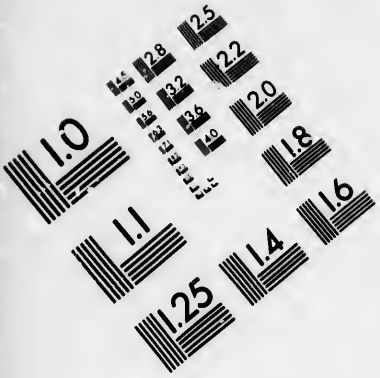

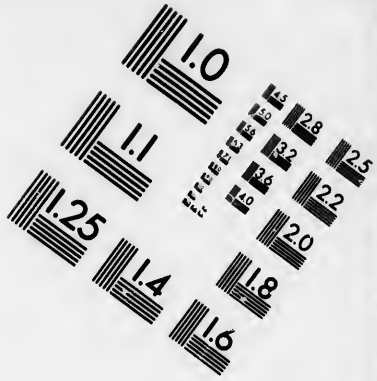

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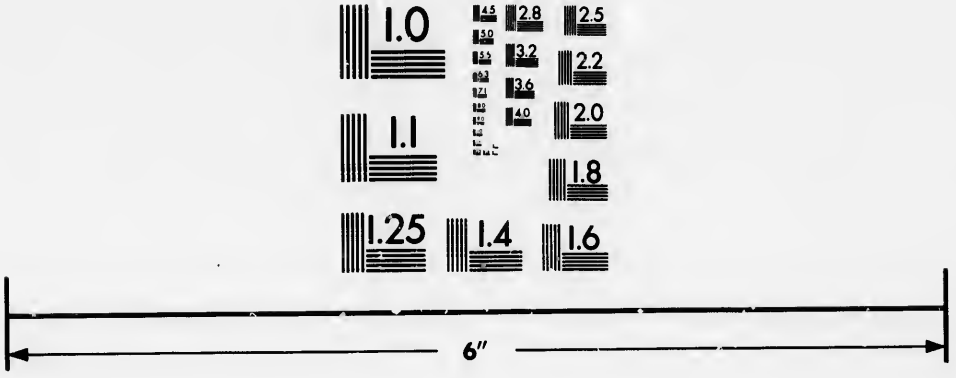

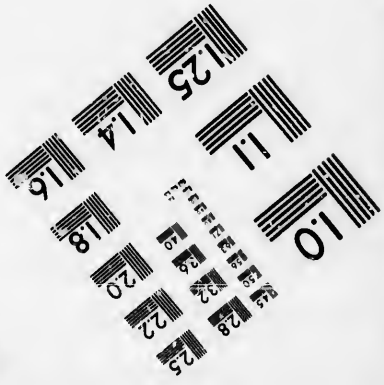

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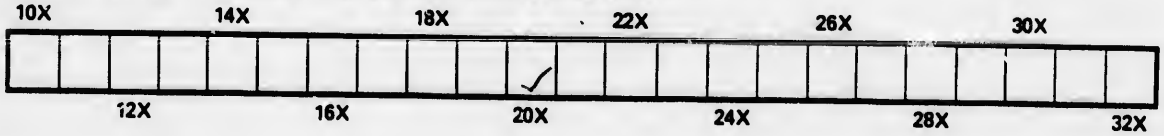

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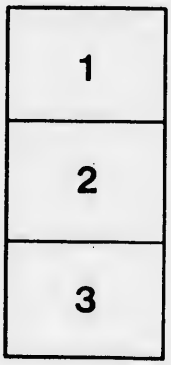

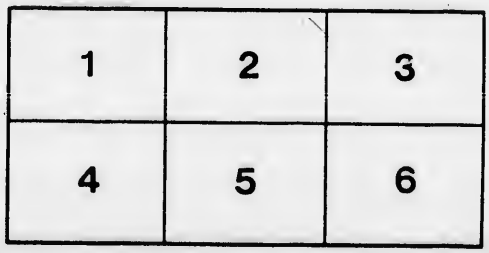

ON THE

LAND AND FRESH-WATER MOLLUSKA

OF

LOWER CANADA.

From the Canadian Naturalist for February and April, 1863.

ON THE

LAND AND FRESH-WATER MOLLUSCA

OF

LOWER CANADA.

BY J. F. WHITEAVES, F.G.S.

Part I.—General Considerations.

Various papers of interest have appeared in the Canadian Naturalist, on the distribution of the land and fresh-water mollusca in Lower Canada. We are indebted to Messrs. Billings, Bell, and D'Urban, for nearly all the information we possess on this subject. Within the last two years new labourers have entered the field, and the result has been some addition to our knowledge of the geographical range of these creatures in Lower Canada.

My friend, Mr. R. J. Fowler has collected assiduously and successfully in the vicinity of Montreal, and in the Eastern Townships. In the summer of 1861 I paid special attention to the inland mollusca of the neighbourhood of Quebec, and collected in several places in the St. Lawrence valley, from Rivière du Loup to Montreal. Last winter I endeavoured to call the attention of the members of the Natural History Society to a short consideration of this subject. On looking over this brief sketch (*vide* Canadian Naturalist, vol. 6, page 452) I find two or three errors have crept in, caused by my want of access to the proper authorities on the subject in Quebec. In the present paper I hope to be able to rectify these mistakes. I propose, partly from original enquiry, and partly availing myself of the labours of others, to collect together in one paper, all that we know of the geographical distribution of the inland mollusca of Lower Canada, up to the present date. I shall also indulge in some general speculations which the subject naturally suggests to my own mind.

Let us first consider the most obvious geographical affinities of

the land and fresh-water shells of the district in question. Eleven of our Lower Canadian species occur also west of the Rocky Mountains. These are,

Margaritana margaritifera, Linn.	Limnæa stagnalis, Linn.
Valvata sincera, Say.	" palustris, Mull.
Physa heterostropha, Say.	" catascopium, Say.
" hypnorum, Linn.	" solida, Lea.
Planorbis corpulentus, Say.	(= L. apicina, Lea.)
" trivolvis, Say.	" pallida, Adams.

According to Mr. Binney, the Planorbis glabratus of Say also inhabits both the Pacific and Atlantic sides of these mountains, but as yet this species has not been detected in Lower Canada. Again, in this Province we have several species, partly land and partly fresh-water, which also inhabit the continent of Europe. Some of these shells, however, present slight differences, and have been considered distinct species. Thus the following unquestionably inhabit both sides of the Atlantic,

Helix hortensis, Muller.	Physa hypnorum, Linn.
" rufescens, Pennant.	(= P. elongata, Say.)
" pulchella, Muller.	Limnæa stagnalis, Linn.
Balimus lubricus, Mull.	(= L. jugularis, Say.)
Margaritana margaritifera, Linn.	" palustris, Linn.
	(=L. elodes, Say.)

The following European and Canadian species may prove identical:

Lower Canada.		*Europe.*
Limax campestris, Gould.	=	Limax agrestis, Muller.
Vitrina limpida, Gould.	=	Vitrina pellucida, Muller.
Succinea obliqua, Say.	=	Succinea amphibia, Linn.
" ovalis, Say.	=	" Pfeifferi, Rossmäss.
Helix chersina, Say.	=	Helix fulva, Muller.
Physa heterostropha, Say.	=	Physa fontinalis, Linn.
Pisidium Virginicum, Brongn.	=	Pisidium amnicum, Muller.
Anodonta cataracta, Say.	=	Anodonta cygnea, Linn.

It may be observed that a much larger percentage of the *marine* shells of the Gulf of the St. Lawrence also inhabit Great Britain and Northern Europe. Dead shells of the European Helix cellaria have been found by Mr. Fowler near gardens in Craig Street, Montreal. Helix rufescens, probably has also been introduced from Europe, and possibly Helix hortensis. The remainder would appear to be of exclusively North American origin, and confined to the region east of the Rocky Mountains.

Unio Canadensis of Lea is supposed, as yet, to be peculiar to Lower Canada. It is, however, a species but little understood and may be detected in the northern New England states. A Valvata found by Mr Bell at Matanne, and Little Lake Matapedia, and perhaps new to science, I have never found in the New England states. It resembles so closely a depressed variety of Valvata piscinalis of Europe, that I hesitate to separate it from that species. The whole of the land and fresh-water shells of Lower Canada, with these two exceptions, are also found in New England.

But in endeavouring to generalize on the geographical distribution of the mollusca in Canada, we cannot afford to ignore the additional evidence afforded by our knowledge respecting other groups of animals, and of the sister science of botany. It will be more philosophical to consider the geographical distribution of plants and animals *generally*, than to take any one isolated group of animals for *special* consideration and study.

Mr. Woodward, in his excellent "Manual of the Mollusca," has considered that the peculiarities of the molluscan fauna of Canada, are so well marked that we are justified in considering the Canadian as a distinct Natural-history province. This view I have endeavoured to show, in a previous paper, is not borne out by an increased knowledge of facts. The naturalist, looking on the map of Canada, observes an irregular peninsula stretching down to the southwest, and at its furthest extremity running parallel to the state of Ohio. From that state it is divided by Lake Erie, which at this point varies from thirty to sixty miles in width. Cutting off this peninsula (say from Georgian Bay in Lake Huron on the west, to Toronto on the east,) we have then left the greater part of Upper and the whole of Lower Canada. The animals and plants of this peninsula appear to have decided affinities with the western Natural-history province. Thus, in the museum of the Natural History Society, the few fresh-water shells from this region are well known western forms. As examples I may cite:

Unio fragilis, Raf.
(= U. gracilis, Barnes.)
" subrotundus, Raf.
(= U. circulus, Lea.)
" costatus, Raf.
(= U. undulatus, Barnes.)
Unio flavus, Raf.
(= U. rubiginosus, Lea.)
" quadrulus, Raf.
(= U. lacrymosus, Lea.)
Physa gyrina, Say.

Judging from what we know of the zoology and botany of

the Canadian area, exclusive of this peninsula, its fauna and flora would seem to be of a mixed character. In Dr. Hooker's essay on Arctic Plants, published in the Transactions of the Linnean Society, he includes a large part of Canada in his sub-arctic botanical province.* Long before I had seen this paper, I had come to the same conclusion from the little I knew of the zoology and botany of Lower Canada. The marine shells of the Gulf of the St. Lawrence correspond remarkably with the shells of comparatively high northern latitudes in Europe: their boreal character is obvious. As indicating a sub-arctic flora, we may point out with Prof. Schouw, "the total absence of tropical families, and a noticeable decrease of forms peculiar to the temperate zone; the prevalence of forests of firs and birches; the abundance of Saxifrages, Gentians, species of Arenaria, Silene, Dianthus, and Lycopodium, the quantity of mosses, and the number of willows and sedges." Such marine shells again as:—

Pecten Islandicus, Chemn.
Leda caudata, Donovan.
(= L. minuta, Fabr. & Mul.)
Crenella nigra, Gray.
Crenella decussata, Montagne.
(= C. glandula, Totten.)
Serripes Grœnlandicus, Chemn.
Astarte elliptica, Brown.
" compressa, Linn.
Tellina proxima, Brown.
Tellina Grœnlandica, Beck.
(= T. fusca, Say, T. Balthica, Lov.)
Cemoria Noachina, Linn.
Margarita undulata, Sow.
" helicina, O. Fabr.
Trochus alabastrum, Beck.
(= T. occidentalis, Migh.)
Scalaria Grœnlandica, Chemn.
Natica clausa, Brod. & Sow.
" pusila, Say.
(= N. Grœnlandica, Chemn.)
Admete viridula, Fabr.
Trichotropis borealis, Brod. & Sow.

Tectura testudinalis, Mull.
Lepeta cæca, Mull.

from the Gulf of the St. Lawrence, are not only typical boreal forms, but have been dredged by Messrs. McAndrew and Barrett on the coasts of Norway and Finmark. The proximity of one of the cold currents of the gulf stream, and the extremely low southern limit of floating ice on this side of the Atlantic, might indeed lead us to suspect the sub-arctic nature of the marine invertebrata of the estuary of the St. Lawrence. It appears to me that the boreal or sub-arctic character of the fauna and flora of part of Canada is tolerably well established.

The animals and plants of Canada, geographically speaking, have yet other affinities. What has been termed by Mr.

Woodward, the Atlantic region, includes the New England states, and all of the more southern states east of the Alleghanies. These mountains appear to divide two well marked groups of land and fresh water-shells. Corresponding perhaps with this zoological province, is the region of Asters and Solidagos, of Prof. Schouw. The difficulty is to separate the flora of the region east of the Alleghanies from that to the westward of those mountains. For although the fresh-water shells, of Pennsylvania, for instance, have a distinct general aspect from those of the state of Ohio, yet the plants of the two states are puzzlingly alike. That is to say, if we try to instance any group of plants, (neither mountainous and probably sub-arctic species, on the one hand, or species naturalized from Europe on the other,) we shall find it very difficult to give a list of species that do not inhabit both sides of the Alleghanies. Yet such plants as Magnolia glauca, Spiræa tomentosa, Tillœa simplex, Gnaphalium decurrens, Kalmia latifolia, Azalea viscosa, with several species of Aster, Solidago, Nabalus (?), and Vaccinium, may be considered perhaps as constituting a fair example of the Atlantic flora. Prof. Schouw's region is described as being characterized by the paucity of Cruciferæ, and Umbelliferæ, by an almost total absence of true heaths, which are represented by Vaccinium, and Gaylussacia; and by the abundance of Asters and Solidagos. This province has not been well defined from a geographical point of view. On the supposition that the Atlantic region, as defined geographically by Mr. Woodward, corresponds with Prof. Schouw's botanical province, I think we may see that in its fauna and flora, part of the Canadian area has affinities with this general natural-history region.

Almost all our Lower Canadian land and fresh-water shells are found in the Atlantic states, north of Cape Hatteras. The same is the case in Upper Canada, so far as we know, with the exception of the southwestern peninsula of that province, as previously defined. It is true, that some small fresh-water bivalves, of the family Cycladidæ, have been described from the neighborhood of Lake Superior, which have not yet been found anywhere else; but these most likely came from the south shore of the lake, in the state of Michigan, and probably belong to the western natural-history region. In Lower Canada, again, many species of Solidago and Aster abound; the genus Erica appears to be wholly absent, several species of Vaccinium and a Gaylussacia (G. resinosa) appearing instead,

while the paucity of species of the large families of Umbelliferæ and Cruciferæ is quite noticeable in Lower Canada.

The line of demarcation between the Canadian part of Dr. Hooker's sub-arctic region, and the outlier, so to speak, of the Atlantic region, in Canada, cannot be accurately defined. No isothermal line will suffice, for the simple reason that since the creation of the still existing fauna and flora, such physical changes have been effected, that the isothermals during the newer tertiary period must have been constantly varying. To sum up this part of our subject,—we have, as it seems to me, in this vast province, fragments, so to speak, of three natural-history regions. Canada, on the whole, as defined on the map, has not a race of animals, or a group of plants which are so special and peculiar to it as to constitute a good natural-history province. As I have endeavoured to shew, the southwest peninsula of Upper Canada is an outlier of the western region; and the remainder of Canada is partly of a sub-arctic type, and partly, so far as its zoology and botany are concerned, has affinities with the northern Atlantic states. With one remark I shall close this part of our subject. Prof. Asa Gray has shown us that the plants of eastern North America bear a greater resemblance to those of Japan, than those inhabiting the tract of land between the Rocky Mountains and the Pacific. At a meeting of the Natural History Society of Boston, Dr. Gould exhibited a marine bivalve shell (a species of Leda) also from Japan, which he considered identical with a living Massachusetts species. It would be interesting to the naturalist to know if the same similarity obtains between the mollusca, &c., of the two countries, as the relations of their flora would seem to warrant.

But in order to be enabled to speculate with any degree of accuracy on the rationale of the present geographical distribution of animals and plants, we must also carefully glean what little evidence we may from the geologic record. Since the creation of at least some of the animals and plants which still people Europe and North America, mighty physical changes on the earth's surface have been apparently effected, to the consideration of which, as bearing directly on my subject, I would call some attention. Dr. Dawson has carefully catalogued the drift fossils from Beauport, the neighborhood of Montreal, Green's Creek on the Ottawa, and part of Maine. To match these we want complete and accurate lists of the marine invertebrata of the Gulf of the St. Lawrence, and carefully

prepared catalogues illustrative of the zoology and botany of the interior of Canada. From Mr. Bell, and from other observers we learn that many of our common fresh-water shells occur in post-pliocene beds of much higher antiquity than our lacustrine marls, while one, if not two, of our Lower Canadian land snails, is of as high an antiquity as the Upper Eocene formation. The Helix labyrinthica of Say, a little snail not uncommon in a living state in Canada, has been found fossil in the Upper Eocene limestones of Headon Hill in the Isle of Wight, and also in the Paris basin. It has been suggested too, that the Helix omphalos, of Searles Wood, another of the Headon Hill fossils, is identical with a living Canadian snail, the Helix striatella of Anthony.

The late lamented Edward Forbes has shown us the importance of studying the fossils of the newer tertiaries in connection with the distribution of living animals and plants. It appears to me to be well, in order clearly to understand our subject, briefly to epitomize, as on a former occasion, his brilliant and most profoundly philosophical generalizations. On the tops of the mountains near the lakes of Killarney, in Ireland, occur a few plants, entirely different from those of the mountains of North Wales and Scotland, but nearly agreeing with those of the Asturian mountains in the north of Spain. According to Forbes, the southern character of these few plants, and their extreme isolation, (together with collateral facts respecting the peculiar distribution of the marine invertebrata of that region) point to a period when a great mountain barrier extended across part of the Atlantic, uniting Ireland with Spain. Soon after this, arguing from similar data, he infers that another barrier of high land connected the west of France with the southwest of England, and thence with Ireland: while a little later England and France were connected by dry land towards the eastern end of the English Channel. As tending to prove this latter view, we may cite the fact, well known to European geologists, that one fresh-water and one land snail, (Bithinia marginata, and Helix incarnata) abundant as post-pliocene fossils in the valley of the Thames, are still living in France, though extinct in Great Britain. 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, and clothed with an Arctic vegetation, which in the gradual upheaval of those mountains, and consequent change of climate, became limited to the

summits of the new formed and still existing mountains. Few botanists who have climbed the Scotch Highlands, will fail to recollect the little isolated patches of Arctic plants on the highest mountain summits, which never occur at a less altitude than from 3000 to 3500 feet above the sea level. Well do I remember standing one fine August morning on the apex of Ben Lawers, the clouds at my feet obscuring everything below, the warm sun shining in the deep blue sky above, and admiring the glorious hue of the Alpine forget-me-not (Myosotis alpestris) the two rare mountain Saxifrages, (S. nivalis and S. cernua,) and a whole array of characteristic ferns, mosses, &c. But I am digressing. After the gradual re-upheavals subsequent to this state of things, it is believed that Ireland was connected with England, and England with Germany, by vast plains, fragments of which still exist as submarine elevations of the land on the west coast of Ireland, charged with the familiar fossils of the period. Upon these lived numerous animals, some of which, as the musk ox, red deer, and horse, yet live. Others, again, as the Arctic elephant (Euelephas primigenius), the two-horned Rhinoceri (Rhinoceros tichorinus, and R. leptorhinus), cave bear (Ursa spelæa), hyæna, etc., though now extinct in Great Britain, have left behind their bones, teeth etc., as post-pliocene fossils in the gravels and clays of our English drifts. According to D'Archiac, the separation of the British Islands from France took place after the deposition of the gravels of the valley of the Somme, in which flint implements have been found. And hence it has been inferred "That the primitive people, to whom we attribute the hatchets and other worked flints of Amiens and Abbeville, might have communicated with the existing country of England by dry land, inasmuch as the separation did not take place until after the deposit of the rolled diluvial pebbles, from among which the hatchets and other objects, have been collected."

The discovery of the fossil remains of an elephant in Sicily, near Syracuse, and at Palermo, identical with the living African species (*vide* Dr. Falconer,) renders it also probable that man lived in Europe at a time when what is now the Mediterranean was a mighty fresh water river. But to come nearer home. It has been held by many of the most eminent geologists that the great depression and subsequent gradual re-upheaval of the land during the post-pliocene age, in Northern Europe and Asia, also took place in temperate north America. Sir Charles Lyell, after careful study of the drift fossils of the United States and Canada,

first propounded this theory, which has since been so ably advocated by Dr. Dawson. Throughout all Canada, at any rate east of the Niagara escarpment, we find, often at considerable heights above the level of the sea, stratified deposits of sand and clay, full of marine shells etc, generally of species which still inhabit the Gulf of the St. Lawrence. These have been so carefully and ably described by Dr. Dawson, that I need here do little more than refer to his papers on this subject. It seems pretty clearly proved that, at the time when these deposits were formed, the whole of Lower Canada was submerged beneath the ocean, with only the very highest points of the land left high and dry.

To explain the great cold which is supposed to have obtained over temperate Europe during the post-pliocene period, it has been ably and ingeniously suggested that at the time of the general depression of the land, the isthmus of Darien, or part of it at least, was submerged and the direction of one of the great currents of the gulf stream consequently changed. Thus the warm current which now washes the Western shores of Great Britain, then, it is urged, ran up the west coast of north America; while the cold current now washing the mainland of Labrador, then flowed around the small area of Europe left unmerged. When the re-upheaval of the land took place, the isthmus of Darien would form an impassable barrier against ocean currents, and would tend to produce the present state of things. Of later years we have obtained a few more facts bearing directly on this theory. Mr. Woodward, quoting the views of Prof. C. B. Adams, states in his Manual, in 1856, that only one marine shell (Purpura patula) is common to both sides of the isthmus. But on referring to Mr. Carpenter's able report on the mollusca of the west coast of North America, (Reports of the British Association for the Advancement of Science, 1857,) we find very different views entertained. Thus he gives a list of thirty-five species which *unquestionably* live both on the Atlantic and Pacific shores. To these he adds twenty-four species which are *probably* common to both sides, and forty-one species inhabiting the same area, which he considers "really separated but by slight differences." It is to be remarked that our knowledge on these points is so limited, that when large series have been procured, many species now separated, may be considered identical. And from later sources, we learn that some species, not included in this Report yet inhabit both oceans. (A series of marine shells collected at Mazatlan by Mr. Moores of Columbus, Ohio, was exhibited to support this view.) Further

to the north it is noticeable that several shells, mostly littoral species, occur on both the Pacific and Atlantic shores. Modiola modiolus, Crenella discrepans, Trichotropis borealis, and Bela turricula, inhabit Oregon, north-eastern America, and northern Europe. Referring again to Mr. Carpenter's Report we see that sixteen species of Arctic mollusca inhabit both the Atlantic and Pacific. These are:—

Rhynchonella psittacea, Gmel.
Mya arenaria, Linn.
Machœra costata, Say.
Tellina solidula. (T. fusca, Say.)
Mactra ovalis, Gould.
Mytilus edulis, Linn.
Anomia patellifornis, Linn.
Margarita arctica, Leach.
" helicina, Mole.
Trichotropis borealis, Brod. & Sow.
Admete viridula, Fabr.
Scalaria Grœnlandica, Chemn.
Natica clausa, Brod. & Sow.
Purpura lapillus, Linn.
Fusus Islandicus, Linn.
" antiquus, Linn.
Trophon clathratus, Linn.

The majority of these are species of considerable geographical distribution; all but two (Machœra costata and Mactra ovalis) also inhabit northern Europe. The Tellina nasuta of Conrad, from Oregon, may be a geographical variety of the Tellina proxima of the eastern coast. In like manner Turritella Eschrichtii may be Scalaria borealis, and Littorina Sitchana of Philippi (also from Oregon) may be only a variety of Littorina patula. We have seen that eleven of the Lower Canadian fresh-water shells also inhabit the west coast of North America. Yet the grand chain of the Rocky Mountains intervenes, presenting, according to the views of most naturalists, an impassable barrier to migration. How then can we account for this apparent anomaly? Admitting that during the post-pliocene period, a great, but gradual depression of the land took place on this continent, do we not begin to see our way a little more clearly? When the mountain tops alone were left uncovered by the ocean, these snails, for instance, could only remain on, or near, the dry land, and when the land re-assumed its present shape and general physical condition, the whole area would be peopled, in part, from these sources. For supposing these creatures confined by the above mentioned causes to what are now the peaks of the Rocky Mountains, it is not difficult to conceive, that on the gradual re-elevation of the land, these molluscs could extend in both an easterly and westerly direction. Whether the theory I have advanced be true, or whether it is more likely that such sluggish creatures as fresh-

water snails should have travelled the entire breadth of this great continent, and have surmounted such obstacles as a mountain chain, the highest peaks of which are from 15,000 to 18,000 feet above the level of the sea, and clothed with perpetual ice and snow, I leave for naturalists to determine.

The large proportion of marine invertebrata common to the coasts of eastern North America and northern Europe has been thought to imply the existence of a pathway across the Atlantic since the creation of the existing flora and fauna. We have seen that eight at least (and probably double that number) of the inland mollusca of Canada also inhabit northern Europe. Some such theory as the one I have alluded to, would seem necessary to explain this rather peculiar geographical distribution. Dr. Hooker's theory of the south westward migration of the Scandinavian flora, and of its subsequent return under altered physical circumstances, would seem to be doubtful on geological grounds, also from the Darwinian reasoning called in to support the latter half of his hypothesis. Dr. Dawson has cited the case of two species of Solidago living on Mount Washington, one of which (S. thyrsoidea,) has a limited range in northeastern America, while the other (S. virgaurea,) has a widely extended distribution, living as far north in Arctic America as from 55° to 65°, occurring also in the Rocky Mountains, in Great Britain, Norway, and many places in temperate Europe. He suggests that the plants which extend over so large an area, may belong to the older Arctic flora, and that the other species, of very local distribution, may belong to a newer flora. (The two species cited are not perhaps the best examples that might have been chosen to support this view, as they have been considered identical by some botanists. I would suggest the two cranberries, Vaccinium oxycoccus, and V. macrocarpon, as unquestionably distinct species, illustrating the same point.) If this theory be correct, it may be that those Lower Canadian shells which have a wide geographical distribution may be members of an older fauna than that which is more especially characteristic of a limited area in northeastern America. Judging from our present knowledge of the older post-pliocene deposits of Canada, it is quite remarkable that the species found in the marine beds are almost universally of very wide distribution.

The science of archæo-geology, or in other words, the connection between geology on the one hand and archæology on the other, may receive benefit from a much more rigorous comparison be-

tween tertiary fossils and their living analogues. Archæologists tell us there are three epochs in man's history; the first, and oldest, of stone, the second of bronze, the third of iron. The discovery of flint implements in European drifts, together with the evidences afforded by the Pfahlbauten (pile-works) or lake habitations, in Switzerland, have taught us that man was contemporary with many extinct mammals, that were once thought to date back beyond the historic period.

As yet we have no definite proof that man existed prior to the deposition of the older marine deposits of the post-pliocene period, represented in this country by the Leda clay and the Saxicava sand. In the stone period we have evidence of two races of mankind, which in all probability were separated from each other by a considerable space of time. Of the primitive race who made the so-called flint hatchets, spear heads, etc., which have been collected in such numbers in the valley of the Somme, we know but little positively. Contemporary with them were Euelephas primigenius, Bison priscus, Hippopotamus major, Rhinoceros leptorhinus, and R. tichorinus (?), the cave bear—a species said by Owen to exceed in size the grizzly bear of the Rocky Mountains—and the fossil hyæna. The fresh-water shells associated with these, with one exception, are of species still living in France. The solitary exception is the well known Corbicula fluminalis, which now inhabits the Alexandrian canal.

Whether the implements of this race were made for warlike or for agricultural purposes is not positively known. But respecting the men of the second period in the stone age, the Celts, we have much fuller knowledge. So many of their settlements have been discovered in Switzerland that it would be tedious to particularize all of them. For instance, on the lake of Geneva, twenty-four such colonies have been found; on lake Neufchatel twenty-six, and on lake Bienne eleven. The dwellers in these lake habitations belonged however to the bronze epoch, as well as to the later of the two stone periods. Some of these colonies must have been large, judging from the size of the piles and the numbers of the huts. Thus in one of the settlements on lake Neufchatel, remains of 311 cabins of large size have been found, and allowing four inhabitants to each hut, we should have an aggregate of 1244 individuals. From similar data it has been calculated that in Switzerland alone, sixty-eight villages of the bronze period contained nearly 43,000 persons; and in the older or stone period the settlements discovered would accommodate nearly 32,000.

Their dwellings appear to have been circular or square huts, grouped on wooden platforms elevated a few feet above the level of and the water, supported above it by huge piles. Each cabin had a trap-door opening on to the lake, and the whole settlement communicated with dry land by means of a bridge. The huts of the pileworks were built of wood, lined with mud, and on the exterior, boughs of wood interlacing each other. We have been enabled to trace the way they felled the trees for their piles. They would burn a circle round the bottom of a tree, chop the charred part away with their stone hatchets, then alternately burn and chop until the tree fell. We see in the stumps the mark of the fire, and the rude cuts of their stone axes. The piles of the habitations of the men of the bronze period were much more elaborate, being made with metal axes. The lake dwellings were apparently first made by the men of the later stone period, to defend themselves against formidable wild beasts; afterwards, in the bronze age, they were found to be useful in protecting the inhabitants from the incursions of hostile tribes. It has been suggested that bronze was introduced into Europe by the Phœnicians about the time of the founding of Carthage, somewhere about the year 800 before Christ The animals most formidable to the men of the stone period in Switzerland (according to Mr. Lubbock) were the brown bear, (Ursus arctos); the wolf, (Canis lupus); the marsh boar, (Scrofa palustris); the common wild boar, (Scrofa ferus); the Urus or wild bull, (Bos primigenius); and the European bison, (Bos bison). The abundance of bones of of the elk and red deer in these settlements would seem to shew how densely wooded was the surrounding country at this time. Twenty-eight species of quadrupeds, seventeen kinds of birds, three of reptiles, and ten of fishes have been found, in fragmentary condition in the pile works. At the village of Concise, on lake Neufchatel, as many as 20,000 objects have been discovered. The stone implements seem to be principally axes, knives, saws, lance and arrow-heads, corn-crushers, &c. These have been elaborately described by Mr. Lubbock in the number of the Natural History Review for January, 1862,—this article is copied entire in Silliman's American Journal for September, 1862. Their arrow-heads the Celts often made out of the bones of animals which they had slain in the chase. Specimens of their food have even been obtained in the shape of unleavened cakes, and as carbonized apples and pears. It is stated that our "rude fore

fathers" were sometimes so reduced by hunger that they condescended to eat foxes. Their pottery seems to have been ornamented in the rudest way with their finger-ends and their nails. The men of the bronze age in Switzerland appear to have lived as late as the early Roman period. Remains indicative of a battle-field have been found in one of the Swiss Pfahlbauten of the bronze period, in the shape of swords, pieces of chariots, and Gauliot coins. In Ireland, lake habitations have been observed, but these are probably of more recent origin, and are mentioned in early Irish history. They were mere artificial islands on lakes; but sometimes the Irish like the Swiss, built their settlements on piles running pier-like into the water. Both of these customs appear to be common to savage nations in the historic period. Thus Venezuela obtained its name, in early times, from its supposed resemblance to Venice. From Herodotus we learn that in Pœonian villages the first platform was made at the public expense, but afterwards, at every marriage (polygamy being allowed) the bridegroom was expected to add a certain number of piles to the common support.

Thus it seems that at any rate during the earlier part of the post-pliocene period, two races of mankind have appeared and disappeared from the face of the earth, and with them have disappeared some of the larger and more powerful mammals of the period. Yet the general aspect of the animal and vegetable kingdoms seems to have changed but little from that time.

Some of the leaders in comparative ethnography have indulged in speculations concerning the geological date of the creation of man, in which they assign to the human race a far higher antiquity than the post-pliocene period. Speaking of the flint-implement-making men, Mr. Lubbock observes: "Whether the drift race of men were realiy the aboriginal inhabitants of Europe, still remained to be ascertained. M. Rutimeyer hints that our geographical distribution indicates a still greater antiquity for the human race." One of our ablest British naturalists goes much further and thus sums up this question. "There was a lapse of prodigious ages since man had appeared on the earth, and through which the savage habits had continued without change. And, immeasurably far back as is the age of the flint implement-making men, *as far*, or *farther back still* from them must we go to trace the primitive abode of the human species. The great battle to prove the existence of man among the mammoths, like many other first battles, has turned out in the

end, a mere affair of outposts; and for the real origin of man we must go immeasurably farther back from that remarkable time, into the great pliocene or miocene age. To this period succeeded another, of which we are as ignorant as of that which preceded it. For as the mammoth, Irish elk and cave bear have disappeared from the face of the earth, so did this early race vanish away, leaving their weapons, their bones and their dwellings as the only traces of their existence. Afterwards, at an enormous interval, came another race, the Celts, in many points resembling their predecessors, living in similar habitations, and unacquainted with the use of metals, but more highly civilized and possessed of more highly finished weapons, and, as the Pfahlbauten of the Swiss lakes shew, cultivating cereals, and to a certain degree, a pastoral people." Pointing in the same direction, are Prof. Muller's theories on the origin of language, and the well known speculations of the Chevalier Bunsen. With the philological argument however the naturalist has nothing to do.

In an enquiry of so much interest and consequence, it be hoves us to be very cautions. Those naturalists who have read Dr. Falconer's able papers on tertiary mammals will see that, according to that careful observer, each subdivision of the tertiary period is characterized by a group of mammals special and peculiar to it. And, as a whole, we find that the higher animals have a much more limited range in time than the lower forms of life. It would seem that the higher the organism, the less likely would it be to hold its own under trying physical vicissitudes, and altered conditions of whatever kind. Thus foraminiferæ, identical with living species, occur in mesozoic strata; and, as we have seen, one at least of our Canadian land snails lived through nearly the whole of the great tertiary period. The gravels which furnished the worked flints of Amiens and Abbeville are fresh-water deposits, not older, if as old, as the post-pliocene deposits in Canada, known locally as the Leda clay and the Saxicava sand. It is much to be wished that in the accounts both of the flint-implement-making men of the valley of the Somme, and of the inhabitants of the Swiss Phfahlbauten, we had more careful lists of the larger mammals of the two periods. As to the geological date of man's appearance on the earth, as far as I can see, we have no *positive evidence* which would date man farther back, at any rate, than the older part of the post-pliocene.

Thus I have endeavoured to jot down, in rather a cursory manner,

some general thoughts which a very short study of Canadian land and fresh-water shells, etc., has suggested to my own mind. It has appeared to me that in order to speculate rationally on the geographical range of the mollusca in Lower Canada, we must take into consideration all the physical changes which have occurred since these creatures were first created. In other words, we should study the post-pliocene fossils of the district in question, and institute a careful comparison between them and the recent shells of the country. Knowing the difficulty of access to scientific works in Canada, I have made a short summary of Edward Forbes's famous essay, and have shortly epitomized Mr. Lubbock's paper on the Swiss Pfahlbauten, hoping that attention drawn to the subject, may possibly result in the discovery of works of human art in our Canadian tertiary or post-tertiary deposits.

Part II.—List of Species Inhabiting Lower Canada.

The writer of this list wishes to acknowledge his obligations to many of the most eminent United States conchologists for practical suggestions and assistance. Mr. Temple Prime has kindly indentified the Cycladidæ; The writer is also indebted to Messrs. Bland, Binney, J. G. Anthony, I. Lea, A. D. Brown, Tryon, and others, for critical advice and sympathy.

In the nomenclature of the Unionidæ, the names given by Rafinesque have been retained; these having priority. The writer has been unable to see why Lamarck's short, insufficient diagnoses of species in this difficult family, should be preferred to the exclusion of the earlier descriptions of the author of "the Bivalve Shells of the Ohio River."

As the Lower Canadian Cycladidæ seem very little understood, Mr. Prime's careful descriptions of these somewhat intricate shells have, with his consent, been added; together with wood-cuts, taken from original drawings.

Note.—The following abbreviations have been made use of in citing the authority for each species in Lower Canada: —R. B. (R. Bell): W. D. (W. D'Urban): E. B. (E. Billings): R. J. F. (R. J. Fowler): J. F. W. (J. F. Whiteaves): W. C. (W. Couper) M. de V. (M. de Villeneuve).

LAMELLIBRANCHIATA.

UNIONIDÆ.

Unio radiatus, Lamarck. Abundant in the rivers and lakes of Canada East. The U. siliquoideus is often taken for this shell.

Unio siliquoideus, Barnes. Equally common with the above. For details of difference between the former species and this, see Conrad's Monograph of the genus Unio. As many able conchologists deny that this is the Unio luteolus of Lamarck, I have preferred keeping the name given to the species by Barnes.

Unio Canadensis, Lea. St. Helen's Island, Montreal; apparently very rare. Some rayed specimens of a Unio which I took at Quebec may be a dwarf form of this species. A single dead *typical* specimen on the beach of the Island of Orleans: J. F. W.

Unio cardium, Rafinesque. (U. ventricosus, Barnes.) St. Lawrence; very fine near Quebec. Unio subovatus, Lea, appears to be the male of this species; and U. occidens, Lea, a variety of the female.

Unio complanatus, Solander. By far the commonest Unio in the district; living (according to Mr. Bell) as far down the St. Lawrence as Berthier below Quebec.

Unio dilatatus, Rafinesque. (U. gibbosus, Barnes.) Widely distributed in the St. Lawrence and its tributaries, but scarce. Some varieties closely resemble the last species.

Unio rectus, Lamarck. St. Lawrence at Quebec and Montreal but somewhat rare.

Unio alasmodontinus, Barnes, (U. pressus, Lea.) Rare: L'Assomption river: M. de V. River St. Pierre, and Lachine canal near Montreal: R. J. F. Rideau canal near Ottawa city: E. B.

Unio alatus, Say. Ottawa river, near Ottawa: mouth of River Rouge: R. B.

Unio olivarius, Rafinesque. (U. ellipsis, Lea, *fide* J.G. Anthony.) St. Lawrence at Quebec and Montreal; fine and not infrequent at Quebec.

Margaritana margaritifera, Linn. (Alasmodon arcuatus, Barnes.) Very large and fine in the St. Charles river near Quebec: J. F. W. Green and Rimouski rivers; both of the Matapedia lakes; Lake St. John: R. B.

Margaritana costata, Rafinesque. (Alasmodon rugosa, Barnes.) Sparingly in the St. Lawrence about Montreal. Yamaska river near St. Hyacinthe: J. F. W.

Margaritana marginata, Say. With the foregoing, but not very common.

Margaritana undulata, Say. Common in the St. Lawrence down to Quebec; at which latter place it is very abundant, and often beautifully coloured.

Anodonta cataracta, Say. (A. fluviatilis, Lea.) Lake Calvaire, near Quebec: abundant in small creeks near the St. Charles river at Quebec: J. F. W. Large and plentiful at Brome Lake in the Eastern Townships: R. J. F. Probably common in suitable places throughout the district.

Anodonta Lewisii, Lea. Lachine canal near Montreal. R. J. F.

Anodonta Benedictensis, Lea. Mississquoi bay, Lake Champlain.

Anodonta implicata, Say. Fine in the St. Lawrence near Quebec: J. F. W. Berthier: R. B.

Anodonta Ferussaciana, Lea. Creek at L'Orignal: R. B. Fine in old stone quarries near the Mile-end toll-gate, Montreal.

Anodonta undulata, Say. St. Charles river about three miles from Quebec.

Anodonta edentula, Say. Lake Matapedia: R. B. Brome Lake in the Eastern Townships: R. J. F. I consider this species, and perhaps even the next, as identical with A. undulata, Say.

Anodonta subcylindracea, Lea. Lachine Canal: R. J. F. St. Lawrence at Quebec. J. F. W.

Anodonta Footiana, Lea. Sixteen Island, Eagle Nest, and Bevan's lakes. W. D.

Anodonta modesta? Lea. A few specimens which appear to me to agree with Mr. Lea's figures and description of this species, were taken by Mr. Bell from Lake St. John.

CYCLADIDÆ.

The genus Cyclas was proposed by Bruguière in the year 1792; but Scopoli's genus Sphœrium bears date 1777; and consequently has priority, as has been shown by Dr. Gray. See Mr. Temple Prime's elaborate monograph of the North and South American species in this genus, published in the "Proceedings of the Academy of Natural Sciences of Philadelphia' for December, 1861.

Sphœrium sulcatum, Lamarck. (Cyclas similis, Say.) Metis lakes, and a small lake six miles S.W. of Metis: R. B. Common

in the St. Lawrence at Montreal; and probably widely diffused throughout the province.

Sphærium solidulum, Prime. Creek at L'Orignal: R. B. It will probably be detected in Canada East, as it has been taken so near the border.

Sphærium striatinum, Lamarck. (Cyclas edentula, Say.) Lachine Canal, near Montreal: R. J. F. St. Lawrence and St. Charles rivers near Quebec, abundant: J. F. W.

Sphærium rhomboideum, Say, (sp.). Gregarious, but very local. Old quarries near the Mile-end toll-gate, Montreal, but apparently confined to a very limited space there. R. J. F., and J. F. W.

Sphærium occidentale, Prime. Swamps on an island near Lachine: R. J. F.

Sphærium transversum, Say, (sp.). Lachine Canal near Montreal: R. J. F. St Lawrence near Quebec: J. F. W.

Sphærium securis, Prime. Old stone quarries filled with water, near the Mile-end toll-gate, Montreal: R. J. F. and J. F. W. Lachine: R. J. F.

Pisidium Virginicum, Brongniart. (Cyclas dubia, Say.) St. Lawrence and St. Charles rivers at Quebec: J. F. W. Montreal, in the St. Lawrence, and the Lachine canal. Probably common in all the large tributaries of the St. Lawrence.

Pisidium altile, Anthony. Fine in the ponds near the Mile-end, Montreal: R. J. F., and J. F. W. A smaller, more compressed variety abounds in the St. Charles River near Quebec; J. F. W. It is the P. compressum of Prime; but Mr Anthony's name seems to have priority.

Pisidium abditum, Haldeman. A very common species in Lower Canada. I cite four localities where I have taken it, as examples. Swamps in woods near the St. Charles river, Quebec: trenches in fields near the Beauport road: marshy ground on the Plains of Abraham,—both near Quebec. Brook near river St. Pierre, Montreal.

GASTEROPODA,—PECTINIBRANCHIATA.

VIVIPARIDÆ.

Paludina decisa, Say. Common throughout the district. Reversed varieties occasionally occur in the St. Lawrence, about Montreal.

Valvata tricarinata, Say. Also abundant. At Quebec the species generally occurs large, with the carinæ sometimes almost obsolete.

Valvata sincera, Say. Marl lake, Anticosti: R. B.

Valvata humeralis, Say. This species, so closely allied to the depressed form of the V. piscinalis of Europe, has been taken by Mr. Bell at the following localities: Matanne; small lake at the head of Awaganasees brook, and Little Lake Matapedia.

Amnicola porata, Say. Lake Calvaire, near Quebec: J. F. W. Little Lake Matapedia: R. B. Near Montreal: R. J. F.

Amnicola tenuipes, Haldeman. St. Lawrence, near Quebec: burrowing in the sand between tide-marks: J. F. W.

MELANIADÆ.

Melania subularis, Lea. (M. acuta, Lea.) St. Lawrence at Montreal.

Melania Niagarensis, Lea. St. Lawrence, from Quebec to Montreal. At Quebec I obtained only the pale yellowish, unbanded variety.

GASTEROPODA,—PULMONIBRANCHIATA.

LIMNÆIDÆ.

Limnœa stagnalis, Linnæus. (L. jugularis, Say.) Common at Montreal in the St. Lawrence, but rare at Quebec. Metis lakes, and lakes on the Rimouski river: R. B. Probably of wide distribution in Canada East.

Limnœa megasoma, Say. Very fine at Nuns' Island, near Montreal: M. de V., and R. J. F. Hawkesbury village: R. B.

Limnœa ampla, Mighels. This fine species was first detected in Lower Canada by R. J. F. at Brome Lake.

Limnœa decollata, Mighels. Great Lake Matapedia, and Rimouski village: R. B.

Limnœa columella, Say. St. Lawrence at Quebec, adhering to stones at low water-mark: J. F. W. The var. macrostoma occurs with the type.

Limnœa reflexa, Say. Upper Metis Lake: R. B. Near Grenville village: W. D.

Limnœa umbrosa, Say. Point Levis: J. F. W. Montreal

Mountain: St. Anne: creek about two miles below Chat river: Metis and Restigouche rivers: R. B.

Limnæa elodes, Say. (L. palustris ? Linn.) Common every where throughout the district. Haldeman in his monograph considers it the L. fragilis of Linnæus. In Europe L. fragilis is considered a variety of L. stagnalis, Linn., and the L. elodes of Say as probably identical with the L. palustris.

Limnæa catascopium, Say. A common species. As unpublished localities, I may cite the St. Charles river near Quebec, and Cap Rouge in the same neighborhood. Dr. Lewis of Mohawk (N.Y.) considers it a variety of the preceding shell.

Limnæa solida, Lea. (L. apicina, Lea: *fide* Haldeman.) Profusely abundant everywhere about the St. Lawrence at Quebec Metis, Rimouski, and White rivers: R. B.

Limnæa caperata, Say. Widely distributed. Abundant with Succinea ovalis, Say, on the banks of the St. Charles river, near Quebec. Limnæa umbilicata, Adams: is generally considered a variety of this species.

Limnæa humilis, Say. (L. modicellus, Say.) Green Island village: Rimouski: St. Anne: R. B. Lake Calvaire near Quebec: and ponds near the Mile-end toll-gate, Montreal: J. F. W. L. parva, Lea, is supposed by Haldeman to be the young of this species.

Limnæa desidiosa, Say, (L. acuta and L. Philadelphica, Lea: *fide* Haldeman.) Upper Lake Metis: Marl lake, Anticosti: (the var. acuta): R. B.

Limnæa pallida, Adams. Great Lake Matapedia: Cape Chat: R. B.

Limnæa alternata (or a new species). Point Levis: R. B. A species which I am unacquainted with.

Limnæa exigua, Lea: (young). In a small lake near Hamilton's farm: W. D.

Limnæa galbanus, Say. Abundant in shell-marl from the bottom of Eagle's Nest lake: W. D.

Physa heterostropha, Say. Common everywhere throughout the district.

Physa ancillaria, Say. St. Charles river near Quebec: J. F. W. near Montreal: R. J. F. Rimouski village: R. B. Doubtful if distinct from the preceding.

Physa marginata, Lea. (not of Say.) Near Rimouski village. Probably a variety of P. heterostropha.

Physa hypnorum, Linn. (P. elongata, Say.) Abundant about Quebec and Montreal. Green Island: Metis: St. Anne: R. B.

Physa aurea, Lea. Several localities in the county of Rimouski: R. B. Near Quebec: J. F. W.

Physa elliptica, Lea. Small lake one mile west of the Indian village in Arundel: W. D.

Planorbis macrostomus, nobis. (see description, and Figure 12.) Ponds near the Mile-end toll-gate, Montreal: R. J. F., and J. F. W.

Planorbis trivolvis, Say. Common throughout the district. Planorbis corpulentus of Say appears to be a variety of this species.

Planorbis lentus, Say. Less frequent than the above. St. Lawrence at Montreal. An almost hyaline variety occurs with the normal form.

Planorbis bicarinatus, Say. Abundant apparently all through the province. Extremely large at Brome Lake, R. J. F. At Quebec a variety with transverse wrinkles, and the upper carina almost obsolete (P. megastoma? De. Kay.) is more abundant than the type.

Planorbis campanulatus, Say. Near Quebec: J. F. W.: Fine at Brome Lake: common in the Richelieu River at St. Johns: St. Helen's Island, Montreal: R. J. F. Near Grenville, and in numerous lakes throughout that district. W. D.

Planorbis exacutus, Say. Scarce: swamps near the City mills, Montreal: R. J. F.

Planorbis deflectus, Say. Near Quebec: J. F. W. Great Lake Matapedia: R. B. Sixteen-Island and Sugar-bush lakes: W. D.

Planorbis parvus, Say. Widely distributed, and plentiful throughout the district.

Planorbulina armigera, Say. (sp.) Trenches in fields near the Beauport road, Quebec: J. F. W., and W. Couper: Nuns' Island, Montreal: R. J. F. Ponds on the top of Montreal Mountain: R. B.

Ancylus fuscus? Adams. Ponds near the Mile-end toll-gate, Montreal: R. J. F., and J. F. W.

Ancylus rivularis? Say. St. Lawrence, at Quebec and Montreal: St. Charles river near Quebec. Not having access to Haldeman's monograph of this genus, I am uncertain about these two species. The last may be A. parallelus, Haldeman.

GASTEROPODA,—PULMONIBRANCHIATA.

HELICIDÆ.

Tebennephorus Carolinensis, Bosc. Point Levis, large and fine: probably common in wooded districts.

Limax campestris? Gould. Abundant under stones in fields: also in woods.

Vitrina limpida, Gould. (=V. pellucida;) Montreal Mountain, abundant: R. J. F., and J. F. W. Rivière du Loup: R. B. and J. F. W. Trois Pistoles: St. Anne: Restigouche river, ten miles above its junction with the Matapedia: R. B.

Succinea obliqua, Say. Abundant everywhere, but generally in dryer situations than most North American Succineas.

Succinea ovalis, Gould. Banks of the St. Charles river near Quebec: J. F. W. Metis, Matanne, and St. Anne: R. B.

Succinea avara, Say. Island of Orleans; J. F. W.

Succinea vermeta, Say. Mouth of the Magdalen and Restigouche rivers: R. B. As many conchologists consider this a distinct species from the preceding, in deference to their opinion I keep them separate.

Helix albolabris, Say. Fine and frequent throughout the district: Mr. Bell appears, however, not to have met with it in the county of Gaspé.

Helix dentifera, Binney. St. Lambert, Montreal: near Brome Lake: R. J. F. Apparently very rare in Lower Canada.

Helix exoleta, Binney. About the Montmorenci river, near the falls: W. C., and J. F. W. Wentworth, Montcalm and Harrington: W. D.

Helix Sayii, Binney. Widely diffused, but scarce: Island of Orleans, near Quebec: W. C., and J. F. W. Montreal Mountain: near Brome lake: R J. F. Restigouche river, about five miles above the mouth of the Matapedia: R. B. Near Doran's lake, Grenville: W. D.

Helix hortensis, Muller. Brandy Pots and Hare Island: extending from Metis to Gaspé bay. R. B.

Helix tridentata, Say. Montreal Mountain, but very rare.

Helix monodon, Racket. Abundant throughout the district, in suitable situations. In Lower Canada the typical form is abundant but the varieties (?) H. fraterna, Say; and H. Leaii, Ward; have not occurred to me in Lower Canada.

Helix multidentata, Binney. In 1861 I found one living specimen of this species on the Island of Orleans, and not noticing the teeth, took it for H. capsella of Gould. I am indebted to Mr. Bland for the correction of this error.

Helix lineata, Say. A species widely distributed throughout the district, but not abundant.

Helix labyrinthica, Say. The same remarks will apply to this species as to the above. Island of Orleans, Montmorenci falls, etc.

Helix alternata, Say. Very abundant everywhere in Lower Canada.

Helix striatella, Anthony. In different situations to the above, but equally common.

Helix rufescens, Muller. Living in abundance at Quebec on that part of the Plains of Abraham known as the Cove fields. J. F. W.

Helix (*Zonites*) *cellaria*, Muller. Dead shells of this species have been taken by Mr. Fowler near gardens in Craig Street, Montreal.

Helix pulchella, Mull. Abundant throughout the province.

Helix concava, Say. Not very common, but apparently with a wide range.

Helix electrina, Gould. Near Brome Lake in the Eastern Townships: R. J. F.

Helix arborea, Say. One of the commonest of the Canadian land-snails.

Helix indentata, Say. Montreal Mountain R. J. F.

Helix asterisca, Morse. Valley of the Marsouin river; R. B.

Helix chersina, Say. (= H. fulva? Mull.) Common in damp situations.

Bulimus lubricus, Mull. Rivière du Loup; Trois Pistoles: Metis lakes, and along the Restigouche: R. B. Montreal Mountain: R. J. F., and J. F. W.

Bulimus harpa, Say. Montreal Mountain: R. J. F., and J. F. W. Rivière du Loup: J. F. W. Metis: mouth of Magdalen river, and very abundant in the Marsouin valley: R. B.

Bulimus marginatus, Say. (Pupa fallax, Say.) Sugar Bush Lake, and near Gate Lake: W. D.

Pupa armifera, Say. Plains of Abraham, Quebec: W. C. and J. F. W.

Pupa contracta, Say. Island of Orleans: J. F. W.

Vertigo simplex, Gould. Rivière du Loup : J. F. W. Valley of the Marsouin : along the Restigouche and at Metis : R. B.

Vertigo Gouldii, Binney. Island of Orleans, and Rivière du Loup : J. F. W. Sixteen-Island lake. W. D. Montreal Mountain : R. J. F.

Vertigo ovata? Say. Montreal mountain : R. J. F., and J. F. W. The only specimen taken was not quite adult, but appeared to belong to this species.

Carychium exiguum, Say. Sixteen-Island lake, one specimen : W. D.

DESCRIPTIONS OF NEW, OR IMPERFECTLY KNOWN SPECIES

SPHŒRIUM.

(Section A. Species with Rounded but not Protuberant Beaks.)

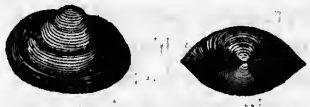

Figure 1.

Sphœrium sulcatum, Lamarck.

Animal white; tubes, a light orange color.

Shell transversally oval, nearly equilateral, light in texture for its size; posterior margin somewhat more pointed: anterior rounded; base slightly curved; valves convex; beaks full raised above the outline of the shell; posterior portion a little longer; sulcations coarse, regular; epidermis dark chestnut brown; interior light blue; hinge margin narrow, nearly a straight line; cardinal teeth small, indistinct, situated somewhat towards the anterior side, double in both valves, and so placed as to assume the shape of the letter V reversed; lateral teeth on a line with the primary teeth, large, strong and prominent.

Long. 11–16; lat. 71–61; diam. 5-16 inches.

The young is more equilateral than the adult, and more compressed; it presents the shape of a quadrilateral, and is of a light lemon colour: the striations are as heavy as those of the mature shell. The hinge-margin is generally straight, but in specimens from Alabama, Pennsylvania, and Rhode Island it is slightly curved.

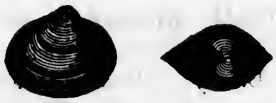

Figure 2.

Sphærium solidulum, Prime.

Animal not observed.

Shell transversely inequilateral, elongated, slightly convex; beaks full, not very prominent; anterior margin rounded; posterior drawn out to an angle; base slightly curved: epidermis variable, dark chestnut or brownish yellow, with sometimes a yellow zone on the basal margin; sulcations coarse, irregular; interior dark blue; hinge margin considerably curved; cardinal teeth double, in the shape of the letter V reversed; lateral teeth large; the anterior placed at an angle with the margin; the posterior more on a continuation of the curve.

Long. 9–16; lat. 7–16; diam 5–16 inches.

Differs from the preceding species in being less elongated, more inequilateral, less convex; the hinge margin is more curved, and the shell is more solid than in the S. sulcatum. Having unfortunately mislaid my only specimen from L'Orignal, the figure is taken from a fine large specimen from the Little Miami river, at Waynesville, Ohio. Canadian specimens will probably be smaller, and with their distinctive characters less strongly marked.

Figure 3.

Sphærium striatinum, Lamarck.

Animal white; tubes light reddish yellow.

Shell slight, transversely elongated, somewhat compressed, inequilateral; anterior margin rounded, posterior distended, inferior rounded; beaks full, not much raised; sulcations irregular, at times so light as hardly to be seen with the naked eye, thus giving the shell a lustrous appearance; colour varying from a light greenish-yellow to a darker shade; valves slight; interior blue; hinge margin

slightly curved: cardinal teeth double, very small, of the same size; lateral teeth larger, not very prominent.

Long. 7–16; lat. 5-16; diameter 4–46 inches.

Compared to the Sphœrium solidulum, this species is smaller, more inequilateral, less tumid, more compressed, less solid, less heavily sulcated, and its posterior extremity is more distended.

A very common species in the rivers of Lower Canada; but appears to have been generally overlooked.

Figure 4.

Sphœrium rhomboideum, Say. (sp.)

Animal; white? syphons reddish-yellow.

Shell sub-globular, rhombic, orbicular, equilateral; anterior margin truncated; posterior slightly angular; basal nearly straight; beaks full, but not prominent; valves slight, convex towards the beaks, gradually decreasing in fullness towards the margins; interior blue; sulcations very delicate; epidermis olive-green, often with a straw coloured zone on the margins; young shell more compressed than the adult; hinge margin nearly straight; cardinal teeth rudimentary; lateral teeth distinct, somewhat acute, not elongated.

Long. 8–16; lat. 6–16; diam. 5–16 inches.

A very local, but gregarious species.

Figure 5.

Sphœrium occidentale, Prime.

Animal not observed.

Shell oval, small, pellucid, fragile, equilateral, margins rounded; valves slight, rather convex; beaks full, rounded, not much raised; sulcations very fine, hardly visible; epidermis horn coloured; cardinal teeth very diminutive, lateral teeth more distinct.

Long. 5-16; lat. 4-16; diam. 3-16 inches.

This species is remarkable for its completely oval shape, which renders it quite distinct from all others. Apparently rather rare in Lower Canada.

(Section B.—Species with Protuberant, or Calyculate Beaks.)

Figure 6.

Sphœrium transversum, Say. sp.

Animal white, syphonal tubes pink, foot white.

Shell transversely oblong, elongated, sub-inequilateral, translucent; anterior side narrow; anterior margin rounded, posterior margin sub-truncate, basal very much curved; beaks placed somewhat on the anterior side, large, calyculate, very much raised above the outline of the shell; striæ very delicate; epidermis greenish-yellow (generally whitish in Canadian specimens), of a darker shade at times in the region of the beaks; valves slight; interior bluish; hinge-margin very nearly straight, narrow; cardinal teeth compressed, in the shape of the letter V reversed, and very much expanded; lateral teeth slightly elongated.

Long. 10-16; lat. 7-16; diam. 4-16 inches.

This large and delicate species is remarkable for its very transverse shape and for the narrowness of the anterior extremity as compared to the posterior.

Figure 7.

Sphœrium securis, Prime.

Animal pinkish; syphons of the same colour.

Shell rhombic-orbicular, ventricose, sub-equilateral, both sides nearly of the same length; anterior margin a little curved; posterior margin abrupt, forming an obtuse angle with the hinge margin; basal margin much longer than the superior margin, rounded;

beaks large, calyculate, slightly inclined towards the anterior, very approximate at apex: valves slight, very convex, especially in the region of the umbones; striæ delicate, regular, hardly perceptible; epidermis glossy in some cases, very variable in colour, but generally of a greenish-horn tint; at times of a brilliant yellow or straw colour (in Canadian specimens often translucent glossy white): hinge-margin curved, narrow; cardinal teeth very small, united at base; lateral teeth slight elongated; very narrow.

Long. 6-16; lat. 5-16; diam. 4-16. inches.

Unlike any other Canadian species.

The descriptions of the Lower Canadian species of Sphœrium have been taken from Mr. Prime's able monograph. The ensuing descriptions are original, except in the case of Limnæa ampla.

PISIDIUM.

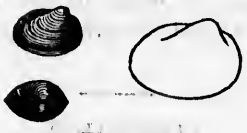

Figure 8.

Pisidium Virginicum, Brongniart.

Shell ovate, elliptical, oblique; strongly concentrically sulcate; "beaks placed much nearer one end;" slightly elevated, rounded, with a decided inclination to the anterior portion of the shell Posterior end elongated, rounded; anterior portion truncate; ventral margin convex. Easily distinguished from all the Lower Canadian Pisidia by its large size, strong concentric sulcations, and general outline.

Figure 9.

Pisidium altile, Anthony.

Shell sub-triangular, very tumid (except in the variety *compressum*, which may prove a distinct species), especially in the region

of the beaks: generally much broader from the umbo to the ventral margin, than in the opposite direction: beaks elongated into an obtuse point: anterior portion shortly rounded, but not truncate; posterior end forming a rounded, slightly pointed angle with the very convex ventral margin. Surface very finely striated.

Figure 10.

Pisidium abditum, Haldeman.

Shell ovate, orbicular, not very inequilateral; ventricose; beaks prominent, rounded: general outline very variable, sometimes very oblique; in others the umbones almost central, the general form being nearly circular, but elongated and very bluntly pointed posteriorly: surface striated, the striæ stronger than in the preceding species.

LIMNÆIDÆ.

Figure 11.

Limnæa ampla, Mighels.

"L. testa amplâ, subovata; anfractibus quinque, convexis, superné geniculatis; suturâ valde impressâ; spira brevi; apertura latâ; umbilico profundo (?); columella valde plicata."

I have copied the original diagnosis of this very characteristic species from the proceedings of the Boston Society of Natural History for June 21st, 1843.

Dr. Mighel's description agrees with our Lower Canadian specimens in nearly every respect; but the Brome Lake specimens

are imperforate, or very nearly so. The species is easily known by its large and wide body-whorl, which is decidedly angulated towards the sutures. The spire varies in length, but is seldom more than half as high as the last volution.

Figure 12.

Planorbis macrostomus, nobis.

Shell in many points closely resembling Planorbis lentus, Say of which it may perhaps be only a variety. It is much larger, higher, and has deeper costæ ; its lines of growth are very prominently marked : the upper angle of the whorls as shown in the mouth, is more prominent. Lip *widely expanded*, and *reflected*, covered with a white enamel. In this latter character it differs from all the North American species of Planorbis. It is a species nearly allied to Planorbis lentus and P. trivolvis; but apparently distinct from both.