.— " undulata, Say. Tr. I, i, 40; iii, 55; Ot. Nat. I, 114; III, 66.
34.— " subcylindracea, Lea. Tr. I, iii, 55.
35.— " Benedictii, Lea. Tr. I, iii, 55; II, 266.
36.— " Lewisii, Lea. Tr. I, iii, 56.
37.— " implicata, Say. Tr. I, iii, 56.
38.— " Footiana, Lea. Tr. I, iii, 56.
39.— " lacustris, Lea. Tr. I, iii, 56; II, 265.
40.— " fragilis, Lam. Tr. I, iii, 56; iv, 74; II, 265.
41.— " fluviatilis, Dillwyn. Tr. I, i, 40 (as cataracta); iii, 56; II, 263, Ot. Nat. III, 66.

B. —Freshwater Univalves.

42.—Campeloma decisum, Say. Tr. I, i, 39; II, 132, 263, 265, 266.
43.—Valvata tricarinata, Say. Tr. I, i, 39; II, 263.
44.— " sincera, Say. Tr. I, i, 39 (as humilis); II, 264.
45.—Amnicola porata, Say. Tr. I, i, 39; iii, 57; II, 265.
46.— " pallida, Hald. Ot. Nat. IV. p. 53.
47.— " limosa, Say. Tr. I, iii, 57.
48.— " Cincinnatiensis, Anth. Ot. Nat. IV. p. 53.
49.— " gra um, Say. Tr. I, i, 39; iii, 57 (as Sayana, Anth.).
50.—? Pomatiopsis lapidaria, Hald. Tr. I, i, 39.
51.—Goniobasis livescens, Menke. Tr. I, i, 39; iv, 74.
52.—Limnæa stagnalis, Linn. Tr. I, i, 39; II, 131, 263.
53.—? " decollata, Mighels. Tr. I, i, 39.
54.— " columella, Say Tr. I, i, 39; II, 132.
55.— " megasoma, Say Tr. I, iii, 58; iv, 74.
56.— " palustris, Müll. Tr. I, i, 39 (as elodes and umbrosa); II, 264.
57.— " catascopium, Say. Tr. I, i, 39; II, 264, 266.
58.— " emarginata, Say. Tr. I, iii, 58; II, 264.
59.— " caperata, Say. Tr. I, i, 39; II, 264.

59*a*.—Limnœ—var. umbilicata, Adams. Tr. I, iii, 58.

60.— " desidiosa, Say. Tr. I, i, 39; II, 263, 265.

61.— " humilis, Say. Tr. I, i, 39.

62.— " gracilis, Jay. Tr. I, i, 39; 62, pl. II, f. 4.

63.—? " lepida, Gould. Tr. I, iii, 58.

64.—Physa Lordii, Baird. Tr. I, i, 39 and 62, pl. II, f. 3; iv. 74; Ot. Nat. III, 67.

65.— " gyrina, Say. Tr. I, iii, 58; II, 264.

66.— " ancillaria, Say. Tr. I, i, 39; II, 263. 264.

67.— " Billingsii, Heron. Tr. I, i, 39 (as brevispira, Lea); I, i, 62, pl. II, f. 5.

68.— " heterostropha, Say. Tr. I, i, 39; II, 264, 265, 266.

69.— " hypnorum, Linn. Tr. I, i, 39.

70.—Planorbis campanulatus, Say. Tr. I, i, 39; II, 263.

71.— " trivolvis, Say. Tr. I. i, 39; II, 263, 4, 5, 6, Ot. Nat. III, 67.

71*a*.— " —var. macrostomus, Whiteaves. Tr. I, i, 39; Ot. Nat. III, 67.

72.— " bicarinatus, Say. Tr. I, i, 39; II, 132, 266; Ot. Nat. III, 67.

73.— " exacutus, Say. Tr. I, i, 39; II, 264.

74.— " deflectus, Say. Tr. I, i, 39; II, 264, 265.

75.— " albus, Müll. Tr. I, i, 39 (as hirsutus); II, 266.

76.— " parvus, Say. Tr. I, i, 39.

77.—? " Billingsii, Lea. Tr. I, i, 39.

78.—Planorbis armigerus, Say. Tr. I, i, 39.

79.—Ancylus parallelus, Hald. Tr. I, iii, 58.

80.— " rivularis, Say. Tr. I, i, 39.

C.—Land Shells.

81.—Selenites concava, Say. Tr. I, i, 40; II, 130, 212, 263.

82.—Limax agrestis, Müll. Tr. I, iv, 74; II, 131, 222.

83.— " campestris, Binney. Tr. I, i, 39; II, 131, 223.

84.—Vitrina limpida, Gould. Tr. I, i, 39; II, 222.

85.—Zonites (Mesomphix) inornatus, Say. Tr. I, i, 40; II, 212, 263, 264.

86.— " (Hyalina) nitidus, Müll. Tr. I, i, 40, 62, pl. II. f. 6; II, 131, 213.

87.—Zonites (Hyalina) arboreus, Say. Tr. I, i, 40; II, 213, 263, 264.

88.— " " radiatulus, Alder. Tr. I, i, 40 (as electrina); II, 213, 263, 264 (as viridula).

89.— " (Hyalina) indentatus, Say. Tr. I, i, 40; II, 214, 264.

90.— " " minusculus, Binney. Tr. I, iii, 59; II, 214.

91.— " " milium, Morse. Tr. I, i, 40 note, 62, pl. II, f. 8; II, 130, 214.

92.— " (Hyalina) Binneyanus, Morse. Tr. II, 214; Ot. Nat. I, 107.

93.— " (Hyalina) ferreus, Morse. Tr. II. 215.

94.— " " exiguus, Stimpson. Tr. I, i, 40; II, 130, 214,

95.— " (Conulus) fulvus, Drap. Tr. I, i, 40 (as chersina); II. 215, 263, 264.

96.— " (Gastrodonta) multidentatus, Binney. Tr. I, i, 40; II, 215.

97.—Tebennophorus Carolinensis, Bosc. Tr. I, i, 39; II, 224, 265.

98.—? " dorsalis, Binney. Tr. II, 264.

99.—Patula alternata, Say. Tr. I, i, 40; II, 215, 263.

100.— " striatella, Anth. Tr. I, i, 40; II, 216, 263, 264.

101.— " asteriscus, Morse. Tr. II, 130, 216.

102.—Helicodiscus lineatus, Say. Tr. I, i, 40; II, 216.

103.—Punctum pygmæum, Drap. = minutissimum, Lea. Tr. I, i, 40, 62, pl. II. f. 7; II, 221; Ot. Nat. I, 107.

104.—Helix (Mesodon) albolabris, Say. Tr. I, i, 40; II, 218, 264, 351.

105.— " " dentifera, Binney. Ot. Nat. IV. 53.

106.— " " thyroides, Say. Tr. II, 219, 265.

107.— " " Sayii, Binney. Tr. I, i, 40; iv, 74; II, 219, 263, 264.

108.— " (Stenotrema) monodon, Racket. Tr. I, i, 40; II, 217, 263.

109.— " (Vallonia) pulchella, Müll. Tr. I, i, 40; II, 221.

110.— " (Strobila) labyrinthica, Say. Tr. I, i, 40; II, 217, 265.

111.—Pupa corticaria, Say. Tr. I, i, 40; II, 226.

112.— " armifera, Say. Tr. II, 225.

113— " contracta, Say. Tr. I, i, 40; II, 225, 265.

114.— " simplex, Gould. Tr. I, i, 40; II, 227.

115.— " milium, Gould. Tr. I, iii, 59; II, 130, 227.

116.—Vertigo ovata, Say. Tr. I, i, 40; II, 226.

117.— " Gouldii, Binney. Tr. I, i, 40; II, 130, 226.

118.— " Bollesiana, Morse. Tr. II, 226.

119.— " ventricosa, Morse. Ot. Nat. III, 68.

120.— " pentodon, Say. Tr. I, i, 40; II, 225.

121.— " curvidens, Gould. Ot. Nat. IV. 53.

122.—Ferussacia subcylindrica, Lin. Tr. I, i, 40 (as B. lubricus); II, 224.

123.—? Succinea aurea, Lea. Tr. I, iv, 74.

124.— " avara, Say. Tr. I, i, 39; II, 131, 229.

125.— " obliqua, Say. Tr. I, i, 39; II, 229, 263; Ot. Nat. I, 107.

126.—Succinea ovalis, Gould. Tr. I, i, 39; II, 130, 227, 265.

127.—Carychium exiguum, Say. Tr. I, i, 40.

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BOOK NOTICE.

THE SCHOOL FERN-FLORA OF CANADA; by Prof. George Lawson, Ph.D. LL.D., F.R.S.C., pp. 221-251, 1889. We have to thank our esteemed member Dr. Lawson for a copy of his School Fern-Flora of Canada, which has been published as an appendix to a reprint of Dr. Asa Gray's "How Plants Grow," lately issued by Messrs. A. & W. Mackinlay, of Halifax, N.S. The whole volume containing both works will be supplied by the publishers for 75c, but a discount of 20% will be allowed if ten or more copies are taken. As is well known, Dr. Lawson has made a special study of our Canadian ferns, and there is no doubt that the publication of this paper will be welcomed by many of our members who are frequently enquiring for a small and intelligible work upon this favourite branch of our native flora. There are no plants which are so universally admired as ferns, and none of greater interest than those which grow wild in our northern woods and rocky ravines. Botanists and lovers of nature are now provided with a means of identifying any fern they may find growing wild, for this little work, which is illustrated by one plate upon which 17 genera are figured, "comprises descriptions of all ferns known to inhabit the Dominion together with an account of their geographical range or prevalence in the several Provinces, and special localities for the rarer species."

The author has adopted names for some of the genera and species which will be unfamiliar to our botanists who have worked with Gray's manual; but it is probable that in most instances these will be accepted; it seems a great pity, however, that the synonyms were not given for at least those species which appear in the Manual under other names. A little more information on the part of the author with regard to some of the localities, particularly those of this district, would decidedly have made the work more useful. These, however, are small defects which will probably be remedied in a future edition. On the whole Dr. Lawson's little book is a welcome addition to the works upon our Canadian flora.

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EXCURSION TO LACHUTE.

An invitation has been received from the Natural History Society of Montreal for the members of the Ottawa Field Naturalists' Club to join them upon their annual spring excursion.

The excursion this year is to be on Saturday, 7th June, to Lachute, on the Canadian Pacific Railway, a beautiful spot about 45 miles from Montreal, which experience has shown presents many attractions for students in every branch of natural history. Addresses will be delivered by Sir William Dawson, Prof. Penhallow, and other eminent naturalists.

Through the courtesy of Mr. W. C. VanHorne, President of the Can. Pac. Ry., tickets will be issued to members of our club and their friends at the low rate of $1.50 for the return trip. These tickets will be issued by the railway authorities, at the railway station or at the Sparks St. office, upon presentation of our club excursion tickets; these can be obtained from any member of the council (the names of all of whom appear on the cover of the Naturalist). As large a delegation as possible to represent the club is of course desirable.

The train leaves the Union Station at 7 o'clock A.M.

NEW MEMBERS.

(Elected since the Annual Meeting, March 18th, 1890).

Alexander, Mrs. J.
Alexander, Miss Isabel.
Angus, Miss L.
Bailey, Prof. L. W., *M.A.*, *Ph. D.*, *F.R.S.C.* (Fredericton, N.B.)
Baldwin, Miss E. G.
Baldwin, Miss H. A.
Bolton. Rev. C. E. (Wiarton, Ont.)
Borden, F. W., *M.D.*, *M.P.* (Canning, N.S.)
Brodie, R. J., *B. App. Sc.*, (Smiths Falls, Ont.)
Crawford, Mrs. Mary.
Darcy, Miss T.
Fisher, S. A., *M. P.* (Knowlton, Que.)
Fletcher, Miss C. F. S.
Gemmell, R. E.
Hardie, Miss Jessie.
Hay, W. H.
Henderson, Thomas.
Laflamme, Revd. J. A. K., *D.D.*, *F.R.S.C.* (Quebec).
Lovick, Miss G.
Matheson, W. M.
MacCabe, J. A., *LL.D.*
MacDougall, P. A., *M.D.*
McNaughton, H. F.
O'Brien, S. E.
Plunkett, J. M.
Robert, J. A., *B. App. Sc.* (Montreal).
Ryckman, Revd. E. B., *D.D.*
Saint-Cyr, D. N. (Quebec).
Saunders, W. E. (London, Ont.)
Saunders, Fred.
Senecal, C. O., *C.E.*
Smithson, Miss B. H.
Steckel, R., *C.E.*
Surtees, Robert.
Sweetland, John. *M.D.*
Topley, Mrs. W. J.
Waghorne, Rev. A. C. (New Harbour, N'f'l'd.)
Wait, F. G.
Weldon, Prof. R. C., *M.P.* (Halifax, N.S.)
Wood, Josiah, *M. P.* (Sackville, N.B.)

SUMMARY

— OF —

Canadian Mining Regulations.

NOTICE.

THE following is a summary of the Regulations with respect to the manner of recording claims for *Mineral Lands*, other than Coal Lands, and the conditions governing the purchase of the same.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting, for mineral deposits, with a view to obtaining a mining location for the same, but no mining location shall be granted until actual discovery has been made of the vein, lode or deposit of mineral or metal within the limits of the location of claim.

A location for mining, except for *Iron* or *Petroleum*, shall not be more than 1500 feet in length, nor more than 600 feet in breadth. *A location for mining Iron* or *Petroleum* shall not exceed 160 acres in area.

On discovering a mineral deposit any person may obtain a mining location, upon marking out his location on the ground, in accordance with the regulations in that behalf, and filing with the Agent of Dominion Lands for the district, within sixty days from discovery, an affidavit in form prescribed by Mining Regulations, and paying at the same time an office fee of five dollars, which will entitle the person so recording his claim to enter into possession of the location applied for.

At any time before the expiration of five years from the date of recording his claim, the claimant may, upon filing proof with the Local Agent that he has expended $500.00 in actual mining operations on the claim, by paying to the Local Agent therefor $5 per acre cash and a further sum of $50 to cover the cost of survey, obtain a patent for said claim as provided in the said Mining Regulations.

Copies of the Regulations may be obtained upon application to the Department of the Interior.

A. M. BURGESS,
Deputy of the Minister of the Interior.

Department of the Interior,
Ottawa, Canada, December 19th, 1887.