

REPRINTS OF RARE ARTICLES ON MOLLUSCA, -- JOSEPH FREDERICK WHITEAVES, 1862, "On the Land and Fresh Water Mollusca of Lower Canada, ..." Canadian Naturalist and Geologist, vol. 6, pp. 452-459.

ARTICLE XXXIV. -- On the Land and Fresh Water Mollusca of Lower Canada, with thoughts on the general geographical distribution of Animals and Plants throughout Canada. By J. F. Whiteaves, F. G. S., Honorary member of the Ashmolean Society of Oxford, &c., &c.

(Read before the Natural History Society of Montreal)

Our knowledge of the land and fresh water mollusca inhabiting Canada generally, is very limited. The papers published by Mr. Bell and Mr. D'Urban in the Canadian Naturalist, together with another in the Canadian Journal by Mr. Williamson, contain all the published information on this subject. During the past summer, (1861) I have given the whole of my time to the investigation of these creatures in Lower Canada, and have obtained some additional information respecting them, which I propose bringing before the public in this paper.

The result of about five months collecting, principally in the neighbourhood of Quebec and Montreal, has been the discovery of nineteen species previously unknown in Lower Canada. They are for the most part well known New England species, which had not previously been detected so far north as Canada. Four of these are land, and fifteen fresh water shells. Of the land shells, the first is, it would seem, an indubitable alien, -- the *Helix rufescens* of Muller, a small snail, common enough in Great Britain, but which has not hitherto been found on the American continent. During my stay at Quebec, I found it living in abundance on that part of the plains of Abraham, known as the Cove Fields.

On the island of Orleans, another rare and beautiful little snail occurred to me, also a-

live, -- the *Helix capsella* of Gould, which has been hitherto only found in the state of Tennessee. Living about decayed logs, under small pieces of timber washed ashore, on trunks of smooth trees and under stones, -- observed only by the prying eye of the naturalist, -- occur sundry little snails, with cylindrical shells, the apertures of which are generally armed with teeth. Owing to the general resemblance of these shells to a small chrysalis, they have received the generic name of Pupa. Of this group two species (*Pupa simplex*, Gould, and *Vertigo Gouldii*, Binney) were previously known to inhabit Lower Canada from the researches of Messrs. Bell and D'Urban. To this number I can add two species, *Pupa armifera*, Say, which lives in quantities under stones on the plains of Abraham, and *Pupa contracta*, Say, which I found on the island of Orleans. The extremes

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of heat and cold, together with the dryness of the atmosphere in Canada seem unfavourable to the abundance of land snails. Hence we must not expect, perhaps, to find many novelties among the terrestrial mollusca, except among the small and critical species. But in this land of lakes and mighty rivers, which may almost be said to be unexplored, many interesting fresh water shells may yet be obtained.

Of the Unionidae, four species new to the published lists, have occurred to me in Lower Canada. Three of these are New England species, while the other was described from the Ohio River.

In the rivers, lakes and swamps, throughout the whole province, living in the sand or mud at the bottom, there occur small bivalves of the genera *Cyclas* and *Pisidium*. The chief difference between *Cyclas* and *Pisidium* is that in

Cyclas the two siphons are distinct, while in Pisidium the siphons are united into a single tube. The shell of Cyclas is nearly equilateral, while that of Pisidium is very oblique. These creatures are most abundant everywhere, but, comparatively speaking, very little is known respecting them. I have eight species not previously recorded as Canadian, while in the proceedings of the Boston Natural History Society, ten species new to science are recorded from the neighbourhood of Lake Superior. I would call special attention to these little shells; the fact of no less than eighteen species having been left out in all the catalogues of land and fresh water shells in the Canadian Naturalist, would seem to shew that our rivers and lakes may contain many rare and curious forms which have yet to be detected.

The remaining three species are *Limnaea columella*, *Planorbis armigerus* and *P. deflextus*; three fresh water snails, mostly critical forms, which have been previously overlooked. A most remarkable fact in connection with these fresh water snails, is that no less than nine species, a large proportion of the whole, occur on both the Atlantic and Pacific coasts. It has been held by many naturalists, that a lofty mountain chain will form an obstacle to the migration of species. Yet here we find that on each side of a mountain barrier, some of the peaks of which are as much as 15,000 and 16,000 feet above the level of the sea, and clothed with perpetual snow, such sluggish creatures as fresh water mollusca both can and do exist, the species in each case being identical. It would seem at any rate, that there are exceptions to this rule, and that the Rocky Mountains, for example, do not present an insuperable obstacle to migration.

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But if we call in the aid of geology, we shall find that, in all probability, this great mountain barrier is of later date than the fauna and flora existing around it. It should be stated too that the fresh water Pulmonifera are remarkable for their world-wide distribution.

The laws which affect the geographical distribution of plants and animals on the surface of our planet, are creating much interest just now in the minds of scientific men. Analogy it has been said favours the supposition that each species whether animal or vegetable was originally formed in some particular locality, whence it spread itself gradually over a certain area; rather than that the earth was at once, by the fiat of the Almighty, peopled as we at present behold it. The majority of our best naturalists are inclined to accept the theory that every species has originated from a common centre, and that numerous such centres were situated in different parts of the world, each centre being the seat of a particular number of species. In accordance with this view, Mr. Woodward, in his admirable treatise on recent and fossil shells, has mapped out the whole globe into molluscan provinces, each of which he supposes to possess a certain number of shells peculiar to it, and to be characterized by definite groups of this class of animals. Prof. Schouw, of Berlin, has carried out the same idea in the vegetable kingdom; but the views of these two gentlemen do not exactly correspond. Mr. Woodward divides the eastern part of North America into two regions, characterized, according to his views, by a peculiar assemblage of land and fresh water shells. One of these he calls the Canadian region, which includes the whole of Upper and Lower Canada;-- and the other the Atlantic region, which comprises all the United States east of the Mississippi valley. In Europe generally, even at the present date, but little is known respecting the natural history of Canada. Hence Mr. Woodward's data were hardly sufficient to enable him to generalize with much confidence. He remarks, "the country drained by the great lakes, and the river St. Lawrence possesses very few peculiar shells, and those mostly of fresh water genera. It is chiefly remarkable for the presence of a few European species, which strengthen the evidence of a landway across the Atlantic having remained till after the epoch of the existing animals and plants."

This landway I propose to say a few words

about presently. And here, it may be observed, that of all the land snails which are common to both sides of the Atlantic, very few can be proved

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to be really indigenous to America. Now, with one exception, all the shells of both Upper and Lower Canada also inhabit the Atlantic region. The little group of fresh water bivalves, to which I endeavoured previously to draw some attention, forms this exception. Eight species of *Cyclas* and three of *Pisidium* are, so far as we know at present, peculiar to Canada, and have never been found elsewhere. But these little shells require to be carefully searched for, and are very similar one to another; hence they may have been overlooked in the New England states.

When we turn to the sister science of botany, we shall find that somewhat different views of geographical distribution have been entertained. If we compare our knowledge of Canadian plants with Prof. Schouw's theories respecting the general geographical distribution of the vegetable kingdom we shall see that in Canada two botanical provinces meet. The first is the well-known Arctic flora, which is characterized by the abundance of mosses, Saxifrages, Gentians, species of *Silene*, *Arenaria*, and *Dianthus*; and also by the presence of many species of willow and sedges.

As defined by Prof. Schouw, the total absence of tropical families, a notable decrease of the forms peculiar to the temperate zone, and the prevalence of forests of firs and birches, form additional characteristics of this region. Geographically, it includes all the countries within the polar circle, with some parts of Europe, Asia and America to the south of it; as for example, the mountains of Scotland and Wales, Labrador, Greenland, and the northern part of Canada. Next we have what Prof. Schouw calls the region of *Asters* and *Solidagos*, characterized by the great variety of oaks and firs, the small number of *Umbelliferae* and *Cruciferae*, by the almost total absence of true heaths, which are

here replaced by *Vacciniums*, and by the abundance of the said *Asters* and *Solidagos*. Geographically it includes Mr. Woodward's Atlantic region, and the southern part of Canada. Thus, judging from the distribution of *Mollusca*, Mr. Woodward thinks that Canada should rank as a distinct natural-history region, while on the contrary, judging from the evidence afforded by the vegetable kingdom, -- according to Prof. Schouw's theory, part of Canada belongs to an Arctic, and part to an Atlantic region. But here again we must not neglect to inquire what light the geology throws upon this question, and turning to the geologic record, we shall find that since the first appearance of these animals and plants on the surface of our globe, great alterations in the relative distribution of land and water and a general subsi-

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dence and re-upheaval of the continents of Europe and America, have been effected. We shall do well to remember the brilliant generalizations of the late Edward Forbes, after a close study of the distribution of animals and plants in Great Britain, and of their connection with the tertiary deposits of the same country.

On the tops of the mountains near the lakes of Killarney, in the south of Ireland, occur a few plants, entirely different from those of the Scotch and Welsh mountains, but nearly agreeing with those of the Asturian mountains in the north of Spain. According to Forbes, the southern character of these Irish plants, and their extreme isolation, point to a period when a great mountain barrier extended across the Atlantic, uniting Ireland with Spain. Soon after this, arguing from similar data, he infers that another barrier connected the west of France with the south-west of England and thence to Ireland; -- and a little later England and France were connected by dry land, towards the eastern part of the Channel. Upon this supposition it is easy to understand why two small snails (the *Helix incarnata* and *Bithinia marginata*,) which abound as Pleistocene fossils in the valley of the Thames,

although extinct in Great Britain, are still found living in France.

At the time of the glacial drift, what are now the summits of the Scotch and Welsh mountains were then -- Forbes argues -- low islands, or members of chains of islands, extending to the area of Norway, through a glacial sea -- clothed with an Arctic vegetation, which in the gradual upheaval of those islands, and consequent change of climate, became limited to the summits of the new formed and still existing mountains. After this upheaval it is believed that Ireland was connected with England, and England with Germany, by vast plains, fragments of which still exist, and upon which lived the Irish elk, two-horned rhinoceri, the Arctic elephant (*Elephas primigenius*), and other quadrupeds now extinct, but which have left behind them in the gravels of our English drift, unmistakable evidence of their having at one time roamed in great numbers over what is now Great Britain.

The array of facts which tends to corroborate Forbes's theories would occupy too much time to explain in detail; -- I have merely stated his general views in so far as they affect the question at issue. Carrying out these well known generalizations, Sir Charles Lyell after visiting this country and studying the peculiar distribution of Pleistocene fossils in Lower Canada, published a theory which he thought would account for these phenomena. This

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was that the land in North America, "after it had acquired its present outline of hill and valley, cliff and ravine," was subjected to a gradual submergence -- and that at a subsequent period it re-emerged from the ocean. Again, it is a well-known fact, that more than half of the marine shells of the northern New England states, and also of the Gulf of the St. Lawrence are common to the seas of northern Europe. This has been held, with much probability, to prove the existence of a landway across the Atlantic since the epoch of the still living animals and plants.

It should be stated that many American shells, which are not now known to inhabit the European seas, occur fossil in the red crag of Great Britain -- this would tend to prove the great antiquity of the existing fauna.

If too the *Helix labyrinthica* (a little snail common in Canada) be, as many of our best naturalists think, identical with a fossil species from the Eocene beds of the Isle of Wight, it is just possible that some of our land shells may prove to be even of still older date. It has been noticed by scientific men in Britain, that these fossil land shells from the Isle of Wight are of a group quite American in character. Neither should we forget the theory that at a period somewhat later geologically than these Eocene beds, the isthmus of Darien, or some portion of it at least, was submerged, and we should take into consideration the supposed consequent alteration of the currents of the gulf stream. It has been suggested that from this cause alone, the climate of Great Britain was then as cold as that of the island of Newfoundland at the present day.

But here in Canada, our knowledge of facts is much too meagre and unsatisfactory to enable us to generalize either on the distribution of plants and animals in British America, or on the connection between existing animals and the tertiary formations of this country. The deposits of land and fresh water shells in our lacustrine marls, require to be carefully worked out, and catalogues of the species which they contain to be published. In the living land and fresh water mollusca, much is yet to be done; -- the neighbourhood of Lake Superior may yet produce many new fresh water forms, while the vicinity of Toronto, and that part of Canada to the south-west of Lake Erie are, conchologically speaking, almost unknown. The opening up of canals has caused a northward emigration of fresh water shells, and by this means several species have been enabled to travel from Ohio into the south-west peninsula of Canada. In my own private collection,

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I have six fresh water shells hitherto not known.

to inhabit Canada, which have been introduced in this way; five are from the Welland Canal, and one is from the Thames river at Chatham, C.W.; they are all well-known Ohio shells. The object of this paper has been a suggestive one, and if by these few remarks I shall have attracted attention to the interesting subject of our land and fresh water shells, my labour will not have been in vain.

List of land and fresh water shells  
hitherto not known as inhabiting  
Lower Canada.

*Anodonta undulata*, Say. St. Charles River, near Quebec.

*Anodonta decora*, Lea. Old quarries near the Mile-end, Montreal.

*Anodonta plana*, Lea. Rideau Canal near Ottawa City.

*Unio luteolus*? Lam. var. Common in the St. Lawrence both at Quebec and Montreal.

*Unio compressus*, Lea. (*U. alasmodontinus*? Barnes). Assumption River, M. de Ville-neuve; Rideau Canal near Ottawa City, Mr. Billings.

*Cyclas rhomboidea*, Say; and two species as yet undetermined; St. Lawrence, at Quebec.

*Pisidium variabile*? Prime; and four species not yet determined.

*Planorbis armigerus*, Say. Trenches in fields near Quebec. This shell belongs to the genus *Planorbis* of Haldeman.

*Planorbis deflectus*, Say. Streams near Quebec.

*Limnaea columella*, Say. Common in the St. Lawrence near Quebec, at low water, with its variety *macrostoma*.

*Helix rufescens*, Muller. Common in the Cove fields, Quebec, but probably introduced.

*Helix capsella*, Gould. Island of Orleans, but very rare.

*Helix dentifera*, Binney. St. Lambert, Montreal.

*Pupa armifera*, Say. Abundant in the Cove fields, Quebec.

*Pupa contracta*, Say. Island of Orleans.

Shells new to Upper Canada.

From the Welland Canal and its neighbourhood:

*Unio gracilis*, Barnes.

" *coccineus*? Lea.

" *plicatus*, Lesuer.

*Paludina integra*, Say.

*Physa gyrina*, Say.

*Helix palliata*, Say.

" *thyroidus*, Say.

From the river Thames at Chatham, C.W.:

*Unio circulus*, Lea.

Canadian fresh water shells which occur also on the west side of the Rocky Mountains.

*Valvata sincera*, Say.

*Limnaea solida*, Lea. (*L. apicina*, Lea).

" *catascopium*, Say.

" *jugularis*, Say. (*L. stagnalis*, Linn.).

" *palustris*, Linn. (*L. elodes*, Say).

" *pallida*, Adams.

*Physa heterostropha*, Say.

" *hypnorum*, Linn. (*P. elongata*, Say).

*Planorbis corpulentus*, Say.

" *trivolis*, Say.

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Of these shells, two are not allowed to be good species; *Limnaea catascopium* being considered a variety of *L. palustris*, and *Planorbis corpulentus* of *P. trivolis*, but in each case they form well marked varieties. My authority for their occurrence west of the Rocky Mountains is Dr. Binney, in his catalogue of the fluviatile gasteropoda of North America, published for the Smithsonian Institution, Washington.

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NOTE. It will be noticed that generic and specific names in this paper are not in italics. This follows the original exactly. EDITOR,