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THE OTTAWA NATURALIST

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FOSSIL COLLECTING.*

By E. M. Kindle.

Introduction.

Away back in the mists of antiquity, so long ago that no record of him survives, "some pastoral savage, more reflective and less practical than his brethren," made the first collection of fossils and placed them in front of his tepee. From the time of this first unrecorded collector to the present, most thoughtful and reflective men have some time or other felt the spell of the past which the discovery of the fossil remains of extinct animals casts over the mind, and have become temporarily at least collectors of fossils. Even statesmen burdened with the affairs of nations have found time to collect fossils. It is related of Thomas Jefferson that when he journeyed on horseback from his Virginia home to Philadelphia to be inaugurated President of the United States, he carried with him in his saddle bags some fossils which he wished to submit to the Philadelphia savants.

From the rude mound of fossils so often met with in the farm-house front yard, or the mantlepiece collection in the mountain cabin, to the great collections of our large geological museums, is a long step, but the former may be regarded as the prototypes of the latter. The mantlepiece and front yard collections usually have slight value because no record of the exact locality of the several specimens has been preserved. The museum collection should show not only the geographical source of the fossils but their geological horizon as well. In other words the fossil exhibits of a properly arranged museum show the specimens in both their space and time relations. The fossil exhibits of large museums like the British Museum show the ancient life of the world in epitome. The educational value of the great museums of geology depends largely upon the extent to which the visitor has prepared himself to understand their message. There is no preparation for receiving the knowledge which museums and books on geology have

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to offer which will compare with the use of the hammer and chisel in collecting fossils from nature's own museum. It is the object of this paper to encourage the reader to collect fossils in such a way that their scientific value will not be impaired or destroyed, as often happens through the use of improper methods.

COLLECTING METHODS.*

In collecting fossils a rather heavy hammer is indispensible. Many palaeontologists prefer the ordinary bricklayer's hammer, with its long broad blade, which is very effective in splitting open blocks of rock and in digging in shales. A small chisel is frequently useful, and a note book should be carried. A tube of glue and a small vial of hydrochloric acid are valuable adjuncts to the collector's outfit. A bag or basket with a supply of old newspapers or tissue paper for wrapping specimens, together with a substantial lunch, complete the essential elements of the collector's outfit for a day in the field.

There is no royal road to finding fossils. But success usually comes to the collector who prostrates himself on the ledges and searches the beds foot by foot as he crawls over the surface. Beds which are nearly or quite barren of fossils are often separated by comparatively thin bands in which fossils abound. Much patience and close scrutiny are often required to detect these rich beds. In this work haste has no place, and keen eyesight plays the same role in finding fossil animals that it does in hunting living ones. Sometimes the fossils are composed of harder material than the enclosing rock, and stand out in strong relief on the surface of the ledge. In such cases they are easily found. But more frequently the only clue to the presence of fossils is the indistinct outline on the surface of the rock of the cross section of fossil shells, which have little resemblance to the specimens as they appear after removal from the matrix. Where the fossils occur in shales they are often found lying loose on the surface, having been set free by weathering.

If the collector wishes the fossils which he finds to have scientific value he must keep a systematic record of the exact geographic locality from which each lot comes. This is easily done by keeping a numbered record in a note book of the collecting stations, and attaching a corresponding number to each lot of fossils collected. It should be the practice of the collector or field geologist to prepare for each specimen or group of specimens a field label before leaving the collecting station, giving:

*No attempt is made here to discuss methods of collecting vertebrate fossils.

(*a*) the serial field number assigned to it, (*b*) a precise definition of the locality from which the specimen was taken, (*c*) name and formation, if known, (*d*) the relationship to each other of the beds from which different lots of fossils have been taken—best shown by reference to a section in the note book of the beds collected from—(*e*) name of collector, (*f*) date: day, month and year; (*g*) number and page of field note book in which the section or bed furnishing the collection is described. The serial field number placed on the label should appear in the note book in connection with the description of the part of the section or bed from which the specimen was obtained. All specimens taken from one bed in one locality, whether representing one or more species or individuals, should be given the same number and label. Fossils collected from different beds, even when only a few feet apart, should as a rule be given distinctive labels, and specimens taken from talus slopes or boulders should be kept separate from those found in place. As a rule, each individual fossil should be wrapped separately in newspaper or tissue paper at the locality where collected. Where the specimens are very fragile, like the shells of the post glacial clays of the Ottawa valley, for example, cotton batting and small vials or pasteboard boxes are required to protect the specimens from breaking. A single label will suffice for all the specimens from one collecting station if heavy manilla paper is used in making them into a secure package. This should be numbered on the outside in addition to having a label inside. Abundant material should be obtained wherever circumstances permit.

The preservation of both the moulds and casts of a fossil where the original material of the fossil has been removed is most important. All of the parts of a broken specimen should be carefully preserved and kept together. A tube of glue for repairing broken specimens should always be included in the collector's outfit. The collector should bear in mind the fact that his collection of fossils may be of much value in furnishing new data regarding the stratigraphic range and geographic distribution of species.

In collecting from a section where a considerable thickness of rock, with several fossiliferous beds, is exposed, the section should be measured as collecting proceeds. The section may be given a number, and each subdivision of it designated by a letter of the alphabet, the several lots of fossils from the different levels being marked with their respective letters. Detailed information concerning the physical and chemical characteristics of each subdivision of the section should be recorded. If the section studied is exposed along the sides of a gorge, a simple method of measuring the beds collected from is to cut a light pole 10 or 15 feet in length and mark it with bands of peeled bark at intervals of 5 feet, one of the 5-foot subdivisions being marked off into 1-foot spaces. The section can then be measured by holding the pole at right angles to the bedding and using it yard-stick fashion. In the case of horizontal beds exposed along the slope of a hill or mountain-side, the aneroid barometer or a Locke's hand level is generally used. When the beds are inclined, neither of these instruments will suffice. The method used by Blackwelder for measuring sections of inclined strata is a modification of the Walcott method, and includes the use of a clinometer compass attached to a rod 5 feet 1 inch in length. Walcott describes this method as follows:—

"The strata, in section to be measured, were inclined to the east 40°. Placing the lower end of the rod at the base of the section, I inclined the rod towards the edges of, and at a right angle to, the line of the dip of the strata, which was indicated by the needle of the clinometer standing at 40°. Then, looking through the compass sights the point where the line of sight touched the ground was marked as the next station for the rod, and on this station the base of the rod was placed for the second sight, which was made exactly as in the first instance, and so on to the end of the section. Frequent trials were made, at the exposed outcrops, to determine the angle of dip of the strata, so that the rod might be held at a right angle to it."

The application of this method is clearly shown by Blackwelder's figure which is given below.

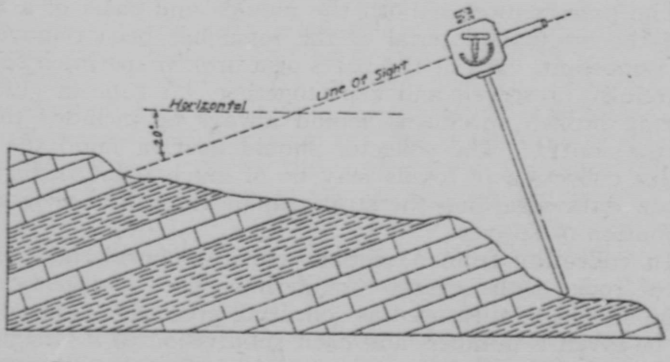

Fig. 1. Diagram illustrating the measurement of strata by means of a spirit level clinometer and sighting arm attached to a five-foot rod. (After Blackwelder.)

In case the collector is not provided with a clinometer compass, fairly accurate measurement of a section of inclined beds may be made with the aid of a roughly improvised T-shaped square. The long arm should be of a known length. The T-shaped staff when used is held vertical to the surface of the inclined beds to be measured, while the eye sights along the short arm in a direction at right angles to the line of strike to a point on the ground which will be the next station base for the staff. Each station occupied will have an elevation above the preceding one in the section corresponding to the length of the staff.

OBJECTS SOUGHT.

Brief consideration of some of the purposes for which fossils are collected will indicate to what extent the methods outlined in the preceding pages are essential in different classes of work, and whether they may be expanded or shortened in connection with collecting which has different objects in view.

There is probably no other branch of natural history collecting which may lead to the solution of such a variety of problems as the collecting of fossils. The problems of the the palaeontologist include within their range those of structural geology, the restoration of ancient physical geographies, and the problem of evolution. Whatever the purpose of the collector may be, however, the precise location of the rocks furnishing the specimens and their relationship to other beds in the locality should always appear on the locality label.

During an earlier stage in the development of palaeontology the discovery of new species was the ultima thule of the collector. This is still an important and legitimate object of the collector's work, for many thousands of species as yet unknown to science doubtless remain to be discovered, described and systematically placed in the immense catalogue of the earth's extinct life. Many collectors and palaeontologists of an earlier generation were content to refer their new species to the Lower Carboniferous, the Upper Silurian, or to a major division of whatever system they were derived from. Our present ideal, though not always attained, is to indicate the place of a new species in the section where discovered with the utmost exactness. This kind of painstaking care on the part of the collector and the author of a new species will ultimately, if not at once, make possible its reference to its proper place in the general geological time scale with a precision comparable to that with which the railway engineer refers a particular station on his line to its exact position above sea level. This tendency toward greater refinement and precision in the methods of the palaeontologist is one of the factors which has lead to an extensive revision and expansion of formational nomenclature. The description of a new species, important as it is, can at present be regarded as only one of several objects to be attained through the collection and study of fossils. The description of fossils is in fact only the first step in their use for the purpose of correlatio in palaeogeography, attacking the far-reaching problems of e lution.

It is worth while recalling here that Wm. Smith, the father of stratigraphic palaeontology, made excellent use of certain fossils even before they were named in tracing the formations which they characterized over a great part of England. Smith's discovery of the value of fossils in correlation enabled him to prepare the first geological map of which we have any record. The fundamental importance of fossils to the geologist in enabling him to recognize or identify the same beds in different areas has been universally recognized since the days of Wm. Smith. It is for this purpose that the fossil collections of the field geologist are generally made. They necessarily often represent a great many localities, and frequently a small number of specimens from the individual localities which may or may not be as large as the conditions incident to the work will permit, and the preparation of stratigraphic sections in connection with them is most important.

Progress in stratigraphic palaeontology in recent years has been largely along the line of increasing our knowledge of the range and distribution of faunas, and of the individual species composing them. The important bearing of this class of knowledge upon questions concerning the evolution and dispersal of faunas is evident. Its interest to the general geologist lies chiefly in the fact that the accuracy with which fossils can be used in correlation is in direct proportion to the completeness of our knowledge of their range. The presence in certain areas of recurrent faunas or faunas which re-appear at higher levels after completely disappearing for a considerable interval from a series of beds, sometimes introduces for particular regions a new and difficult factor into the use of fossils in correlation until the inter-relations of the recurrent with the associated faunas has been worked out. Such areas require an amount of collecting and careful comparison of faunas and sections which would be unnecessary in ordinary regions. The recurrence in the Devonian section of southern New York of *Tropidoleptus carinatus* in the Chemung, 2,000 feet above its disappearance at the top of the Hamilton formation, is an example of this phenomenon.* (See fig. 2.) We learn from it and similar examples that the disappearance of a fossil from a section may not mean that it has become extinct, but that it has changed its habitat.

*E. M. Kindle, Jour. Geol., vol. XIX, pp. 346-347, 1911.

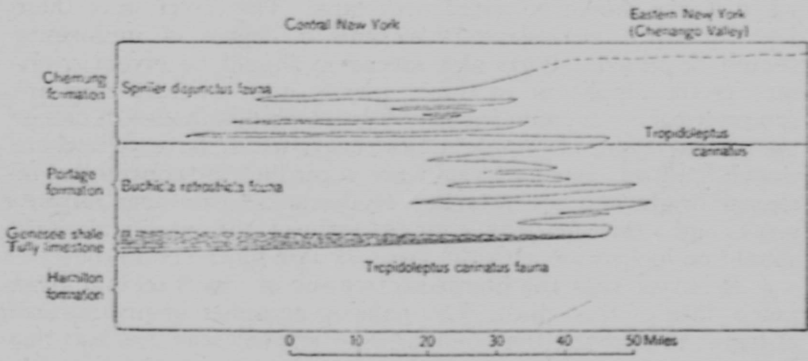

Fig. 2. A diagrammatic east-west cross-section of the Middle and Upper Devonian of southern New York, showing the relations of *Tropidoleptus carinatus* to the western faunas during Portage and Chemung time. Total thickness of the section is about 2,700 feet.

The presence of a recurrent Hamilton species like *Tropidoleptus carinatus* in the Chemung fauna of southern New York involves its withdrawal from at least the major part of the New York area at the end of Hamilton sedimentation to some part of the sea furnishing a more congenial environment than that which accompanied Genesee and Portage sedimentation. In the newly adopted habitat, or in a small portion of the old one, it found a haven where those conditions of the Hamilton sea which were essential to its life were maintained throughout Genesee and Portage time. With the initiation of Chemung sedimentation *T. carinatus* extended its habitat back again over a part of the area which it had previously occupied, as shown in fig. 2.

These recurrent faunas furnish convincing evidence of the existence during the Palaeozoic of distinct faunal provinces. It seems safe to conclude that the recurrence of a fauna has been due to the oscillation or migration of the factors which conditioned its geographic distribution.

Palaeogeography is a field of knowledge to the extension of which the collection of fossils contributes most important data Collections which will contribute most to this subject are those concerning which the collector has supplied, in addition to the data already mentioned under methods of collecting, complete data regarding the physical features of the rocks in which they are found. This physical data should indicate very fully the nature of the sediments associated with individual faunules, as to composition, texture, hardness and colour. The collector should note the character of the lamination, whether in thin or thick sheets or variable, and whether uniform or alternating composition characterizes the beds. The presence or absence of cross bedding, ripple marks, current marks and wave marks should be noted with care. The direction of these features when successive beds show a degree of uniformity should be noted. Particular attention should be given to observing the amplitude of ripple marks, and whether they are symmetrical or asymmetrical. A great predominance of one or the other type of ripple mark may, as I have elsewhere shown,* afford conclusive evidence regarding the continental or marine origin of a set of beds. Mud cracks, rain drop impressions, and other features characteristic of the intertidal zone, should be looked for with the greatest care by the collector.

It is true that the literature treating of fossils seldom gives much data of this kind. The palaeogeographer in making use of fossils in drawing the boundaries of ancient seas, has had but little data of this class to curb his imagination or stay his hand. Structural features of comparatively recent origin have too often assumed for him a significance which they did not possess, while the really significant features indicating proximity to a shore line were neglected because unrecorded by palaeontologists and geologists.

The observation and record of the physical characters which have just been enumerated are of the utmost importance in connection with the collection of certain classes of fossils, like the eurypterids and certain fishes whose normal habitat is still a subject of discussion. It is to the careful study of the physical features of the beds enclosing such fossils that we must look for the solution of the problems relating to the character of their habitat.

Zoology gave to the world the hypothesis of evolution, but its demonstration and its actual history is the province of palaeontology. It is the privilege of the collector of fossils to assist in discovering the actual course which the steady upward trend of life has followed through the geologic ages. For the study of problems relating to orthogenesis, saltation and other elements in evolution, fossils offer a great advantage over living animals and plants. The time element in the latter is an undetermined factor, while in the geological section its value may be determined. Zoologists are too little acquainted with the excellent results which have been attained in this field through the work of such men as Waagen on mutation, Hyatt on the cephalopods, and Beecher on the evolution of spines. Only very well preserved material can be utilized in studies of this class. The collector of perfectly preserved fossils derives an added pleasure from his work through knowing that it may be of value in contributing to the solution of some of the most fundamental problems of the organic world.

*Recent and Fossil Ripple Marks (in Press).

"GLEANINGS IN FERNLAND."

BY FRANK MORRIS, PETERBOROUGH COLLEGIATE.

(*Continued from page* 110.)

From our summer schedule of trips, the first place to suffer a "washout" this wet season was the Bruce Peninsula between Wiarton and Tobermory; the next was Manitoulin Island, where the Parsley Fern has been recorded; and the third was the north margin of Twin Lake, near Port Sydney. Here grows a magnificent colony of the Virginia Chain Fern (and with it the handsome rein-orchid *Habenaria blephariglottis*). The Woodwardia I have never found except here, and, as you may remember from our "field day" in 1910, the sight of it in its ordered ranks made a profound impression. The fronds seemed all standing to attention, and facing one way out over the "mud lake" from their beds of sphagnum, buckbeans, cranberry, and plants of the heath family. I suggested that sunlight was the key to the mystery, for it certainly was mysterious to see those silent forms standing in the midst of an open space in the heart of forest and swamp, as though all endowed with one conscious purpose, and obeying some unseen power: "Eyes front!" and every member of every rank stood focused to the same point in space. This was one of the "moot questions" referred to before. The fern is peculiarly fond of moisture, often growing submerged in water, and spreading by very long runners under the surface. Just as the fruiting pinnae of the Crested Fern are twisted into a new plane at right angles to the rhachis in order to protect the sporangia from the sun's rays, so where there are not shrubs enough to throw healing shadows for a colony of Virginia Chain Fern, every stalk will be found twisted on the underground runner so as to face due south to the sun at its zenith; by keeping "eyes front" to the foe, the fronds preserve the spore-cases from parching and evaporation. This was first observed by D. C. Eaton, author of "Ferns of North America."

A second moot point was the determination of one of the smaller species of *Botrychium*. This was a plant first found by me under cedars fringing the tamarack swamp near Newtonville. The first colony was discovered west of the corduroy road that leads to Starkville. Since then I have found the plant—in hundreds—at nearly a dozen points, over a space whose diameter is perhaps 1½ miles. I have also found it in the neighbourhood of the Rideau, of Stony Lake, of Peterborough, and of Garden Hill. Always under cedars in rich swamps, usually in thin moss, occasionally in sphagnum, often in detritus of cedar and spruce. It has always been, to my mind, a form of *B. simplex* peculiar to moist, shady situations. The plant ranges from 2 or 3 to 6 or 8 inches in height. The barren frond consists of from one to four or five pairs of lunate sessile lobes, opposite to alternate, and terminates in a notched lobe. This barren leaf is decidedly fleshy; apparently the plant seldom lives more than three or four seasons, for though in a colony I have found hundreds of plants, the vast majority appear to have sprung recently from wind-blown spores, and to be not more than two years old. Very rarely large plants are found with four or five pairs of lobes on the barren frond, and, still more rarely, in such patriarchs of the colony the basal pair of lobes show a tendency to become compound by branching out into similar lobes. My first specimens were sent to the late Prof. Fletcher, in Ottawa. He inclined to think them *B. matricariae* (*ramosum*), but was not familiar with these smaller members of the genus, so handed them over to Prof. Macoun. He also thought them *B. matricariae*.

Next season I found the genuine *B. matricariae* by hundreds in the Algonquin Park, but remained convinced that my earlier find was *B. simplex*. Later on I found the strange fern in the Rideau district, and still never wavered, though I was unable to get more than a doubtful assent to my view from other collectors in the Province. Then I sent specimens of both ferns to W. N. Clute, of the Fern Bulletin, but to my chagrin he too pronounced the stranger a variety of the Matricary Fern; luck was against me, it seemed the wind simply *wouldn't* blow my way. At last (more than four years ago) I sent specimens to Prof. Robinson, of the Asa Gray Herbarium, and waited for nearly a year. Then I wrote again, and heard that my first consignment had gone astray or been lost. By this time I was desperate, but made my last venture with a parcel of specimens to Harvard, from five or six different localities. My Argosy came to port safely with its precious cargo, and I got word that every specimen forwarded in the half-dozen sheets of plants, was undoubtedly *B. simplex*.

If the last week in Owen Sound was wet, our three weeks under canvas on Birch Island were to prove little better. But we managed to snatch a few days and half days out of the deluge and salvage them to some profit. We gathered blackberries and raspberries galore; we caught lake trout and black bass, we made flapjacks and jam, and ate them too; and every now and then we paddled our own canoe (a new one) to various portages and explored the trails. Once I made my way to the back of "Skymount" and gathered in, from a certain trough of the hardwoods that I had found years before, specimens of

Botrychium ramosum and *Botrychium lanceolatum*, and on the return trip (for curiosity) *Botrychium Virginianum* and *Botrychium ternatum*. Another day, after gathering plants of *Aspidium fragrans* from a cliff overlooking the lumber slide on the Madawaska, I crossed the railway and explored the woods for shaded cliffs. Here I stumbled on a veritable El Dorado, for on three successive outcrops of rock in the depths of the forest, I found clump after clump of silvery green fronds—the Fragrant Shield Fern in all its aromatic loveliness. Passing out from the woods to the cliff exposed at the lake shore, I found dense masses of *Woodsia ilvensis*, but no more *Aspidium fragrans*.

These two or three trips sent my enthusiasm up to fever heat, and whenever I saw a piece of woodland, the botanist in me ettled to explore it, and as the woods were everywhere, I was forever diving into their recesses and carefully scanning the ground for some lilliputian treasure, or hurrying over to a line of cliffs in the background.

That will-o'-the-wisp of the unknown led me many a dance all to no purpose; but one day, while exploring a piece of cliff near one of the trails, I found a small fern growing in the rock seams that I could not reconcile with any familiar species. It was much like the Brittle Bladder-fern in frond, but the rootstock was different; it was very much like the Rusty Woodsia, but neither "rusty" nor jointed; it grew in loose, detached moss at the base of the cliff, up and down a vertical seam, along a horizontal ledge, and inside a crevice some 20 feet up; it extended over 30 or 40 yards of the cliff, and formed a colony of three or four score plants. It was closely tufted, the stipes were dark brown, and the rhachis and frond covered with white hairs and yellow resinous glands. I had no microscope, nor even a table, in camp, but I made the plant out to be *Woodsia scopulina*. A guest in our camp, who scorns to be initiated into the noble brotherhood of "men of grass" (to use the title given to Douglas by the Indians), went so far as to school his wife to greet me on my return to civilization with the magic password: "Woodsia Scopulina." I understand there were dress rehearsals of the scene, but the best laid schemes of mice and men gang aft agley, and when there fell on my ear words that sounded like "Woodulina Scopsia," I was only a little less bewildered than the old bishop who, wakened out of slumber at a country vicarage by a thunderous knock at his bedroom door, and asking in quavering tones "Who's there?" heard the appalling response: "The Lord, my boy."

Specimens of the new find were sent to the Asa Gray Herbarium at Harvard, and identified at first sight as *Woodsia obtusa*, but Mr. J. M. Macoun, at the Victoria Museum, Ottawa, and (I believe) Prof. Fernald, of Harvard, both inclined to the view that it was *W. scopulina*. Accordingly I sent the plant to Prof. Maxon, of the Smithsonian Institution, and in due course heard from him that the plant was undoubtedly *Woodsia scopulina*, and this has now been corroborated at Harvard.

By way of summary. The list of our finds in 1910 amounted to 37, but since then two varieties have been given specific importance, viz., *Aspidium bootii* and *Botrychium obliquum*; so our list was virtually 39. Add *Pellaea densa* from near Durham, and the Parsley Fern from Manitoulin, and you have 41. The six new species added to our list this season make a total of 47, and all these in *old* Ontario—I mean from Detroit in the west to Montreal in the east—and for northern marches, the French River, Lake Nipissing, and the Mattawan. In New Ontario, between the Lake of the Woods, James Bay and Lake Abitibi, some seven more species are known to occur, and of these, it seems to me quite likely that two or three at least may be discovered by some happy enthusiast nestling among the thousand-and-one yet unsearched nooks and crannies this side of North Bay. I will end our ramble by listing the fern-flora of the Province:—

I.	1.	Polypodium	vulgare.
II.	2.	Phegopteris	polypodioides.
"	3.	"	hexagonoptera.
"	4.	"	dryopteris.
III.	5.	Adiantum	pedatum.
IV.	6.	Pteris	aquilina.
V.	7.	Pellaea	atropurpuria.
VI.	8.	Cryptogramma	densa.
"	9.	"	acrostichoides.
"	10.	"	stelleri.
VII.	11.	Woodwardia	virginica.
VIII.	12.	Asplenium	viride.
"	13.	"	trichomanes.
"	14.	"	platyneuron.
"	15.	"	angustifolium.
"	16.	"	acrostichoides.
"	17.	"	filix-femina.
IX.	18.	Scolopendrium	vulgare.
X.	19.	Comptosorus	rhizophyllus.
XI.	20.	Polystichum	acrostichoides.
"	21.	"	lonchitis.
XII.	22.	Aspidium	thelypteris.
"	23.	"	noveboracense.
"	24.	"	fragrans.

XII.	25.	Aspidium marginale.
"	26.	" filix-mas.
"	27.	" goldianum.
"	28.	" bootii.
"	29.	" cristatum.
"	30.	" spinulosum.
XIII.	31.	Cystopteris bulbifera.
"	32.	" fragilis.
XIV.	33.	Woodsia ilvensis,.
"	34.	" scopulina.
XV.	35.	Dicksonia punctilobula.
XVI.	36.	Onoclea sensibilis.
"	37.	" struthiopteris.
XVII.	38.	Osmunda regalis.
"	39.	" claytoniana.
"	40.	" cinnamomea.
XVIII.	41.	Ophioglossum vulgatum.
XIX.	42.	Botrychium simplex.
"	43.	" lanceolatum.
"	44.	" ramosum.
"	45.	" obliquum.
"	46.	" ternatum.
"	47.	" virginianum.

ONTARIO, N. AND N.W.

II.	48.	Phegopteris robertiana.
VIII.	49.	Asplenium ruta-muraria (?).
XIII.	50.	Cystopteris montana.
XIV.	51.	Woodsia glabella.
"	52.	" hyperborea.
"	53.	" oregana.
XIX.	54.	Botrychium lunaria.

BUPRESTIDÆ KNOWN TO OCCUR IN THE OTTAWA DISTRICT.

BY BRO. GERMAIN, of the Christian Schools, Académie De La Salle, Trois-Rivières.

In 1909, Mr. G. Chagnon published an interesting monograph of the Buprestidæ of Quebec. Practically all of the species mentioned were recorded from Montreal, Rigaud, and a few from Hull. The following is a list of these interesting beetles which the writer has captured in the Ottawa district. I hope it will prove of value to Canadian coleopterists. The asterisks indicate those species which are not included in the literature above mentioned. The numbers preceding each species are those given in Henshaw's List of Coleoptera of America, North of Mexico:—

CHALCOPHORA Sol.

4568—angulicollis Lec.
4569—virginiensis Drury.
4570—liberta Germ.
4572—fortis Lec.

DICERCA Esch.

4576—prolongata Lec.
4577—divaricata Say.
*4578—pugionata Germ.
caudata Lec.
4579—obscura Fab.
4583—tenebrosa Kirby.
4585—tuberculata Chev.

POECILONOTA Esch.

4594—cyanipes Say.

BUPRESTIS Linn.

*4598—rufipes Oliv.
4601—lineata Fab.
4602—consularis Gory.
4604—nuttalli Kirby.
4606—maculiventris Say.
4607—fasciata Fab.
*4608—sulcicollis Lec. (1 sp. det. by Schwarz).
4609—striata Fab.

MELANOPHILA Esch.

4619—logipes Say. (acuminnata DeG.)
4621—drummondi Kirby.
4622—fulvoguttata Lec.

ANTHAXIA Esch.

4630—viridifrons Lap.
*4631—viridicornis Say.
4633—quercata Fab.

CHRYSOBOTHRIS Esch.

4639—femorata Fab.
4640—floricola Gory.
4647—dentipes Germ.

Chrysobothris Esch. (continued).

4650—trinervia Kirby.
4651—scabripennis Lap. & Gory
*4652—pusilla Lap. & Gory. (Ent. Rec. 1901).
4657—sexsignata Say.
4658—chrysoela Ill.
*4660—azurea Lec.
4661—harrisii Hentz.

ACMÆODERA Esch.

4699—pulchella Hbst. (Ent. Rec. 1901.)
4707—culta Web. (Ent. Rec. 1901.)

EUPRISTOCERUS Deyr.

4718—cogitans Web.

AGRILUS Steph.

4721—ruficollis Fab.
4724—otiosus Say.
*4724a-pusillus Say.
4727—bilineatus Web.
4731—fallax Say.
4738—acutipennis Mann.
4739—anxius Gory.
4742—politus Say.
4746—egenus Gory.
10109—obsoletoguttatus Gory.
10112—masculinus Horn.
*10118—pensus Horn.
10119—blanchardi Horn.

TAPHROCERUS Sol.

4755—gracilis Say.

BRACHYS Sol.

4758—ovata Web.
4761—aerosa Melsh.
4762—aeruginosa Gory.

PACHYSCELUS Sol.

4766—laevigatus Say.

MUSEUMS AS AIDS TO FORESTRY.

BY HARLAN I. SMITH, GEOLOGICAL SURVEY, OTTAWA.

In gaining due recognition and support from the great mass of the people, museums may be great aids to forestry. Even the further application of museum methods in forestry, may be of valuable service. The extent of the possibilities in these lines of recruiting aid by means of museum methods of publicity, recreation, instruction and research can hardly be forecast. Such museums or methods, however, must be properly administered to be effective. The methods used, for intance, in the large and costly Botanical Museum in New York, would be of little or no avail to forestry. That museum may be of use to scientists, but is not of much human interest to me, and, therefore, I judge, not to the average citizen, lumberman or forester.

Vast expenditure of time and money is not necessarily needed to secure valuable aid by these means. Museum cases, if such are really required, may be made at a cost of less then four dollars per foot front, as I have pointed out in THE OTTAWA NATURALIST of May, 1915, and The Scientific American of May 29, 1915. A large collection of specimens, maps, photographs and labels is not needed to inoculate whole regions with the germs of the ideas of the practicability and economic importance, to say nothing of aesthetic values and the love of forestry. A small exhibit may teach the general and valuable principles of forestry, perhaps even better than a complete exhibit of all kinds of trees, such as is shown in the American Museum of Natural History in New York. Such a complete exhibit might confuse or burden. The persons to be influenced to give aid to forestry might be lost in the woods as it were.

In the Rocky Mountains Park Museum at Banff, Alberta, a beginning to a tree exhibit has been made. There are eleven species of trees in the Park. Five grow in the valley, but the other six are found only on the higher land. A complete collection of the trunks and leaves of the trees growing in the valley was made in two half days as a bi-product of other work, and without any expense except as for time in cutting the trunks to lengths for exhibition. At the same time two photographs were made of each of these five kinds of trees; one of a grove or group of each kind of tree from a distance, and one of the details of the trunk, bark, leaves and such flowers or fruits as were then in season. Later photographs are to be made of the parts of the trees not yet taken, and of uses and abuses of each tree and its products. Tentative labels had previously been prepared at my request by the late Mr. Abraham Knechtel, Chief Forester of the Parks Branch of the Department of the Interior. These refer particularly to the Park, and consequently are to be revised, so as to serve as labels to the same trees in any other museums that may accept the labels. Supplementary labels describing the peculiarities of the same trees as to the Park are also in preparation. These labels were printed in the Handbook of the Rocky Mountains Park Museum, and from the same type the labels were printed for labelling the specimens in the museum. The museum labels were printed on card of a yellow colour to harmonize with the furniture of the museum, and with a brown ink for the same purpose. They were framed and securely screwed to the trunks of the specimens, so that they cannot easily be displaced. The glass covering them, which can be cleaned readily by any janitor, protects the label from dirt or breakage. When these labels are revised to include instruction and explanation of the most important of the forestry abuses and needs and when specimens of uses of the lumber and other tree products, such as wood alcohol, charcoal and turpentine, are added with full labels, this exhibit will be the beginning of a suggestion for a museum aid to forestry. An example of such a fact as should go in a label is that the obnoxious pitch of the balsam is so largely in the bark that the wood, formerly not used at all for paper pulp, is exceptionally valuable for this purpose. The qualities of a great number of woods may be shown by the exhibition of the volumes of American Woods published by Hough, illustrated by cross radial and longitudinal sections of actual trees. But certainly to accomplish the best results expert foresters who know the scientific facts must co-operate with those who understand people well enough to translate forestry facts into terms that not only can be understood by those whom forestry seeks to convert to its aid, but into terms that will also attract those people to read the labels and study the specimens.

The same labels may serve as outlines for lectures, each label being illustrated by lantern slides made from the photographic negatives previously mentioned. It is part of the work of all progressive museums to give popular lecture interpretations of science, as well as scientific lectures and recreation based on instruction. Then, too, the museum may send out both travelling exhibits of forestry and lecture outlines made up of the labels together with loan sets of lantern slides.

The President of the Ohio Academy of Science, speaking at the 25th anniversary of the Academy, stated that the existence of the Academy was unknown to the great majority of the people of Ohio, and a "Pan-American Scientific Congress" was organized last month in Washington, under the chairmanship of the third assistant United States Secretary of State, with a program of nine sections, but ignoring Canada, and also mathematics, physics, pure chemistry, pure geology, zoology, psychology and botany, so it was really a Congress of American Republics, neither Pan-American nor scientific. The United States Secretary of the Navy, in selecting the societies to elect members of the Naval Advisory Board, ignored the National Academy of Science, which is by law the advisor of the Government, and also ignored the American Association for the Advancement of Science, which is the great democratic body of over 4,000 scientific men of the United States and Canada. He apparently never heard of either association. These striking examples seem sufficient to suggest that the forestry branch of science, as well as the whole tree, would do well to seek aid by every means of publicity, recreation, entertainment, education and research possible. Since all these means are included among museum methods and in the work of up-to-date museums, museums may become of great aid to forestry, while forestry may provide museums with many necessary scientific facts.

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