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A LIST OF THE TURTLES, SNAKES AND BATRACHIANS OF MANITOBA.*

By Ernest Thompson Seton.

THE PRAIRIE MUD TURTLE OR PAINTED TURTLE, *Chrysemys marginata bellii* (Gray).

This is the common turtle of Manitoba. It is a small inoffensive species, readily recognized by its size (about 4½ inches along the back—115 mm.), the bright red spots on the edge of its shell and the dark irregular blotch or cloud on the plastron, which last most readily distinguishes it from its near relative, the Eastern Mud Turtle.

I found it rather common in the Red river, near Winnipeg, and about Carberry in the large ponds and streams. It is also reported from many points in the prairie region—Boissevain, (A. S. Barton); Riding Mountain, (C. C. Helliwell); Austin, (Dr. Shaw).

Evidently, it is of general distribution in the south-west quarter of Manitoba, but is unknown at Shoal Lake or anywhere on the east side of Lake Manitoba. Richardson records it occurring at the south end of Lake Winnipeg and gives "Asaté" as its Chippewa name.

There is no available information on its breeding habits, but the female of the kindred species *picta* lays eggs during June, in a dry sunny bank, often remote from water. The eggs are white, leathery and nearly round; they measure about one inch (26 mm.) through, and number about half-a-dozen. All the eggs of the season are laid at one time and hidden in a single hole. This hole is three or four inches deep, scooped out by the hind feet of the mother; the eggs are left in several layers and covered with earth and leaves, so carefully as to be difficult of detection. The mother takes no further interest in the nest. The young hatch out after two weeks, crawl to the nearest swamp, and shift for themselves.

"The process of reproduction by laying is not commenced before the eleventh year . . . . . enough has been seen to warrant the assumption that from the eleventh to the fourteenth year is about the age at which most, if not all our native fresh water turtles lay their eggs for the first time; . . . . . not one of our turtles makes more than a single nest [each year]. They deposit all the eggs at once. The Painted Turtle has an almost identical period of incubation with the Snapping Turtle, namely, from the 11th to the 25th of June." [L. Agassiz, on Painted Turtle, 1857].

To this, Professor H. A. Surface adds (Turtles of Penna. 1908, p. 149): "The Painted Turtle is known to lay only from five to seven eggs a year, although more may be found within the body at any time. These do not all come to maturity during the same year."

The eggs are much preyed upon by skunks, raccoons, gray squirrels, etc., which search them out and devour them with keen relish.

The natural food of the turtle is insects, worms and fish, but it is known to add fruit and leaves to its diet.

In the autumn, it buries itself in the mud, at the bottom of a pond, below the frost line, and remains torpid till the following May.

The first sharp frost at Cos Cob, Connecticut, came about the beginning of December (?) one year. There was no snow; the ice was very clear; looking through it I saw on the bottom of the lake in three feet of water 20 or 30 Painted Turtles slowly crawling in one direction; that is, toward the inlet of the lake. They were not apparently associated.

The reappearance of the Mud Turtle is a sign of spring at its flood; but the Scriptural line, alluding to the "voice of the turtle in our land," refers not to

*The nomenclature is that of Stejneger and Barbour's Check List of N. A. Batrach. and Reptiles, 1917.

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this, but to the turtle dove; the Mud Turtle is believed to be mute, except for the slight hiss it utters on retiring into its shell.

SNAPPING TURTLE OR SNAPPER,
Chelydra serpentina (Linn).

In 1848, Richardson wrote: "As a contribution to what is known of the geographical distribution of reptiles, on the east side of the Rocky Mountains, frogs may be set down as attaining the 68th parallel of latitude; snakes as reaching the 56th; and tortoises as disappearing beyond the 51st, at the south end of Lake Winnipeg. There the *Emys geographica* of Le Seur [probably this refers to the preceding *C. m. bellii*] named Asaté by the Chippeways, occurs; and also, one with a flexible neck, called by the same people, *Miskinnah*, which is probably the Snapping Turtle." (Arc. Search. Expd. 1851. Vol. I., p. 204).

The first and only Snapper I ever saw in Manitoba, was taken in the Assiniboine, near the Little Souris, in 1896, by John S. Charleson (now in possession of John Riddington, of Winnipeg). It was 30 inches long; the shell 12 inches long and 11½ inches wide. I have heard of several specimens taken near Winnipeg, but the species must be considered rare in Manitoba; for this we should be thankful, for it is a ferocious reptile of great strength and insatiable appetite. It preys on fish, ducks, goslings, and, indeed, all aquatic animals big enough for its food and smaller than itself. I have seen this turtle take down a full-grown duck, seizing it by the legs from below; and, as an ordinary Snapper weighs ten or fifteen pounds, the duck, one-quarter his weight, has no chance of escape.

The nest of this turtle is much like that of the foregoing, but its eggs are larger and less round, and more numerous, as those of a single nest often number as high as two dozen.

In the latter part of August, 1917, a pile of building-sand was dumped about 100 feet from the lake on my land at Greenwich, Connecticut. Next morning, we found six good-sized Snappers on it. They were each about six or eight pounds in weight. We found no eggs and could see no reason for their congregating there, or how they all found it so quickly.

The Snapper is of very slow growth. The enormous specimens sometimes found are undoubtedly of great age.

COMMON GARTERSNAKE,
Thamnophis sirtalis parietalis (Say).

This Gartersnake is found at least throughout the southern half of Manitoba. I expect to find it in every part of the province, for Preble found it common about Edmonton, Alta. (N. A. Fauna No. 27, p. 500). I got two specimens in the Salt River County, ne Great Slave river; and Richardson records it north to lat. 56, near Isle a la Grosse, Arctic Search. Exp., Vol. I., p. 98. In a footnote, p. 204, ibid, he records the killing of a snake on "Porcupine river far within the Arctic Circle." It is readily recognized by the two black stripes separated by green, that run the whole length of its body.

It is about two feet long when fully grown, but specimens over thirty inches long have been found. Though a small snake, it is the largest of those that have hitherto been found in the province.

It is perfectly harmless, and its usual prey is frogs, minnows and insects.

Near Carberry, I once heard a loud squealing, in a marsh. On going near, I saw a frog with a Gartersnake holding to its hind legs. The frog was kicking with the other leg and, at the same time, clinging to a tuft of grass with his arms and squealing lustily. According to the laws of the chase, he belonged to the Gartersnake; but the ancient quarrel of man and the snake put me on the side of the frog, and I saved his life.

When camping at Lake Winnipegosis in 1904, I was warned not to go near Snake Island, as it was "swarming with all kinds of venomous snakes." That was enough; I made straight for Snake Island, and camped there a day-and-a-half, with my friend E. W. Darbey, but saw only four harmless Gartersnakes. When we left the place, and were over two miles away, we found in the water two snakes swimming toward the island. They seemed perfectly at home in the water, and I doubt not the rocky cliffs of the island furnish attractive winter dens that bring many snakes from their summer range in the far-reaching marshy shores of the adjoining parts of Lake Winnipegosis.

There are several places in the province that are, or were, noted for their vast congregations of Gartersnakes, one of the most famous being that at Stony Mountain. These places are usually high, dry, rocky dens, surrounded by a region of swamps; the latter furnish the snakes with a congenial summer range, and the former a dry denning place for hibernation.

There is no doubt that Stony Mountain was an island at one stage of the ancient Lake Agassiz; as the lake grew shallow and marshy, the snakes would increase. The island became a natural gathering-place, and the annual resort thither of the snakes *en masse* to-day is, possibly, an instinctive local migration, established in those remote times.

In the early fall of 1881 or 1882, I am told, there was a general and fierce prairie fire between Winnipeg and Stony Mountain. After it, thousands of

snakes were found dead on the prairies; all, apparently, headed for Stony Mountain. In spite of this destruction, thousands of Gartersnakes were yet to be seen at Stony Mountain and Balmoral, till they were destroyed for nuisances, although all were of the same harmless, even beneficent, species.

In June, 1902, at Shoal Lake, I got a female Gartersnake with 26 eggs ready for hatching; they were in one column of 21 and a short parallel column of 5. The stomach of this snake was examined by Dr. S. D. Judd, of the Biological Survey, Washington, D.C. He reported its contents as follows:—"Hind legs and pieces of stomach of *Rana pipiens*, one *Agonoderus pallipes* and another small carabid beetle, one tenebrionid beetle, one caterpillar (*Agrotis*), two flies, one ichneumon fly (Hymenoptera), one aculeate hymenopter (*Pompilus*), eight spiders, one ragweed (*Ambrosia*), two seeds of *Polygonum*. The insects were in a finely comminuted state." Whether they were originally swallowed by the frog or the snake is not clear. A case in which the tables were turned, so that a small Gartersnake was even devoured by a Wood-frog is recorded by John J. Schoonhoven, in *Guide to Nature*, April, 1910, p. 400.

In late summer, as with all Gartersnakes, the young of the species are born alive. According to H. A. Surface (Serpents of Perna. 1906, p. 145), the young in Pennsylvania are born between July 25th and August 25th. The mother "lives near the young and guards them during the fall. They pass the winter in rubbish, in the earth, beneath stones, or in hollow logs; and in spring the young shift for themselves."

THE PLAINS GARTERSNAKE, *Thamnophis radix* (Baird and Gerard).

This species is much like *sirtalis;* but it has the light side-stripes on the third and fourth row of scales; whereas, *sirtalis* has them on the second and third.

A specimen that I took at Carberry, in 1883, was identified by Dr. J. H. Garnier as *radix*. Donald Gunn took another at Lake Winnipeg.

Dr. Stejneger gave this name to one I sent him from Winnipeg; and Dr. E. Coues reported it along the boundary at Pembina, Turtle Mountain and Souris River; so that it is probably of general distribution in southwestern or prairie Manitoba.

THE GREEN-SNAKE OR GRASS-SNAKE, *Liopeltis vernalis* (Harlan).

This brilliant little creature is abundant along the Assiniboine river, south of Carberry. During August, Green-snakes can be seen in numbers where the hot, sunny banks of the river valley rise near any grassy thickets, affording basking-places near coverts of safety. It is also reported from Winnipeg and Shoal Lake and Boissevain. Unfortunately, its exquisite green is lost in alcohol, being replaced very soon by a pale-blue. The species is perfectly harmless.

An individual that I caught on the banks of the Assiniboine, July 14, 1884, and kept captive at Carberry, produced six eggs on July 27th; it refused all food and died July 31st.

RED-BELLIED SNAKE OR COPPER SNAKE, *Storeria occipto-maculata* (Storer).

This species is rare, compared with the foregoing. I had heard of it several times before seeing it or securing a specimen. The one in my collection was captured at Carberry by Frank Dickie, in 1904; and it has been observed occasionally as far north as Shoal Lake. A. S. Barton reports it rare at Boissevain; but John S. Charleson says it is common at Blythe, near Little Souris river. Like the other snakes found in Manitoba, this species is perfectly harmless. Its food is chiefly insects, and its range seems to be the south-western part of the province.

MUD-PUPPY OR SPOTTED SALAMANDER, *Necturus maculosus* (Rafinesque).

The two specimens in my collection were taken by E. W. Darbey at Winnipeg.

WATER-LIZARD OR PRAIRIE SALAMANDER, *Ambystoma tigrinum* (Green).

This species is generally distributed in southwestern Manitoba, that is, all the prairie region. It is not a lizard at all, but a cousin to the frogs. It is well-known in two different stages; first, as a big, soft water-creature in the ponds and in the ditches along the railways; second, as a yellow-and-black spotted land-animal like a lizard; but it is not generally known that these are one and the same animal; the Water-lizard being the tadpole stage, the land-animal is the stage corresponding with the frog.

It is a remarkable fact that the species occasionally breeds in the tadpole as well as the adult stage.

In the autumn, when they are seeking a winter den, the crawlers are found in cellars and post-holes in numbers. I found them exceedingly numerous at Boissevain in September, 1904. I have several times found them in gopher holes where they had denned up for the winter. Notwithstanding their appearance, they are perfectly harmless.

WOODLAND SALAMANDER, *Ambystoma jeffersonianum* (Green).

Among some alcoholic specimens sent me from Beausejour, Whitemouth river, eastern Manitoba,

by Walter Sidebottom, was an example of this species, the only one I know of taken in the province, although the species should be found in most of the wooded regions. It was identified by Dr. L. Stejneger. The specimen is now in the American Museum, New York.

LEOPARD-FROG OR SPOTTED GREEN-FROG,
Rana pipiens Schreber.

This is the common frog of Manitoba. I found it abundant at Winnipeg, Lower Fort Garry, Selkirk, Shoal Lake, Lake Winnipegosis, Carberry, Brandon, Whitewater Lake and Boissevain; Preble reports it from Norway House (N. A. Fauna No. 22, p. 133.) It is, doubtless, found throughout the province.

It is readily distinguished by the conspicuous black spots outlined in white with which its green skin is decorated.

On June 16, 1888, near Toronto, I killed a common Gartersnake. It had in its stomach a frog which had in its stomach a potato beetle and a large water shell.

W. L. Hine related to me a curious incident:—"One day," says he, "when out collecting, I shot a goldfinch. I marked it down, and, though there was little cover, I could not find it. A large green frog was hopping away from the place, and I saw something sticking from its mouth. This, on closer view, proved to be the legs and wings of the goldfinch. I recovered the specimen, but it was spoiled. Many specimens of small birds mysteriously disappear when shot near frog ponds; and I doubt not that the above contains the explanation."

Like most of the frogs, it winters deep in the mud, though not necessarily under water.

WOOD-FROG,
Rana cantabrigensis cantabrigensis (Baird).

This small frog is much less abundant than the preceding. I found it at Winnipeg, Lower Fort Garry, Selkirk, Shoal Lake and Carberry. Preble found it at Norway House, Playground Lake, York Factory and Fort Churchill (N.A.F. 22, p. 133), and notes it as the common frog of the Mackenzie River Basin (N.A.F. No. 27, p. 501). He calls it *latiremis*.

It is easily distinguished by the absence of conspicuous spots, except the broad black bar along the cheek. It is found in the woods, often far from water; in the early spring it makes the ponds resound with its short, harsh, quacking notes.

In late July, 1918, at my country home, Greenwich, Connecticut, four deep post-holes were dug for a fence and left open some weeks. During the last of July, or perhaps the first week of August, the Wood-frogs were performing their usual overland migration away from the water. About a score or more fell into each of the holes. During August I was away, but I returned in mid-September. The frogs were still hopping about in the holes, but hopelessly imprisoned. I now set them free; all seemed fat and lively; yet apparently all had been without food or water for six or seven weeks. With them were one or two Toads, also some beetles and a berry-bug.

NORTHERN OR MINK FROG,
Rana septentrionalis Baird.

Recorded by Kennicott as taken at Selkirk Settlement. So called because it smells like a mink.

BULL-FROG.(?)
Rana catesbeiana Shaw.

This has been reported to me from the Red River Valley, but I have not seen specimens, and enter it with a question.

In my Connecticut home I have seen great numbers of tadpoles of the Bullfrog, all winter long, in the ice, and washed up on the ice during January freshets. As they were strictly in tadpole stage, this illustrates the fact that they are two years in maturing.

The following interesting note on the age of Bullfrogs appears in the *Guide to Nature* for November, 1910, p. 277, quoted from *Brooklyn Museum News*:

"Our two Bullfrogs, *Rana catesbeiana*, after having been in captivity for eight years, died in August. Frequent mention of these frogs have been made in previous numbers of the *Museum News*, but as little seems to be known concerning the age of Bullfrogs, it may be worth while to record the following data: The frogs came to us from Elmhurst, L.I., in the summer of 1902, when fully grown. The male measured 12.6 inches and the female 14.4 inches total length. Three days before death the male weighed 15 ozs., and the female 25 ozs. Allowing two years for the tadpole stage and 3 years for the growth as frogs, our two captives must have been at least 13 years old, counting from the egg state. Under natural and favorable conditions, it seems possible that Bullfrogs live from 15 to 20 years."

SPRING PEEPER OR HYLA,
Hyla crucifer Wied.

According to Stejneger and Barbour, this well-known pond whistler ranges from New Brunswick to Manitoba; therefore, it is listed here, although I do not know of any specimens taken in the province.

NORTHERN SPRING PEEPER, PEEPER FROG, OR SWAMP WHISTLER, *Pseudacris triseriata* (Wied).

This tiny frog, an inch long from nose to stern when full grown, is abundant in all places of the

province where I have collected in summer; that is, Winnipeg, Lower Fort Garry, Selkirk, Shoal Lake, Carberry and Boissevain. As, according to Preble, it is distributed northwest to York Factory and Great Bear Lake (N.A.F. No. 22, p. 134), it is to be looked for in all parts of Manitoba.

The *crucifer* is easily recognized by the dark St. Andrew's cross on its back; whereas, the *septentrionalis* has only a number of long blotches or stripes.

Though its piercing "*prreep prreep*," from the chilly pond, in early springtime is familiar to all, very few have seen the originator of the noise or know that it is a tiny frog that makes this small steam-whistle. While uttering it, his throat is blown out like a transparent bladder and is nearly as big as himself At Shoal Lake, in 1901, I found them still singing in the first week of July. The note is more rattled than that of *H. crucifer*. The Peeper is in full song about the first of May; they are very abundant; sometimes there are hundreds of them singing in one pond, with their noses above water; and yet, any one who succeeds in seeing one while it sings may congratulate himself upon having achieved a difficult exploit in woodcraft.

A specimen that I took at Lower Fort Garry, August 22, 1904, was a brilliant grass-green on all its upper surface; but this, Dr. Stejneger said, was merely an individual variation.

COMMON TOAD,
Bufo hemiophrys (Cope).

The Common Toad is abundant everywhere from Winnipeg and Shoal Lake to Brandon, from Boissevain to Winnipegosis, and, probably, throughout the province. Its spring note is a soft trilling, uttered about twice a minute and lasting about three seconds each time.

An interesting article on the homing power of the Common Toad appears in *Guide to Nature* (Oct., 1918, p. 142). The writer, F. H. Sidney, mentions instances of marked Toads returning to their home places from distances of 3 to 10 miles, to which they had been carried; and doing this within a few days.

AN OTTAWA BEACH OF THE CHAMPLAIN SEA.

By E. M. KINDLE.

INTRODUCTION.

Before the advent of the science of geology men lived in what was supposed to be a completed or dead world. Except for the waggon ruts in the roads and a few other minor alterations by man the earth was believed to have been created, just as we see it, a few thousand years ago. Historical geology has enabled us to peer "far back into the night of time." In place of the finished world of a few generations ago we now recognize a constantly changing world which has been tenanted by an endless succession of plants and animals, each unlike and a little in advance of those which preceded it. The geography of to-day we now know to be no more permanent than the cloud forms of yesterday. Familiarity with geological concepts has contributed enormously to mobility of mind and broad intellectual hospitality. The man who can visualize clearly the physical geography of eastern Canada as it was some ten thousand years ago is prepared to comprehend as well as to meet and direct the great changes incident to the evolution of the social, economic, and political world in a way that his brother who still lives in the finished world of yesterday cannot. It is perhaps something more than a coincidence that the science of geology and the principles of political liberty first took root in England.

In the light of these considerations it should be clear to the non-professional reader that historical geology has a broad cultural value which will well repay one for the trouble of acquainting himself with the salient features of his local geological environment. There are few localities where the recent chapters in the geological history of the continent can be more easily read than in the Ottawa district. This is because the Ottawa and St. Lawrence valleys were invaded by the sea at a very recent period, geologically speaking,—perhaps not more than 10,000 years ago.

AN ANCIENT SEA BEACH.

The deposits of the latest marine invasion of the Ottawa valley are of two distinct types, fine textured blue clay and beds of sand. The sand deposits, which are widely distributed throughout the Ottawa river valley, represent, frequently and perhaps generally, deposits of an ancient sea shore. These beaches are not of the type which the reader may have seen at Cape Anne or some other rock bound part of the exposed Atlantic coast where a ridge of granity boulders six or eight feet high shows unmistakably the border of the sea and the prowess of its waves. The beaches of the arm of the Champlain or Pleistocene sea, which invaded the Ottawa and St. Lawrence valleys shortly after the retreat

of the glaciers from the region, are comparable with those of the Bay of Fundy, where the strand line is generally defined by the margins of broad nearly flat stretches of sand or mud. Across these broad intertidal belts the sea in many places retreats for miles at the turn of the tide, leaving nothing to mark its maximum landward extent beyond the margin of the tide-borne sand or mud.

Here and there in the Ottawa valley, where they have escaped erosion, we find vestiges of the old sea beaches and the life which flourished on them. Southwest of Ottawa, six miles, the Rideau river has cut into one of these old Pleistocene beaches at a locality a few hundred yards below the Black rapids. The work of the river, combined with the extensive excavation of sand for use in the City of Ottawa, has furnished an excellent section of the old beach sands (fig. 1). The removal of this old beach deposit by the river began immediately after the birth of the Rideau and Ottawa rivers, an event which followed directly on the retreat of the sea from the region. This surviving remnant of the old beach can therefore give but an imperfect conception of the original extent and outline of the old sea shore.

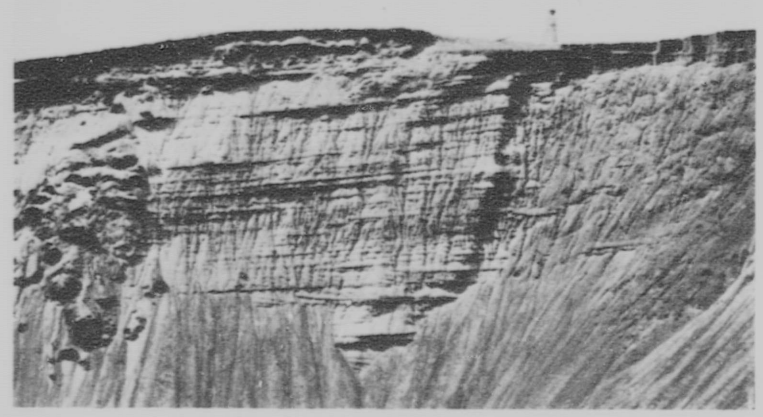


Fig 1.—Face of sand pit, near Rideau Junction, Ont. These sands represent a shallow water deposit of the Champlain sea.

If the visitor to this interesting locality should approach it by way of the charming canoe route up the Rideau canal and river he will pass, at the picturesque Hogs Back rapids, extensive exposures of Ordovician limestone,—the product of another long extinct sea which compares in age with the sand pit deposits very much as the Pyramids do with the Ottawa Union station. In contrast with the limestones of the Ordovician, whose age we estimate in millions instead of thousands of years, the sands of the Rideau pits may with propriety be referred to as representing a sea beach of yesterday.

The face of the sand pit, which is kept nearly vertical by constant removal of sand, exposes about 60 feet of clean quartz sand. The sand furnishes in its cross bedding evidence of the wave and current action which characterizes most beach deposits. (fig. 1). From the top of the pit the surface of the sand stretches away toward the east as an approximately level surface. Except for slight irregularities represented by a few low dunes and a very moderate amount of reduction by erosion, the surface of this sand plain shows about the same topographic contour which it had as a beach or bar in the shallow waters of the Pleistocene sea.

The location of Ottawa, more than 200 miles from the nearest salt water, in a region where lakes are common, might lead the intelligent layman to enquire what evidence there is for calling this deposit of clean washed sand a sea deposit rather than a lake beach formation. And if it is of marine origin, he may ask what proof can be offered of the shallow water origin which its reference to a sea beach implies. The answer to both of these questions is found in the fossil fauna which the sand beds hold.

THE FAUNA.

Some of the upper beds of the sand pit hold a great abundance of marine shells. All of these belong to species now living in the Gulf of St. Lawrence and thus attest the comparatively recent withdrawal of the sea from the Ottawa river valley. (fig. 2). The following species have been collected by the writer: *Mytilus edulus, Macoma bathica, Saxicava rugosa, Balanus* sp.

Perhaps the most interesting and significant species in this list is *Mytilus edulus*. The shell is abundant nearly everywhere on our present Atlantic coast, at

or a little above low water. But it is seldom found in water of any depth. Exposure to the air between tides appears to be as essential to the vigorous growth of this shell as it would be fatal to the majority of shells. The presence of *M. edulus* in these beds in abundance thus affords evidence of their origin in very shallow water. *Macoma bathica* is also a shallow water species occurring according to Whiteaves "usually at or a little below low water mark." The presence of *Saxicava rugosa* in the fauna has but little significance regarding the depth of water in which the fauna lived since this species is now found living in Canadian waters from low tide level to a depth of 50 feet. Temperature appears to be the chief factor which controls the vertical distribution of this shell. While it is never found in very shallow water in the Gulf of St. Lawrence, in Arctic and sub-Arctic waters it has been found living near low tide level. The association of this cold water-loving shell with such a typically intertidal species as *M. edulus* suggests colder climatic conditions, since water sufficiently shallow to be a satisfactory habitat for *M. edulus* in our present climate would have too high a temperature to accommodate *S. rugosa*.

A noteworthy feature of this fauna is the absence from it of most of the shells which are most common in the fossil fauna found in the widely distributed Pleistocene blue clay. The blue clay fauna represents species which were contemporaneous with the fauna of the sand beds but which occupied a different bathymetric zone—relatively deeper as well as distinctly different in the character of the bottom materials. The species most commonly met with in the clay beds include the following shells: *Portlandica arctica, Saxicava rugosa, Macoma calcarea,* and *Nucula tenuis.*

The collector of fossils is often puzzled by the very marked contrast in the relative abundance of fossils which the same type of sediments display at different localities. While the marine sands may be extremely rich in sea shells at certain localities like the Rideau river sand pits they may at other localities be entirely barren of fossils. One of the reasons for such barren areas is doubtless the tendency of sands to move rapidly under current action and smother the marine life which attempts to live on them. Dr. G. A. Huntsman who has been engaged in studying the conditions under which marine animals live in the Gulf of St. Lawrence has directed attention to another factor in producing lifeless zones. He states*:

"By means of these traps we discovered that a barren zone existed off the Cape Breton shore, comprising the part of the sloping bottom between the depths of 10 and 20 fathoms. In this zone the temperature at the bottom underwent violent fluctuations often in the course of a day or so, at one time being as high as 65° F., and at another as low as 39° F. This was caused by the winds for when the wind was blowing on shore it drove the surface water against the coast and heaped it up, forcing the deeper colder water down, then when it changed and blew off-shore the warm surface water was driven away from the coast and the cold water welled up from below to take its place and so flooded the zone. The effect of this on the slow moving bottom animals may be imagined. Few of them would be able to stand such changes, but the active fishes are able to move up and down the slope and avoid these changes."

It is probable that we can safely ascribe to the variable temperature factor some of the paucity of life which in many places characterizes the Pleistocene clays as well as the sands of the Ottawa valley.

*Canadian Fisherman, May, 1917.

THE INSTABILITY OF SHORE-LINES.

The advance or retreat of shore-lines results from two distinct causes. Elevation or subsidence of the land through the action of deep-seated forces within the earth is a very slowly acting but potent agent in changing geographical features. The second great factor in making new shore lines is the sea itself which is everywhere either cutting away or adding to existing shore lines. The rapidity of this constructive and destructive work of the sea varies enormously according to the hardness of the rocks and the behaviour of waves and currents, as well as the topography of the shore.

Everywhere along the Atlantic coast of America the first named factor has wrought enormous changes in the shore line since the close of the Glacial epoch. A profound subsidence of the land in eastern America which accompanied or followed the disappearance of the glacial ice sheet brought the sea far inland along all the great valleys leading to the sea coast (fig. 2). At one time during this marine invasion it has been estimated that the sea was at least 200 feet deep over Parliament hill. The re-elevation of the land and withdrawal of the sea in eastern Canada and New England was the last great geological event of the Pleistocene epoch.

Elevation or subsidence of the land, although the most powerful factor in producing the major features of coastal geography operates with extreme slowness and is subject to long periods of inactivity, while the sea in revising its boundary never ceases work for a single year. Enormous changes are sometimes wrought in a very short period where the shore line is composed of sand or clay. Sable island off the east coast of Nova Scotia furnishes

some striking examples of the rapid changes which a coast line may undergo. Hon. Joseph Howe a number of years ago reported that by actual measurement 11 miles of the west end of the island had disappeared in 30 years. The commodious harbour on Sable island which was formerly a favorite haven of safety for fishing vessels was closed by a gale in 1836 shutting in two American vessels whose ribs are now buried in the sand.

On parts of the south coast of England the work of the sea is largely constructive. Some of the towns on the coast which were located on the sea shore in the days of the early English kings, are now one or more miles inland. During storms from the south-west the waves and currents drive enormous quantities of shingle and gravel onto this coast, often making it difficult or impossible to keep the harbours open. At the Port of Dover it was long the custom for the Mayor to summon with a drum, by day or night, all the householders in the city to the harbour to shovel shingle whenever it was endangered by the influx of shingle drift.

Facts like these had been observed long before the development of modern science. Some of the more reflective minds of the Middle ages were deeply impressed by them. Mohammed Kaswini an Arab writer of the 13th century had at that early period felt the spell of the mighty past of geological time. His impressions were put into allegorical form. They are given in the following narrative of Kidhz, an allegorical personage: "I passed one day by a very ancient and wonderfully populous city and asked one of its inhabitants how long it had been founded. It is indeed a mighty city, replied he, we know not how long it has existed, and our ancestors were on this subject as ignorant as ourselves. Five centuries afterwards as I passed by the same place I could not perceive the slightest vestige of the city. I demanded of a peasant who was gathering herbs upon its former site, how long it had been destroyed. In sooth a strange question, replied he, the ground here has never been different from what you now behold it. Was there not of old, said I, a splendid city here? Never, he answered, so far as we have seen and never did our fathers speak to us of any such. On my return there five hundred years afterwards I found the sea in the same place and on its shores were a party of fishermen of whom I inquired how long the land had been covered by the waters. Is this a question said they for a man like you? This spot has always been what it is now. I again returned five hundred years afterwards and the sea had disappeared. I inquired of a man who stood alone upon the spot how long ago this change had taken place; and he gave me the same answer as I had received before. Lastly, on coming again, after an equal lapse of time, I found there a flourishing city more populous and more rich in beautiful buildings than the city I had seen the first time; and when I would fain have informed myself concerning its origin, the inhabitants answered me, Its rise is lost in remote antiquity; we are ignorant how long it has existed, and our fathers were on this subject as ignorant as ourselves."

This allegory of the old Arab writer was doubtless inspired by finding somewhere fossil sea shells representing, like those of the Rideau sand pits, a long vanished sea. In this ancient story we can discern a glimmer of the dawn of the science of historical geology.

Fig 2.—The Champlain submergence. The shaded portion of the map indicates the extent of this invasion of the sea. (After F. Taylor).

OUR CANADIAN NUT TREES.

By F. E. Buck, Ottawa.

The nut trees of Canada belong to two families. The walnuts and hickories belong to the Walnut Family and the chestnuts, hazelnuts, beechnuts and oaks to the Beech Family. They vary in size from the shrub-like hazel to the stately hickories. One peculiarity of most of the nut trees is that the small branches dip down and then grow up again. The walnuts, when growing as single specimens, form roundish or triangular shaped crowns and frequently stand out as land marks in old pastures and rocky fields. Both walnuts and hickories, when growing with other species in the woods become modified in form, generally growing taller with a much smaller crown.

The heights which are given in the following descriptions relate to specimens growing throughout Canada, but as we go south into the United States these measurements, in most cases, must be increased.

Nut trees are valuable for their wood and for their fruit. The United States has a considerable import trade with nuts and 1910 figures give the total value of imported nuts at thirteen million dollars, or in quantity, one hundred and fifteen million pounds. This does not, of course, take into consideration the very considerable quantity of home-grown nuts. The food value of nut trees, therefore, must be looked upon as already considerable and of growing importance.

The Wood.

Nearly all of the nut trees produce a very hard quality of timber and, in the case of black walnut, much of it is used for fine cabinet work and for high-class furniture. Owing to its popularity in that connection it now has an almost prohibitive price. The wood of the butternut is somewhat softer and lighter in weight. It is used for boat building and interior finish work. The wood of the various species of hickories is very similar and is seldom separated on the market. It is amongst the hardest, toughest and strongest of the timbers of commerce. In Canada it is used chiefly for vehicle stock, tool handles, agricultural implements, machinery parts and sporting goods. Chestnut wood is highly prized for the manufacture of tanning extracts and also for fence posts because of its durability in contact with the soil.

The Fruit.

The following brief descriptions of the fruit of the most important nut trees may be interesting:—

BLACK WALNUT. Nut almost round, about one inch in diameter or smaller. Shell hard, black, cut with deep ridges. Husk blackish with an aromatic odour. Kernel oily, sweet and edible. A marketable nut.

BUTTERNUT. Nut oblong, pointed at one end, two or three inches long. Shell deeply furrowed with many sharp irregular ridges. Husk brown and very sticky. Kernel good flavor and edible.

HICKORIES. (1) The Bitternut hickory has a very bitter kernel with a thin shell and thin husk. (2) The Shagbark has a nut which is compressed laterally and is four-ridged. The kernel is sweet and edible and is of greater commercial value than that of any of the other hickories. (3) The Mockernut has a very thick shell and the nut is large. The husk is also hard and thick. The kernel is sweet but small and difficult to extract. (4) The Pignut produces nuts which vary in size and in shape. The kernel is bitter or sweet. The husk of the hickories split into four sections as the nuts ripen.

CHESTNUT. The fruit of the chestnut is contained in a spiney burr which holds one to three shiny, brown, thin-shelled, sweet, edible nuts. The burrs split open as the nuts ripen. The native nuts are much smaller than those of the European species.

HAZELNUT. The fruit, which is a small nut about one-half inch long, is enclosed within a pair of broad, leafy, cut-toothed bracts. It is chestnut brown in color and almost globular in shape. The fruit of the beaked hazelnut is ovoid in shape and is enclosed in a leafy covering terminating in a long tubular beak.

HORSE CHESTNUT. The nut of the horse chestnut is not edible. It is large, varying from one to one and one-half inches in diameter, contained singly within a smooth pod covered with soft spines. The nut itself is aromatic and bitter narcotic.

The Food Value of Nuts.

Nuts have an important food value on account of the large percentage of protein and oil which they contain. It is for this reason that they are recommended for diabetics, except perhaps the chestnut which is the only one which also contains a considerable percentage of starch.

Nuts are used also in very large quantities in commercial work, especially by confectioners. They are used for making candies of all kinds and in the icing on various cakes, etc. Nuts are also used in salads. The flavor of nuts depends upon the oil. All nuts are rich in mineral matter and contain, on the average, about two per cent of mineral substances.

In the cracking of nuts it should be remembered that the hickory nut can be cracked most easily by

applying pressure or force to the thin side of the nut, while the butternuts and walnuts can be cracked by applying pressure to the end. If this is remembered the nuts will crack along certain definite lines without injuring the kernel to any extent. At the present time nuts are not expensive as an article of diet because they supply a large amount of energy at a reasonable price per unit. They constitute a very concentrated form of food, even more so than cheese.

The English walnut is also used for pickles, catsups and preserves, and in France many tons a year are made into oil which is used as a substitute for olive oil.

THE MOST VALUABLE NUT TREE.

The Persian or English walnut is, without doubt, the most important nut tree from the commercial standpoint and as this will thrive in many parts of British Columbia, as well as in certain parts of southern Ontario, it will be of interest to call special attention to some interesting facts about this important variety. At the present time Canada and the United States import more dollars' worth of the English walnut than both these countries export in apples. There is little reason why this should be as the nut could be grown on this continent with considerable success. It is perhaps the finest flavored of all the nuts. It was called by the Romans, the nut of the gods, and trees distributed by the Romans throughout southern Europe have left descendants behind which are now over 1,000 years old. One tree has been known to produce as many as 100,000 nuts in a single year, and the value of the wood of a single tree has been known to exceed $3,000.00. The English walnut was first introduced into America about the year 1758, and is grown commercially chiefly in the state of California, where about 12,000 tons are produced. It is possible, however, that trees would do even better in British Columbia than in California, as it succeeds well in almost every section of England. Frosts in the early autumn are an advantage as they induce the outer shucks to crack and release the nuts. The harvesting then becomes a very simple matter.

The Experimental Farm at Agassiz, B.C., has grown, since its formation, many of the varieties of nuts with complete success.

THE WALNUTS.

There are about ten known species of walnut widely scattered throughout the four continents. Four are native to North America and two of them are also found in Canada. The Black Walnut is found in Ontario, south to a little north of Ottawa, and the Butternut from the lakes southeast to the coast. In addition, the Japanese Walnut is hardy at Ottawa and in the southern parts of Canada from coast to coast, while the Persian or English Walnut thrives in British Columbia, but winter kills to the snow line at Ottawa.

THE BLACK WALNUT, *Juglans nigra*. This tree, growing in the open under favorable conditions, attains a height of from 50 to 90 feet with a diameter from 2 to 5 feet. In the forest, however, it grows differently; the trunk is tall and columnar, the head narrow and rigid instead of the rounded crown of the field specimens.

It requires a deep, rich, well-drained loam to do well. At Ottawa trees growing in the Forest Belts in poor and unsuitable soil have made poor growth. In thirty years they made a growth of only 16 feet with a 3-inch diameter when planted in low sandy loam, and a maximum of 24 feet and 4 inches in diameter when planted in a better type of soil. The tree occurs naturally in Canada only in southern Ontario where it is a fairly fast grower and is tolerant of shade. It might be mistaken for the Butternut except that its bark is darker. The buds are smaller than those of the Butternut, while the compound leaves consist of fifteen to twenty-three leaflets.

BUTTERNUT, *Juglans cinerea*. This tree is found throughout the hardwood region of Ontario and east to New Brunswick, growing at its best in well-drained loam solitary or in small groups with other trees. The single specimens grow from 40 to 50 feet high and from 1 to 3 feet in diameter. The crown is roundish to triangular-shaped. At Ottawa single specimens become medium-sized trees about 30 feet high, but those in the Forest Belts, growing in poor soil, have made an average growth of only 13 feet in thirty years. The bark is light gray and the ridges smooth-topped. The leaflets are from nine to seventeen to a leaf.

JAPANESE WALNUT, *Juglans Sieboldiana*. This walnut is hardy at Ottawa where probably some of the oldest trees of the species are to be seen. Native to Japan it was not introduced into Europe until about 1860 by Siebold. Its nuts are edible and sweet and are valued as food in Japan. It becomes a tree of about 50 feet in height, with leaves about two feet long, composed of eleven to seventeen leaflets. It may gain in value as a commercial tree after it has been more widely distributed.

ENGLISH WALNUT, *Juglans regia*. In a former paragraph a fuller description of this tree is given and it is not necessary to do more than mention it here. As a tree it grows from 60 to 100 feet high with rounded spreading crown. The leaves are composed of five to nine leaflets, occasionally even as many as thirteen.

THE HICKORIES.

All of the twelve known species of hickory belong to this continent and five or six of them are native

to Canada. None are found west of Ontario and most are confined to the southern part of the province and south-western Quebec. The "pecan" of commerce is the fruit of *Carya illinoensis*, the southern species.

BITTERNUT HICKORY OR SWAMP HICKORY, *Carya cordiformis*. This is a tree which grows from 50 to 60 feet high, with a large spreading crown when growing in the open. It has slender twigs as compared with other species and its winter buds are sulphur-yellow. The leaves consist of seven to eleven leaflets. The tree prefers low, wet situations near streams, although it thrives well in good soil on higher ground. It is an important species on account of its relatively wide distribution.

SHAGBARK HICKORY, *Carya ovata*. This is one of the largest hickories, reaching a height of 50 to 80 feet. It has a straight and columnar trunk and in the open the crown resembles an inverted cone in outline. In the forest the crown is small and flat. It receives its name from the fact that the bark shags off in large plates free at both ends. The buds are yellowish-brown and large. The leaves consist of five to seven leaflets. It requires a good, rich soil, deep and well-drained on account of its long tap root.

MOCKERNUT HICKORY, *Carya alba*. A tall tree, 75 to 90 feet high in the forest, but shorter with a broad, round-topped crown when growing in the open. The buds are large and can be distinguished from the shagbark by their lack of persistent outer scales. Leaves consist of seven to nine leaflets. Prefers well-drained, rich slopes and is found in the counties of Ontario bordering the lakes.

PIGNUT HICKORY, *Carya glabra*. This is a smaller species with much-twisted and contorted branches. It reaches a height of 40 to 50 feet and the crown is narrow and long, reaching well down the trunk. Winter buds small and yellowish-brown. Leaves composed of seven to nine leaflets. Found in the Niagara Peninsula and the counties bordering Lake Erie. *Carya microcarpa*, the Little Pignut, is a variety of this species. One or two specimens of *Carya ovata* are hardy at Ottawa.

Carya illinoensis, "the pecan" is not hardy in Canada, except perhaps in parts of British Columbia. Several young trees planted at Sidney, B.C., have done well so far.

THE CHESTNUTS.

SWEET CHESTNUT, *Castanea dentata*. Only one of the four known species of true chestnuts is native to Canada. This species, however, is highly prized for both its wood and its fruit. It grows naturally in Canada only in a restricted portion of Ontario from the Niagara river westward to the Detroit river and Lake St. Clair.

It is generally a large tree, about 75 feet high. The crown is spreading and usually rounded. The leaves are about six inches long, narrow and taper-pointed with toothed margins. A few specimens of this tree are hardy at Ottawa, but do not produce nuts. In the Niagara district the nuts are produced in large quantities and are collected as they fall from the trees in September and October. There is a good local market for the nuts and quantities are used by those who collect them from the woods. Large single trees growing in the open are very productive. The tree thrives in any good soil and is common in pastures and rocky woods. Unfortunately a parasitic bark disease, *Diaporthe parasitica*, is destroying it in large quantities. The tree bears fruit at the age of five years and is valuable for its timber at about 15 years of age. *Castanea sativa* is the European species and a variety of this known as Paragon is also planted for commercial purposes in the Niagara district.

THE HAZELNUTS.

The hazelnuts are mostly shrubs, rarely trees. There are eleven known species throughout Europe, Asia and America and many horticultural varieties are cultivated. The hazelnuts belong to the Beech Family and are therefore closely related to the chestnuts and oaks. Two species are native to Canada and many of the horticultural varieties succeed in southern parts of British Columbia and Ontario. Efforts have been made to make profitable plantings in certain parts. These efforts have been handicapped by the fact that the fungous disease, *Cryptospora anomala*, common on the native species, also attacks imported varieties. The hazelnuts require moderately rich, well-drained soil. Injury from frost is generally a possibility as both staminate and pistillate catkins develop in the autumn and quickly swell under the influence of mild weather in the late winter.

The Kentish Cob, or Filbert, derives its name "Filbert" or "Fullbeard" from its longer husk which extends beyond the nut. The generic name, hazel, is from the Anglo-Saxon "haesel", a hood, which the shorter husks of the hazel resemble.

HAZELNUT, *Corylus americana*. This species is a shrub growing from three to eight feet high. It furnishes the brown hazelnut of the market, which is gathered during August and September. It is common in thickets and hedge rows in the southern parts of Canada.

BEAKED HAZELNUT, *Corylus rostrata*. This species is also found in thickets and hedge rows. The fruit is covered by a bristly cup which terminates in a long tubular beak, hence its name.

MICROSCOPY AND BIOLOGICAL ACTIVITIES AT RUHLEBEN.*

(British Civil Prisoners of War Camp).

Among the unfortunate students in Germany who early in the war lost their liberty and found themselves interned at Ruhleben, was Grant Lochhead, only son of one of this society's esteemed members, Wm. Lochhead, Professor of Biology, of Macdonald College, Que.

Grant Lochhead studied at the University of Leipzig, having just been granted his Ph.D. degree; but he did not succeed in leaving Germany in time when war broke out. Those who know the pleasant, courteous and happy disposition of Grant Lochhead, will be glad to hear how he and other young Britishers succeeded by a dogged determination in overcoming to some extent, the boredom and ennui—to say the least—of a prisoner's camp life.

MR. GRANT LOCHHEAD
Lately a Canadian prisoner at Ruhleben Camp, Germany.

". . . . Ruhleben camp is situated on a bleak plateau on the site of the well-known race course to the west of Berlin. This fact will account for the mention of "betting booth, hay loft and grandstand."

"Roughly the camp is made up of students from the Public Schools and Universities. The educational work has been going on there for the past two and a half years. As an introduction to the prospectus of work for the autumn term 1916, we find among other notices the following:—In most subjects the tuition provided at the school, ranges from that required by absolute beginners to that required by advanced university students. The term consists of fourteen weeks; the total subscription of 3.50 marks should be paid in advance, if possible."

From a letter of Dr. A. Eckley Lechmere to R. Paulson, F.R.M.S., dated August 14th, 1917:

"When the laboratory started in the spring of 1915, we were fortunate enough to have several microscopes at our disposal. These were supplied by people in the camp who had their instruments in Germany. I had been working at plant diseases in Munich with Professor von Tubeuf, and the cytology of sex in insects with Dr. Büchner, so I was fortunate in having both instruments and a certain amount of material at hand which Prof. von Tubeuf kindly sent me here. Since then several more instruments have been obtained by other students. We have now an excellent microscopical outfit for general laboratory work. The instruments include the following items:—

One Leitz binocular, two Leitz C, two Leitz GH, two Winkel, one Seibert, and one Nietsch, one Baker Diagnostic, and a set of eight dissecting lenses, two polariscopes, micrometer eye-pieces, camera lucida and microspectroscope, one Leitz Minot microtome.

For sitting accommodation we use a large deep bench, fitted under the windows in the wall of the loft. The windows themselves have been much enlarged, and this year we have had skylights let into the roof. For work in the evenings I have arranged a small transformer to work from the main electric supply, which gives sufficient current to run twenty 4-volt lamps; at the same time it can supply current for heating a small drying-box for the microtome slides, and is further used for an electric needle for orientation of sections in wax.

The general instruction in laboratory work and the preparation of lectures do not leave much time for original work. The only things I have attempted here have been a series of stages in the development of the Orange Scale insect (*Aspidiotus*), and a few preparations of a curious mite infesting the earwig. The body of each mite has a long stalk which forms a branching meshwork gradually covering the body of the host. I have never seen it before, and do not know the genus. During the months of May

*Abstracted from "Microscopy at Ruhleben", a paper read by R. Paulson, F.R.M.S., Jour. Roy. Micr. Soc., March, 1918, part one, p. 26 (H.T.G.)

and June this year I kept a series of eggs of *Limnaea stagnalis*, *Planorbis corneus* and *Valvata piscinalis* under observation for the early stages of development. I have a large number of eggs embedded for future cutting, after using pereny and acetic sublimate as fixing reagents. Towards the end of an egg-laying period in *L. stagnalis*, I frequently found some of the egg-capsules with numerous eggs, up to fifteen in number instead of the normal single egg. I also managed to hatch out several cases of two embryos from one capsule. A curious incident occurred with the aquarium in which there were specimens of *P. corneus* and the only specimen of *Paludina vivipara* I have been able to find. One night five of these snails including the *Paludina*, were dragged out of the aquarium and devoured by a rat. The aquarium is now removed to a safer place for protection from further invasion."

course on the Protozoa, while I continued a course of twenty lectures on Heredity. At Christmas, 1915, the loft of Barracks 6 became available for educational purposes, and the first weeks of the new year saw the conversion of a corner of a somewhat dilapidated hay-loft into a biological laboratory. By the end of January the accommodation for eight microscopes was provided. The necessary glassware and reagents were got in from Messrs. Leitz, and practical botany, of a necessarily elementary character, was started with twenty-one students.

In the following terms regular lecture courses in botany were given by myself, and the corresponding practical work was of a more thorough and extensive nature. The ground covered has been as follows:—Bryophytes and Pteridophytes (Summer, 1916); Gymnosperms (Autumn, 1916); Algae (Lent, 1917); Angiosperms (Summer, 1917).

". . . . the camp is made up of students from the public schools and universities." Ruhleben, Germany.

Report of Biological Activities in Ruhleben. From Michael S. Pease, B.A., Cantab., dated August 14, 1917.

"The first outward sign of biological activity in Ruhleben appeared in the spring of 1915, when Dr. A. E. Lechmere started a series of lectures on Elementary Biology. These were held in a disused betting-booth, and attended by half-a-dozen enthusiasts. In the summer, one of the grand stands was set aside for lectures, and Dr. Lechmere continued his

Spirit material was kindly presented to us by Prof. A. C. Seward, Dr. Darbishire, and Prof. Tubeuf.

We are indebted to Prof. Engler for a weekly supply of flowers from the Kgl. Botanischer Garten, Dahlem, for the systematic course. A pond within the race-course has been our source of fresh material for Algae and Protozoa.

The equipment of the laboratory has been continuously improved. A cable was laid on to give us electric current day and night. A transformer

was constructed on the premises, and each microscope provided with a 4-volt lamp for work after dark.

Several electrically heated incubators were also fitted up, and last Easter permisson was obtained to put in sky-lights and to fit up a water-supply.

With the possibility of a continuous source of heat, we were able to consider paraffin embedding.

Serious difficulty has been encountered in the construction of a satisfactory automatic electric thermostat for the embedding bath. We have recently secured a Hearson's capsule, and an improved model of embedding bath is now being made. Nevertheless, a considerable quantity of material has been satisfactorily imbedded, and a beginning is being made with the technique of Cytology. Last Christmas a first-class microtome (Minot model by Leitz, cutting to 1a) was purchased, but the rigours of the winter, followed almost instantly by those of a phenomenally hot May and June, made it impossible to start microtomy until recently.

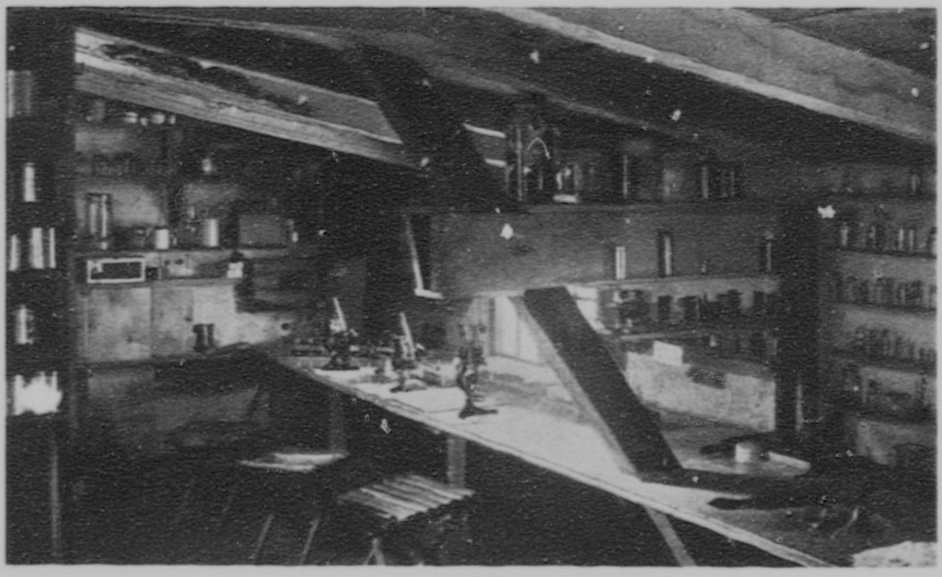
It has been impossible to do practical work in Zoology, but Dr. Lechmere's lectures have continued to draw an enthusiastic band of students. His course so far has covered:—Protozoa (one term); Coelenterata (one term); Vermes (three terms); Echinodermata (one term).

And he has just finished the second term of his course on Mollusca.

At the same time he has also started a course on Invertebrate Embryology. Animal physiology has been very exhaustively treated (again only theoretically) by Mr. S. R. Edge, B.A., Cantab. Practical instruction has been given in the testing of agricultural seeds by Mr. A. Hill, B.Sc., Aberdeen, and for this course a large electrically-heated incubator was constructed.

This summer, new space was allotted to science, and this was made use of to accommodate a library, shared jointly by the biologists, chemists and physicists. The library provides a seating accommodation for working, and contains over 500 volumes, mostly the property of the science staff, but many also supplied by the Board of Education.

At the present "Nature" is at once our only periodical and only link with scientific activity outside."



View of the laboratory, Ruhleben Camp, Germany.

LOCATION OF TOWNS AND VILLAGES IN THE OTTAWA VALLEY.

By J. Keele, Ottawa.

(Continued from page 70).

In the October issue the writer stated that the exact location of villages in the valley of the Ottawa was determined either by water power or by points on former routes of transportation.

In most cases the land in the vicinity of the sites selected was of such a surface character that it was suitable for the requirements of habitation and the growth of villages into towns. In other words the topography in general presented no serious problems to municipal engineers in the matter of street grades, drainage, bridging, or water supply.

The growth of a village has been influenced by its location and environment. In most cases the growth around the original mill site was due to its becoming a trading centre for the surrounding farming community. In some cases a basic industry like lumbering and saw mills furnished the mainstay of the village while trading was secondary.

The construction of lines of railway connecting up these towns and villages with one another and with the main highways of commerce was a later development bringing in the industrial stage, when towns competed for industries to come and locate within their limits. At this stage favourable location with regard to natural resources and to land and water transportation were of importance; although other considerations which had nothing whatever to do with geography, such as offering a bonus to manufacturers, was taken into account in the decision.

A short sketch of the physical geography of the region in a general way has been given so that we are now in a position to consider a few localities in more or less detail. From what has been said, however, we see that the character of the surface has had considerable influence on the population, the flat clay land being the most important in the development of large communities while a great part of the upland sets its face rigorously against any attempt at cultivation and human habitation. Between these two extremes there is much good agricultural land as well as considerable debatable ground where such considerations as, whether forest would not be more economic than cultivation, enter in.

RIDEAU RIVER AND TRIBUTARIES.

The Rideau river drains a group of lakes of the same name situated in the less rugged portion of the upland underlain by the belt of crystalline rocks which extend southward to the St. Lawrence between Brockville and Kingston. On emerging from the lakes and the upland it flows over a drift covered plain-like region, where it has cut down to bedrock only at a few places. At most of the points where it flows on bedrock there are rapids or falls, the most notable being the last one on its course where it tumbles from a cliff into the Ottawa river at Ottawa.

The Rideau is a good example of a recent drainage channel almost entirely controlled by the character and distribution of the glacial drift and not by the underlying bedrock. It would normally flow eastward and enter the Ottawa river much further down than it does but on encountering the belt of morainal ridges which stretch from Ottawa to Prescott it is diverted toward the north.

It is stated that in the year 1793 three brothers named Burritt from Connecticut explored the Rideau river, probably coming in by way of Brockville from the St. Lawrence route, and took up land on its banks. The point on the river known as Burritts Rapids which may have been their original location never developed into a village, but Merrickville which is situated on a fall about 7 miles above this point did grow to be a village.

A canal was constructed primarily for military purposes by the Royal Engineers during the years 1828 to 1832, which utilized the Rideau lakes and river to their full extent. The long stretches of quiet water with only an occasional obstruction where locks had to be built made it especially favourable for this purpose. A series of three locks was necessary at Smiths Falls, a point which afterwards grew to be a town of some importance.

The western limit of marine clay sediments appears to occur here, but there is no large area of it in this locality, the clay being confined to a few patches along the Rideau river. Glaciation seems to have removed a good deal of the older soils from the level region east and north of Smiths Falls and much of the land is poor in consequence as the soil consists only of a thin sheet of sandy drift overlying the bed rock. The bed rock in that area is mostly badly creviced magnesian limestone through which the rain water disappears quickly from the surface, so that it becomes almost barren during dry spells.

Land of this character does very well for fruit trees or for wood lots as a source of fuel and other merchantable timber but is of little value for cultivation of crops. Its chief use in farming is to furnish pasturage for sheep and is well adapted for this purpose in moist weather when the grass is good.

The first railway to enter the Ottawa valley started from the main line of the Grand Trunk at Brockville and was designed to serve the towns of

Almonte, Arnprior and Renfrew, as well as Ottawa. The first portion of the road was, therefore, built northward to Smiths Falls and from this point lines were extended both east and north to reach their objective stations. A branch line was also built westward from Smiths Falls to Perth about the year 1850.

Later on, the Ontario and Quebec railway projected from Toronto to Montreal acquired that portion of the line between Perth and Ottawa, and finally the whole became part of the Canadian Pacific Railway system. Smiths Falls was made a divisional point in the system, and a location for railway car works and so became a place of residence for a considerable number of railway employees.

A point like this on a navigable waterway and with such good railway connections had considerable advantages for manufacturing purposes as the various industries could assemble raw materials and distribute finished products with ease; and we find that several manufacturing firms availed themselves of these facilities.

It would appear then that Smiths Falls owes its development as a centre of population more to railway and manufacturing influences than it does to farming.

The town of Perth is built on the Tay river, the largest tributary of the Rideau river. It is situated on the Canadian Pacific Railway about eleven miles west of Smiths Falls.

The town site and surrounding country was occupied by settlers, principally made up of soldiers from regiments disbanded at the close of the Napoleonic wars. These were offered a free passage, 100 acres of land, some farming implements and a limited amount of rations by the British Government if they would locate in Canada instead of the United States where so many were going at that time. The townships of Bathurst, Drummond, and Beckwith were surveyed with this object in view and the first company of settlers arrived in 1816. A site for a village was chosen which would be a centre for the community and doubtless the factor which determined this site was the waterfall on the Tay river where a saw mill and grist mill could be erected later on. The settlers who chose to locate in this district were especially fortunate as most of the land carried a deep fertile soil and in time it became one of the best agricultural districts in the Ottawa valley. The farms along the Scotch Line road for about six miles out of Perth in a southwesterly direction are especially productive and the appearance of the dwellings and farm buildings are visible evidence of prosperity.

The Perth district is on the boundary between the hilly country underlain by granite gneisses and other crystalline rocks and the nearly level valley plain which is floored with sandstones and dolomites.

The granitic rocks are mostly covered with a fairly thick sheet of boulder clay, so that glaciation seems to have improved this district for agricultural purposes at the expense of the district further east where the soils are very thin. The movement of glacial ice in this region was from northeast to southwest. The boulder clay left from the glacial ice did not reach very far to the west of Perth and an almost barren region as far as agriculture is concerned is encountered beyond the clay limits, and we do not find another point of importance on the railway line until coming to Peterboro a distance of 120 miles, where clays and limestones begin again.

Perth has developed a stone architecture that gives a certain distinction to the town, on account of the opportunity offered by the beds of sandstone in its immediate vicinity which are easily quarried and make a good enduring building stone. This sandstone formation furnishes two varieties, a white or light grey stone and a mottled pink and grey stone. The Anglican church is a good example of the use of the white stone as well as being one of the best pieces of Gothic architecture in any of the towns of the region. The C.P.R. station is an example of the use of the mottled stone. Besides its local use these building stones have been quarried and shipped to outside points, some of it going as far as Montreal, the canal connection to Perth making it economical to ship heavy cheap material such as stone. There was considerable mining activity in the past in the neighborhood of Perth particularly in the township of North Burgess, which assisted to some extent in its development as a centre. Mica, phosphate, and iron were the principal minerals that were mined in this locality.

Several of the residences in Perth were built by farmers of sufficient means who desired the social advantages offered by the town for the remainder of their years, leaving the business of farming to be carried on by the next generation.

Of late years the town has been augmented by various industries which include woolen mills, chemical and drug and soap works, and a shoe factory, but this was after it had attained a considerable growth due to the productivity of the surrounding land.

MISSISSIPPI RIVER AND TRIBUTARIES.

The Mississippi river drains a perfect maze of lakes situated in the Laurentian upland in Frontenac and Addington counties. A reference to the map will show the curious course the river takes after it

issues from the upland. Instead of continuing to flow eastward and becoming a tributary of the Rideau river it actually flows toward the northwest and enters the Ottawa river about four miles below the mouth of the Madawaska river where the town of Arnprior is situated. The erratic course taken by the Mississippi river is owing to its entering a pre-glacial depression which existed almost along the contact of the Paleozoic rocks of the Ottawa valley plain and the granitic rocks of the upland and which lay nearly at right angles to the course of the upper part of the river. In thus shortening its course the river had to drop a vertical height of 200 feet in a distance of 25 miles in reaching the Ottawa. It accomplishes this by a series of falls between comparatively still stretches of water. The towns and villages of Galetta, Pakenham, Almonte, Appleton, and Carleton Place, named in order from the mouth of the river up are situated on these falls.

One of the principal features of the trough occupied by the lower porton of the Mississippi river is the large lake known as Mississippi lake. One of the first white settlers in 1823 wrote that "some of the islands of this lake were inhabited by Indians whose hunting ground is on the north side of the lake and who are far from being pleased with the encroachments our settlers are makng on their territory." This lake is now a popular resort in the summer for the people of Carleton Place and other towns.

The first railway line into the Ottawa valley projected from Brockville, Smiths Falls and thence to Renfrew, follows the valley of the Mississippi river and served all of the above points except Galetta as the railway line diverges to Arnprior before reaching that point.

The marine stoneless clay is found in the valley of the Mississippi river as a continuous sheet from Almonte to Pakenham but is restricted to a narrow strip owing to the proximity of the Laurentian escarpment along the west and to low ridges of Paleozoic limestone, whose flat tops are nearly bare of soil, along the eastern side of the valley. The Laurentian upland, however, just west of Almonte does not prove such a barrier to cultivation as it does at other parts of the region by reason of the broad bands of crystalline limestone occurring here which carry productive soils. The surrounding diversified farming lands whose business is tributary to Almonte as well as the woolen industry which is established there contributed to the development of this very picturesque village.

In 1820, two brothers named Morphy located at what is now known as Carleton Place but then as Morphys Falls, and in the same year a Mr. Coleman purchased the waterpower at that point. The condition of the purchase was that within six months after the date of sale a bushel of wheat should be ground in the mill about to be erected. This was the first mill on the road from Perth to Bytown (Ottawa).

When the Canadian Pacific railway constructed its transcontinental route it included part of the old line from Brockville to Renfrew in the system. The point at which the transcontinental line coming from Montreal through Ottawa joins the old line is at Carleton Place, which became a junction point. A few industries took advantage of the transportation facilities offered at Carleton Place, but the chief business is in supplying the needs of the surrounding farming population. One of the minor industries of Carleton Place is lime burning, the stone used being the white crystalline limestone which occurs in large masses a few miles west of the town. The burned lime or quicklime is shipped to many distant points.

The Clyde river is the principal tributary of the Mississippi and lies wholly within the Laurentian upland, in the county of Lanark.

The Lanark settlement was an extension of the Perth settlement to which reference has been made. It was occupied by immigrants from the western part of Scotland in 1820. An old record of this settlement states that "the face of the country here is more diversified with small hills than in the Perth settlement but where the soil is not encumbered with rocks it is equally good. In a convenient spot on the banks of the river a village was laid out and a government store erected. A saw mill and a grist mill were erected soon after the village was laid out, and timber being abundant in the neighbourhood, one inch board can be procured at six dollars a thousand feet."

The convenient spot was the falls on the Clyde river about two miles above its junction with the Mississippi.

Although the village of Lanark draws its chief business from a district situated wholly within the area of Archean rocks and is the only village in the region under discussion that does so, it should be noted that a great deal of bedrock in this locality is crystalline limestone and that the boulder clay sheet covers most of these and the accompanying granite rocks in the neighbourhood. At a distance of about 10 miles north or west of Lanark a rugged country absolutely devoid of clay and with very little crystalline limestone is encountered where agriculture ceases or becomes sporadic.

The village of Lanark was long famous for the excellence of the products of its woolen mills, but these were accidentally destroyed by fire a short time ago and the industry moved to Perth.

Intelligent administration on the part of the local authorities and a convenient supply of good materials have made this locality famous in another very desirable way, the construction and maintenance of good roads.

Crushed crystalline limestone is the chief road material used but there is an abundance of gravel in the glacial kames and eskers which are one of the most interesting features in this locality.

THE MADAWASKA RIVER.

The Madawaska river is the largest tributary of the Ottawa within this region. The greater part of the Algonquin Provincial Park with its innumerable lakes, and large portions of Haliburton, Hastings, and Renfrew counties are drained by this river and its branches. The Madawaska river, therefore, lies almost wholly in the rugged Laurentian upland and only emerges from it when within about 10 miles from the Ottawa. In this part of its course it flows across a plain covered with stoneless marine clay.

Notwithstanding the length and volume of this stream and the extent of territory which it drains there is only one town on its course, viz. Arnprior, situated at its mouth and one village, Bancroft, in Haliburton county on the York branch. Calabogie, Combermere, and Barrys Bay are small trading points situated on its course but none of these ever attained the size of incorporated villages.

Traditions concerning lumbering operations attach more frequently to the history of the Madawaska river than to any other stream in the region on account of the large area of its drainage basin, the vast groves of red and white pine it contained and the turbulence of its waters.

As long as the pine lasted lumbering was the business of the river from its headwaters to its junction with the Ottawa and everything else was subsidiary to it.

The origin of Arnprior is part of the story of the last Laird of McNab, a picturesque character who conceived the bold if ill-fated design of repairing his broken fortunes and re-establishing the once powerful clan of which he was chief, by a settlement on the shores of the Ottawa. Following an agreement with the Government of Upper Canada, the meaning of which was later to become a subject of fierce dispute, McNab arrived in 1825 with the first of the settlers to be located by him as tenants in the township which perpetuates his name. He proceeded to erect a dwelling on the high shore of the Ottawa river just west of the mouth of the Madawaska, a site of much dignity and natural beauty now embellished by the fine grounds and residence long occupied by the late H. F. McLaughlin.

The chief's house was according to Bouchette in his British Dominions, "exceedingly comfortable," and he extolls "the well furnished board and the cordiality of a Highland welcome" as mitigating for a period the hardship of a canoe trip down the Ottawa in the course of which he became a guest of the "Noble Gaël."

The circumstances of McNab as landlord to a few scattered settlers were not such as to entail the growth of a village about his residence which was moreover subsequently removed to White lake, 10 miles west of Arnprior. He had induced, however, three brothers named Buchanan, kinsmen of his, to join his little colony and create a sawmill at the falls of the Madawaska. A hamlet thus came into being and was by the Buchanans named Arnprior after their family seat in Scotland.

At that time and for many years after the business of sawing lumber at this region was of no great importance, except as regards local needs. Pine timber for export was hewn in the bush and floated down the rivers to tide water in rafts. The business done at the Arnprior sawmills gave little promise of the volume it was afterwards to assume and an English firm to whose hands it passed from the Buchanans, closed down the mill. We must suppose the village, therefore, to have been almost deserted when in 1852 the property was purchased by Daniel McLaughlin, who became also the owner, then or subsequently, of much adjacent land formerly owned by McNab.

With this event the permanent growth of the place may be considered to have commenced. Two mills were built at the falls and supplied from the vast quantity of pine logs which for many years were floated down the Madawaska. With the expansion of the business which has continuously been owned by the same family, large steam driven mills were erected on the Ottawa and with the sources of supply made available by that great river and its tributaries the firm's operations reached dimensions which classed it as one of the most important producers of pine lumber in the world. Lately the water mills were removed as the Madawaska has ceased to be an important factor in the log supply and the water power has temporarily gone into disuse. For some years the mills have been supplied largely from the firm's lumber holdings in the Petawawa, Black river and Kippawa districts.

From this brief outline it will appear that although Arnprior is situated in a fertile highly cultivated district its origin, growth, and the occupaton of its people have a closer relation to the forest than to the farm.

The natural resources of the district surrounding Arnprior consist of an extensive area of flat clay lands, which have great agricultural possibilities.

The clay extends about 10 miles west of Arnprior and about 6 miles to the northwest. Beyond these limits certain patches in the upland underlain by crystalline limestone are capable of cultivation.

Brick and tile are made from the upper part of the marine clay in the banks of Dochert Brook just outside the town limits. The tile are extensively used for underdraining the clay lands in the neighborhood and are also shipped to distant points for this purpose.

This is an example of supplying geographic needs by using the natural resources at hand.

Outcrops of limestone both of Archean and Paleozoic are abundant in this vicinity. The former is a banded grey and white marble which was used for the interior of the senate and commons chambers in the house of Parliament at Ottawa destroyed by fire a few years ago.

(*To be continued*).

NOTES AND OBSERVATIONS.

A CORRECTION. In a list of amphibians and reptiles of the Ottawa, Ontario, district, published in the September, 1918, number of THE OTTAWA NATURALIST, *Pseudacris triseriata* should be *Pseudacris feriarum*.

CLYDE L. PATCH.

THE NESTING OF THE BLACK-CROWNED NIGHT HERON IN SOUTHERN ONTARIO.—In answer to W. E. Saunder's query as to the nesting locality of the Black-crowned Night Heron in western (southern) Ontario, I think it well to record some evidence that I obtained in 1909 at Detroit, Mich. In the first week of May of that year I was presented with a female bird that had been killed by a Mr. Meredith, of the New York Coal Co., in the preserves of the Toronto Shooting Club on the Indian reservation, Walpole Island, St. Clair Flats. Mr. Meredith stated that they were very common and nested on the ground in such numbers that he could have gathered a bushel of eggs with ease. This species usually nests in trees often in company with Great Blue Herons, but ground nesting has often been recorded for the species. Without doubt this was and may still be one of the important nesting colonies of this heron in the section. Herons feed at great distances from their rookeries and it is not improbable that the London specimen hails from this one.

P. A. TAVERNER.

A BIRD CAUGHT IN A TREE.—Last summer while walking on the north side of Watson lake, British Columbia, I heard a woodpecker give a startled or pained cry, and, on approaching, found it caught by the neck in the crotch of a tree, and clinging vigorously to the tree at a point above its head. Watson lake is on the somewhat arid Fraser plateau of the interior of southern British Columbia. The country is monotonous, being rather flat but slightly rolling, with interspersed jack pines, poplars and but few other trees, with small lakes and meadows. Many of the lakes are saline.

The bird, so far as I am able to judge, was some species of sap sucker.

I took hold of the bird and with some difficulty unclasped his feet from the tree, at the expense of a slight prick from one of his talons. Lifting the bird I was surprised to find that his head was not held tightly in the crotch, but was simply loose in it—the bird being apparently too greatly frightened to let go with his feet. In fact, had he done so, a fall of his body might have either wedged his neck in the crotch or broken his neck.

After carrying the bird some distance, while thinking of his disposal, I concluded that I did not care to skin him in order to make a museum specimen. I released him, and to my surprise, instead of falling or flying a short distance and gathering himself together, he flew strongly out of sight.

HARLAN I. SMITH.

BIRD MIGRATION.—Just what power birds possess in shaping their migration flights and what directs the course they persue is not definitely known. It has been attributed to their instincts. They never fail to reach their ultimate destination. In a very interesting article which appeared some time ago in the *St. Louis Republic*, the writer, a scientist, discussing the subject of bird migration, considered the idea of birds flying in the rarified atmosphere three miles above the earth's surface, and being guided by the topography of the country at night when flights are mostly made, as being somewhat erroneous. He was of the opinion that on their long flights birds are guided by the stars, and he supported his theory by citing as evidence the fact that "when the stars were obscured by clouds the flocks become bewildered and seek the ground." Birds possess the sense of perception and orientation in a much greater degree than man and under like conditions, as a

traveller at night makes his observations and directs his course by the stars, so it seems reasonable to assume that birds may do the same. It has been observed in Bermuda that after very dark nights, large numbers of migrants are found all over the islands. The first clear night they are off again.

C. B. HUTCHINGS.

GANNET COLONIES.—I was much surprised in reading the May issue of THE OTTAWA NATURALIST to learn that, so far as is known to ornithologists, but two colonies of gannets exist in eastern North America.

Mr. P. A. Taverner, to whom readers of THE NATURALIST are indebted for a very interesting description of "The Gannet Colonies of Bonaventure Island," I am sure, will be quite pleased to learn that there is yet another colony of gannets that has escaped the ravages of the ruthless hunter.

On the south coast of Newfoundland, near Cape St. Mary's, there is quite a large rookery, situated on a very inaccessible, detached rock, standing, separated from the main land by a narrow chasm.

This asylum stands with its feet in the wild surf and rears its head fully two hundred feet above the sea. Here the gannets "secure from guns and men," congregate in thousands, and undisturbed bring forth their young.

As a lover of the defenseless things of nature I am delighted to see gentlemen like Mr. Taverner making so brave an effort to bring us into more intelligent and sympathetic relationship with the humble things that shame us by living their little lives in such perfect harmony with the will of the Divine Creator.

I hope, at a later date to submit an account of the rookery above referred to.

ARTHUR ENGLISH, ST. JOHNS, NFLD.

ORIGIN OF PLACE NAMES IN OTTAWA VALLEY. —*The Name Gatineau.* Referring to Philemon Wright's farm Gatenoe (Keele, OTTAWA NATURALIST, October, 1918) Wright gives its location as "4 miles up a large river called Gatenoe". He elsewhere uses the spelling Gateno.

Nicholas Gatineau dit Duplessis resided at Three Rivers from 1650 to his death in 1683. He traded with the Indians on the St. Maurice river, whose source is near that of the Ottawa and Gatineau. He seems also to have traded on the Ottawa river.

It is an open question whether the river or the point at the mouth was first named for Gatineau. Mr. Sylvain, Library of Parliament, quotes Mr. Sulte for the statement that Gatineau traded with Indians at Gatineau Point, which became known as the "Pointe de Monsieur Gatineau."

The Name Britannia. Philemon Wright began Britannia farm 1804 and had cleared 700 acres by 1823. Through the farm it is stated in Crown Lands Committee Report, 1824, there is "a good road running in a westerly direction and (it) also has two fronts upon the great road leading from the Columbia falls to Lake Chaudiere."

The great road referred to was built in 1818 when "we laid out a road to the lake Chaudiere, seven miles in length, called Britannia road."

Columbia farm and Britannia farm apparently commemorate Wright's native country and his parents'.

Is there any connection between this Britannia farm and road on the Quebec side of the river, and Britannia on the Ontario side, concerning which, in Murray's British America, 1839, it is stated:

"Some distance above Bytown is Britannia, a valuable property with extensive mills, finely situated near the beautiful rapid Des Chenes."

R. DOUGLAS, *Secretary*,
GEOGRAPHIC BOARD, OTTAWA.

PROGRAMME OF WINTER LECTURES, O.F.N.C., 1918-1919.

December 10, 1918—"Natural History and Affairs in the Tropics." Major J. L. Todd, Board of Pension Commissioners, Ottawa, lately Professor of Parasitology, McGill University.

January 8, 1919—"New Plants for Old." Dr. M. O. Malte, Dominion Agrostologist, Experimental Farms Branch, Dept. of Agriculture.

January 22, 1919—"The Development of a Design." Dr. E. Sapir, Head of Division of Anthropology, Geological Survey of Canada.

February 5, 1919—"The Game Resources of the Yukon." Mr. Frederick J. Lambert, formerly of the Alaska-Yukon Boundary Survey.

February 19, 1919—"The Work of the Dominion Astronomical Observatory." Dr. Otto Klotz, Director, Dominion Astronomical Observatory.

March 5, 1919—"Our National Parks." Mr. J. B. Harkin, Commissioner of Dominion Parks.

March 18, 1919—Presidential Address. Dr. C. Gordon Hewitt, Dominion Entomologist and Consulting Zoologist.

At the conclusion of this address the Annual Meeting of the Club will be held for the purpose of receiving reports, election of officers for the ensuing year, and the transaction of other business.