

Brooks

ART. IV. GEOGRAPHICAL DISTRIBUTION OF THE
RECENT MOLLUSCA OF NEWFOUNDLAND

By STANLEY TRUMAN BROOKS
AND
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The following summary constitutes the final report covering the collections made by us between 1934 and 1938 upon the island of Newfoundland. We feel that in Newfoundland we have found a territory of critical value in the study of animal distribution. The several species found within the confines of the Great Island, which are not known from the United States and Canada, will lead many to believe that they have been introduced through commerce. This may well be, but if attention is paid to the localities in which many of these species live, the uninhabited islands off the rocky shores, the deep fastnesses of the Rocky Downs, and other localities along this ancient shore, then the conviction will grow that we have found a natural fauna distributed by nature through the centuries that have passed. The majority of these forms witnessed the Ice Age and through that troublous time retained the stations they inhabit today. Introduction through commerce may have occurred not only once but many times within certain areas such as the city of St. John's. However, this locality is the least important and probably the most barren of all. Before one may form a conclusion it should be remembered that all of the shipping to this country has been done by fishermen and by merchant-fishermen. None of these has imported much garden material and the small islands along the Southern Shore, which has been found to be the critical area, have scarcely been touched by the foot of man. Some of them are uninhabitable even for a frugal goat. True, the fisherman may have drawn up his nets from the sea and spread them out to dry or at the most, he may have pastured a few sheep upon their rocky summits. In the main, however, these islands and these headlands may be thought of as uninhabited areas.

RESUME OF TRAVELS

The first trip¹ to Newfoundland was made in 1934. This was accomplished by the senior author alone and was a survey from the east to the

¹ Brooks, S. T., *The Land and Freshwater Mollusca of Newfoundland*. Annals of the Carnegie Museum, vol. 25, p. 83-108, pls. 12, 13, 1936.

July 3, 1940;

west, along the track of the overland railway, and thence north to the deep fiord of Bonne Bay on the west coast. This trip, which we consider now as a journey of reconnaissance, was fruitful in bringing to light many forms heretofore unknown from this region. Not only did new species come to light, but also the major divisions of the fauna were then determined. This will be discussed later in this paper.

The second trip, which also included only the senior author, was accomplished partly through the kindness of Captain "Bob" Bartlett of the Schooner "Morrissey." Eight days with Captain "Bob," whose cargo included a cow, a calf, two dozen hens and innumerable gold fish and "guppies," landed him at Brigus where field work started. Leaving Brigus, trips were made to some sixty-three ports along the northeastern coast of Newfoundland and southern Labrador. In most instances the time was too short, or the paucity of specimens made collecting a discouraging business. Three weeks were spent at the Grenfell Hospital at St. Anthony, partly in field work for molluscs and partly in researches in human parasitism.² The shores near this port were traversed for miles in each direction and only in rare cases were good collecting localities found. The encroachment of vegetation in the many lakes and ponds in this vicinity has made a situation inhospitable to molluscs and whatever fauna once lived there has now been lost in oblivion. Wherever one finds patches of blue grass or hardwood trees one finds a few specimens.

The third trip to Newfoundland allowed a greater coverage of territory. Mrs. Brooks and the three children, all ardent collectors, located on the Southern Shore at the village of Ferryland, Lord Baltimore's former home. There intensive and exhaustive collecting brought to light the largest number of forms yet to be collected in Newfoundland. While Mrs. Brooks filled her five months sojourn with travels in and along the southern coast, the writer engaged in many short trips over the Avalon Peninsula and went north for an extended trip to Labrador.

The collections made in the summer of 1937 brought to light the fact that several interesting European species occur in Labrador and on the islands off the shore of Ferryland. It was therefore planned to concentrate during the summer of 1938 on making a collection from these islands. This was accomplished by Mrs. Brooks at Mobile, on the numerous rocky islands in that district, and in the deep indentations at Placentia, North-east Arm, and Southeast Arm of Placentia Bay. On nearly every island

² Brooks, S. T., *A Short Study of Human Parasitism in the Middle North*. The Journal of Parasitology, vol. 23, No. 1, p. 104, Feb. 1937.

the fauna that we had discovered the dated. But only two months of the study as our ultimate goal was England and the British Museum.

DEFINITION OF THE N

With the exception of a few species from this island, the molluscan fauna of the area which existed in this area during the Pleistocene, and before the separation of the continents. In our study we have made a distinction between the following:

1. The circumboreal species that have their centers of origin down into the continental interior.
2. Those species characteristic of the North American fauna derived from an earlier migration from the North Pole. Under the circumboreal species we include those with a similar distribution as well as those which are more west than to the west. It is the belief of the senior author that the fauna herein united under the heading circumboreal is either fossil or recent state in the United States and Siberia. It may be possible, however, that some of these species, hitherto so far unknown to us, there may have been introduced into eastern America from Holland during the Pleistocene spreading and joining with their northern relatives. The criterion for this statement is that the fauna from Siberia, Alaska, and the great southern part of northern Canada, Newfoundland, Labrador, and Iceland. Again we must recognize that the species from these extensive areas may not be the exact range of our "European Species." The species which have been the subject of careful studies are made of the North American fauna have been one of our most enticing and important. It also may be stated that the "European forms" are not importations but are native to the distribution of the basic species of the North American fauna. The distribution of the basic species of the North American fauna will be discussed under the heading of the North American fauna. The North American fauna 41.7 per cent is from the North American fauna and 58.3 per cent then must be from the North American development upon the North An

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the fauna that we had discovered the year before at Ferryland was dupli-
cated. But only two months of the summer could be allowed for this work
as our ultimate goal was England and the extensive collections of the
British Museum.

DEFINITION OF THE NEWFOUNDLAND FAUNA

With the exception of a few species and subspecies that are unique to
this island, the molluscan fauna of Newfoundland today is the same as
that which existed in this area during and very likely even before the
Pleistocene, and before the separation of Newfoundland from the main-
land. In our study we have made a division of this fauna into two groups:

(1) The circumboreal species that have migrated from their Holarctic
centers of origin down into the contiguous land areas and;

(2) Those species characteristic of the continental areas which have
been derived from an earlier migration of progressive forms.

Under the circumboreal species we include those with a truly circum-
polar distribution as well as those which now show greater affinities to the
east than to the west. It is the belief of the authors that all of the forms
herein united under the heading circumboreal will, in the future, be found
in either fossil or recent state in the unknown portions of northern Canada
and Siberia. It may be possible, however, that, due to geographical con-
ditions so far unknown to us, there was an influx of so-called European
species into eastern America from Holarctica and that these were prevented
from spreading and joining with their fellows of eastern Europe. Our only
criterion for this statement is that the majority of these are not known
from Siberia, Alaska, and the great spaces of Canada, but are common to
eastern Canada, Newfoundland, Labrador, and in many cases to Green-
land and Iceland. Again we must realize that there exists a paucity of
collections from these extensive areas and that we will be able to determine
the exact range of our "European Species" in North America only when
more careful studies are made of these regions. This, it may be said, has
long been one of our most enticing dreams and perhaps one of the most
important. It also may be stated that *in the main*, these so-called "Euro-
pean Forms," are not importations through commerce, but are a part of
the distribution of the basic species *via* Holarctica. The evidence pos-
sessed by us will be discussed under the various headings. Of the entire
Newfoundland fauna 41.7 per cent is included in the circumboreal group.

Around 58.3 per cent then must fall within the other group which had
its development upon the North American continent. This brings us to

another interesting observation. In Newfoundland we find a very definite eastern and western distribution. The forty-six species occurring on the western side of the island are predominantly of American origin, whereas the eastern fauna, consisting of thirty-nine species, is predominantly Holarctic in origin and contains the so-called "European forms."

It is very doubtful whether there is anything significant in the fact that these dual faunas occupy the areas of the geosynclines,³ the Acadian and the St. Lawrence, while there is an obvious paucity in the central region or that of the New Brunswick Geosyncline. The activity of the former two geosynclines, is probably responsible for the present ecological conditions that enable these eastern and western faunas to live, but it is interesting to note that the map of this billion-year old scene of orographical activity is also the one of the present molluscan distribution.

Much knowledge is still hidden in the rocks and folds of this rugged island, for Newfoundland is an ancient land, the major portion of it having been above the surface of the sea for the last one-hundred million years. Twenhofel⁴ tells the story of the subsequent folding, faulting, and erosion.

During the Tertiary, Newfoundland was a low plain with the drainages following the structure of the ancient formations, much the same as they are today. In the middle or late Tertiary there came an uplift and tilting which raised the region of the Long Range (western) some 2000 feet and the northeastern coast to some 700 feet, with a subsequent sinking to the south. A greater submergence of the shore line occurred following the glaciation, which accounts for the great bays of the eastern portion of the island as well as the drowned valleys along the western periphery (formation of Bonne Bay and the Bay of Islands). It is with this latter submergence that the many interesting islands fringing the shores of the Avalon were formed. In the late Pleistocene,⁵ the submergence also caused the formation of the Bay of St. Lawrence and the Strait of Belle Isle, which separated Newfoundland from the American continent.

Now one thing is obvious and that is that the fauna of present-day Newfoundland attained its place in that island subsequent to any total

³ Twenhofel, W. H., *Newfoundland: Geology and Peoples*. Sigma Xi Quarterly, vol. 27, p. 103-112, 121, 1939.

⁴ Twenhofel, W. H., *Physiography of Newfoundland*. American Journal of Science, vol. 33, p. 1-24, 1912.

⁵ Schuchert, C. and Dunbar, C. O., *Stratigraphy of Western Newfoundland*. Memoirs Geol. Soc. Am., no. 1, 1934.

glaciation that may have occurred would cause the extermination of the fauna that occupied the island. If the glaciation was to have been covered and no plant or animal life existed at that time. Just when such an event occurred in Newfoundland is not yet known. There are many theories and theories but one thing is certain, a disastrous glaciation has occurred on the island.

Chamberlin (1895)⁶ states that he has the impression "that the glaciation is probably attributable to the development of the ice fields of the mainland." He says that "no granitic erratics from the interior of the island mingle with the local red sandstone." These facts indicate an extremely recent glaciation.

Coleman (1926)⁷ indicates that the only small evidence (Southern Shore of Jersey) and was of several hundred years ago occur along the present shore, but not at Fermeuse. He says that, although there is no evidence, we conclude that:

(1) there was an ice cap spread over the island;

(2) there were probably two invasions, one in the late, the other in the early Pleistocene, the latter being a sheet of the mainland. There was no evidence of a heavy ice sheet and it was not heavy enough to divide the island.

Twenhofel (1912)⁸ described the Long Range, as a remnant of an extensive plateau which was elevated and then dissected by glacial activity and erratics of glacial origin. The "peaks" (table lands) of the Long Range divide the island into three parts:

⁶ Chamberlin, T. C., *Notes on the Geology of Newfoundland*, p. 467, 1895.

⁷ Coleman, A. P., *The Pleistocene of Newfoundland*, vol. 34, no. 3, pp. 200-204, 1926.

⁸ *ibid.*, cit.

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glaciation that may have occurred. We are assuming that a total glacia-
tion would cause the extermination of the flora and fauna of the region it
occupied. If the glaciation was *total*, then all populated areas would have
been covered and no plant or animal could have existed or lived through
that time. Just when such an absolute glaciation may have occurred in
Newfoundland is not yet known. There are various conflicting evidences
and theories but one thing is certain. The snails seem to indicate that no
disastrous glaciation has occurred since *their last* migration into this
island.

Chamberlin (1895)⁶ states that the evidences in Newfoundland give
the impression "that the glaciation of the isle was more probably at-
tributable to the development of local ice sheets than to an extension of
the ice fields of the mainland." As to the Avalon Peninsula he says that
"no granitic erratics from the interior nucleus, or at most extremely few,
mingle with the local red sandstone and gray crystalline rocks in the drift.
These facts indicate an extremely local derivation."

Coleman (1926)⁷ indicates that the glaciation of the critical (for land
snail evidence) Southern Shore was quite ancient; either Kansan or
Jerseyan and was of several hundred feet in thickness. No true moraines
occur along the present shore, but a few large, transported blocks do occur
at Fermeuse. He says that, although the evidences are sparse, he would
conclude that:

(1) there was an ice cap spreading out from the center of the peninsula,
and;

(2) there were probably two invasions of the ice; one in the early Pleis-
tocene and another in the late, the latter corresponding to the Wisconsin
Sheet of the mainland. There was no indication of powerful ice action
and it was not heavy enough to depress the shore.

Twenhofel (1912)⁸ described the western portion of the Island, the Long
Range, as a remnant of an extensive peneplain, cretaceous in origin, which
was elevated and then dissected. This region shows extensive glacial
activity and erratics of glacial origin are found on the tops of the highest
"peaks" (table lands) of the Long Range. Physiographically, Twenhofel
divides the island into three parts: the Long Range and coastal region;

⁶ Chamberlin, T. C., *Notes on the Geology of Newfoundland*. Bull. Geol. Soc.
Amer., p. 467, 1895.

⁷ Coleman, A. P., *The Pleistocene of Newfoundland*. The Journ. of Geology,
vol. 34, no. 3, pp. 200-204, 1926.

⁸ *loc. cit.*

the central region between the Long Range and Placentia and Trinity Bays; and the Avalon Peninsula. All evidences point to a greater glacial activity in the western and central portion, with the least activity in the Avalon. However, there is an indication that the southern region of the Long Range was not glaciated. Valley glaciers have deposited boulder clay and erratics only to an altitude of 500 feet and the table lands show little glacial activity and no erratics.

In his later paper, Twenhofel (1939) states that during the Ice Age most, if not all, of Newfoundland was covered by the ice. His reaction to the finding of what presumably are plant relicts, as indicating unglaciated areas, is that this evidence may well exist but that more work must be done in this field. He also correlates the last glaciation with the Wisconsin advance and believes that the ice had disappeared from 25,000 to 50,000 years ago. Following this there were some submergences of the coast during which time the larger bays and long salients were formed. In the more northerly part of the island there has been a reversal of the subsidence, but to the south there is a continued sinking.

THE SPECIES AND THEIR SIGNIFICANCE

Euconulus fulvus is a species of the eastern, central, and western portions of the island. In the aggregate, the *Euconulids* are circumboreal in distribution and as fossils are first found in the Pliocene beds.

Vertigo modesta and its races form one of the most important of the circumboreal complexes. The genus is widespread in the Pliocene having then attained a distribution which, at present, is restricted to some extent by subsequent glaciations, especially in western America and in Siberia. In Newfoundland it is limited to the western area and the northern peninsula. The races of this group include *V. krausseana* of Siberia and Alaska; *V. arctica* of Lapland and Alaska (?); *V. hoppi* of Greenland; and *V. modesta* and varieties of North America. In our study of *V. arctica* and *V. hoppi* in the British Museum, and of the former in the Bryant Walker Collection of the University of Michigan, we have come to the conclusion that they are both *V. modesta*. In a collection made this past year in the islands of the Belcher Group, Hudson's Bay, by Dr. Arthur C. Twomey, of the museum staff, we have specimens of true *modesta* that are absolutely identical with *arctica* and which prove to our satisfaction the unity of these species. The Newfoundland specimens are all more typical of the southern American forms.

Pupilla muscorum is another circumboreal species which has occurred

since the Pliocene and is now found in the Long Range (west coast) and Ferryland. This species is noted and to the present time has been foundland, the Long Range and

Vallonia pulchella, another Pliocene only on the Avalon Peninsula, an area. *Zoogonetes harpa* and *Purpura* between Trinity Bay and the western coast. *Copula lubrica* is found generally on

Limax arborum is a species, widespread in America. It had previously been described by T. D. A. Cockerell. In the same astounding find through dissection bearing its unmistakable flagellum. We collected it at seven localities in Ferryland, along the Southern Shore. It was more strikingly found on a specimen from Torr's Cove. It is difficult to see all of these localities.

Only two specimens of *Limax* were foundland; one from St. John's, locality the specimen was darker than *fulvus* and not of *maximus*. A dissection of the appendix or caecum of *flavus*.

Deroceeras laevis and *D. agrestis* are circumboreal and both have been found in the former is found sparsely in the central part of the island, and the latter generally in the southern part.

Zonitoides nitidus is found only in the southern part of the island. *Limpida* is found on the islands of the Belcher Group and northern peninsula. The species *alaskana*, *V. limpida*, *V. pellucida* are other circumboreal complex, suggesting a long geological history.

Retinella electrina (the American form) is another widely spread form on the island. Another widely spread form is *Retinella*. Its varieties, it may be collected

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since the Pliocene and is now found in Newfoundland at various localities in the Long Range (west coast) and *on an island off the Southern Shore*, at Ferryland. This species is noted for its "spotty" distribution in America and to the present time has been found only in the two regions in Newfoundland, the Long Range and the Avalon Peninsula.

Vallonia pulchella, another Pliocene, circumboreal, immigrant is found only on the Avalon Peninsula, and *Columella edentula* only in the western area. *Zoogenetes harpa* and *Punctum pygmaeum* both occupy the region between Trinity Bay and the west coast of Newfoundland, while *Cochlicopa lubrica* is found generally over the entire island.

Limax arborum is a species, which in a natural state, is new to North America. It had previously been found in greenhouses in Colorado by T. D. A. Cockerell. In the same manner as Cockerell we approached this astounding find through dissection and, upon finding the penis sheath bearing its unmistakable flagellum, we decided that it could be no other. We collected it at seven localities along the shore from Aquaforte and Ferryland, along the Southern Shore, to Brigus on Conception Bay, and more strikingly found it on a small island, Fox Island, off the shore at Torr's Cove. It is difficult to see how it could have been introduced into all of these localities.

Only two specimens of *Limax maximus* have been identified from Newfoundland; one from St. John's, and one from Bay Bulls. In the latter locality the specimen was darker, and the respiratory orifice was typical of *flavus* and not of *maximus*. A dissection, however, did not show the rectal appendix or caecum of *flavus*.

Deroceras laeve and *D. agrestis*, probably, are both circumboreal in distribution and both have been introduced over much of the world. The former is found sparsely in the central, western, and eastern parts of Newfoundland, and the latter generally over the entire island.

Zonitoides nitidus is found only on the Avalon Peninsula while *Vittrina limpida* is found on *the islands of the east coast*, and on the western coast and northern peninsula. The *Vittrinas* in the aggregate, including *V. alaskana*, *V. limpida*, *V. pellucida*, *V. angelicae*, and *V. exilis*, form another circumboreal complex, such as *Vertigo modesta*, and also have an equally long geological history, appearing in the late Eocene.

Retinella electrina (the American form of the European *R. hammonis*), is another widely spread form and in Newfoundland is found over the entire island. Another widely spread species is *Stagnicola palustris*, for, with its varieties, it may be collected over the entire island.

Helix hortensis is undoubtedly a circumboreal form, but at present it is known only from Europe and North America; the Asiatic localities being in some doubt. It is spread over the entire island of Newfoundland with its greatest population being along the face of the moist Long Range. This species was first discovered in America in the Pleistocene of Maine, and is now found in Massachusetts, Maine, New Hampshire, Vermont, Connecticut, and New York. It has been reported from the Amur Valley in Siberia; from "debris" of Indian camps in Nebraska, and it lives in goodly numbers in the Province of Quebec, and on the islands of Michelon and St. Pierre.

Trochulus striolatus (*Hygromia rufescens*), is known to occur in Siberia, Europe, Labrador, and Quebec. It has been found in large numbers by us in the vicinity of St. John's and Placentia.

Helicigona arbustorum, an inhabitant of northern Europe, Iceland, and Quebec, was reported from St. John's, Newfoundland, by Whiteaves, in 1863. We had questioned its presence in Newfoundland since no amount of labor on our part had succeeded in turning it up. We were assured, however, by the workers in the British Museum, that Whiteaves had not made a mistake, and that it either had become extinct through destruction of its habitat or that we had not yet discovered its lair.

Vallonia excentrica was found in great numbers on the headlands around St. John's and along Conception Bay at Harbour Grace.

Arion ater, a presumably introduced form, is commonly found from St. John's south along the Southern Shore. Finding it in the tangled fastnesses of the uninhabited Rocky Downs, miles from any semblance of gardens and farms, might point to an earlier migration than that of man might afford. Since it occurs in Maine, it should, if an ancient migrant, ultimately be found along the intervening shores. In this regard we believe that more extensive collections from the islands of our eastern coast and from those farther north must be made to more fully know the distribution and past history of many of these so-called introductions. *Arion hortensis* occupies the Avalon and the west coast of Newfoundland although not in great numbers. *Arion subfuscus* (= *fasciatus*), has been reported from Trepassey and Whitbourne and has been collected by us from the islands of the Avalon Peninsula and along the shore from the southern reaches of the eastern shore north to St. Anthony on the northern Peninsula. It is undoubtedly generally distributed. *Arion circumscriptus* is here reported for the first time from Newfoundland. It is much more common along the eastern shores than is *hortensis*. The dissection of this form showed genitalia typical of the species.

Vertigo alpestris is one of our most given as "Europe," and Mozley, in a listed it from Vladivostock, Lake Bail foundland it was first found by Mrs (Nancy's Portion, at Ferryland, the 5 occurred in great numbers which stim along the shores of the Avalon. Durin again found it on small islands in No one of these islands could be or eve of them are mere heaps of stone rising tides. The snails were found deep am moisture-holding moss (*Dicranum* sp. whitish mould covering the lower dead they were over a foot below the visible were found in blue grass and were fee urchins and other limy shells droppe has not been found on the mainland *limpida*, *Helix hortensis* (ranging sma other species. We feel that this is an and by no means an introduction. It enabled it to persist to this day althou (can ascertain) from the mainland. Th islands occurred during the late Pleist.

Oxychilus lucida is found all along

Discus rotundatus is another myster; for the first time in North America. A of this species in the ruins of buildings It was not found on the islands but occurred, *Discus cronkhilei* and *Discus* Its isolated occurrence is not one to migration. It may later be found in c found, become more important to our

The distribution of *Discus cronkhilei* Newfoundland is interesting. The fo mountainous area of America, extenc region of Canada and Alaska. The lat limits of North America, but even th Great Slave Lake.

The presence of *Discus cronkhilei*

Vertigo alpestris is one of our most important finds. Its distribution is given as "Europe," and Mozley, in a personal communication with us, listed it from Vladivostock, Lake Baikal, and Irkutsk, Siberia. In Newfoundland it was first found by Mrs. Brooks on a small rocky island (Nancy's Portion, at Ferryland, the Southern Shore), in 1937. Here it occurred in great numbers which stimulated us to seek it on more islands along the shores of the Avalon. During the summer of 1938, Mrs. Brooks again found it on small islands in the deep arms of Placentia Bay. No one of these islands could be or ever has been occupied by man. Some of them are mere heaps of stone rising only a few feet above the highest tides. The snails were found deep among the stones and rubble under a moisture-holding moss (*Dicranum* sp. and *Hypnum* sp.), feeding upon a whitish mould covering the lower dead layers of moss. In some instances they were over a foot below the visible surface. On Nancy's Portion they were found in blue grass and were feeding upon the bleached tests of sea urchins and other limy shells dropped by the gulls. So far, this species has not been found on the mainland. Associated with it were *Vitrina limpida*, *Helix hortensis* (ranging smaller than the mainland forms) and other species. We feel that this is an ancient migrant to Newfoundland and by no means an introduction. Its isolation on the small islands has enabled it to persist to this day although it has disappeared (as far as we can ascertain) from the mainland. The subsidence and formation of these islands occurred during the late Pleistocene.

Oxychilus lucida is found all along the Southern Shore of the Avalon.

Discus rotundatus is another mystery shell found in the summer of 1937 for the first time in North America. Mrs. Brooks collected large numbers of this species in the ruins of buildings at Ferryland, on the South Shore. It was not found on the islands but only in this one district. Where it occurred, *Discus cronkhitei* and *Discus cronkhitei anthonyi* were not found. Its isolated occurrence is not one to offer much evidence for a natural migration. It may later be found in other parts of the island and will, if found, become more important to our problem.

The distribution of *Discus cronkhitei* and *Discus cronkhitei anthonyi* in Newfoundland is interesting. The former is a species of the western mountainous area of America, extending north throughout the coastal region of Canada and Alaska. The latter is confined to the more southern limits of North America, but even then attaining a distribution north to Great Slave Lake.

The presence of *Discus cronkhitei* in Newfoundland, and not in the

intervening spaces, can be explained by assuming that the species formerly had a continuous distribution from west to east. The absence of this species in the marls and loess of the intervening spaces may be explained by assuming that the distribution was a northern one and that the species did not penetrate into the southern limits (of the subspecies) before the advance of the ice destroyed its continuity. But again there is no reason to believe that the two species gained their dispersal into Newfoundland simultaneously. *Discus cronkhitei* is logically the oldest form and therefore could have made its way into Newfoundland at an early time. Then the strong American subspecies found it possible to encroach upon the entire southern territory of the parent (?) species and in so doing it spread over all the areas now occupied. However, the subspecies had an early start and gained a very wide dispersal before the period of island formation in the late Pleistocene.

Radix pereger is a versatile species found in Europe, Iceland, and in Newfoundland. Formerly it had been confused with the variety *geisericola* of Iceland, but according to F. C. Baker the Newfoundland variety is *lacustris* Leech. We collected it in great numbers in the small lakes at Whitbourne and in goodly numbers in Clam Cove River far to the south of the Avalon Peninsula. It occurs only on the Avalon. There is little evidence that this species was *introduced* into Newfoundland from Europe. Whitbourne is in the more populous part of the island and this species could have found its way into the lakes there from some kind of railway shipments, but Clam Cove River is a small stream far out of the beaten track (crossed by a spur of the railway that once served the Southern Shore), and it would stretch one's credulity to imagine any of the local fishermen accidentally seeding the area with this species from any kind of imports. We have confidence that this will prove to be one of the natural migrants of the Pleistocene or earlier periods.

Succinea groenlandica is to be viewed with some suspicion. We have been unable to compare our specimens with any from Greenland, but they have been authoritatively determined to be of this species. However, its scanty distribution in the Bonne Bay (Lomond) district does not stimulate much faith in its importance in a study of distribution.

Margaritana margaritifera is found over the entire island of Newfoundland. The late great student of the molluscs, Bryant Walker, put forward the theory that America has been the recipient of two distinct immigrations of this species; one by the western route (Siberia), and the other by an easterly route from Europe. The reasons he gave for this theory are

the absence of this species in America, and its presence in Europe. As Pilsbry and others have shown, it goes so far back into geological time that it has altered the apparent pattern of the most ancient of any continental fauna. Therefore, we do not feel that it is delineated in order to explain its dispersal from the Holarctic realm to America. It is more recent migrants. The only to the one portal, the circum-polar mass which held Asia, Europe, and North America. Our distributional phenomena are in line with the geological findings of Schuchert. The taxonomic expressions of the evidence among the species is *limited within the Holarctic*. It is these species that we have that the fauna of the continent is some force of nature which has. However, the possibilities are sufficient to pique the curiosity.

It is hardly necessary to group of American origin in a "chart of the species," their affinities although scattered and nearly all are from circumpolar. *Discus cronkhitei* in Newfoundland points to its early dispersal into Newfoundland. The dual character again indicates that natural migration. The greater part of Newfoundland recent forms. That there is a Newfoundland area by the then follows that the Holarctic Newfoundland would indicate this fauna having been able to withstand the fluctuating ice sheet. Not

y assuming that the species formerly west to east. The absence of this intervening spaces may be explained a northern one and that the species limits (of the subspecies) before the continuity. But again there is no reason their dispersal into Newfoundland geologically the oldest form and there Newfoundland at an early time. Then it possible to encroach upon the (?) species and in so doing it spread. However, the subspecies had an early before the period of island formation

nd in Europe, Iceland, and in New used with the variety *geisericola* of the Newfoundland variety is at numbers in the small lakes at Clam Cove River far to the south ly on the Avalon. There is little into Newfoundland from Europe. part of the island and this species s there from some kind of railway small stream far out of the beaten y that once served the Southern ility to imagine any of the local with this species from any kind is will prove to be one of the nat-er periods.

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er the entire island of Newfound-rces, Bryant Walker, put forward recipient of two distinct immigra-route (Siberia), and the other by ions he gave for this theory are

the absence of this species in the extensive central region of North America, and its presence in both the eastern and western areas. However, Pilsbry and others have stated, the past history of the molluscs extends so far back into geological time that various geographical changes may have altered the apparent pattern of their distribution. This species is one of the most ancient of any of the forms with which we shall have to deal. Therefore, we do not feel that any especial pattern of distribution must be delineated in order to explain the present range. It is obviously a species from the Holarctic realm which followed the same path later trod by the more recent migrants. This Holarctic realm was not necessarily limited only to the one portal, the Siberian doorway, but was the emerged circumpolar mass which held in common embrace the northern reaches of Asia, Europe, and North America. In no other way are we able to explain our distributional phenomena and in so doing we are following the geological findings of Schuchert and Chamberlin, and the paleontological-taxonomic expressions of Matthew and Pilsbry. There is, however, sufficient evidence among the molluscs to cause one to think of a migration limited within the Holarctic realm to those species of western Europe, and it is these species that we have been discussing. But the possibility remains that the fauna of the contiguous areas may have been exterminated by some force of nature which would thus render Walker's picture untenable. However, the possibilities of a migration from western Europe are sufficient to pique the curiosity.

It is hardly necessary to enumerate the species forming the large group of American origin (58.3% of the fauna), as they are all included in a "chart of the species," which follows. They are typically American in their affinities although some are known from Asia (*Zonitoides arboreus*), and nearly all are from circumboreal genera. We feel that the presence of *Discus cromkhitei* in Newfoundland, and in its present range in America, points to its early dispersal throughout North America, inclusive of Newfoundland. The dual character of its distribution within Newfoundland again indicates that nature extirpated many of these forms from the greater part of Newfoundland and then allowed a later influx of more recent forms. That there have been successive waves of migration into the Newfoundland area by the American species seems to be above doubt. It then follows that the Holarctic-European aspect of the eastern coast of Newfoundland would indicate a more ancient dispersal, the members of this fauna having been able to withstand the subsequent vicissitudes of the vacillating ice sheet. Not only are these remnants found in Newfoundland

but also to a limited degree in Labrador, eastern Canada, and New England. It would seem that this dispersal took place before the formation of the Strait of Belle Isle and the St. Lawrence Gulf, during the late Pleistocene.

CONCLUSIONS

1. In Newfoundland there exist the relicts of two major dispersals of molluscan life:

- (a) those species of Holarctic origin;
- (b) those of American origin.

2. The majority of those more closely related to the present European fauna are found in eastern Newfoundland (the Avalon Peninsula).

3. In Newfoundland, the majority of the species of American origin are found in the western portion of the island.

4. This populating of Newfoundland took place (once or many times) before the submergence, forming the Strait of Belle Isle and the Bay of St. Lawrence, occurred.

5. The species of Holarctic origin are of two groups:

- (a) those truly circumboreal in distribution;
- (b) those not known to be truly circumboreal, but which are of the western European fauna (including Greenland and Iceland).

6. In view of the lack of evidence for any absolute extermination of life, no total (therefore fatal) glaciation of Newfoundland has occurred since the depression of the Strait of Belle Isle and the Bay of St. Lawrence.

7. The species found on the islands of the Southern Shore indicate that there has been no total glaciation of eastern Newfoundland since the formation of the fringing islands of the Avalon Peninsula and since the advent of the species found there.

8. Newfoundland had freshwater connections with Holarctica through which the mussels and aquatic snails, both circumpolar and American *in origin*, made their way into the various drainage systems.

LIST OF LOCALITIES

1. *Helix hortensis* (Müller)
2. *Helicigona arbustorum* (C.)
Reported by White
3. *Trochulus striolatus* (C.)
Collected by us in
Road, Signal Hill
4. *Oxychilus lucida* (Drap.)
Circular Road.
5. *Vallonia excentrica* (Ste.)
Collected in great
6. *Limax maximus* Linnae
Rare in Newfoundl.
7. *Deroceras agrestis* (Linn)
8. *Arion circumscriptus* Jo
9. *Helisoma campanulata* (Linn)
In Murray's Pond
10. *Ammicula limosa* (Say)
11. *Stagnicola palustris* per
12. *Cochlicopa lubrica* (Mül)

TH

1. *Arion ater* (Linnaeus)
1. *Limax maximus* Linnae
2. *Limax arborum* Bouch.-
3. *Arion ater* (Linnaeus)

1. *Zonitoides arboreus* (Say)
2. *Limax arborum* Bouch.-
3. *Deroceras agrestis* (Linn)
4. *Arion circumscriptus* Jo
5. *Arion subfuscus* (Drap)

Th

1. *Helix hortensis* (Müller)
A colony of this s
found in the village

*Unless otherwise designated, all specimens are deposited in the Carnegie Museum.

LIST OF LOCALITIES AND SPECIES IN NEWFOUNDLAND*

St. John's

1. *Helix hortensis* (Müller)
2. *Helicigona arbustorum* (Linnaeus)
Reported by Whiteaves in 1863.
3. *Trochulus striolatus* (C. Pfr.)
Collected by us in St. John's proper at Forest Road, Circular Road, Signal Hill and at Quidi Vidi village.
4. *Oxychilus lucida* (Draparnaud)
Circular Road.
5. *Vallonia excentrica* (Sterki)
Collected in great numbers at Forest Road and on Signal Hill.
6. *Limax maximus* Linnaeus
Rare in Newfoundland.
7. *Deroceras agrestis* (Linnaeus)
8. *Arion circumscriptus* Johnston
9. *Helisoma campanulata* (Say)
In Murray's Pond and Quidi Vidi outlet.
10. *Amnicola limosa* (Say)
11. *Stagnicola palustris perpalustris* Baker and Brooks
12. *Cochlicopa lubrica* (Müller)

THE SOUTHERN SHORE

Petty Harbour

1. *Arion ater* (Linnaeus)

Bay Bulls

1. *Limax maximus* Linnaeus
2. *Limax arborum* Bouch.-Chant.
3. *Arion ater* (Linnaeus)

Mobile

1. *Zonitoides arboreus* (Say)
2. *Limax arborum* Bouch.-Chant.
3. *Deroceras agrestis* (Linnaeus)
4. *Arion circumscriptus* Johnston
5. *Arion subfuscus* (Draparnaud) equals *fasciatus* Nils.

The Ferryland District
(Mainland fauna)

1. *Helix hortensis* (Müller)
A colony of this species exists at Aquaforte but has not been found in the village of Ferryland.

*Unless otherwise designated all the species listed are in the collections of the Carnegie Museum.

2. *Zonitoides arboreus* (Say)
Collected at Chance Cove and Spout Pond.
3. *Striatura exigua* (Stimpson)
Collected only at Chance Cove.
4. *Retinella electrina* (Gould)
Collected at Ferryland Village, Chance Cove and Spout Pond.
5. *Oxychilus lucida* (Draparnaud)
Living in Ferryland Village and south in the wilds of Spout Pond.
6. *Discus rotundatus* (Müller)
Collected for the first time in North America in ruins of Church of England (1937), in Ferryland Village. This has not been found in any other locality.
7. *Discus cronkhitei* (Newcomb)
Neither this nor the following species were found within the *rotundatus* area but were collected at Chance Cove.
8. *Discus cronkhitei anthonyi* (Pilsbry)
9. *Cochlicopa lubrica* (Müller)
10. *Limax arborum* Bouch.-Chant.
11. *Deroceras agrestis* (Linnaeus)
12. *Arion subfuscus* Ferussac
Collected at Aquaforte, Chance Cove, Trepassey, and Brigus Cross-Roads.
13. *Arion ater* (Linnaeus)
Chance Cove, Aquaforte.
14. *Arion hortensis* Ferussac
15. *Arion circumscriptus* Johnston
16. *Fossaria umbilicata* (C. B. Adams)
Two small streams, Priest's River and Freshwater R.
17. *Radix pereger lacustris* (Leach)
Clam Cove River and an interesting find.
18. *Helisoma campamulata* (Say)
Spout Pond.
19. *Anodonta brooksiana* van der Schalie
A species described by Dr. van der Schalie from material collected in Spout Pond. It is also found at Whitbourne.
20. *Margaritana margaritifera* (Linnaeus)
Spout Pond.

The Ferryland District
(Island Fauna)

Nancy's Portion Island

1. *Helix hortensis* (Müller)
2. *Euconulus fulvus* (Müller)
3. *Zonitoides arboreus* (Say)
4. *Retinella electrina* (Gould)

5. *Vitrina limpida* (Gould)
6. *Discus cronkhitei* (Newcomb)
7. *Discus cronkhitei anthonyi* (Pilsbry)
8. *Vertigo alpestris* Alder
9. *Pupilla muscorum* (Linnaeus)
10. *Cochlicopa lubrica* (Müller)
11. *Deroceras laevis* (Müller)
12. *Arion subfuscus* (Draparnaud)

The Isle of Bo

1. *Discus cronkhitei* (Newcomb)
2. *Cochlicopa lubrica* (Müller)

Harry's Islan

1. *Helix hortensis* (Müller)
2. *Cochlicopa lubrica* (Müller)
3. *Discus cronkhitei anthonyi* (Pilsbry)

Ship Island

1. *Discus cronkhitei* (Newcomb)
2. *Discus cronkhitei anthonyi* (Pilsbry)

Gull Island

1. *Cochlicopa lubrica* (Müller)
2. *Zonitoides arboreus* (Say)
3. *Discus cronkhitei anthonyi* (Pilsbry)
4. *Deroceras agrestis* (Linnaeus)
5. *Arion subfuscus* (Drap.)

Fox Island

1. *Cochlicopa lubrica* (Müller)
2. *Zonitoides arboreus* (Say)
3. *Discus cronkhitei* (Newcomb)
4. *Discus cronkhitei anthonyi* (Pilsbry)
5. *Deroceras agrestis* (L.)
6. *Limax arborum* Bouch.-Chant.
7. *Arion subfuscus* (Drap.)

Pee Pee Is

1. *Vitrina limpida* (Gould)
2. *Retinella electrina* (Gould)
3. *Vertigo alpestris* Alder
4. *Discus cronkhitei* (Newcomb)
5. *Discus cronkhitei anthonyi* (Pilsbry)

and Spout Pond.
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 age, Chance Cove and Spout Pond.
 ge and south in the wilds of Spout

in North America in ruins of Church
 and Village. This has not been found

ving species were found within the
 llected at Chance Cove.
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ance Cove, Trepassey, and Brigus

s)
 River and Freshwater R.

eresting find.

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 van der Schalie from material col-
 lso found at Whitbourne.
 eus)

nd District
 Fauna)

tion Island

5. *Vitrina limpida* (Gould)
6. *Discus cronkhitei* (Newcomb)
7. *Discus cronkhitei anthonyi* (Pilsbry)
8. *Vertigo alpestris* Alder
9. *Pupilla muscorum* (Linnaeus)
10. *Cochlicopa lubrica* (Müller)
11. *Deroceras laevis* (Müller)
12. *Arion subfuscus* (Draparnaud)

The Isle of Boise

1. *Discus cronkhitei* (Newcomb)
2. *Cochlicopa lubrica* (Müller)

Harry's Island

1. *Helix hortensis* (Müller)
2. *Cochlicopa lubrica* (Müller)
3. *Discus cronkhitei anthonyi* (Pilsbry)

Ship Island

1. *Discus cronkhitei* (Newcomb)
2. *Discus cronkhitei anthonyi* (Pilsbry)

Gull Island

1. *Cochlicopa lubrica* (Müller)
2. *Zonitoides arboreus* (Say)
3. *Discus cronkhitei anthonyi* (Pilsbry)
4. *Deroceras agrestis* (Linnaeus)
5. *Arion subfuscus* (Drap.)

Fox Island

1. *Cochlicopa lubrica* (Müller)
2. *Zonitoides arboreus* (Say)
3. *Discus cronkhitei* (Newcomb)
4. *Discus cronkhitei anthonyi* (Pilsbry)
5. *Deroceras agrestis* (L.)
6. *Limax arborum* Bouch.-Chant.
7. *Arion subfuscus* (Drap.)

Pee Pee Island

1. *Vitrina limpida* (Gould)
2. *Retimella electrina* (Gould)
3. *Vertigo alpestris* Alder
4. *Discus cronkhitei* (Newcomb)
5. *Discus cronkhitei anthonyi* (Pilsbry)

PLACENTIA BAY		Nam
Village of Placentia (Mainland Fauna)		
1. <i>Trochulus striolatus</i> (C. Pfr.)		
2. <i>Cochlicopa lubrica</i> (Müller)		1. <i>Zonitoides arboreus</i> (Say)
3. <i>Vallonia excentrica</i> (Sterki)		2. <i>Cochlicopa lubrica</i> (Mülle
4. <i>Zonitoides arboreus</i> (Say)		
5. <i>Deroceras agrestis</i> (L.)		1. <i>Zonitoides arboreus</i> (Say)
6. <i>Arion circumscriptus</i> Johnston		2. <i>Discus cronkhitei</i> anthony
		3. <i>Cochlicopa lubrica</i> (Mülle
		4. <i>Deroceras agrestis</i> (L.)
Cape Shore Road		Island F
1. <i>Helix hortensis</i> (Müller)		(
2. <i>Retinella electrina</i> (Gould)		Sev
3. <i>Discus cronkhitei</i> (Newcomb)		1. <i>Zonitoides arboreus</i> (Say)
4. <i>Discus cronkhitei anthonyi</i> (Pilsbry)		2. <i>Euconulus fulvus</i> (Müller
		3. <i>Vertigo alpestris</i> Alder
		4. <i>Discus cronkhitei</i> anthony
Glendon's Cove, Pointe Verde		Sev
1. <i>Cochlicopa lubrica</i> (Müller)		1. <i>Cochlicopa lubrica</i> (Mülle
2. <i>Zonitoides arboreus</i> (Say)		2. <i>Vertigo alpestris</i> Alder
3. <i>Discus cronkhitei anthonyi</i> (Pilsbry)		
Island Fauna of Placentia Bay (Southeast Arm)		Se
		1. <i>Zonitoides arboreus</i> (Say)
		2. <i>Vertigo alpestris</i> Alder
		3. <i>Discus cronkhitei</i> anthony
Verran's Island		Sev
1. <i>Zonitoides arboreus</i> (Say)		1. <i>Zonitoides arboreus</i> (Say)
2. <i>Vertigo alpestris</i> Alder		2. <i>Discus cronkhitei</i> anthony
3. <i>Discus cronkhitei</i> (Newcomb)		
4. <i>Discus cronkhitei anthonyi</i> (Pilsbry)		
5. <i>Deroceras agrestis</i> (L.)		
The Little Island		St. John's
1. <i>Zonitoides arboreus</i> (Say)		1. <i>Trochulus striolatus</i> (C. P
2. <i>Euconulus fulvus</i> (Müller)		2. <i>Oxychilus lucida</i> (Drapar
3. <i>Vertigo alpestris</i> Alder		3. <i>Deroceras agrestis</i> (Linna
4. <i>Discus cronkhitei</i> (Newcomb)		4. <i>Limax arborum</i> Bouch.-C
5. <i>Discus cronkhitei anthonyi</i> (Pilsbry)		5. <i>Arion circumscriptus</i> Joh
Round Island		C
1. <i>Zonitoides arboreus</i> (Say)		(
Nameless Island No. 1		A
1. <i>Zonitoides arboreus</i> (Say)		A
		1. <i>Arion hortensis</i> Ferrusac

BAY
 Placentia
 Fauna)

Nameless Island No. 2.

1. *Zonitoides arboreus* (Say)
2. *Cochlicopa lubrica* (Müller)

Phillips Island

1. *Zonitoides arboreus* (Say)
2. *Discus cronkhitei anthonyi* (Pilsbry)
3. *Cochlicopa lubrica* (Müller)
4. *Deroceras agrestis* (L)

Road

Island Fauna of Placentia Bay
 (Northeast Arm)

Seven Islands No. 1.

1. *Zonitoides arboreus* (Say)
2. *Euconulus fulvus* (Müller)
3. *Vertigo alpestris* Alder
4. *Discus cronkhitei anthonyi* (Pilsbry)

Pointe Verde

Seven Islands No. 2.

1. *Cochlicopa lubrica* (Müller)
2. *Vertigo alpestris* Alder

Placentia Bay
 (Arm)

Seven Islands No. 3.

1. *Zonitoides arboreus* (Say)
2. *Vertigo alpestris* Alder
3. *Discus cronkhitei anthonyi* (Pilsbry)

Island

Seven Islands No. 4.

1. *Zonitoides arboreus* (Say)
2. *Discus cronkhitei anthonyi* (Pilsbry)

Island

St. John's north to Conception Bay

Torbay

1. *Trochulus striolatus* (C. Pfr.)
2. *Oxychilus lucida* (Draparnaud)
3. *Deroceras agrestis* (Linnaeus)
4. *Limax arborum* Bouch.-Chant.
5. *Arion circumscriptus* Johnston

Island

Conception Bay
 (Mainland Fauna)

Manuels River

Island No. 1

1. *Arion hortensis* Ferrusac

Brigus

1. *Vertigo perryi* Sterki
2. *Amnicola limosa* Say
3. *Ferrissia caurina* Cooper
4. *Deroceras agrestis* (L.)
5. *Limax arborum* Bouch.-Chant.
6. *Arion circumscriptus* Johnston

Harbour Grace

1. *Vallonia excentrica* (Sterki)
2. *Cochlicopa lubrica* (Müller)

Carbonear and Carbonear Island

1. *Cochlicopa lubrica* (Müller)
2. *Deroceras agrestis* (L.)

Trinity Bay

(Mainland Fauna)

Shoal Harbour and Clarenville

1. *Helix hortensis* (Müller)
2. *Zonitoides arboreus* (Say)
3. *Striatura milium* (Morse)
4. *Euconulus fulvus* (Müller)
5. *Retinella electrina* (Gould)
6. *Punctum pygmaeum minutissimum* (Lea)
7. *Discus cronkhitei* (Newcomb)
8. *Discus cronkhitei anthonyi* (Pilsbry)
9. *Succinea ovalis* Say
10. *Zoogenetes harpa* Morse

Trinity

1. *Cochlicopa lubrica* (Müller)
2. *Zonitoides arboreus* (Say)

Whitbourne (on Newfoundland Railway)

1. *Helix hortensis* (Müller)
2. *Arion fasciatus* Nils. (records of the A.N.S.P.)
3. *Arion subfuscus* (Drap.)
4. *Stagnicola palustris papyracea* Baker and Brooks (Type locality)
5. *Radix pereger lacustris* (Leach)
6. *Valvata sincera nylanderi* Dall
7. *Amnicola limosa porata* Say
8. *Helisoma campanulata* (Say)
9. *Margaritana margaritifera* (Linnaeus)
10. *Anodonta marginata* Say
11. *Anodonta brooksiana* van der Schalie

Terra Nova (on Newf

1. *Helix hortensis* (Müller)
2. *Succinea ovalis* Say

Grand Falls (on Newf

1. *Zonitoides arboreus* (Say)
2. *Euconulus fulvus* (Müller)
3. *Retinella electrina* (Gould)
4. *Deroceras laeve* (Müller)
5. *Helicodiscus parallelus* (Say)
6. *Discus cronkhitei* (Newcomb)
7. *Discus cronkhitei anthonyi* (Pilsbry)
8. *Succinea ovalis* Say
9. *Cochlicopa lubrica* (Müller)
10. *Stagnicola palustris perpalustris* I
11. *Helisoma campanulata minor* (Du)
12. *Physa heterostropha* Say
13. *Amnicola limosa porata* Say
14. *Margaritana margaritifera* (Linnae

The Southwest Co

1. *Helix hortensis* (Müller) (from Po
2. *Margaritana margaritifera* (Linnae
3. *Succinea ovalis* Say (in B. Walker

Bay of Islands (

1. *Helix hortensis* (Müller)
2. *Zonitoides arboreus* (Say) (A.N.S.)
3. *Euconulus fulvus* (Müller) (A.N.S)
4. *Retinella electrina* (Gould) (A.N.S)
5. *Helicodiscus parallelus* (Say) (A.N
6. *Punctum pygmaeum minutissimum*
7. *Discus cronkhitei* (Newcomb) (A.)
8. *Arion hortensis* Ferrusac (A.N.S.F
9. *Succinea ovalis* Say
10. *Vertigo gouldii paradoxa* Sterki (A
11. *Cochlicopa lubrica* (Müller)
12. *Physa heterostropha* Say (M.C.Z.)

Bonne Bay (V

1. *Helix hortensis* (Müller)
2. *Zonitoides arboreus* (Say)
3. *Zonitoides nitidus* (Müller)
4. *Striatura exigua* (Stimpson)
5. *Hawaii miniscula* (Binney)

rigus

Terra Nova (on Newfoundland Railway)

1. *Helix hortensis* (Müller)
2. *Succinea ovalis* Say

ur Grace

Grand Falls (on Newfoundland Railway)

1. *Zonitoides arboreus* (Say)
2. *Euconulus fulvus* (Müller)
3. *Retinella electrina* (Gould)
4. *Deroceras laeve* (Müller)
5. *Helicodiscus parallelus* (Say)
6. *Discus cronkhitei* (Newcomb)
7. *Discus cronkhitei anthonyi* (Pilsbry)
8. *Succinea ovalis* Say
9. *Cochlicopa lubrica* (Müller)
10. *Stagnicola palustris perpallustris* Baker and Brooks (Type locality)
11. *Helisoma campanulata minor* (Dunker)
12. *Physa heterostropha* Say
13. *Annicola limosa porata* Say
14. *Margaritana margaritifera* (Linnaeus)

Carbonear Island

ty Bay
nd Fauna)
and Clarenville

The Southwest Coast to Cape Ray

1. *Helix hortensis* (Müller) (from Port au Port)
2. *Margaritana margaritifera* (Linnaeus)
3. *Succinea ovalis* Say (in B. Walker Collection, University of Michigan)

um (Lea)

Bay of Islands (West Coast)

bry)

inity

1. *Helix hortensis* (Müller)
2. *Zonitoides arboreus* (Say) (A.N.S.P.)
3. *Euconulus fulvus* (Müller) (A.N.S.P.)
4. *Retinella electrina* (Gould) (A.N.S.P.)
5. *Helicodiscus parallelus* (Say) (A.N.S.P.)
6. *Punctum pygmaeum minutissimum* (Lea) (A.N.S.P.)
7. *Discus cronkhitei* (Newcomb) (A.N.S.P.)
8. *Arion hortensis* Ferrusac (A.N.S.P.)
9. *Succinea ovalis* Say
10. *Vertigo gouldii paradoxa* Sterki (A.N.S.P.)
11. *Cochlicopa lubrica* (Müller)
12. *Physa heterostropha* Say (M.C.Z.)

wfoundland Railway)

of the A.N.S.P.)

Baker and Brooks (Type locality)

Bonne Bay (West Coast)

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1. *Helix hortensis* (Müller)
2. *Zonitoides arboreus* (Say)
3. *Zonitoides nitidus* (Müller)
4. *Striatura exigua* (Stimpson)
5. *Hawaii miniscula* (Binney)

6. *Euconulus fulvus* (Müller)
7. *Helicodiscus parallelus* (Say)
8. *Retinella electrina* (Gould)
9. *Punctum pygmaeum minutissimum* (Lea) (A.N.S.P.)
10. *Discus cronkhitei* (Newcomb)
11. *Discus cronkhitei anthonyi* (Pilsbry)
12. *Arion hortensis* Ferrusac
13. *Succinea ovalis* Say
14. *Succinea avara* Say
15. *Succinea groenlandica* (Beck) Müller
16. *Succinea peoriensis* "Wolf" Walker
17. *Pupilla muscorum* (Linnaeus) (A.N.S.P.)
18. *Vertigo modesta* (Say) (A.N.S.P.)
19. *Vertigo gouldii paradoxa* Sterki (A.N.S.P.)
20. *Vertigo elatior* Sterki
21. *Columella edentula* (Draparnaud) (A.N.S.P.)
22. *Cochlicopa lubrica* (Müller)
23. *Vallonia albula* Sterki (A.N.S.P.)
24. *Planogyra asteriscus* Morse
25. *Carychium exiguum* (Say)
26. *Stagnicola newfoundlandensis* Baker and Brooks (Type locality)
27. *Fossaria obrussa* (Say)
28. *Fossaria obrussa brooksi* Baker (Type locality)
29. *Fossaria umbilicata* (C. B. Adams)
30. *Gyraulus hornensis* Baker
31. *Helisoma campanulata davisii* (Winslow)
32. *Physa heterostropha* Say
33. *Valvata lewisii* Currier
34. *Margaritana margaritifera* (Linnaeus)

Northwest Coast including White Bay

1. *Helix hortensis* (Müller) (Parson's Pond) (Pointe Riche)
2. *Zonitoides arboreus* (Say)
3. *Euconulus fulvus* (Müller)
4. *Retinella electrina* (Gould)
5. *Vitrina limpida* (Gould)
6. *Deroceras agrestis* (Linnaeus) (Plumb Point, Brig Bay; La Scie; Starke's Bight, Goose Cove; St. Anthony; Port Au Choix; Englee.)
7. *Deroceras laeve* (Müller) (A.N.S.P.)
8. *Punctum pygmaeum minutissimum* (Lea) (A.N.S.P.)
9. *Discus cronkhitei* (Newcomb)
10. *Discus cronkhitei anthonyi* (Pilsbry)
11. *Succinea ovalis* Say (A.N.S.P.)
12. *Succinea avara* Say (A.N.S.P.)
13. *Succinea verrilli* Bland (A.N.S.P.)
14. *Pupilla muscorum* (Linnaeus) (A.N.S.P.)

15. *Vertigo modesta* (Say)
16. *Vertigo modesta parietalis* Ancey (f)
17. *Vertigo modesta castanea* Sterki (A.)
18. *Vertigo gouldii* Binney (var.)
19. *Vertigo gouldii paradoxa* Sterki (A.)
20. *Columella edentula* (Draparnaud)
21. *Cochlicopa lubrica* (Müller)
22. *Vallonia albula* Sterki (A.N.S.P.)
23. *Zoogenetes harpa* Morse
24. *Stagnicola palustris* (Müller) (A.N.)
25. *Gyraulus parvus* (Say)
26. *Physa gyrina* Say (A.N.S.P.)
27. *Valvata lewisii* Currier (A.N.S.P.)
28. *Margaritana margaritifera* (Linnaeus)
29. *Anodonta marginata* Say (A.N.S.P.)
30. *Arion circumscriptus* Johnston (L.)
31. *Arion subfuscus* (Draparnaud) (L.)
Goose Cove; Englee.)

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Pond) (Pointe Riche)

mb Point, Brig Bay; La Scie;
Anthony; Port Au Choix; Englee.)

(Lea) (A.N.S.P.)

S.S.P.)

15. *Vertigo modesta* (Say)
16. *Vertigo modesta parietalis* Ancey (A.N.S.P.)
17. *Vertigo modesta castanea* Sterki (A.N.S.P.)
18. *Vertigo gouldii* Binney (var.)
19. *Vertigo gouldii paradoxa* Sterki (A.N.S.P.)
20. *Columella edentula* (Draparnaud)
21. *Cochlicopa lubrica* (Müller)
22. *Vallonia albula* Sterki (A.N.S.P.)
23. *Zoogenetes harpa* Morse
24. *Stagnicola palustris* (Müller) (A.N.S.P.)
25. *Gyraulus parvus* (Say)
26. *Physa gyrina* Say (A.N.S.P.)
27. *Vahata lewisii* Currier (A.N.S.P.)
28. *Margaritana margaritifera* (Linnaeus) (A.N.S.P.)
29. *Anodonta marginata* Say (A.N.S.P.)
30. *Arion circumscriptus* Johnston (La Scie)
31. *Arion subfuscus* (Draparnaud) (La Scie; St. Anthony; Starke's Bight, Goose Cove; Englee.)

CHART OF SPECIES SHOWING DISTRIBUTION

CHART OF SPECIES SHOWING ORIGIN

Species	Newfoundland Distribution			Origin			Species	West D
	West	Central	East	Holarctic	European	Am.		
1. <i>Helicigona arbustorum</i>.....	..	..	X	..	X		<i>clathor</i>	X
2. <i>Helix hortensis</i>	X	X	X	..	X		<i>edentula</i>	X
3. <i>Zonitoides nitidus</i>.....	..	..	X	X	..		<i>fulva lubrica</i>	X
4. <i>Zonitoides arboreus</i>	X	X	X	..	..		<i>albula</i>	X
5. <i>Hawaii minuscula</i> *.....	X	..	..	..	..		<i>excentrica</i> *.....	..
6. <i>Striatura exigua</i> *.....	X	..	..	..	..		<i>pubchella</i> *.....	..
7. <i>Striatura milium</i>*.....	..	..	X	..	..		<i>harpa</i>	X
8. <i>Euconulus fulvus</i>	X	X	X	X	..		<i>asteriscus</i> *.....	X
9. <i>Retinella electrina</i>	X	X	X	..	..		<i>exiguum</i> *.....	X
10. <i>Vitrina limpida</i>	X	..	X	..	..		<i>procer lacustris</i>.....	..
11. <i>Limax maximus</i>*.....	..	..	X	..	X		<i>palustris</i>	X
12. <i>Limax arborum</i>***.....	..	..	X	..	X		<i>palustris papyracea</i> **.....	..
13. <i>Deroceras agrestis</i>	X	..	X	X	..		<i>palustris perpalustris</i> **.....	..
14. <i>Deroceras laeve</i>	X	X	X	X	..		<i>newfoundlandensis</i> **.....	X
15. <i>Discus cronkhitei</i>	X	X	X	..	..		<i>obrusa</i> *.....	X
16. <i>Discus cronkhitei anthonyi</i>	X	..	X	..	..		<i>obrusa brooksi</i> **.....	X
17. <i>Helicodiscus parallelus</i>	X	X	..	..	..		<i>umbilicata</i> *.....	X
18. <i>Punctum pygmaeum minutissimum</i> *.....	X	..	X	X	..		<i>parvus</i>	X
19. <i>Arion ater</i>.....	..	..	X	..	X		<i>rossensis</i> *.....	X
20. <i>Arion hortensis</i>	X	..	X	..	X		<i>canapa nudata davisi</i> *.....	X
21. <i>Arion subfuscus</i>	X	X	X	..	X		<i>canpanulata minor</i> *.....	..
22. <i>Arion circumscriptus</i>.....	..	..	X	..	X		<i>serena</i>	X
23. <i>Trochulus striolatus</i>*.....	..	..	X	..	X		<i>calceostropha</i>	X
24. <i>Oxychilus lucida</i>*.....	..	..	X	..	X		<i>travassii</i>	X
25. <i>Discus rotundatus</i>***.....	..	..	X	..	X		<i>obrusa var.*</i>
26. <i>Succinea ovalis</i>	X	X	X	..	..		<i>obrusa var.*</i>
27. <i>Succinea avara</i>	X	..	..	..	..		<i>obrusa margaritifera</i>	X
28. <i>Succinea peoriensis</i> *.....	X	..	..	..	..		<i>marginata</i>	X
29. <i>Succinea groenlandica</i> *.....	X	..	..	..	X		<i>new-keliana</i> **.....	..
30. <i>Succinea verilli</i>	X	..	..	..	..		Totals.....	46
31. <i>Pupilla muscorum</i>	X	..	X	X	..			
32. <i>Vertigo perryi</i>*.....	..	..	X	..	..			10
33. <i>Vertigo alpestris</i>***.....	..	..	X	..	X			4
34. <i>Vertigo modesta</i>	X	..	..	X	..			32
35. <i>Vertigo modesta parietalis</i>	X	..	..	..	..
36. <i>Vertigo modesta castanea</i>	X	..	..	..	..
37. <i>Vertigo gouldi</i>	X	..	..	..	..
38. <i>Vertigo gouldi paradoxa</i>	X	..	..	..	..

* The species added to the Newfoundland fauna.
 ** The species new to science.
 *** The species new to North America.

