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THE OTTAWA NATURALIST.

VOL. XIV. OTTAWA, APRIL AND MAY, 1900. No. 12

ANNUAL REPORT OF THE OTTAWA FIELD NATURALISTS' CLUB, 1899-1900.

The Council of the O. F. N. Club beg leave to submit the following report for the year now ending. Forty members have been elected during the year, and thirty have resigned, or had their names struck from the list on account of non-payment of dues. The total number now enrolled is about 235. Fourteen council meetings have been held.

The President, Dr. Ami, represented the club at the meeting of the Royal Society of Canada, held in this city in May last.

The following elementary lectures were arranged for at the first meeting of Council, and were held on the respective dates :

April 10th, *Geology*, by Dr. H. M. Ami.
" 17th, *Ornithology*, by Mr. A. G. Kingston.
" 24th, *Entomology*, by Dr. James Fletcher.
May 1st, *Conchology*, by Hon. F. R. Latchford.
" 8th, *Botany*, by Mr. R. B. Whyte.
" 15th, *Zoology*, by Mr. W. S. Odell and Prof. J. Macoun.
" 22nd, *Planting and Care of Forest Trees*, by Sir Henry Joli de Lotbinière.

Dr. MacCabe kindly placed the Assembly Hall of the Normal School at the disposal of the Club for these lectures, and the attendance was most encouraging to all concerned, a large number of the ladies and gentlemen attending the Normal and other city schools being present at every lecture, of which they took copious notes.

As usual the sub-excursions were an important feature of the year's work, though in the first held the lateness of the spring made it necessary to confine the observations largely to a study of the rocks, and to the collection of fossils. All of these excur-

sions were well attended, in some cases over 150 members and friends of the Club being present.

The first general excursion was to Chelsea, and was attended by nearly 300. Two prizes were offered for the best collections of plants, and evoked much interest among the botanists. The second general excursion was to Aylmer Park, where seventy-nine species of plants were noted. The geology and archæology of this district and of Lighthouse Island proved of much interest to those studying these subjects. The third general excursion was to Cumberland and, though not largely attended, was of much interest. The elementary lectures, the sub-excursions and the general excursions have been described at length in THE OTTAWA NATURALIST.

During the winter the usual evening meetings were held, and many valuable lectures were given and papers read, of which the full programme was given in THE OTTAWA NATURALIST for December, 1899, the only change in the original programme being that on March 6th, instead of Mr. T. W. E. Sowter's paper, Mr. D. B. Dowling gave an illustrated address on Lake Winnipeg, and Mr. W. S. Odell read a paper "On a Salamander."

At the kind invitation of the Rector of the University of Ottawa, one of our evening meetings, that of February 20th, was held in the Academic Hall of that institution and was very largely attended. The two Conversaziones held in the Normal School were also well attended; at these many interesting specimens were exhibited.

THE OTTAWA NATURALIST has been published every month, and the eleven numbers already out contain 276 pages. Six pages of plates and many interesting articles have appeared, among which the following may be mentioned:

The Mineral Resources of the Ottawa District. Dr. R. W. Ells.

Progress of Geological Work in Canada. Dr. H. M. Ami.

Ottawa Coleoptera. Extra—limital Insects Found at Ottawa, by W. H. Harrington.

On Reptilian Remains from the Cretaceous of North-western Canada. Lawrence M. Lambe.

The Bermuda or Easter Lily. H. B. Small.

Some Recent Additions to the Labrador Flora. M. L. Fernald and J. D. Sornborger.

Notes on Fresh-water Polyzoa. Walter S. Odell.

The Birds of a Garden, and My Feathered Jester. A. C. Tyndall.

List of Fresh-water Fishes of the Gaspé Peninsula and a Preliminary List of Batrachia of Gaspé Peninsula and the Maritime Provinces. Dr. Philip Cox.

Winter Birds of the Okanagan District. Allan Brooks.

Some Plants from the North-west Shore of Hudson Bay. M. L. Fernald.

Paddle-nosed Sturgeon in Ontario. Prof. E. E. Prince.

Notes on a Geological Trip over a Portion of the North-west Territories. T. C. Weston.

Notes on some Botanic Gardens. W. T. Macoun.

Belinurus grandævus, a new species of Palæozoic Limuloid Crustacean. Dr. H. M. Ami.

List of Plants Collected by J. B. Tyrrell in the Klondike Region, 1899. Prof. John Macoun.

Archæology of Lake Deschenes. T. W. E. Sowter.

Rangifer Dawsoni; preliminary description of a new species of Caribou from Queen Charlotte Island. E. Seton-Thompson.

Annual Address of the President. Dr. H. M. Ami.

The different branches report a successful year's work. In Geology the work done has been in tracing out the boundaries of formations and collecting fossils. Some of the fossils were found to be new to this locality.

The Botanical Branch reports that four species of mosses new to science, and five to the Ottawa flora have been discovered. A sedge new to the Ottawa flora was found at Chelsea by Prof. J. Macoun. They also report that Mr. Cowley, besides locating many rare specimens, discovered in Osgoode Township two forms of *Botrychium ternatum* not before collected here, viz., *B. ternatum dissectum* and *B. ternatum obliquum.*

Entomology.—A full report of this branch has been published in THE OTTAWA NATURALIST. In this report the leaders draw special attention to original work in the critical study of insects.

Archæology.—One of the leaders in this branch, Mr. Sowter, discovered a beach workshop on the Quebec side of the Ottawa River just below the little Chaudière Rapids. The workshop extends along the whole west shore of Squaw Bay from the southerly end of Mountain street in Tétreauville, a distance of

about 800 feet. The shore at frequent intervals is strewn with the usual flint chippings.

Full reports of all the branches will be published in THE OTTAWA NATURALIST at an early day.

The Treasurer reports that the finances of the Club are in a satisfactory condition. After paying all indebtedness we have on hand for the new year a balance of $146.30. The Treasurer's report, as usual, will appear in the first number of the new volume.

The Club acknowledges with thanks the kindness of Dr. J. A. MacCabe in providing rooms in the Normal School for council meetings, for the library, and for public meetings. Our thanks are also due to the Young Men's Christian Association for the use of their Assembly Hall; to the Rector of the University of Ottawa for placing at our disposal the Academic Hall of that institution for one of our meetings; to the Ottawa Electric Light Company for putting in wires and lamps for the microscopes free of charge; and to the daily newspapers for inserting notices of our meetings.

W. J. WILSON,
Secretary.

HENRY AMI,
President.

TREASURER'S REPORT FOR THE YEAR 1899-1900.

To the President and Members of the Ottawa Field Naturalists' Club.

The Treasurer begs to again report that although the finances of the Club are in a satisfactory condition, so far as the balance is concerned, they are in a *very unsatisfactory state* with regard to the payment of subscriptions by members at the time they are due. By an expenditure of much time and labour, a large amount has been collected for arrears ; but the payments on account of the current year's subscriptions are not at all what they ought to be. The Treasurer makes an earnest appeal to the members to pay in their subscriptions at the beginning of the Club year instead of waiting until the end. The printers must be paid month by month, and, were all fees paid when due, the Council could carry out much good work which has to be left undone, owing to uncertainty as to when funds will be available. Further, owing to neglect on the part of members to pay their fees unsolicited, the Club is put to much extra expense for postage, and the work is much more than doubled.

Another matter which the Treasurer considers it his duty to again bring prominently before the members of the Club, is the patronage of those firms who help the Club by advertising in THE OTTAWA NATURALIST. These are all first class houses who will supply goods at least equal in quality to those to be obtained anywhere else, and it is only reasonable that they should expect to receive an increase of business from the members of the Club, whose interests they serve by advertising in the Club organ.

Your obedient servant,

JAMES FLETCHER,

Treasurer.

SUBSCRIPTIONS ARE PAYABLE IN ADVANCE, and are due on the day of the annual meeting each year.—J. F.

OTTAWA FIELD-NATURALISTS' CLUB.

Treasurer's Statement for the Year ending March 20th, 1900.

RECEIPTS.			EXPENDITURE.		
1899.			1900. March 20.		
March 14. Balance		$67 33	Printing OTTAWA NATURALIST, including wrapping and postage, April, 1899, to March, 1900, (12 numbers)	$312 78	
Subscriptions received—			Less discount	18 41	
1899-1900 .....$128 97				294 37	
Arrears 83 00			Authors' extras $37 33		
	211 67		Illustrations .. 23 25		
Government grant...	200 00			60 58	
Advertisements	69 40				$354 95
Authors' extras sold	30 40		Miscellaneous printing—Circulars, Spring Announcements, etc., and postage ..		45 10
OTTAWA NATURALISTS sold..	11 30		Stationery		5 25
			Binding sets of THE OTTAWA NATURALIST for the Governor General and the Paris Exposition		7 75
			Conversazione expenses		24 50
			Postage		4 75
			Prize for Excursion No. 1....		1 50
			Balance		146 30
		$590 10			$590 10

JAMES FLETCHER,
Treasurer.

Audited and found correct.
J. BALLANTYNE, } *Auditors.*
R. B. WHYTE, }
March, 1900.

SUB-EXCURSION No. 1, 1900.

The first sub-excursion of the season was held on the 28th April to Rockliffe, and thence to Beechwood. About twenty were in attendance, the majority of whom were Normal School students. Two of the Club's Leaders were present, viz., Messrs. Wilson and Gibson. The afternoon was pleasantly spent but the backwardness of the season, owing to the cold, late spring made it very difficult to find specimens of interest. Hepaticas, a few Trilliums, and Dogtooth Violets, with Aspens, Willows, Red and Silver Maples, together with a few other common spring flowers were all that rewarded the naturalists. Mr. Gibson secured some specimens of *Grapta Faunus*, Edw., an uncommon species in this district.

SOME INTERESTING MOTHS TAKEN AT OTTAWA.

BY ARTHUR GIBSON, CENTRAL EXPERIMENTAL FARM.

(Read at meeting held 12th Dec, 1899.)

The Order *Lepidoptera* is divided into two sub-orders, viz. : *Rhopalocera* and *Heterocera*, or in other words, Butterflies and Moths.

In America, north of Mexico, there are over 5,400 different distinct species of moths. all of which have their interest, some on account of their size, some on account of their beautiful markings, and others on account of their rarity. In other words, each has its own peculiar interest to the student or to the collector. To a person not interested in entomology, specimens mounted and arranged neatly in a cabinet, generally attract attention ; but to the student this interest is aroused not only on account of this charm, but chiefly centres around those species about which little is known, either with regard to the earlier stages in their life histories, or in connection with the mature forms of these insects. Of course, the systematist is especially interested in classifying as complete a collection of specimens as he can possibly gather together, studying them and making known the result of his observations as to their points of difference and the characteristics peculiar to each genus and species. In later years more work has been done by the student studying the earlier stages of our moths, telling us the appearance of the eggs laid by the females, what the larvæ in their different moults look like, what is the shape, colour, etc., of the pupæ and cocoons, in fact everything bearing upon a complete knowledge of the earlier stages of these insects.

Very few new moths are found nowadays, except in localities where collectors are few. There are, however, in Canada many places which have never been worked up, and, if these points were visited and collections made, undoubtedly new species would be discovered. But it must be remembered that this branch of natural science is sadly neglected by naturalists, only a very small number being really interested in entomology from a scientific standpoint, notwithstanding its enormous importance economically.

In view of this it is altogether likely that some time will elapse before information as to the local forms frequenting such districts will be made known. In the United States a vast amount of work has been done in studying the fauna of the different States, but little is known about the habits of the greater number of moths native to Canada.

Collectors of moths use various methods in order to secure specimens. Some entomologists record good success in securing the imagoes by certain means, which others find unprofitable. For instance, traps made of sheets of glass so arranged in a wooden box, that when a moth once enters it cannot return, have given excellent results in the hands of some. The attraction to such a trap is due to the rays of a bright light, which is placed behind the sheets of glass, and, when the moth gets as far into the box as the trap allows it, the fumes of some poisonous substance, such as chloroform, either kills the insect at once, or else keeps it quiet until the collector comes to examine the captures of the night.

In cities and large towns the attraction which the electric light has for night-flying insects, probably furnishes the best general results for a collection of moths. Where the electric light is placed on the outskirts of a settlement, particularly close to the woods, a visit on dark, close nights, in the month of June especially, will generally be very productive. Some moths, however, which mature in early spring or in August, and even as late as October and November, are, of course, to be looked for in these months, but those which hibernate in the mature form may be found both in the autumn and in the spring.

Another way in which these insects are collected is that of "sugaring" trees, that is, painting a daub of molasses mixed with sour beer over a small portion of one side of a tree. Moths are very fond of such mixtures, and if the application is made in localities where insects are at all plentiful good results will be certain. June and July I have found to be the best months for "sugaring," and if warm, close evenings are selected many moths undoubtedly will be secured.

Another plan is to visit flowers in the early part of the evening, as many species are exceedingly fond of nectar and will be

found frequenting certain flowers. Caraganas, or the so-called Siberian pea-trees, honey-suckles, lilacs, petunias, etc., have a great attraction for many moths, and, if these plants are visited in the early evening before dark, many specimens can easily be captured.

The Ottawa locality undoubtedly offers a good field for investigation, and much useful work can be accomplished in studying the moths occurring in this district. During the past summer in my official duties it was my privilege to do considerable work in the collection of these insects, and, when asked by Dr. Fletcher to contribute a paper to read before the Ottawa Field-Naturalists' Club, it occurred to me that a brief mention of some of the moths which I had taken this year at Ottawa might be of interest. As the moths have always been special favourites of mine, I may be privileged in time to contribute some further notes for THE NATURALIST in reference to Ottawa Heterocera, which may not be without interest to those who study these forms of insect life.

In the Heterocera, the *Sphingidæ*, or Hawk-moths, are classified first, according to Prof. J. B. Smith's standard list of the Lepidoptera of Boreal America. In the genus *Hemaris*, or Bee moths, of the family *Sphingidæ*, only two species were met with, viz.: *H. diffinis*, Bdv., and *H. thysbe*, Fabr. These are both day-flyers frequenting flowers, particularly lilacs, and, unless the eye is experienced, are easily taken for the ordinary bumble bees. Although many of the hawk-moths are found around the flowers in early twilight, the electric lights furnish a much better attraction. Some of these moths taken the past season are as follows: *Deilephila chamænerii*, Harr., and *D. lineata*, Fabr., which when flying resemble very much humming birds; *Protoparce celeus*, Hbn., which, although rare here in the imago state, commonly occurs destructively to tomato plants as a larva; *Sphinx drupiferarum*, S. & A., also injurious in the caterpillar state, particularly to plum trees; *Sphinx gordius*, Cram., a rare moth, two specimens being taken; *Sphinx chersis* Hbn., one of the largest of the genus, and which occurs injuriously at times to ash and lilac; *Triptogon modesta*, Harr., a large moth, one of the handsomest among the sphingids; and *Smerinthus*

cerisyi, Kirby, which is an exceedingly rare insect in eastern parts of Canada, being only occasionally met with.

The *Sesiidæ*, or Clearwings, follow the *Sphingidæ*, and are all small moths with slender bodies. They have much the appearance of wasps, and like these insects fly by day. Their larvæ are known as Borers, and often cause much damage to maple, peach, and other trees, besides injuring seriously certain plants, such as the squash, etc. The species are very interesting; they are also hard to get, especially so in the adult stage. *Sesia tipuliformis*, Linn., occurs here, and often causes injury to currant bushes. Besides this species, Dr. Fletcher tells me that he has taken in the past at Ottawa, *Podosesia syringæ*, Harr., and *Sesia acerni*, Clem., with the statement that they both occur rarely.

Of the *Arctiidæ*, often called the Tiger Moths, nearly twenty representatives have been found in this locality. *Callimorpha contigua* Walk, and *C. confusa*, Lyman, are both interesting, and being day-flyers, frequent open places in woods. *Euprepia caja*, *L. a americana*, Harr., the large tiger moth, expands about 2½ inches, and is a beautiful species. I was fortunate enough to secure two specimens of this moth on the 31st July last, and, from one, got some eggs, and had the pleasure of breeding the species through all its different stages during the past season. The full grown larva is about an inch and three-quarters in length, and in general appearance is a black caterpillar with rusty red sides, and covered with long sweeping silvery hairs.

Of the *Notodontidæ*, the most interesting species taken the past summer, are *Notodonta simplaria*, Graef., *Lophodonta ferruginea*, Pack., *L. georgica*, H.-S., *Pheosia rimosa*, Pack., and *Nerice bidentata*, Walk. These moths average about an inch and a half in expanse of wings, and are brownish or reddish in appearance.

The large moths belonging to the family *Saturniidæ* always attract attention. *Actias luna*, Linn., the large delicate green species with long tail like appendages, is one of the most handsome moths in Canada. *Attacus promethea*, Dru., *A. cecropia*, Linn., and *Telea polyphemus*, Cram., also among our largest

moths, while common from the collector's standpoint, are likewise worthy of much admiration.

In the *Hepialidæ*, two specimens of *Hepialus argenteomaculatus*, Harr., were taken at the electric light by Mr. C. H. Young, who very kindly presented one to the Division of Entomology at the Central Experimental Farm. This is a beautiful moth of a brownish and ashy-gray colour, the wings bearing silvery white spots. When the wings are expanded, it measures about four inches across.

The *Noctuidæ* make up the largest family we have, and comprise in North America no less than 2,900 different species. They vary greatly as to size, markings and colour, and many are exceedingly difficult to classify. These moths are those which are mostly attracted to "sugar," and in this way many can be captured. A great many of the noctuids are extremely scarce. A rare species reared during the past summer is *Barathra occidenta*, Grt., the larvæ of which were collected by Mr. J. A. Guignard feeding on a perennial Delphinium. No detailed description of the larvæ was taken further than that they were "black caterpillars with a yellow irregular line on each side of the back. They fed on both the leaves and the flowers." Previous to this there was no knowledge of the preparatory stages of this species. About fifteen different species of the genus *Mamestra* were met with during the past season: *Mamestra atlantica*, Grt.; *M. subjuncta*, G. & R.; *M. rosea*, Harv.; *M. legitima*, Grt.; *M. adjuncta*, Bdv.; *M. meditata*, Grt., and *M. assimilis* Morr. are the most interesting secured. In addition to these, Mr. C. H. Young took a specimen of *Mamestra olivacea*, Morr. One example of *Arzama diffusa*, Grt., was taken on the Experimental Farm by Dr. Fletcher, and although not a very handsome species is interesting owing to its rarity. *Orthosia euroa*, G. & R., also an unassuming species with regard to beauty, was likewise met with but once, at the electric light. While collecting at the Mer Bleue on the 30th Aug., in company with Mr. Young, Dr. Fletcher captured a specimen of *Epiglæa apiata*, Grt. This is a beautiful species and is the first record of its occurrence in this locality; when taken it was in excellent condition. A single specimen of *Scopelosoma sidus*, Gn., was taken at the electric light, as was also one of

Scopelosoma morrisoni, Grt. The moths of this genus are always welcome captures and are amongst those which mature in autumn, hibernating in the perfect state. The genus *Plusia* contains some very attractive insects. Eight different species were met with last season, those which occurred rarely being *P. balluca*, Geyer; *P. contexta*, Grt.; and *P. striatella*, Grt., all of great beauty. The moths of this genus are beautiful glossy insects, usually spotted or striped on the front wings with silvery markings.

In the *Noctuidæ* probably the genus which attracts the most general attention, especially to a beginner, is the genus *Catocala*, which comprises over 80 species in North America. These moths are handsome creatures and of large size, often expanding three inches, or more. The forewings are usually of a brownish or greyish colour, marked with wavy or zigzag lines. The ground colour of the hind wings varies with the species, but in many instances these wings are conspicuously banded with red, yellow or white: owing to this peculiarity they are often termed Underwings. In the daytime the moths have the habit of resting on the trunks of trees, but it needs experienced eyes to detect them, as the colours of the forewings of these insects are usually protective. During the past season very few species were observed, and, as I was constantly on the look out for them during the months they fly, I judge that they were scarce. On the 31st May Dr. Fletcher and I found eleven full grown larvæ of *C. cerogama*, Gn., feeding on basswood, the general colour of four being greenish, while the remainder were greyish. These caterpillars spun a light cocoon between the leaves in about a week's time, and gave us the perfect moths on the 13th July. Other *Catocalæ* taken the past season were *C. briseis*, Edw.; *C. concumbens*, Walk.; *C. relicta*, Walk.; *C. ultronia*, Hbn., and *C. grynea*, Cram.

In the early days of spring, towards the end of April and beginning of May, a beautiful little moth of red and blackish colour is sometimes seen flying around birch trees. This is *Brephos infans*, Moeschl., a day-flyer, and being uncommon in Canada is always an interesting capture.

Some of the moths mentioned in this paper have been brought to the meeting to-night and no doubt will prove of interest to those who may care to look at them.

BOTANY.

MANITOBA'S WILD FLOWERS.

There are few countries which can vie with Manitoba in the number of beautiful flowering plants which from early Spring to late Autumn make her glorious prairies one blaze of magnificent colour.

At the Conversazione held in the Normal School, Ottawa, on Monday evening, February 6th, was exhibited a beautiful collection of 100 water colour drawings of Manitoban plants, all collected and painted by Mr. Norman Criddle, at Aweme, Manitoba. This collection was very much admired by everyone. The drawings were particularly characterised by their botanical accuracy and the artistic taste with which each species was delineated. The facies of each plant was well shown and the colouring of the flowers was admirable.

Aweme is situated about twenty miles south-east of Brandon, thirteen miles south of Sewell, and six miles north of Treesbank, among the sand hills, and in the vicinity of a large swamp. Among the paintings were several rare plants, and many others were of interest for their beauty or for their occurrence at the locality where they were found. Perhaps the most admired of all these paintings was a white-flowered form of the truly magnificent Drummond's Thistle (*Cnicus Drummondii*), a giant species calculated to charm the heart of every Scotchman with its enormous flowers between three and four inches across. There are two forms of this Thistle, one with many heads arranged up a stout stem over two feet high, and an entirely acaulescent form with one large flower lying close to the ground, in the centre of a mat-like rosette of acanthus-like leaves, every prickle of which is tipped with purple.

The very rare yellow-flowered variety *lutescens* of *Aster ptarmicoides* was well represented. I have had this variety growing vigorously for four years; the root was collected at Virden, Man., and since the first year after transplanting has borne each year three or four strong stems, the flowers retaining their yellow tinge as well in the East as on its native prairies. A specimen of

this rare plant was also collected at Griswold, Man., some years ago. Mr. Criddle's painting represents the variety admirably.

Another rare plant of interest to botanists, of which the drawing was much noticed, was *Townshendia sericea*. *Boltonia asteroides*, which has been seldom collected in Canada, was found by Mr. Criddle at Aweme.

Some of the interesting varietal forms represented in this collection were albinos of *Liatris punctata*, *Monarda fistulosa*, var. *mollis*, *Silene antirrhina*, and *Anemone patens*, var. *Nuttalliana*. There was also a yellow-fruited form of wild raspberry (*Rubus strigosus*) and a pale-yellow-flowered form of *Lilium Philadelphicum*. *Polygala paucifolia* was of interest as the first record of this pretty flower in Manitoba. *Corallohiza striata*, a widely distributed but always rare plant, attracted much notice on account of its rarity in the Ottawa district. *Oxytropis Lambertii* was shown with both colour varieties, the ordinary yellowish white and the rose purple. This plant is the "Loco weed" of the South-western States, but no ill effects to horses on our plains have ever been recorded. A variety of *Lepachys columnaris* with the golden-yellow flowers blotched with seal-brown, which is not very uncommon on the plains, would be a valuable acquisition in the flower garden.

These paintings of Mr. Criddle's are only a part of his collection, as he has previously sent down two equally large packets similar to the present one, every plant in which was drawn with the same accuracy and taste as those above referred to. Mr. Criddle is also making a collection of drawings of the insects of Manitoba, from which some new records for the Province have been made. It is just such careful individual work as Mr. Criddle is doing which is of most value to specialists when working up the scientific geographical distribution of plants and animals.—J. FLETCHER.

ORNITHOLOGY.

BIRD NOTES.

BY W. T. MACOUN.

Spring is the best time to begin a study of our birds. Almost every day for several weeks there are new arrivals to help maintain one's enthusiasm once it has been aroused. There are few species of birds in Canada, compared with the number of insects and plants, and they are so readily recognized after a little study that it is surprising more people do not know a greater number of them. Will not some of the younger members of the society begin a study of our birds this spring? They will find themselves well repaid.

Few birds were noted last winter, and the Pine Grosbeaks which often come in great numbers were seen but rarely. Birds were again late in coming this spring, though not quite so late as last year. The following list has been compiled from notes made by various observers this spring. As a rule, when a bird is observed several days after the first record, the date is not published as it would make the list too cumbersome.

1899.

Nov. 2—WHITE-WINGED CROSSBILL, *Loxia lencoptera*. Flock of a dozen. Miss Harmer. On Nov. 16th, Mr. C. Guillet saw seven feeding on alder seeds near Patterson's creek, three of which were males. He saw two more on Dec. 4th.

Jan. 9—SHARP-SHINNED HAWK, *Accipiter velox*. One seen by Mr. Geo. R. White.

18—PINE GROSBEAK, *Pinicola enncleator*. Flock of a dozen eating tamarac buds. Dr. James Fletcher. A flock of six was seen by Mr. Geo. R. White on March 9th. There are no other records of this bird.

Feb. 4—SAW-WHET OWL, *Nyctala acadica*. One seen by Mr. White, and one found dead in a shed in Jannary by Mr. J. A. Guignard.

11—PRAIRIE-HORNED LARK, *Otocoris alpestris praticola*. Two seen by A. B. Rowan-Legg near Hurdman's Bridgs. Seen by Dr. Fletcher at the Experimental Farm on Feb. 14th. Numerous after that date.

12—AMERICAN CROW, *Corvus americanus*. Mr. Geo. R. White. Crows could be seen from time to time at the Experimental Farm all winter, but this is the first definite record. Mr. White says the migration occurred on March 17th.

18—RED POLL, *Acanthis linaria*. Flock of thirty. Mr. White.

23—CEDAR WAXWING, *Ampelis cedrorum*. Five seen by Dr. Fletcher

March 1—PINE SISKIN, *Spinus pinus*. Flock seen by Dr. Fletcher. Flocks seen by Mr. White on March 17th, and April 10th and 15th.

18—AMERICAN GOSHAWK, *Accipiter atricapillus*. A male seen by Mr. White.

29—AMERICAN ROUGH-LEGGED HAWK, *Archibuteo lagopus sancti-johannis*. Mr. C. H. Young.

31—SONG SPARROW, *Melospiza fasciata*. Mr. C. H. Young; April 1st, Dr. Fletcher. Belated specimens were seen by Mr. Young on Jan. 11th, and by Dr. Fletcher on Jan. 18th. Recorded first on March 11th in 1898 and on April 6th in 1899.

April 1—ROBIN, *Merula migratoria*. Dr. Fletcher and A. B. Rowan-Legg; April 2nd, Miss Harmer and Mr. White. Recorded first on March 15th in 1898 and on April 6th in 1899.

1—BLUEBIRD, *Sialia sialis*. Dr. C. E. Saunders and A. B. Rowan-Legg; April 2nd, Mr. Young and Mr. W. T. Macoun.

2—BRONZED GRACKLE, *Quiscalus quiscula*. Mr. White; April 3rd, Miss Harmer.

2—MEADOWLARK, *Sturnella magna*. Mr. Macoun.

5—CANADA GOOSE, *Branta Canadensis*. Mr. White.

5—HOARY REDPOLL, *Acanthis Hornemannii exilipes*. Mr. White. Seen also by him on April 8th.

9—RED-WINGED BLACKBIRD, *Agelaius phœniceus*. Dr. Fletcher; April 10, C. H. Young.

9—MARSH HAWK, *Circus hudsonius*. Mr. Young.

10—COW-BIRD, *Molothrus ater*. Mr. Young.

12—SLATE-COLOURED JUNCO, *Junco hyemalis*. Miss Harmer.

12—BLACK DUCK, *Anas obscura*. Flock of thirty. Mr. White.

15—VESPER SPARROW, *Poocœtes gramineus*. Miss Harmer; April 17th, Mr. Macoun.

15—PHŒBE, *Sayornis phœbe*. Miss Harmer.

15—LONG-TAILED DUCK, *Clangula hyemalis*. Mr. White.

15—TREE SWALLOW, *Tachycineta bicolor*. Mr. White.

16—WOOD DUCK, *Aix sponsa*. Mr. White.

17—TREE SPARROW, *Spizella monticola*. Miss Harmer; April 18th, Mr. White. Numerous at the Experimental Farm on April 21st.

17—YELLOW-BELLIED SAPSUCKER, *Sphyrapicus varius*. Mr. White.

17—GOLDEN-CROWNED KINGLET, *Regulus satrapa*. Mr. White.

17—GREAT BLUE HERON, *Ardea herodias*. Mr. White

18—CHIPPING SPARROW, *Spizella socialis*. Mr. White.

18—RUSTY BLACKBIRD, *Scolecophagus carolinus*. Mr. White.

23—BELTED KINGFISHER, *Ceryle alcyon*. Mr. White.

23—GREAT NORTHERN SHRIKE, *Lanis borealis*. Dr. Fletcher.

The following notes taken near London, Ont., and sent by Mr. William Saunders of that city for publication in THE NATURALIST are interesting for comparison.

Robin, Junco, March 11th; Meadowlark, March 12th; Bluebird, March 13th; Tree Sparrow, Brown Creeper and Golden Eye, March 17th; Song Sparrow, March 18th; Red-shouldered Hawk, March 20th; Red-winged Blackbird, Bronzed Grackle, Kildeer, Golden-crested Kinglet, Sparrow Hawk, March 23rd, Red-tailed Hawk, Bufflehead, March 25th; Cowbird, March 27th; Hooded Merganser, March 29th; Phœbe, Yellow-billed Sapsucker, April 3rd; Marsh Hawk, Wood Duck, Great Blue Heron, Sharp-shinned Hawk, Canada Goose, Cooper's Hawk, Mallard, April 5th; White-rumped Shrike, April 7th; Vesper Sparrow, April 8th; Towhee, April 9th; Belted Kingfisher, Mourning Dove, April 13th; Chipping Sparrow, April 16th; Flicker, Ruby-crowned Kinglet, Field Sparrow, April 19th.

Departure for the north from London, Ont.: Snowflake, March 21st; Red Poll, April 5th.—W. E. S.

EARLY NESTING OF PRAIRIE HORNED LARK.

Prairie Horned Lark (*Otocoris alpestris praticola*). A nest with four eggs, already slightly incubated, was found by Mr. C. H. Young at Hurdman's Bridge on April 11th. The earliness of this date this season is remarkable, the ground being still in many places covered with snow, and up to the present we have had very few days which even by the greatest stretch of politeness might be called "spring-like." The location of the nest for this species was no less remarkable than the early date of its construction. It was on the ground between the ends of two ties on the Canadian Pacific Railway, and was passed over by several trains every day and night.—J. F.

CONTRIBUTIONS TO THE NATURAL HISTORY OF THE NORTHWEST TERRITORIES.

By EUG. COUBEAUX, Prince Albert, Sask.

I.

THE BIRDS OF SOUTHERN SASKATCHEWAN.

The following annotated list is the result of a few researches during the last five years in the southern part of the Saskatchewan Territory, mainly in the region between 105° and 106° west longitude, and 50° 30′ and 53° 20′ north latitude. This small portion of the "rolling" prairie belongs chiefly to the partly wooded prairie, its south-west corner however showing the vicinity of the open prairie country. In the middle of it runs the Birch Hill range, with its three summits, the "Matinasse," the Birch Hill and the Red Deer Hill, that cut the south branches of the Saskatchewan.

Throughout the country are found a number of drainage basins, marshes, ponds, and lakes of considerable size, of these only one, the head waters of the Carrot River, is teeming with fish. These waters are more or less alkaline and contain a species of *Amblystoma*. West of these hills are found a great number of erratic boulders of the glacial period and a great number of dried up rivers, showing there was at one time an epoch of greater humidity. The commonest tree is the Aspen, *Populus tremuloides*, of which with *Salix rostrata*, the "bluffs" or "iles" throughout the country chiefly consist. With the exception of a few small areas in the south, the coniferous forest begins north of Prince Albert.

NATATORES—SWIMMING BIRDS.

Order PYGOPODES.

1. *Colymbus auritus*. This bird is here a common summer resident, breeding in great numbers in all the marshes and ponds of the prairie. It arrives about the middle of May and remains rather late in the autumn.
2. *Colymbus nigricollis californicus*. Sometimes met with, but much rarer than the preceding.
3. *Urinator imber*. This splendid bird breeds on every large lake or pond, preferring those where fish are plentiful. It arrives in May and remains till late in the fall, like the above mentioned species.

Order LONGIPENNES.

4. *Larus argentatus smithsonianus.* Summer resident, most plentiful during the spring and fall migrations about the larger bodies of water; probably breeding in the country.

5. *Larus delawarensis.*
6. *Larus franklinii.*
7. *Larus philadelphia.*

These three species are pretty common, and breed on nearly every large body of water in the country. They arrive about the middle of May and remain together in large flocks till the end of September, except during the breeding season when they disappear suddenly.

8. *Sterna hirundo.* Summer resident, but not very common. Only on large bodies of water, and undoubtedly breeding, as I met with a few specimens once on Crooked Lake, the head waters of the Carrot River, on July 7th, 1897.

9. *Hydrochelidon nigra surinamensis.* A very common summer resident from about the end of May to the middle of September, and breeding in great numbers in all the marshes and on ponds of any size. Seems to prefer however the wettest and most inaccessible marshes, where it breeds in large colonies.

Order STEGANOPODES.

10. *Phalacrocorax dilophus.* A tolerably common summer resident about the large lakes and bodies of water; breeding in all suitable but retired places.

11. *Pelecanus erythrorhynchos.* Not very common, seen chiefly during its migrations; probably breeding on the larger and retired lakes. First observed in the country in large numbers on the 27th of July, 1896, but subsequently more commonly in large flocks, transient.

Order LAMELLIROSTRES.

12. *Lophodytes cucullatus.* A common summer resident found in all the smaller ponds and lakes.

13. *Anas boschas.* An abundant summer resident breeding in nearly all the small marshes, chiefly those in the woods. Sparingly and early during the migratory season, and in flocks or associated with flocks of other Anatinæ in the fall.

14. *Anas strepera.* This species seems to be rare here. I have shot a few in the autumn, 1896, and since then one or two occasionally during the same season.

15. *Anas Americana.* Not very common, but frequently met with and breeding in the region.

16. *Anas carolinensis.*
17. *Anas discors.*

Both tolerably common and breeding abundantly throughout the prairie.

18. *Spatula clypeata.* Quite common and breeding abundantly throughout the country.

19. *Dafila acuta.* Common, but less common than the Mallard, with which it arrives early. Breeding in nearly all the ponds and marshes of the country.

20. *Aythya americana.* Common summer resident and breeder.

21. *Aythya vallisneria.* Uncommon, migrant; shot only during the migration seasons.

22. *Aythya marila nearctica.* As uncommon as the preceding, and only seen during its migrations.

23. *Aythya affinis.* Exceedingly abundant; one of the most abundant species, breeding throughout the prairie on every marsh and pond. Remaining quite late in the fall.

24. *Glaucionetta clangula americana* } These two species may be said to
25. *Charitonetta albeola.* } be not uncommon, but still not quite common; breeding in the region but more frequently seen during their migrations.

26. *Oidemia deglandi.* The most abundant of the Anatidæ with *Aythya affinis*, and breeding in nearly all the marshes and ponds of the country. Remaining rather late in the fall.

27. *Chen hyperborea.* Occasional and only transient.

28. *Anser albifrons gambeli.* Several times heard and noted, but only during the migratory season.

29. *Branta canadensis.* } Both early in spring, as soonas the ice
30. *Branta canadensis hutchinsii.* } begins to break up; going northward, and passing down to the south in vast flocks in the fall. Formerly breeding here but rarely now, and only in the most retired places; the region begins to be too much settled for them.

31. *Olor columbianus?* I noted, but only during the season of migration, a few flocks of Swans and I suppose them to be of the Olor columbianus.

CURSORES—TERRESTRIAL BIRDS.

Order HERODIONES.

32. *Botaurus lentiginosus.* Occasionally heard and seen, but not very common; probably breeding, for they can be shot and heard during the whole summer.

33. *Nycticorax nycticorax nævius.* A regular but not common summer resident; individually seen during the whole summer, and breeding here and there on the most retired marshes and ponds,

Order PALUDICOLÆ.

34. *Grus americana.* } Both tolerably common but only seen in large flocks
35. *Grus mexicana.* } during the seasons of migration.

36. *Porzana carolina.* Common summer resident, breeding in all suitable marshes.

37. *Fulica americana.* A tolerably common summer resident and breeder.

Order LIMICOLÆ.

38. *Phalaropus tricolor.* Common, but an irregular visitor; breeding in the region as I have killed it during summer.

39. *Recurvirostra americana.* A rather rare straggler. Chiefly around saline ponds and lakes.

40. *Macrorhamphus scolopaceus.* Common, but chiefly as a migrant, in company with the Yellow-legs and the following.

41. *Tringa minutilla.* As common as the preceding, chiefly too, as a migrant; must breed as it has been killed in summer.

42. *Limosa fedoa.* A regular summer straggler that may breed in the region.

43. *Totanus melanoleucus.* Rather common, summer resident and breeder, but not so abundant as the common Yellow-legs.

44. *Totanus flavipes.* Exceedingly abundant throughout the region,—breeding in great numbers and forming large flocks in fall.

45. *Bartramia longicauda.* Extremely abundant throughout the prairie and breeding pretty early.

46. *Charadrius squatarola.* }
47. *Charadrius dominicus.* } Both common in spring and fall as migrants, in small flocks and in company with the Yellow-legs and the Long-billed Dowitcher.

48. *Aegialitis vocifera.* Abundant throughout the prairie, and breeding in all suitable places. Rather early in spring in very small flocks of four or five and very soon paired. Living then a very long while in family.

Order GALLINÆ.

49. *Bonasa umbellus.* }
50. *Bonasa umbellus umbelloides.* } Both common residents wherever there are woods.

51. *Lagopus lagopus.* Rare, and probably in severe winters only. Only one shot in winter of 1897, and another in 1898. Very few heard of.

52. *Pediocætes phasianellus.*

53. *Pediocætes phasianellus campestris.* Both abundant and permanent residents throughout the prairies. The former, however, seeming to migrate a little from the north in winter.

INSESSORES—AERIAL BIRDS.

Order COLUMBÆ.

54. *Ectopistes migratorius.* Common; a straggler during the migrating season, and oftenest seen in fall.

Order RAPTORES.

55. *Cathartes aura.* Not rare but not very frequently seen. I have not observed it myself, but have heard about it very often. Probably breeding in the region, but in the most retired places.

56. *Circus hudsonius.* Abundant summer resident, breeding throughout the prairie and frequently seen in both plumages, From middle of April till November.

57. *Accipiter velox.* }
58. *Accipiter cooperi.* } Both common but not so abundant as the preceding.

59. *Accipiter atricapillus.* Frequently seen as a migrant, chiefly in the fall.

60. *Buteo borealis.*
61. *Buteo lineatus.* } Both rather common residents from the end of April.

62. *Buteo swainsoni.* Very abundant throughout the prairie in summer.

63. *Haliæëtus leucocephalus.* In summer only and somewhat rare. I shot a male and female of this bird breeding near a lake where fish were abundant in June, 1895, and last year in May (26th) I noted another pair of this powerful bird nesting at the same place.

64. *Falco columbarius.*
65. *Falco sparverius.* } Both frequently seen and breeding throughout the country; the former rarer than the second.

66. *Asio accipitrinus.* Common resident, undoubtedly breeding; more often seen in the fall, especially about the marshes surrounded by bushes.

67. *Ulula cinerea.* A very rare winter visitor. Only two seen and shot in five years.

68. *Bubo virginianus subarcticus.* Common resident, breeding throughout the prairie in all suitable places.

69. *Nyctea nyctea.* A regular and tolerably common winter visitor.

70. *Surnia ulula caparoch.* A somewhat rare straggler, only noted in the fall and at the beginning of the winter.

Order COCYGES.

71. *Ceryle alcyon.* Rare; first seen and shot on September 19th, 1896, near a lake without fish but with plenty of amblystomæ. Probably more frequently seen in the vicinity of bodies of water frequented by fishes, but nevertheless rare.

Order PICI.

72. *Dryobates villosus leucomelas.* Abundant permanent resident, breeding throughout the prairie.

73. *Sphyrapicus varius.* Nearly as common as the preceding, in summer only, and breeding in the region.

74. *Colaptes auratus.* Very abundant throughout the prairie, breeding wherever there is timber, and arriving somewhat early in the spring.

Order MACROCHIRES.

75. *Chordeiles virginianus Sennetti.* A very abundant summer visitor, breeding in numbers throughout the region.

76. *Trochilus colubris.* Rare, occasional in summer. Not yet noted but heard about very much as specially visiting the sunflowers of gardens.

77. *Tyrannus tyrannus.* One of the commonest summer visitors, breeding wherever there are any trees or bushes.

78. *Empidonax minimus.* Very abundant, nearly as common as the Kingbird and breeding in numbers in thickets.

Order PASSERES.

79. *Otocoris alpestris praticola.* Abundant spring and fall visitant, in company with the Lapland longspurs. Probably breeding.

80. *Pica pica hudsonica.* Rare; only two noted and one male shot in five years, on November 16th, 1897.

81. *Cyanocitta cristata.* Not uncommon, resident and more frequently seen in winter along the wooded river banks of the Saskatchewan and in the well wooded parts of the prairie.

82. *Perisoreus canadensis.* Wisky-John, comes as soon as winter is here, and is then seen in numbers everywhere. When the cold is severe or when the weather is windy and bad, like many birds, if not all, it disappears suddenly for a little while; it retires into the woods, to come back again merrily as soon as the temperature is milder. It departs very early in spring, nearly as soon as the snow begins to melt.

83. *Corvus corax principalis.* Permanent resident but very scarce, and only seen in winter in the great woods or about them.

84. *Corvus americanus.* This is our first messenger in spring. As soon as the snow begins to melt and show the ground, they arrive, by twos, by threes, by fours, then more and more numerously, from every point, barking, croaking, like packs of small hounds, hunting for something to eat, for some carcase. They mate very early and begin to build their nests long before the leaves begin to appear.

85. *Dolichonyx oryzivorus albinucha.* Uncommon and seen only just now about Duck Lake and Carleton.

86. *Molothrus ater.* Abundant summer resident, and breeds throughout the region. In company with the blackbirds.

87. *Xanthocephalus xanthocephalus.* Scarce, though frequently seen in company with the red-winged blackbird. Breeding in the region.

88. *Agelaius phœniceus.* Common summer resident, frequenting the willows and poplar edged sloughs and marshes where it breeds in numbers.

89. *Sturnella magna neglecta.* The Prairie lark is here a common summer resident, breeding throughout the country. Early in spring one hears his merry notes and ceaseless song from early in the morning till late at sunset.

90. *Icterus galbula.* The handsome Baltimore Oriole is a regularand not uncommon summer visitor; frequently seen and heard chattering in the thickets, where he hangs his pretty nest.

91. *Scolecophagus Carolinus.*
92. *Scolecophaguscy anocephlaus.*

93. *Quiscalus quiscula æneus.* All three very abundant and wandering along in company. They arrive early in spring, for the ploughing and seeding time, in small flocks. They breed in great numbers in colonies,

among the thickets and the willow and poplar-edged marshes, where they gather into large flocks, which are much feared on account of the depredations they commit in the oat and wheat fields.

94. *Coccothraustes vespertina.* I have not yet seen this bird myself, but someone showed me two mounted specimens as having been killed in the vicinity of Prince Albert. However, it is scarce.

95. *Pinicola enucleator.* Tolerably common in small flocks and more frequently seen along the banks of both branches of the Saskatchewan. This bird is one of our regular winter visitors, arriving about the end of October and departing about the end of March.

96. *Carpodacus purpureus.* I saw this beautiful finch for the first time last year in the end of April and at the beginning of May, as the snow and the bad weather lasted a long while that year. In company with the Spizelea monticola, the Junco hiemalis and some other sparrows. I think it is not so rare as it is irregular in its migrations.

97. *Acanthis linaria.* Common and a regular winter visitor. Arriving in smal[l] flocks nearly at the same time as the Pine Grosbeak, and remaining sometimes late in spring. I noted it feeding like Spinus tristis on the seeds of the Solidagos and the cottony heads of the Cnicus, and in the woods, on the fruit of the birch.

98. *Spinus tristis.* Tolerably common, summer resident, breeding throughout the region, but never seen in large flocks as during the seasons of migrations.

99. *Plectrophenax nivalis.* The Snowflake is very abundant every winter. It arrives as soon as the cold and the snow appear, usually about the middle of October, and remains as long as the weather is cold and bad. For the first time last year, early in spring, as the bad weather lasted a long while, I noted a large flock of them in summer plumage.

100. *Calcarius Lapponicus.*
101. *Calcarius ornatus.* } Both numerous every spring and fall, in company with the Prairie Horned-Lark.

102. *Poöcœtes gramineus confinis.* Quite a common summer resident throughout the country, and to be seen running ahead on every trail. Breeding too in great numbers in the region.

103. *Ammodramus sandwichensis alaudinus.* Not uncommon, but in summer only, and breeding here in the prairie.

104. *Zonotrichia leucophrys.* First noticed in numbers last spring. Probably common, but irregular, transient.

105. *Spizella monticola.* Abundant summer resident every year and breeding in great numbers throughout the country.

106. *Spizella socialis.* Not uncommon, but much less abundant than the preceding , breeding in the region.

107. *Spizella pallida.* Commonly seen in company with the Sp. monticola, and probably breeding too here.

108. *Junco hyemalis.* Very abundant migrant in spring and fall, in company with Spizella monticola and s. pallida, but never seen in summer.

109. *Melospiza fasciata.* First noticed in numbers last spring, in company with Spizella monticola, Junco hyemalis, Zonotrichia leucophrys, and a few Carpodacus purpureus and Passerella iliaca. Probably not uncommon, but an irregular transient.

110. *Passerella iliaca.* Migrant, not very common.

111. *Habia ludoviciana.* Rare, only a few during summer; probably breeds in the country.

112. *Progne subis.* Not uncommon but local. Noted breeding every year in great numbers in the dead trees of a willow and poplar thicket among marshes.

113. *Tachycineta bicolor.* Abundant every year and breeding in great numbers throughout the region.

114. *Ampelis garrulus.* Uncommon straggler, shot once only, but twice noted in spring of 1895.

115. *Ampelis cedrorum.* More frequently seen than the last, but not common.

116. *Lanius borealis.* Very common and regular summer visitor, breeding throughout the country.

117. *Dendroica æstiva.*
118. *Dendroica coronata.*
} Very abundant summer residents in thickets, arriving in May and breeding in company.

119. *Galeoscoptes carolinensis.* Uncommon; several times heard in the thickets, but only once seen; and, from the time of year in which it was seen, I have no doubt of its breeding in the region.

120. *Troglodytes aëdon aztecus.*
121. *Troglodytes hyemalis.*
} Both frequently seen, but in summer only.

122. *Parus atricapillus septentrionalis.* Common permanent resident, but, although it disappears during the summer months, I believe it breeds in the country, as I noted once a family late in summer, wandering among the low bushes and thickets.

123. *Turdus fuscescens.* Not uncommon and probably more common than I believe; breeding in the region, as I once found one nest with four blue unspotted eggs, and killed the hen near by.

124. *Turdus ustulatus swainsoni.* As frequently seen as the preceding and also breeding in the region.

125. *Merula migratoria.* Very abundant summer visitor, and breeding in great numbers throughout the country.

126. *Sialia sialis.* Local and not uncommon, and breeding in suitable places.

BOOK NOTICES.

A REVISION OF THE GENERA AND SPECIES OF CANADIAN PALÆOZOIC CORALS, by Lawrence M. Lambe, Assistant Palæontologist to the Geological Survey of Canada. Contributions to Canadian Palæontology, Vol. IV., Part 1.

Students of Palæontology owe a debt of gratitude to Mr. Lawrence M. Lambe for undertaking such a task as the revision of the Canadian Palæozoic Corals. The literature on the subject is very difficult to obtain. The work of Billings, although published in Canada, is out of the reach of ordinary students; that of Nicholson was only partly published in Canada, his recent and most valuable work appearing only in expensive monographs and journals in Great Britain. Professors Hall and Rominger, the most prominent investigators in the United States, of Canadian fossil corals, have naturally published the results in that country, so that the plight of the Canadian who desires to study these organisms, but who has not a large palæontological library at his command, has been well nigh hopeless. But to those who have access to the extensive and scattered literature of palæozoic corals the condition of the nomenclature combined with the lack of pre cision in description and the inadequate illustration of the details of structure, has deterred from the study of corals many who have been steady workers in other branches of palæontology. In the the nature of palæontological investigation this condition must be present more or less in each of the main divisions of the animal and vegetable kingdoms as represented by fossils, until, after the collection of ample material, someone undertakes a revision similar to that of Mr. Lambe. The recent work of Wachsmuth and Springer in the camerate Crinoids, and of Hall and Clarke in the Brachiopods affords ample evidence of the necessity for patience in the accumulation of information before revision is justifiable.

The material in the possession of our Survey, gathered during the last half century from widely separated areas, and the accumulation of observations on fossil corals by the scientific world during that time, make it clear that the time for revision has come. The labour involved in this revision must have been very great, and at first sight it might seem out of proportion to the result if

we judge merely by pages and plates. In the ninety-six pages forming Part I, the *Madreporaria Perforata* and the *Alcyonaria* are dealt with, the remaining sections of the *Zoantharia* being reserved for the second part. The first part contains five plates and the second will contain thirteen. This seems a small compass in which to cover so much ground, but Mr. Lambe has succeeded admirably, and if his monograph closes with a sufficiently full index it will be invaluable as a point from which both to commence the investigation of a species and to conclude it after the various references have been examined. Mr. Lambe's revision, as usual, has resulted in the discovering of many synonyms, and thus a number of specific names become obsolete, but many species hitherto imperfectly recorded, both as to description and illustration, have been firmly established, and there has been a rectification of the generic and specific nomenclature throughout. His descriptions are precise and ample, and yet as briefly expressed as one could wish, dealing especially with points of structure hitherto overlooked, misunderstood, or, inadequately described.

Mr. Lambe's ability as a palæontological draughtsman is well known, and the illustrations are artistically what we would expect from him, but they also give important evidence of his ability in the selection of points to illustrate. Five octavo plates provide a very small field for illustrating such a large subject, and yet we think we may safely say that more satisfactory illustrations of fossil corals are not often seen. Mr. Lambe has not, of course, space in which to provide figures of the various species referred to in his revision and is limited to the details of species which have been imperfectly illustrated hitherto. In studying corals we find that illustrations of the general appearance of specimens found in a particular locality are frequently quite accurate but are nevertheless of little real service, but illustrations of details which may be vital in studying genera and species are generally unsatisfactory, and in this respect Mr. Lambe's work is admirable.

Mr. Lambe has now made a special study of living sponges and of fossil corals. The writer ventures to suggest that he should take up the Stromatoporoids. His previous studies will all be most valuable in this connection, and as Canada is so rich in these interesting and difficult forms, a monograph bringing be-

fore Canadian students the good work done by Nicholson, brought up to date and revised by Mr. Lambe, would be acceptable to students and creditable to the Palæontological Department of our Survey.—B. E. WALKER.

STORIES OF INSECT LIFE, Series I and II. By Clarence M. Weed and Mary E. Murtfeldt. (Ginn & Co., Boston.)

Two charming little booklets, of 54 and 72 pages respectively, have been issued by the above named well-known entomologists. These little books are well printed and freely illustrated. The articles treat of many common and well-known insects, and the most interesting features in the life histories or structures of insects are well presented. The main object of the authors has been well adhered to, viz., to lead the pupil to fuller observation of the insects about him and develop his perceptive faculties in such a way as to create a desire to discover the significance of their structure, colour and habits of life.

Series I consists of twenty short chapters written in just the simple, earnest language calculated to catch the attention and gain the confidence of children. There is hardly a long word, and not a Latin name in either of the books. Series I is intended to be used in the spring months, and consequently such insects as then occur are treated of, *e.g.*, the Tent Caterpillars, Cabbage Worms; Red and Black Tiger Caterpillar, Spring Butterflies, May Beetles, Ant lion, Potato Beetle, Lace-winged Fly, etc.

Series II is to be used during the latter part of the summer and autumn ; so we have chapters on insect musicians, including Cicadas, Crickets, Katydids ; the Pear Slug, Fireflies, Fall Webworms, Ladybird Beetles, Tomato worms, Praying Mantis, etc. These little books will help, we believe, to open the eyes of many boys and girls to the delights to be found in the study of the common insects around them and perhaps, later, may prove to have been a means of first turning to the useful study of Economic Entomology, one who may develop into a shining light of that brands of science.

J. F.

GLEANINGS FROM NATURE. By W. S. Blatchley. 8vo. Indianapolis, 1899.

Elementary books of general natural history dealing in a scientifically accurate but popular way with common objects of the country are by far too few. The general statement may be made that everone is largely interested in natural history, although many do not know it until an accidental occurrence turns their attention to something which forms a stepping-stone into the wondrous fairyland in which the naturalist lives.

Professor Blatchley has recently published some of his "Gleanings from nature" in a well printed, particularly well illustrated, neat volume of 350 pages. This book is based upon extensive observations made directly from nature in the woods and fields of Indiana, and is an effort, and a most successful one, to present, in language that all can understand, primarily, to the 800,000 boys and girls on the farms of Indiana to whom it is dedicated, facts concerning some of the commoner plants and animals which are our friends, our helpers and our neighbors in the country. The first chapter is appropriately entitled Harbingers of Spring. The chapters are, for the most part, short and are crisply written, showing that the matter presented has been gathered by the writer from his own observations and gives the idea that he knew more about the subjects treated of than it was convenient to write about in the present volume. Prof. Blatchley has made a special study of several branches of natural history. These, as might be expected, are treated of at rather greater length than others. It may be thought by some who do not live in the Hoosier State that an undue space is given to the Indiana caves, but it must be remembered that these are of special interest to those for whom the book was written, and others will be well repaid a perusal of Gleanings from Nature by several other chapters on subjects seldom written about: The chapters on Snakes, Birds, and Katydids and their Kin, are specially attractive. Twelve Winter Birds and Plants and Animals in Winter, will be read with pleasure by all whether naturalists or not.

Two or three of the illustrations are particularly beautiful.

Special attention may be drawn to these of the Skunk Cabbage, the Banded Rattlesnake, Washington's Monument in the Marengo Cave and Winter Birds.—J. F.

ANNOUNCEMENTS.

The first of the General Excursions of the Club will be held on Saturday afternoon, May 26th, when Chelsea, that favorite and most picturesque hunting ground of our local naturalists, will be again visited. This locality presents such a variety of attractions that it is never exhausted. The convenience of reaching it too by the Gatineau Valley Railway makes it possible to enjoy an excursion into this beautiful part of the country and return again to Ottawa thoroughly tired out and satisfied, at the expense of only half a day's time. As usual, leaders in all the different branches will be in attendance, willing and anxious to give assistance to all desiring information concerning their favorite studies. Addresses will be delivered at the end of the day, and the excursion will start at the ordinary time advertised by the railway, leaving Ottawa somewhere about 1 o'clock, and returning about 7 or 8 o'clock in the evening. The summer time-table is not yet published, but this will be about the time. Tickets will be obtainable from members of the Council, who will be in attendance at the railway station a quarter of an hour before the train starts. It is hoped that some Fellows of the Royal Society will be present.

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SOILS AND THE MAINTENANCE OF THEIR FERTILITY THROUGH THE GROWTH OF LEGUMES.

By FRANK T. SHUTT, M.A., F.I.C., F.C.S., F.R.S.C.,
Chemist, Dominion Experimental Farms.

Four years ago I had the honour to bring before the members of the Montreal Natural History Society an account of the work accomplished by the Chemical Division of the Experimental Farms during the eight years that had passed since these valuable institutions, designed to promote the agricultural interests of Canada, had been established by our Government.* In that brief review it was shown that our chemical work practically covered the whole field of agriculture, and included the analysis of soils, naturally-occurring fertilizers fodders, dairy products, insecticides and fungicides, in addition to the carrying on of such investigations in connection with economic plant and animal production as required the aid of chemistry for their successful prosecution.

On the present occasion, instead of making a general *resumé* of our researches and results, I purpose considering a single branch of investigation, one that has been carried on in the fields and laboratories of the Experimental Farm with signal success and that has yielded results of the highest value to those who wish to maintain or recover the productiveness of their land. I refer to to the improvement of soils through the growth of legumes.

* A lecture delivered in the Summerville Course (Montreal), April 1896, and entitled "Chemical Work in Canadian Agriculture."

PLANT FOOD AND ITS SOURCES.

To understand and appreciate the full significance of my subject, the improvement and recuperation of soils by the growth of legumes, it will be necessary for us to first consider the sources of plant food, the nature of soils, and the manner in which soils are affected by cultivation.

The analysis of plants shows that they are composed of some thirteen chemical elements, present, as might be expected, in varying proportions, according to the nature of the plant and the part of it examined. Though these are built up by the plant into numerous combinations, we can readily recognize in all vegetable structure three distinct classes of compounds, viz.: water, mineral or ash compounds, and organic compounds. The elements comprising these are drawn from two sources, the atmosphere and the soil, both of which, as we shall see, furnish this food in forms or compounds suitable to plant life, for it is well to remember that the uncombined elements are practically valueless, considered as plant foods for farm crops.

The following scheme permits one to see at a glance the constituents of plant food, their sources and products:

PLANT CONSTITUENTS.

2 Soils

THE ORGANIC ELEMENTS	Carbon, Oxygen	Carbonic Acid	Starch, Sugar, Fibre, Oil	Albuminoids	AIR DERIVED ELEMENTS
	Hydrogen	Water			
	NITROGEN				
THE INORGANIC ELEMENTS	Calcium, Magnesium, POTASSIUM, Sodium, Iron, Manganese		PHOSPHORUS, Silicon, Sulphur, Chlorine		SOIL DERIVED ELEMENTS

The carbonic acid gas of the air, though present only to the extent of 4 parts in 10,000, furnishes all the carbon required for the organic compounds of plants, of which starch, sugar and albumen are the chief. These compounds constitute fully 80 per cent. of their water-free substance, and are those which give to all vegetable tissues their chief value as food for man and beast. Some idea of the extent to which plants appropriate their nourishment from this source may be gained from the statement that an acre of wheat, by virtue of the green colouring matter of its foliage in the presence of the sunlight, will remove during its season of growth nearly one ton of carbon, or as much as would be contained in a column of air over that area three miles in height. Though this is a very large amount, the practical agriculturist needs not to concern himself with this class of food; for nature always furnishes an abundant, a practically unlimited, supply.

Water is invariably found in all the tissues of plants, from 75 to 95 per cent., as in green stem and foliage, to 8 or 10 per cent., as in the seed. From one point of view, water is to be regarded as the most important of all forms of plant food, since without it all other nourishment is unavailable. Though not of the soil, looked at geologically, it is only water present in the soil which is of use to plants. Their whole supply is drawn by the rootlets from this source. Apart from irrigation, we can only indirectly control this supply. Indirect methods for the conservation of soil moisture, chief of which are under-drainage and surface cultivation (which by the formation of a dry earth mulch arrests or checks surface evaporation), are now considered matters of the greatest importance and worthy of equal consideration with problems for supplying plant food. For indeed water not only forms a large proportion of all plant tissues, but it is the vehicle whereby all soil food is appropriated and assimilated. That nourishment which plants take from the air is certainly in the form of a gas, but that which they absorb from the soil must be in the form of a dilute solution. Solids, as such, cannot be utilized; they must first be dissolved. If they cannot be attacked either by the soil water or the slightly acid fluid that exudes from the rootlets, then no matter how rich such solid materials may be in food constituents, they are of no value to crops. The knowledge of this

fact has within the last few years led to many important changes in the use and application of the so-called chemical fertilizers.

The amount of water used by crops in their feeding, that is, absorbed by their roots and lost by transpiration through their leaves, is enormous, equalling several hundred of tons per acre. Taking the mean of a number of determinations, Hellriegel found that for every ton of dry matter produced in plants, in the neighbourhood of 325 tons of water were required. An acre of Indian corn probably uses in this way during its growth 1,000 tons of water.

Notwithstanding these considerations, it is, from the practical standpoint, those elements, or rather compounds, other than water, withdrawn from the soil that, as agriculturists, we must regard as most important. It is their removal by successive cropping without any concomitant return, that results in soil exhaustion and reduces the yield below the mark of economical production.

What are these elements? First, there are the mineral or ash constituents. These comprise calcium, magnesium, iron, potassium, sodium, silicon, sulphur, phosphorus and chlorine, and occasionally traces of several of the rarer elements. As already explained, these are found in the plant variously combined, and not in the elemental condition. They form, say, from .1 per cent. to 3.0 per cent. of the weight of fresh plant tissue, the proportion depending largely on the part examined. Though crops differ in their demands for ash constituents, the amount withdrawn per acre by average yields of farm crops usually lies between 200 lbs. and 300 lbs.

Now with regard to the above-mentioned elements, the majority of them are present in soils in quantities so abundant, and the amounts required by plants by comparison so extremely small, that their return to the soil by the farmer may be neglected. Indeed, as the result of scientific research as well as of practical experience, it is known that to maintain fertility—as far as these inorganic constituents are concerned—it is only necessary generally to replace two or, at most, three of them. They are commonly spoken of in agriculture as potash and phosphoric acid, with lime as third in importance.

The following table presents the approximate amounts of these elements abstracted, per acre, by some of the more common farm crops:

PLANT FOOD REMOVED BY CROPS.*

CROP.	POUNDS PER ACRE.						
	Gross Weight.	Nitro-gen.	Phos. Acid.	Pot-ash.	Lime.	Silica.	Total Ash.
Wheat, 20 bush.	1,200	25	12.5	7	1	1	25
Straw	2,000	10	7.5	28	7	115	185
Total	.....	35	20	35	8	116	210
Barley, 40 bush.	1,920	28	15	8	1	12	40
Straw	3,000	12	5	30	8	60	176
Total	.....	40	20	38	9	72	216
Oats, 50 bush.	1,600	35	12	10	1.5	15	55
Straw	3,000	15	6	35	9.5	60	150
Total	.....	50	18	45	11.0	75	205
Corn, 65 bush.	2,200	40	18	15	1	1	40
Stalks	3,000	35	2	45	11	89	160
	.....	75	20	60	12	90	200
Peas, 30 bush.	1,800	.....	18	22	1	1	64
Straw	3,500	.....	7	38	71	9	176
Total	.....	.....	25	60	75	10	240
Mangels, 10 tons	20,000	75	35	150	30	10	350
Meadow Hay, 1 ton	2,000	30	20	45	12	50	175
Red Clover Hay, 2 tons	4,000	.....	28	66	75	15	250
Potatoes, 150 bush.	9,000	40	20	75	25	4	125
Flax, 15 bush.	900	39	15	8	3	.5	34
Straw	1,800	15	3	19	13	3	33
Total	.....	54	18	27	16	3.5	87

* The Chemistry of Soils and Fertilizers, Snyder.

Secondly, we have nitrogen. The percentage of this element in the tissues of plants will vary from .1 to 3.0, the largest proportion being found in the seeds. With the exception of the legumes, farm crops, indeed all plants, obtain their necessary supply of nitrogen from that contained in the humus of the soil. This so-called organic nitrogen is not directly assimilable, but must first be converted by certain soil micro-organisms into compounds known as nitrates. The process by which this change of inert nitrogen into valuable food forms takes place, is known as nitrification and is one of the most remarkable and important in the whole field of agriculture.

The amounts of nitrogen as nitrates consumed by crops is variable; while some remove not more than 20 lbs. per acre, others utilize 100 lbs. or more. Of the legumes (clover, peas, beans, &c.) and the source of their nitrogen we shall speak more particularly later on.

The cropping of the land, therefore, we are to understand, depletes it more particularly of certain amounts of potash, phosphoric acid, and nitrogen—the so-called essential elements of fertility. To maintain productiveness, it is essential that the stores of these elements in available forms be preserved; to increase productiveness they must be added to.

The rate of soil exhaustion is indicated by the subjoined data of an orchard and field crop.

ESSENTIAL ELEMENTS OF FERTILITY REMOVED APPROXIMATELY IN 20 YEARS FROM AN ACRE OF SOIL.

	Nitrogen. Lbs.	Potash. Lbs.	Phos. Acid. Lbs.
Apples, fruit, leaves and wood (trees in full bearing)	1,300	1,800	300
Wheat, grain and straw	700	700	400
Mangels, roots and tops	1,500	3,000	700

THE NATURE OF SOILS.

Having now taken this cursory review of the plant's requirements, we must turn our attention to soils, and learn somewhat of their nature and the manner in which they are affected by cultivation. All arable soils consist chiefly of two classes of con-

stituents : mineral or inorganic, derived from the disintegration of the original rock surface of the earth, and organic, resulting from the decay of past generations of plants, and grouped under the general term humus. Besides these, air and water are present, making the soil a suitable and comfortable medium for the growth of plants, and playing an important part in the preparation of their food. And, lastly, as we have learned in recent years, there are in every fertile soil myriads of micro-organisms, working, under conditions that afford them warmth and moisture and air, in the convertion of inert or locked-up plant nourishment of the soil into substances and compounds more or less immediately available for crops. The transformation of the useless nitrogen of humus, first into nitrites and finally into nitrates, is an important example of the valuable work done for agriculture by these microscopic plants.

We must not now stay to consider in detail the origin of soils nor the various natural agencies and forces that have been and are now at work in their formation. The whole subject is one of peculiar interest and magnitude, and merits a much more careful and systematic treatment than would be possible in this lecture. I can do little more than mention the fact that agriculturally, as well as geologically, the name of soils is legion. There are clay soils and sandy soils, so called from the predominance of clay and sand respectively, and soils rich in humus, and a host of intermediate soils known as loams. Save in the case of transported soils, such as the deltaic soils formed at the mouth of rivers, their mineralogical composition will accord with that of the underlying rock. But whatever the nature of soils, their chief agricultural function always remains the same, viz., to furnish certain mineral substances, among which potash, phosphoric acid and lime are the most prominent ; to offer, in combined forms, nitrogen, a further essential for plant life ; to hold moisture and air necessary for the growth of plants, and to form a firm, comfortable and warm support for their growth.

Before proceeding to speak of the amounts of plant food in soils, it is desirable that I should call your attention to the importance of humus as a soil constituent, since the method of employing clover at a fertilizer, which I am to bring before you

to-night, is dependent in a very large degree for its value upon the fact that it adds vast quantities of this material to the soil. I shall endeavour to do this very briefly.

THE AGRICULTURAL IMPORTANCE OF HUMUS.

1st. It is the natural store-house and conservator of nitrogen, which element is the most expensive of all plant foods when it becomes necessary to purchase it in commercial fertilizers.

2nd. It furnishes the food upon which the soil micro-organisms live and which by their life functions convert its organic nitrogen into nitrates.

3rd. It possesses considerable amounts of the mineral food constituents. These, in the further decomposition of the humus—a process continually going on in summer—are liberated in forms available to growing crops. We have reason to believe from recent research that the mineral humates furnish a large proportion of the potash, lime, etc., used by crops.

4th. It serves to increase the absorptive and retentive power of soils for moisture.

5th. It regulates and protects against extremes of soil temperature.

6th. It opens up and mellows heavy soils.

7th. It serves to materially diminish the loss of fertilizing elements by drainage, thus permanently improving in the best way light soils.

From these considerations, it is evident that humus is to be regarded as a soil component of a very high order.

The relation of humus content to nitrogen present in soils of similar origin under similar meteorological conditions, is practically constant. It has been noticed that the amount of humus present gives an excellent though not an infallible indication of the amount of organic nitrogen the soil possesses. Further, it has been observed that as the humus disappears the nitrogen goes with it. Cultivation, that is, exposing the substance of the soil to the air, as by our ordinary farm methods with the plow, harrow, etc., tends to dissipate the humus and, as a natural consequence, to decrease the nitrogen. Soils growing grain exclusively year after

year lose, it is stated, more nitrogen by this humus oxidation than is removed in the crop, and this loss is greatest in those soils which are richest in nitrogen. At the Minnesota Experiment Station it was determined that for every 25 pounds of nitrogen absorbed by the crop (grain following grain for a number of years) 146 pounds of nitrogen were lost, due to oxidation of organic matter.

These facts are of the widest importance and worthy of study by our farmers not only in the older provinces, but also in those Western areas which to-day are overlaid by such phenomenally fine soils.

During the past twelve years a great many Canadian soils—both virgin and cultivated—have been examined in the laboratories of the Experimental Farms. We have placed on record in our reports complete analyses of over one hundred samples, and data of a more or less incomplete character respecting many more. The soils examined are representative of many districts and large areas in all the provinces of the Dominion,* but we cannot now discuss the data of these analyses in detail. It must suffice to say that judged by the standards accepted by agricultural chemists we find many soils in Canada fully as rich in plant food as the most fertile soils of any part of the world. I refer now particularly to soils over large areas in Manitoba and the Northwest Territories—quite the equal, as shown by analysis, of the renowned black soil of Russia. In all the other provinces there are virgin soils of more than average fertility, comparing most favourably with those of other countries. As is only natural to expect, there are areas also of poor, impoverished soils.

It is well to have some idea of the amounts of plant food contained in an acre of soil, taken, say, to a depth of eight inches, a quantity that would weigh in the neighbourhood of 2,500,000 lbs. From data obtained in the Experimental Farm laboratories, I estimate our soils of extreme richness will contain from 10,000 to 20,000 lbs. of nitrogen, from 15,000 to 25,000 lbs. of potash, and

* In the year 1897 a paper giving the results of our soil work to date was presented to the Chemical Section of the British Association. It appears *in extenso* in the Report of the Chemical Division of the Experimental Farms, 1897.

from 5,000 to 10,000 lbs. of phosphoric acid. Similarly, in soils of good average fertility we find : nitrogen, 2,500 to 5,000 lbs.; potash, 5,500 to 11,000 lbs., and phosphoric acid 3,500 to 6,000 lbs.

From comparing these figures with those that I gave representing the amounts used by various crops, it would at first sight appear as if adding plant food to the soil were quite unnecessary, a "carrying of coals to Newcastle"; that where there is such an abundance of food there would be no economy in supplying more. The explanation lies in the fact that while the vast stores that we have mentioned are truly present, but a *very small percentage of them is immediately available to plants.* In this we recognize a wise provision of nature, for if it were otherwise soils might soon become exhausted by the leaching of the food constituents below the reach of roots, and by the selfish practices of farmers who care nought for posterity and return nothing to the soil. I have alluded to the agencies and forces instrumental in soil formation; it is by a continuation of these and by the solvent action of root sap that soil constituents are being continually prepared for the use of the higher plants. We have to recognize that the very small proportion of the nitrogen present as nitrates, and those minute percentages of phosphoric acid and potash soluble in water or in 1% citric acid solution—a solvent of approximately the same activity and strength as root sap—represent all the quantities immediately available to crops, and give a measure of the soil's productiveness. We have made determinations of this soluble plant food in many Canadian soils. One instance is given below of a rich and fertile black loam from British Columbia.*

*COMPARISON of "Available" with "Total" Amounts of Potash and Phosphoric Acid.

No.	Soil.	Potash.			Phosphoric Acid.		
		Total Potash.	Available Potash.	Percentage of total Potash available for plant use.	Total Phosphoric Acid.	Available Phosphoric Acid.	Percentage of total Phosphoric Acid available for plant use.
1	Surface	0.23	0.00483	2.20	0.19	0.01020	5.66
2	Between 12 and 18 ins.	0.23	0.00299	1.36	0.19	0.01055	5.85
3	Between 18 and 24 ins.	0.26	0.00169	0.64	0.12	0.00588	4.90

From the data presented it is evident that the amounts per acre of mineral plant food of immediate agricultural value are very small, compared with the amounts of total plant food present. Nor must we suppose that the whole of these supplies—small as they are—can be secured by any crop, for its root system occupies necessarily a more or less restricted area and does not envelope every soil particle. A poor physical condition of the soil and lack of sufficient moisture are factors that still further prevent the utilization of this available plant food. One of the chief functions of mechanical processes for disturbing soil is to hasten the conversion of inert material into these more valuable compounds. The principal object—indeed, in most instances the only object—in applying manures and fertilizers is to add to this store of available plant food. The quantity of soluble food so added is insignificant, compared with that already present in an insoluble state, but the increased yields resulting, fully corroborate the statement that a soil's productiveness should be measured by the amounts of its plant food which are more or less available, rather than by the amounts of that shown by extraction by a method of analysis employing strong mineral acids. This view can scarcely be unduly emphasized; it explains, as we shall see, in a large degree, the value of the clover crop as a fertilizer, which we shall now consider.

We have already mentioned that the legumes—of which clover is a prominent member—have a source for their nitrogen other than and additional to that present in the soil. Like other plants, they are unable to absorb free nitrogen of the air through their leaves ; like in other plants, that which they absorb through their rootlets must be as nitrates. In what way, then, is the indisputable fact that they can make use of atmospheric nitrogen to be explained ? The careful researches of Hellriegel, Wilfarth, and other chemists have shown that the legumes obtain the nitrogen of the air existing in the interstices between the soil particles through the agency of certain micro-organisms present in the soil. These bacteria, whose special function is the assimilation of free nitrogen, attach themselves to the roots of the growing clover or other legume, forming thereon nodules or tubercles. These nodules, swarming with countless hosts of the germs, are to be found in sizes varying from a pin's head to a pea, and frequently

scattered in vast numbers over the roots of the legume. When they are not present, the clover, as regards its nitrogenous food, is in the same category as other plants. The nitrogen elaborated by these microbes is passed on to the host plant and there built up into the usual nitrogenous compounds of the tissues of the roots, stem and leaves. These facts, so briefly put, represent the most important discovery in agricultural science of the nineteenth century.

For the reason that, as far as we know, the legumes alone offer themselves as suitable hosts to these germs and are thus able to appropriate nitrogen that is useless to all other vegetation, they have been termed nitrogen-collectors. All other plants, in contradistinction, are known as nitrogen-consumers. The legumes are especially rich in nitrogen, and though we are unable to say exactly what proportion of this element is taken by them from the air by the means I have mentioned, we may be sure that under favourable conditions the greater part is from that source.

To be continued.

THE LABRADOR FLYING SQUIRREL.

By J. D. SORNBORGER, Cambridge, Mass., U.S.

Three specimens of *Sciuropterus*, sent me by my friend Rev. Walter W. Perrett, from Makkovik, Labrador, seem so different from previously described forms, that I propose for them the name : SCIUROPTERUS SABRINUS MAKKOVIKENSIS, new subspecies, the Labrador Flying Squirrel.

Both above and below, this form is the darkest of the flying squirrels of eastern North America. The composition of its predominant colours, compared with those of a specimen from Moose Factory, by means of the colour top,* is approximately :

* The "colour top" made by the Milton Bradley Company, of Springfield, Mass. See C. B. Davenport, Science, 1899, p. 416 ; A. G. Mayer, Proc. Bost. Soc., Vol. XXVII, p. 246. This method of colour determination was suggested to me by Prof. C. B. Davenport, now of the University of Chicago, and, though subject to many limitations, is, in most instances, far better than any other method known to me.

		% Black.	% Red.	% Yellow.	% White.
Labrador specimens	Above	40.	40.	15.	5.
	Below	10.	17.	13.	60.
Moose Factory specimen	Above	35.	40.	19.	6.
	Below	3.	1.	32.	64.

Above, however, it is darker than the table shows. Only tawny areas were matched with the colour top, the scattered black hairs and the black tips of the party-coloured hairs were, so far as possible, ignored since it was impracticable to accurately measure their effect.

The proportions of colours on the party-coloured hairs of a number of specimens from various localities are approximately:

	Plumbeous.	Tawny.	Black.
Labrador specimens	17.	4.	2.-3.
Moose Factory	15.	5.	0.
Cumberland House	19.	3.	a trace
Matamagaminque, Canada	17.	4.	0.

The skin from Cumberland House is the most like the Labrador form in the colour of the back of any I have examined.

Perhaps the most noticeable character of *makkovikensis* is the sooty tail, which is darkened for more than half its length. A skin in the collection of Mr. C. F. Batchelder, from Tadousac, Quebec, though immature and in summer pelage, approximates this condition, and it would seem to show that the conditions producing the dark form are operative at least so far west on the north shore of the St. Lawrence as the Saguenay River.

From a comparison of the measurements given in this article *S. s. makkovikensis* may be assumed to be the largest of North American flying-squirrels with perhaps the exception of *S. alpinus* (and specimens from Alaska ?).

My acknowledgments are due to Mr. Outram Bangs, Mr. C. F. Batchelder, Mr. Gerrit S. Miller, Jr., of the U. S. National Museum, and particularly to Dr. Walter Faxon, of the Museum of Comparative Zoology, for the use of material and for other favours received.

CRANIAL MEASUREMENTS (in millimeters).

	Anterior end of nasal to anterior end of supraoccipital.	Greatest length of lower jaw.	Length of lower molar series on alveoli.	Greatest zygomatic breadth.	Least interorbital breadth.	Medial length of frontals.	Basilar length of Hensel.
7709. Collection of E. A. & O. Bangs. ♂	38.	23.4	8.	21.	8.	14.	30.8
7710. Collection of E. A. & O. Bangs. ♀	41.4	25.9	8.	25.	8.9	16.	33.
7711. Collection of E. A. & O. Bangs. ♀	39.3	21.	8.	26.2	9.	15.2	
4915. Collection of E. A. & O. Bangs. ♂	35.	21.	7.	21.2	7.5	15.	27.9
4958. Collection of E. A. & O. Bangs. ♀	36.	22.3	6.7	22.4	7.1	14.	29.
4959. Collection of E. A. & O. Bangs. ♂	35.	21.3	6.9	22.	6.9	14.2	27.9
37216. Collection of the U. S. N. Museum	.....	....	....	23.2	7.8	16.	
1540. Collection of J. D. Sornborger ...	.....	25.	8.2	24.	8.1	16.1	32.
1541. Collection of J. D. Sornborger ...	.....	25.	8.2	25.	8.2	16.	
1542. Collection of J. D. Sornborger ...	39.2	24.2	8.	23.6	8.	16.	

LENGTH OF HIND FEET (in millimeters, from dry skins).

7709. Collection of E. A. & O. Bangs	40.	39.5
7710. Collection of E. A. & O. Bangs	37.	37.5
7711. Collection of E. A. & O. Bangs	37.5	37.5
7069. Collection of the U. S. National Museum	41.	41.
6505. Collection of the U. S. National Museum	40.	
5515. Collection of the Museum of Comparative Zoology	40.	39.5
7189. Collection of the U. S. National Museum.....	38.	38.
7190. Collection of the U. S. National Museum.....	49.	
5430. Collection of the Museum of Comparative Zoology	40.	39.5
5431. Collection of the Museum of Comparative Zoology	38.	39.
1624. Collection of C. F. Batchelder.....	36.	35.
1540. Collection of J. D. Sornborger.....	40.5	
1541. Collection of J. D. Sornborger.....	41.	42.
1542. Collection of J. D. Sornborger.....	42.	

MATERIAL EXAMINED.

Fort Yukon, Alaska.

5433. Collection of the Museum of Comparative Zoology.

Tongas, Alaska.

5435. Collection of the Museum of Comparative Zoology.

Big Island, Great Slave Lake.

7069. Collection of the U. S. National Museum.

6505. Collection of the U. S. National Museum.

5432. Collection of the Museum of Comparative Zoology.

Red River Settlements.
5438. Collection of the Museum of Comparative Zoology.
Red River.
5439. Collection of the Museum of Comparative Zoology.
Selkirk Settlements.
5437. Collection of the Museum of Comparative Zoology.
Red Deer, Alberta.
7710. Collection of E. A. & O. Bangs.
7711. Collection of E. A. & O. Bangs.
Gull Lake, Alberta.
7709. Collection of E. A. & O. Bangs.
Idaho Co., Idaho.
6960. Collection of E. A. & O. Bangs.
Idaho.
5435. Collection of the Museum of Comparative Zoology.
Home Bay.
5516. Collection of the Museum of Comparative Zoology.
Cumberland House.
22030. Collection of the U. S. National Museum.
Hudson Bay.
13189. Collection of the U. S. National Museum.
Moose Factory.
5515. Collection of the Museum of Comparative Zoology.
Lake Superior.
1563. Collection of the Museum of Comparative Zoology.
Matamagaminque, Canada.
5430. Collection of the Museum of Comparative Zoology.
5431. Collection of the Museum of Comparative Zoology.
7189. Collection of the U. S. National Museum.
7190. Collection of the U. S. National Museum.
Greenville, Maine.
4915. Collection of E. A. & O. Bangs.
Digby, Nova Scotia.
2032. Collection of E. A. & O. Bangs.
Pak's Cove, Nova Scotia.
4958. Collection of E. A. & O. Bangs.
4959. Collection of E. A. & O. Bangs.
Tadousac, Quebec.
1624. Collection of C. F. Batchelder.
Makkovik, Labrador.
1540. Collection of J. D. Sornborger.
1541. Collection of J. D. Sornborger.
1542. Collection of J. D. Sornborber.
SKULL.—37216. Collection of the U. S. National Museum.
Matamagaminque, Canada.

BIRD NOTES, ETC.

The sub-editors will be much obliged if members will send them notes of interest for publication. These should be sent in before the 15th of each month.

ADVERTISEMENTS.

The Council directs the attention of the readers of THE OTTAWA NATURALIST to our advertisers and solicits patronage for these firms.

MENTE ET MALLEO.—At the recent Convocation in the Faculty of Arts of McGill University, Montreal, the degree of LL.D. (Doctor of Laws) was conferred upon Mr. Joseph F. Whiteaves, F.G.S., Palæontologist and Zoologist of the Geological Survey of Canada, for distinguished services in the two fields of scientific research with which he is officially connected at Ottawa. Dr. F. D. Adams, Logan Professor of Geology at McGill, introduced Mr. Whiteaves to Principal Peterson, the Chancellor and other members of Convocation present. Dr. Whiteaves has been a member of the Club for nearly twenty years.

Alfred Ernest Barlow, M.A. of McGill University, and also of the Geological Survey, well known for his advanced views and researches in the geology of the primitive crust of the earth as exhibited in portions of Eastern Canada, received the post-graduate degree of D.Sc. (Doctor of Science) in course at the same Convocation. Dr. Barlow is one of the Associate-Editors of THE OTTAWA NATURALIST.

We tender our hearty congratulations to both, and trust that they may be spared for many years to continue their valuable investigations for the advancement of science in Canada.

THE TWO-LINED SALAMANDER, *SPELERPES BILINEATUS* (Green).

By WALTER S. ODELL, Ottawa.

This active amphibian is, according to Prof. Wilder, widely distributed over the United States, and presumably over Canada, but on account of its habits may not be readily found. The adult newt is from seven to nine c.m. in length, resembling the general form of lizards. The head is long and flat, the body graceful and slender, having a flattened tapering tail-fin about half its length. *Spelerpes* in colour is dark brown with a dorsal stripe light brown or fawn colour, lighter at its outer edges and bordered by a dark brown stripe—hence its name "*bilineatus*." It is marbled along the sides; the ventral side is a light lemon colour, without pigment spots. Its heart, like that of frogs, has but one auricle, while the heart of lizards has two. But unlike the frogs it has no lungs, but depends upon the surface of its integument and the walls of the pharynx for respiration. As it is nocturnal in its habits, the adult is not frequently seen.

LOCALITY AND HABITAT.—The adults are found in and about running brooks plentifully supplied with small stones, and underneath bits of fallen logs that lie in the immediate vicinity of the edges of brooks. The larvæ are sought for in water at the bottoms of gravelly pools or underneath flat stones in springs or small mountain brooks. They much resemble small minnows at this stage, and when disturbed dart away with as great swiftness. It was this fact which first brought them to my attention. Finding several so-called minnows in a tiny spring in the gravel pits at Britannia, where it was unlikely minnows would be found, I was led to examine them closer, and to my surprise found a strange animal, between an eel and a minnow, with a head like the latter, having gills projecting like horns from each side; with four feet having toes not webbed, and with a long tail like an eel's.

Specimens were sent to Prof. L. Stejneger of the Smithsonian Institution at Washington. He very kindly identified them for me, and also referred me to Prof. Wilder, Northampton, Mass.,

who is the author of a paper on this subject. I had been unable to obtain adults, although the Hon. F. R. Latchford in a short paper *re* "Ottawa Salamanders," in THE OTTAWA NATURALIST, January, 1877, described where several species were found. From information as to habitat gathered in Prof. Wilder's papers, several larvæ were found without difficulty when Britannia was visited on Christmas Day. On the 20th January, 1900, four adults and seven larvæ were collected, but as I neglected to replace the cover on the aquarium, three adults escaped into the room and were never found, even after most careful search. The remaining adult remained in the aquarium, only because through some accident he was minus a tail when found, and was thus unable to climb over the edge. From the 20th January to the 12th February his tail had grown 7 mm. and has since grown to date, March 5th, 1.5 cm. Since specimens were obtained on the 1st September, 1899, and later, little opportunity has been found for observing their development. The following notes on the eggs are from Prof. Wilder's admirable paper, not from observation.

The eggs of *S. bilineatus* may be obtained during May and June. He records them as found between May 27 and June 12 in Massachusets; here a little later. "They are deposited in a single layer on the lower side of submerged stones, each batch containing from 30 to 50 eggs, generally in the more rapidly flowing portions of the brook, attached separately to the surface of the stone by gelatinous threads proceeding from the outer envelope. Within the eggs the embryos lie free. When the stone is overturned the eggs resume their normal position.....The eggs are protected by three membranes, two that fit closely and an outer loose one.....It is by means of strings proceeding from this that they are attached to the surface of the stone.....The eggs are holoblastic, lack the black pigment of the frog's egg, and hatch in from 15 to 17 days.....The young swim actively when hatched, which they do early, and continue for a long time in the larval state, probably two to three years."

These Salamanders in their larval state are suitable specimens for an aquarium, requiring little attention if placed along with some of the water moss, *Fontinalis*. One placed in a jar with *Fontinalis* last September has not been touched since, merely a

little water supplied at intervals and feeding small larvæ of flies have been his only care.

"The adults, because of their peculiarities in respiration and the consequent necessity of keeping their skin moist, cannot be kept either in water or a dry atmosphere, but may easily be kept for months in an ordinary fernery where the atmosphere is constantly saturated with moisture."

The adults here exhibited have been kept since Christmas, 1899, in a small fernery made for the purpose 10″ x 10″ x 14″ holding a shallow zinc tray one half of which is planted with the ordinary greenhouse plant called Lycopodium, the other is coarse sand and gravel; in this sand a small dish is sunk level containing water. This miniature tank is an aquarium on a small scale and contains small stones, gravel and sand, *Anacharis* and *Spirogyra*, and furnishes a suitable abode for some small larvæ. It supplies at the same time sufficient moisture for the adults and for the Lycopodium. A glass cover must be kept at all times over the fernery to prevent the escape of the captives, who seem to require little food. Mine have had some larvæ of flies occasionally put in the small tank; no other attention has been given them.

ZOOLOGICAL NOTES.

1. THE SQUID, IN ST. JOHN HARBOUR, SEPT. 2, 1899.

While in the City of St. John, N.B., I had the privilege to witness a sight which was both unusual and interesting, and, in my estimation, worthy of record. On the morning of September 2nd, 1899, the harbour of St. John, in many of its approaches and shores was visited or literally infested with an unprecedentedly large school of Squids (*Ommatostrephes illecebrosa*, LeSueur). This is the common "squid" of the Gulf of St. Lawrence, Newfoundland and North Atlantic waters, generally used by fishermen as bait in the cod fishery, and belongs to the section *Decapoda* of the *Cephalopoda dibranchiata*. My attention was first called to the occurrence of this creature by a number of small boys who had in their possession a number of narrowly elongate and transparent or hyaline shafts or arrow-like pens about nine inches in length.

On reaching the basin at the foot of King street, I noticed the shores literally strewn with the dead bodies of these calamaries or sea-arrows, as they are sometimes called. I was informed by sailors on the wharf that between fifty and sixty barrels had been gathered that morning, between tides, by Norwegian sailors. They are considered good eating by many, although not used to any extent in this direction in Canada. Captain Ross, an old seaman and resident of St. John, who visited the harbour that day, informed me that "squid" is extremely rare in St. John harbour.

Mr. Robert Chalmers, of the Geological Survey of Canada, informs me that in 1886 a school of squids visited the passage between Miscou and Shippegan Island, said to be chased by cod. Three specimens of this species from St. John Harbour were secured by the writer and preserved in alcohol. They are now in the National Museum, Ottawa.

There were many persons in St. John who held the view that the squid seen in the harbour that day had been chased by some whale.—H. M. A.

2. BRITISH AMERICAN ECHINODERMS.

During the voyage of H. M. S. Challenger in the Norts Atlantic, a number of echinoderms were obtained in the dredgiing which may help to throw light upon the doubtful form obtaned by the writer in one ofthe calcareous nodules from the Pleistocene clays of Besserers,* near Ottawa, and recently noticed by Sir Wm. Dawson in the December issue of THE OTTAWA NATURALIST.

In the Challenger report on the Echinodermata by Alex. Agassiz, part 9, 1881, on page 201, *Schizaster fragilis* is recorded from "off the coast of Nova Scotia," and on page 221 the same species is also recorded from the Gulf of St. Lawrence.

Strongylocentrotus Drobachiensis is recorded on page 211 from the east coast of America, and is found most abundantly throughout the shallows of the shores of the Maritime Provinces.

Echinus acutus, Lamarck, was obtained off "Halifax" as recorded on page 13, whilst *Echinus elegans*, Dub. & Kov., also occurs there.

Echinarachnius parma, Gray, was collected off the coast of Labrador.

Echinarachnius parma, Gray, and *Strongylocentrotus Franciscanus*, A. Ag., on pages 216 and 212 respectively of the same Challenger report, from the Pacific waters of the St. George's Bank, Vancouver Island.—H. M. A.

* "Note on an Echinoderm, etc." OTTAWA NATURALIST, Vol. 13, No. 9, pp. 201—203. December, 1899.

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SOILS AND THE MAINTENANCE OF THEIR FERTILITY THROUGH THE GROWTH OF LEGUMES.

By FRANK T. SHUTT, M.A., F.I.C., F.C.S., F.R.S.C.,

Chemist, Dominion Experimental Farms.

(*Continued.*)

The chief value of green manuring, as the system of ploughing under a growing crop of clover is called, lies in the addition of nitrogen, otherwise unobtainable. By the subsequent decay in the soil of the turned-under clover, this nitrogen is set free and converted by nitrification into available food for future crops of grain, fruit trees, roots, etc., as the case may be. The growth and harvesting of the nitrogen-consumers leave the soil poorer in nitrogen, the growth of clover and other legumes—even when the crop has been harvested and the roots only left—leaves the soil invariably richer in this constituent. But there are other advantages, though of less importance, to be obtained by this method. Humus in large amounts is formed in the soil from the organic matter of the clover. To the great value of this constituent we have already referred to in detail. All that we have said respecting its functions and importance might be repeated with emphasis for this method of manuring with clover. There is the mechanical as well as the chemical improvement of the soil, the addition of food materials, and the encouragement of microbic life within the soil.

Further, considerable amounts of potash, phosphoric acid and lime are during the growth of the clover absorbed and built up into its tissues. These, in part at least, are obtained from depths of the soil not reached by the roots of other farm crops,

and, therefore, the turned-under clover crops can be considered as adding largely to the mineral supply of the superficial soil layer. But the feature specially worthy of note in this connection is that this mineral food now offered as humates for the use of succeeding crops, is much more available than before the clover appropriated it; it is, as it were, already digested and, therefore, the more easy of assimilation. To these benefits must be added the good work that clover does as a "catch" crop, preventing the loss of soluble nitrates and other plant food through the leaching action of autumn rains.

Though it has been long known in a vague and indefinite way that clover, unlike other crops, benefited rather than impoverished the soil, that the yield of grain after a crop of clover was greater than it would have been without such a previous seeding of clover, there has not been until lately any intelligent appreciation or application of the truth involved. The practice of soil enrichment by means of clover has only received anything like general attention on the part of our farmers in Canada during the last few years, though since the announcement of Hellriegel and Wilfarth in 1886, furnishing proof that the legumes appropriated the uncombined nitrogen of the air, there has been more or less interest evinced in the subject by those who were keeping abreast of the times.

Since the spring of 1893 systematic investigatory work to determine the fertilizing value of the clover crop has been prosecuted on the Central Experimental Farm, Ottawa. Experiments on the branch experimental farms commenced in 1896.

In most of our trials the clover has been sown with grain, wheat or barley, in the spring. This has always resulted in a good stand of clover before the close of the season, as it grows rapidly after the grain is harvested. If the land is intended for grain, the ploughing under of the clover is done late in the autumn; if a crop of potatoes or Indian corn is to be grown the next season, the clover is left till the following spring, when about the second or third week of May the clover will be quite heavy and furnish a large amount of material for turning under. Our first experiment, the clover having been sown in the spring with grain and the estimations made in the following May, showed the nitrogen contained in the crop of one year's growth, including the roots taken

to a depth of four feet, to be 172 pounds. A similar trial with the second year's growth gave 117 pounds. The details are set forth in the following table :

NITROGEN IN CLOVER CROP.

Clover cut and roots dug on 25th May, 1895.	Weight of material in grammes per square foot.	Weight of material in pounds per acre. (Calculated.)	Percentage of "dry matter."	Weight of "dry matter" in pounds per acre.	Percentage of Nitrogen in fresh material.	Pounds of Nitrogen per acre in fresh material. (Calculated.)
One year's growth—						
Leaves and stems (green)..	209.0	20,070.0	13.29	2,667.30	.505	101.3
Roots, to a depth of 4 feet.	119.5	11,476.0	16.19	1,857.96	.423	48.5
Semi-decayed material on surface of ground.....	32.0	3,073.0	23.53	723.07	.732	22.5
Total	.....	34,619.0	.....	5,248.33	.....	172.3
Two years' growth—						
Leaves and stems (green)..	117.0	11,235.0	19.51	2,191.95	.447	50.0
Roots, to a depth of 4 feet.	193.0	18,535.0	18.85	3,483.85	.354	61.5
Semi-decayed material on surface of ground.....	13.0	1,248.0	35.73	445.91	.410	5.1
Total	.....	31,018.0	.....	6,121.71	.....	116.6

In the same year Dr. Saunders, Director of the Dominion Experimental Farms, instituted a course of experiments to ascertain if the growth of clover, using from two to ten pounds of seed per acre, sown with grain, lessened the yield of the latter. The results did not indicate any diminution in the weight of grain, nor in any subsequent trial—and this experiment has been repeated many times—have we found the yield to be materially affected from the presence of the growing clover.

In the following year an investigation to ascertain the relative merits of certain clovers as "cover" crops for orchards was begun. The seed was sown in July, and the analyses were made on plants collected in October of the same year, the roots being taken to a depth of two feet. The chemical data are given in the subjoined table :

ANALYSES OF CLOVERS, 1896.

CLOVER.	COMPOSITION.			NITROGEN.	WEIGHT OF CROP PER ACRE.		AMOUNT OF CERTAIN CONSTITUENTS PER ACRE		
	Water.	Organic Matter.	Ash.				Organic Matter.	Ash.	Nitrogen.
(Sown July 13, 1896, Cut Oct. 20, 1896)					Tons.	Lbs.	Lbs.	Lbs.	Lbs.
Crimson Clover –									
stems and leaves.	83.32	13.91	2.77	0.382	11	234	2,093	602	85
roots	83.89	12.92	3.21	0.304	3	201	801	199	19
Total	.....	.....	.....	.....	14	435	2,894	801	104
Alfalfa—									
stems and leaves.	71.63	23.81	4.56	0.671	5	1,192	2,664	510	75
roots	64.74	29,47	5.79	0.557	5	558	3,120	613	61
Total	.....	.....	.....	.....	10	1,750	5,784	1,123	136
Mammoth Red—									
stems and leaves.	79.13	17.05	3.82	0.620	6	1,210	2,269	508	82
roots	77.57	19.41	3,02	0.662	3	1,260	1,409	219	48
Total	.....	.....	.....	.....	10	570	3,678	727	130
Common Red—									
stems and leaves.	76.24	18.84	4.92	0.718	4	1,779	1,842	481	70
roots	71.22	25.61	3.17	0.784	2	1,445	1,394	172	47
Total	.....	.....	.....	.....	7	1,224	3,236	653	117

Similarly, it was found in 1897 that the weight of clover, leaves and stems, together with roots to a depth of nine inches, per acre, determined at the close of the season, varied from five tons to ten tons, according to variety and thickness of seeding, &c.

To find out what value this system might have in locations where clover would not live through the winter, we ascertained the amounts of fertilizing constituents found in the clover residues the following spring after winter killing. Though less than the amounts previously mentioned, the nitrogen is seen to be present in notable quantities.

ANALYSES OF CLOVER RESIDUES, 1897.
(Roots, dead stems and leaves.)

All the clovers were sown at the respective rates mentioned below, on the 5th May, 1896, with Odessa barley at the rate of 1¾ bushels per acre. The barley on all the plots was cut 27th July, 1896. The clover residues (roots, dead stems and leaves) were collected 1st May, 1897.	COMPOSITION.			Nitrogen.	Weight of Clover Residue per acre.		AMOUNT OF CERTAIN CONSTITUENTS PER ACRE.		
	Water.	Organic Matter.	Ash.		Tons.	Lbs.	Organic Matter	Ash.	Nitrogen.
	p.c.	p.c.	p.c.	p.c.			Lbs.	Lbs.	Lbs.
Mammoth Red Clover sown 14 lbs. per acre.	71.51	24.45	4.04	.903	3	636	1,622	268	59
" 12 "	69.73	25.28	4.99	1.109	3	976	1,762	349	77
" 10 "	59.43	33.19	7.38	1.417	2	1,955	1,978	439	81
" 8 "	70.00	26.18	3.82	1.123	3	976	1,783	258	76
" 6 "	72.00	24.00	4.00	1.041	3	806	1,634	272	70
" 4 "	63.34	31.74	4.92	1.260	2	594	1,458	226	58
Common Red Clover, sown 10 lbs. per ac.	72.50	23.61	3.89	1.016	3	125	1,446	238	62
Alsike Clover, sown 6 lbs. per acre. . .	71.58	22.63	5.79	1.020	1	1,233	732	187	33
Alfalfa, sown 14 lbs. per acre	61.54	34.79	3.67	1.075	1	212	772	79	26
Crimson Clover, sown 24 lbs. per acre. . .	62.82	33.01	4.17	.827		1,322	478	60	12

In 1898 further examinations were made of a somewhat similar character. The average weight per acre of clover, including roots to a depth of nine inches, obtained at the close of the first season's growth, *i.e.*, in November, was between five and six tons. On another series of plots the clover was allowed to remain until there was a strong growth the following spring (May 21), and the average weight per acre, including roots to a depth of nine inches, was found to be between thirteen and fifteen tons. On all these plots the clover had been sown with grain. As a rule,

the weight of clover material of the first season is greater than that of the second year's growth, but, as the data just recited show, this is not always the case. Favourable climatic influences have much to do with a productive luxuriant growth of clover, and consequently as seasons differ so greatly it is only to be expected that any rule as to yield would be subject to many exceptions. The practical question as to the best time, from a manurial standpoint, to turn under the clover, must, necessarily, take many factors into consideration, and is capable of several answers, according to conditions of soil and crop requirements. I may add, however, that the practice now generally in vogue for some years past is one that receives support and commendation alike from labratory and field results It consists of sowing eight to ten pounds of clover seed with the grain crop of the rotation ; if the crop of the succeeding year is to be Indian corn or potatoes, the clover is allowed to remain until, say, the second or third week in the May following (when there is usually a strong growth, the plants reaching a height possibly of two feet) and then ploughed under; if another crop of grain is to follow, the clover is turned under at the close of the first season of growth, say in October or November.

It would be impossible to place before you in this address any detailed account of all our experiments—field and laboratory—and I have, therefore, made the following estimate, based upon our published results. The data may be interpteted as showing, approximately, the manurial value of the clover crop :—

AVERAGE AMOUNTS, estimated per acre, of Nitrogen, Phosphoric Acid and Potash, in Clover Crop, including roots to a depth of nine inches.

	NITROGEN.			PHOSPHORIC ACID.			POTASH.		
	Foliage.	Roots.	Total.	Foliage.	Roots.	Total.	Foliage.	Roots.	T'l.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
First year crop	90	48	138	30	16	46	75	40	115
Second " "	50	60	111	17	20	37	45	51	96

The fertilizer universally used is barnyard or stable manure. Such contains, if of good average quality, about ten pounds of nitrogen per ton. It is evident, therefore, that by this clover method we can furnish the soil with at least as much nitrogen as would be supplied by a dressing of ten tons of manure per acre. And in addition to this nitrogen—the greater part of which is obtained from an otherwise unavailable source--there are, as we have already pointed out, considerable amounts of potash, phosphoric acid and lime, liberated in the decay of the clover, in forms much more valuable as plant food than they were originally, and therefore in a very true sense to be considered as a distinct addition to the soil's store of available mineral plant food.

It might be urged that the burying of such a large amount of rich food material as is contained in a crop of clover is wasteful and bad farming practice. This, in a certain measure, is true if the farmer has the stock to consume it, for by feeding it there is the opportunity of converting a part into high-priced animal products and returning to the soil by far the larger portion (practically 75 per cent.) of the fertilizing elements of the crop in the waste product of the animal economy. On too many farms, however, there is not sufficient stock for this purpose. We have indeed in this fact the reason for many of our exhausted soils in the older provinces, where farming in certain districts has consisted in growing grain, or oats, or hay, year after year. For such districts, even where stock is now kept in greater numbers, we strongly advocate the growing of clover for recovering fertility, for we know of no fertilizer or manure of equal value that can be so cheaply purchased. The benefits that I have enumerated are to be procured from sowing eight to ten pounds of clover seed per acre, costing $1 to $1.25. The lowest price for nitrogen in fertilizers is ten cents per pound. Since, as we have seen, practically 100 pounds, can be obtained by this method of green manuring, a moderate estimate of the manurial value of the clover would be $10 per acre.

But nearly one-half of the fertilizing value of clover is in the roots, so that if the crop is harvested and sold off the farm there is still a large addition to the soil's store of available plant food and the land is considerably enriched.

It only remains for me to say in this connection that clover requires, comparatively speaking, large amounts of the mineral constituents, potash, phosphoric acid, and lime. These being present in sufficient quantities, the clover plant with the aid of the germs I have referred to will obtain its own nitrogen. This points to the economy, where the soil is poor in these mineral elements, of supplying a certain amount of them either as wood-ashes—our own special product, and one that we are parting with to farmers in the United States at a price much below their true value –or some form of German potash salts supplemented by superphosphate or basic slag, to encourage the growth of the clover.

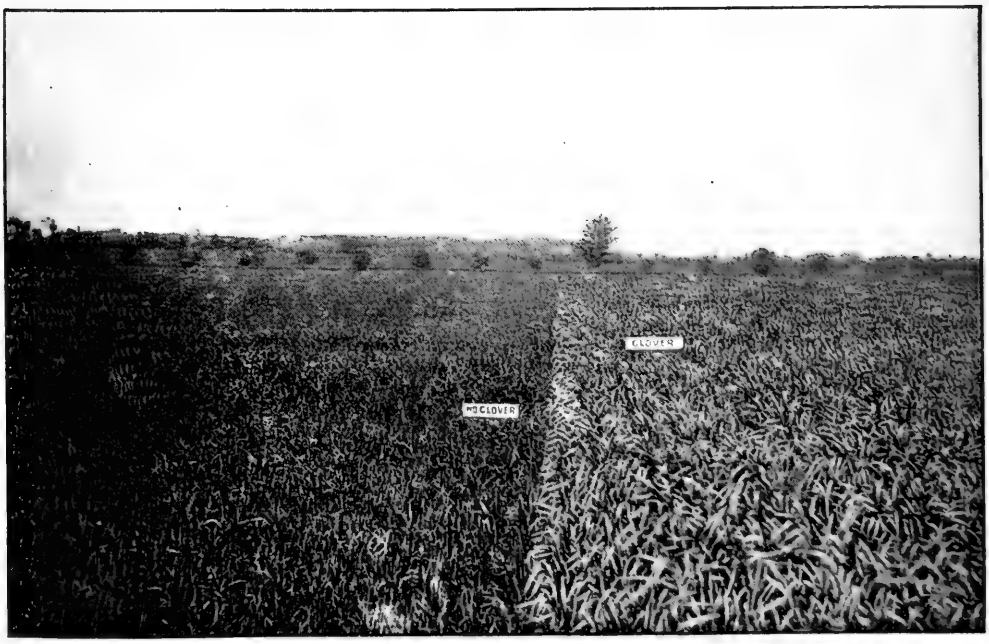
In conclusion, I propose to present some of our field results, showing the beneficial effects upon grain and other crops from this system of manuring by clover. They are of an exceedingly striking character, and furnish ample corroboration of the claims I have made for the clover crop as a means for increasing the soil's productiveness. These field experiments, I should add, were all conducted by Dr. Saunders, Director of the Experimental Farms.

GRAIN AFTER CLOVER.

In 1897, eight plots were sown with grain, four with the addition of clover seed at the rate of 10 pounds to the acre, four without the addition of clover. In October of the same year the crop of clover was turned under, the adjoining "no clover" plots being ploughed at the same time. The grain sown on these plots were: Preston wheat, Banner oats, Bolton barley, and Odessa barley. This land without any application of manure was sown in 1898 with Banner oats. Regarding the appearance of the growing crops on these plots, Dr. Saunders speaks as follows:—"The difference in the growth of the grain on these plots was soon very noticeable, and, as the season advanced, especially just before the heads appeared, the difference in height and vigour of growth in favour of the plots where the clover had been grown was very remarkable. So clearly was this manifest, that the difference could be distinctly seen at a considerable distance, and the outline of those plots on which no clover had been sown could be readily traced by the manifestly shorter and less vigorous growth. After the grain was fully headed, the difference in appearance was not so clearly seen at a distance, but by careful examination it could be easily traced." The plots were cut and threshed separately, and weighings made of the grain and straw from each plot obtained. The results showed an average increase in the yield of grain from the four clover plots of more than 11 bushels per acre over that on the plots on which there had been no clover sown.

PLATE I.

Showing the method of collection of Clover roots for analysis.



Crop of Oats photographed July 4th, 1899, after Brome grass and clover, respectively. The oats after clover are 20 inches taller than on land previously sown with Brome grass.

To ascertain what manurial value there might be from the clover the second year after ploughing under, these same plots, without the addition of any manure or fertilizer, were sown in 1899 with Mensury barley. Again a great difference on the plots that had grown clover in 1897 was noticed, and the harvested results showed the average yield on the four clover plots over that of the four "no clover" plots amounted to almost nine bushels per acre.

The weights of grain and straw harvested from these plots in 1898 and 1809 are given in the subjoined table ;

GRAIN AFTER CLOVER—Results showing fertilizing effect of Clover (a) first year, and (b) second year after being ploughed under.

Plot.	Nature of Crop sown in 1897.	1898—1st Year. Banner Oats.			1899—2nd Year. Mensury Barley.		
		Straw per acre. Lbs.	Grain per acre. Bus.	Lbs.	Straw per acre. Lbs.	Grain per acre. Bus.	Lbs.
1	Preston wheat and clover ..	3,770	56	6	3,120	40	20
2	" " no clover....	2,160	37	2	1,740	25	20
	Increase due to manurial effect of clover	1,610	19	4	1,380	15	0
3	Odessa barley and clover ..	2,180	37	12	2,620	32	29
4	" " no clover	1,450	30	10	2,440	27	44
	Increase due to manurial effect of clover	730	7	2	180	4	33
5	Bolton barley and clover	3,180	51	26	2,470	33	26
6	" " no clover	2,090	44	24	2,000	29	28
	Increase due to manurial effect of clover	1,090	7	2	470	3	46
7	Banner oats and clover	5,110	55	0	3,270	44	38
8	" " no clover.....	2,260	44	4	2,320	33	36
	Increase due to manurial effect of clover	2,850	10	30	950	11	2
	Average increase on four clover plots.....	1,570	11	1	745	8	32

Another experiment in which equally striking and important results were obtained may be described as follows :—In 1897 two plots adjoining each other and uniform as regards size and character of soil, were selected : No. 1 was sown with barley and a grass mixture containing clover seed ; No. 2 was similarly sown, with the exception that there was no clover seed in the grass mixture. In 1898 two crops of hay were taken off each plot. In the spring of 1899 they were ploughed and sown with Bavarian oats. The yield per acre on No. 1 was 46 bushels 4lbs. ; that on No. 2, 36 bushels 6 lbs., an increase of 9 bushels 22 lbs. of grain to the acre on the plot which had grown clover over that on the plot sown with grass seed only. This increase was practically due to the fertilizing constituents set free by the decay of the clover roots only, for in 1898 two crops of hay had been taken off.

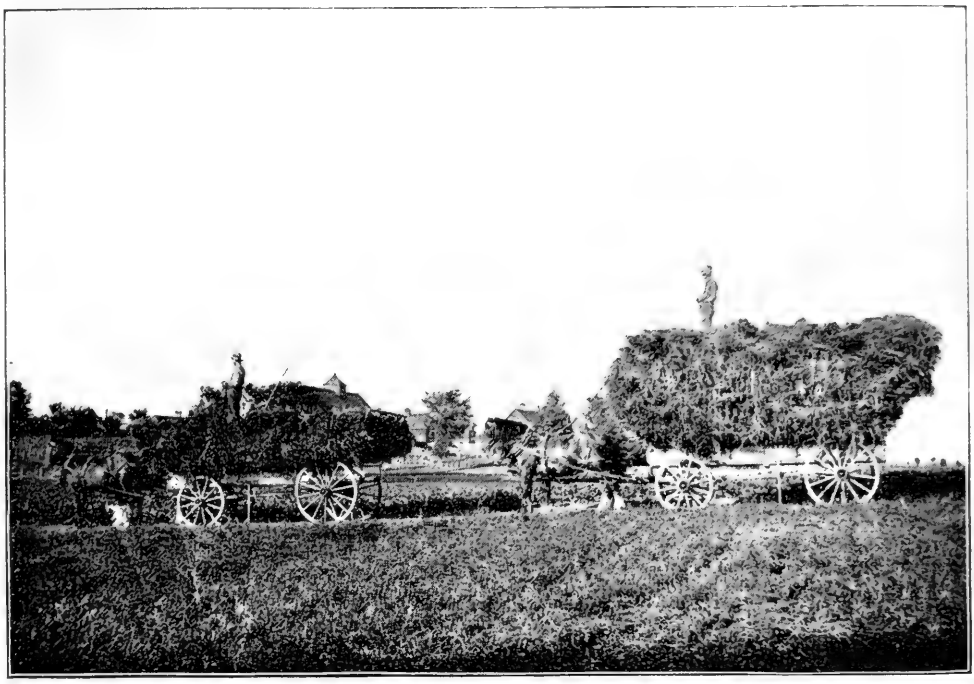
INDIAN CORN AFTER CLOVER.

In 1897 a number of plots were sown with grain and clover, check plots being left throughout the series upon which grain only was grown. The clover was allowed to remain through the winter, and on May 23rd., 1868 (at which date there was a heavy mat of growth), ploughed under. It was planted with Indian corn. The yields in detail are to be found in the report of the Experimental Farms for 1898. I will now merely state that the average yield from three plots that had previously grown clover was 16 tons 240 lbs. of fodder corn, while that from the plots on which there had been no clover was 13 tons 380 lbs.

POTATOES AFTER CLOVER.

The following experiment shows that, as with grain and fodder corn, an increased yield of potatoes was obtained by preparing the land with clover.

Plots Nos. 1 and 2, of similar size and character of soil, and adjoining each other were selected in the spring of 1898. No. 1 was sown with grain and clover ; No. 2 with grain only. In May, 1899 (there being an excellent growth of clover on No. 1), the plots were ploughed and planted with potatoes. The yield of potatoes was, on No. 1, at the rate of 146 bushels 27 pounds per acre ; on No. 2, 104 bushels 57 pounds per acre.



OATS, 1899.—Wagons contain yield from adjoining plots of uniform size; that to the left is crop after grass, yield 36 bus. 16 lbs. per acre; that to the right shows crop after grass mixture containing clover, yield 46 bus. 4 lbs. per acre.

OATS, 1899.—To the left are seen four shocks of oats grown second year after ploughing clover under; yield 53 bus. 13 lbs. per acre. To the right are seen three shocks of oats grown on an equal area of land not so treated; yield 41 bus. 6 lbs. per acre.

The data which I have just cited—obtained by careful experiments over a number of years, employing the cereals, Indian corn and potatoes as test crops—are, in my opinion, of such a striking character as to leave no doubt as to the conclusion to be drawn therefrom. They unmistakably assure us that the clover crop has a most marked effect in increasing a soil's productiveness, and confirm in the most emphatic manner the chemical results.

We have referred to the fact that in certain of the western provinces of the Dominion we find extending over very large areas some of the richest wheat soils in the world. To support this statement we have not only our own analyses, but those of European chemists. Where these soils are being cultivated the system of continuous cropping with wheat is in vogue, and practically nothing is being put back into the soil. From what has been stated in this address it will be apparent that not only are such soils becoming poorer in available plant food constituents by the amounts removed yearly in the crops, but that much organic matter and nitrogen is necessarily oxidized and lost by the indispensable cultural operations. When a short time ago in Portage la Prairie, one of our very best wheat areas, I was told by several careful and observant farmers that already a diminution in the yield other than that which could be ascribed to climatic influences (for it was a more or less steady decrease) was to be observed on the older lands, that is, on those that had been consecutively cropped with wheat for twenty or twenty-five years. Thus it comes about that the farmers in many districts of the Northwest are now recognizing the necessity of adopting some plan for the maintenance of soil fertility, and interested and encouraged by the results obtained through the use of clover in Eastern Canada, have already commenced a trial of this method.

If it behooves the Western farmer who has tilled but for a quarter of a century one of the most fertile soils of the world, to pay attention to this matter of the restoration of the nitrogen, humus and available mineral food, how much more important is this subject for the farmers of Eastern Canada, where for the most part the soil has been much longer tilled, and where originally it was not of that extreme richness as in the Northwest! In my opinion, the average yield in all our Eastern provinces would be

considerably raised by the more extensive and regular growth of one of the legumes.

You must not imagine from what I have said in this address that there are any grounds for considering our cultivated soils and their productiveness as seriously impaired ; such is not the case, save in a few localities in restricted areas. I do, however, say that in many parts of Canada we have, either through ignorance or carelessness, or both, practised a very foolish and irrational system of farming, one in which much has been taken out of the soil and little or nothing returned, a system which has necessarily resulted in diminished yields—the first and most serious step towards unprofitable farming. Since it is almost impossible to materially lower within a few years what I have termed the "total" stores of mineral plant food in the soil, it is evident that our one-sided system of farming has exhausted the land of those very small, but nevertheless most valuable, supplies of soluble available constituents which go to nourish crops. It is to restore these economically, to add humus and nitrogen, that this method of manuring by the clover is strongly advocated. I trust sufficient evidence has been brought forward to show that theory and practice alike justify us in recommending this system as one of the most effective, and certainly the cheapest for soil restoration.

We may well consider our soils as a natural resource of great and permanent value. They are a resource which should increase rather than deteriorate in value as time goes on, and I have no doubt that such will be the case. Of the capabilities and possibilities of agriculture in Canada we cannot as yet form any adequate conception, for little more than one-tenth of our agricultural lands is as yet tilled. Thousands upon thousands of acres of fertile soil yet await the husbandman to yield their quota of wealth. We may be said to be only beginning farming, but nevertheless we have sufficient evidence to show that Canada is pre-eminently a food-producing country. It is all important, therefore, that no pains should be spared in the investigation of agricultural problems and in the dissemination of information arising therefrom. Every year marks an advance, and the most encouraging sign of all is that our agricultural work is being more

and more prosecuted on rational lines, a result no doubt of the fact that the scientific principles underlying the practice of agriculture are becoming more widely known. Of improved methods based upon scientific truths that the Experimental Farm system has been instrumental in introducing, none give more promise of fruitful results than the one which I have brought before your attention in this lecture : The maintenance and increase of soil fertility through the growth of legumes.

NOTES ON RARE BIRDS OCCASIONALLY BREEDING IN EASTERN ONTARIO.

By REV. C. J. YOUNG, B.A., Wolfe Island, Ont.

From time to time very interesting local lists of birds have appeared in THE OTTAWA NATURALIST, but I have not recently noticed any additions to the Ottawa list, published in Vol. V, 1891. If the radius of the district covered by that list is a little extended, so as to take in parts of the counties of Leeds and Frontenac, several birds may be added.

For instance, Brunnich's Murre has been seen in numbers and shot on the River St. Lawrence several times during the past five years, and last winter (1900) a specimen was captured in a field near the village of Lansdowne, Ont., which the writer saw alive.

2. The American Merganser breeds occasionally, selecting a hole in a tree. One such location was at Bobs Lake, near Sharbot Lake, Ont., where the same nesting site was resorted to for several years. This bird also breeds in trees near the head of Wolfe Island, Ont.

3. The Red-breasted Merganser is a common species and breeds both at Charleston Lake, County Leeds, and on small islands at the foot of Lake Ontario. There was a nest last year on Pigeon Island, Lake Ontario.

4. The Wood Duck is unfortunately becoming quite uncommon, and seldom breeds now.

5. The Old Squaw (*Clangula hyemalis*) is very common this year about Kingston, and many are flying over the water at this date, May 15th.

6. The Green Heron (*Ardea virescens*) is a regular summer visitor to the neighbourhood of Kingston and Charleston Lake, and last year (1899) I saw three nests with eggs. It might probably be met with nearer Ottawa, most likely along the Rideau. I may say that I thought I had found a permanent nesting home of these birds in Eastern Ontario. Last year, as stated above, we found three nests; this year (1900) I visited Charleston Lake on the 31st May, two days later than last year, and did not see any new nests, nor a sign of any birds. The three old nests were as we left them last year, close to the lake, and wonderfully preserved, considering what frail structures they are, but as for new ones there was not a sign of one. This appears very strange, for I think birds, if not killed in the interval, as a rule always return to their former nesting localities.

7. A very fine specimen of the King Rail was caught by Mr. Stratford, taxidermist, of Kingston, during the past winter. It is now in his shop, and was secured by him in Cataraqui Marsh, December, 1899.

8. The Bartramian Sandpiper is by no means a rare species. It breeds from Kingston eastwards as far as the neighbourhood of Brockville. I frequently see it, and on May 21st saw, about five miles from Kingston, a nest with two eggs in. Many pairs bred this year.

9. The Buff-breasted Sandpiper I believe breeds in the same district, but I have no certain knowledge of this; though I have seen the bird in the summer, and saw one May 21st.

10. The Red-shouldered Hawk is the commonest hawk in this district, though stated to be very rare nearer Ottawa.

11. On the other hand, the Broad-winged Hawk is quite rare, seldom breeding, though it is a common hawk in the Ottawa valley. A nest was seen near Lansdowne in 1898.

12. The Bald Eagle is rapidly becoming rare. This year (1900) on the 28th April, a nest was located within a few miles of Kingston, and two eggs secured, one of which is in my possession.

13. The Scarlet Tanager breeds sparingly in the township of Lansdowne. I saw a nest with four eggs June 5th, 1898.

14. The Rose-breasted Grosbeak and Towhee Bunting also

occasionally breeds in this district, and I have seen the nests of both in 1898 and 1899.

15. I shot a specimen of the King Eider in December, 1896, among the Thousand Islands, near the Fiddler's Elbow. The bird was in very poor condition, and probably came from the Hudson Bay region, where I believe the Brunnich Guillemots, that have visited the St. Lawrence recently, come from, and not from the Gulf.

16. A specimen of the Horned Grebe in full summer plumage was shot by Mr. Stratford, of Kingston, in April last, in Cataraqui Marsh.

17. The Least Bittern spends the summer in the marshes between Kingston and Brockville, and last year I saw eggs that were taken near Kingston in June.

18. Cooper's Hawk occasionally nests in the same district, but is not common.

19. The Saw-whet Owl very rarely breeds. I have seen one that was caught among the Thousand Islands in June.

20. The Screech Owl (*Scops asio*) is becoming quite common, and the young are met with every year.

21. Two specimens of the American Barn Owl have recently been obtained near Kingston. One of them was caught alive by D. Breakey, of Wolfe Island, and is now in his possession.

22. The Black-billed Cuckoo.—This bird is very common in the vicinity of Kingston, as it also appears to be down the St. Lawrence. It frequents moist and marshy locations, and is not often met with far from water. This year I met with two nests each containing one egg on the 8th and 9th of June respectively. The nest was the frailest affair possible. With regard to the nest of the 9th June, I visited it again on the 12th, and to my surprise it contained five eggs, whereas only four could have been expected. In addition to this the nest was greatly improved and strengthened since the visit of June 9th, and showed plainly that the bird had added to it after laying her first egg.

23. The Yellow-billed Cuckoo occasionally nests around Lansdowne, Ont., but is rare. Three eggs appear to be the usual number laid. I saw nests in 1898 and 1899.

ORNITHOLOGY.

BIRD NOTES.

The following observations on the arrivals of birds were practically all made by Mr. Geo. R. White. All members of the Ottawa Field-Naturalists' Club having notes of observations of birds and their habits are asked to send them to me at the Experimental Farm, that they may be compiled and published in THE NATURALIST. During the remainder of the season many interesting facts may be noted regarding the nesting of birds, and these would be especially welcome. Notes should be sent in between the 15th and 20th of each month.

1900.

April 24—RED-SHOULDERED HAWK, *Buteo lineatus.* Mr. Geo. R. White.
24—FLICKER, *Colaptes auratus.* Mr. White.
27—CHIMNEY SWIFT, *Chætura pelagica.* Mr. White.
27—FOX SPARROW, *Passerella iliaca.* Mr. White.
29—WHITE-THROATED SPARROW, *Zonotrichia albicollis.* Mr. White.

May 1—BARN SWALLOW, *Chelidon erythrogaster.* Mr. White.
2—RUBY-CROWNED KINGLET, *Regulus calendula.* Mr. White.
3—AMERICAN OSPREY, *Pandion haliaëtus carolinensis.* Mr. White.
4—SPOTTED SANDPIPER, *Actitis macularia.* Mr. White.
4—HERMIT THRUSH. *Turdus aonalaschkæ pallasi.* Mr. White.
5—CLIFF SWALLOW, *Petrochelidon lunifrons.* Mr. White.
5—PURPLE MARTIN, *Progne subis.* Mr. White.
6—BROAD-WINGED HAWK, *Buteo latissimus.* Mr. White.
7—BANK SWALLOW, *Clivicola riparia.* Mr. White.
10—KINGBIRD, *Tyrannus tyrannus.* Mr. White.
10—OLIVE-BACKED THRUSH, *Turdus ustulatus swainsonii.* Mr. White.
10—MYRTLE WARBLER, *Dendroica coronata.* Mr. White.
10—PARULA WARBLER, *Compsothlypis americana.* Mr. White.
10—WHITE-CROWNED SPARROW, *Zonotrichia leucophrys.* Mr. White.
10—AMERICAN SPARROW HAWK, *Falco sparverius.* Mr. White.
10—WILSON'S THRUSH, *Turdus fuscescens.* Mr. White.
11—CAPE MAY WARBLER, *Dendroica tigrina.* Mr. White.
11—YELLOW WARBLER, *Dendroica æstiva.* Mr. White.
11—BLACK AND YELLOW WARBLER, *Dendroica maculosa.* Mr. White.

11—YELLOW PALM WARBLER, *Dendroica palmarum hypochrysea.* Mr. White.

11—HOUSE WREN, *Troglodytes aedon.* Mr. White.

11—BLACK-THROATED BLUE WARBLER, *Dendroica cærulescens.* Mr. White.

11—CRESTED FLYCATCHER, *Myiarchus crinitus.* Mr. White.

11—CEDAR WAXWING, *Ampelis cedrorum.* Mr. White.

12—AMERICAN BITTERN, *Botaurus lentiginosus.* Mr. White.

12—GREATER YELLOW-LEGS, *Totanus melanoleucus.* Mr. White.

12—SOLITARY SANDPIPER, *Totanus solitarius.* Mr. White.

13—BALTIMORE ORIOLE, *Icterus galbula.* Mr. White.

13—SAVANNAH SPARROW, *Ammodramus sandwichensis.* Mr. White.

14—CATBIRD, *Galeoscoptes carolinensis.* Mr. White.

14—OVEN-BIRD, *Seiurus aurocapillus.* Mr. White.

15—BLACK-POLL WARBLER, *Dendroica striata.* Mr. White.

15—AMERICAN REDSTART, *Setophaga ruticilla.* Mr. White.

15—BAY-BREASTED WARBLER, *Dendroica castanea.* Mr. White.

16—NASHVILLE WARBLER, *Helminthophila ruficapilla.* Mr. White.

17—BLACK-THROATED GREEN WARBLER. *Dendroica virens.* Mr. White.

17—AMERICAN WOODCOCK, *Philohela minor.* Mr. White.

18—CHESTNUT-SIDED WARBLER, *Dendroica pennsylvanica.* Mr. White.

18—BLACKBURNIAN WARBLER, *Dendroica blackburniæ.* Mr. White.

18—PINE WARBLER, *Dendroica vigorsii.* Mr. White.

19—AMERICAN HERRING GULL, *Larus argentatus smithsonianus.* Mr. White.

19—BLACK AND WHITE WARBLER, *Mniotilta varia.* Mr. White.

20—NIGHT HAWK, *Chordeiles virginianus.* Mr. White.

20—SCARLET TANAGER, *Piranga erythromelas.* Mr. W. T. Macoun. Mr. White, 23rd.

21—RUBY-THROATED HUMMINGBIRD, *Trochilus colubris.* Mr. White.

24—MOURNING WARBLER, *Geothlypis philadelphia.* Mr. White.

24—CANADIAN WARBLER, *Sylvania canadensis.* Mr. White.

24—LEAST FLYCATCHER, *Empidonax minimus.* Mr. White.

24—RED-EYED VIREO, *Vireo olivaceus.* Mr. White.

27—RED-HEADED WOODPECKER, *Melanerpes erythrocephalus.* Mr. Macoun.

W. T. MACOUN.

BOOK NOTICES AND REVIEWS.

CANADIAN SURVEYS AND MUSEUMS, AND THE NEED OF INCREASED EXPENDITURE THEREON. Proceedings of the Canadian Institute. (Issued as a separate pamphlet, 15 pp.) By B. E. Walker, Esq., F.G.S., President.

Following up the remarks made by Dr. G. M. Dawson in his inaugural address as President of the Royal Society of Canada in 1894, Mr. Byron E. Walker, of the Canadian Institute, Toronto, (a Society which has now reached the 51st year of its existence,) draws attention to two very live practical questions of the day, viz., National Surveys and Museums. The place that these occupy in the economy or government of a country like ours, their value and the extent to which they ought to be supported and fostered, has been treated in a masterly way in the above paper read before the Institute last November.

Mr. Walker first reviews the work of the early explorers and surveyors of British North America, in which he notices the names of Admiral Bayfield (1814), Lieut. Baddeley and Sir Richard Bonnycastle (1829), Prof. A. Lockwood, Major Samuel Holland (1748) and his grand-nephew Lt.-Col. Joseph Bouchette (1832), Dr. J. J. Bigsby (1819), Samuel Hearne (1769-1772), Sir Alexander MacKenzie (1789), Capt. George Vancouver (1790-1795), David Thompson (1784-1850), Sir John Franklin (1819-1822), Capt. John Palliser, Blakiston, Hector and G. Gladman (1857-9), Henry Youle Hind, W. H. E. Napier and S. H. Dawson (1857), John Keast Lord (1868-82) and Dr. G. M. Dawson (1874-75).

Mr. Walker then calls attention to the United States surveys and explorations carried on by the Federal Government before the establishment of a regular geological survey. He then describes in broad general outlines the geological and survey work carried on in the old Province of Canada under Sir William Logan, Alexander Murray, James Richardson, Robert Bell, E. Billings, A. Michel and Thos. Macfarlane. Referring to work done in other provinces he notices that of Dr. Abram Gesner (1838-1844), J. F. W. Johnston (1850), L. W. Bailey (1864), G. F. Matthew, L. W. Bailey and C. F. Hartt (1865). Work in Labrador (1861) by

Prof. H. Y. Hind is then recorded, also his work in 1864 in New Brunswick published 1865. The labours of Charles T. Jackson and F. Alger (1832), together with those of Sir William Dawson in Nova Scotia (1855-1878), are also referred to, as also those of Prof. H. A. Nicholson (1874-5) for Ontario, and later, reports of the Mining Bureau of Ontario, under Mr. Archibald Blue, and those of British Columbia by the various officers of that province. Mr. Walker, who, from his high scientific attainments and accurate knowledge of geology—with special reference to that captivating department, palæontology—and from his practical experience as a financier, has watched the work carried out by the Geological Survey in Montreal, and later, in Ottawa, can speak intelligently on this subject. He then goes on to describe the present work of the Geological Survey, with its natural history departments, as at present constituted. He points out that "we should have the Dominion and Provincial surveys working out the topography in a far more minute manner, and on a greatly larger scale than at present." He points out also that no surveying party is complete without a trained geologist and a trained naturalist attached thereto, to record the economic resources of the district surveyed.

As to Public Museums, Mr. Walker has a word in season, knowing as he does, the value of Canada's mineral resources, being also well acquainted with the hundreds of thousands of the specimens that have been examined, reported upon, and analyzed by the Canadian Geological Survey, which specimens are now stored in the tottering and inadequate building, the so-called National Museum on Sussex street, Ottawa. After describing what a National Museum should contain (p. 14), he goes on to say: "The necessity of a new building at Ottawa is admitted. The crime of leaving exposed to fire, in a wretched building never intended to protect anything of value, the precious results of over fifty years of collecting, has been pointed out in a recent official report; but the Government seem deaf to such claim. I can only repeat that we are rich enough to bear the cost with ease, but we are not intelligent enough to see our own interest in spending the money."

Such a statement ought to awaken the attention and consideration of our legislators.

I am led to understand that the Canadian Institute has distributed a copy of Mr. Walker's most valuable memoir to each member of the Senate and House of Commons of Canada,

In face of the statements made, of their strict accuracy, and of the great necessity of a new building, it is earnestly hoped that the Government will see its way clear to place a sum in the estimates for a National Museum, wherein to properly house the invaluable national collections in geology and natural history. Such a building would enable the department to carry on its work in a much more efficient manner.—H. M. A.

A PRIZE FOR MOSQUITOES.

In view of the important bearing mosquitoes are now known to have upon the spread of certain diseases among human beings, a more complete knowledge of these little-studied insects is thought to be very desirable. The subject was vividly brought before a large Ottawa audience by Dr L. O. Howard, the United States Entomologist, at the recent meeting of the Royal Society of Canada, and the Council of the Ottawa Field Naturalists' Club have decided to offer a prize to the member of the club who makes during the present season the largest collection of species of mosquitoes. These collections are to be exhibited on the Entomological evening in next winter's lecture course and may be made in any part of Canada.

The specimens must be pinned and each one labelled with the locality and date of capture.

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ADDITIONS TO THE NORTH AMERICAN AND EUROPEAN BRYOLOGY (MOSS-FLORA).

By N. CONR. KINDBERG.

Since the publication of my "European and North American Bryineæ (Mosses) described" (1897, December), I have received many mosses, collected by Prof. *John Macoun* in the Rocky Mountains, 1897, in Cape Breton, 1898, in New Brunswick and Nova Scotia (with Sable Island) 1899; by Mr. *J. M. Macoun* in Alaska; by Rev. *A. C. Waghorne* in Newfoundland; by Prof. *C. F. Baker* in Alabama and Colorado; by Mr. *C. M. G. Machado* in Portugal; by Mr. *F. A. Artaria* in Italy; by Dr. *H. V. Arnell*, Mr. *J. Persson* and Mr. *P. Larsson* in Sweden.

The results of the new discoveries in America are very interesting because of new localities for many species, described by myself as new, sometimes from a single place. Also several ones described as sterile, have been found in a fruiting state. Several species discovered in British Columbia, have since been found in other districts.

There are also some new species and varieties to be added. A species belonging to the family *Hypopterygiacæ*, hitherto not found above the Tropic of Cancer, was collected on Queen Charlotte Islands, situated in lat. 56°, off the coast of British Columbia, in the Pacific Ocean.

Some species are new both to America and Europe.

I will also propose some remarks concerning some families and genera following my treatise "Studien über die Systematik der pleurokarpischen Laubmoose," Botan. Centralblatt, 1899, 2 and 12.

"**Meteoriaceæ**," differing from **Hookeriaceæ** only in pe dent stem, may be considered as a group *(Meteorieæ)* of th family; but the genus *Papillaria* (not found in N. America) m consist of a proper family, *Papillariaceæ*.

"**Thuidiaceæ**" are rather a group *(Thuidieæ)* **Hypnaceæ**.

"*Hypnum nigrescens*, Swartz" was related by Jæger a Sauerbeck to *Papillaria*, by myself (Bot. Centralblatt, 1899, to a new genus, *Tricholepis*. Its characters are:

Capsule exserted; peristome double; endostome "tricholepid (with filiform segments). Calyptra glabrous. Leaves limbate short cells; inner cells minute, shortish, faintly or not papillos costa short, double. Stem pendent. "*Meteorium nigresce* Mitten." Lesq. et James, Manual of the Mosses of N. Americ It is to be placed in the family *Cryphætaceæ*.

"*Leskea tristis* Cesati," was found in Japan in fruiting stat describedas **Haplohymenium** Sieboldi, by Dozy and Molkenboe but identified by Mitten. Its name may be *Haplohymenium tri* (Cesati) Kindberg, Revue Bryol., 1899, 2, so characterized Capsule globose; endostome wanting; lid rostrate; pedicel re Calyptra rough and hairy. Stem without paraphyllia. Leav crenulate by papillæ; alar cells indistinct. Dicœcious. Famil *Anomodontaceæ*.

Hypopterygiaceæ. Secondary stem (as in many hepatics, vi **Jungermania**) furnished with amphigastria. Leaves quite c stichous (not subdistichous as in *Neckeraceæ*); primary ste rhizomatic (subterranean), the secondary tree-like; leaves smoot cells subrhombic; costa simple; capsule symmetric; endoston "dicholepide stenolepide" (with carinate and narrow segments calyptra cucullate; pedicel smooth. Pleurocarpous.

HYPOPTERYGIUM, Bridel.

1. **Hypopterygium canadense**, Kindberg, Revue Bryol 1899, 2.

Branch-leaves small, crowded and appressed, broadly ova apiculate, dentate nearly all around, narrowly limbate by hyalin narrow cells; other cells subrhombic, about 0.02 mm.; costa shor

amphigastria rotundate dentate limbate; costa confluent with the point. The naked part of stem about 1 c.m., the upper one scarcely longer. Capsules and male plants unknown.—Rocks near Pacific Ocean r.; Amer. Canada, British Columbia, Queen Charlotte Islands, 1898 (growing together with the fern *Asplenium viride*): Dr. Newcombe, communic. Macoun.

Cryphæa pendula, Lesquereux & James. Outer peristome reddish. Alabama: C. F. Baker. *Anomodon platyphyllus*, Kindb.; *A. rostratus* (Hedwig) Schimper; Alabama: Baker. *A. subrigidulus*, Kindb., and *A. tectorum* (Al. Braun) Kindb.—Canada, Rocky Mountains: Macoun.

Fabronia Wrightii, var. *brachyphylla*, Kindb., with ovate-oblong leaves, yellow peristome and lid of capsule furnished with longish often curved point, and *F. Ravenelii*, Sulliv. Alabama: Baker.

Neckera Macounii, C. Müller & Kindberg (related to *N. obtusata* by Mitten) is generally diœcious and rarely fruiting; it is not easily (as *N. Jamesii*, Schimper) distinguished from *N. trichomanoides* in a barren state.—Newfoundland (sterile): Waghorne.

Thelia compacta, Kindb.; *Leskea polycarpa*, Ehrhart. *L. subobtusifolia*, C. M. & Kindb.; *L. Cardoti*, Kindb.—Alabama: Baker.

Leskea obscura, Hedwig. Canada: Macoun; Alabama: Baker; Europe, Italy, Argegno by Lago di Como: F. A. Artaria ("*Pseudoleskea Artariæi*," Thériot, Revue Bryol., 1891, 1). New to Europe. *Entodon seductrix* (Hedw.), C. M.; *E. compressus* (H.), C. M.; *E. brevisetus* (Hooker & Wilson), Kindb.; *Platygyrium repens* (Bridel), Br. Eur. Alabama: Baker. *Pseudoleskeella catenulata* (Bridel), Kindb. Canada, Rocky Mountains: Macoun. New to America. *Thuidium delicatulum* (L.), Mitten, var. *repens*, with creeping stem. N. Brunswick: Macoun. *T. Philiberti*, Limpricht, with smaller capsule than in *T. delicatulum* and allied species. N. Brunswick: J. Moser, com. Macoun. ("*T. laxifolium* (Schwægr)" is doubtful, perhaps *Eurhynchium reflexum*.)

Pylaisia intricata (Hedw.), Schimp.; *P. polyanthos* (Schreber) Br. eur.-Alabama: Baker.

Raphidostegium laxepatulum (Lesq. & Jam.), Kindb. Canada, Cape Breton: Macoun. Alabama: Baker.

Rhynchostegium serrulatum (Hedw.), Kindb. Alabama Baker.

Plagiothecium pseudo-latebricola, Kindb. Canada, Cap Breton : Macoun. *P. albulum* (C. M.), Kindb. Alabama : Baker

2. **Plagiothecium denticulatum** (L.). Br. Eur. * **P. Ruthei** Limpricht.

Capsule larger and more curved ; cilia sometimes appendiculate ; pedicel often 4 c.m. long ; leaves large, generally without point, nearly undulate when dry. Not very distinct. Europe Sweden! "Germany" : Limpricht.

3. **Plagiothecium curvifolium**, Schliephacke; Limpricht.

Leaves somewhat small, often partly recurved, ovate-oblong with a short often curved point; capsule not large, faintly oblique ; cilia present ; lid usually muticous. Monœcious. Resembling **P. lætum** and nearly agreeing with **P. aciculari-pungens**, C. M. & Kindb. Rocks r. ; Eur., Norway! Sweden : P. Larsson ; "Germany" : Limpricht.

4. **Calliergon subgiganteum**, Kindberg, n. sp.

Differs from *C. giganteum* in monoecious inflorescence, from *C. cordifolium* in stems or branches pinnate and leaves auricled—from both in the very short costa of the leaves, in stem-leaves generally nearly indistinct, in branch-leaves reaching to the middle. America, Canada, "Sask., Prince Albert," 1896, (fruiting) : Macoun.

5. **Calliergon subeugyrium**, Renauld et Cardot. *Hypnum*, Ren. et Card. ; *Calliergon*, Kindb. ; **C. dilatatiforme**, Kindb., in litt. ad Macoun.

Leaves broadly ovate or rotundate, obtuse, not decurrent ; cells generally sublinear, except the finally reddish alar ; costa usually short and double ; capsule arcuate, very strangulate. Monœcious. Tufts often brownish or golden glossy ; stem without rhizoids. Habit of *C. molle*. "Agrees with *C. palustre* in capsule not annulate." Rocks in water r. Amer., Canada, N. Brunswick and Cape Breton : Macoun ; Newfoundland : Waghorne.

Camptothecium acuminatum (Hedw.), Kindb. Pedicel of

capsule smooth; *Eurhynchium illecebrum* (Beauvois), Milde. Alabama: Baker.

Eurhynchium glaciale (Br. Eur.), Kindb., and *E. labradoricum* Kindb. Canada, Cape Breton: Macoun. *E. scabridum*, Lindb., new to America. Newfoundland: Waghorne.

6. **Eurhynchium lusitanicum**, Kindberg, Revue Bryol., 1898, 6 and 1899, 1.

Stem decumbent, not creeping; paraphyllia numerous; leaves subdistichous, nearly crowded, not distinctly decurrent; alar cells oblong, generally not well-defined; other cells sublinear; costa vanishing near middle or somewhat above it; stem-leaves from cordate base attenuate with longish subpiliform point, sinuolate below middle, entire above; branch-leaves oval-oblong acuminate apiculate, denticulate all around. Perichetial leaves small, narrow. Capsule small, piriform, sub-symmetric, strangulate; pedicel smooth. Monœcious. Resembles *E. megapolitanum* but peculiarly differing through the present paraphyllia. Europe, Portugal, Coimbra: C. M. G. Machado.

7. **Brachythecium cyrtophyllum**, Kindberg, in OTTAWA NATURALIST, IV, 63.

Leaves small and short, not plicate, sometimes recurved at one side, not or slightly decurrent, loosely appressed when dry. Stem-leaves round-ovate or ovate, subobtuse or short-acuminate acute, generally entire; branch-leaves ovate, longer-acuminate, denticulate all around; alar cells small, numerous, green or sometimes pellucid; upper cells narrowly rhomboidal, inner sublinear; costa vanishing near middle. Dicœcious. Capsules not seen. Tufts green, faintly glossy. Resembles *B. Fendleri*, which differs in all leaves denticulate long-pointed or long-acuminate, etc. Elm logs r. Amer., Canada, Ontario: Macoun.

Brachythecium Hillebrandi, Lesquereux. Branch-leaves subovate acute, slightly acuminate; alar cells hyaline, well-defined from the green ones. Alabama: Baker.

Brachythecium "fagineum" (H. Müller) was "by Spruce named *Hypnum tenuicaule*." Has not muscol. gall.; its name must therefore be changed to *Brachythecium tenuicaule*, but

"*Eurhynchium germanum*, Grœbe (Limpricht)" is a much younger name.

Campylium unicostatum, C. M. & Kindb. Alabama: Baker. *C. sinuolatum*, Kindb. Capsule small, curved; perichetial leaves costate, gradually long-acuminate, not striate. Canada, Cape Breton: Macoun; N. Brunswick: Moser, com. Macoun; Alabama: Baker.

Myurium Boscii (Schwægr.), Kindb. Alabama: Baker. *M. hebridarum*, Schimper (1860) was "already—1844—in Seubert, flora azorica, by Schimper named *Hypnum Hochstetteri*." Braithwaite, Brit. Mossflora, 1899, p. 68. It must be named *Myurium Hochstetteri*. Azores, San Miguel: Machado.

Hypnum fluviatile, Swartz. Alabama and Wisconsin: Baker. *H. Bambergeri*, Schimper. Canada: Macoun. *H. vernicosum*, Lindb., may be considered as a proper species.

8. **Hypnum exannulatum**, Guembel. ***H. pseudo-lycopodioides**, Kindberg, n. subsp. (n. sp. ?).

Agrees with *H. exannulatum* in leaves long decurrent and their large hyaline alar cells; but leaves are shortish and entire with generally obtusate acumen; costa thicker; capsules not seen; resembles in habit *Calliergon ochraceum*, but stem-leaves are plicate, as in *Hypnum lycopodioides*. Amer., Canada, Cape Breton: Macoun.

9. **Hypnum polycarpon**, Blandow; Limpricht.

Differs from *H. Kneiffii* in leaves generally striate, with shortish acumen; cells narrow. Eur. r. Italy, Como: Artaria; "Germany": Limpricht.

Hypnum Sendtneri, Schimper in part; Boulay. It may be accepted as a proper species. England (fruiting): G. A. Holt.

Hypnum plicatile (Mitten), Lesq. & Jam. * *H. revolutum* (Mitten), Lindb., with large capsule and broad paraphyllia and sometimes at insertion pale leaves (as in *H. plicatile*). Colorado (fruiting): Baker.

Hypnum Renauldi, Kindb. Alabama: Baker In this species cilia of endostome are variable, either smooth or appendiculate, as in *H. curvifolium* and *H. Lindbergii*. In the figure of *H. curvi-*

folium in Sullivant's Icones cilia are smooth but described as appendiculate.

Hypnum fertile, Sendtner. Canada: Macoun; Sweden, Oroust: P. Larsson.

10. **Hypnum imponentiforme**, Kindb. N. sp.

Stem green, irregularly divided; branches complanate; paraphyllia broad; leaves not recurved, entire, short-acuminate, not striate; those of stem ovate-oblong, the other ones longer; insertion pale yellow; cells sublinear except the distinct hyaline but not numerous alar. Dicœcious. Capsules not seen. Resembling *H. pratense* in habit, but allied to *H. imponens*. Turfy soil r. Eur., Italy, near Como, 1897: F. A. Artaria.

11. **Hypnum pseudo-circinnale**, Kindberg N. sp.

Differs from *H. circinnale*: Leaves yellow at insertion, not striped; alar cells hyaline; stem-leaves tapering to a longer acumen; capsule cylindric, nearly straight; teeth pale yellow; stem with few rhizoids. Logs r. Amer., Canada, N. Brunswick: Macoun.

12. **Hypnum recurvatum**, Lindberg & Arnell; Stereodon, Ldb. & Arn.; Hypnum, Kindb.

Differs from H. dovrense: Leaves more gradually acuminate, sometimes more recurved, often denticulate at acumen; alar cells more distinct. Monœcious. Stem more regularly pinnate; tufts green or yellowish, not glossy; capsule small. Eur. r., "Finland"; Brotherus. Asia, Siberia: Arnell.

Fontinalis disticha, Hooker & Wilson. Alabama: Baker. *F. microphylla*, Schimper; Limpricht and *F. baltica*, Klinggraeff; Germany: Lützow, com. Warnstorf. *F. gigantea*, Sulliv., and *F. seriata*, Lindb. (fruiting). Canada, Cape Breton: Macoun.

Catharinea angustata, Bridel. Alabama: Baker. *C. Hausknechtii* (Juratzka & Milde), Brotherus. Canada, Cape Breton and Prince Edward Island: Macoun. England, Surrey: E. F. Shepherd, com. Waghorne.

Fissidens Ravenelii, Sulliv. Canada, Owen Sound: Macoun. *F. subbasilaris*, Hedw. Alabama: Baker.

13. **Fissidens rufulus**, Bryol. Eur. * **F. Warnstorfii**, Fleisch (as species).

Leaves loosely disposed, less opake, with paler, often hyalin borders; capsules not seen. In water r. Eur., Italy: Fleische com. Warnstorf.

"*Leucobryum*" *Leanum* (Sulliv.), Kindb., appertains t *Campylopus*, agreeing in capsule and calyptra, not described b Sullivant & Lesquereux, or to *Brothera* C. Mueller.

Dicranum fulvum, Hooker. N. Brunswick (fruiting): Mose com. Macoun. *D. Scottii*, Turner. Spitzbergen: com. Mr. K Johansson. *D. subulifolium*, Kindb. N. Brunswick: Macou *D. pachyneuron* (Molendo), Kindb.; capsule as in *D. longifoliu* Italy, Como (fruiting); Artaria. *D. consobrinum*, Renauld Cardot. Canada, Ontario and Nova Scotia, Sable Island: Macou *D. scopariiforme*, Kindb. Canada, not r.: Macoun; Colorado Baker. *D. pallidum*, Bruch & Schimper. Alabama: Bake *D. undulifolium*, C. M. & Kindb.; capsule smooth. Canada (frui ing): Macoun. *D. Roellii*, Kindb. Canada, Vancouver Island Macoun. *D. majus*, Smith, var. *undulascens*, Kindb., Oefversig of K. V. A. (Roy. Swed. Acad. of Sciences) foerhandl. 1899 n. 1 leaves often undulate. Sweden, near Rostock in Dalsland! *D. camptophyllum*, Kindb., var. with smaller capsules and poros leaf-cells. Canada, Rocky Mountains: Macoun. *D. longirostr* (Weber & Mohr). Canada, Cape Breton: Macoun. *D. molle* Wilson. Canada, Labrador: A. P. Low, com. Macoun. *D. algidum*, * *D. subspadiceum*, Kindb.; capsule sulcate. Canada Macoun. *D. crispulum*, C. M. & Kindb.; capsule sometime strumose; Canada, Cape Breton: Macoun. *D. rhabdocarpum* Sulliv.; capsule erect and nearly straight. Colorado (fruiting) Baker. *D. groenlandicum*, Bridel. Canada, Labrador: A. P. Low com. Macoun.

Dicranella cerviculatula, Kindb.; capsule generally erect symmetric. Canada, Cape Breton: Macoun.

Grimmia prolifera, C. M. & Kindb.; stem not always pro liferous. Alaska: J. M. Macoun. *G. robustifolia*, Kindb. Canada, N. Scotia: Macoun. *G. pulvinata* (L.), Smith, var. *cana*. Ala bama: Baker.

14. **Grimmia** (Pseudo-Racomitrium, sect. Trichophylloideæ) **subcurvula**, Kindberg, K. V. A. foerh. (Transactions of Roy. Swed. Acad. of Sciences) 1899 n. 10.

Resembling *G. pulvinata* in capsule smooth, pedicel curved and inflorescence monoecious, also in rectangular cells at the angles of leaves. Differs in: leaves somewhat longer, broadly ovate-lanceolate; inner cells distinctly sinuous; hairpoint short; tufts low, about 1 c.m., blackish when dry, small and not pulvinate. Schistose rocks r. Eur., Sweden, near Rostock in Dalsland!

15. **Grimmia pilifera**, Beauvois. * **G. longidens**, Philibert, Revue Bryol., 1898.

Differs principally in "monoecious inflorescence." Rocks r. Eur., "Switzerland, Culmann": Philibert, l. c.

16. **Grimmia subflaccida**, Kindberg. N. sp.

Agrees with the European *G. flaccida* (Notaris) Lindb., not found in America, in brittle orange peristome and channelled ovate-lanceolate entire leaves with not distinctly sinuous cells; differs in leaves smaller, recurved nearly all around, muticous or with short rough hairpoint; also in capsule narrower. Lid and calyptra not seen. Rocks r. Amer., Canada, N. Brunswick: Macoun.

Racomitrium micropus, Kindb. Canada, N. Scotia; Macoun.

"*Grimmia calyptrata*, Hooker," was already (1867) by Hampe, in Bryol. Mittheil aus dem Herbarium, p. 5, related to *Coscinodon*, but named *C. Hookeri*.

Brachystelium incurvum (Schwægr.), C. M. Alabama: Baker. *B. incurvum*, * *B. glyphomitrioides* (Balsamo & Notaris), C. M. Italy: Artaria.

Barbula nitida (Lindb.), Juratzka. Sweden, near Rostock in Dalsland! New to Sweden. *B. Solmsii*, Schimper, var. with percurrent costa of leaves. Portugal, Coimbra: Machado. *B. Vahlii* Schultz. Italy: Fleischer, com. Warnstorf. *B. macrostegia* (*Trichostomum*, Sulliv.) was by Mitten, Musci Austro-Amer., p. 45, named *Rhamphidium macrostegium* and related to *Dicranaceæ*.

Didymodon trachyneuron, Kindb.; capsule cylindric; lid conic acute. Canada, Owen Sound (fruiting): Macoun.

17. **Didymodon azoricus**, Cardot.—Trichostomum, Cardot, Mosses of the Azores and of Madeira, in report of the Missouri Bot. Garden, 1897; Didymodon, Kindb.

Plants very small; stem 2-3 mm. Differs from *D. triumphans*, leaves larger; costa not excurrent; capsule oblong; pedicel pale red. Portugal, Coimbra: Machado. New to Europe.

18. **Didymodon crispulus** (Bruch), Wilson. * **D. mucronatulus**, Cardot, as proper species.—Trichostomum, Cardot, moss. of the Azores; Didymodon, Kindb.

Stem 5-7 mm. high; leaves sublinear-oblong: capsule (not described by Cardot) subcylindric; lid rostellate; pedicel pale red. Portugal, Coimbra, 1868: Machado. New to Europe.

Weisia rutilans (Hedw.), Lindb. **W. Ganderi*, Juratzka. Sweden, Nacka, near Stockholm: J. Persson.

19. **Weisia Perssoni**, Kindb., in Botan. Notiser, 1898.

Differs from *W. viridula*: leaves not involute; capsule constricted to a very small mouth; pedicel short. (Peristome is present.) Rocks r. Eur., Sweden, Scania (Skaone) near Kullaberg 1898: Apothecary J. Persson.

Encalypta alpina, Smith. Canada, Rocky Mts.: Macoun.

Orthotrichum Bolanderi, Sulliv., and *O. Watsoni*, James. Canada, Rocky Mts.: Macoun. *O. Kingii*, Lesquer. Colorado: Baker. *O. affine*, Schrader; * *O. sublimbatum*, Kindberg, new name ("*O. subulatum*, C. M. & Kindb.," not "*O. subulatum* Mitten," Musci Austro-Amer.) var. *sublæve*, Kindb., with nearly smooth leaves. Canada, Cape Breton: Macoun. *O. psilocarpum*, James, and *O. diaphanum* (Gmelin), Schrader. Alabama: Baker. *O. cupulatum*, Hoffman. Colorado: Baker.

Zygodon Mougeotii, Br. Eur. Canada: Macoun. *Z. Sullivantii*, C. M.; leaves recurved. Canada, Cape Breton · Macoun. New to Canada.

20. **Anœctangium canadense**, Kindberg; n. sp. "A. Hornschuchii," Austin in Herb. Macoun; "Zygodon cæspitosus (Mitt.)," Kindb. Eur. and N. Amer. Bryineæ, p. 316.

Leaves small, channelled, involute, smooth and (also at base) entire, from broad base abruptly acuminate; only lowest basal

cells narrow; costa scarcely excurrent; tufts dense, rusty-red with green branch-tops, about 5 cm. high; capsules not seen. Amer., Vancouver Island, 1875: Macoun.

Cinclidium Macounii, Kindb. Canada, "Sask., Prince Albert" 1896: Macoun.

Bartramia viridissima, Bridel, and *B. circinnulata*, C. M. & Kindb. Alaska, St. Paul's Island: J. M. Macoun.

Philonotis Arnellii, Husnot. Sweden, near Uddevalla (fruiting): P. Larsson. Not before found in fruiting state.

Funaria serrata, Beauvois, and *Physcomitrium Langloisii*, Ren. & Card. Alabama: Baker.

Timmia megapolitana, Hedwig; sheath of leaves (as in *T. norvegica*) papillose at back. Norway, in Dovrefjeld, fruiting! New to Scandinavian countries.

21. **Timmia austriaca**, Hedwig; ***T. comata**, Lindberg.

Agrees with *T. austriaca* also in sheath of leaves smooth at back, as in *T. arctica* and *T. bavarica*; differs from *T. austriaca* in smaller leaves and short stem. Eur., "Finland": Brotherus; (Asia, Siberia: Arnell).

Mnium hymenophylloides Hübener. Canada, Cape Breton: Macoun. *M. rostratum*, Schrader, is usually syncœcious. *M. cuspidatum* (Schreber), Leysser, var. *pachyphyllum*, Kindb.; leaves crowded, short-decurrent, crisped when dry; stolons wanting. Alabama: Baker. *M. ciliare* (Greville), Lindb.; distinct from *M. affine* in leaves with ciliiform teeth, inner leaf-cells rotundate. Canada, Cape Breton: Macoun. New to Canada. *M. rugicum*, Laurer. Newfoundland: Waghorne. *M. spinosum* (Voit), Schwægr. Canada: Macoun. Colorado: Baker. *M. spinulosum*, Br. Eur.; **M. macrociliare*, C. M. & Kindb. Alabama: Baker.

Bryum Fercheii, Funck, and **B. suecicum*, Kindb. Sweden, Dalsland! *B. Duvalii*, Voit. Alaska: J. M. Macoun. *B. Reyeri*, Breidler; allied to *B. alpinum* (not to *B. ventricosum*); leaves indistinctly limbate. Austria: Breidler, com. Warnstorf. *B. fuscum* Lindb. Sweden: J. Persson. *B. occidentale*, Sulliv.; spores nearly 0.02 mm.—*B. gemmuligerum*, Kindb. Canada, Ottawa, clay bank: Macoun. *B. meeseoides*, Kindb. Newfoundland: Waghorne. Eur., "Norway": Dixon, Revue Bryol., 1899.

B. lacustre, Blandow ("*B. maritimum*, Bomanson," Arnell). Sweden, Gestrikland: Arnell. *B. Knowltoni*, Barnes; leaves ovate or ovate-lanceolate; tufts not always tomentose. N. Scotia, Sable Island, Macoun. *B. globosum*, Lindberg. Newfoundland (forma monoica: Waghorne. New to America. *B. Græfii*, Schliephacke (*B. grandiflorum*, Arnell). Sweden: Arnell. *B. lapponicum*, Kaurin; tufts sometimes 3 c.m. high. Sweden, Gestrikland: Arnell. *B.* (Webera) *Lescurii*, Sullivant. Alabama: Baker. *B.* (Webera) *carneum* L. Vancouver Island: Macoun.

Bryum "*atropurpureum*," Schimper, not Wahlenberg, is to be named *B. bicolor*, Dickson.

22. Bryum Donii, Greville; * B. humile, Kindberg, Revue Bryol., 1898, 6.

Stem not very distinct, with small buds; leaves smaller, nearly entire, narrowly limbate and not distinctly recurved; capsule smallish, brown or blackish, not shining; pedicel 1.5 c.m. Dicœcious. Eur., Portugal, Coimbra; Machado.

23. Bryum microstegioides, Kindberg. N. sp.

Differs from *B. submicrostegium*: leaves short-acuminate; capsule with large lid; endostomial membrane very low; cilia short, smooth. Amer., Alaska, Pribyloff Islands, 1891: Palmer.

24. Bryum (Webera) pseudo-carneum, Kindberg. N. sp.

Differs from B. carneum in leaves shorter, ovate-oblong, and long-decurrent; costa percurrent. Capsules not seen. Sandy soil. Amer., Canada, N. Scotia, Sable Island: Macoun.

25. Bryum (Webera) atropurpureum, Wahlenberg, H. Lindberg, acta societ. pro fauna et flora fennica, t. xvi, n. 2, 1899.

Differs from B. carneum principally in stomata of capsule superficial and generally narrower leaf-cells. Amer., Brit. Columbia, Revelstoke and Cascade Mountains: Macoun. New to America. Eur., "Sweden, Norway, Finland, Russia, Germany": H. Lindberg, l. c.

Andreæa nivalis, Hooker. Greenland: com. Macoun, 1899. New to America.

Ephemerum Ruthei, Schimper. Germany: Ruthe, com. Warnstorf.

Linkoeping, Sweden, March, 1900.

ROYAL SOCIETY OF CANADA.

POPULAR SCIENCE LECTURE, 1900.

One of the most enjoyable features of the annual meeting of the Royal Society of Canada this year was the Popular Science Lecture delivered on the evening of May 31st by Dr. Leland O. Howard, the United States Entomologist, of Washington. The lecturer is so well known as a leading and accurate authority on practical entomology that it is unnecessary to refer to that feature of the lecture. Few of our members, however, had previously had the privilege of meeting Dr. Howard and hearing him speak. For over an hour the large audience which filled the lecture hall of the Normal School was charmed with the masterly way in which the subject was presented and the beautiful slides with which it was illustrated were explained. Dr. Howard is a fluent and easy speaker, and from his perfect acquaintance with his subject he was able to convince his hearers of the importance of a knowledge of the life-histories of common insects and the bearing of this knowledge in many unthought-of ways, upon the ordinary affairs of every-day life.

In introducing his subject the lecturer spoke of the wide commercial distribution of injurious insects, which, in these modern days of rapid ocean voyages, is becoming so pronounced that quarantine services are being established in different countries in the endeavour to bar out injurious insects from abroad. As an example, he described briefly the recent carriage of the San José Scale upon nursery stock and fruits to many different quarters of the world, and mentioned the legislation which had been effected in different countries from this incitive. It was his purpose, however, he said, not to dwell so much upon this aspect of economic entomology, as to show the good which could be accomplished by well planned introductions of beneficial insects from one country to another. He told once more the well-known story of the introduction of the Lady-bird beetle *Novius cardinalis* from Australia by the United States Department of Agriculture, and the resulting saving of the citrous crops of California which had been threatened with extinction by the White or Fluted Scale, an insect which had

been previously accidentally introduced from the same country. He showed how more recently the same insect had been introduced into the Hawaiian Islands, Egypt, Cape Colony and Portugal with equally beneficial results. He described other importations of beneficial insects into the United States, and dwelt at some length upon his recent introduction and establishment in California of *Blastophaga grossorum*, the well-known fertilizer of the Smyrna fig crop in oriental regions.

He then took up briefly the subject of insects as carriers of disease, reviewing the many instances in which the function of insects in this direction has been recently proved. He dwelt more especially on the relations between mosquitoes and malaria, indicating comparatively the biology of *Culex* and that of *Anopheles*, showing for the first time a series of pictures illustrating a complete life-round of *Anopheles quadrimaculatus*. He also spoke at some length on the carriage of typhoid germs and the germs of other diseases of the alimentary tract by flies, showing a number of illustrations of dipterous insects reared from human excreta.

Dr. Howard closed his address with the exhibition of a number of slides relating to protective resemblance and protective mimicry, many of which were entirely new.

The chair was taken by the Patron of the Club, His Excellency the Governor-General of Canada, who at the end of the lecture spoke in highly appreciative terms of the manner in which so much useful information had been presented to the audience. A hearty vote of thanks was proposed by the Hon. Sidney Fisher, the Minister of Agriculture, who complimented the audience on having had an opportunity of hearing Dr. Howard's delightful lecture. He reminded them of the great losses suffered every year by farmers from the attacks made upon their crops and live stock by injurious insects. He was much pleased to notice the growing appreciation of the science of economic entomology among all classes. The yearly losses among farm crops were enormous. For instance, it had been estimated that the annual loss in the United States of America alone footed up the astonishing amount of $300,000,000, while in Canada the loss has been placed at not less than ten per cent. of every crop that is grown. It is, however, now well known that much of this loss can be pre-

vented by following the practical advice given by such men as the lecturer of the evening. He felt proud that Canada in no way lagged behind other countries in the prosecution and application of these studies. The Dominion Entomologist was doing excellent work, highly appreciated both at home and abroad.

Dr. Fletcher, the Dominion Entomologist, in seconding the vote of thanks, considered it an honour to have an opportunity of expressing his opinion, not only of the lecture of the evening, but of the splendid work which Dr. Howard had been doing for so many years. He drew attention to some of the triumphs in Applied Entomology in which that gentleman had taken an active part, mentioning, among other things, the discovery of practical remedies for some of the worst enemies of the farmer and fruit grower, the improvement of machinery for the distribution of insecticides and many other kindred subjects. He felt very happy this evening on account of the honour which was being paid his dear and particular friend, Dr. Howard, as well as the science of Entomology, and which was well attested by the presence of His Excellency the Governor-General, the Hon. Minister of Agriculture, and the large audience now before him, as well as by the rapt attention which was paid to every word uttered by the lecturer and the hearty and frequent applause.

The skilful manipulation of the lantern by Mr. J. P. Dunne was favourably commented upon by Dr. Howard.

THE BILLINGS MEMORIAL.

A PORTRAIT TO BE PLACED IN THE GEOLOGICAL SURVEY DEPARTMENT.

Under the auspices of the Ottawa Field-Naturalists' Club last fall a movement was inaugurated with the object of perpetuating, in some visible and tangible manner, the memory of one of Canada's greatest sons, Elkanah Billings, who departed this life some 24 years ago. Elkanah Billings, well known in old Bytown and in Ottawa's earliest days as a barrister, was an ardent naturalist and geologist. He published the "Canadian Naturalist and Geologist" for several years, first in Ottawa, but later in Montreal, whither Sir William Logan had induced him to go and join him in investigating the geological resources of old Canada (Quebec

and Ontario). For twenty years Mr. Billings laboured in the Survey, and by his good work achieved for Canada as well as for himself a reputation in the scientific world of which the greatest might be proud. The name of Billings in the field of geology and especially in the domain of palæontology is a household word and one synonymous with accuracy of observation and description. He possessed in a high degree an analytic as well as a synthetic mind. He has left behind him monuments of imperishable fame in the species and genera he described. Except for the many fine collections now exhibited in the show-cases of the National Museum on Sussex street, which, as has been frequently pointed out, run the daily risk of being destroyed by fire, there is nothing to recall his memory in our midst.

As an outcome of a suggestion made by the President of the Ottawa Field-Naturalists' Club a committee was appointed with the object of having a suitable portrait of the late Mr. Billings painted. Mr. Charles E. Moss, R.C.A., has been requested to paint this portrait. He has just returned from Montreal, where he found an excellent likeness of Billings hanging in the rooms of the Natural History Society of Montreal which that society has generously placed at the disposal of the artist, and has given Mr. Moss every facility possible for the completion of his work. Many of Mr. Billings's old friends are still living, and the geologists of Ottawa and Canada are joining hands in doing honour to such an eminent scientist. It is the intention to present the portrait to the Geological Survey Department to be placed in the Museum in a suitable spot not distant from the numerous collections on which he devoted so much care, time and study with such glorious results. Billings's works are constantly quoted to-day in Europe as well as in America, and as Canadians we are justly proud of him. Among the Canadians on the committee appointed by the Club are the names of Sir James Grant, Dr. J. F. Whiteaves, Mr. B. E. Walker (Toronto), Prof. John Macoun, Dr. James Fletcher, Mr. W. J. Wilson and Dr. H M. Ami (convener).

With a view of enlisting the co-operation of all the friends and numerous admirers of the late Mr. Billings and giving all an opportunity of taking part in this memorial the committee have thought it desirable to announce that all subscriptions, however small, will be accepted. When the list is complete, the names of the subscribers will be published in THE OTTAWA NATURALIST. Contributions may be sent in to any member of the committee. It is expected that the presentation will take place in the near future.

NOTES ON THE PERIODICAL APPEARANCE OF ANTS IN A CHIMNEY AND ON AN UNUSUAL SITE FOR A HUMBLE-BEE'S NEST.

By HENRY S. POOLE, F.G.S., Stellarton, N.S.

(Read before Nova Scotian Institute of Science, Feb. 12, 1900.)

For many years, possibly fifteen, a flight of ants has annually tumbled down a chimney in the office of the Acadia Coal Co. at Stellarton, N.S., generally on August 24th, sometimes a day or two later, and occasionally a few ants again appear as late as the middle of September. Fires are used in the chimney each winter. A tinned roof has been put on the office since the ants first were seen, and the top of the chimney has been thoroughly repaired by masons without finding a nest. The habitat selected seems unusual, and so far has not led to the similar adoption by colonies of other chimneys in the same building.

In a grove of young fir trees, about eight feet from the ground, I noticed one autumn a large Robin's nest in unusually good repair. On pulling down the tree top the nest was found to be full, with a dome-shaped cover. It was occupied by Humble-bees and a small comb with larvæ in it. Such a situation for a Humble-bee's nest, I am told, has been seen before, but apparently it is unusual.

IN MEMORIAM.

It is with deep regret that we have to record the death of one of our members who for many years has been an active field-botanist in the little-worked island of Newfoundland, the Rev. ARTHUR C. WAGHORNE, late of the Bay of Islands, Nfld. Owing to ill-health, Mr. Waghorne resigned his charge this spring and died recently at Gordon Town, in Jamaica.

"Mr. Waghorne came to Newfoundland over twenty-five years ago.....He was a man of strong personality, devoutly attached to his Church and her interests, and was an ardent student of Botany, especially that of this country. His contributions to this science have made his name well and widely known outside of this island, many plants peculiar to it bearing his name."—St. John's *Evening Telegram.*

CONCHOLOGY.

ON AN ADDITION TO THE MOLLLUSCAN FAUNA OF CANADA.

By BRYANT WALKER, Detroit, Mich., U.S.A.

While examining recently a suite of *Gastrodonta multidentata*, Say, from Ottawa, received several years ago from Mr. Gilbert Heron, I was surprised to find a single well marked specimen of *Gastrodonta lamellidens* Pils. This little species was described in 1898 from specimens collected in 1897 in the Great Smoky Mountains of Tennessee. It was then supposed to be peculiar to the southern Appalachians. But recently specimens have been recorded from Deering, N.H., and Greenwich and Litchfield, N.Y. This new find extends its range far to the north and west of any previous records. It is very rare, even in Tennessee. For the benefit of those who are not familiar with it, it may be stated that in size and shape it is very similar to *G. multidentata*, but instead of having two or three radiating rows of separate teeth on the internal base of the shell, there are two or three long, radiating, somewhat flexuose lamellæ similarly situated.

In the Ottawa specimen referred to, these lamellæ appear to be more slender and rather more bent than in specimens from the original locality. It is quite possible that this species is more widely extended than has been supposed, but has been hitherto overlooked from its great similarity to *G. multidentata*. It is very desirable that collectors should carefully examine their suites of that species for specimens of *lamellidens*. Any new localities should be reported at once for publication in the proceedings of this society.

BOTANY.

BOTANICAL CLUB OF CANADA—Annual Report for the year May 20th, 1898, to May 20th, 1899, issued as part of vol. v, Trans. Roy. Soc. Can., 2nd series, 1899-1900 (35 pages). Distributed March 31st, 1900, by Dr. A. H. MacKay, General Secretary-Treasurer.

This report contains a sketch of the history of "Phenological Observations in Canada." It also indicates the progress of botanical research, points out the results obtained in Newfound-

land, as well as in Labrador, Prince Edward Island and Nova Scotia. This is followed by "Observations in a Wild Garden," by Dr. G. U. Hay, of St. John, New Brunswick, besides notes on work done in Ontario. Prof. Macoun's researches in the "*Cryptogamic Flora of Ottawa*," published in THE OTTAWA NATURALIST, Mr. James M. Macoun's "*Contributions from the Herbarium of the Geological Survey of Canada*," have been published in "The Canadian Record of Science" and in THE OTTAWA NATURALIST.

Full descriptions of the new species of Ottawa Violets were given, with excellent plates, in THE OTTAWA NATURALIST of January, 1899, No. 10, Vol. xii, and reference is also made to *Viola Watsoni*, Green, from Prince Edward Island, and another new species from British Columbia, besides notes on the genus *Antennaria* and *Fragaria*.

From Alberta, Assiniboia and British Columbia reports are also sent in. The Teachers of the Department of Public Instruction in Nova Scotia, of which Dr. A. H. MacKay is Superintendent, have been most active in recording phenological observations, from which excellent results were recorded.

The officers of the Botanical Club of Canada are then added.

President—John Macoun, M.A., F.L.S., F.R.S.C., Ottawa.

General Secretary-Treasurer—A. H. MacKay, LL.D., Halifax.

Secretaries for the several Provinces—

Newfoundland, Rev. A. C. Waghorne, Bay of Islands.
Prince Edward Island, Principal John MacSwain, Charlottetown.
Nova Scotia, Dr. A. H. MacKay (General Sec.-Treas.), Halifax.
New Brunswick, George U. Hay, M.A., Ph.B., St. John.
Quebec, Prof. D. P. Penhallow, B.Sc., McGill University, Montreal.
Ontario, Principal Wm. Scott, B.A., Normal School, Toronto.
Manitoba, Rev. W. A. Burman, B.D., Winnipeg.
Assiniboia, Thomas R. Donnelly, Esq., Pheasant Forks.
Alberta, T. N. Willing, Esq., Olds.
Saskatchewan, Rev. C. W. Bryden, Willoughby.
British Columbia (mainland), J. K. Henry, B.A., High School, Vancouver.
Vancouver Island, A. J. Pineo, B.A., High School, Victoria.

H. M. A.

OTTAWA NORMAL SCHOOL—BOTANICAL COMPETITION

THE PREMIER'S PRIZE.—Some months ago the Honourable G. W. Ross, Premier of the Province of Ontario, informed the President of the Ottawa Field-Naturalists' Club that he would be glad to offer for competition among the students of the Ottawa Normal School a Medal or prize in books for the best work done in connection with the Ottawa Field-Naturalists' Club. Later, a second prize was offered by the President of the Club for the same object and the Normal School authorities were apprised of the same. The work selected was in the form of collections of plants from the Ottawa District, to be obtained, pressed, named and classified, according to the requirements of the Science Master of the Provincial Normal School and in accordance with the wishes of the Club.

Accordingly, a large series of collections (over ninety) were sent in for competition and the Council of the Club appointed Professor John Macoun, Dr. James Fletcher and Dr. H. M. Ami, as Judges in the said competition.

From the report made to the Normal School authorities by the Committee of Judges, it appears that the collections were both excellent and numerous and the competition was very keen. The neatness and care with which a large number of these were prepared showed clearly that more than a passing acquaintance with the plants mounted, prepared and classified was obtained by the great bulk of the contestants.

In reporting the result of the competition to Council, the Judges expressed the great satisfaction they had experienced while examining these collections. In this connection, the following notes may not be out of place :—

The collection which the judges consider gave on the whole the best indication of excellence in preparation, care, accuracy in determination, &c., was that of Miss Elma Cannon, of Athens, Ont., and to this lady was awarded the Ross prize.

The next best collection was that of Miss Mary E. Robson, of Grey County, Ont., and to this lady was awarded the President's prize, which consisted of a copy of the recently issued beautiful work entitled "Nature's Garden," by Neltje Blanchan.

It would be unfair not to mention a number of other collections which were sent in and exhibited such a degree of excellence as to be worthy of honourable mention in this competition ; they were those of Messrs. J. A. Graham, F. H. Breckenridge and Elmer Bolton ; and those of the Misses L. Mabel Graham, M. VanAlstyne, and M. M. Mackenzie. Also those of Miss Reilly, Messrs Byrnes, M. E. Watson, F. Shannon, J. W. Gibson, C. Ramsay, C. McLennan, F. C. Thompson.

The thanks of the Committee of Council are due Mr. J. H. Putman, Science Master, for his valuable assistance in the matter of the preliminary examination and arrangement of the collections to be judged.

At stated above these collections showed plainly that great care had been taken by the students in working up the collections many of which were so nearly equal in excellence that a scale of marks had to be prepared and the individual specimens in the different collections compared before the prizes could be awarded.

The Committee beg to thank Dr. Ross and to congratulate him on the success of his effort as shown by the very evident interest he has called forth in the study of Botany, as well as the Science Master of the Normal School on the enthusiasm he has instilled into his students.

BOOK NOTICES.

REVISION OF AMERICAN VOLES OF THE GENUS MICROTUS. North American Fauna, No. 17. By Vernon Bailey. Washington, D.C., U.S.

Mr. Vernon Bailey, Chief Field-Naturalist of the Division of Biological Survey of the United States Department of Agriculture, has just published under the above title a complete synopsis of the interesting genus *Microtus*, which he has prepared under the direction of Dr. C. Hart Merriam, and which work includes the species from British North America as well as those of the United States.

The American Voles or Meadow Mice burrow in the ground and from their burrows make little smooth trails to their feeding grounds. Their bulky nests of grass and soft plant fibres are found either underground or on the surface of the ground under

snow, logs or dense vegetation. "These nests are the sleeping-places of the old and the nurseries of the young. They are kept surprisingly clean and fresh, and new ones are frequently made. The food of Meadow Mice consists mainly of green vegetation, roots and bark."

As to their economic status, Mr. Bailey says: "Too small and too numerous to be successfully destroyed by traps, guns or poison, they prove one of the most difficult enemies with which the farmer has to contend." "With a stroke of their chisel-like teeth they fell the stalks of wheat and oats and eat the tender parts, together with some of the grain. In shocks of corn and wheat the grain is often completely devoured."

The following are the British-American species, and they are described and illustrated in the publication:

1. *Microtus Acadicus*, Bangs. Digby, N.S.
2. *Microtus Drummondi* (Aud. and Bach.). Rocky Mountains, vicinity of Jasper House, Alta.
3. *Microtus enixus*, Bangs. Hamilton Inlet, Labrador.
4. *Microtus fontigenus*, Bangs. Lake Edward, Que.
5. *Microtus labradorius*, Bailey. Fort Chimo, Ungava, Labrador.
6. *Microtus Macfarlani*, Merriam. Fort Anderson (north of Great Bear Lake), Mackenzie.
7. *Microtus Richardsoni* (DeKay). Near foot of Rocky Mountains, vicinity of Jasper House, Alta.
8. *Microtus serpens*, Merriam. Agassiz, B. C.
9. *Microtus terrænovæ* (Bangs). Codroy, Nfdld.
10. *Microtus tetramerus* (Rhoads). Beacon Hill Park, Victoria, B. C.
11. *Microtus xanthognathus* (Leach). Hudson Bay.

Mr. Bailey subdivides the genus *Microtus*, which comprises in all seventy species, into nine subgenera. The above Canadian species Nos. 1, 2, 3, 4, 5, 6, 9, 10, and 11 come under the subgenus *Microtus*, No. 7 under the subgenus *Arvicola* and No. 8 under the subgenus *Chilotus*.

H. M. A.

ON THE OCCURRENCE OF A SPECIES OF WHITTLESEYA IN THE RIVERSDALE FORMATION (EO-CARBONIFEROUS) OF THE HARRINGTON RIVER ALONG THE BOUNDARY LINE BETWEEN COLCHESTER AND CUMBERLAND COUNTIES, NOVA SCOTIA, CANADA.

By H. M. AMI, of the Geological Survey of Canada, Ottawa.

During the collecting season of 1895-6-7-8-9, the writer has spent a portion of his time in making a palæontological survey of the various rock-formations in critical localities comprised in the counties of Pictou, Antigonish, Colchester, Cumberland, Hants and King's, in Nova Scotia, for the Geological Survey Department, with a view of ascertaining the field-relations and succession of the faunas and floras entombed in them and determining their position in the column of Palæozoic sediments. Much of the work has been in the direction of defining the precise geological horizon of the so-called Devonian rocks of Union and Riversdale as described by Mr. Hugh Fletcher,* which series or formation of rocks also correspond to those described by Dr. R. W. Ells † in his "Report on the geological formations of Eastern Albert and Westmoreland Counties, New Brunswick, and a portion of Cumberland and Colchester Counties, Nova Scotia, embracing the Spring Hill Basin and the Carboniferous System north of the Cobequid Mountains," in which he describes as doubtfully Lower Carboniferous, and probably Devonian, rocks having the same geological relations as those "rocks of Union and Riversdale" referred to above.

Rocks of this formation in Nova Scotia had been referred by Sir William Dawson to the Carboniferous (Millstone Grit); and my best endeavours were directed to the finding of evidence to prove the age to which these rock formations were to be referred; whilst in doing so I have kept constantly in view the discovery of Devonian types. In the summary reports of the Department for the past three years, brief results, as obtained from season to season, have been published, in which it will be seen that the rocks in question are now referred to the Carboniferous System, from the definite and irresistible flood of internal evidence which has accrued and been obtained from them.

In a paper "On the Sub-divisions of the Carboniferous System in Canada, with special reference to the position of the Union and

* Annual Rep. Geol. and Nat. Hist. Survey of Canada, Vol. 2, p. 65 P; 1887. Montreal.

† Annual Rep. Geol. and Nat. Hist. Survey of Canada, Vol. 1. p. 51 E. etc. 1886. Montreal.

Riversdale formations of Nova Scotia, referred to the Devonian System by some Canadian geologists," * the writer presented some of the evidence obtained in the field, which went to show clearly, we believe, that the fauna and flora found entombed in the Riversdale formation, had in every respect a Carboniferous facies and consequently could not be referred to the Devonian System, but to the Carboniferous.

Along the banks of the Harrington River, near Lower Five Islands, forming the boundary line between Colchester and Cumberland Counties in Nova Scotia in strata consisting of sandstones, siliceous and carbaceous shales, the writer obtained in 1897 and 1898 quite an assemblage of plant remains which have been forwarded to Mr. Robert Kidston, who refers them to a decided Carboniferous horizon. The animal remains have been submitted to a preliminary examination and all the forms noticed also indicate a Carboniferous age.

From the 1898 collections a number of remains of an interesting form have been recently selected which shew clearly the occurrence of a species of the genus *Whittleseya*, defined by Newberry in 1874. †

All the North American species of *Whittleseya* (W. elegans, W. integrifolia, W. undulata, W. microphylla,) have been discovered from the Coal Measures of the United States. As far as the writer is aware this is the first time that the genus has been discovered in Nova Scotian strata and the present note, or brief paper is to place it on record and express the view that the Harrington River strata, from which the interesting specimens of *Whittleseya* were obtained, afford additional proof of their Carboniferous age.

The following plants were determined by Mr. Kidson and were found associated with the species of Whittleseya by the writer :—

1. Asterophyllites acicularis, Dawson (=Calamocladus equisetiformis, Schlotheim). 2. Sphenopteris marginata, Dawson. 3. Alethopteris dilatata, Dawson. 4. Alethopteris splendens, Dawson. 5. Alethopteris Harttii, Dawson. 6. Alethopteris discrepans, Dawson. 7. Aneimites Acadica, Dawson. 8. Cardiocarpum cornutum, Dawson. 9. Psilophyton? glabrum, Dawson.

Another species of Whittleseya has been noticed by the writer from his collections made at West Bay, near Parrsborough, in Cumberland County. The latter were associated with fossil insects and Anthracomyæ, all of which have also a decided Carboniferous facies. It will thus be seen that the evidence is cumulative, which has been gathered, and goes to prove that the strata from which it was obtained cannot be referred to the Devonian System.

* Trans. Nov. Scotian Inst. Sc., Vol. X, Session 1899-1900, pp. 167-178, Halifax.

† Proc. Cleveland Acad. Sciences, p. 43.

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AN ORNITHOLOGICAL INCURSION INTO FLORIDA, FEBRUARY, 1900.

By W. E. SAUNDERS.

To the casual northerner Florida is Florida, a land of oranges and palms, but the tourist finds that his ticket, which is for Jacksonville, lands him at almost the northernmost and least interesting part, and that to reach a truly tropical zone he must travel at least 200, and better 300, miles further down the coast at a cost of four cents a mile each way. When that is done, he finds the Florida of the guide books, but for at least 175 miles south of Jacksonville the orange industry has been killed by the annually recurring frosts, and the vegetation of the tropics is absent.

The extreme dampness of the atmosphere on the Atlantic coast is best illustrated by the growth of the most interesting fern of the country, the Hoary Polypody, *Polypodium incanum*. Although the house-roofs have not a steep slope, and the sun must be nearly vertical for part of the year, yet the northern half of the roofs of most of the older houses in St. Augustine was covered with this fern, growing in the moss which seemed to find an easy lodgment there. Floridians call it the Resurrection Fern, from its habit of curling up and exposing the hoary back of the frond in dry weather, and reopening flat and green on the return of dampness. In the woods of this moist climate the Live Oak, *Quercus virens*, attains an enormous spread of branches. I frequently walked twenty paces from the trunk to the tip of a long branch which would not rise more than twenty-five feet from the ground. This would give a total diameter of 120 feet, about double the height of the tree, and greater than that of most of the forest trees

of Ontario. These long limbs were thickly covered with the Hoary Polypody, and occasionally one would find the native orchids of the genus *Epidendrum* mingled with it. This fern did not appear to grow freely on any tree except the live oak, while its larger relative, *Polypodium aureum*, was found solely on the tall Palmettos, aud always at a height of at least ten feet, and the ease with which short wet moss rubs off on one's trousers is a great discourager of climbing, consequently we failed to get a good specimen of this fern.

The winter visitor meets with very many familiar birds, and some few strangers in considerable numbers, but the conditions are so different to those in the north that it takes one some time to become facile in the hunt. Ninety-nine one-hundredths of the interior of Florida, as we saw it, is either open water, cypress swamp or pine barrens ; that is to say, the dry land, with practically no exception, is pine barrens; and the name is well chosen. Occasional Live Oaks, Black Jack, and scrub Palmetto form the only break in the woods, and the almost absolute bareness of the soil is oppressive to a northerner. No grass, no weeds, no shrubs, no ferns—none of the thrifty upland growth of the north meets the eye.

Then where are the birds? Well, after sufficient search we find that they are mainly in the villages, where the plant growth is more varied and the food supply more abundant. In the streets of Tarpon Springs, on the Gulf coast, we could hear and see all day troops, couples and singles of the Florida Purple Grackle, and of the Boat-tailed Grackle, singing from the shade trees, feeding in the roads and in the yards, but in three weeks I did not get one chance to collect a single specimen of the Purple Grackle, and only one Boat-tail, very close to the town. This latter is a most amusing fellow. His song defies description. Some clear notes that might belong to a thrush, some grackle-tones, and a large variety of chuckles, crackles and grunts which are peculiarly his own, surprise and delight his new acquaintance. The male, while not really much larger than our Bronzed Grackle, looks so on account of his long tail, and at first sight one hesitates to recognize the female as a

Grackle at all, so light is her colour, which resembles the tint of the female Cowbird, but is lighter and browner. The Florida Purple Grackles are elegant birds, slightly smaller than our Bronzed Grackle, but so tame and so common in some towns, and with such a brilliant iridescence reflecting the rays of the bright sun, that one is moved to think that there are few handsomer birds.

It was at Tarpon Springs, too, that we met the little Ground Dove—a true dove in manners, grace and habits, but just about the size of the Shorelark. There we found them, with the Mourning Dove (also common), feeding with bunches of Grackles, Mocking Birds and Towhees in the streets, and we all thought them one of the most charming of our new acquaintances. When they flew, the inner wing feathers displayed a bright brick red colour, contrasting vividly with the greyish fawn of the rest of the bird. It was truly ludicrous to see this little fellow, thinking evidently that he was a real pigeon, walking along with the stately and graceful dove-step, and nodding his head with each footstep.

Of all the birds I have seen, none stay on the wing so continuously and with such superlative ease as the Vulture. Regardless of wind, regardless of rain, regardless of sun, they could be seen at all hours of the day from about 8 a.m. to 5 p.m., soaring without a flap of the wing ; sometimes singly or in couples, sometimes in groups of twenty or thirty, and when such a company appeared every onlooker was forced to admire their grace and beauty—at a distance. Both kinds, the Black Vulture and the Turkey Vulture were common at most points. They alight on the shade trees, on the houses, and even in the back yards, showing scarcely any fear of man, and they certainly do a most useful work in this hot climate where many of the inhabitants are too indolent to take the first step towards keeping their premises clean. The peculiar position occupied by these most useful scavengers, who are said to clean up all the back yards of Florida, is well illustrated by the following occurrence.

In Tarpon Springs I said to a little girl, "See, what bird is that?" "That aint a bird, that's a buzzard," came the reply.

Driving on the ocean beach in the Indian River district, I saw

some dark objects far ahead. Turning my glass on them I saw that one was an Eagle, feeding on what proved to be a stale fish, while a Black Vulture patiently waited four or five feet away in the hope that his superior would leave him some pickings. On our approach, both flew, but the Vulture soon returned and finished the feast when we had passed by. Eagles were abundant —to our eyes. Accustomed to consider the sight of an eagle as a rarity it was a new experience to be able to sit on the verandah by the Atlantic coast and have an Eagle almost always in sight, while sometimes two or three were visible at once. We were favoured with one or two exhibitions of the celebrated contest between the Eagle and the Osprey, for a fish just caught by the latter, but the persecuted one escaped each time, somewhat to our regret, though perhaps we should not have favoured the thief as against the industrious Osprey.

In addition to the large birds already mentioned, one can often see from his doorway Herons, Loons, Marsh Hawks, Terns, Gulls and Brown Pelicans. On Tampa Bay, which was reached on the morning of February 26th, the last were in great abundance and extremely entertaining. Our first glimpse of them was from the train as we ran out nearly half a mile on a long dock to meet the boat. Two Pelicans, utterly fearless, came up flying parallel with the train, four or five feet above the water, and only twenty yards away; gradually passing our window one of them suddenly sighted a fish, put his head down and tail up, and went in head first. The fish was near the surface, however, so he sat up at once and gulped it down in full view. This seemed to be their regular method of fishing and from the deck of the steamer whence one could scan the bay with a glass for miles, in every direction Pelicans could be seen, some resting and some flying; but it was never needful to watch long before seeing one splash in, and then sit on the water while he devoured his catch. As the train left the boat at the other side of the bay, it ran parallel with a dismantled dock, many of the posts of which still remained; most of these posts were crowned with a resting Pelican, and though only twenty-five or thirty yards from the train, the birds paid no attention whatever to anything but the business in hand, which was—loafing.

In this bay, too, we saw the first Porpoises, which played under the very bows of the advancing steamer, and whose dorsal fins were to be seen in many directions, rising and then sinking beneath the water.

Among the very small birds, one of the most interesting was the Brown-headed Nuthatch, which was confined exclusively to the pine lands and was not very common there, but when one did meet with a little band of them they were most interesting. Their habits, and particularly their happy call-notes, show a strong resemblance to those of the Pigmy Nuthatch of British Columbia, and certainly these two are the noisest birds of their size I ever met. When two or three of them get chattering at once they really make enough noise for a whole flock of ordinary birds, and in the west I was once deceived by the Pigmy into thinking there must be several Red Squirrels chattering near by. After a shot the Brown-headed Nuthatches always flew and were very quiet, so that it was with difficulty that I succeeded in obtaining two or three specimens.

The pine barrens also held, in troops, a large number of warblers, mostly Pine and Palm, both of them feeding on the ground and constantly rising from the rear rank and flying over to the front. But the only other new and striking bird of the barrens was the Cockaded Woodpecker, which is black and white, some what after the pattern of our Hairy Woodpecker, only blacker. The full plumaged male, which unfortunately I did not meet, has a large red patch on each side of the head, but in all my birds this patch was white. This bird has an interesting note, something like that of the Red-bellied Woodpecker with which it associated.

Throughout all Northern Florida the most abundant bird was the Myrtle Warbler, and in the shade trees of Ste. Augustine it fairly swarmed. The Shrikes, too, were quite common, and very tame, paying only the slightest attention to the casual passer, and if alarmed soon returning to the same perch. Some of them may have been the southern variety, but the only one I shot was the same that we have in Ontario in summer.

Four birds whose notes the visitor does not soon disentangle are the Cardinal, Tufted Tit, Carolina Wren and Mocking-bird.

My three weeks were only sufficient to enable me to make a good guess at the author. The latter is the most prominent singer in the towns, living all over, and probably nesting in back yards as our Robin does. The Robin was there too, and was much hunted by the poorer people *for food*. These birds fed mainly on the Palmetto berries in the towns, and were too wild in the woods to be watched. As our visit ended in early March we did not hear a really fine song from the Mocking-bird, but still we found him a fairly constant singer. The Cardinal, though conspicuous, had scarcely begun to tune up, but the Carolina Wren, in the woods, gave us beautiful thrush-like songs from little bunches of scrub Palmetto, where he was difficult to see.

One of the interesting water birds, seen on the Ocklawba River only, was the Limpkin, a large and beautiful Rail-like bird of a rich seal brown colour, with vivid white streaks, which often alights in trees, although its feeding place is the marshy edges of the rivers. The Anhinga, or Snake-bird, was seen once or twice, but never at short range except for a mere glimpse, while the Herons, which were simply innumerable twenty-five years ago, are now nearly extinct, and the few that are left are wild inhabitants of the open country where a near approach is impossible.

Another bird whose acquaintance we made at the water only, though not a water bird, was the Fish Crow, coloured exactly as our crow, and of the same size, but one could guess them by their flight, and if the bird spoke there was no longer any doubt, as the voice was a harsh weak croak, quite trifling when compared with our vigorous northerners. We saw these birds only when flying to and from the salt water, and had no opportunity of making any closer acquaintance.

A summary of all the birds seen during the trip, lasting from February 13 till March 3, shows 64 old acquaintances, 6 that are very rare in the north, and 23 that were absolutely new, and while the proportion of well known birds was large, yet the new ones—winter residents of Florida—were in many instances so common and so interesting that it seemed as though there were new ones on hand at every turn. The only nests seen were a few of the Eagle and Osprey, along the water courses, and they were inac-

cessible to the tourist who had left his climbing irons in the frozen north.

I have mentioned the dislike of Floridians to work, and the more one lives in the south, the more he feels the southern langour creeping over him. It is said that a man becomes a "regular Florida cracker" in seven years, but I should guess that the average time required would be less. Coming north again, one could feel the air, hour by hour, becoming more invigorating and bracing, and when finally Canada was reached it seemed only a fitting end that the train should be run into a blizzard and incur five hours' delay on a four hours' run, but even this could not depress the spirits of one, who, after breathing the languid air of the south for a few weeks, once more felt the tonic qualities of a snow-laden atmosphere.

A CONDENSED SUMMARY OF THE FIELD-WORK ANNUALLY ACCOMPLISHED BY THE OFFICERS OF THE GEOLOGICAL SURVEY OF CANADA FROM ITS COMMENCEMENT TO 1865.

By D. B. DOWLING.

The reports published during the above term are not in any sense annual reports and it is often difficult to follow the annual wandering of the members of the staff, especially during the compilation and publication of the report for 1863. The impression is very general that owing to the reduced grant the staff were employed during this interval mostly in the office on the compilation. The field-work was nevertheless carried on, although the results were absorbed in the published volumes. As the reports previous to 1863 are not available to many, this summary may be considered as a supplement to the preface of the latter volume.

The information is drawn from the reports from 1843 to 1866, the Life of Sir Wm. Logan by Prof. B. J. Harrington, and information from Dr. Robert Bell.

GEOLOGICAL SURVEY OF CANADA.

Before the union of the Provinces of Upper and Lower Canada, several petitions were sent to the Governor and notices of bills given in the Legislature of Upper Canada for the creation of a Geological Survey. A vote of £1,500 had been passed in 1841, but the selection of a geologist was not made until 1842, when W. E. Logan received the appointment. He arrived in August at the capital, Kingston, but finding the political situation very complex, he made several excursions at his own expense to various localities. A visit was made to Marmora to see the iron mines of that region, and also to Brockville, Kingston Mills, Oliver's Ferry and Perth. The first report of this work of 1842 was only preliminary, and was afterwards incorporated in the report of 1843. Private business called him away to England in the autumn, and while there he secured the services of Alexander Murray as assistant.

1843.

Logan landed at Halifax on May 31st from England. He visited the Joggins on his way to Gaspé and made a complete section of the rocks there. He next visited Dorchester, Richibucto and Mirimichi and examined the coast for fifty miles from Bathurst, and also along the south side of the Bay of Chaleurs from Jacket River to Pockshaw. Then he worked between Cape Rosier and Paspebiac.

Murray arrived from England in May and called at Kingston, but commenced his work at Toronto by examining the country between the Credit and Don rivers. Then he went to Lake Simcoe and explored its shores. From Simcoe he went down the Severn River to Lake Huron and along the coast to Coldwater River and as far as Penetanguishene. Returning to the narrows of Lake Simcoe and to Barrie he struck west through Nottawasaga Township following the Niagara escarpment for a short distance but returned to the Lake Ontario shore, visiting Scarborough, Pickering and Whitby. Next from Oakville he traced the rocks west through Esquesing and back by Nelson and Trafalgar Townships. Subsequently he examined the couutry lying

between the Grand River as far up as Paris, and Lake Ontario east to the Niagara River.

1844.

Logan and Murray left Montreal in May and proceeded to Gaspé arriving June 1st. They commenced work at Cape Rosier and continued to Cape Chat and then ascended the Chat River to the vicinity of the Notre Dame Mountains. Crossing to the Cascapedia River, their Indians built bark canoes, in which they descended to the mouth and coasted to Paspebiac. From there Murray was sent up the Bonaventure River, while Logan visited Port Daniel and returned to New Richmond. The coast was examined to Dalhousie and the Restigouche to Campbellton and thence to the mouth of the Matapedia. Up this stream they journeyed to Lake Matapedia and from thence by road the country was examined on foot.

1845.

Logan this year commenced the exploration of the Ottawa River. With J. McNaughton he surveyed not only the main river but several tributaries. He ascended the Rivière à la Graisse and the Rivière du Nord some distance, the Mississippi River to Pakenham, the Madawaska to High Falls, and the Bonnechère to Jessups Rapids. From Portage du Fort he went around Calumet Island, and passing Coulonge Lake reached Pembroke, From the mouth of the Mattawa he made a visit to Lake Nipissing.

Murray spent the summer in Gaspé where he made surveys on the Matane, Ste. Anne and St. John rivers. Later in the year he collected fossils at Thetford, Ont.

1846.

The nucleus of a museum was this year moved from 40 St. James street to Little St. James street, Montreal.

Logan and Murray, with McNaughton as surveyor, formed a party to explore the north shore of Lake Superior. James Richardson is said to have accompanied this party.

De Rottermond, who had been acting as chemist, resigned.

Dennison Olmstead, Jr., received the appointment but owing to ill health could not assume the duties. He died early in the year.

T. Sterry Hunt, at the age of 21 years, received the appointment and came to Montreal the following February.

1847.

Logan devoted most of the season to work on the south side of the St. Lawrence, from Montreal and Lake Champlain to the Chaudière River.

Murray went to explore the northern shore of Lake Huron. He took four Indians from Montreal. Going by Detroit he took steamer to Sault Ste. Marie and from there explored the north shore and the Manitoulin Islands to Manitowaning. He left La Cloche on August 16th to survey the French River to Lake Nipissing.

Hunt spent part of the summer with Logan, but afterwards went to Lachute and Grenville to collect fossils from the limestones of the Ottawa. He visited the falls on the Gatineau and examined the rocks there, and also the iron-ore at Hull. From there he went to Perth and examined the apatite deposits of North Burgess. The mineral, perthite, was analyzed by his pupil, Mr. Hartley. Mineral waters were collected from Caledonia Springs, Tuscarora, Charlotteville and Ancaster, Ont.

1848.

Logan spent only two months in the Eastern Townships when he determined to pay a visit to Lake Huron. There he examined the Bruce Mines, and with Marray ascended the Thessalon River before returning to the Eastern Townships.

Murray made a short excursion up the Grand River to Galt and then went to Goderich, examining the rocks on the Ashfield, Maitland and Bayfield rivers. Then he proceeded along the lake shore to Sarnia, and by Lake St. Clair to Windsor. Then from Detroit he took steamer to Sault Ste. Marie and joined Logan at Bruce Mines. Separating from Logan on September 5th, he went along the coast to Spanish River and ascended it for sixty miles.

After examining the Wallace mining location he coasted the east coast of Georgian Bay to Penetanguishene and Collingwood.

Hunt visited mineral springs at St. Leon, Caxton, Champlain, Quebec, Varennes, Sabrevois and St. Benoit, Que.

1849.

Logan and Murray spent most of the summer in the Eastern Townships between the Chaudière and the Temiscouata road. As coal was supposed by some to occur near Murray Bay and Bay St. Paul, Que., and petitions for borings had been sent to the Legislature, Logan was asked to make an examination. This took some time, and he did not finish his work in the Eastern Townships.

Hunt accompanied Logan on the St. Francis and Chaudière rivers, but later visited portions of the west to collect soils. Mineral waters also occupied part of his attention.

1850.

The Provincial Act creating the Survey expired in March, and it was August before it was renewed.

Logan was part of the time in London superintending the collection of exhibits for the Exhibition, but later continued the examination of the gold-bearing gravels of the Chaudiere.

Murray spent the summer in Western Ontario tracing the rocks of the Niagara escarpment.

Hunt was with Logan in the Chaudiere district. In September he went to the north shore of the St. Lawrence below Quebec and then returned to Montreal to continue laboratory work.

Richardson collected fossils at Cornwall.

1851.

Logan went to England with the exhibit but returned in August, then, with Richardson, studied the outcrop of the Potsdam sandstone near the St. Lawrence.

Murray worked between the Ottawa and St. Lawrence rivers east of Gananoque. He made a short excursion to Enniskillen Township, in Western Ontario, to examine into the reports of mineral pitch or petroleum. He also collected fossils at Edwardstown and in Township Beverly, Wentworth, Ont.

Hunt spent some time with Murray in Eastern Ontario, and then went to the village of St. Nicholas, Kamouraska County, Que., to examine metamorphic rocks. Several short excursions were also made to collect mineral water.

1852.

The museum was moved in the spring from Little St. James street to St. Gabriel street, to a building formerly the residence of the Hon. Peter McGill.

Logan went to England but returned in May and began an examination of the north shore of the St. Lawrence between Montreal Island and Cape Tourmente.

Murray examined the country between Kingston and Lake Simcoe tracing the outcrop of the lower fossiliferous rocks.

Richardson assisted Logan between Montreal and Three Rivers.

Hunt continued his investigations of the mineral waters of Canada.

1853.

Logan examined the rocks at Grenville, Que.

Murray ascended the Muskoka River and descended by the Ottawa to Allumette Lake. Then he ascended the Bonnechère and passed from it to the Madawaska. Ascending the York or south-west branch he crossed several tributaries of the Ottonabee River and came out by Balsam Lake.

Hunt made analyses of dolomites and limestones and also continued his investigation of the mineral waters of Canada.

Richardson collected fossils at Stafford, Fitzroy and Ottawa, Ont.

1854.

Logan studied the rocks at Point Levis and collected material for the Exhibition at Paris.

Murray examined the Meganatawan River and commenced the survey of Lake Nipissing.

Hunt examined the triclinic felspars of the Laurentian and also various ores.

Richardson and E. Billings collected fossils at Point Levis, Que.

1855.

Logan and Hunt went to Paris. A large collection of graptolites from Levis were taken to Prof. James Hall, at Albany, to be described.

Murray, with Prof. Hall, visited some of the fossil localities in Ontario. Then he went to Lake Nipissing by way of Lake Huron and surveyed the west coast from the outlet.

Hunt reported on iron-ores, cement, plumbago, peat, and the extraction of salt from sea-water.

Richardson and Billings collected fossils at Levis, Que., and Thetford, Ont.

1856.

Logan was knighted January 29th. He stayed most of the summer in Toronto trying to get another Act passed for the Survey.

Murray, with Mr. Brown as assistant, ascended the Sturgeon River from Lake Nipissing for 52 miles, then the Maskinongé for 30 miles, and crossed to the Wahnapitae River and back to the French River. Another survey was made from the Wahnapitae by the Whitefish River to Lake Huron.

Hunt continued laboratory work.

E. Billings was appointed Palæontologist on August 1st.

Richardson went in June by way of the Mingan Islands to Anticosti. At both places examinations were made, but the greater part of his time was spent at the latter place. Logan seems to have made him a short visit and collected fossils.

Capt. E. D. Ashe was employed on longitude determinations by means of the electric wire.

R. Barlow, one of the engineers employed on the construction of the Victoria Bridge, was appointed chief draughtsman June 1st.

S. Barlow was employed to assist his father at mapping, appointed Dec. 1st.

1857.

Logan was detained in Montreal at the meeting of the American Society for the Advancement of Science. He went to Gren-

ville in October and spent a few weeks tracing the limestone bands of the Laurentian.

Murray, with J. Johnston as assistant, made a survey of the mouth of the French River and then went to the Bruce Mines and Echo Lake to study the copper deposits. A survey was made of Echo Lake and River, the northern part of Great Lake George, Little Lake George and Garden River. He also collected fossils at Galt and Woodstook with Billings.

Richardson, with Scott Barlow as assistant, surveyed the Magdalen River and the coast of Gaspé to Gaspé Bay. A traverse was made from Griffin Cove to Peninsula Cove in Gaspé Bay, then up Dartmouth River and to Grand Etang.

R. Bell was another of the party and collected objects of natural history on which he specially reported. After the St. Lawrence was reached, the party crossed over to the Saguenay and ascended to Lake St. John. Richardson and Barlow walked across to Bay St. Paul.

Billings ascended the Ottawa and Bonnechère rivers, collecting fossils. At Eganville he engaged J. McMullen, and with him visited Lake Clear in Sebastopol Township. He then returned and ascended the river to Golden Lake. The rocks of the fourth chute were examined while the water was shut off. Later he visited Galt, Woodstock and Port Colborne, Ont.

Hunt continued his chemical work on the dolomites of Canada and also investigations on fish manures.

Ashe reported on his longitude determinations.

1858.

Logan spent six months in the Grenville region and ascended the Rouge River to Iroquois Chute. In August he attended the meeting of the American Society for the Advancement of Science.

D'Urban accompanied Logan to Grenville and collected natural history specimens.

James Lowe was employed by Logan in the Grenville region.

Murray and Johnston, with S. Barlow as assistant, continued the examination of the copper deposits north of Lake Huron between the coast and Thessalon River. They connected their work to Echo Lake and around Rock Lake. They also examined the coun-

try and coast between Thessalon and Mississagui Rivers and surveyed the upper part of the latter.

Richardson, with Bell as assistant, explored the country between Rivière du Loup and Ste. Anne de Monts and along the coast to Marsouin River. He ascended the Ste. Anne River and crossing overland to the Barn-shaped Mountain he continued to Lake Matapedia and descended to Dalhousie, collecting fossils down to Patapedia. He ascended the Patapedia and crossed by the lakes of the Metis River to the St. Lawrence. Before returning to Montreal he visited several townships south of Rimouski and Trois Pistoles, Cacouna and Rivière du Loup.

Hunt continued work on the intrusive rocks of Montreal Mountain and the metamorphic Silurian rocks of the Eastern Townships.

1859.

Logan went to the Mingan Islands in June, and in July to Burlington and St. Alban's, Vermont. In September he was in Carleton Place, and afterwards visited Acton and the copper mines of the Eastern Townships.

Richardson accompanied Logan, but afterwards visited Perry, Lubec and Bangor, Maine. He also collected fossils in Western Ontario at Bosanquet and Thetford.

Murray was also employed most of the summer along the north side of the Ottawa River, taking latitude observations and making surveys in the vicinity of Grenville.

Bell was sent to explore the north shore of Lake Huron in the vicinity of the Manitoulin Islands, where he also collected fossils. Returning to Owen Sound he traced the outcrop of the Silurian along the Niagara escarpment to Lake Ontario.

Billings collected fossils near Montreal.

1860.

Logan continued making measurements at the copper mines in Acton and Milton Townships, Quebec. He records observations on the Island of Montreal, and visited Orleans Island and Point Levis in September.

Richardson made a long traverse along the north shore of

the Gulf of St. Lawrence to the Straits of Belle Isle, from near the Mingan Islands.

Murray was instructed to make explorations west of Sault Ste. Marie, on the coast of Lake Superior. His assistant this year was R. Bell, who made many of the necessary surveys, such as a triangulation of Bachewanung Bay and Goulais Bay and River. A visit was paid to the Limestone Mountains near Lake Anne on the south shore. After Murray had sailed for Sarnia, the party under Bell coasted the north shore to Bruce Mines, calling at the Manitoulin Islands. and collecting fossils From Collingwood, Bell ran several long lines of levels through the townships south, and also established heights of points on the Blue Mountains. The surface geology of this region was also studied.

Lowe made surveys in Grenville and Chatham Townships, Quebec.

1861.

Logan was mostly in the Eastern Townships, but in November he visited Phillipsburgh and Swanton, Vermont, making many sections of the Phillipsburgh series, which were published in the report of 1863.

Richardson spent the season in Newfoundland on the west shore.

Murray visited several points along the escarpment near Owen Sound, and then went up the lake to Drummond Island, calling at Colpoys Bay, Gun Point and Flowerpot Island. The first part of September he was on Barr River and Lake George.

Bell worked out the distribution of the formations westward of the Niagara escarpment in the counties of Grey, Bruce, Huron, Wellington, Waterloo, Perth, Brant and Haldimand. He also collected specimens for the International Exhibition of 1862.

Lowe made surveys in the vicinity of Grenville, Quebec, in De Salabery Township.

1862.

Logan was a juror at the International Exhibition, London, but made a short trip in August to Point Levis and Island of Orleans. In September he paid a visit to Phillipsburgh and Swanton, Vt.

Murray traced the limestone band north of Lake Huron in the Huronian rocks east of the Mississagui River and upward to Wahcomatagaming Lake above Salter's base line to the contact with the Laurentian ; also eastward along the Marsh River to Blind River and north-west to the narrows of Macomang Lake.

Richardson spent a short time in Newfoundland visiting Burnt Cape, Table Head and St. Paul Bay.

Bell surveyed the Dartmouth, York, Malbay and Grand rivers in Gaspé, Que., and also made large collections of fossils at Port Daniel and Gaspé Bay.

Lowe made surveys in the vicinity of Grenville, Que.

1863.

Logan visited Sherbrooke, Ascot and Point Levis in February and was in the vicinity of Montreal during June and July, but visited Point Levis and Orleans Island in August. In the fall he visited Albany, N. Y.

Richardson and Bell spent the summer in the Eastern Townships.

Murray, with S. Barlow as assistant, explored the country north of Lake Huron, surveying the following : Lakes Macomang and Tandanaidah on Blind River, and from Trout Lake to the Little White River.

Lowe made surveys in Ponsonby Township, Que.

T. C. Weston was collecting fossils with Richardson and visited Maine with Logan.

In autumn R. Bell was appointed Professor of Natural Science at Queen's College, Kingston.

1864.

Logan visited Quebec in May, making measurements and examinations at Point Levis. In July a short trip was made to the Eastern Townships. The publication of the Atlas to the report of 1863 obliged him to go to England, where he remained till spring.

Richardson spent the summer in the Eastern Townships.

Murray left early in the spring for his new field of labour in Newfoundland.

Weston was sent to Troy, N.Y., to collect fossils. He spent some time at Bald Mountain and Glen Falls.

Lowe made surveys in St. Jerome Township, Que.

1865.

Logan arrived in Canada early in June. He ascended the Petite Nation River in September, but was recalled to Montreal by his brother's death.

Richardson spent the summer in the Eastern Townships.

A. Michel, mining engineer, was engaged to explore the gold-bearing gravels and quartz veins of the Chaudiere River, Que.

Bell was employed during the summer on an exploration of Manitoulin Island. H. G. Vennor, accompanied him.

Thomas Macfarlane examined the north-east shore of Lake Superior and visited the copper mines of Portage Lake, Michigan.

Weston was sent to Anticosti and Silver Brook, Gaspé, to collect fossils.

Hunt made assays of gold-ores from the Chaudiere River, Que.

Lowe made surveys in Suffolk and Petite Nation Townships, Que.

THE KENTUCKY COFFEE TREE.

(Gymnocladus Canadensis.)

By REV. JOHN MORRISON, London, Ont.

When on my holiday trip in the summer of 1898, I visited my friend H——— and his beautiful home on the east side and closely overlooking the little river Sydenham, just over the boundary of Lambton County, in Kent. As I tied up my horse I was surprised to notice beside the driveway some five or six very fine specimens of the *Gymnocladus Canadensis*, about four inches in diameter and fifteen feet high. On enquiring where he got them, I was doubly surprised when told that fifteen years before he dug them up about a mile away on the western side of the river believing them to be walnuts; that only quite recently had he discovered they were not walnuts, and he did not know what they were, nor did anyone who had looked at them, and one man urged him to cut them down lest they might be of a poisonous nature. I informed him what they were, and not having time then I was compelled to wait a year. Then, when on my annual holiday I spent some

time searching for them, but failed to find them. On August 7th this year I went there determined if there were any of them growing in the locality to find them, and after some time spent in a most careful search I was rewarded by finding on a plat of ground not more than one hundred feet square about fifty specimens. About a dozen will average from three and a half to four and a half inches in diameter and twenty-five feet high. There are some fifteen or sixteen others from one inch and a half to two and a half in diameter and ten to twelve feet high ; the others are from one foot to four feet in height, and there are some six or eight stumps averaging six inches in diameter where the largest ones in the group have been cut down.

They grow upon a little knoll on the edge or rather in the midst of a swampy piece of ground about a quarter of a mile west of the River Sydenham and within half a mile of the northern boundary of Kent County, or on the old maps of twenty-five years ago within the southern boundary of Lambton. I searched carefully to find traces of a parent tree from which they might have come but failed. That they are native and not planted I am satisfied. I conversed with a member of the family on whose farm they grow ; she has lived there for many years and her father before her—one of the old settlers. She knew nothing at all about them, and as they are half a mile from the farm-house and buildings, it is another evidence they were not planted, at least by any white person within two generations.

In Macoun's Catalogue of Canadian Plants, pt. I, p. 123, we are told of their being found (native, I take it) on Pelee Island, and nowhere else in Canada unless planted. Now, what are we to believe regarding this group—nearly one hundred miles as the crow flies north-east of Pelee Island ; has a young tree or a seed been planted there generations ago by the neutral Indians, who are believed to have used Pelee Island as part of their highway from the south into Canada (see Archæological Report, 1899, pages 32-33) and so started the group now found, or are they the "last of their race" driven south by the cold climate which succeeded the warm semi-tropical climate which once prevailed over all this country? Who will solve this riddle? In any case the discovery is a most interesting one to the lover of the rare and strange in the scientific field, and I gladly respond to the invitation of Prof. John Macoun, the Dominion Botanist, (to whom I reported my find) to write it up, believing there are many who will be interested to know of it.

ENTOMOLOGICAL NOTES.

A HINT TO GARDENERS.—The well-known Cutworms which destroy so many young plants in spring are the caterpillars of several kinds of moths which lay their eggs in autumn upon weeds and other rubbish too frequently left unattended to by gardeners at this time of the year. The destruction of all weeds and the burning up of all old plants from which the crop has been gathered, such as the vines of peas and beans, the haulms of potatoes and tomatoes, the stems of Indian corn from which the ears have been gathered, etc., etc., will prevent the eggs of many Cutworm moths from being laid in a garden where the caterpillars might do harm the following year. The experience of many has shown that gardens kept scrupulously clean of weeds and useless vegetation are much freer of Cutworms than those which are left in a neglected condition during the autumn months. Not only are the moths of Cutworms attracted to this rubbish to lay their eggs, but many other insects gather around them seeking places to pass the winter. The early destruction of all weeds of course also prevents the ripening of seeds. The bonfire is a good servant of the gardener and should be kept constantly at work throughout the autumn, burning up his worst enemies, weeds and rubbish, with many insects' eggs, and turning them into useful fertilizers.

BOTANICAL NOTES.

JEWEL WEED, *Impatiens fulva*.—The form of this plant with spotless flowers has been growing along the sidewalk in Anne street (or as it has been lately called Gladstone avenue) and also along the St. Louis dam road to the Experimental Farm, in small numbers for several years. During the past summer several patches have been noticed, and those of our botanists who wish to obtain specimens can now collect them in fine condition.—J. F.

EXCURSION TO KIRK'S FERRY.

The last excursion of the season will be held on Saturday next to Kirk's Ferry, a beautiful locality on the Gatineau River. It is hoped that many of the ladies and gentlemen attending the Normal School Jubilee will be present. The train will leave the Union Depot at 1.30 p.m.

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NOTES BEARING ON THE DEVONO-CARBONIFEROUS PROBLEM IN NOVA SCOTIA AND NEW BRUNSWICK.

(Based on Dr. David White's recent Report entitled :— "*The Stratigraphic Succession of the Fossil Floras of the Pottsville Formation in the Southern Anthracite Coal Fields of Pennsylvania.*")

By H. M. AMI, of the Geological Survey of Canada.

From recent studies pursued with great care and diligence, extending over a period of many years in the Floral zones of the Pottsville formation in Pennsylvania and the Eastern States, Dr. David White, Palæozoic palæobotanist to the United States Geological Survey, has given to the world a most elaborate and comprehensive report in Part II. of the 20th Annual Report of the United States Geological Survey—General Geology and Palæontology—in which the results there given have considerable bearing upon and are closely in line with the results obtained in Canada during the last few years by the writer.

In May, 1898, I had the good fortune of visiting the Anthracite coal-fields of Pennsylvania, in company with Dr. David White, and of examining several of the sections in the Carboniferous system of that state, with a view of obtaining evidence that would tend to throw light upon the Devono-Carboniferous problem in Nova Scotia and New Brunswick. Near the town of Pottsville, at Maunch Chunk, Tremont, Brookside, and many other localities, typical sections were observed, and a number of

characteristic fossils obtained. The succession of strata in the Pottsville Gap gave the following series of formations in descending order :

Carboniferous	Coal Measures. Pottsville. Maunch Chunk. Pocono.
Devonian	Catskill. Chemung.

The above constitutes an unbroken though somewhat tilted series which, if followed down, would be found to be continuous with the Silurian system without any apparent unconformity or break, and presenting a series of estuarine and terrigenous deposits of the Carboniferous system, from the Coal Measures proper down to the Pocono, (the probable equivalent of the Horton formation of Nova Scotia according to Sir William Dawson, Dr. White and other authorities), followed by the terrigenous and estuarine Catskill series, and in close contact with, but preceding in point of time the marine sediments of the Chemung and earlier Devonian strata, with their brachiopod and crinoidal faunas.

The Pottsville formation underlies the productive Coal Measures* of Pennsylvania just as the so-called "Millstone grit" of Nova Scotia underlies the productive Coal Measures of that province. Workable seams of coal occur in the Pottsville (Lykens series) as well, yet not so extensively, as in the Coal Measures of Pennsylvania. In Canada, the Millstone Grit (or Westville formation of the Pictou coal field) is held to be for the most part barren of productive coal seams. A detailed study of the fossil floras which accompany and characterize the productive Coal Measures of both the Upper and Lower Coal Measures of Pennsylvania and elsewhere, by Dr. White, has enabled him to locate definitely the horizon of the various seams met with, and I have no doubt that similar detailed palæobotanical studies in Canada would also yield important and definite results.

* The term Coal Measures is not by any means a good formational name, it is one conveying economic and petrographical relations, and should not be used in nomenclature.

In the present volume and report by Dr. White, among the "Pottsville" plants described and recorded by him are noticed quite an array of species characteristic of that formation, which were however originally described from the "fern ledges" of New Brunswick, andfor the most part, referred to the "Middle Devonian." This reference was very probably based more on apparent metamorphic and petrographic grounds than for any other reason. The importance of this finding of Dr. David White's cannot be too strongly emphasized, and in calling attention to the forms in common between the Pottsville formation and the Lancaster formation, at this juncture, the writer presents it as an additional argument in favour of the Carboniferous age of the New Brunswick deposits known as the Mispeck Group, Cordaites shales, "Fern ledges," the "Little River Group" the "Dadoxylon sandstone" and the "Bloomsbury conglomerate." The strata constituting these "fern ledges" containing a large and abundant flora and fauna has been recently designated by the writer as the Lancaster formation.

The following species from the Pottsville formation of Pennsylvania also as identical or allied species in New Brunswick, whilst a number of them have also been recorded from Nova Scotia.

1. *Trigonocarpon Dawsonianum*, D. White.

On page 910 Dr. White describes this new species and writes: "it agrees so completely with the fragments figured by Dawson from the 'fern ledges' at St. John as 'fruit or bracts of uncertain nature,' that I have ventured to include a portion of the latter material as well as the same species." Dr. White further adds: "The figures given in the 'Devonian Flora' will serve to illustrate the Pottsville material which I name in honour of the late distinguished Palæontologist of America."

2. *Cardiocarpon obliquum*, Dawson.*
3. *Cardiocarpon cornutum*, Dawson.*
4. *Cardiocarpon Girtyi*, D. White. (Allied to *Cardiocarpon Baileyi*, Dawson.)*

* The species marked with an asterisk (*) were described by Sir William Dawson in Q. J. G. S., Vol. XVIII, 1862, pp. 296-330, London, Eng.

5. *Cordaites angustifolius*, Dawson (possibly young leaves of *Robbii*, Dawson).*

6. *Cordaites Robbii*, Dawson.*

7. *Annularia latifolia*, (Dawson)* Kidston.

8. *Annularia acicularis*, (Dawson)* Sp. (Under this species note that Dr. White employs the term "Lancaster formation" suggested for the strata described as "Middle Devonian" from the "fern ledges" of Lancaster, New Brunswick.)

9. *Asterophyllites parvulus*, Dawson.*

10. *Neuropteris Pocahontas*, var. *inæqualis*, n. var. Allied to *Cardiopteris Eriana*, Dawson,* and *Odontopteris squamosa* Dawson, which, bye the bye, has been called *O. Dawsonian* by S. A. Miller. Dr. White adds that it deserves a special comparison with the *Neuropteris Pocahontas* group of Pottsville forms.

11. *Megalopteris plumosa*, D. White, n. sp. This species closely resembles *M. Dawsoni*, Hartt, from the so-called Middle Devonian of New Brunswick.

12. *Alethopteris discrepans*, Dawson.* This species, originally described from the "fern ledges" of New Brunswick occurs in the Pottsville formation at the New Lincoln Mine. Of specimens from this place, Dr. White says: they "appear to agree in all respects with specimens from the 'fern ledges' at St. John." "The occurrence of this species," he adds, "together with *Sphenopteris Harttii*, *S. pilosa* and *Pecopteris serrulata*, Hartt in the Upper Lykens division of the Pottsville formation points strongly to the close relationship between the flora of the latter and that of the supposed Middle Devonian beds at St John, a relationship so close as to convince me that no appreciable difference in age exists between the plant beds at the two localities." (p. 886.)

13. *Pecopteris serrulata*, Hartt.

14. *Sphenopteris pilosa*, Dawson.*

15. *Sphenopteris Harttii*, Dawson.*

Besides the above 15 Canadian so-called Devonian species ecorded by Dr. White from the Pottsville formation in Pennsylania in his description of the species from the southern Anthracite oal field, he also records additional evidence, which in the writer's idgment, points clearly to the view advocated in referring the ancaster formation of New Brunswick with its abundant flora f ferns and with insects, etc., to the Carboniferous and not to the Devonian System.

6. *Annularia laxa*, Dawson, sp. (*Asterophyllites laxus*, Dawson*), referred to in a subsequent paragraph, adds another species to the list of forms common to the Pennsylvania Carboniferous and the New Brunswick strata.

In his summary of conclusions regarding the floral zones of ne Pottsville formation Dr. White devotes paragraph 14 to the llowing statement, which will be of special interest to the udents of systematic geology, not only of America, including ne United States and British North America, but also of Europe. le thus writes :

"The flora of the Pottsville formation is so far identical, in oth its genera and specific composition, with that from the supposed Middle Devonian beds of St. John, New Brunswick, as to ave no room for a great difference in the age of the latter. In ct, the plants from the 'fern ledges' include a flora essentially quivalent to that of the Sewanee zone, which appears to be presented by a portion of the section at St. John."

Such a statement, coming from so eminently qualified a orker in and student of Palæozoic floras, taken into consideraon with the report of Mr. R. Kidston, of Sterling, Scotland, on ssil plants, from strata belonging to the Riversdale formation of ova Scotia (the recognized equivalent of the Lancaster formaon of the New Brunswick "fern ledges") compels me to re-affirm ne statement made in the "Summary Report of the Director of ne Geological Survey Department for the year 1897" (p. 135), nat these formations "hold plants and animals which in their road general character resemble those of the Eastern American arboniferous."

This statement was intended to convey the idea that the iversdale and Union formations had a Carboniferous facies and

were, in addition, the equivalents of those fossil plants from La caster in New Brunswick, "held to be of Devonian age," th implying that whatever one series was, the other must be al and hence the Lancaster "fern ledges" must also have a Carbo iferous facies though coloured Devonian.

Later, in the "Summary Report of the Director of the Ge logical Survey Department for 1898" (p. 181), I made the followi statement: "Regarding the general results of this Devo Carboniferous problem from a palæontological standpoint it wo appear, in reviewing the value and amount of the evidence afford by fossils obtained during the past three seasons, that, in so far the faunas are concerned, they clearly indicate a 'Carbonifero facies.'"

Subsequently, in the "Summary Report of the Director the Geological Survey Department for the year 1899" (pp. 201-20 the writer gives the result of an examination made by Mr. Kidston, F.G.S., of the material collected from the so-call "Devonian" strata of Nova Scotia, and as regards the rocks of t Horton formation he says they "appear to be undoubtedly Low Carboniferous."...."there is no evidence at all to support t opinion that they are of Devonian age"....."all the eviden derived from the study of these fossils points very strongly agai this view." Of the Riversdale series of plants, Mr. Kidston giv them "a pronounced Upper Carboniferous facies, and marke possess the characteristics of a coal measure flora. Judged fr a European comparison, no other conclusion can be arrived at."

Such evidences, relative to the Devono-Carboniferous proble and the various results given, all seem to indicate that both Nova Scotia and New Brunswick we find a series of fos plants which in one province had been assigned to the Carbo iferous and in the other to the Devonian, but whose characte and affinities as adduced and understood respectively necessar place them both in the Carboniferous system.

For brief notes upon the succession of the strata in t Carboniferous of certain portions of Nova Scotia with spec reference to the Union and Riversdale formations the reader referred to the writer's paper on that subject in the Transactio of the Nova Scotian Institute of Science, Vol. 10, 1900, pp. 1

178, and in the various summary reports of work carried on by the writer during the seasons of 1896-7-8-9, issued by the Geol. Survey.

The writer desires to emphasize the fact that he has done his utmost to search for evidence in support of the Devonian age of the strata in question. He has failed to do so except in the case of the strata constituting the *Knoydart formation*—a term used to designate the red shales, sandstones, marls and impure calcareous beds such as are developed in McArras Brook, Knoydart Brook, etc., and coloured Upper Devonian on the map prepared by the Geological Survey Department—in which remains of *Pteraspis*, *Cephalaspis*, *Pterygotus* and *Onchus*—examined by Dr. Henry Woodward and Mr. Arthur Smith Woodward, of London, England, and pronounced by them (as palæontological evidence warrants) as belonging to the base of the Old Red Sandstone type of the Devonian, and very similar in faunal as well as lithological character to strata of Devonian age in Herefordshire, England, and in Spitzbergen, as has been pointed out to the writer by these gentlemen.

Ottawa, 3rd Sept., 1900.

FAUNA OTTAWAENSIS.

DIPTERA.

By W. HAGUE HARRINGTON, F.R.S.C.

The publication of the following list of some Ottawa Diptera has been made possible through the courtesy of Dr. L. O. Howard, the Chief of the Division of Entomology in the Department of Agriculture, Washington, U.S. By his kind permission the determinations of the species were made by Mr. D. W. Coquillett, an eminent specialist and authority in this order. The specimens submitted to him had gradually accumulated in my cabinets, but they were taken only as "extras," during the collecting of Coleoptera and Hymenoptera. The list is, therefore, only a fragmentary contribution toward a knowledge of the Ottawa fauna, and is presented with the hope that at some future time others

may make systematic collections and studies of these insects, so numerous both as regards species and individuals. The minute and delicate forms of which the order of flies is largely composed, as well as many of the larger forms which have long fragile legs, require special care and skill in collecting and preserving. For these reasons a list such as the following is by no means typical of the fauna, as whole groups of the most common species may be entirely lacking.

I have tried to group the species in agreement with the classification published by Dr. Williston, so as to indicate the families represented.

When sending my flies for determination I requested Dr. Howard to retain for the U. S. National Museum's unrivalled collections any specimens which might prove to be of special value, and I was gratified to find that about fifty were deemed to be worthy of retention. The remark "U. S. Nat. Mus." after any species denotes that its representative is to be found there.

CECIDOMYIDÆ.

Cecidomyia, sp. Very common on willows.
Diplosis pini-inops, O.S. Bred from puparia upon pine-twigs.
Diplosis, sp. One specimen,

MYCETOPHILIDÆ.

Sciophila, n. sp. ? U. S. Nat. Mus.

CULICIDÆ.

Culex impiger, Walk. A very abundant and obtrusive pest.

CHIRONOMIDÆ.

Chironomus cristatus, Fabr. Common early in May.

TIPULIDÆ.

Limnophila macrocera, Say. One specimen.
Limnophila rufibasis, O.S. One specimen.
Tipula angustipennis, Loew. A very common species.
Pachyrrhina lugens, Loew. Also common.
Amalopis inconstans, O.S. One specimen.
Ctenophora, n. sp. ? U. S. Nat. Mus.
Ctenophora, n. sp. ? U. S. Nat. Mus.

RHYPHIDÆ.

Rhyphus alternatus, Say. One taken 28th June.
Rhyphus punctatus, Fabr. Two specimens.

BIBIONIDÆ.

Plecia heteroptera, Say. Several at Hull 24th September.
Dilophus serraticollis, Walk. A very common species.
Bibio pallipes, Say. Everywhere in early spring.
Bibio albipennis, Say. Equally common with above.
Bibio gracilis, Walk. U. S. Nat. Mus.

LEPTIDÆ.

Xylophagus fasciatus, Walk. One specimen.
Cœnomyia ferruginea, Fabr. This large species is rare.
Atherix variegata, Walk. One specimen.
Leptis mystacea, Macq. Very common on tree-trunks on margin of woods.
Leptis vertebrata, Say. One specimen.
Chrysopila quadrata, Say. Somewhat abundant in June and July in damp woods.
Chrysopila flavida, Bigot. One specimen.
Chrysopila proxima, Walk. A common species in June.
Xylomia, n. sp. ? U. S. Nat. Mus.

STRATIOMYIDÆ.

Nemotelus nigrinus, Fall. Common in May.
Euparhyphus bellus, Loew. Abundant in June.
Allognosta fuscitarsis, Say. Two specimens in August.
Allognosta obscuriventris, Loew. This species is common.
Beris viridis, Say. Less abundant.
Sargus viridis, Say. Moderately abundant in May.
Sargus decoris, Say. Occasionally taken, from May to September.
Odontomyia interrupta, Oliv. Apparently not common.
Odontomyia pubescens, Day. Very abundant. Several dead ones in Cypripediums.
Odontomyia cincta, Oliv. Upon flowers in June; not common.
Odontomyia virgo, Wied. Occurs with preceding species.
Odontomyia vertebrata, Say. Two specimens of this smaller species.
Stratiomyia barbata, Loew. A common frequenter of flowers.
Stratiomyia apicula, Loew. One specimen 18th May.
Stratiomyia discalis, Leow. Common; our largest species.
Stratiomyia badius, Walker. One specimen.

TABANIDÆ.

Chrysops celer, O. S. A common and aggressive fly in woods.
Chrysops exitans, Wied. One specimen.
Chrysops niger, Macq. One specimen.
Chrysops fugax, O. S. Rather common.
Chrysops vittatus, Wied. Common in midsummer in woods.
Chrysops obsoletus, Wied. Less abundant and not so troublesome.
Atylotus bicolor, Wied. One specimen 21st July.

Therioplectes lasiophthalmus, Macq. One of our commonest species of Horse-fly.
Therioplectes septentrionalis, Loew. Rare.
Therioplectes affinis, Kirby. One example of this larger form.

ASILIDÆ.

Laphria pubescens, Will. Not very abundant.
Laphria sericea, Say. A common and rapacious insect.
Laphria gilva, Linn. Almost as abundant.
Laphria canis, Will. Common.
Dasyllis flavicollis, Say. Abundant.
Dasyllis posticata, Say. Not so common.
Dasyllis sacrator, Walk. A large and abundant species.
Dasyllis grossa, Fabr. The largest of our Bumble-bee mimics.
Leptogaster testaceus, Loew. This slender species is common in June.
Cyrtopogon chrysopogon, Loew. Also common.
Nusa fulvicauda, Say. One specimen.
Asilus notatus, Wied. Not common.
Asilus annulipes, Macq. Abundant.
Asilus novascotiæ, Macq. Rare.
Asilus callidus, Will. One specimen.

BOMBYLIIDÆ.

Anthrax tegminipennis, Say. Our largest Bee-fly; not common.
Anthrax fulviana, Say. Abundant in midsummer.
Anthrax alternata, Say. One specimen.
Anthrax lateralis, Say. Not common.
Argyramœba analis, Say. Our commonest species.
Argyramœba œdipus, Fabr. One specimen of this pretty fly, 30th July.
Bombylius major, Linn. One taken 18th May.
Systœchus vulgaris, Loew. Common but difficult to capture.

THEREVIDÆ.

Psilocephala hæmorrhoidalis, Macq. Several in June and July.
Psilocephala munda, Loew. One specimen 18th May.

ACROCERIDÆ.

Pterodontia flavipes, Gray. U. S. Nat. Mus.
Opsebius pterodontinus, O. S. U. S. Nat. Mus.
Oncodes costatus, Loew. U. S. Nat. Mus.

EMPIDIDÆ.

Syneches rufus, Loew. Abundant.
Empis varipes, Loew. U. S. Nat. Mus.
Empis otiosa, Coq. Two specimens.
Rhamphomyia rustica, Loew. Two specimens.
Rhamphomyia pulla, Loew. Two specimens.

Rhamphomyia lævigata, Loew. U. S. Nat. Mus.

DOLICHOPODIDÆ.

Psilopus caudatulus, Loew. U. S. Nat. Mus.
Psilopus patibulatus, Say. A very common species.
Dolichopus laticornis, Loew. Less often observed.
Dolichopus albiciliatus, Loew. U. S. Nat. Mus.
Dolichopus incisuralis, Loew. U. S. Nat. Mus.

CONOPIDÆ.

Physocephala furcillata, Will. Common upon goldenrods.
Myopa vesiculosa, Say. Two specimens.
Myopa obliquefasciata, Macq. One specimen.
Zodion fulvifrons, Say. One specimen.
Oncomyia abbreviata, Loew. One specimen.
Dalmannia nigriceps, Loew. U. S. Nat. Mus.

SYRPHIDÆ.

Chrysogaster pictipennis, Loew. Common in May.
Chrysogaster pulchella, Will. Also common.
Paragus angustifrons, Loew. U. S. Nat. Mus.
Paragus bicolor, Fabr. Occurs from May to September.
Xylota anthreas, Walk. One bred from puparium found under stone.
Xylota pigra, Fabr. A common and handsome species.
Xylota curvipes, Loew. This fine insect is less abundant.
Xylota ejuncida, Say. Several specimens.
Syrphus arcuatus, Fall. Rare.
Syrphus torvus, O. S. Rare.
Syrphus ribesi, Linn. Four specimens taken in June and July.
Syrphus disjectus, Will. One specimen.
Syrphus umbellatarum, Schin. One specimen.
Melanostoma mellinum, Linn. Rather common.
Melanostoma obscurum, Say. Two captured in July.
Platychirus quadratus, Say. Common.
Pyrophæna ocymi, Fabr. Only two specimens observed.
Sphærophoria cylindrica, Say. Very common.
Mesogramma parvula, Loew. Rare; July and August.
Mesogramma geminata, Say. Two specimens, June and July.
Neoascia globosa, Walk. Several in middle of June.
Syritta pipiens, Linn. Somewhat abundant May and June.
Rhingia nasica, Say. Common in May; taken also in August.
Helophilus conostomus, Will. Common. Found dead in Cypripedium.
Helophilus lætus, Loew. One specimen in June.
Helophilus bilinearis, Will. One specimen in May.
Helophilus similis, Macq. Three specimens of this large species.
Helophilus, n. sp. ? U. S. Nat. Mus.

Helophilus latifrons, Loew. More abundant.
Helophilus chrysostomus, Wied. Several dead in Cypripedium blossoms.
Criorhina analis, Macq. One taken near Hull, June 2nd.
Baccha fascipennis, Wied. Two of this slender species; middle of August.
Brachyopa notata, O. S. One specimen.
Microdon tristis, Loew. Rare.
Sphegina Keeniana, Will. U. S. Nat. Mus.
Brachypalpus inarmatus, Hunter. U. S. Nat. Mus.
Ceria abbreviata, Loew. U. S. Nat. Mus.
Spilomyia 4-fasciata, Say. This fine fly is moderately abundant.
Spilomyia fusca, Loew. Two only of this large and handsome species.
Sericomyia militaris, Walk. One specimen only.
Sericomyia chrysotoxoides, Macq. Three in July.
Temnostoma alternans, Loew. Three in June.
Temnostoma æquale, Loew. One taken near Hull, June 14th.
Temnostoma bombylans, Fabr. Several in June.
Volucella evecta, Walk. One specimen.
Eristalis flavipes, Walk. One specimen, May 31st.
Eristalis bastardi. Macq. Common during the summer.
Eristalis tenax, Linn. Also a common species.
Eristalis dimidiatus, Wied. Less abundant.
Eristalis Brousi, Will. A few taken in May.
Pipiza pisticoides, Will. One specimen.

TACHINIDÆ.

Ocyptera carolinæ, Desv. Common in June and July.
Ocyptera dosiades, Walk. Several in May and June.
Cistogaster immaculata, Macq. One specimen July 30th.
Gymnosoma fuliginosa, Desv. One specimen August 22nd.
Bombyliomyia abrupta, Wied. Common in July.
Echinomyia algens, Wied. One only in my collection.
Melanophrys insolita, Walk. Common, as is probably the preceding.
Peleteria tessellata, Fabr. One specimen.
Frontina Frenchii, Will. One specimen.
Exorista vulgaris, Fall. One specimen.
Tachina rustica, Fall. One specimen. These species may all be common.
Hypostena ænea, Coq. U. S. Nat. Mus.
Œstrophasia clausa, Br. & Berg. U. S. Nat. Mus.
Exoristoides, n. sp. ? U. S. Nat. Mus.
Alophora diversa, Coq. U. S. Nat. Mus.

SARCOPHAGIDÆ.

Sarcophaga ægra, Walk. One specimen.
Sarcophaga, sp. Two specimens.
Helicobia helicis, Town. One specimen, May 24th.

MUSCIDÆ.

Pollenia rudis, Fabr.
Pseudopyrellia cornicina, Fabr.
Calliphora erythrocephala, Meig.
Cynomyia cadaverina, Desv.
Musca domestica, Linn.
Stomoxys calcitrans, Linn.
Myospila meditabunda, Fab.

Probably all the species of this family are common, although with the exception of the common House-fly they are only represented in my collection by single specimens.

ANTHOMYIDÆ.

Homalomyia canicularis, Linn. Two specimens.
Phorbia fuscipes, Zett. Two specimens.
Mydæa ansoba, Walk. Common.
Mydæa diaphana, Wied. One specimen.
Hyetodesia nigripennis, Walk. One specimen.

SCATOMYZIDÆ.

Scatophaga stercoraria, Linn. Our common species.
Scatophaga furcata, Say. Also abundant.
Neuroctena anilis, Fall. One specimen.
Cordylura setosa, Loew. U. S. Nat. Mus.
Cordylura pleuritica, Loew. U. S. Nat. Mus.
Cordylura munda, Loew. U. S. Nat. Mus.
Cordylura varipes, Walk. This interesting species is common.
Cordylura gracilipes, Loew. Two specimens.
Orthochæta gilvipes, Loew. One specimen.

PSILIDÆ.

Loxocera cylindrica, Say. Common in July.
Loxocera pectoralis, Loew. U. S. Nat. Mus.
Psila bicolor, Meig. One specimen.

HELOMYZIDÆ.

Helomyza longipennis, Loew. U. S. Nat. Mus.
Leria pubescens, Loew. U. S. Nat. Mus.

MICROPEZIDÆ.

Calobata alesia, Walk. Common.
Calobata antennipes, Say. Rare.
Calobata univitta, Walk. Three specimens.

SCIOMYZIDÆ.

Tetanocera Boscii, Desv.
Tetanocera saratogensis, Fitch.
Tetanocera decora, Loew.
Tetanocera ambigua, Loew.
Tetanocera arcuata, Loew.
Tetanocera pictipes, Loew.
Tetanocera canadensis, Macq.
Tetanocera plumosa, Loew.
Sepedon fuscipennis, Loew.
Sepedon armipes, Loew.
Sepedon pusillus, Loew.

These flies, many of which have the wings very prettily mottled, are all poorly represented in the collection, although some of the species are probably quite common.

DIOPSIDÆ.

Sphyracephala brevicornis, Say This curious fly is not often observed.

SEPSIDÆ.

Nemopoda cylindrica, Fabr. Two specimens.
Sepsis violacea, Meig. Two specimens.

TRYPETIDÆ.

Trypeta longipennis, Wied. Common; May and June,
Trypeta sparsa, Wied. One specimen, August 22nd.
Trypeta solidaginis, Fitch. Galls common on goldenrods.
Trypeta tabellaria, Fitch U. S. Nat. Mus.
Trypeta florescentiæ, Linn. U. S. Nat. Mus.

ORTALIDÆ.

Rivellia flavimana, Loew. Two specimens.
Chætopsis ænea, Wied. Our commonest species; May and June.
Seoptera vibrans, Linn. Also common.

SAPROMYZIDÆ.

Sapromyza notata, Fall.
Sapromyza philadelphica, Macq.
Sapromyza lupulina, Fabr.
Lauxania cylindricornis, Fabr.

The members of this family are poorly represented in the collection.

OSCINIDÆ.

Chlorops proxima, Say.
Chlorops assimilis, Macq.
Chlorops variceps, Loew.
Eurina exilis, Coq.

The foregoing remark applies equally well to this family.

DROSOPHILIDÆ.

Drosophila ampelophila, Loew. A large number bred from grapes.
Drosophila colorata, Walk. U. S. Nat. Mus.

AGROMYZIDÆ.

Phytomyza, sp. Mines in leaves of Thalictrum.
Agromyza æneoventris, Fall. One specimen.

PIPUNCULIDÆ.

Pipunculus nitidiventris. Loew. One specimen, June 2nd.

EPHYDRIDÆ.

Ochthera mantis, DeG. Three specimens, July and August.

(Families, 37; Genera, 134; Species, 234.)

THE FINDING OF A FLAMINGO'S NEST.

The Mangrove tree is one of the characteristic growths of Florida, and a Mangrove swamp is perhaps the hardest travelling in the world. The tree sends forth drooping horizontal roots from the trunk, even as high as four or five feet, and these eventually grow down into the mud beneath. My friend Captain S. D. Kendall, of Tarpon Springs, gave me a keen insight into the difficulties of Mangrove travel in the following anecdote. He was cruising near the southern extremity of Florida, and happened on a place where Flamingoes fed abundantly on a wide tide-flat. Now one of these birds stands about five feet high, is clear pink throughout, and is an ornithological prize; and their nest is seldom seen, being placed in almost inaccessible localities. However, my friend thought these birds were breeding, and not being in a hurry (as is the contented manner of a Floridian) nor yet afraid of any obstacle that might exist, he spent some time watching these birds, feeding, then flying in, flying out, and feeding. After watching a good while, and making a line on the breeding grounds from all possible points, he settled on one point as being closest to the breeding ground, and in the early morning left his comrade, telling him, "If I don't come out in three days, you needn't wait," and started in. The swamp was a mass of Mangrove roots from entrance to centre, and in that whole day of hard labour he covered only about four miles. All through the long night the mosquitoes swarmed, and the bull Alligators roared near by; he could only sit, and smoke, and fight mosquitoes. Next morning he started at daylight and proved the correctness of his alignment by arriving at the nesting ground in a short time. It was an

open glade in the swamp, and here were many Flamingoes, coming, going, and brooding the eggs. The nests, instead of being tall cones of mud, as usually pictured, were large structures of sticks, and the bird curled her ungainly legs until the bones protruded horizontally far behind the nest, wherein were two chalky eggs. After completing his examination, and killing a single specimen, he started to retrace his steps, carrying this additional burden with him, and by dint of hard labour and good judgment, sharpened by experience, he reached open water the same night. The bird made a very fine specimen, and some time later, when he had it and several other choice specimens at New York, it excited much admiration. One visitor took a special fancy to it and asked the owner to set a price on it. Not wishing to sell, he named a figure which he thought far above its commercial value, and was chagrined beyond measure when the enquirer promptly paid the money, thus losing to him a specimen for which he had performed so much toil.

W. E. SAUNDERS, London, Ont.

ENTOMOLOGICAL NOTES.

COLIAS EURYTHEME.—A remarkably unusual number of the above beautiful orange-coloured Colias have been taken and observed around Ottawa during the latter part of September and the first week in October. This is a rare butterfly in this district, only an occasional specimen having been observed each season in years past. On October 1st, five nice examples were taken on and close to the Experimental Farm by Dr. Fletcher and the writer, and as many as a dozen others have been observed. Mr. C. H. Young has also taken over twenty specimens on his farm on the Rideau River, near Hurdman's Bridge. Among the specimens caught three of the recognized forms, viz., Eurytheme Eurytheme, Eurytheme Keewaydin and Eurytheme Eriphyle were represented. Many of the specimens when taken were in a fresh condition and looked as if they might have just emerged from the chrysalis. A number of examples of this butterfly have been also taken by collectors in Toronto, and it is probable that this species was fairly prevalent in many parts of Ontario this fall. Owing to the fact that it is a western species occurring commonly throughont Manitoba and the North-west Territories, its presence in such numbers so far east as Ottawa is interesting and worth recording.

ARTHUR GIBSON.

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DR. NANSEN'S SCIENTIFIC RESULTS.

By PROFESSOR EDWARD E. PRINCE, Dominion Commissioner of Fisheries, Ottawa.

On Dr. Nansen's return from his perilous Arctic expedition, doubt was expressed in many quarters as to the utility and value, scientific or otherwise, of any results which he might give to the world. Even in scientific circles, the risks and hardships involved were regarded by some as greatly overbalancing probably meagre additions to our knowledge, and the question "Cui bono?" was not infrequently urged. Many critics, indeed, did not hesitate to pronounce the North Pole expedition to be a somewhat foolhardy enterprise. Nothing could be further from the truth, as those felt who knew Nansen as a scientific worker, and especially those who knew him personally as a friend.

It cannot, of course, be denied that the chief aim of some Arctic discoverers, so-called, has been self-glorification. Their object was achieved when the columns of the newspapers were filled with accounts of their elaborate preparations, or their theatrical embarkations. Even an explorer like Peary, of the United States Navy, declared to the American Geographical Society (in Chickering Hall, 1897), that "his aim had always been to push the Stars and Stripes to the very apex of the globe!"

Wholly different were Dr. Nansen's aims. His methods were entirely the reverse of that. His object above all was to add to the world's knowledge, and Lord Lister succinctly expressed the truth upon this matter when he said, addressing the

Royal Geographical Society in London (on Feb. 5th, 1897), that "nothing is more remarkable than the scientific element in Nansen's expedition."

How far Dr. Nansen succeeded we have now some means of judging in the handsome volume of scientific memoirs, published in London a few months ago.

When Dr. Nansen was in Ottawa, three years ago, I ventured to ask him what his results were likely to be, and when the scientific world might expect their publication. He said that he had accumulated in his trip such a mass of observations, physical, meteorological, geological, as well as biological, that some years would of necessity elapse before they could be fully worked up into treatises. "The specimens of Crustacea alone," he informed me, knowing my special interest in zoology, "will take my brother-in-law, Dr. Sars, about three years to completely study." That was in 1897, and like so many of Dr. Nansen's anticipations, it has been literally fulfilled, for of the five splendid scientific memoirs contained in the quarto volume just issued by Nansen, the longest, and in some respects most striking, is that upon the Crustacea by Professor G. O. Sars, the brilliant Norse zoologist. It contains some very unexpected information. Thus we learn that floating surface animals of minute size, are abundant even in the most northerly polar waters, though almost perpetually covered by a layer of ice. Mr. Tyrrell has told us that there are lakes in the northern barren grounds sheeted over with thick ice at midsummer, yet abounding in whitefish ; but the plenitude of minute crustaceans in the icy surface waters of the Arctic is even more surprising. Most of them are Copepods, an order of almost microscopic crustaceans, of which the common freshwater mite, *Cyclops*, is a familiar example. Most of the sub-class *Entomostraca*, to which the Copepods belong, are small crustaceans with a thin firm cuticle, never a thick shell like the lobster or crayfish, a simple organization, and a variable number of segments or body rings, and jointed legs. Like Cyclops they have usually a single median eye at the front of the head. Copepods are frequently colourless and translucent, though they may be orange red, and one species which I observed off the west coast of Ireland, was appropriately enough of a brilliant green colour. They form the

staple food of young fishes in the sea, where they are very widespread in the surface waters. In the cold seas of the north the number of species is extraordinary, and they often discolour the sea's surface by reason of their multitude. Dr. Sars tells us that, oddly enough, the largest catches in Polar waters were made not at the surface, but at a depth of 250 or 300 yards (200 to 300 metres); indicating that the presence of ice makes the uppermost strata too frigid for even these hardy members of the crab and shrimp class. It is no doubt paradoxical to speak of the open sea in reference to the Polar basin, which, for so large a part of the year, is frozen over to a great thickness; but Dr. Nansen's tow-netting in the long lanes of water, which opened between the long ridges of hummock ice, revealed a rich pelagic life at apparently all seasons. British, German, Norse, and American investigators have found that typical surface animals constantly descend, and many species appear to frequent the basal waters 20 to 50 fathoms deep ; but the mid-water zone of life described by Dr. Sars, at 200 to 300 metres depth, is a new fact of interest. Naturalists anticipated that there might be a rich fauna on the floor of the Arctic seas. The reverse appears to be the case. Indeed the paucity of animal life there is most striking. As Dr. Nansen held the view that the polar waters were probably shallow, the good ship "Fram" was not well provided with deep-sea gear : but Professor Sars reports that in the deep sea soundings which were made every indication appeared of a scanty abyssmal fauna. Only one bottle in Dr. Nansen's extensive collection contained true bottom-living animals. The more considerable depths, 1600 to 1900 fathoms, occurred northward of 79 deg. N. latitude. Near the Siberian coast, and up to 79 deg. N. latitude, the water rarely exceeds 90 fathoms : but a little south of the latitude named, the shallows began to disappear, deeper soundings were recorded, and the depth increased with amazing suddenness, thus overthrowing altogether the preconceived conception of a North Polar sea. Indeed the great depth discovered appears to be a continuation of that North Atlantic channel which extends between Spitzbergen and Greenland. One peculiar shrimp-like creature, an Amphipod called *Cyclocaris guilelmi*, was found clinging to the sounding line, when hauled up from depths of 1100 to

2000 fathoms. Its eyes were very rudimentary—indeed it was almost blind—and it afforded every evidence that in its abyssmal habitat no light strayed down from the surface waters. The deep sea fauna may however be more varied than Nansen's fragmentary investigation appears to indicate. Perhaps the most remarkable facts to the minds of naturalists have been the discovery in polar waters of Copepods which are identical with, or closely allied to, species hitherto found in tropical waters and in some cases not nearer than twelve thousand miles. What can be the meaning of this strange occurrence of the same or similar animals in localities so far asunder? It is less surprising to find that some Calanoids, small crustaceans rarely larger than a grain of sand, were recognised at once by Sars as species he had got in deep fjords off the west and south shores of Norway, at depths never less than 100 fathoms. The conditions at that depth in the fjords are evidently the same as those characterizing the more superficial Arctic strata. A similar fact has long been known to naturalists in regard to the higher Amphipodan type, Norwegian and Swedish naturalists having described many species of Amphipods which were known to be Arctic also. Species of Calanus are widespread, and along the whole route of the "Fram" specimens were secured in almost every haul. Dr. Sars imagines that these minute crustacean worms have, for the most part, been carried north and east by a warmer Atlantic current flowing from the west beneath the cold Siberian current moving from the east, just as a cold northern current flows southward along the coast of Nova Scotia on the top of the deeper and warmer water of the Gulf Stream. Contrary to all previous hydrographical experience in the extreme north, the temperature was found by Nansen to rise as the thermometer descends in the water to greater depths, thus showing that the warmer currents referred to permeate and influence the conditions which prevail in the very heart of the ice world. Dr. W. B. Carpenter long advocated an hypothesis that a warm current "interdigitated" with an Arctic stream flowing south, but it had remained for Dr. Nansen to confirm it with some modifications. Nansen explains this deeper warmer current as the last remnants of the Gulf Stream spending itself in these frigid zones, a much more questionable theory than

Carpenter's equatorial current. Thus an abundant floating fauna has been introduced, as Nansen argues, from the west, while the food supplies to support this vast marine population come from the east. "I think that the Siberian current is of great importance," says Dr. Sars, "in conveying a constant supply of nourishment to the pelagic animals of the north polar basin. This nourishment consists of microscopic algæ, chiefly Diatoms, which are found to abound in the superficial polar water of the Siberian Sea, though gradually diminishing in quantity westwards, apparently owing to their being largely fed upon by the various pelagic animals. Indeed, without such a constant conveyance of nourishing matter, there could be no such rich animal life in the polar sea." The dark bands and discolorations exhibited by ice in northern waters are mainly due to these lowly plants (diatoms), though mingled at times with mineral dust, probably volanic. The ochre, brownish red, or dull green tints seen on the sides and margins of large bergs, floes, and even pans, are found to be due to these vegetable organisms.* Dr. Wakeham, when in Hudson Straits with the "Diana" in 1897 reports, July 14th, "A great deal of the ice we have seen to-day is discolored and soiled; in some of it we noticed sand and gravel; the most of it, however, is covered with an alga, similar to that we have seen on the ice through the strait." (Hudson Bay Exped. 1897, Report Marine and Fisheries, 1898, p. 17.) Mr. Andrew Halkett, in the report mentioned, figures these plant forms, of which there appear to have occurred more than a dozen species. Professor Cleve, on his first examination of Dr. Nansen's material, distinguished sixteen species, all of which were identical with Kellwan's specimens from Behring Strait, and twelve are unknown elsewhere. Cleve was struck by the fact that two areas so far removed should be the habitat of the same organisms, utterly unlike others from other localities.

Still more remarkable facts are, however, detailed in this report. A minute crustacean, unique in its external characters, a species of *Hemicalanus* was obtained in the very centre of the "polar basin." All previous records of this genus are either in

* Dr. Robt. Brown "On the Discoloration of the Arctic Seas." Quart. Journ. Mic. Sci., 1865.

the distant waters of the Mediterranean Sea or in the tropical zones of the Atlantic and Pacific. None are recorded in British or Norse seas, or in the Atlantic waters of Europe. A precisely similar find was that of two species of *Oncœa*, which Dr. Sars to his uncontrollable astonishment found to be identical with species quite recently captured by Dr. Giesbrecht in the Bay of Naples, and described in one of his last papers. A beautiful Copepod so perfectly colourless and translucent as to be almost invisible when swimming in the water, Dr. Sars recognized as a *Mormonilla*—a highly remarkable genus established by Dr. Giesbrecht, and of which only two species are known. Both species, strange to say, are strictly confined to tropical Pacific waters, south indeed of the equator. Yet here we find in the remote polar seas, over twelve thousand miles away, Arctic specimens which can hardly be distinguished from the Tropical species. Dr. Sars would have conferred upon the Arctic form the name bestowed by Dr. Giesbrecht on the tropical form, "were it not" he says "that the great distance between the occurrences seems to forbid such an identification." Hardly less remarkable and of extreme interest not to zoologists alone, but to geologists and physiographers, is the fact that two polar species of Amphipods * (*Pseudalibrotus*) brought back by Nansen are closely allied to forms peculiar to the Caspian Sea. It is hardly possible to conceive of a more erratic occurrence of creatures practically identical, and the most reasonable explanation is that already provided by the geologists' supposition, usually accepted, viz : the former continuity of the Caspian and the Polar seas.

Many interesting lines of thought are suggested by these remarkable results of Dr. Nansen's expedition. Either the species, practically identical, have originated independently in widely separated localities, or they have been carried from one centre to remote and isolated areas, and have left us representatives in the intervening waters. In the case of the Copepoda there is this profoundly significant point to be noticed that zoologists are agreed upon their primitive and unspecialised character. The Copepoda are regarded as generalised, indeed the whole sub-class Entomostraca is looked upon as resembling the ancestors of the modern

* The common fresh-water shrimp (*Gammarus*) is a typical Amphipod.

specialised Crustacea. Professor F. M. Balfour says (Comp. Embryol, Vol. I., p. 487): "The free Copepoda are undoubtedly amongst the lowest forms of those Crustacea which are free or do not lead a parasitic existence. Although some features of their anatomy, such for instance as the frequent absence of a heart, may be put down to retrogressive development, yet from their retention of the median frontal eye, ... their simple biramous swimming legs, and other characters, they may claim to be very primitive forms, which have diverged to no great extent from the main line of Crustacean development."

In a brief notice of the Paddle-nosed Sturgeon in Ontario (*Ottawa Naturalist*, October, 1899, Vol. xiii) I indicated what meaning the naturalist feels bound to attach to the local occurrence, in areas remote from one another, of any primitive or generalised type of animal. The same deep significance attaches to the Copepods and Amphipods referred to above.

Of the birds observed during the expedition Dr. Nansen himself writes conjointly with Dr. Collett, and the account is full of interest. Between 81 deg. and 83 deg. N. latitude there is an abundance of bird life. Oddly enough, young birds seem to prevail in these inhospitable regions. Vast numbers of certain species were noticed including the Little Auk (*Mergulus* or *Alle alle*, Linn.) and the Ringed Plover (*Ægialitis hiaticula*, Linn.). *Cepphus mandtii*, *Crymophilus fulicarius*, and *Pagophila eburnea*, the Ivory Gull, were also obtained, and one specimen of Sabine's Gull (*Xema sabinii*, Sabine). During the spring of 1894, it was on May 13th, when the "Fram" was moving towards the most northerly point in her drift through the ice, a gull was noticed, apparently *Pagophila eburnea*, and others were seen occasionally until Aug. 23rd, but after the lanes between the hummocks and the channels around the ship began to freeze, about the end of August, no more birds were seen for over eight months. Indeed, the first to appear the next year was noticed on May 14th. Readers of "Farthest North" will remember Nansen's references to the beautiful and rare Ross's Gull or the Roseate Gull (*Rhodostethia rosea*, Macgill), and for the first time a fully detailed description of the species is now published with exquisitely tinted illustrative plates. In the waters around Hirtenland, the four

glacier-capped islands in 81 deg. 38 min. N. lat. and 63 deg. E. long., numbers of that scarce and weird bird appeared. Its beautiful rose-coloured breast, wedge shaped tail, and airy flight, make it, as Nansen tells us, "the most beautiful of all the animal forms of the frozen regions." Though too late to find its nest or eggs there appeared no doubt that its breeding grounds were in that area.

Lastly, some results are published of great value in a geological and palæontological sense. The second and third papers in the volume are by Dr. Pompeckj, Professor Nathorst and Dr. Nansen; they deal with the stratigraphy and fossils of Cape Flora and the adjacent territory, and of Franz Josef Land. Dr. Nansen treats of the geological structure of Cape Flora, while the fossils obtained there in the Jurassic sedimentary rocks are described by Dr. Pompeckj, who determined twenty-six species of animal forms in the collection—a less extensive list than that made by the Jackson-Harmsworth expedition. Both collections go to establish close affinity with the Jurassic of Central Europe, and invalidate Neumayer's scheme of climatic zones in the Jurassic period. Dr. Nathorst's report on the palæophytology of Cape Flora is valuable, as the fossil plants he describes from Cape Flora are relegated to the Upper Jurassic, and to an earlier horizen than the Wealden, which in his view is not Cretaceous but Jurassic. Fine plates accompany these papers.

Most readers of Nansen's simple but thrilling story "Farthest North," had their attention rivetted upon the mammals, few in species, which make their home in these fields of eternal ice. Foxes were found by Nansen and Johansen further north than any other air-breathing animals. It was in 86 deg. N. latitude on April 25th 1895, very little south of their most northerly point (which was 86 deg. 14 min. N. and about 95 deg. E. longitude); and their astonishment may be imagined when they observed the foot-prints of two foxes in these remote Arctic snows apparently untrodden by any other living thing. These foxes probably subsist on small crustacea, which they must dip out of the shallow watery lanes between the rugged ice-ridges. They shot a large bearded seal in 82 deg. N. latitude, and a little further south killed three polar bea.s. It appears as though animal life (so far as

quadrupeds and birds are concerned) wholly ceases in the extreme north, and over the vast ice fields no moving thing is visible. Of the polar waters, on the other hand, it may be affirmed that they everywhere abound in minute examples of animal organisms, some of which have been hitherto pronounced by naturalists to be Mediterranean or even equatorial species.

It is apparent that warm and cold currents so affect and modify submarine life as to complicate very much the problems with which the palæontologist deals. As the late Dr. Carpenter long ago pointed out, Arctic shells have been found as far south as Gibraltar, a clear proof that the glacial temperature exists there beneath the waves without making any difference in the terrestrial climate. *Vice versa* we find Tropical species in Arctic waters. The late Sir William Dawson once wrote to Dr. Carpenter that the latter's accounts of the temperature of the deep-sea and its effect upon animal life while they tended to modify geological theory, explained facts otherwise difficult to interpret, especially the evidences of glacial conditions in periods when such conditions were not regarded as existing. "I am quite prepared," wrote Sir William, "to accept the conclusion that glacial beds may have been formed in any latitude and at any geological period."

WINTER LECTURES.

The Soirée Committee are now preparing the programme for the series of winter lectures, and will be obliged if any members who wish to read papers, or who have short notes of interest to communicate at any of the meetings, will at once send in their titles, and at the same time state at what date they would wish to present their papers. This information may be sent to Dr. R. Bell, F.R.S., the chairman of the Soirée Committee, Dr. H. M. Ami, F.R.S.C., or any member of the Council. It is probable that there will be a Conversazione or two, and six or seven Lecture nights. From the papers which have been already promised, the coming season promises to be one of exceptional interest. It is hoped that the first meeting will be held early in December. All titles of papers must therefore be in the hands of the Committee at the latest by the 15th November.

GANNETS AND CORMORANTS, WITH SPECIAL REFERENCE TO CANADIAN FORMS.

By ANDREW HALKETT, Ottawa.

The following notes are mostly about the Solan-goose or Common Gannet (*Sula bassana*, L.) and several species of Cormorants (*Phalacrocorax*), with brief references to allied species.

The Toti-palmate order of birds, which embraces the Pelicans (*Pelecanus*), the Darters (*Plotus*), the Frigates (*Tachypetes*), the Tropic Birds (*Phaëthon*), the Cormorants (*Phalacrocorax*), and the Gannets (*Sula*), are distinguished from all other birds, by having, as the name implies, the feet completely webbed. Ducks, gulls and murres have only two webs to each foot; the toti-palmates have three. This is occasioned by the hallux, or hind toe, being located semi-laterally, which admits of three webs to each foot. Another distinguishing character is the possession of a gular-pouch which in the Pelicans and Frigates is enormously expanded; is rudimentary and unfeathered in the Gannets, Cormorants and Darters; and rudimentary and feathered in the Tropic Birds.

The Pelicans *(Pelecanus)* like the Cormorants and Gannets are gregarious, resembling in their habits the former in being both marine and inland birds, while the latter are solely marine.

There are two North American species: the White Pelican *(P. erythrorhynchos)* and the Brown Pelican *(P. fuscus)*, and some consider that there is a third, the California Brown Pelican *(P. californicus)*. I remember seeing a fine White Pelican in captivity, whilst passing through the prairies. A nicely mounted specimen of the Brown Pelican, an adult male, is to be seen in the museum of the Geological and Natural History Survey, Ottawa, which was shot on the eastern end of Pictou Island, Nova Scotia, by Mr. J. W. Hogg, on 15th May, 1892.

An examination of a specimen of this species to which I had access, showed in brief as follows: The plumage variegated and dark, a whitish spotted band from the top of the head down each side of the neck, the bill very large and long in proportion to the head, and terminating in a hook, the gular-pouch of enormous size.

The Darters *(Plotus)* unlike all other genera of the order are not maritime in their habits. If we are to see them in their native haunts they must be followed to almost impenetrable swamps in the tropics. These birds have long slender necks, with numerous cervical vertebræ, so that they sometimes receive the name of Snake-birds. There are only a few species of Darters, one of which *Plotus anhinga* belongs to North America,

The Frigates *(Tachypetes)* like the Pelicans have the gular-pouch of great size. There is one well defined species *Tachypetes aquilus*. This bird has the feet very small, and the wings of great size and strength, so that it is not only marine in its habits, but pelagic. It is a poor swimmer, can hardly walk, and cannot dive at all, but its power of flight is astonishing.

Of Tropic birds *(Phaëthon)* there are three known species: *P. flavirostris*, *P. æthereus*, and *P. rubricauda*, the two first mentioned of which are North American. The following is an examination of a specimen of the Yellow-billed Tropic Bird (*P. flavirostris*). It had a yellow bill and black toes: the bill being very like that of a tern and was not hooked. The rudimentary gular-pouch was covered with feathers, instead of being naked as is generally the case with toti-palmate birds, and the nostrils were open, which is an uncommon feature in other birds of the order. The middle feathers of the tails were of great length. The general colour of the plumage was white, nicely contrasted with black.

Of Gannets there are now recognised six distinct species indigenous to North America. These are the White Gannet or Solan-goose *(Sula bassana)*, the Brown Gannet or Booby *(S. leucogastra* or *S. sula)*, the Blue-faced Booby *(S. cyanops)*, the Red-footed Booby *(S. piscator)*, the Blue-footed Booby *(S. gossi)*, and Brewster's Booby *(S. brewsteri)*.

The first time I ever saw a Gannet was when a boy at a small inland town about eight miles from the sea, on the east side of Scotland. Some fifty miles from this town at the Bass Rock, in the Frith of Forth, the White Gannets congregate in prodigious numbers: indeed this species which is otherwise called the Solan goose, receives its specific name *bassana* from the Bass Rock. The bird I saw was in the hands of a fish-monger, or cadger as that functionary is designated in some parts of Scotland, and it

had doubtless strayed from the Bass Rock or from the coast of Fife. The Solan-goose is not considered edible, yet forsooth the Scotch are sometimes charged with eating them. Still the cadger sought not to dispose of his gannet as he did of his turbot and skate, and one of the things yet vivid in my memory is that bird sitting at the end of the cart greedily gulping down a fish every time its owner offered one, whilst the patient horse drew the load of fish up the steep High street.

Last August and September (1899) I had a rare opportunity of seeing the white gannets at their native haunts at the Bird Rocks and at Bonaventure Island, in the Gulf of St. Lawrence. The nesting season was then of course over, and some of the birds had seemingly migrated south, yet this was one of the finest sights I have witnessed in my natural history studies. On certain dull evenings in summer the chimney-swifts congregate around the Parliament buildings in immense numbers, and if those who are familiar with the spectacle presented by an assemblage of some thousands of these birds, can in imagination magnify them in size to that of a goose, and bring them comparatively low down so that the effect of size is not lost, some idea may be formed of what I saw. At Bonaventure Island the Gannets readily associate with the murres and gulls, but never with their allies, the cormorants, and *vice versa* with the cormorants at Percy Rock adjacent, and it is a funny sight to see the rocks of the one place white with gannets, and the rocks of the other black with cormorants, both species being in full view at the same time. It is like the old story repeated about the Jews who had no dealings with the Samaritans.

In examining the bodies of four specimens of gannets I was surprised to find the entire absence of fat, just where one would have expected to find it—in a water bird. Instead there was a wonderful provision of nature. The skin hung loosely, as it were away from the body, being connected to it by membranous tissue forming a wonderful receptacle for air: thus giving to the bird great buoyancy.

Nothing could well be imagined more beautiful than the iris of the white gannet. The books describe it as white, but it is difficult to give it any true description, and must be seen in order

to appreciate its beauty. It is silvery or ice-like in colour, and certainly is as beautiful a bird's eye as I have yet seen.

The following outline of some of the external characters of the white gannet was made from a few skins. The bill is longer than the head, and cleft beyond the eyes. It tapers towards the tip, and is not hooked, as it is in the case of the cormorants. The mandibles have keen cutting edges, as I experienced, for one bird almost bit the top of my thumb off. There is a nasal groove, but the nostrils are abortive. The gular-sac is rudimentary but unfeathered. The wings are of great expanse—one I measured was fully six feet from tip to tip. The tail is wedge-shaped and the shape and position of the feet give an equi-balance to this species which is lacking in the other birds of the order.

The eggs of Gannets are encrusted in a calcareous deposit. When that is removed they are of a pale bluish-white colour. The specimens I have examined were all denuded of the rough outer coating. Gannets are said to lay only one egg at a hatching.

An interesting fact, in connection with Gannets, was brought to light in the year 1888, in the discovery in the Gulf of California, by Col. Goss, of two new species, one of which has been ascribed to him as *Sula gossi*, its vernacular name being the Blue-footed Booby; whilst the other is called *Sula brewsteri*, the vernacular name of this species being Brewster's Booby.

In the possession of Prof. Cope are fossil remains of a Gannet (*Sula loxostyla*) from the Miocene of North Carolina.

After what has been pointed out relative to our Gannet, I need hardly enter into the structural peculiarities of Anserine birds, in order to convince the incredulous that the Solan-goose is no goose.

About half the species of Toti-palmate birds are Cormorants, and they are almost cosmopolitan in their distribution. It is well known that the Chinese employ them in fishing. I have been fortunate enough to observe them in the Atlantic and Pacific oceans, and in one instance in the Behring Sea. Never can I forget the quaint appearance of a craggy rock or islet in Barclay Sound, Ucluelet, at the west side of Vancouver Island, with three Shags or Cormorants sitting bolt upright upon it. The cormorant I saw in the Behring Sea was a stray individual, as these birds do

not wander far out to sea. I saw it alight among some other marine fowls which do go a great distance from land, and at the place there was no land for several hundreds of miles from either the American or Asiatic sides.

The Double crested Cormorant (*P. dilophus*) is the only Canadian inland species. The young birds lack the side plumes which belong to the adults. The iris is green, a very common colour with Cormorants, but most uncommon among birds in general.

Fossil remains of a Cormorant (*P. macropus*) are in the possession of Prof. Cope from the Pliocene of Oregon; and fossil remains of another (*P. idahensis*), from the Pliocene of Idaho, are in the Yale museum at New Haven, Conn., but when I visited that institution some years ago I was not specially interested in Totipalmate Birds, so the pleasure of seeing the specimen is in reserve.

HEMPHILLIA GLANDULOSA.

A SLUG NEW TO THE CANADIAN LIST.

By GEO. W. TAYLOR, Nanaimo, B.C.

A couple of days ago one of my boys brought in a specimen of *H. glandulosa*, which he had found near the banks of the Nanaimo river, about three miles from its mouth. As the species was new to British Columbia and to Canada, I devoted an hour or two this morning to an examination of the spot where the slug had been found, and was rewarded by the capture of eleven other specimens. They were all taken under the dead fronds of ferns (*Aspidium munitum*) growing in a rather open spot on the banks of the river.

H. glandulosa was discovered nearly thirty years ago at Astoria, Oregon, by the indefatigable Henry Hemphill, and was described as the type of a new genus by Bland & Binney in the Annals of the Lyceum of Natural History of New York for 1872. It has since been found at other points in Oregon, and at Chehalis, Olympia and Tacoma, in Washington, but has not been recorded, I think, from any locality outside these two States. A second species of the genus (*H. camelus*) has however been described

recently from Idaho, by Messrs. Pilsbry & Vanatta. [See "Nautilus," Vol. XI, p. 44.] A full account of the genus, with figures and anatomical details of both species, has been published by the last-named authors in the Proceedings of the Academy of Natural Sciences of Philadelphia for 1898. The paper, with which I suppose most Canadian conchologists are familiar, is entitled, "Revision of the North American Slugs: *Binneya*, *Hemphillia*, *Hesperarion*, *Prophysaon* and *Anadenulus*." For the benefit of those who have not paid much attention to slugs, I may say that the genus *Hemphillia* differs from all other genera represented in our fauna in that the mantle has a large opening above (about 5 x 3 mm. in extent) exposing to view nearly the whole of the internal shell.

Figure No. 75 in Binney's Manual is an accurate representation of our slug as contracted in alcohol, but figure 78 in the same work bears small resemblance to it either alive or dead.

Nanaimo, B.C., Oct. 15, 1900.

A NATIONAL MUSEUM.

The recently issued report of the United States National Museum drawn up by the Acting Assistant Secretary, C. D. Walcott, and containing 246 pages, shows the progress made during the last year. Part I discusses the condition and progress of the Museum itself, whereas Part II treats of the papers describing and illustrating the collections of the National Museum.

Part I is of special interest and gives an idea of the equipment of the Museum and staff. The Department of Anthropology alone has seventeen curators and assistants. The Division of Animal Biology has twenty-seven curators and assistants besides three honorary associates. The Division of Plants counts eight curators and assistants, whilst the Division of Geology and Mineralogy numbers eighteen curators and assistants. The Museum authorities consist of a Secretary and Keeper, the Hon. S. P. Langley; an Assistant Secretary, the Hon. C. D. Walcott, and an Executive Curator, Mr. F. W. True; besides two

Librarians, one Editor, one Chief of Correspondence and Documents, and one Chief of Buildings.

The main purposes of the National Museum are these: 1: Exhibition of Collections. 2. Access to reserve collections for specialists. 3. Identification of specimens. 4. Library. 5. Donation of specimens to educational institutions. 6. Donation of publications. 7. Lecture Course during the year. 8. Correspondence and Information.

In looking over these figures and reports it appears to indicate clearly the line in which it is confidently expected that at no distant date our politicians will see to it that a National Museum will be established at Ottawa and properly maintained. It is an urgent necessity that a Central Bureau exist, where not only information on all kinds of subjects can be obtained from specialists, but a record may be kept of the information gathered from the result of studies made in connection with the resources of our great Dominion, sent from al directions. The incalculable value to the United States of the National Museum has been recognized by Congress, and it is hoped that our Canadian statesmen will see that before long a suitable building shall be erected and a thoroughly equipped staff established, so that we can take our place and properly exhibit and illustrate those wonderful natural resources which we possess in our own country, Canada.

H. M. A.

TO OUR READERS.

Although there is actually no time of the year when *nothing* can be seen or collected by the naturalist, the collecting season in most branches of natural history study is now practically over; there is, however, much good work for our members yet to do. All collections should be put in order for exhibition and notes revised for presentation at the winter soirees. All should realise that what has ~~int~~erested or seemed new and strange to them in their out-door observations will also be of interest to many others. Short, consise notes, with specimens if possible, are what we particularly want at our evening meetings. These will give a live character to the meetings and make the Club more and more useful and attractive.—J. F., Act'g Editor.

THE OTTAWA NATURALIST.

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CATALOGUE OF THE RECENT MARINE SPONGES OF CANADA AND ALASKA.

By LAWRENCE M. LAMBE, F.G.S.

For convenience of reference, the names of the species of recent marine sponges referred to or described in a number of papers by the writer, published in the Transactions of the Royal Society of Canada, at various dates since 1892, are here brought together in the form of a catalogue. Although the species enumerated are for the most part to be found in Canadian waters, a number are mentioned that occur outside of this limit. In the west, localities are given as far south as California, and some of the more northern forms are recorded from the Alaskan Arctic, with frequent reference to Behring Sea and North Pacific species. In the east, species from off the western coast of Greenland are considered to be from Canadian waters. The Canadian and foreign distribution of each species is given, although in the latter case a complete statement of the geographical range outside of Canada is not always attempted. It is thought desirable to state where the type, or specimens used in the description, of species that have been described as new, were collected and where they are now to be found.

A bibliographical index is appended as well as the names of a number of species, recorded by different authors as occurring off the coast of Greenland and in Behring Sea and Strait.

An asterisk placed before the name of a species denotes that that species is not represented in the collection of the Geological Survey.

The numbers in heavy type refer to the Bibliographical Index.

I. MONAXONIDA.

1. HALICHONDRIA PANICEA, Johnston. 1842. (14)

Distribution—River and Gulf of St. Lawrence (**37**); coast of New England (**33**); Vancouver Island; Queen Charlotte Islands and Behring Sea. (**15, 16, 17, 18**)

Foreign distribution—Coasts of Great Britain (Johnston, Bowerbank); Basse Rocks, off southeast coast of Ceylon (Carter); Kerguelen Island (Carter, Challenger); Torres Strait (Ridley "Alert"); Japan (Challenger); coasts of Norway, Sweden, Novaya Zemlya and western Greenland (Fristedt).

2. HALICHONDRIA DISPARILIS, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 25, pl. ii, figs. 1, 1a; type in the museum of the Geological Survey of Canada.

Type locality—Gulf of Georgia, near Comox, Vancouver Island, B.C.

3. EUMASTIA SITIENS, O. Schmidt. 1870. (26)

Distribution—River and Gulf of St. Lawrence and coast of Nova Scotia; Greenland; North Pacific Ocean and Behring Sea. (**17, 18**)

Foreign distribution—Pitlekai, eastern Siberia (Fristedt).

Schmidt's specimens are from Greenland.

4. PETROSIA HISPIDA, Ridley and Dendy. 1886. (23)

Locality—Middleton Island, Gulf of Alaska (**17**).

Foreign locality—Royal Sound, Kerguelen Island (Challenger).

5. RENIERA CINEREA, Grant. 1827.

Locality—Blunden Harbour, B.C. (**16**).

Foreign distribution—Coasts of Great Britain (Grant, Bowerbank); Philippine Islands (Challenger); Spitzbergen (Fristedt).

6. RENIERA RUFESCENS, Lambe. 1892.

Described in Transactions, Royal Society of Canada, vol. X, p. 75, pl. iv, fig. 6, and pl. v, figs. 12, 12a; type in the museum of the Geological Survey of Canada.

Type locality—Petropaulowski, Kamtschatka.

Distribution—Arctic Ocean (Kotzebue Sound), Behring Sea and North Pacific Ocean; Gaspé coast and Orphan Bank, off the entrance to the Baie des Chaleurs, Gulf of St. Lawrence. (**15, 17, 18**)

7. RENIERA MOLLIS, Lambe. 1893,

Described in Transactions, Royal Society of Canada, vol. XI, p. 26, pl. ii, figs. 3, 3a; type specimen in the museum of the Geological Survey of Canada.

Type locality—Elk Bay, Discovery Passage, Vancouver Island, B.C.

Distribution—Vancouver Island; coast of Labrador, Orphan Bank, off the entrance to the Baie des Chaleurs, and Hudson Bay. (**16, 18, 20, 21**).

8. CHALINA OCULATA, Pallas. 1766.

Distribution—River and Gulf of St. Lawrence (**37**), coast of Nova Scotia (**18**); New England coast (Verrill, **33**).

Foreign distribution—Between England and Belgium (Pallas); Northumberland coast and Firth of Forth (Johnston); coast of England (Bowerbank).

9. GELLIUS ARCOFERUS, Vosmaer. 1885. (35)

Distribution—Gulf of St. Lawrence (**18**); Greenland (Fristedt, **12**).

Foreign distribution—Barents Sea (Vosmaer); Siberian Arctic Ocean (Fristedt).

10. GELLIUS FLAGELLIFER, Ridley and Dendy. 1886. (23)

Distribution—Gulf of St. Lawrence (**18**).

Foreign locality—Off Marion Island (Challenger).

11. GELLIUS LAURENTINUS, Lambe. 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 20, pl. i, figs. 1, 1a; type material in the museums of University College, Dundee, Scotland, and of the Geological Survey of Canada.

Distribution—Gulf of St. Lawrence; Davis Strait.

12. TOXOCHALINA BOREALIS, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 115, pl. ii, figs. 2, 2a—e; type material in U. S. National Museum at Washington, D.C., and in the museum of the Geological Survey of Canada.

Type locality—Kyska Harbour, Kyska Island, Aleutian Islands.

13. TEDANIA FRAGILIS, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 116, pl. ii, figs, 3, 3a—c; type specimen in U. S. National Museum at Washington, D.C., and authentically named examples in the museum of the Geological Survey of Canada.

Distribution—Amaknak Island (type locality), Aleutian Islands ; Sooke Vancouver Island, B.C.

14. DESMACELLA PEACHII, var. GRŒNLANDICA, Fristedt, 1887. (12

Locality—Between Anticosti and the Gaspé Peninsula, Gulf of St Lawrence (**18**).

Foreign locality—East coast of Greenland (Fristedt).

15. DESMACELLA PENNATA, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 129 pl. iv, figs. 6, 6a—d ; type specimen in the museum of the Geologica Survey of Canada.

Type locality—Sooke, Vancouver Island, B.C.

16. ESPERELLA LINGUA, Bowerbank. (Sp.) 1866. (1)

Distribution—Gulf of St. Lawrence (**18**) ; northeast coast of the United States (Verrill, **33**) ; Greenland (Fristedt) ; Adak Island, Aleutian Islands (**17**).

Foreign distribution—Western Islands, Outer Skerries and Unst, Scotland (Bowerbank); off northern coast of Norway (Vosmaer).

17. ESPERELLA SERRATOHAMATA, Carter. (Sp.) 1880.

Locality—Sooke, Vancouver Island, B.C. (**17**).

Foreign locality—Gulf of Manaar, India, (Carter, **7**) and (?) Korea Strait (*Esperella macrosigma*, Lindgren, **39**).

18. ESPERELLA HELIOS, Fristedt. (Sp.) 1887.

Distribution—Alaskan Arctic Ocean; Behring Strait and Behring Sea.

Type locality—Pitlekai (Fristedt).

19. ESPERELLA HISPIDA, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 27, pl. ii, figs. 4, 4a—c; type specimen in the museum of the Geological Survey of Canada.

Type locality—Near Suquash, off Pulteney Point, Queen Charlotte Sound, Vancouver Island, B.C.

20. ESPERELLA ADHÆRENS, Lambe. 1893.

Described in Transactions. Royal Society of Canada, vol. XI, p. 27, pl. ii, figs. 5, 5a—d ; type in the museum of the Geological Survey of Canada.

Type locality—Elk Bay, Discovery Passage, Vancouver Island, B.C.

Distribution—Vancouver Island, North Pacific Ocean and Behring Sea (**16**, **17**).

21. ESPERELLA OCCIDENTALIS, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 28, pl. ii, figs. 6, 6a—e; type in museum of the Geological Survey of Canada.

Tpye locality—Gulf of Georgia, near Comox, Vancouver Island, B.C.

22. ESPERELLA MODESTA, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 118, pl. iii, figs. 1, 1a—d; type material in the U. S. National Museum at Washington, D.C., and in the museum of the Geological Survey of Canada.

Localities from which material was first examined—Chika Island, Akutan Pass; Simeonof Island, Shumagin Islands.

Distribution—Behring Sea and North Pacific Ocean; Gaspé coast, Gulf of St. Lawrence (**18**).

23. ESPERELLA FRISTEDTII, Lambe, 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 21, pl. i, figs. 2, 2a—h; specimens in the U. S. National Museum at Washington, D.C., and in the museum of the Geological Survey of Canada.

Distribution—Davis Strait.

Foreign locality—West from Taimur Peninsula (Fristedt); the specimen from this locality was referred to Carter's species *Esperia cupressiformis* (**12**, p. 457).

24. ESPERELLA MINUTA, Lambe. 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 23, pl. i, figs. 3, 3a—c; type in the U. S. National Museum at Washington, D.C.

Type locality—Davis Strait, off Cape Wild.

25. ESPERIOPSIS RIGIDA, Lambe. 1892.

Described in Transactions, Royal Society of Canada, vol. X, p. 68, pl. iii. fig. 4, and pl. v, figs. 3, 3a—g; type in museum of the Geological Survey of Canada.

Type locality—Entrance to Malaspina Inlet, B.C.

26. ESPERIOPSIS VANCOUVERENSIS, Lambe. 1892.

Described in Transactions, Royal Society of Canada, vol. X, p. 68, pl. iii, fig. 5, and pl. v, figs. 4, 4a—d; type specimen in museum of the Geological Survey of Canada.

Type locality—West coast of Vancouver Island, B.C., north of Quatsino Sound.

27. ESPERIOPSIS QUATSINOENSIS, Lambe. 1892.

Described in Transactions, Royal Society of Canada, vol. X, p. 69, pl. ii figs. 8, 9, and pl. v, figs. 8, 8a, 8b, 8c ; types in museum of th Geological Survey of Canada.

Type localities—West coast of Vancouver Island, B.C., north of Quatsin Sound, and near Lasqueti Island, Strait of Georgia.

Distribution—Behring Sea and North Pacific Ocean as far south as th State of Washington.

28. ESPERIOPSIS LAXA, Lambe. 1892.

Described in Transactions, Royal Society of Canada, vol. X, p. 70, pl. ii fig. 10, and pl. v, figs. 13, 13a, 13b, 13c ; type in museum of the Geo logical Survey of Canada.

Type locality—Oyster Bay, Vancouver Island, B.C.

29. CLADORHIZA ABYSSICOLA, M. Sars. 1872.

Distribution—Between Anticosti and the Gaspé Peninsula, Gulf of S Lawrence (Whiteaves, **37**) ; coast of New England (Verrill, **33** Baffin Bay (Fristedt, **12**).

Foreign distribution—Coast of Norway (Sars, **25**); between the nort coast of Scotland and the Faroe Islands (Carter).

30. CLADORHIZA GRANDIS, Verrill. 1879. (? syn. C. NOBILIS Fristedt. 1887.)

Distribution—Off the coast of Nova Scotia (Verrill, **32**) ; eastern coast Greenland (Fristedt).

31. CLADORHIZA NORDENSKIOLDII, Fristedt. 1887.

Locality—Between Anticosti and the Gaspé Peninsula, Gulf of S Lawrence (**18**).

Fristedt's type specimen is from the east coast of Greenland.

32. CHONDROCLADIA ALASKENSIS, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 11 pl. ii, figs. 7, 7a–e ; type material in the U. S. National Museum a Washington, D.C., and in the museum of the Geological Survey o Canada.

Distribution—Behring Sea and North Pacific Ocean.

33. CHONDROCLADIA PULCHRA, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 11 pl. ii, figs. 8, 8a—d ; type material in the U. S. National Museum a Washington, D.C., and in the museum of the Geological Survey o Canada.

Distribution—Aleutian Islands.

34. DESMACIDON (HOMŒODICTYA) PALMATA, Johnston. 1842.

Distribution—Nova Scotia and northeast coast of the United States (**18**, **33**).

Foreign distribution—Coasts of England and Scotland (Johnston and Bowerbank).

35. IOPHON CHELIFER, Ridley and Dendy. 1886.

Distribution—Vancouver Island, B.C., (**16**); Gulf of St. Lawrence (**18**); Davis Strait (**21**).

Foreign distribution—Off the Cape of Good Hope, off Prince Edward Island (lat. 46° 41′ S., long. 38° 10′ E.) and off Crozet Island (Challenger).

36. *IOTROCHOTA MAGNA, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 120, pl. iii, figs. 2, 2a—d; type in the U. S. National Museum at Washington, D.C.

Localities from which material was examined—Kyska Island and Nagai Island, North Pacific Ocean.

37. MYXILLA INCRUSTANS, Johnston. 1842.

Distribution—Gaspé coast, Gulf of St. Lawrence (**18**).

Foreign distribution—Coast of Great Britain (Johnston, Bowerbank).

38. MYXILLA BARENTSI, Vosmaer. 1885.

Distribution—Alaskan Arctic Ocean, Behring Sea, and North Pacific Ocean as far south as Vancouver Island (**17**).

Foreign distribution—Arctic Sea (Vosmaer, **35**).

39. MYXILLA LACUNOSA, Lambe. 1892.

Described in Transactions, Royal Society of Canada, vol. X, p. 70, pl. iii. fig. 3, and pl. v, figs. 5, 5a–g; type specimen in the museum of the Geological Survey of Canada.

Type locality—West coast of Vancouver Island, B.C., north of Quatsino Sound.

40. MYXILLA ROSACEA, Lieberkühn, var. 1892.

Described in Transactions, Royal Society of Canada, vol. X, p. 71, pl. iii, fig. 6, and pl. v, figs. 6, 6a, 6b—f; specimen in the museum of the Geological Survey of Canada.

Locality—Oyster Bay, Vancouver Island, B.C.

41. MYXILLA PARASITICA, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 31, pl. ii, figs. 8, 8a—f; specimens in the museum of the Geological Survey of Canada.

Distribution—Vancouver Island, B.C.

42. MYXILLA BEHRINGENSIS, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 121, pl. iii, figs. 3, 3a—f, type material in the U. S. National Museum at Washington, D.C., and in the museum of the Geological Survey of Canada.

Distribution—Behring Sea and North Pacific Ocean.

43. MYXILLA AMAKNAKENSIS, Lambe, 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 122, pl. ii, figs. 10, 10a—e; type material in the U. S. National Museum at Washington, D.C., and in the museum of the Geological Survey of Canada.

Distribution—Behring Sea and North Pacific Ocean as far south as Vancouver Island, B.C.

44. MYXILLA FIRMA, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 122, pl. iii, figs. 4, 4a—f; type material in the U. S. National Museum at Washington, D.C., and in the museum of the Geological Survey of Canada.

Distribution—Kyska Island (North Pacific Ocean) and Vancouver Island, B.C.

45. CLATHRIA LOVENI, Fristedt. 1887.

Localities—Chika Island, Akutan Pass; Unalaska Island (17).

Type locality—Cape Yakan (Fristedt).

46. CLATHRIA LÆVIGATA, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 31, pl. ii, figs. 9, 9a—f; type specimen in the museum of the Geological Survey of Canada.

Type locality—Near Comox, Vancouver Island, B.C.

47. CLATHRIA DELICATA, Lambe. 1896.

Described in Transactions, Royal Society of Canada, second series, vol. II, p. 192, pl. ii, figs. 2, 2a—h; type specimen in the museum of the Geological Survey of Canada.

Distribution—Coast of Nova Scotia.

There are two specimens from Portland, Maine, in the Peter Redpath Museum, McGill University, Montreal.

48. *PLOCAMIA MANAARENSIS, Carter. 1880.

One specimen, from coast of California, in the U. S. National Museum at Washington, D.C (**17**).

Carter's type is from the Gulf of Manaar (**7**).

49. PHAKELLIA VENTILABRUM, Johnston. 1842.

Distribution—River and Gulf of St. Lawrence (**37**), Hudson Bay (**20**), Davis Strait and the northeast coast of the United States (**33**); North Pacific Ocean, Behring Sea and the Alaskan Arctic Ocean.

Foreign distribution—British Seas (Bowerbank, Johnston, &c.); Ireland, (Johnston); Shetlands (Bowerbank); between Scotland and Faroe Islands (Carter); southwest coast of Norway (Schmidt); Arctic Ocean, off Norway (Vosmaer); Baltic Sea (Fristedt); Florida, Gulf of Mexico, and Barbadoes (Schmidt); off Brazil and northeast coast of Falkland Islands (Challenger).

50. *PHAKELLIA DALLI, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 125, pl. iii, figs. 5, 5a—d; type specimen in the U.S. National Museum at Washington, D.C.

Type locality—Chika Island, Alaska.

51. AXINELLA RUGOSA, Bowerbank. (Sp.) 1866.

Distribution.—Chika Island and Unalaska Island, Alaska (**17**); Greenland (Fristedt **12**).

Foreign distribution.—Orkney and Shetland Islands (Bowerbank).

52. SUBERITES SUBEREA, Johnston, 1842.

Distribution—Vancouver Island, North Pacific Ocean, and Behring Sea (**17**); New England coast (Verrill, **33**).

Foreign distribution—Coasts of British Isles (Bowerbank).

53. SUBERITES FICUS, Johnston. 1842.

Locality—Sable Island, off the coast of Nova Scotia (specimens in the Peter Redpath Museum, McGill University, Montreal, **18**).

Foreign distribution—Coasts of Great Britain (Johnston and Bowerbank).

54. SUBERITES HISPIDUS, Bowerbank. 1864.

Described in Canadian Naturalist, second series, vol. I, p. 304; type

specimen in the Peter Redpath Museum, McGill Uuiversity, Mor treal; one specimen in the museum of the Geological Survey c Canada.

Localities—Portland, Maine (type locality), and off the coast of Anticosti Gulf of St. Lawrence (**18**); New England coast (Verrill, **33**).

55. SUBERITES MONTALBIDUS, Carter. 1880. (8)

Localities—Unalaska Island, Alaska, **17** (one specimen in the U. S National Museum at Washington, D.C.) and Richmond Gulf, Hudson Bay, **20** (one specimen in the museum of the Geological Survey o Canada).

Distribution—Behring Sea and Strait, Beaufort Sea, the Siberian Arctic Ocean, the Kara Sea, the European Arctic Ocean, Barents Sea (type specimen from near the southwest end of Novaya Zemlya) and the west and east coasts of Greenland.

56. *SUBERITES MONTINIGER, Carter. 1880, (8)

Locality—Granite Cove, Port Althorp, Cross Sound, Alaska (one specimen in the U. S. National Museum at Washington, D.C.).

Type locality—Barents Sea from the southwest end of Novaya Zemlya, in lat. 71° 6′ N., long. 50° E.

57. SUBERITES SIMPLEX, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 32, pl. iv, figs. 4, 4a; type specimen in the museum of the Geological Survey of Canada.

Type locality—Gulf of Georgia, near Comox, Vancouver Island, B.C.

58. SUBERITES PACIFICA, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 32, pl. ii, figs. 10, 10a—d; type specimen in the museum of the Geological Survey of Canada,

Type locality—Gulf of Georgia, near Comox, Vancouver Island, B.C.

59. SUBERITES CONCINNUS, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XII, p. 128, pl. ii, figs. 12, 12a; type material in the U. S. National Museum at Washington, D.C., and in the museum of the Geological Survey of Canada.

Distribution –North Pacific Ocean, Behring Sea and Alaskan Arctic Ocean.

60. POLYMASTIA MAMMILLARIS, Johnston. (Sp.) 1842.

Distribution—Gulf of St. Lawrence (**37**, **18**) and off the coast of Nova Scotia (**24**); northeast coast of United States.

This species has a wide geographical range. According to Topsent (**38**, p. 135) it is found, outside of Canadian waters, in the Arctic Ocean (Kara Sea, White Sea, Spitzbergen, Greenland, &c.); in the North Atlantic (coasts of Norway, Belgium, British Isles, France, Spain); in the Mediterranean (coast of France, Naples, Adriatic); Pacific Ocean (Amboina Island, Japan).

1. POLYMASTIA ROBUSTA, Bowerbank. 1860.

Distribution—Gulf of St. Lawrence (**18**); off the coast of Nova Scotia (**24**); northeast coast of United States (Verrill, **33**).

Foreign distribution—British Isles (Bowerbank, Norman, Hanitsch); North Sea, Shetland Islands (Norman); entrance to the Baltic (Levinsen); French coast of the English Channel and of the Atlantic (Topsent).

2. POLYMASTIA LAGANOIDES, Lambe. 1894.

Described in Transactions, Royal Society of Canada, vol. XI, p. 129, pl. iv, figs. 5, 5a—c; type in the U. S. National Museum at Washington, D.C.; part of the type specimen in the museum of the Geological Survey of Canada.

Type locality—Behring Island, Behring Sea.

3. TRICHOSTEMMA HEMISPHÆRICUM, M. Sars. 1872.

Distribution—Gulf of St. Lawrence (Whiteaves, **37**) **18**; northeast coast of the United States (Verrill, **33**).

Foreign distribution—Lofoten, Norway (Sars); Arctic Ocean, off the coast of Norway (Vosmaer).

4. TENTORIUM SEMISUBERITES, Schmidt. (Sp.) 1870. (26)

Distribution—Gulf of St. Lawrence (Whiteaves, **37**); off Nova Scotia (Challenger); Baffin Bay, Omenak Bay, west and east coast of Greenland (Fristedt); Davis Strait and East Greenland (Lambe, **21**); Greenland (Schmidt); northeast coast of United States (Verrill, **33**).

Foreign distribntion—Off the Shetland Islands (Wyville Thompson); Arctic Ocean off the coast of Norway (Vosmaer); Inaccessible Island, South Atlantic Ocean (Challenger).

5. STYLOCORDYLA BOREALIS, Lovén. (Sp.) 1868. (22)

Distribution—Gulf of St. Lawrence (Whiteaves, **37**); south of Halifax, Nova Scotia (Challenger); northeast coast of the United States (Verrill, **33**).

Foreign distribution—North Sea and coast of Finmark (Lovén); off the coast of Finmark (Vosmaer); Lofoten, Norway (Sars); between the north of Scotland and the Faroe Islands (Wyville Thompson, Carter);

off Bahia, Brazil, and between Marion and Crozet islands, Sou Indian Ocean (Challenger).

66. CLIONA CELATA, Grant. 1826.

Locality—North shore of Prince Edward Island, Gulf of St. Lawrenc (**18**); New England coast (Verrill, **33**).

Foreign distribution—Coasts of Great Britain (Bowerbank); Norwa Denmark, Belgium, France; Mediterranean—France, Naples, Adr atic (Topsent); Florida; South of Australia (Carter, Dendy); Ne Guinea (Ridley and Dendy).

II. TETRACTINELLIDA.

67. CRANIELLA CRANIUM, Müller. (Sp.) 1798.

Distribution—Richmond Gulf, Hudson Bay (**20**); Greenland (Fristedt).

Foreign distribution—The Island of Arran, Galway, Ireland (Bowerbank The Minch, Scotland (Norman); between the Faroe Isles and tl North of Scotland (Carter); Shetland Islands (Bowerbank); Ko Fjord, Norway (Norman, Sollas); lat. 61° 0′ N., long. 4° 49′ E. a lat. 72° 53′ N., long. 21° 51′ E. (Hansen); near last mentioned locali (Vosmaer).

68. CRANIELLA VILLOSA, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 3 pl. iii, figs. 1, 1a—f; type specimen in the museum of the Geologic Survey of Canada.

Type locality—Houston Stewart Channel, Queen Charlotte Islands, B.C

69. CRANIELLA SPINOSA, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 3 pl. iv, figs. 1, 1a—j; type specimen in the museum of the Geologic Survey of Canada.

Localities from which material was examined—Elk Bay, Discovery Pa sage and Gulf of Georgia, near Comox, Vancouver Island, B.C.

70. THENEA MURICATA, Bowerbank. (Sp.) 1858.

Distribution—Gulf of St. Lawrence (Whiteaves, **37**); northeast coast the United States (Verrill, **33**); Baffin Bay, Davis Strait and ea coast of Greenland (Fristedt); east coast of Greenland (Lambe, **2**

This species is known to range through the Arctic and North Atlan oceans, from about lat. 42° to 75° N., and from long. 60° W. to 32°

71. CYDONIUM MULLERI, Fleming. 1828.

Distribution—Vancouver Island and Queen Charlotte Islands.

Type locality—Island of Fulah and Unst (Shetland Islands).

According to Vosmaer (**35**, p. 6) the geographical distribution of this species is "Atlantic (Shetland, Iceland, Florida) and Arctic Oceans."

III. HEXACTINELLIDA.

72. RHABDOCALYPTUS DAWSONI, Lambe. (Sp.) 1892.

Described in Transactions, Royal Society of Canada, vol. X, p. 73, pl. iv, fig. 2, and pl. vi, figs. 2, 2′, 2a, 2a′, 2b, 2b′, 2c, 2d--i, 2k ; type in the museum of the Geological Survey of Canada.

Localities—Off mouth of Qualicum River (type specimen) and Strait of Georgia near Comox. Vancouver Island, B.C.

This species referred to **13**, p. 54.

73. APHROCALLISTES WHITEAVESIANUS, Lambe. 1892.

Described in Transactions, Royal Society of Canada, vol. X, p. 74, pl. iii, fig. 2, and pl. vi, figs. 3, 3a--n, 3p ; type specimen in the museum of the Geological Survey of Canada.

Type locality—Strait of Georgia near Comox, Vancouver Island, B.C.

74. STAUROCALYPTUS DOWLINGII, Lambe. (Sp.) 1893.

Described in Transactions, Royal Society of Canada, vol. xi, p. 37, pl. iii, figs. 2, 2a--h ; type in the museum of the Geological Survey of Canada.

Type locality—Strait of Georgia, near Comox, Vancouver Island.

Foreign locality—Sagami Sea, Japan (Ijima, **13**).

IV. CALCAREA.

75. LEUCOSOLENIA CANELLATA, Verrill. 1874 (13).

Distribution—Gulf of St. Lawrence (Whiteaves) ; Strait of Belle Isle (Lambe) ; northeast coast of the United States (Verrill, **33**) ; Davis Strait (Lambe).

76. SYCON COMPACTUM, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 38, pl. iv, figs. 3, 3a--f ; type in the museum of the Geological Survey of Canada.

Type locality—Elk Bay, Discovery Passage, Vancouver Island, B.C.

77. SYCON PROTECTUM, Lambe. 1896.

Described in Transactions, Royal Society of Canada, second series, vol. II, p. 204, pl. iii, figs. 6, 6a--g ; type in the museum of the Geological Survey of Canada.

Distribution—Off Bonaventure Island, Baie des Chaleurs (type locality); Strait of Belle Isle, and Upernavik, Baffin Bay (Lambe); near Nanaimo, Vancouver Island (Lambe).

78. SYCON ASPERUM, Lambe. 1896.

Described in Transactions, Royal Society of Canada, second series, vol. II, p. 205, pl. ii, figs. 8, 8a—c; type in the museum of the Geological Survey of Canada.

Type locality—Off Bonaventure Island, Baie des Chaleurs, Gulf of St. Lawrence.

79. SYCON MUNDULUM, Lambe. 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 28, pl. iii, figs. 7, 7a—e; of two specimens, one (the type) is in the museum of University College, Dundee, Scotland, the other in the museum of the Geological Survey of Canada.

Distribution—Exeter Harbour (type locality) and off Cape Raper, Davis Strait.

80. *SYCON EGLINTONENSIS, Lambe. 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 29, pl. ii, figs. 6, 6a—e; type in the museum of University College, Dundee, Scotland.

Type locality—Eglinton Harbour, Davis Strait.

81. GRANTIA COMOXENSIS, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 39, pl. iii, figs. 3, 3a—c; type in museum of the Geological Survey of Canada.

Type locality—Strait of Georgia, near Comox, Vancouver Island, B.C.

82. GRANTIA CANADENSIS, Lambe. 1896.

Described in Transactions, Royal Society of Canada, second series, vol. II, p. 206, pl. iii, figs. 7, 7a—c; two specimens, one (the type) in the museum of the Geological Survey of Canada, a third in the Peter Redpath Museum, McGill University, Montreal.

Distribution—Between Pictou Island and Cape Bear (type locality); off Bonaventure Island; Little Metis. Gulf of St. Lawrence.

83. GRANTIA MONSTRUOSA, Breitfuss. 1898.

Described in Memoires de l'Académie des Sciences de St. Pétersbourg, eighth series, vol. VI, No. 2, p. 24, pl. ii, fig. 16, and pl. iii, fig. 19; type specimen from the North Polar Sea off the coast of Russia.

Specimens in the U. S. National Museum at Washington, D.C., and one in the museum of the Geological Survey of Canada, from Copper Island, Commander Islands, Behring Sea.

84. *GRANTIA PHILLIPSII, Lambe. 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 30, pl. iv, figs. 9, 9a--i ; type in museum of University College, Dundee, Scotland.

Type locality—Cape Aston, Davis Strait.

85. *GRANTIA INVENUSTA, Lambe. 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 32, pl. vi, figs. 14, 14a--f ; type in the museum of University College, Dundee, Scotland.

Type locality—Off Cape Raper, Davis Strait.

86. LEUCONIA PYRIFORMIS, Lambe. 1893.

Described in Transactions, Royal Society of Canada, vol. XI, p. 40, pl. iii, figs. 4, 4a--d ; type in the museum of the Geological Survey of Canada.

Type locality—Strait of Georgia, near Comox, Vancouver Island, B.C.

87. LEUCANDRA VALIDA, Lambe. 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 32, pl. iv, figs. 10, 10a--e, and pl. v, figs. 11, 11a--e; of two specimens, one (the type) in the museum of University College, Dundee, Scotland, the other in the museum of the Geological Survey of Canada.

Type locality—Exeter Harbour, Davis Strait.

88. LEUCANDRA CUMBERLANDENSIS, Lambe. 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 34, pl. v, figs. 12, 12a--j ; type specimen in the museum of University College, Dundee, Scotland, one specimen (co-type) in the museum of the Geological Survey of Canada.

Localities—Cumberland Sound, Kingawa Fjord ; off Cape Raper, Davis Strait.

89 LEUCANDRA TAYLORI, Lambe. 1900.

Described in Transactions, Ottawa Naturalist, vol. XIII., p. 261, pl. vi, figs. a--i ; type in the collection of the Rev. George W. Taylor, Nanaimo, B.C. ; one specimen (co-type) in the museum of the Geological Survey of Canada.

Type locality—Boat Harbour, near Nanaimo, Vancouver Island, B.C.

90. HETEROPIA RODGERI, Lambe, 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 35, pl. vi, figs. 13, 13a--g ; type specimen in the museum of University College, Dundee, Scotland, one specimen (co-type) in the museum of the Geological Survey of Canada.

Type locality—Off Norman's Light, Strait of Belle Isle, Gulf of St. Lawrence.

91. AMPHORISCUS THOMPSONI, Lambe. 1900.

Described in Transactions, Royal Society of Canada, second series, vol. VI, p. 36, pl. iii, figs. 8, 8a--j ; type specimen in the museum of University College, Dundee, Scotland, co-type in the museum of the Geological Survey of Canada.

Type locality—Off Norman's Light, Strait of Belle Isle, Gulf of St. Lawrence.

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The following species according to L. L. Breitfuss (in "Kalkschwamm fauna des Weissens Meeres, &c.") occur in the waters of East Greenland :—

Leucosolenia coriacea, Montagu.
,, lamarcki, Hæckel.
Ascandra corallorrhiza, Hæckel.
,, fabricii, O. Schmidt.
,, mirabilis, Fristedt.
,, reticulum, Hæckel.
Sycon ciliatum, Aut. (Hæckel).
,, raphanus, O. Schmidt.
Grantia arctica, Hæckel.
,, utriculus, O. Schmidt.
,, compressa, Aut. (Hæckel).
,, clavigera, O. Schmidt.
Amphoriscus glacialis, Hæckel.
Leuconia ananas, Montagu.
,, stiligera, O. Schmidt.
,, egedi, O. Schmidt.

In his "Catalog der Calcarea, der Zoologischen Sammlung des Koniglichen Museums für Naturkunde zu Berlin," the same author cites the occurrence of the following species from Greenland :—

Leucosolenia lamarcki, (Hæckel).	East Greenland.	
Ascandra fabricii, (O. Schmidt).	West Greenland.	
,, reticulum, (O. Schmidt).	,,	,,
Sycon karajakense, Breitfuss.	,,	,,
Grantia arctica, (Hæckel).	,,	,,
,, pennigera, (Hæckel) Breitfuss.	Greenland.	
,, utriculus, (O. Schmidt).	West Greenland.	

Amphoriscus glacialis, (Hæckel). East Greenland.
Leuconia ananas, (Montagu). West Greenland.
,, egedi, (O. Schmidt). Greenland.

Fristedt in "Sponges from the Atlantic and Arctic Oceans and the Behring Sea," mentions the following sponges from the "Sea west from Greenland"—

Hyalonema foliata, Fristedt.
Amorphina panicea, Pallas (O.S.).
Isodictya Dicksonii, Fristedt.
Suberites montalbidus, Carter.
Thecophora semisuberites, O. Schmidt.
Tethya muricata, Bowerbank.
,, cranium, Lamarck.
Desmacella porosa, Fristedt.
Cornulum ascidioides, Fristedt.
,, textile, Carter.
,, enteromorphoides, Fristedt.
Experia lingua, Bowerbank (O.S.).
Cladorhiza abyssicola, Sars.
Clathria corallorhizoides, Fristedt.
Axinella vermiculata, Bow. (Fristedt) var. erecta, Carter.

And a number as below from Behring Strait and Sea :—

Halisarca Dujardinii, Johnston.
Amorphina renieroides, Fristedt.
,, fibrosa, Fristedt.
Suberites montalbidus, Carter.
Hastatus Robertsoni, Bow. (Fristedt).
Myxilla septentrionalis, Fristedt.
Esperia lingua, Bow. (O.S.) var. arctica, Fristedt.

Also the following from Beaufort's Sea :—

Ascandra complicata, Montagu (Hæckel).
Leucandra cylindrica, Fristedt.
Cribrochalina variabilis, Vosmaer.
Amorphina grisea, Fristedt.
Eumastia sitiens, O. Schmidt.
Suberites montalbidus, Carter.
Tethya Sibirica, Fristedt.
Esperia helios, Fristedt.

ZOOLOGICAL NOTES.

A CANADIAN POCKET MOUSE—(*Perognathus Lordi*, Gray).

Under the direction of Dr. C. Hart Merriam, Chief of Division of Biological Survey of the United States Department of Agriculture, (one of the corresponding members of the Ottawa Field-Naturalists' Club,) Mr. Wilfred H. Osgood, Assistant Biologist, has prepared a "Revision of the Pocket Mice of the Genus Perognathus," just issued at the Government Printing Office in Washington, and forms Bulletin No. 18 of the "North American Fauna," a series of peculiar interest to all naturalists.

Upwards of 3,000 specimens have been examined in the course of preparation of this monograph. The progress made up to date in researches concerning the interesting group of the Heteromyidæ, one of the most peculiar groups of New World mammals, is therein given.

Besides *Perognathus*, the other genera of the Pocket Mice are: *Heteromys*, *Dipodomys*, *Perodipus* and *Micropodops*.

Perognathus is divisible into two sub-genera: *Perognathus* proper, and *Chætodipus*, the latter containing the large coarse-haired and long-tailed "forms," whilst *Perognathus* includes the small soft-haired species.

Of the forms described, *Perognathus Lordi*, Gray, is recorded from British Columbia, the type locality, as a member of the "Parvus" group, *i.e.*, of the group of *Perognathus parvus* (Peale). Mr. Osgoode thus describes this little animal:

"*General characters.* Similar to *P. parvus*; size, large (nearly equalling *Magruderensis*; tail, long; feet and ears, moderate; antifragus, lobed; color, dark; interparietal, narrow

"*Color.* Above, pale slatey buff, strongly mixed with black; general color as in the gray phase of *P. parvus*; hairs of belly generally with plumbeous bases and buffy tips, leaving a small marginal and a large pectoral patch pure white; sub-auricular spot small but distinct; tail tricolor as in *P. parvus*.

"*Skull.* Size large and audital bullæ and mastoids inflated; andital bullæ always connected anteriorly; interparietal, squarish pentagonal, deeply notched by occipital.

"*Measurements.* Average of seven adults from Oroville, Wash.: Total length, 183; tail vertebrae, 97.7; hind foot, 23.2; skull, basilar length of Hensel, 16,5 mm.; occipito-nasal length, 23 mm.; greatest mastoid breadth, 11.8 mm.; greatest width of interparietal, 4.3 mm.

These are the measurements of *P. Lordi*, Gray :

Basilar length of Hensel (which is measured from the anterior margin of the foramen magnum to the posterior run of the alveolus of the middle incisor) 18.7 ; occipito-nasal length, 26.7 ; greatest mastoid breadth, 13.6: length of interparietal, 4.7 ; number of specimens averaged, 5.

Perognathus Lordi, Gray, was originally described as the Northwest Pocket Mouse in "Proceedings of the Zoological Society of London for 1868," p. 202, and subsequently noticed by Rhoads in Proc. Acad. Nat. Sc. Phil. for 1893, p. 405.

Specimens of this species are recorded from the following British Columbia localities as follows :—Ashcroft, 14 ; Kamloops, 6 : Okanagan, 12 ; Vernon, 2.—H.M.A.

OBITUARY.

CHARLES JULES EDME BRONGNIART.—It is with profound regret that we have to chronicle the death of this eminent palaentologist at the early age of 40. His special studies lay in the direction of fossil insects, and he described a very large number of new or hitherto imperfectly known species from the carboniferous rocks of France. His first paper on fossil insects was written at the early age of fifteen. His researches and knowledge at that youthful period led him to recognise an insect in a specimen of fossil fruit which his grandfather, the distinguished palæobotanist, was examining at the time, and published the same with his own illustrations in an entomological magazine. This paper was most favourably commented upon, and ever since his energies have been directed in working out the " Faune fossile entomologique de France." Charles Brongniart's principal work was published in 1893 in two large quarto volumes with atlasses of plates. He had in his laboratory at Paris, where I had the pleasure of meeting him in 1885, a very large collection of the fossil insects from the open air coal mines of Commentry which have been rendered famous by these very remains of insect life. Some of the fossil dragon flies and springtails of the Carboniferous system were of enormous size, compared with their modern representatives. Shortly before his death Monsieur Brongniart kindly examined an interesting wing of a *neurorthopterid* from the Riversdale formation of Colchester County, and he pronounced the form closely allied to *Miamia Bronsoni*, a carboniferous insect.

WILHELM HEINRICH WAAGEN.—This celebrated Palæontologist died March 24th, 1900. His principal work is found in the series of volumes constituting the "Palæontologica Indica," which

include his studies of the Jurassic Cephalopoda of Kutch and the Salt Range Fossils. From 1870 to 1875 he was palæontologist to the Geological Survey of India. He then married and settled in Vienna, where he was tutor at the University and subsequently went to Prague to occupy the Chair of Mineralogy and Geology at the German Technical High School. On the death of the illustrious Joachim Barrande—the prince of palæontologists—he assisted in issuing the remaining volumes on the "Systeme Silurien de la Bohême," and in conjunction with Professor J. J. Jahn wrote the section bearing on the Crinoidea. In 1890 he succeeded Neumayer at the University of Vienna as Professor and held that position at the time of his death. His researches on the Cephalopoda and Brachiopoda are of great value and interest.

H. M. A.

BOOK REVIEW.

A NEW PHYSICAL GEOGRAPHY.

Probably in no other scientific branch has there been such a change of method in the matter of presentation as in the study of the topography and physiography of the earth's crust. In the old days it was all included under geography, which it was *in toto*, with the exception of a brief prefatory explanation of planetary relations and the phenomena of changing seasons and temperatures. Geography in the old days dealt with the rivers and mountain ranges, the valleys and bodies of water, but chiefly with the arbitrary divisions of the earth's surface made by man, the political centres and commercial marts. All this has been changed in recent years. The natural has been separated from the artificial, and the former has been given its rightful place in school curricula. An important addition to the text books on physiographical geography is that by Jacques W. Redway, published by Charles Scribner's Sons, New York. This volume, as the author states in his preface, "is designed to show that the distribution of life is governed very largely by the conditions of geographic environment, and that human history and industries are always closely connected with geographic laws—in many instances the direct resultants of them." The book is planned for use in high schools and in normal schools. Some of the more important chapters, are "The wasting of the land; by rivers, by underground waters, by avalanches and glaciers, and by imperfect drainage. The dispersal of life; distribution of plants and animals and the industrial regions of the United States are also treated. The matter is excellently arranged. The author's style is succinct and clear. The volume is well printed and freely illustrated with a good grade of half tones. It is a book to be commended.

JOHN CRAIG.

Cornell University, Ithaca, N.Y.

PROGRAMME FOR WINTER SOIRÉES, 1900-1901.

1900.

Dec. 11.—Opening Conversazione. Exhibition of specimens.
President's Inaugural Address, Dr. H. M. Ami, F.R.S.C., etc.
Presentation (by the subscribing members of the Club) of a portrait in oils of the late E. Billings to the Government of Canada for the Geological Survey Museum.
On Various Phases of the Forests of Canada, with lantern illustrations, by Dr. Robert Bell, F.R.S., etc.

1901.

Jan. 8.—Meeting for conversation, exhibition of specimens and reading of papers.
The Rocky Mountains, with special Reference to the Crow's Nest Pass, by Prof. John Macoun, M.A., F.R.S.C.
Observations on the Crow's Nest Pass, by Mr. James McEvoy, B.Sc.
Report of the Botanical Branch.

Jan. 22.—Meeting for conversation, exhibition of specimens, and reading of papers.
Explorations in Baffin Land, with lantern illustrations, by Dr. Robert Bell, F.R.S.
On the Arboretum and Botanic Garden at the Central Experimental Farm, Ottawa, by Mr. W. T. Macoun.
Some Iron Ore Deposits of the Cambrian and Cambro-Silurian of Ontario, by Mr. E. D. Ingall, Assoc. R. S. M.
Report of the Geological Branch.

Feb. 12.—Meeting for conversation, exhibition of specimens, and papers.
Ancient Channels of the Ottawa River, by Dr. R. W. Ells, F.R.S.C.
Some Points in Reference to the Algonquin Park, by Mr. A. M. Campbell.
Notes (1) *On the Autumn-flowering of various Native Plants in 1900*, by Mr. C. Guillet. (2) *On Mosquitoes*, by Dr. J. Fletcher.
Report of the Ornithological Branch.

Feb. 26.—Meeting for conversation, exhibition of specimens and reading of papers.
On the Region between the Nelson and Churchill Rivers, by Mr. D. B. Dowling, B.Sc.
Prehistoric Camping Grounds along the Ottawa River, by Mr. T. W. E. Sowter.
On Recent Discoveries in the Utica Formation at Ottawa, by Dr. H. M. Ami, F.G.S.

Mar. 6.—Meeting for conversation, exhibition of specimens, and papers.
Fat in the Animal Body, its Function and Origin, by Mr. A. T. Charron, B.A.
Trees and Shrubs for the Adornment of Streets, Parks and Homes, with lantern illustrations, by Dr. W. Saunders, F.R.S.C., etc.
Report of the Entomological Branch.

Mar. 12.—Meeting for conversation, exhibition of specimens, and papers.
The Sources and Distribution of the Gold-bearing Alluvions of the Province of Quebec, by Mr. Robert Chalmers.
Corundum, with Special Reference to its Occurrence in Ontario, by Dr. A. E. Barlow.

Mar. 19.—**Annual Meeting** of the O.F.N.C. for the reception and adoption of the Reports of Council, the election of officers, and other business.

N.B.—At each meeting various objects of natural history will be exhibited and the papers will be discussed.

TIME AND PLACES OF MEETINGS.

The Opening Conversazione, by kind permission of Principal McCabe, will be held in the Assembly Hall of the Normal School. The Young Men's Christian Association has again generously placed its commodious Lecture Hall on O'Connor street at the disposal of the Club for the remaining meetings, all of which will be held on Tuesdax evenings, and will begin at 8 o'clock *punctually*.

THE OTTAWA NATURALIST.

VOL. XIV. OTTAWA, JANUARY, 1901. No. 10.

DESCRIPTION OF A NEW SPECIES OF *UNIO* FROM THE CRETACEOUS ROCKS OF THE NANAIMO COAL FIELD, V. I.

By J. F. WHITEAVES.

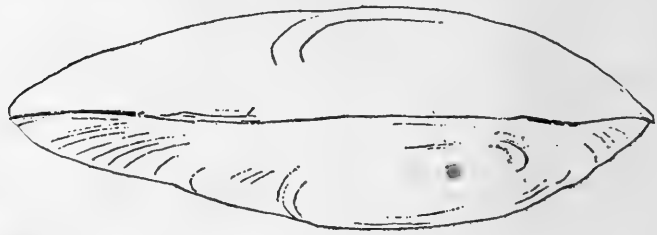
In the second volume of the Palæontology of California, published in 1869, Mr. W. M. Gabb described and figured a Cretaceous species of *Unio*, which he called *U. Hubbardi*. This species was based upon a single specimen, which is said to be "from the Nanaimo Coal Mine, Vancouver Island," and to have been "kindly loaned" to Mr. Gabb by Mr. Samuel Hubbard. It has long seemed to the writer that the evidence for this locality is very unsatisfactory, and that there are two strong reasons for supposing that some mistake has been made in regard to it. The first of these reasons is that no similar specimens have since been found in the Cretaceous rocks at Nanaimo, or any other locality in Vancouver, or any of the immediately adjacent islands, by members of the staff of the Geological Survey of Canada, or by local collectors. The second is that numerous very typical specimens of *U. Hubbardi* were collected at the Cowgitz coal mine, on Graham Island (one of the Queen Charlotte Islands) by Mr. James Richardson in 1872, and by Dr. G. M. Dawson in 1878.

No other land or fresh-water shells have yet been recorded as occurring in the Cretaceous rocks of the Nanaimo, Comox, or Cowitchan coal fields. But in March, 1894, a nearly perfect but somewhat crushed and slightly distorted bivalve shell was found

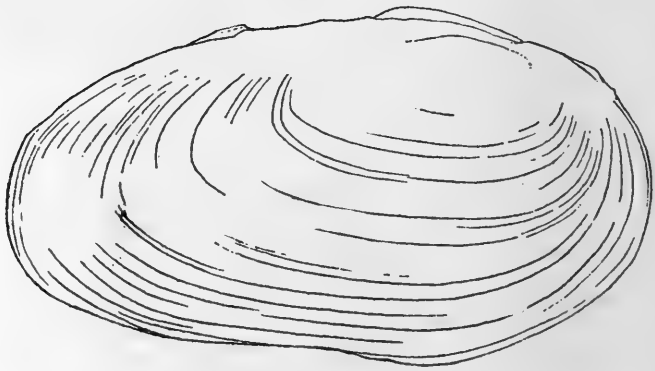
by Mr. W. Haggart, in shale at the top of No. 6 Pit, Wellington Colliery, Nanaimo. Tbis specimen is now the property of the Provincial Museum at Victoria, B.C., and has been forwarded to the writer by Dr. C. F. Newcombe, of that city, for examination and comparison.

Judging by its external form and surface markings, this fossil seems to be a specimen of a previously undescribed species of *Unio*, that is quite distinct from *U. Hubbardi* and from any of the Unionidæ of the Cretaceous or Laramie rocks of North America. The species may now be provisionally named and characterized as follows :—

UNIO NANAIMOENSIS (SP. NOV.)



1*a*



1

FIG. 1.—*Unio Nanaimoensis*. Side view of the only specimen known, in outline.

FIG. 1*a*.—Dorsal view of the same, also in outline, to show the proportionate convexity of the closed valves.

Both the figures are of the natural size.

Shell compressed-convex, ovately subelliptical, much longer than high, higher than broad, and very inequilateral. Anterior end short, rounded ; posterior end much longer than the anterior, its extremity obliquely subtruncate above, produced and somewhat narrowly rounded below ; beaks placed in advance of the mid-length ; posterior umbonal slopes not at all angulated.

Surface marked only with numerous concentric lines of growth. Hinge dentition, muscular impressions, and pallial line unknown.

Approximate dimensions of the specimen figured :—Maximum length, sixty-eight millimetres ; greatest height, thirty-seven millimetres ; maximum breadth or thickness, twenty-four millimetres.

The slight distortion and somewhat slickensided movement to which the specimen has been subjected has so displaced the normal position of the valves that the marginal outline is not as distinctly defined as might be desired, and the beaks are no longer quite opposite

As compared with *U. Nanaimoensis*, *U. Hubbardi* is a much more convex shell, with distinctly angular or subangular posterior umbonal slopes, and it is much more attenuate posteriorly.

For the two drawings which are reproduced in this paper, the writer is indebted to his friend and colleague, Mr. L. M. Lambe, F.G.S.

Ottawa, December 4th, 1900.

BOTANY.

Mr. C. Guillet, whose paper "On the Late-flowering of Native Plants," is announced for February 12th, in the Programme of the Club's Winter Soirees, would be glad to receive notes and records of observation on the same subject by other members of the Club.

This notice should have been announced at the last meeting of the Club but was inadvertently omitted.

H. M. A.

A PRELIMINARY NOTE ON AN AMYGDALOIDAL TRAP ROCK IN THE EASTERN TOWNSHIPS OF THE PROVINCE OF QUEBEC.

By JOHN A. DRESSER, Richmond, Que.

A few years ago Mr. J. C. Sutherland called the writer's attention to an apparently peculiar occurrence of feldspar in sedimentary slates in the vicinity of the old St. Francis copper mine, near Richmond, and on subsequent reference to the following description of the occurrence by Sir William Logan (Geology of Canada, 1863, pp. 606-607), suggested a microscopic examination which it has not yet been found possible to carry out. But from several observations made at various times, it is evident that the rock is one of considerable scientific interest and economic importance.

It was thus described by Logan, "Orthoclase . . . . . is found under remarkable conditions among the argillaceous rocks at the St. Francis copper mine in Cleveland. Here beds of a soft, fine-grained, somewhat schistose dark bluish-gray argillite enclose small ovoidal or elongated masses of crystalline feldspar, which have a general parallelism, and are oblique to the divisional planes of the rock. The laminae of this conform to the feldspathic masses which give a knotted surface to the exterior of the rock. These are in some portions from one eighth to one-tenth of an inch in diameter, and are nearly spherical, or elongated two or three diameters. In other portions of the rock they are an inch or more in length, and more irregular, though always rounded in outline. The exterior of the nodules is a white or pinkish feldspar. In some parts the feldspar is seen to extend from the nodules, in thin layers among the laminae of the slate, giving to such portions a gneissoid aspect. In most cases, however, the rock has completely the aspect of an amygdaloid; especially in sections which exhibit the feldspar surrounding the quartz in the ovoidal masses."

Epidote also forms the cores of some of these masses, while the material of others, though not certainly distinguished from orthoclase by its physical properties, yields much water when heated in the closed tube, and hence is probably a zeolite in part at least. Veins of calcite as well as masses of chlorite, specular

iron, and various ores of copper, especially chalcocite, bornite, and chalcopyrite are of frequent occurrence.

The examination of four thin sections under the microscope suffices to show that the rock is of volcanic origin, and hence is a true amygdaloid instead of an argillite. Although it is much altered, crystals of primary plagioclase can be distinguished in it with certainty. In arrangement they suggest the structure of diabase, but as the interstitial material is wholly secondary, chlorite, iron ore, leucoxene, &c., further evidence is needed to determine its precise original character. This was probably variable, as fibrous hornblende occurs in some quantity at a point about three miles west of the St. Francis river. Also near the same place the rock contains nodular masses three or four inches in diameter, which are composed chiefly of concentric layers of quartz and epidote.

The copper ores, as far as seen, occur in connection with either calcite or quartz, in which cases the latter minerals do not appear to form veins having either uniform width or well defined edges, although they frequently do so in other cases when the veins are much smaller in size. The copper-bearing masses of calcite and quartz, however, seem rather to occupy crevices and fissures, such as might have been produced by the intense dynamic metamorphism by which the entire region has been greatly disturbed, and as the copper, from its position, must have been deposited contemporaneously with these gangue materials, it must like them be regarded as of secondary nature, probably deposited by infiltration.

In its mode of occurrence this rock seems to conform to the stratification of the region, and shares in the foliation which the adjacent rocks have suffered. It lies in the pre-Cambrian, as recently divided by Dr. Ells (Annual Report Geological Survey of Canada, Vol. VII, N. S., Part J, 1894), appearing, wherever it has been observed, between the Cambrian on the northwest and pre-Cambrian strata, generally dolomite or quarzite, on the southeast.

As it has resisted denudation better than most of the associated rocks, it usually forms a rather conspicuous feature of the landscape. The width varies from one to two miles, and the extent along the strike has not been ascertained..

It has been crossed in four different places* viz., about a mile east of the St. Francis River in the township of Cleveland; along the west bank of the St. Francis, and also about three miles further west, in the township of Melbourne; and near Foster Junction on the Canadian Pacific Railway in the county of Brome. The last mentioned locality is about forty miles from the first, yet the stratigraphical relations seem to be the same, it being the most northwesterly member of the pre-Cambrian exposed along the Sutton Mountain anticline.

The economic importance of this rock is due to the copper deposits which are contained in, or are associated with, it. As far as it has been possible to ascertain, all the copper localities of any known importance that are mentioned in the Report of the Geological Survey of Canada for 1866 (pp. 310—314) in connection with the rocks of the Sutton Mountain fold, occur in association with this amygdaloidal trap. Amongst these are the St. Francis, Balrath and Coldspring mines, as well as others which have been more or less minutely described (op. cit. pp. 38-39). From the descriptions of other localities given in the Geology of Canada, 1863, (pp. 606-607) it appears that rocks of this type may have a wide distribution in the Eastern Townships, especially in the copper-bearing districts.

The occurrence of similar rocks also of cupriferous † character in the Appalachians of Pennsylvania**and elsewhere is well known, and the separation of these from the sedimentary strata of the Eastern Townships would be an important step towards a scientific determination of the economic possibilities of this part of the province, as well as towards a more detailed elucidation of its complex geological structure than the progress of scientific investigation in Canada has yet permitted.

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* The examination in Melbourne was made with the assistance of Mr. F. W. Major of Bishop's College, Lennoxville, and that at Foster by the aid of Mr. H. A. Honeyman of Knowlton.

**Bulletin U. S. Geol Survey, No. 136, pp. 25—27. "Ancient Volcanic Rocks of South Mountain, Pennsylvania." F. Bascom.

† The line of copper deposits in the State of Vermont, from Berkshire and Richford along the boundary line southward as far as Waterbury, may also indicate the extension of this rock to the south. Vide "Geology of Vermont," 1861, pp. 850 et. seq., by Edward Hitchcock, and "The Report of the State Geologist on the Mineral Resources of Vermont," 1899-1900 pp. 7 & 12, by G. H. Perkins.

THE NESTING OF THE CERULEAN WARBLER.

By W. E. SAUNDERS, London, Ont.

Among the rarer small birds of the Great Lakes region, none have attracted me more than the Cerulean Warbler. Perhaps this has been on account of the difficulties encountered in watching it, and the almost prohibitive heights at which it conducts its matrimonial affairs, or perhaps on account of its dainty colours, pure white beneath and blue above; but from whatever cause, the attraction has certainly existed. Except in the period of nest building, it seldom comes to the ground, and as a rule the song comes from such a height that it takes some minutes to locate the singer. In Ontario, this Warbler is fairly well distributed, and is common from the west end, by the Detroit River, at least as far east as St. Thomas, but as the distance north from Lake Erie grows greater, it becomes less common and more local. Near London it is rare and very local; five males, in widely scattered woods being noted within seven miles of the city this year, while at Bryanston, fifteen miles northeast, there are some woods in which it is fairly common. Its summer distribution on the whole continent is from the Alleghanies west to the plains, and from Tennessee, Kansas, and Missouri north to Central New York, Southern Ontario, Michigan and Minnesota. Throughout this range there are many points of abundance, but its habit of living so high up in the trees makes the finding of its nest so difficult that its eggs are rare in collections, and its intimate acquaintances are few among men; and indeed until I was equipped with a good field glass I accomplished little in the solving of their nesting problem, but this year, encouraged by the experience of Robert Elliott, who found one inaccessible nest in May, 1899, near Bryanston, Ont, I determined to really do some work on this interesting bird.

As its nearest centre of abundance is near the west end of the Ontario peninsula, where I had already met with it in great numbers in a previous year, a preliminary trip was made some miles below Chatham, which resulted in finding two woods where

they were abundant, but there appeared to be no sign of nesting as yet. On June 5th, Mr. Harry Gould went with me for a day with these elusive creatures, and it was well that he did, for in the morning's hunt, which we spent apart from 5 a.m. till ten, he found one nest building, and I none, but in the afternoon, working together, we found five, one of which was building, one with one egg, and the other three with sets of four in each. After failing in the morning we were much disheartened, but during our lunch time, a female was seen working around in the tree-tops beside us, and, watching her while we ate, we were first cheered and then made suspicious, and, as suspicion deepened, we separated, and by dint of the most intent watching, with constant remark from the other person when she was out of the sight of one of us, we at length found the nest with one egg. After that, the operation was more simple, as a single example will show. Hearing a male singing, we approached, and at length spied him preening his feathers and singing between whiles. As this occupation might last for some time, one of us wandered on while the other waited and watched. After perhaps ten minutes, he ceased preening and began to feed. The other hunter was then called in, and establishing himself in a favorable position, both kept our eyes on him, so that when he became invisible to one, the other would inform him of his movements. Soon he made a quick short flight after another bird, and as soon as they alighted we saw it was his mate. Then, with every sense on the alert we left him entirely, and watched her alone, and after feeding for about five minutes she left the feeding tree, flew past me, and right out through an open glade to the nest, 60 yards away in plain sight on the limb of a basswood tree, 50 feet up and 6 feet out from the trunk.

This nest, which is a typical one, is supported almost entirely by its contact with the main limb, which is one inch in diameter. It is built of grasses and bark-strips covered externally with silvery gray bark-strips, in the same manner as the Redstarts, and lined with black horsehairs on the bottom and on one side, the other side being less heavily built and lacking the lining. It measures on the outside 2 inches high and 3 inches wide, and on the inside 15-16ths of an inch deep by 1⅞ inches wide.

These are about average measurements, and this extreme shallowness is only rendered safe by the heavy limbs on which the nests are built, the least diameter of the supporting limb among the eight nests I examined this year being 7/8 inch. The eggs, 4 in number, closely resemble some sets of the Yellow Warbler, but the spots are more brownish.

Near London I found two more nests this year, which were both made by the same birds, but for some unexplained cause the first was never occupied. The second yielded me a set of four eggs, larger, more creamy, and handsomer than those from our western trip, of which I have two sets. All these were taken with the nest attached to the limb as placed by the birds. Of the eight nests found this year four were in basswood, two in maple, and two in oak.

To show how much an acquaintance with the birds affects one's ability to find their nests I may mention that of three species whose nests I never found before, I took three sets of each, viz., the Cerulean Warbler, Yellow-throated Vireo, and Sharpshinned Hawk ; in fact, the latter bird rather bewildered the three active oologists of London, who had searched a great deal without finding any nests in previous years, but this year we took between us six sets, comprising 27 eggs, the most distant nest being less than four miles from the city limits.

WINTER SOIREES.

The inaugural meeting of the winter lectures took place on the 11th December in the large Assembly Hall of the Normal School. The proceedings were opened by the delivery of an Address of Welcome by Mr. J. H. Putman, the Science Master of the Normal School. This was followed by the Inaugural Address of the President, Dr. H. M. Ami, F.R.S.C., etc. An interesting feature of the evening was the presentation of a fine portrait of the late Elkanah Billings to the Government of Canada for deposition in the museum of the Geological Survey Department. This portrait was painted by Mr. C. E. Moss, from a painting in the possession of the Natural History Society of Montreal, and was received

by Dr. Geo. M. Dawson, F.R.S., etc., the Deputy Minister of that Department, with a suitable acknowledgment. Dr. Robert Bell, F.R.S., etc., delivered a lecture on "Various Phases of the Forests of Canada," illustrated with beautiful lantern slides showing typical forms of the more important forest trees of Canada. The president's address, as well as those of Dr. Dawson and Dr. Bell will appear in later numbers of the Ottawa Naturalist. The following is the

ADDRESS OF WELCOME.

By J. H. Putman, B.A., Science Master, Ottawa Normal School.

Mr. President, Ladies and Gentlemen :—

I desire in the first place, on behalf of Principal MacCabe who is unavoidably absent, to extend a cordial welcome to the Field Naturalists' Club and to their friends. I also desire to bear personal testimony to the many kindnesses shown the Ottawa Normal School by the Field Naturalists' Club. The President of the Club and several of its officers have given us much valuable assistance and have shown the deepest interest in our work in science. I am certain that among the happiest memories carried away from Ottawa by our students will be those of pleasant outings with your Club.

May I be permitted for a few moments to touch upon one or two aspects of the work of such an organization as this, as it presents itself to a teacher interested in Nature study. While all of us know that man's intellectual life is a growth from sensation, perhaps we are all prone to underestimate the advantages of having this early sensory training as definite and varied as possible. And yet nothing can be more certain than that, other things being equal, the man who has had his senses well-trained, will have a fuller, richer, happier and healthier intellectual life than the man whose contact with things, and especially with the things of Nature, has been limited. He who has seen but never tasted a strawberry has a poor and very vague idea of that fruit, and he who sees the rose but misses its fragrance, has at most only half the reality.

Oliver Wendell Holmes, in speaking of the little power that some have to observe, says : "Yet there are multitudes

who are present at as many as threescore and ten of Nature's twelve-act performances and never see the scenery, listen to the music or observe the actors." If I understand aright the aims of such a society as the Field Naturalists' Club, they are to help us to hear and interpret the music of Nature's orchestra, the birds, the bees, the winds, the brooks, to aid in our study of the scenery and to encourage us to learn whatever may be known of the actors. It is true there is a utilitarian aspect to Nature study, and this aspect is of great national importance, but, in my opinion, the purely utilitarian aspect need concern us very little. If we, as a nation, can learn to love Nature and to interpret Nature, we shall be certain to make the most of natural resources.

It is really wonderful how much "seeing" is a matter of training, how little may be seen by some and how much can be seen by others; and this training in observation, to be effective, must begin very early in the life of the child. This Society can hope to do very little in gaining the real interest of those who have reached middle life or passed it. This class may be interested for an evening or for a day in some special and very interesting feature of Nature study; they may be amused at any time if the lecturer be interesting, but, unless they have learned to see for themselves and to enjoy the company of Nature, any interest on their part in Nature's wonders is likely to be spasmodic and short-lived. The hope of every society for the encouragement of Nature study lies in the young, and I firmly believe that, were it possible to interest every Canadian child in Nature study, the problem of elementary education would be practically solved. There is something good in every boy or girl. The problem is how to turn the impulses in the right direction. Many children already take a deep interest in the field excursions of this Society, and its officers are to be commended for encouraging them. The inclination towards a study of science has often been received at an early age and sometimes from a beginning apparently trivial. Wm. Hamilton Gibson, the great American exponent of Nature study, whose death a few years ago removed a man of great promise, relates as follows concerning his own beginning: "I was very young and playing in the woods. I tossed over the fallen leaves and came across a chrysalis. There was nothing remarkable in that, for I knew what

it was. But wonderful to relate—providentially I deem it—as I held the object in my hand, a butterfly slowly emerged, then fluttered in my fingers." "You were pleased with its beauty," said a friend. "Oh, it was more than that. I do not know whether I was or was not a child with an imagination, but suddenly the spiritual view of a new or of another life struck me. I saw in this jewel born from an unadorned casket, some inkling of immortality. Yes, that butterfly breaking from its chrysalis in my hand shaped my future." And who can tell how many young people may have received during excursions of this Club an impetus or a spiritual insight into some of Nature's mysteries that has given a permanent bent to the whole life !

One of the saddest sights of these closing days of the 19th century, and particularly sad because it seems to be a picture that must grow still darker during the coming century, is the sight of hundreds of thousands of little children growing up in tenement houses, shut away from Nature, denied access to wholesome and pure sights, sounds and odours. "When one thinks of the Greeks," says Ouida, "playing, praying, labouring, lecturing, dreaming, sculpturing, training, living everlastingly in the free wind and under the pure heavens, and then reflects that the chief issue of civilization is to pack human beings like salt herrings in a barrel, with never a sight of leaf or cloud, never a whisper of breeze or bird. Oh, the blessed blind men who talk of progress !"

Fortunately, as yet, our Canadian cities are comparatively free and open and the difficulties of bringing the child into contact with Nature are not great.

I wish for a moment to direct attention to another phase of Nature study and to emphasize another feature of the good work that is done by every society such as this. We pride ourselves upon our 19th century advancement in education and general intelligence. We quote with an air of satisfaction, figures to show that illiteracy is almost unknown among us. This is well, and perhaps there is some justification for our complacency, but I ask you, does the mere ability to read and write necessarily make men and women better ? It is true that the mastery of those elements is an essential condition of further progress. But, whether a man is to be a better man because he can read, must in the end depend

on *what* he reads, and, unless we teach *what* as well as *how*, we have made little real progress. Even if we take the most optimistic view, we can get little satisfaction out of statistics bearing on this question. The mass of the people read gossip or thrashy fiction and consider their tastes are above the ordinary if they can appreciate light magazine articles. It is extremely doubtful if the percentage of English-speaking people who really enjoy Chaucer, Shakspere, Milton, Wordsworth or Tennyson, is any greater than it was a quarter or even a half century ago.

What has this to do with Nature study? In my opinion it has everything to do with it. In Fra Lippo Lippi, Browning says, "We're so made that we love them first when we see them painted, things we have passed perhaps a hundred times nor cared to see." Here we have a great truth, and it makes no difference whether the artist has painted with colour or with words. Unless his work means something to us, we cannot interpret it. Every great poet from Homer to Tennyson has been a lover of Nature. Indeed we may almost say that he has been a great poet because he was first a lover of Nature. Every lover of Nature knows something of the poet's thoughts, even though he lacks the power to convey them to others. It is quite impossible, however, to teach either child or man to appreciate the beauties of poetry, unless he has had the necessary training in Nature study, because the subjects of Nature study are the raw material out of which the poet forms his pictures.

Prof. Halleck, of Yale, has, after a careful study, found internal evidence to prove that Shakspere knew the names, notes, habits, eggs and plumage of at least forty birds. Note the following from Shakspere :

> "I know a bank where the wild thyme blows,
> Where oxlips and the nodding violet grows,
> Quite over-canopied with luscious woodbine,
> With sweet musk-roses and with eglantine."

Try if you can to leave out of this picture the wild-thyme, the oxlips, the violet, the woodbine, the roses and the eglantine. Really nothing is left that could convey any intelligible meaning. May we not say then that, not only is a knowledge of nature a joy within itself and an ample reward to a diligent student, but also

that it is absolutely necessary as a touchstone for the interpretation of the highest and best in literature?

LECTURE NIGHT.

The next Evening Meeting of the Club will be held on January 8th, in the lecture room of the Young Men's Christian Association on O'Connor Street, when two most interesting papers, by Prof. John Macoun, and Mr. James McEvoy, both of the Geological Survey Department, will be delivered upon the Crow's Nest Pass. The meeting will be opened punctually at 8 o'clock, and the audience is requested to be in time to take their seats before that hour, so as not to disturb the lecturers and listeners after the meeting has begun. On the same evening the Report of the Botanical Branch will be read, which always elicits a lively discussion. Among other interesting exhibits their will be on view a beautiful collection of paintings of Manitoban plants, by Mr Norman Criddle, of Aweme, Man.—Acting Editor.

PALÆONTOLOGICAL NOTES.

Observations on and Descriptions of Arctic Fossils. By R. P. Whitfield. Extracted from Bulletin of the Amer. Mus. Nat. Hist., Vol. 13, Article 2, pp. 19—22, Plates I and II. New York, April, 6, 1900.

The above is the title of an interesting paper by Prof. Whitfield, the able palæontologist of the Central Park Museum of Natural History. In it he describes a few fossils new to science, and records others of much interest, from collections sent to that Museum by the Peary Arctic Club of New York. Some of these were collected by the expedition of 1898 at "Cape Harrison, on Princess Marie Bay and Summit, Cape d'Urville, in the Arctic Regions," whilst others came from "near the head of Frobisher Bay," and were obtained from Eskimos by G. Cromer, Esq., of Boston, who sent them to Prof. Franz Boas of the Amer. Mus.

of Nat. History. These latter include fourteen species of fossils belonging to the Trenton formation.

The new species described are: 1. *Receptaculites Peuryi*, Whitfield, Cape Bay, Princess Marie Bay, 1898. 2. *Halysites agglomeratiformis*, Whitfield, Cape Harrison, Princess Marie Bay, 1898. 3. *Calapœcia borealis*, Whitfield, Cape Harrison, Princess Marie Bay, 1898. 4. *Heliolites perelegans*, Whitfield, Cape Harrison, Princess Marie Bay, 1898.

Of the above, *R. Pearyi* resembles *R. Oweni*, Hall, from the Trenton (Galena) of Manitoba, and of Illinois, Wisconsin and Iowa; *Halysites agglomeratiformis* resembles *H. agglomeratus* Hall, and *Heliolites perelegans* is related to *H pyriformis*. Prof. Whitfield adds: "These specimens would indicate a geological horizon about the same as that of the New York, Niagara or Clinton group."

H. M. A.

BOOK NOTICE.

THE PALÆOZOIC FAUNAS OF PARA, BRAZIL. 1. *The Silurian Fauna of the Rio Trombetas.* 2. *The Devonian Mollusca of Pará.* By J. M. Clarke, Archivos do Museu Nacional do Rio de Janeiro, Vol. 10, 127 pp., 1899. Author's English edition, 1900.

I. The discovery of these fossils "was one of the results of an expedition made under the direction of the late Prof. Ch. Fred. Hartt while Director of the Commissao Geologica do Brazil," and they now form part of the palæontological collections in the Museu Nacional. Silurian rocks occupy a belt of country bordering the metamorphic region of Guiana, and are about 1,000 feet in thickness. Amongst the interesting fossils described we note:

1. *Arthrophycus Harlani*, Conrad, a very characteristic form in the Medina (Silurian) of Grimsby and St. Catherines, Ontario.

2. *Lingula*, cf. *L. oblata*, Hall, the latter a Clinton species found in Ontario and also in New York State.

3. *Lingulops Derbyi*, Clarke, a form related in many respects to *Lingulops Granti*, Hall & Clarke, from the Niagara of Hamil-

ton, Ontario, and *L. Whitfieldi*, Hall, from the Maquoketa (Ordovician) of Iowa, U.S.A.

4. *Orbiculoidea Hartti*, Clarke, a form probably more nearly related to *O. tenuilamellata*, Hall, than to any other species. *Discina Clara*, Spencer, from Hamilton, Ont., is placed here as a synonym of *Orbiculoidea tenuilamellata*, Hall. Schuchert places *Discina Clara*, Spencer, as a syn. under *Schizotreta tenuilamellata*.

5. *Pholidops Trombetana*, Clarke. This form recalls to mind the *Pholidops implicata*, Sowerby.

6. *Orthis (Dalmanella) Freitana*, Clarke, a form resembling *Orthis (Dalmanella) emacerata*, a variation of *Orthis testudinaria*, Dalman.

7. *Chonetes*, sp. cf. *C. Nova-Scotica*, Hall.

8. *Anoplotheca (Anabaia) Paraia*, Clarke.

9. *Anabaia Anticostiensis*, Clarke. Of this Dr. Clarke writes :

"By a fortunate incident I have discovered a species from the middle Silurian of Cape East, on the Island of Anticosti, which is very similar to *A. Paraia*. It possesses valves of the same contour lacking the reflection of the margins, which may be accidentally absent, as the specimens are preserved in limestone ; the peculiar plication of the brachial valves is quite the same, the opposite valve differing only in the presence of a single median plication in the sinus. These specimens have shown a trace of everted oblique internal spires.

The species is without a name, as far as I can ascertain, unless it be that identified by Mr. Billings as *Leptocælia hemispherica (Atrypa hemispherica*, Sowerby). That it is not the British species, nor that member of the Clinton fauna of New York, passing under the name of *A. hemispherica* (Sowerby) Hall, I am confident. In order to determine whether it was the form referred to by Mr. Billings, I asked Mr. H. M. Ami, of the Geological Survey of Canada to compare it with the types of the Anticosti species in the collections of the Survey, and this he has kindly done, without finding anything that can be regarded as identical or closely similar. I have given a figure of the Anticosti shell on account of its interesting relations to the Brazilian species, and it may be

designated *Anabaia Anticostiana* (see plate I, figs. 26, 27, 28); also more properly called *A. Anticostiensis*, p. 23.

10. *Clidophorus Brazilianus*, Clarke—a form related to *C. planulatus*, Conrad, and to forms from the Silurian of Arisaig.

11. *Bucaniella trilobata*, Conrad, var. *vira. mundo*, Clarke. This is esteemed a variety of *B. trilobata*, a form of which occurs also in the Silurian of Arisaig.

Besides the above there are species of Conularia and Tentaculites, &c., which, taken with preceding and other species described and recorded, form an assemblage bearing affinities to Silurian and Ordovician, and would constitute a Middle Silurian fauna with a different association (as Dr. Clarke states) from the Anticosti Middle Silurian.

II. The Devonian fossils described in Part 2 of this memoir were mainly derived from material collected in the Devonian strata about the little village of Ereré and along the banks of the rivers Mæcurú and Curuá—obtained by Prof. Chas. Fred. Hart when director of the now extinct *Commisao Geologica do Brazil.* Messrs. Hartt and Rathbun had described Devonian fossils from the Ereré-Monte-Alegre District. The Geol. Survey collections of Brachiopoda (24 species) were reported upon by Mr. Rathbun and the trilobites by Dr. Clarke. In this memoir Dr. Clarke describes the Molluscan fossils. It forms an elaborate publication describing and illustrating (as all faunas should be illustrated, from various portions of the continent) all the discovered species of fossils in the Pará Devonian not previously treated. They include seven species of *Platyceras*; three of *Diapharostoma*, one *Pleurotomaria*, two of *Bellerophon*, one *Bucania*, two of *Bucaniella*, two of *Plectonotus*, one *Tropidocyclus*; *Ptomatis*, a new genus of Bellerophontes of type of *B. patulus*, from Corniferous and Hamilton faunas, besides three *Tentaculites.* Of Pelecypoda, two species of *Actinopteria*, one of *Liopteria*, three of *Modiomorpha*, one *Goniophora*, a new sub-genus *(Toechomya)* of Schizodus, of authors, and two species of this new type; two of *Sphenotus*, two of *Cimitaria*, one *Guerangeria* or *Nyassa*, two of *Cypricardella*, six *Granunpiæ*, one *Pholadella*, one *Edmondia*, two of *Nucula*, four of *Nuculites*, five of *Palæoneilo*, and one *Leda*,

Dr. Clarke then discusses "the inter-relations of the faunas of the Rios Mæcurú and Curuá and the Ereré-Monte-Alegre district; and their degree of equivalence with faunas of other regions." The peculiar association of fossils in the sandstones of the Rio Mæcurú leads the author to state: "There is no similar association of trilobitic species in the North American faunas," yet there are distinct Lower Devonian (Hercynian) traits. There are no Cephalopoda in all the Para Devonian faunas so far as known. A "Lower Devonian" facies is indicated by the Gasteropoda. The Pelecypoda outnumber the Brachiopoda and indicate an eminently Devonian facies in part about Upper Helderberg with "Spiriferen-sandstein" affinities, also inclination towards Middle Devonian or Hamilton. The Brachiopoda indicate Upper Helderberg and Hamilton affinities, many forms having a Hercynian and Lower Devonian aspect.

Then follow discussions on the "Sandstones of Ereré," the "Sandstone of the Rio Curuá," &c., in which the author cites the conclusions of Sir William Dawson on the two Sporangites (*Protosalvinia Braziliensis* and *P. bilobata*), and closes with a table showing the vertical and geographical distribution of the same or allied specific types.

H. M. AMI.

MINING STATISTICS.

The Report of the Ontario Bureau of Mines shows that during the first half of 1900 the yield of gold was $136,269; silver, $51,000; arsenic, $8,980: zinc, $900; iron, $19,532. Two blast furnaces smelted $511,209 worth of ore. The open hearth steel produced was valued at $25,515; nickel, at $413,771; copper ore, $169,986. The total value of metal products for six months was $1,353,287, or two-thirds as much as for the whole of last year. In 1899 Ontario produced forty per cent. of the world's nickel.

BOTANY: An elementary text-book. By L. H. Bailey. 12mo. Half leather. 500 illustrations. Pages XIV—335. The Macmillan Company, N.Y. Price $1.10.

The amount of literature relating to the study of plants which has appeared during the last five years is truly astonishing. For a quarter of a century or more Gray's Lessons with plants was the standard class-room botany. About the time his "New Manual" was published, in 1887, there appeared also other books presenting the study of botany in quite a different manner. Since that time, each year has marked divergences of opinion among botanists regarding teaching methods.

Gray's Lessons did not take up the subject from the present day point of view of botanical science. It is a question with many whether the botanical science standpoint is best for the pupil—the average pupil. There are many text-books for the student of botany. The admirable works of Coulter, Barnes, Atkinson and Canong are written for the college student. There are a few text-books for the pupil. In the present day botany, individuals of the plant kingdom illustrating its lowest and simplest forms are studied first. More complete forms are examined in natural order and regular sequence. This is the logical, scientific method, the one approved by those versed in pedagogy.

Bailey's Botany "is made for the pupil," so its author announces. "There are four general subjects in the book: The nature of the plant itself; the relation of the plant to its surroundings; histological studies; determination of the kinds of plants." The author's position on the teaching of botany in the secondary school has no doubt been much influenced by his intimate association with the Nature study movement in New York, which in itself has been a great training school, is as follows: "In the secondary schools botany should be taught for the purpose of bringing the pupil closer to the things with which he lives, of widening his horizon, of intensifying his hold on life. It should begin with familiar plant forms and phenomena. It should be related to the experiences of the daily life. It should not be taught for the purpose of making the pupil a specialist; that effort should be retained for the few who develop a taste for special knowledge.

It is often said that the high-school pupil should begin the study of botany with the lowest and simplest forms of life. This is wrong. The microscope is not an introduction to Nature. It is said that the physiology of plants can be best understood by beginning with the lower forms. This may be true: but technical plant physiology is not a subject for the beginner. Other subjects are more important. . . . . Good botanical teaching for the young is replete with human interest. It is connected with the common associations. . . . . When beginning to teach about plants, one should think more of the pupil than of botany. The pupil's mind and sympathies are to be expanded; not the science of botany to be extended. The teacher who thinks first of his subject teaches science; he who thinks first of his subject teaches nature study. . . . The old way of teaching botany was to teach the forms and the names of plants. It is now proposed that only function be taught. But one cannot study function intelligently without some knowledge of plant forms and names. He must know the language of the subject. The study of form and function should therefore go together. Correlate what a plant is with what it does. What is this plant? What is its office, or how did it come to be? It were a pity to teach phyllotaxy without teaching light relation· it were an equal pity to teach light relation without teaching phyllotaxy."

Of the book itself there is little need to speak. The subject matter is excellently edited; the illustrations are ela' orately profuse—perhaps unnecessarily so—mostly half-tones; the paper and binding are of the best It is an exceedingly attractive volume, and there is not a dull page between its handsome covers.

Wə shall watch the success of this book, which in a measure is a reversion to former botanical teaching ideals, with a great deal of interest. There is unquestionably a tendency on the part of the advanced teacher of botany to cater to the specialist in scientific botany rather than to the student who wishes to study plants. I think this book has a distinct mission and will find a large constituency awaiting.

J. CRAIG.

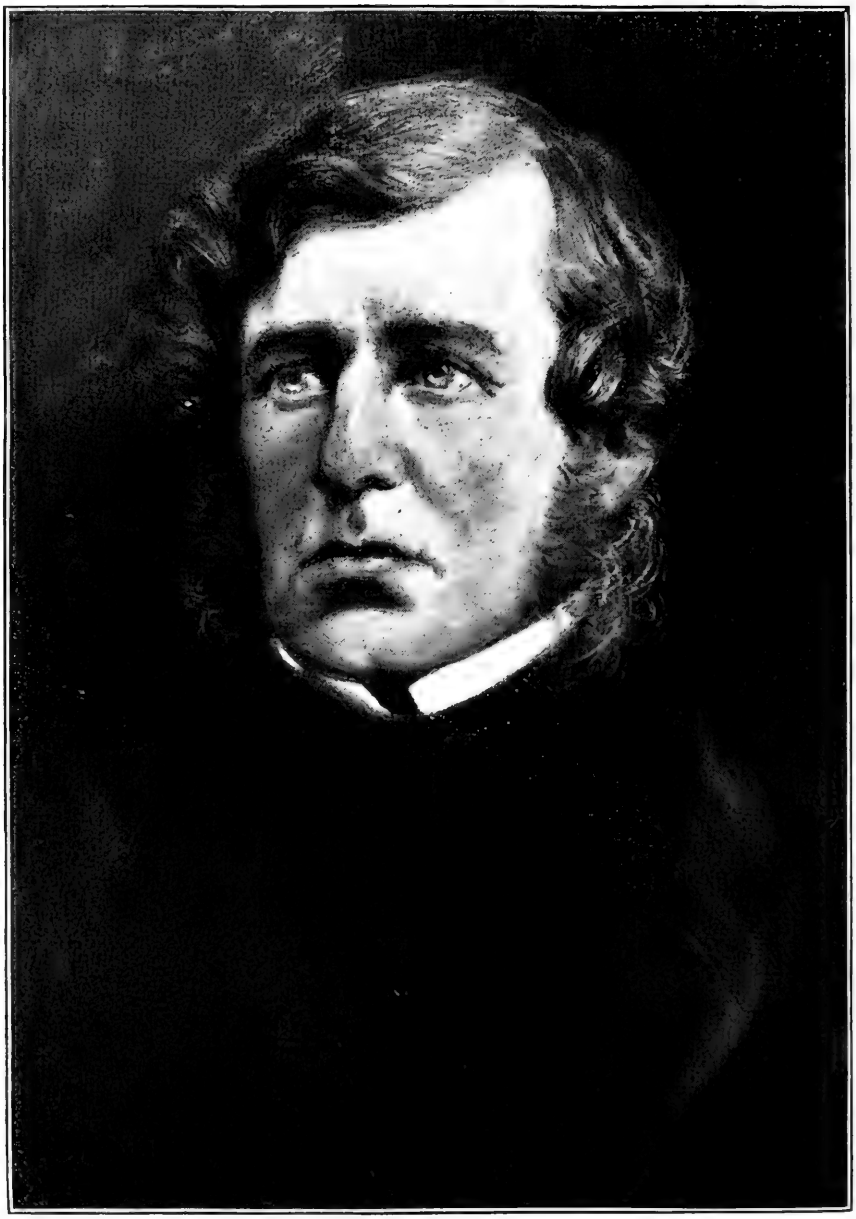
In common with all the sorrowing subjects of

HIS IMPERIAL MAJESTY KING EDWARD the SEVENTH

the members of

THE OTTAWA FIELD-NATURALISTS' CLUB

desire to record their deep sense of sorrow and loss at the demise of their beloved Sovereign Lady, QUEEN VICTORIA, during whose most glorious reign of sixty-four years, scientific work and original research, such as our Club aims to accomplish, have received unprecedented impetus.



E. Billings

THE OTTAWA NATURALIST.

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ANNUAL ADDRESS OF THE PRESIDENT OF THE OTTAWA FIELD-NATURALISTS' CLUB.

(Delivered December 11, 1900.)

Ladies and Gentlemen:

Another year has passed since we met to inaugurate our last course of winter soirées. As a general statement of the condition of the Ottawa Field-Naturalists' Club to-day, I have no hesitation in stating that we are in a healthy and vigorous condition. The *membership* has possibly never been higher; the finances are, I am informed by our worthy Treasurer, very encouraging; the excursions or sub-excursions or outings, held by the Club last season, have been unusually well attended; and, as far as we can see by the programme of winter soirées which the soirée committee has prepared for us, there is in store many a treat in various branches of the Club's work during the coming season. I take this as an earnest of the good work done and results obtained by the members of the Club at the outings.

EXCURSIONS AND SUB-EXCURSIONS.

These were held at regular intervals last spring and during the summer months. Beechwood, Britannia, Hemlock Lake, Beaver Meadow, Kirk's Ferry, Montebello, Cumberland, are some of the localities visited. Notices of these outings have appeared from time to time in THE OTTAWA NATURALIST.

THE OTTAWA NATURALIST.

The official organ of the Club, THE OTTAWA NATURALIST, is fast

becoming the most rapid medium of publication in Canada for notes on the Natural History of our various Provinces.

There is much to be done yet in the way of publication, and it is to be noted that considerable time and labour would be spared the editor, if the associate editors appointed by the Council and responsible for several most important departments of research in Canadian science would co-operate with him and form a committee of supply which would not only prove most interesting but make THE NATURALIST less one-sided perhaps—a phase which at different times it may appear to assume owing to circumstances over which none but the Associated Editors can have control.

THE ROSS PRIZE.

Nearly a year ago, during his visit to Ottawa, the Hon. G. W. Ross, then Minister of Education for Ontario, now the Premier of that Province, met a number of the officers of our Club and, noticing the educational work which we were trying to do in our midst, proposed of his own accord to grant a prize or medal for the student of the Normal School doing the best work in connection with our Club.

Competition was keen, and as a result the following communication was prepared by the committee of judges.

Mr. J. H. Putman, Ottawa, June 12th, 1900.
Science Master, etc.,
Ottawa Normal School.

On behalf of the Judges appointed by the Council of the Ottawa Field-Naturalists' Club to examine the collections of plants sent in for competition, I have the honour and pleasure to report that after a very careful and critical examination of said collections we have come to the conclusion that owing to the excellence of the collections and large number of specimens sent in and correct identifications of species, the first prize, presented by the Hon. Dr. Ross (Premier of Ontario) falls to Miss Elma Cannon, and the second prize, presented by the President of the Club (proxime accessit) to Miss Mary E. Robson.

The collections of Messrs. J. A. Graham, H. F. Breckenridge and Elmer Bolton, comprising the exact number of twenty-five

species each, are worthy of special mention, as also the collections of Miss L. Mabel Graham, Miss Van Alstyne, and Miss M. M. Mackenzie.

The Judges report that it was no ordinary task of awarding the prizes, as the all-round excellence of the collections demanded critical comparison of specimens with specimens throughout, before decision could be arrived at.

P.S.—The Judges appointed by the Club were :—Dr. James Fletcher, Prof. John Macoun, and the President of the Club, Dr. H. M. Ami.

THE NATIONAL MUSEUM.

I am not one of those whose motto is "despair." In fact it is with considerable satisfaction and reasonable hope that we look forward to the early meeting of the Canadian Parliament when the realization of the promises made by our worthy representatives are to be fulfilled. We expect a National Museum—a building commensurate with the needs of the times, adapted for the specific purposes for which it is designated—as a repository of authentic and representative specimens illustrating the immense wealth and natural resources of our great Dominion. We hear from all sides the cry that the present building on Sussex street, the building on O'Connor street and other repositories of Canadian collections are "too small," "very inadequate," "totally unfit," "dangerously situated" and running the daily risk of being destroyed by fire, although they contain probably more "types" and typical series of collections illustrating the mineral wealth, forest products, products of earth, sea and sky of Canada than would take a half century to acquire and replace. The fact is, ladies and gentlemen, if the types now displayed, say, in the Geological Museum on Sussex street, were ever destroyed, they could never be replaced and an irreparable loss to Canada as well as to science (or exact knowledge) would be the result. The people of Canada, all the Natural History Societies of the Dominion, the Council of the Ottawa Field-Naturalists' Club, and its members will hail with special delight the first tangible proof of the erection of a National Museum at the capital.

ROYAL SOCIETY MEETING.

In May of this year, the Royal Society of Canada again met

in Ottawa, and, as delegate of the Club, I had the honour to lay before that body, with which we have been affiliated since 1882, the results of the previous year's work. This report has been published and a number of extra copies have been issued. These give a fairly comprehensive view of the aims and methods of work carried on by our Club.

SUMMER SCHOOL OF SCIENCE.

The Club has heard of the possibility of a Summer School of Science being organized in this portion of Ontario. From the results achieved by a similar organization in the Maritime Provinces, a vast amount of most useful information has been gathered not only by the teaching fraternity for whom these schools of science are generally organized, but also by all who may come into contact with their workings and any of their published results.

The Club heartily welcomes such an organisation in the Ottawa Valley, and trusts that not only the teachers of the Ontario side of the Ottawa River will constitute its membership, but also teachers from the Quebec side. Schools of science for the purpose of becoming better acquainted with the natural resources of our country might well be established in every part of the Dominion, so that, instead of scattering our forces during the holiday season, we might acquire much useful knowledge, in a pleasant and profitable way—never as a task, but as a delightful pastime in the broad field of Nature.

I feel confident that I echo the sentiments of every member of the Ottawa Field-Naturalists' Club when I say that the Club is willing to do all in its power to assist such a Summer School of Science whenever established in our midst.

MEMBERSHIP.

It had been my purpose, when selected by you to fill the responsible position to which you have once more re-elected me, to organise a *membership committee* of the Club. I am convinced that the Club does not count within its membership one-half, nor one-third of the citizens of this City who are anxious to join us. On all sides I meet with such questions and statements as these :

"Oh ! may I join your club ?" "I'm not scientific enough to join your Club !" "Can I really join your Club ?"

Certainly you can join the Club ; any lover of Nature or student of the Natural Sciences ought to join our Club, and the sooner we see our membership roll increased, and the readers of THE OTTAWA NATURALIST also increase in their interest in its pages, the sooner will our city awaken to the fact that we are in the midst of a most charming locality, full of attractions and useful studies in all branches of natural history and geology. There is plenty of work for the Club on all sides, whether we concentrate on our special locality, Ottawa, or whether we deal with notes and observations on other parts of Canada. The work carried on by the *Royal Society of Canada* in our midst, by the *Ottawa Literary and Scientific Society*, by the *French Canadian Institute*, by the *St Patrick's Literary and Scientific Society*, by the *Scientific Society of Ottawa University*, possibly the youngest of our sister societies, has its place, and Ottawa is all the better for these organizations. We are all trying to plant thoughts. May they grow and multiply.

It is not my purpose to detain you very long this evening. I have not prepared any elaborate address such as I would have wished for, on an occasion of this kind. In its stead I have brought together a few words regarding two persons, one, a great Canadian scientist, twenty-four years gone to his rest ; the other a member of our Club, but a few months, gone, whose loss we oft-times feel, for we miss him at our excursions and his familiar face is no longer with us.

ARCHIBALD LAMPMAN.

The issue of that simple, chaste but excellent volume of poems from the pen of Archibald Lampman, recalls a duty unaccomplished by us at our last annual inaugural meeting. I refer to the too early demise of our friend and fellow member, the sweet poet of Ottawa, Archibald Lampman.

It was on the 10th day of February, 1899, that he was taken from us, the result of too severe a strain upon his delicate constitution some three years previous, followed by a severe attack of pneumonia two days prior to his death. His ardent love of Nature

and all she teaches in lake, in forest, in autumn, in winter, in sorrow, in comfort, led him into those numberless nooks and sequestered spots which enchant the eye, please the mind and entrance the soul.

In him the Club has lost one of its best friends and sympathizers. His was an observant as well as a contemplative soul. We have caught him many a time fairly revelling in the beauties of Nature-scenes surrounding our city, especially in those least frequented spots in the wilds of Nature where the ruthless hands of man hath not yet laid everything low. How he loved to pore over the harmonies of Nature as his pure true spirit saw them in their virgin beauty and grandeur with which his soul communed ! His poems ought to be in the hands of every field-naturalist. The seasons, the flowers, the birds, the forest, the storm, were so many voices to him which the tender and responsive chords of his delicate nature and temperament understood and with which he was intensely enamoured. In the volume edited by our fellow townsman, Mr. Duncan Campbell Scott, his descriptions reveal a heart that has tasted and seen the lovelinesses and beauties of the favourite haunts of our Club about Ottawa, where Lampman used to drink in those lovely sights that our eyes have witnessed and which his pen has so happily traced. We mourn his loss, but cherish and revere his memory.

BILLINGS MEMORIAL.

The late Elkanah Billings, who for twenty years was palæontologist to the Geological Survey of Canada and was the founder of the "Canadian Naturalist and Geologist," was born in the township of Gloucester, along the right bank of the Rideau River in the old, and now demolished Billings homestead situated a few yards below the present bridge which spans that river at the little village of Billings Bridge. He was the second son of Mr. Bradish Billings whose ancestors came from England while those on his mother's side came from Wales. His grandfather was a Brockville physician, Dr. Elkanah Billings, after whom the subject of this sketch was named. Both his parents, however, were born in the United States, his father in Massachussets and his mother in New York State.

From Dr. Whiteaves's obituary notice of Elkanah Billings the following extracts are made :

"Elkanah Billings, our esteemed associate for so many years, was born at the family homestead on the 8th of May, 1820. His first teacher was a governess, Miss Burritt, his next a family tutor named Maitland, and he afterwards went to three small schools in the neighborhood kept respectively by Messrs. Colquhoun, Collins and Fairfield. In 1832 the youth was placed at Rev. D. Turner's school in Bytown as a day pupil, and after four years' interval during which he remained at home on the farm, his parents sent him in 1837 to the St. Lawrence Academy at Potsdam, in the State of New York, of which the Rev. Asa Brainerd was Principal.

"On leaving this institution, Mr. Billings entered the Law Society of Upper Canada as a student in 1839 and was articled to Mr. James McIntosh, a Barrister in Bytown. Mr. McIntosh died in the same year and was succeeded by Mr. Augustus Keefer, with whom Mr. Billings remained for nearly four years ; and it appears that he was for a short time also in the office of the late Mr. George Byron Lyon Fellowes in the same town. In 1843 he went to Toronto and studied for a twelvemonth longer with the legal firm of Baldwin & Wilson, and was admitted to practice as an attorney in the fall of 1844. Soon after this he returned to Bytown and entered into partnership with Mr. Christopher Armstrong, who was then one of the judges of the County Court, but, a law having been passed prohibiting judges from pleading, the partnership was dissolved after having lasted only six months."

In 1845 Mr. Billings married a Toronto lady, a sister of the Hon. Judge Adam Wilson. Between 1845 and 1848 he practised law in Bytown, having been called to the Bar in 1845. In 1849, however, he removed to Renfrew, where he practised his profession until June, 1852, when he returned to Bytown where most of his time was engaged in journalistic and scientific pursuits. He occupied the editorial chair of "The Citizen" from the fall of 1852 until late in 1855. Many of Mr. Billings's leading articles in "The Citizen" of those days comprised popular disquisitions on geological topics and natural history subjects, which served to indicate

the trend of thought of the man whose subsequent life led him into enquiries of the highest scientific type, whose writings are now held in the highest esteem and well known the whole scientific world over. It was during these years of residence in Bytown that he began the systematic study of the fossiliferous rocks which are so extensively developed along the banks of the Ottawa River in the vicinity of our city. Probably at first entered upon more as a pastime and relaxation from his journalistic duties, these researches culminated in his final adoption of geological studies, especially in the department of fossil organic remains, for the remainder of his life. The magnificent collections of crinoids, cystideans and star-fishes from the Trenton limestone of Ottawa that are now exhibited in the Museum of the Geological Survey of Canada, testify to his remarkable success and energies in these researches, for it must be remarked that these organisms are extremely rare and great diligence as well as patience must be exercised if satisfactory results are to be expected.

Early in 1856 Mr. Billings issued the first number of the "Canadian Naturalist," of which and the succeeding numbers of the first volume he was practically the sole contributor. The production of this number marks an epoch in the history of the progress of scientific research and discussion in Canada. The articles contained in the first volume of the "Canadian Naturalist and Geologist" at once stamp Mr. Billings as a master in the description of fossil organic remains as well as of recent natural history objects.

Previous to the issue of this magazine, Mr. Billings had been brought into direct communication with Sir William Logan, then Director of the Geological Survey of Canada, and it was not long, yea, but few months elapsed, before the latter with his usual clear-sightedness engaged the services of Mr. Billings, his friend, as Palæontologist to the Geological Survey of Canada. It was in August, 1856, that Mr. Billings entered upon his duties as Government Palaeontologist, and until his death which took place June 14, 1876, a period of nearly twenty years elapsed in which he worked ceaselessly in the domain of palæontology and in assisting his chief and director in assigning geological horizons to the

various geological formations of eastern Canada, involving numerous and difficult problems which made it a task of no mean importance, but fraught with results that the world of to-day can, not only appreciate, but esteem, as amongst the best performed work it has to consult.

His first geological paper was published in April, 1854, and was entitled "On Some New Genera and Species of Cystidea from the Trenton Limestone." It was published in the "Canadian Journal," Toronto, page 215. On removing to Montreal in 1856, Mr. Billings removed also the headquarters of his Magazine—"The Canadian Naturalist and Geologist"; from that date on the same was published in Montreal under the same designation and under the name of "Canadian Naturalist and Quarterly Journal of Science." until 1883, when it was superceded by the "Canadian Record of Science," and became the recognized official organ of the Natural History Society of Montreal. Of this Society he was regularly elected a Vice-president for 14 years, having declined the office of President proffered to him on many occasions.

In 1858 Mr. Billings paid a visit to Europe, where he came in contact with leading geologists of the time and examined the various collections in geology throughout Great Britain. These he studied most zealously and made a comparative study of the Silurian (including both the lower and the upper Silurian of Murchison) and Devonian fossils of Western Europe with those of Canada and arrived at the conclusion that there were but few species identical with those of Canada. In April 1858, when in London he was elected a F. G. S. (Fellow of the Geological Society of London); Sir Roderick Murchison, Professor A. Ramsay, and Prof. T. H. Huxley, having nominated him. He visited Paris where he met a number of distinguished men, amongst others the great Bohemian palæontologist, the Abbé Joachim Barrande, with whom, and in conjunction with Sir William Logan a most interesting discussion arose regarding the age of several rock formations occurring in the Province of Quebec, to which Sir William Logan gave the name "Quebec Group"—a controversy which included many difficult problems and in which the "Taconic Question" was a conspicuous factor.

The term "Quebec Group" will invariably be associated with

the excellent work performed by Sir William Logan and Mr. E. Billings.

Notwithstanding all the attacks that had been made upon the validity of that term and the discussions on its significance, it is as truly a natural group or division in the succession of palæozoic sediments in Eastern Canada to-day as it was in the 50's and 60's, and the chapters devoted to this most important study in the "Geology of Canada" for 1863, are replete with wisdom and forethought.

On several occasions Mr. Billings made extensive collections in the Silurian as well as in the Devonian formations of Ontario and in the vicinity of Montreal, as can be seen from the collections now in the Geological Department, but the bulk of his time was devoted to the determination of geological horizons for mapping purposes and the description of new genera and species brought into the Department by the various field-geologists. Of genera new to science, Mr. Billings described no less than sixty-one and in all described 1065 new species of fossil organic remains from various horizons in the Palæozoic of Canada. He also contributed many papers on natural history and zoology.

He did much in assisting Sir William Logan to establish and build up the Geological Museum ; for, besides the large number of type species which he described, he identified as many more again, species from Canada with forms previously described by Conrad, Hall, Emmons, Vanuxem, Sowerby, and other palæontologists of America and Europe.

His writings indicate a clear and precise mind, coupled with a rare judgment, couched in a phraseology simple and to the point. He published upwards of 170 distinct papers, memoirs, or reports, many of which are now very difficult to obtain or entirely out of print. The bulk of his writings are embodied in the reports of the Geological Survey of Canada, comprising the figures and descriptions of Canadian fossil organic remains. or "Decades I, III, and IV, the Palæozoic Fossils, vol. i., parts 1 to 5 ; Pal. Fos. vol. iii, part 1" ; part 3 of which is still unpublished. While residing in Montreal he was a constant contributor to the "Canadian Naturalist" ; he also wrote important papers in the

"American Journal of Science and Arts," New Haven, the "Geological Magazine," London, and the "Journal of the Canadian Institute," Toronto.

He was an indefatigable worker. From early morning till late at night he was at his desk, and later on at home into the hours of night he carried on his studies, and thus accomplished much in those twenty years of official connection with the Geological Survey of Canada.

Billings left behind him a large amount of unfinished work, numerous and important lists of organic remains bearing upon the geology of the older Provinces of our Dominion. Many of these lists would form most important contributions to Canadian Geological Science, should they ever be published. As noted by Dr. Whiteaves in his obituary noticeand in Memoriam paper Can., Nat. and Q.J.S., vol. iii., No. 5, p. 261, "Mr. Billings died before he could describe the whole of the material he had studied and carefully examined, including collections by Sir Wm. E. Logan and Prof. (now Dr.) Robert Bell, at Gaspé; Mr. T. C. Weston, at Arisaig; T. Curry, at Port Daniel and Bay of Chaleurs. The whole of the material from these localities had been carefully examined, and it only remained to write the "descriptions of the different species, but this, alas, he was not destined to accomplish."

Those who had the pleasure and privilege to know Mr. Billings state that he was characterized "by great firmness and decision and an unswerving love of truth and justice, by an unaffected and winning modesty of demeanor."

To do him honour and tell the world of science what Billings did for Canadian Geological Science many a palæontologist in America and Europe has named genera and species after him. The genera Billingsia, Billingsites, Billingsella, Elkania, have been erected by Walcott, Hall, Ford and Hyatt, whilst upwards of thirty species of corals, crinoids, brachiopods, lamellibranchiata, gasteropods, cephalopods, ostracods, trilobites and other fossil organic remains have his name affixed as their specific names.

The Bibliography of Mr. E. Billings, prepared from my card catalogue of contributions to Canadian palæontology of some years' standing, which last year was withdrawn for a season, will it is hoped, form an appendix to this already too long address.

Such Bibliographies are a necessity nowadays.

During his lifetime Mr. Billings received many tokens of appreciation. In 1867 the Natural History Society of Montreal voted him its silver medal for "his life-long efforts for the promotion of science in Canada." He was awarded a bronze medal (in Class I) by the Jurors of the International Exhibition of London in 1862 and a similar one at the Paris Exposition of 1867.

In connection with this evening's programme comes the presentation of the portrait of the late Mr. E. Billings to the Geological Survey of Canada, and after these few remarks by your President on the career and work of that eminent Canadian, it may not be out of place for me to read three or four extracts of notes and communications received from a number of well-known palæontologists and others whose words appear to me to show the eminently high esteem in which Billings is held to-day after a lapse of twenty-four years since he died. These communications include letters from the Hon. C. D. Walcott, Director of the United States Geological Survey; Prof. R. P. Whitfield, Curator of the Geological Department of the American Museum of Natural History, Central Park, New York City; Prof. Charles Schuchert of the U. S. National Museum and Smithsonian Institution; Prof. J. M. Clarke, N. Y. State Palæontologist at Albany, and the successor of the late Prof. James Hall.

Prof. J. M. Clarke writes: "I sincerely regret that circumstances do not permit me to testify *propria persona*, on the occasion of the presentation of the Billings memorial portrait, to my profound appreciation of the great work accomplished by Mr. Billings for his elect science of palæontology. My admiration for his keenness of observation and correctness of orientation grows with the continued study of his results. At one time and another I have had occasion to study some part of his work with critical care, and no instance occurs to me in which any of his determinations appeared open to question. In this day we often seem to be building for others to pull down, and one works with the ever present consciousness of a multitude of critical witnesses, but Billings's tenacious adherence to facts and his ability to recognize the truth, have rendered his work stable and enduring. Mr. Billings was in

these respects an ideal palæontologist, and his contributions to the palæozoic faunas of America are of tremendous value. There was a large element in his results which his contemporaries in American palæontology did not infringe upon nor compete with, the faunas of the early Siluric ; and had he not lived and laboured, or were our knowledge of these faunas *debillingsed*, the science would be thrown backward a generation. There is little danger of future palæontologists forgetting their obligations to Elkanah Billings, father of a thousand palæozoic children. His name will always remain familiar to, and honoured by the workers in the science to which he devoted his life."

Prof. R. P. Whitfield thus writes : " I never met Mr. E. Billings but twice, once at Albany, N.Y., and again at Montreal while looking through the Survey Museum with a class of students from the Troy Polytechnic Institute. Mr. Billings was sick at the time but came into the Collection and spent some time with us and interested us all much with the collections then under his charge. I have been familiar with his work in Palæontology and also with some of his more popular articles in the magazines and have admired his keen appreciation of the nature of the objects with which he was dealing. He must have been a close student of Nature and have fully appreciated and understood the bearings of the objects with which he was dealing.

" His Palæontological work is very well known and thoroughly appreciated among all workers in that line of investigation and will stand as a lasting Monument to his credit."

The Hon. C. D. Walcott, Director of the U. S. Geological Survey, Washington, D.C., has sent the following communication :—

" I am very much pleased to learn that it is intended to present a memorial portrait of the late Mr. E. Billings to the Geological Survey Museum. It will be a fitting tribute to the man who did so much to assist Sir William Logan in unravelling the stratigraphic geology of the Palæozoic rocks in Canada. I have always regretted that I was not personally acquainted with Mr. Billings, as I was impressed, when study-

ing his descriptions and correlations, with the fact that he was a man of unusual ability, and possessed of a keen appreciation of the value of thorough palæontological work."

Dr. Charles Schuchert, Assistant Curator of the U.S. National Museum at Washington also writes :—

"When in Ottawa last summer I was much pleased to see the splendid portrait of Elkanah Billings and delighted to know that it was to be shown amongst the many Canadian fossils which he immortalized. His short but brilliant descriptions hit off the salient characteristics of the species, proof positive of a distinguished palæontologist. In short, Elkanah Billings's name stands high amongst North American Invertebrate palæontologists and is one of that great triumvirate of pioneers in our sciences : Hall, Billings and Meek."

Besides these brief but genuine appreciations of the man whom we seek to honour this evening, I feel constrained to add another tribute paid to the memory of Mr. Billings by one who formed the main theme and subject of our address last year, viz., Sir William Dawson. In his volume entitled "Salient points in the History of the Earth," Sir William dedicates Chapter XII "to the Memory of Elkanah Billings, first Palæontologist of the Geological Survey of Canada, who laid the foundations of our knowledge of the invertebrate fossils of Canada."

I shall not attempt to give you any further details of his life works or writings, suffice it to say that "though dead he still lives" and his name stands unusually high in the estimation of all who have had anything to do with the unravelling of the Geological problems of Canada, especially as they present themselves to us in the older Provinces of our Dominion.

In 1876 Billings died, and to fill his position the department engaged the services of the present distinguished occupant of the position of Palæontologist and Zoologist, Dr. J. F. Whiteaves, a member of our Club since 1883.

I regret exceedingly that Dr. Whiteaves is not present on this occasion. He has requested me to present his sincere regrets to this audience. We expected some words from him, but he is unfortunately prevented from being here by an indisposition, and

we can only say that in Dr. Whiteaves, the Government has had an earnest and painstaking officer as successor to the eminent name of Billings.

THE PORTRAIT.

The portrait before us is the result of the work of our fellow townsman, Mr. Charles E. Moss, R.C.A., whom we are pleased to see with us this evening.* It is a faithful reproduction of that excellent likeness of Mr. Billings, now hanging in the Lecture Hall of the Natural History Society of Montreal by W. Raphael, Esq., painted in 1876, from a photograph by Notman in 1861.

It is the intention of the Committee to have a tablet prepared for the portrait with the following inscription :—

ELKANAH BILLINGS, Esq., F.G.S.,
Palæontologist from 1856 to 1876.
Presented to the Geol. Survey of Canada by a Committee of the
Ottawa Field-Naturalists' Club, Dec. 11th, 1900,
on behalf of his friends and admirers.

I will now formally present this memento of Mr. Billings to the Dominion Government as represented here this evening by Dr. Geo. M. Dawson, the Director and Deputy Minister of the Geological Survey Department.

The following is a synopsis of Dr. Dawson's apt remarks when accepting the portrait :

My duty this evening is an easy and a very pleasing one, consisting as it does in receiving, on the part of the Geological Survey Department, this excellent portrait of Elkanah Billings, who for many years was Palæontologist to the Survey. I can promise it a place of honour near the collections to which his labours were devoted, and I trust a still more conspicuous position may be found for it in the new and spacious Museum in which we hope, before long, to see these collections adequately housed.

In thus honouring Billings's memory the Ottawa Field-Naturalists' Club, have, I feel, equally done themselves honour. It is particularly appropriate that a Committee of members of this organization has been instrumental in arranging for the production

* The excellent frontispiece to this number is reproduced from the portrait by the Grip Printing & Publishing Co., Toronto. J. F., A'g Ed.

of this portrait, for all Mr. Billings's early associations were connected with Ottawa, the fossils contained in its rocks were the first objects of his scientific study, and, although much of his work was afterwards done in Montreal, the collections to which his time was devoted have come back to be preserved here.

Billings was one of a remarkable triumvirate connected with its initiation and early work of the Canadian Geological Survey, all well in the van of scientific progress at the time, but each working along his own lines. Logan and Hunt were his associates, but his scientific eminence was less recognised in Canada because his work was less obviously connected with the economic problems that the Survey had set itself to solve. His audience was not so much in the little Canada of that day as in the studies and laboratories of Europe and the United States.

The accuracy of his observations is evidenced by the permanence of his reputation among those palæontologists of a later generation that has arisen since his day. It is not often that, nearly twenty-five years after the death of a man whose time was devoted to purely scientific pursuits, interest in his life and work have been maintained in such a way as to render a memorial like this possible, and I may therefore close by again congratulating both those who initiated and those who have aided by subscribing towards the production of this portrait.

POWERS OF ADAPTATION IN FISHES.

By PROFESSOR EDWARD E. PRINCE, Dominion Commissioner of Fisheries.
Ottawa.

Fishes are frequently classed as fresh-water species and marine species, but there are many which occupy a kind of neutral position, and have the habit of spending part of their time in fresh water and part in the sea. The salmon, sea-trout, smelt, striped bass, sturgeon, shad, &c., are familiar examples, many of them being anadromous, and ascending into fresh water for spawning purposes, while a few are catadromous, like the eel, and deposit their spawn in the sea. The power of adaptation

implied in this change of environment is most remarkable, and appears, in many instances at least, to be acquired during the life of the individual. Thus, a newly-hatched salmon soon dies if placed in sea-water, and the eggs of that species are also fatally affected by the same treatment ; yet later in life the salmon lives indifferently in salt water and in river water. Further, many species, which normally migrate, have lost the habit and, like the land-locked salmon, smelt, flounder, or herring, may pass their days without ever tasting salt water. Some curious instances of extreme changes of habitat in certain mollusks are on record, as, for instance, the bed of cockles (*Cardium edule*) which was described before the Wernerian Society in Edinburgh in 1825 as existing in a Yorkshire peat moss 40 miles from the sea. These shell-fish lived in a sandy channel, communicating with the river Tees, and were precisely like those distributed over the vast beds, eight or ten square miles in extent, at the estuary of that river. To the taste, however, they were distinctly less salt in flavour. A Mr. Brand, more than a hundred years earlier, had described, in an account of the Orkney Isles, a bed of cockles in the fields a mile from the sea. They were in a deep furrow to which salt water might have had access during an exceptional storm. Specimens of the sea-whelk (*Buccinum undatum*) have been found in a fresh-water lake on the island of Yell, a mile and a half from the sea, and as the apex or tip was fractured it was thought that sea-birds or crows had carried them to their new location. Yet, the shell being somewhat thinner in texture, and more distinctly banded, it seems more probable that they had lived for a long period in their fresh-water environment, and thus differed from the marine forms.

Oysters, as is well known, flourish in brackish water, and can endure transference to water almost destitute of salinity ; but they do not appear to breed or maintain a healthy state, they merely fatten and increase in size.

Many fishes in the same way are unfavourably affected if prevented from performing their usual migrations from or to salt water. Dr. Barfurth discovered that the ovaries become diseased, and the eggs degenerate in fishes which are prevented from normally migrating. The same observer has recorded the fact

that the ill-effects reappear in the following season, the eggs and brood of the fish, permitted after confinement to ascend to the spawning grounds, being very inferior and clearly affected detrimentally. The eminent Scottish authority, Professor W. C. McIntosh, some years ago described flounders that became egg-bound and swollen while confined in salt-water tanks; and ultimately they sickened and died.

The results, in all cases, are not so unfavourable. Sir J. G. Maitland kept some sea-salmon fry from March, 1881, when they were hatched, until 1884, and took the eggs and milt, so that he secured young salmon fry of small parent fish (smolts) which had never been to sea. Dr. Francis Day has told us that some of the young brood had attained a length of 5½ inches in 1886. The retention of sea-salmon in fresh water is found usually to retard their growth, and in one of the earliest experiments (at Lier, in Norway) the weight reached in five years was under two pounds, less than one-tenth of that normally reached by migratory salmon. Sea-salmon planted in Lake Huron prior to 1883 were reported by the late Mr. Wilmot to be smaller than those found along the coast. The ouananiche of Lake St. John, P.Q., like their land-locked congeners in Lake Onawa and other waters in Maine, and the Chamcook Lakes in New Brunswick, are smaller than sea-salmon. In many cases access to the sea is possible; but if from some geological or other natural cause the fish were originally prevented from descending to the sea, the catadromous habit appears not to have been resumed, partly no doubt owing to the abundance of food in their fresh-water habitat. Land-locked smelt are very often abundant in waters containing land-locked salmon, and they afford an ample supply of food. Pacific salmon exhibit the same phenomenon, of which Kennerley's salmon is an example; but the spring salmon artificially land-locked in California in 1875 or earlier, bred, and their progeny reached a weight of eight or ten pounds, though on account of scarcity of food, another series were found in nine years to barely reach a weight of two pounds. The spring salmon or quinnat is a large species ranging from 15 to 50 or 60 pounds or even more. The salmon retained at Tadousac, and in certain small lakes adjacent to the Restigouche proved to be

stunted, and weighed less than a quarter the weight normally reached at the age of the specimens referred to. The adaptability of smelt *(Osmerus mordax)* has long been known. Nearly seventy years ago Col. Meynell acclimatised smelt and bred them in a small sheet of water in England, and quite a number of lakes in New Brunswick, Lake Utopia and others contain land-locked smelt.

Only one or two members of the cod family *(Gadidæ)* are indigenous to fresh water. All the rest are marine, the fresh-water species being the cusk or burbot, often called ling or lawyer. The tom-cod *(Microgadus)*, while it prefers saline or brackish, water can survive in a fresh-water environment, and occurs in abundance in Lake St. Peter, below Montreal. An allied form, the silver hake *(Merluccius bilinearis)* is recorded as abundant in Darling's Lake, near Rothesay, N.B., attracted from the sea by the ascending schools of gaspereaux, which are their favourite food. In the Baltic Sea, the true cod, as well as the haddock, pollock, and other gadoids, occur, but reach only one-quarter of the size which these fishes attain in the sea. In the Bras d'Or Lakes cod are stated to be large (sometimes 56 or 58 pounds), but the head is of disproportionate size, as though they were not well fed. They are caught through the ice at Whycocomagh, far inland and in water of low salinity.

Of the herring tribe at least five species come up into fresh water annually, and some have become land-locked like the gaspereaux or alewives *(Pomolobus pseudharengus)* of Lake Ontario and Lakes Cayuga and Seneca (N. Y. State) and other inland waters. They are often erroneously called shad or menhaden, and they die in immense numbers in early summer owing to some unfavourable circumstance connected, doubtless, with their non-sea-going habit. True sea-herring are not known to be land-locked in Canada; but in Iceland and in the Baltic a fresh-water variety occurs. Some of the Baltic herring were kept for a long period in tanks by Professor McIntosh in Scotland, the water supplied to them being perfectly fresh. They were somewhat stunted.

Many fish when permanently shut off from the sea improve in size and table qualities. Dr. J. C. Mitchell, an authority on the

fishes of Egypt, affirms that three species of mullet reached a large size and were of finer flavour after retention in fresh water than those in salt or brackish water. In Florida red fish *(Pagrus)* confined in a fresh-water lake were found 38 pounds in weight, and improved in delicacy of flavour, while numerous other marine species survived the change, but some sharks and sting-rays succumbed, owing, it was surmised, to the winter cold of 1885. The shark tribe are essentially marine, and ill-able to adapt themselves to non-marine surroundings. I know of one record only of a marine species found far from the ocean, viz., a questionable instance of a dogfish, which was stated to have followed the salmon schools for a distance of 1,500 miles from the Pacific shore. The fish was recorded to have been killed up the Bruno River, Nevada, by the wheel of a waggon crossing a ford. There are, it is true, some fresh-water sharks, like *Carcharias gangetica* in the Ganges, and the Senegal saw-fish, also Indian and South American rays (*Narcine*, *Torpedo*, &c.). Certain whales also are non-marine, such as the small *Platanista gangetica* in the Ganges, and *Inia* and *Pontoporia*, belonging to the Grampus and Porpoise family, and found in the Amazon and other South American rivers. The white beluga ascends the St. Lawrence for 150 miles, and goes up the Saguenay River for some distance.

The carps, of which our suckers and mullets are examples, are credited with much plasticity. The German carp can not only endure but survive changes of a remarkable character, living in mud and existing far from lakes or streams for a long period. Certain suckers can endure alkaline and other chemical impurities, and an extraordinarily high temperature. In that wonderful volcanic geyser area, the Yellowstone Park, Professor Jordan found suckers and chubs in water of 85° F. and 88° F. and young trout in a temperature of about 75° F.

The catfish and bull-heads are notoriously tenacious of life. Thoreau, indeed, said that *Ameiurus nebulosus* opens and shuts its mouth for half an hour after its head has been cut off; but there are only one or two questionable instances of their surviving removal from favourable surroundings. More experiments are, however, desirable. If, as Bloch stated, the delicate grayling (*Thymallus*) can flourish in brackish water, contrary to Sir

Humphrey Davy's dictum that salmon and trout will do so, but the fastidious grayling cannot do so, it is possible that the variety of fishes capable of acclimatisation in saline, alkaline or other waters may be considerable. The sticklebacks, while normally frequenting fresh water, except *G. spinachia*, flourish in brackish water, and in shore pools reached by high tides. The marine flat-fishes, the flounder, &c., are found up rivers far from the sea, while the striped bass has been successfully retained for years in fresh water, but the climax is reached in that paradoxical fish, the blenny of Ceylon and the Celebes, which habitually lives on damp rocks, leaping from one to the other, and shunning the water to avoid being drowned! *Periophthalmus*, as it is called on account of its projecting eyes, leaps, when pursued, like a frog, and, as Dr. Günther says, seems to "prefer escaping in that way to swimming beneath the surface."

The plasticity and adaptability of various fishes to new surroundings is not only a matter of peculiar biological interest, it is of eminent practical importance. Hence the brief sketch which I have prepared has been amplified and in a somewhat detailed form will appear as a special report in the forthcoming Blue Book of the Fisheries Department to be laid before Parliament at the approaching session. The subject is one needing fuller investigation. If barren waters remote from the sea, and unfavourable, from conditions of temperature, alkalinity, and the like, for indigenous inland species, can be stocked with fine species of fish, marine or brackish in their habitat, the possibility of conferring immense benefit upon the public becomes plainly apparent. From our present fragmentary knowledge it may be surmised that no small number of species have such powers of endurance as to facilitate the work of acclimatization.

NOTES ON THE ACADIAN OWL *(NYCTALA ACADICA)* IN CAPTIVITY.

By F. NORMAN BEATTIE, Guelph, Ont.

On the fourth of November, 1899, while strolling through a small swale near this city, I noticed an Acadian Owl with a field mouse in its claws, perched on a small bush. Thinking I might capture him, I sent my companion around in front to engage his attention while I sneaked up behind to grab him. The dodge worked, and I soon had him safely stowed in the pocket of my coat. He did not seem to mind being caught in the least, not even snapping his bill, but he objected when I took his mouse away. We took him home and let him loose in a small room which is not used for anything in particular. He immediately took possession, and now he started to puff himself up and snap his bill at anyone who went near. This wore off in a short time, though he always resented being handled. For some time he did not take readily to beef, leaving it strictly alone if he could get anything else, but sometimes I was forced to give it to him, and in the course of a few weeks he overcame his dislike to it and ate it freely. His favourite food was mice, which, unfortunately, I was not always able to give him. However, he was also fond of a squirrel or a small bird. His method of eating a bird was peculiar. First he would pounce down upon it as if it were alive and then, holding it down with one foot, would pull out a fist-full of feathers with the other. He would repeat this operation, changing feet each time, till most of the larger feathers were out; then he would pull off the head and swallow the body if small enough; if not, he would pull it apart, holding it with one foot and pulling with his beak. I never knew him to swallow a bird's head though he always did a mouse's. He invariably pounced down upon his food and seized it firmly in his claws as he evidently was in the habit of doing with live game.

He could gulp a surprisingly large piece of beef, in fact, when several pieces were given him he always chose the largest first. If too large to swallow whole he would take a few bites and then put down the remainder.

In the case of mice he always pulled off the head and swallowed it first; in fact, the mouse he had when I caught him was minus the head. Before eating the body he gave it a couple of rolls about in his mouth and crushed the bones with his bill. He always waited a while after swallowing the head, before he attacked the body. In most cases he put his food down in short order, but sometimes when satisfied he would perch himself on a piece of beef and take an occasional nip at it.

I never tried him with crickets or grasshoppers, but a Screech Owl which I kept the previous spring, ate them readily as it did earth worms also. The latter did not seem to contain much nourishment, for the Owl became very thin during the week I fed him on them.

On the evening of the day I caught the Acadian Owl he threw up two pellets, one containing fur and bones, the other fur and the crushed skull of a mouse. All skulls which he ejected were crushed and covered with fur. I am unable to say whether more pellets were thrown up after birds than after mice but I am of the opinion that such was the case, as those ejected after mice were more compact. The bones contained in the pellets were in small pieces and badly splintered. I never saw him in the act of regurgitation, but I am of the opinion that more pellets were ejected during the morning and evening, as most new ones were found then, especially in the evening.

For the first two weeks I had him, I never heard him make a sound beyond the snapping of his bill ; but after this he would favour us at night with a series of little squeals or shrieks, or he would often give vent to a single note. Each note certainly had some resemblance to the sound made by a file drawn once across a saw, but when several were uttered at once I failed to perceive the resemblance. Perhaps this was due to the proximity and my knowledge of the origin of the sound. His notes were generally heard in the evening and early morning, and never in the daytime. He frequently squealed just after attacking a piece of meat or any other article of food. I once caught him jerking away at the skinned body of a squirrel and squealing his best.

During the day, when not disturbed or when not eating, he struck a very queer looking position to go to sleep. He would

draw himself up perfectly erect with his feathers close to his body, making himself look far taller and thinner than usual. He would then slowly close his eyelids in a funny crooked line and go to sleep. His whole appearance changed in the evening, as, with feathers fluffed out and body bent forward, he would move his head from side to side and peer with an anxious expression into all the nicks and crannies in the room.

I was always conscious of his flight even when not watching him, owing to a slight breeze which his wings made in the room, but even when he flew close to my head I could not distinguish the faintest sound.

Although I supplied him with a box of sand in which was sunk a dish of water, I never saw him either drink or bathe, and the water did not seem to decrease, but got dirty in a few days. His feathers never looked as if th y had been near water.

But my pet came to a tragic end at last in the following manner. I paid him a visit one morning, and, unnoticed by me, the cat followed me into the room but did not follow me out again. Shortly after there was a slight tussle, followed by a faint shriek and then all was still. Going into the room I saw the cat with my pet in her mouth. The cat had evidently got the owl in a corner, and I knew how he would back up and show fight, and so the tussle I heard is explained. One of the cat's fangs had penetrated its skull just over the eye and all one side of the head was smashed.

When skinned the bird proved to be a male and was in fairly good condition, though not fat. During the few months I had him, he proved a most in eresting pet, and I was sorry indeed to lose him.

CORRECTION.—A most unfortunate error occurred in the Notice of Prof. Bailey's Botany on page 196 of the last number. In line 13 the word "subject" should read pupil.

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NOTES ON SOME LAND AND FRESH-WATER MOLLUSCA FROM FORT CHIMO, UNGAVA BAY, UNGAVA.

By J. F. WHITEAVES.

In 1864 Dr. A. S. Packard made a small collection of land and fresh-water mollusca on the Gulf and Atlantic coasts of Labrador. The names of the species in this collection are included in his "View of the Recent Invertebrate Fauna of Labrador," published in the first volume of Memoirs of the Boston Society of Natural History. Omitting *Alasmodonta arcuata*, which is included only on hearsay evidence, and *Hyalina electrina* and *Zoogenetes harpa*, which seem to have been found only on the Gulf coast, the species recognized from the Atlantic coast are as follows, the land shells having been determined by Prof. E. S. Morse.

PISIDIUM STEENBUCHII (Moller).

=Cyclas Steenbuchii, Moller, 1842.

"Abundant in fresh water streams and swampy lands at Square Island and Strawberry Harbor."

ISTHMIA (PUPA) HOPPII, Beck.

"Common at Strawberry Harbor."

CONULUS (HELIX) FABRICII, Beck et Moller.

"At Strawberry Harbor, July 26. Found under sticks in a retired and protected valley."

VITRINA ANGELICÆ, Beck et Moller.

"Common, generally occurring with '*Hyalina electrina*.' Taken at Strawberry Harbor."

LIMAX AGRESTIS, Linn.

"Not uncommon at Strawberry Harbor and at Square Island, under stones."

In 1883 and 1884 Mr. Lucien M. Turner, of the Smithsonian Institution, collected a few specimens of land and fresh-water mollusca, still farther to the northward, at or near Fort Chimo. These specimens are referred to by Dr. W. H. Dall, on pages 202 and 203 of a paper published (in 1886) in the ninth volume of Proceedings of the United States National Museum, where they are identified with the following species.

LIMNÆA PALUSTRIS, Muller, var. VAHLII.

= Limnæa Vahlii (Beck), Moller, 1842.

LIMAX (AGRIOLIMAX) hyperboreus, Westerland.

ZONITES (CONULUS) CHERSINA, var. EGENA, Say.

= Helix Fabricii, Beck, 1837; Conulus Fabricii, Packard; and probably the same as the northern European shell now called Conulus fulvus or Petasia fulva.

PUPA DECORA, Gould.

Much more recently, in 1896, while assisting Mr. A. P. Low, of the Geological Survey of Canada, in his Labrador explorations, Mr. W. Spreadborough collected a small but interesting series of fresh water shells at Fort Chimo. In this little collection, also, there are four species represented, of which one is a *Limnæa* that is evidently the same as that collected at the same place by Mr. Turner, and identified by Dr. Dall with *L. palustris*, var. *Vahlii*. The others appear to be as follows:

PISIDIUM STEENBUCHII (Moller).

Eight perfect specimens, which, upon the whole, agree very well with the rather vague description of this species, without any illustration, in the "Index Molluscorum Groenlandiæ."

VALVATA SINCERA, Say.

About thirty living specimens, in fine condition, with their operculа.

Many years ago Canadian examples of this species were erroneously referred to *Valvata humeralis*, Say; and Mr. W. G. Binney at one time thought that they should be regarded as a smooth form of *Valvata tricarinata*. As now understood, the true *V. sincera* appears to range over nearly the whole of the northern part of this continent. Living or recent specimens of it have been collected at the following localities. In the Province of Quebec, at three different lakes or rivers in the county of Rimouski; in fresh water streams on the Island of Anticosti; and in the Lachine Canal at Montreal. In Ontario, at Lake Nipigon; in Assiniboia, on the east fork of Milk River; and in British Columbia, at two localities in the East Kootenay district. Similar specimens have been found at Great Slave Lake; at Sturgeon Lake, Athabasca; and on the Peace and Upper Mackenzie rivers. The species is also known to occur in great abundance, in a semi-fossil state, in many shell marl deposits in Quebec and Ontario, from Anticosti to Owen Sound.

PLANORBIS ARCTICUS (Beck) Moller, 1842.

Seven specimens, which seem to be referable to this species, though *P. arcticus* may be only a synonym of *P. parvus*, Say (1816) which Binney says is found as far to the northward as Moose Factory in James Bay, and Fort Simpson on the Mackenzie River.

Ottawa, January 11th, 1901.

A NEW SONG FOR A COMMON BIRD.

By W. E. SAUNDERS, London, Ont.

On May 3rd of the present year Mr. H. Gould and I spent the day twenty-five miles west of London, seeking with some success the nests of the larger hawks. Near the close of the day there lay a few miles between us and the railway-station, and we chose the longer of two ways "for a walk," to see the country and to hear the birds. When the light had grown so dim that we could no longer see a bird at any distance, our attention was arrested by a harsh nasal "gaap," delivered in a tone midway between that of a snipe and a night-hawk, to the latter of which we were at first inclined to refer it. Sitting down to listen, we were in a few minutes startled to hear the bird evidently flying our way, and uttering all the time a most peculiar set of twitterings, which we could not accurately describe. When over our heads we caught a glimpse of it, still rising, then turning, and in a few seconds more the twitterings ceased and then the monotonous, regular "gaap" reached us again, from about the locality of his former perch. While awaiting further developments we speculated on the identity of the singer, and what we considered our best guess was the snipe, for the notes appeared to have some characters which fulfilled our ideas of the kind of song a snipe might sing—if he could. Continuing our vigil, we were favoured with several repetitions of the flight song, the "gaap" being continuously rendered at intervals of say five seconds during all the time when the bird was on the ground. It was too dark to see to shoot the bird, and much too dark to have found it, if we had shot it, and, besides, we had no gun; so we were compelled to leave it, and for some months were in ignorance of its identity, no one to whom the problem was referred being able to throw the least light on the matter.

Recently, however, in reviewing the pages of the "Nidologist" I read an interesting article (Page 6, vol. IV.) by Mr. R. B. McLain, of Elm Grove, W. Va., on the twilight song of the Meadowlark which seems to parallel our own exactly, and as this opens up

an almost unknown chapter of this common bird's life I quote his article at length: "In 1895, the writer, chancing to be in close proximity to a field, observed a bird perched in a tree-top. Its position and actions proclaimed it a Meadowlark at the first glance. As I approached, it took wing and flew swiftly upward, its wings vibrating rapidly as the bird ascended spirally into the air, uttering a hushed but penetrating, chattering noise resembling somewhat the notes of the *Chætura pelagica*. Suddenly these chattering noises are interrupted by loud 'chirps' or 'cheeps' like those of a Canary uttered in quick succession. The bird flew in almost a circle, slowly descending to the ground again It seemed to have great power of ventriloquism (or else the damp air caused a misleading influence in determining its position by hearing), for the notes appeared to come out of the tree—near which I stood—but every twig was visible and no bird was to be seen: and, as I had lost sight of it in its flight, I knew not where it could be. The notes grew louder and louder. I was positive the bird was in the tree. But it was not, for I was still gazing upward, above and partially through it. I was puzzled. The bird was certainly coming nearer, for the notes continued to grow louder, until I almost imagined it would end by lighting on my head. But the misleading notes did not end here. The noise ceased for a moment, then a sharp and harsh grating 'cheep' came from a point in the field above, 80 or 100 feet distant. I was vexed the first time this occurred, but realized that either the bird was deceiving me or the air had a hand in the deception. The loud, hoarse call was repeated at intervals, and I could easily determine its position. A few moments later it again took wing, and the chattering began, broken in upon occasionally by the chirping, until it again seemed almost upon me. Then a repetition of the intervals of silence and once more the tell-tale 'cheep' from the field. On one occasion while gazing up, the bird flew directly over my head only about thirty feet above; his voice had so bewildered me that I could not ascertain his whereabouts until I saw him sail smoothly over. Whether the dampness, the clear moist air, or the bird itself caused this ventriloquial effect I do not know, but I rather favour the latter supposition."

This experience was ours exactly; the ventriloquial quality was not so marked, but it was present: the height of the flight was about the same, and our bird also described a circle when near the end of its song. I do not know any more satisfying occurrence in the experience of a bird student, than to open a new page in the life history of a common bird, and this is a chapter that is certainly rarely entered upon by anyone.

The time of day at which the song occurs, usually finds us wheeling homewards, if not already at home, and the season for this song is doubtless very short, so that it may be counted among one's rarest ornithological recollections. The Ovenbird has a similar song, fairly well known in the aggregate, but which has been well heard by but few persons. And why not? How many persons know the call of the Sawwhet Owl, which is to be heard near most cedar swamps in March and April? Is it not true that we miss these and many other novel phases of bird life by spending the evening and early night under cover?

NOTES TAKEN IN THE PEACE RIVER, ATHABASKA, AND ADJACENT COUNTRY.

The following interesting letter from Mr. J. A. Macrae, Commissioner to deal with Indians and Half breeds in the Athabaska districts in 1900, has been kindly placed at the disposal of the OTTAWA NATURALIST by Dr. Otto J. Klotz, Astronomer to the Department of the Interior, at whose request the observations were made during Mr. Macrae's official visit to the far north last summer.

"Ottawa, January 22nd, 1901.

"My dear Dr. Klotz—

I have already told you how sorry I am not to be able to bring you back more detailed and useful information from the North, but in case the few observations I am able to report may be of use to you I give them here.

The only thermometrical readings I can give you are as follows:—

April 18, 6 p.m. 30°.
" 19, Carrot Creek: minimum 18°, 6 a.m. 26°, noon 58°, 6 p.m. 30°.
" 20, Pembina Valley: minimum 28°, 6 a.m. 30°, noon 43°, 6 p.m. 41°.
" 21, Pembina Valley: minimum 26°, 6 a.m. 30°, noon 57°, 6 p.m. 50°.
" 22, Paddle River: minimum 33°, 6 a.m. 37°, 6 p.m. 40°.
" 23, Six miles north of Paddle River: minimum 33°, 6 a.m. 35°, 6 p.m. 42°.
" 24, Six miles north of Paddle River: minimum 32°, 6 p.m. 42°.
" 25, Athabasca River: minimum 30°, 6 p.m. 40°.
" 26, Six miles north of Athabasca River: minimum 32°, 6 a.m. 32°, 6 p.m. 39°.
" 27, Deep Creek: minimum 24°, 6 a.m. 35°, 6 p.m. 40°.
" 27, Deep Creek: minimum 24°, 6 a.m. 35°, 6 p.m. 40°.
" 29, Deep Creek: minimum 18°, 6 a.m. 22°.
May 1, Swan Hills: minimum 28°, 6 a.m. 30°.

I observe from notes made in my diary that frogs were heard on April 21st for the first time, between Pembina River and Paddle River. The frost was already a foot out of ground on the roads. I find a note made on the 27th April that anemones were well up and plentiful at Deep Creek, and young grass was about three inches high. A caribou was seen, a fact which I mention as I think that it was rather far southwest.

April 29. The frost is still in the ground. On the 28th the first mosquitoes were seen. Northern lights of great brilliancy on this date. No rustling or crackling noticeable.

On May 1st I crossed the Swan Hills, finding very deep snow on the summit. The aneroid both in ascending and descending the hills showed that poor Chalmers's reading of 1,000 feet is about correct. Your instrument read 995 feet. The grass on the south slope of the hills was very much more advanced than any we had seen yet.

On May 3rd we saw the first wild ducks. Upon leaving the high country on May 14th and going down into Peace River

Valley I was much surprised to note the difference in vegetation. It was at least two or three weeks ahead of that about Lesser Slave Lake, and this is said to be always the case. The poplars and tamaracks were all in leaf and mosquitoes plentiful.

It is of interest to us who have so long known the North West Territories, and I think have observed how frost does damage in valleys whilst high ground escapes, that in the Upper Peace River Valley the contrary is the case ; frost blights vegetation on high ground but not in the valley. This is probably due in part to the great height of the table lands and in part to the enormous body of water contained in the river.

On May 20th, south of Clear Hills on the road to Fort St. John, I noticed strawberries, raspberries, saskatoon, wild cherries, and snap-dragon in flower, anemones and wild flax in seed. At Peace River they informed me that the season was always a couple of weeks ahead of Lesser Slave Lake. The depth of Pine Valley I made out from the aneroid to be 725 feet. On the 21st, 22nd, and 23rd of May we found the grass very much more in advance of what it had been elsewhere, and it appears that, as the mountains are neared in going up the Peace River, the vegetation becomes more rapid and the season earlier.

At Vermillion on the night of June 23rd at its darkest I was able to read print ouside of my tent, and night was only twilight on Slave River on July 14th. Strawberries, gooseberries, and saskatoon berries were ripe.

The pelicans, which gather in great numbers at Pelican Rapids on Slave River, had gone north ten or twelve days before July 18th.

At Fort Chipewyan, Fort Smith, and Fort Resolution I made close inquiries into the number of Wood Buffalo remaining, having an opportunity to do this owing to meeting so many Indians fresh from their grounds—such as, I think, no one else has enjoyed. Some of the Indians who came in to meet me at each place had lately been near the buffalo, and had counted the different herds, which are, generally speaking, three in number ; one ranging from Salt River to Peace Point on Peace River, one from Salt River north to Great Slave Lake, and one from Salt River east and west. They number I conclude from 500 to 575 head. You

will, of course, understand that errors in count may have occurred, few Indians counting reliably, but I think that it is quite safe to say that about the number stated are left. Some eight or nine were killed last winter, but as I tried and punished those who killed them it is thought in the country, and is hoped by me, that no more depredations will occur. I understand that there has been an increase, since the animals were protected, of perhaps a couple of hundred, and it would appear to be only necessary to continue vigorous protective measures in order to perpetuate the herd. It is noticeable that the fur of the Wood Buffalo, owing no doubt to climatic conditions, is longer and thicker than was that of its brother of the plains, and it has that straightness and thickness which characterizes that of the Musk Ox.

I was informed that it was never safe to count upon Great Slave Lake being open before July 1st.

On 23rd July we had exceedingly hot weather, but the nights continued pleasant and cool.

Four tribes of Indians, representatives of which had never before entered into treaty relations with the Crown, were dealt with, namely, the Slave or Slavey Indians of Hay River, the Dogribs, the Yellowknives. and the Cariboo Eaters. The habitat of the Dogribs is to the north and south of the central portion of Great Slave Lake ; the Yellowknives come from Fond du Lac or Great Slave Lake near old Fort Reliance ; the Slaves inhabit the Hay River basin, and the Cariboo Eaters, the country east of Slave River.

On September 6th we experienced frost, and on September 13th had a very cold storm of rain and sleet with some frost. The leaves along the Athabasca had changed colour and were falling from September 3rd.

I do not understand the naming of the Great Slave River. It is in fact identical with Peace River ; yet, after the waters from Lake Athabasca enter it, making no appreciable difference in its size or course, its name changes to the Great Slave. Locally it seems to be as often called the "Peace" as it is the "Great Slave."

With my report in the blue book of the Department of Indian Affairs will be published a map that may interest you showing

roughly the habitat of various Indian tribes. Please note the incursion of the Crees, who are of Algonquin stock, into the country of the Tinnie or Dhinnie family. Of the existence of the Iroquois about Jasper House you will have been long aware.

J. A. MACRAE.

TWO WARBLERS NEW TO CANADA.

By W. L. KELLS, Listowel, Ont.

Among the most interesting ornithological events to the students of natural science in the season of 1900 was the securing of specimens of two species of birds new to the avifaunian lists of Canada. Both of these birds belong to the family of the Warblers and the genus *Dendroica*, and both of the specimens obtained were of the male sex. The names of the new visitants are the Kirtland's Warbler (*D. Kirtlandi*), and the Prairie Warbler *D. discolor*). The specimen of the latter was taken on the 11th of May and that of the former on the 16th of the same month, and the fortunate collector was Mr. J. H. Samuel, an ornithologist of Toronto, who reports his discovery of these as well as the discovery of other rare specimens to Mr. C. W. Nash, who edits the "Studies in Nature" department of *The Farming World*. In introducing Mr. Samuel's report Mr. Nash says :—"These records will be of the greatest interest to naturalists, as they include two species of birds that have never before been found in Canada."

THE KIRTLAND'S WARBLER.

Regarding the Kirtland's Warbler, Mr. Nash remarks : "The capture of the Kirtland's Warbler near Toronto is quite the most interesting event of the season. This warbler is one of the least known of North American birds, only seventy-five specimens being in American collections up to Jan. 1st, 1899, and, of these, fifty-five were taken in the Bahamas, the other twenty having been taken in the United States. The rarity of this bird makes it improbable that we shall hear or see anything of it again for some time,

unless, like Cory's Bittern, the few that come northward should select this province for their future home."

This member of the Warbler family received the name of Kirtland from Dr. J. P. Kirtland, of Ohio, who appears to have been the first to introduce the species to the notice of American ornithologists, and add its name to the list of the warblers of North America, of which it is among the rarest.

The male of this species is about five and a half inches in length, and the plumage on the upper parts is of a slaty blue colour, the front of the head being black and the crown streaked with lines of the same hue, the under parts yellow, whitening toward the extremities, and the wings and tail are each marked with spots and lines of a clear white. The female is a little smaller in size than the male and the marking of her plumage is much similar, but the colours are of a duller hue. The bill and feet are black.

Of the nesting and general habits of this species but little is known, but in its migratory movements and food-seeking actions it does not appear to differ from the other members of its genus.

Dr. Coues, in his "Key to North American Birds," gives a full description of the size and plumage of both sexes of this species, and after noting its habitations "Eastern United States," says that it is the rarest of all the warblers, and that up to 1884 only about a dozen specimens had been collected.

In the general notes of the first volume of "The Auk," page 389, under the heading "Another Kirtland's Warbler from Michigan," Mr. Robert Ridgway, of the Smithsonian Institute, Washington, contributes the following note regarding this species;—"The national museum has recently acquired a fully adult male of this species which, on the collector's label, bears the following legend: 'No. III. collection of N.Y. Green (*Dendroica pinus*) Pine Creeping Warbler; Battle Creek, Mich., May 11th, 1883.' This specimen, which was generously presented to the National Museum by Mr. J. H. Batty, of Parkville, L.I., is in the highest state of plumage of the fully adult male, and has the yellow of the under parts entirely free from markings on the jugulum which are present in the type (an immature male changing to spring plumage) and in two of the three females in the collection.

The reader will note that though the collector of the above specimen labelled it as the Pine Warbler, yet Mr. Ridgway identified it as a fully plumaged specimen of Kirtland's species.

Referring to "The Birds of Michigan," by Prof. A. T. Cook, we find that author recording the Kirtland as a rare straggler in that State, mentions the specimen taken at Battle Creek in May, 1883, and identified by Mr. Ridgway, and speaks of another taken at Ann Arbor in May, 1888, and refers to another captured at the Straits of Mackinaw and identified by Dr. Merriam. Up to 1878 but nine specimens were known, the fifth and ninth of these having been taken by Mr. Covert at Washtenan, in that State.

THE PRAIRIE WARBLER.

Referring to the taking of a specimen of a male Prairie Warbler, by Mr. Samuel, near Toronto, on the 11th of May, 1900, Mr. Nash remarks :—"The Prairie Warbler, which has also made its appearance for the first time, is a much better known bird than the Kirtland Warbler, and as its summer range includes most of the States immediately south of our border, its occasional appearance here may be expected."

Among the birds of New England the Prairie Warbler is recorded as a rare summer visitant. In Florida it is also listed as a rare bird, but in that State it is met with in the winter season more commonly than in the summer months. In Virginia, it is a more common species, and in all the lists of the birds of the Northern States from New York to the great plains it is recorded as a summer visitant or resident and probably will be found as such in the southern parts of Manitoba. Mr. Goss, in his list of the birds of Kansas, records the Prairie Warbler as a rare summer resident of that State, but says that it arrives there about the first week in May and begins to nest towards the end of that month. The nest is placed in bushes or on the lower branches of trees, in open or thickly-wooded lands, and at an elevation of from two to eight feet off the ground ; the site is in upright forks or among twig-like branches, and the nests are made of leaves, strips of plants, fibres, and lined with hair-like rootlets. The eggs are four or five to the set, of an oval form, and average in size .67 x

.49. These are of a white colour, thickly spotted with lilac, purple, and brown.

In general appearance the plumage of both sexes of the Prairie Warbler is much alike, and the colour of the young differs chiefly in being of a duller hue. In length it is nearly five inches, and the extent across the wings about seven inches. The plumage on the upper parts is of a yellow olive hue, with dottings of brick-red on the back, the forehead, and a line on the head; two wing-bars and the whole under parts are a fine yellow. On each side of the head is a three-pointed black mark, with marks of the same hue on the neck and other parts of the body. The places where it is found in the greatest abundance are the middle and southern States, and it passes the winter season on the borders of the Gulf of Mexico and the West India Islands. From this region it begins to move northward in February, and reaches the borders of the Great Lakes in the first week of May. Its general haunts and home is in the sparse low woods, cedar thickets, and old fields grown up with scrub pine. It is remarkable for its peculiar and curious song, and is an expert fly-catcher, being constantly in hunt of winged insects after the manner of the redstart and all proper fly-catchers.

The Prairie Warbler was tolerably well known in the time of Audubon, and Alexander Wilson, in his "American Ornithology," thus records his first impressions regarding the species :—"This pretty little species I first discovered in that singular tract of country in Kentucky, commonly called Barrens. I shot several afterwards in the open woods of the Chactaw-nation, where they were more numerous. They seem to prefer these open plains and thinly wooded tracts, and have this singularity in their manners, that they are not easily alarmed; and they search among the leaves, the most leisurely of any of the tribe I have yet met with, seeming to examine every blade of grass and every leaf, uttering at short intervals a feeble chirr. I have observed one of these birds to sit on the lower branch of a tree for half an hour at a time, and allow me to come up nearly to the foot of the tree without seeming to be in the least disturbed, or to discontinue the regularity of its occasional note. It is slow in its movements and

rather a scarce bird in the countries where I found it. Its food consists principally of small caterpillars and winged insects."

Prof. Cook, in "The Birds of Michigan," records this species as a rare migrant, but otherwise relates that it is a summer resident of that State, and has been found to nest as far north as Mackinaw Island. Prof. Davie, in his work on the nests and eggs of North American birds, gives the observations of many persons in regard to the nesting of this species. It is known to breed in various localities east of the Alleghanies, from the latitude of Massachusetts southwards. It is also known to nest in Ohio, but more commonly in Virginia. Dr. Coues found it nesting in great numbers within a small area near Washington, in the month of May. The nests were only a few feet from the ground and were placed preferably in hickory and dogwood bushes. It has also been found nesting in New York State in the latter part of May and first half of June. The nest is a very pretty, deep, cup-shaped fabric, composed of vegetable fibres and fine grass, closely matted and lined with hair. The set of eggs is usually four, rarely five; their colour is whitish, with a greenish tinge, and the markings resemble specks of chestnut and burnt umber, and are usually in the form of wreaths about the larger end.

THE HUDSONIAN CURLEW IN MIDDLESEX CO., ONT.

A Hudsonian Curlew (*Numenius hudsonicus*) was shot near Strathroy, Ont., on September 15th last by a sportsman from that town. The specimen fell into the hands of Mr. L. H. Smith, but was so much decomposed that it was buried. Urged by a telegram, however, he exhumed and skinned it. The specimen was exhibited at the September meeting of the Ornithological Section of the Entomological Society of Ontario at London. Mr. Smith apologized for the condition of the skin, but, considering the circumstances, it was thought by the members of the section that Mr. Smith's efforts deserved commendation rather than that an apology should be received.

W. E. SAUNDERS, London.

REVIEW.

GEOLOGICAL SURVEY OF CANADA. GENERAL INDEX TO THE REPORTS OF PROGRESS, 1863 to 1884. By D. B. Dowling, B.A.Sc., Ottawa, 1900. 475 pages.

In the terms of the prefatory note by the Director of the Geological Survey, Dr. G. M. Dawson, "the present General Index begins with the volume of 1863 for which an entirely new index has been made, and embraces the succeeding reports to that of 1882-83-84 inclusive. It covers sixteen volumes and two short summaries, making in all 6,585 pages of text to which more than 31,000 entries are given. It thus provides a ready means of reference to practically the entire body of observations published by the Geological Survey up to the year 1884."

From 1885 to the present time, "Annual Reports" have been issued by the Department, each of which is separately indexed. The "General Index" just issued forms publication No. 638 of the Geological Survey, and contains 475 pages of text divided into three parts, viz. :—

Part 1. Districts described in the several reports.
Part 2. Special Examinations.
Part 3. The General Index.

These include :—(1.) The reports analysed geographically and arranged under Provinces, Counties, and Districts, so that under any county or district in a province, a list of references to reports, arranged in chronological order, is given. (2.) Rocks, ores, minerals, or fossils, that have been subjected to assay, analysis, miscroscopical examination, or were scientifically described. (3.) The general index, in which the arrangement under a reference to a place, is usually chronological, while under a subject, references will be found alphabetically arranged, or in case of common occurrences, as of iron, fossils, &c., localities may be grouped under provinces.

The "Reports of Progress of the Geological Survey of of Canada," and the "Annual Reports" of the same, contain a

vast amount of useful and practical information on the mineral and other resources of the Dominion, as do also the maps which accompany these reports, giving in a graphic form the leading geological features of the territory included. This "General Index" is therefore hailed with delight, as a work which gives ready reference to the various economic products in a series of volumes containing 6585 pages of text, not only by all who are interested in the resources of our great Dominion but also by all students in science who may desire to carry on further researches in the various districts comprised in the reports indexed. The amount of time henceforth to be saved in searching for information on the thousand and one points referred to in each of the volumes indexed cannot be over-estimated, and all persons into whose hands this index may fall will bless its projector as well as its author. An index to all the Geological maps referred to in the Reports may be found under the word "Maps."

Mr. Dowling's Index will also be of much value for bibliographic references on the work performed by the various officers of the Geological Survey from 1866 to 1885 under the name of each officer; and, as the readers of THE OTTAWA NATURALIST are aware, we were favoured by Mr. Dowling, in vol. XIV., No. 6, of THE OTTAWA NATURALIST for September last, with a chronological index to the field work done by the officers of the Survey from its commencement to 1865, so that there is now available for ready reference for geology and geological work in Canada a complete record from 1843 to the present time.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

We have received a General Index to the Reports of this important Society, covering all of their annual Reports from the beginning in 1870, until the end of 1899. There is no series of reports on practical entomology of greater value to Canadian farmers, fruit-growers and gardeners, than these popular publications. The present Index will be of inestimable value to the thousands of Ontario farmers who have frequent occasion to consult these reports, which now cover a period of thirty years. The work has been excellently well done by the Rev. Dr. Bethune, of London, who since the foundation of the Society, has always taken a most active part in advancing its interests. The price of the Index is 25 cents in paper, or 50 cents neatly bound in cloth. It is on sale by the Society at London, Ont.

INDEX

TO THE

OTTAWA NATURALIST, VOL. XIV, 1900-1.

Zoology—