

rus, Cape Breton, is one specimen which seems to merit special notice.

The weight of the specimen is  $2\frac{1}{4}$  lbs. It is an ore of iron, called by Dana *Magnetite*. It very much resembles some of the magnetites of Nictaux. It is evidently part of a bed in metamorphic rocks. The rocks of the region where it is said to have been found are of lower silurian and pre-silurian age (Archæan).

The specific gravity of the Cape Breton magnetite is . . . . 4.3

That of Moose River. . . . . 3.6

Of Blomidon and Extension rocks. . . . . 5.0

The Nictaux and Moose River magnetites are of middle silurian age; of Blomidon, post triassic.

ART. VII.—ON THE DWELLINGS OF THE MUSKRAT AND BEAVER OF NOVA SCOTIA. BY J. BERNARD GILPIN, A.B., M.D., M.R.C.S.

(Read April 11, 1881.)

THE constructive mammals are very few, throughout the world. To say nothing of the burrowers which construct winding holes, or galleries by digging beneath the earth, the most part, are content for a home with what nature gives them; a hollow tree, a den amongst rocks, or a form hollowed by the possessor itself, from the thick grass, is sufficient for their nests, from the strong lion down to the timid hare. And so it was from ancient times, as the bones of the lion and cave bear wrapt with the gnawed relics of their victim, in one stoney mantle, still mark the feasting spot and home of their all but mythic forms. In opposition to this, our Province of Nova Scotia possesses two mammals, each of whom construct dome houses, standing in and out the water still, in our Alpine lakes, and broken streamlets, and which now unseen except by the woodsman, the hunter or Indian, may be readily visited and studied by the naturalist and student. I have thought the members of the Institute would be interested in this paper, in which I have given a few not new facts, but facts old enough, but looked at with new eyes and in perhaps new combinations of scene and climate. The muskrat, (Fiber

zibethicus, Lim.) is very common over the whole northern part of North America. Formerly he was classed with the Beaver, but lately more justly, with the sub-family Arvicolinæ, or field rat. Still his habits, his tail, and his hind foot so allied to the lobipes in the class of birds, and webbed by ciliated hairs, causes him to stand prominently forward in any classification. But it is of his building habits, I wish this paper to be. In our Province they are divided into those who live in holes, and those who build. The far greater number live in holes ; not from any difference in habit, or form, or species, which I could discover, but from an instinctive adaptation of external circumstances. In running streams connected with our estuaries, they burrow holes in the muddy sides of the stream, the mouths of which are submerged at high tide, and probably bared at ebb. These burrows must slant upwards, so that the extreme end should lie above high-water mark, and here he rudely constructs his sleeping form, lining it with dried grass. The tides are too rapid, and the difference of level between high-water and ebb, too far as well as the angle of the bank-slope too great for him to found a house. Hence though he abounds any where along the deep estuaries of the Province connected with Bay of Fundy tides, his house is rarely seen. A few years ago one stood solitary in Steel's pond, in the suburbs of Halifax, whilst a pair had sought refuge in Griffin's pond on the Halifax common, making no houses, but living in the drains and giving amusement to the many loiterers there about, in watching their fluvial gambols, ending with a dive, preceded by a splash of water caused by a sharp slap of their tail upon its surface. Here we had the dome builders, and the dwellers in holes close before us for our study. I think I saw a dome near Marshal's on the second Dartmouth lake, and again one at Yarmouth. But in all the wide Annapolis valley where they abound, I know none save in Winslow's lake, on the top of the north mountain, as that huge barrier of Triassic trap elevated to about six hundred feet, and bounding the whole north-west or Bay of Fundy edge of our Province, is called. There is a narrow valley in the centre ridge of this whole formation, with hills on either side ; a few

lakes or rather large ponds naturally are formed here from the rains of the adjacent hills, one of which is in Winslow's lake, about four miles from Digby town. This alpine lakelet of about eighty or one hundred acres, hidden by sterile hills of columnar trap, lightly fringed by spruce, fir and pine, scrubby bushes, its shores paved with rugged trap boulders, and its clear waters fringed with rushes, affords a secluded home for the muskrats which have colonized it for years. A wounded scoter unable to rise the hills betwixt the Bay of Fundy and the Digby basin finds his rest there, and an annual flock of spirit ducks (*B. albeolæ*.) the gaudy purple male, dusky female with obscurely marked young, always during autumn make a halt there. Save an idle boy from the town, or prying naturalist added, no others disturb his quiet. We visited the lake in Nov. 11th, 1880, conveying a canoe over the mountain with us; a cold November wind was curling its waters into tiny wavelets, and we soon reached their domes; about twenty yards from shore, in two feet water, and standing amongst the thick rushes and tall grasses. We found cones from two and a half to three feet high, and about four feet diameter, formed of sods of water grass in masses of five or six inches, conical heaps of sodded grass. The lake may have contained from twenty-five to thirty within its borders. The grass they were constructed from was very abundant, growing at the lake bottom, and spread in heaps and festoons, along the lee shores of the lake, being torn by the roots from the shallow waters by the autumn gales. Separated from its sods and wreaths, it resolved itself into distinct rootlets, very fibrous and about three inches long, surmounted by a tussock of grass with leaves about three inches in length. My friend Dr. Somers classified it for me, as (*Eriocaulon septangulare* Pipeworth). Our canoe was soon grounded upon one of these grass made conical heaps, and my son with his paddle tore off its head. After tearing away about a foot, we came to a cavity roughly formed by the body of the muskrat, lined with grass, and scarcely double his own size. It looked in its careless roughness like the nest of the flying squirrel found often in the interior of a mass of grasses and moss gathered in the forks of a pine tree. Proceeding in our de-

struction, we came to a hole on one side, plunging the paddle into which, we soon came to the waters beneath. Here now was the whole design complete; a dry bed about a foot and a-half above the surface of the lake, covered by about a foot of roof, and having a submarine approach from below, into which the owner entered by diving. The whole cone was solidly constructed from the bottom of the lake, leaving only a narrow hole from the bottom to the nest. The inmate must breathe through the loose top of the cone, as it stands surrounded by water. In another larger cone we pulled to pieces, we found two cavities unconnected with each other, but each having a separate passage to the water below, although the majority were symmetrically conical, yet we found two uneven, one with a perpendicular side, most probably unfinished, as they had not done building for the winter. In building they must place their material on the bottom of the lake, where it soon becomes water sodden, and having a passage open, built up above the surface of the water. They build at night and very rapidly, as one is surprised at seeing cones standing out of the water where none were the day before. November finds them well housed for the winter, and as the ice is never frozen so soon where rushes grow, they no doubt can keep water holes open around them during December, but towards March their houses—the ice often at that period attaining a thickness of two feet and a-half,—are covered by at least two feet of snow. We must suppose that during this period they hibernate as it is impossible for them to reach the surface from beneath the ice; towards the end of April the spring freshets elevate and sweep the ice to the lee side of the lake, carrying with it all their houses, relegating them back to their summer holes, where they breed and raise their young—remaining all summer. Other climates, the warmer ones, where he is said to be common, must modify all his habits, perhaps his building instincts; but in our Nova Scotia variety, we find him almost as marine an animal as the seal, never seeking the land for choice, save for rest, fairly holding his own as the country becomes populous, and getting his dry nest above water, by the strictest and most instinctive means.

Our other constructive mammal, the historical beaver, differs

widely from the muskrat. A far more powerful frame, armed by powerful teeth, more terrestrial in its habits, and constructing larger and more durable houses, and of stronger materials. He constructs on running streams, which he has already dammed across, thus giving to his work a perpetual head of water. It is apart from this paper to describe these dams, accounts of which have come down to us clothed with magnificent exaggeration. Yet no one can stand over and inspect the workman of them as they appear on the small streams of our Province, where the labor is little and the natural obstacles of water flow few, but to confess that the simplest truth is above all exaggeration, and the design of instinct labor, or the appearance of it at least, equal, if not beyond, that adaptation of labor and material to different obstacles to be overcome, that is supposed belong to pure thought. The adaptation of beaver work to broad running streams, narrow streamlets and sluggish water courses, to rocky bottoms, or mud-timbered banks, even still remaining in N. Scotia, is worthy of a paper by itself. Sweeping softly in your canoe over a slight expanse of the many head waters of the Sissiboo river, slowly falling towards the Bay of Fundy, you find the stream tied by a beaver dam some half mile ahead of you, and almost immediately you pass a grey granite rock sloping into the stream. There upon the down stream slope you find a very flattened cone like an inverted saucer of white and peeled sticks in endless confusion, thatching its shallow convex roof. One side, the upper rests upon the grey rock, the other descends beneath the water. This one had two processes, slightly elevated but still thatched, dividing, as it were, the mass entering the water so as to make two ridges running into the stream. The whole was built on the down stream slope of the rock to prevent it being carried away by the ice. Were it not for the milk-white and peeled sticks standing everywhere outwards, it looked like a cart of rubbish shot down a slope. A sweep of the paddle and the canoe grated upon the sticks, and we saw grasses, clay and moss betwixt their interstices. In another dome which we opened from the top by our axes and hands, we cut through two feet of layers of clay, dried hay, a few stones and mosses; we then came to a narrow, sloping shelf edge, around a

central hole. The angle of slope was about fifteen degrees, and about one foot from the water. It was neatly lined with grass, far more neatly than the nest of the muskrat, and the projecting ends of the white sticks into the sides were neatly gnawed smooth. Through the central hole we could see the water flowing beneath. The upper part of the shelf, near the sides of the dome, was much drier and better lined than the edge near the water, which seemed wet and damp. The galleries to the water in this one were two, and though we did not discover them, there must have been towards the rock side air-holes, as no air could come through the two feet of mud thatch. The height of the structure was about three feet; the long diameter about twelve, and the short one about six feet.

Another which I opened in Annapolis County in the head waters of the Allen river, was somewhat larger, and gave greater trouble in breaking open. I put my feet through the opening and stood upon the floor of the internal nest. It seemed so solid beneath me that I supposed it rested partly upon the shelving rock. The structure, both of these domes and the muskrats, will be understood far easier by the sketches and sections I show you. They differ in some respects from the description of Hearne, a most accurate describer, and others. Hearne speaks of them as eight feet in thickness and composed of many cavities, added afterwards to the central nest with which they communicated; other writers speak of double stories. Without for a moment disbelieving their accounts of buildings, modified by differences of climate, and of seclusion, found near the Polar circle, I can only describe the less pretentious dwellings of our own Province, where numbers are less, and complete solitude, bringing with its wants a greater need of concealment, is never found. On the bottom of the stream, near the houses, are narrow and deep grooves in the mud usually formed, these connect with the submarine water galleries. These marine trenches serve, when the water is low upon the stream, for the beavers to swim in without exposing themselves above water, and are, no doubt, caused by their excavating the mud and water grasses in building their domes. They are also very well seen about the muskrat houses. The Indians tell us that their trenches as well as the galleries on the way

to their nests inside are filled with sticks and twigs of various trees, gnawed very short, and dragged below the surface as a store-house of food for the winter, the beavers eating the bark. Indeed, the appearance not only of the thatch of their houses, but of the sticks and twigs of the entire dam, and others lying loosely around, all nicely peeled, well prove the truth of these assertions. Their cream-like color contrasted with the dark greens of the waving grasses, as well as their inextricable interlacing, joined to the trill of the falling waters, through their slender barriers, the lilly pads, coating the stream like a rich carpet, and the back-ground of rugged spruce firs wrapping the whole, as it were, in a frame, form a sylvan scene few forget. Our Indians tell us each house contains about five or six inmates ; all trees of the forest serve them in their barks as food, but the poplar wood seem the favorite rather than birches or maples. I have seen very large oaks stumped by them, but it is rare. The roots of the yellow water lily are a very favorite food, and are found growing in abundance around their houses. Though the beaver for its size is an extraordinarily cover-keeping animal, working by night, never seen by fair day-light, his presence is known only by his works ; the tree-stumps he leaves, or the houses he constructs, or his dams, sometimes sending back water for two or three miles, and cutting off working water from small sawmills erected in the woods. It is impossible from these prominent signs for him to retain his presence even in a half cultivated country for long. Indian hunters and the idlers will invade his charming home for the skin he wears, now very much fallen in value. I have known the indignant millwright tear up the dam that spoilt his water ; a settler waging war with him for flooding his meadows, and even the lumbermen sweep away with axes, the white-peeled, beautifully interlaced brush weir that stayed his log-rafts floating down to salt tide. Hence it is we will not have him long with us ; civilization will sweep his wood-gnawed thatch from him, as well as the less-laboured bark wigwam of the Indians, for so many years his idle neighbors. For many years they have become extinct from the eastern parts of the Province, that is, no skins are brought to market from these parts. In 1840, old hunter Hardwicke was supposed to have trapped the

last beaver in Annapolis County. A few years afterwards they recuperated themselves so that there were fifty skins brought to market during one year from one section of country alone, and within a range of twelve miles from Annapolis Royal I visited five of these stations in more or less stages of repair or desertion. They are now diminishing again, and notwithstanding their resolute attempt of holding their own, must inevitably fade away before that army of lumberers who invade their silent homes with crash of axe and loud cry to toiling cattle, and who, worse than all, by artificial dams, alter the level of the inland lakes, so that no sheet of water of any magnitude may be found that has not its waters deepened by dams to create a higher head, which is used at stated times in making artificial freshets, carrying with them the stores of lumber to the sea.

In this paper I have endeavored to put before you the dwellings of our two constructive mammals, the first of aquatic grasses alone, yet a beautiful example of instinctive labour, formed of the simplest materials and nearest at hand, regular cones—reminding us, with their submarine entrance, of the ancient lake dwellings of a prehistoric race, or of the conical ant hills of Africa, and certainly more perfect constructions than those still inhabited by the degraded Melanasian in Australia. The other constructions are of a less perishable nature, and with their dams constructed of timber, oftentimes nearly three feet in diameter, and varied so often by external circumstances that we must allow instinctive, in some cases, to precede skilled labour. No one coming upon the beaver dams still remaining in our forests, seeing heavy timbers felled by gnawing, to fall at a certain point; seeing upright posts standing in the running stream; seeing parallel logs gnawed to certain lengths and interlaced between these uprights, and the boles of living trees on the stream sides; and again, seeing the top horizontal bars loaded with stone to prevent them from floating, but must admit the narrow margin betwixt instinct and reason; and yet I give all these facts as to be seen by the idlers on the stream flowing down the Valley of Annapolis, N. Scotia.