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LAND SNAILS FROM THE CANADIAN ROCKIES

BY

S. Stillman Berry

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CONTENTS

	PAGE
Introduction.....	1
Bibliography	2
Notes on the species represented.....	3

Illustration

Plate I. Rocky Mountain land snails.....	19
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By S. STILLMAN BERRY

INTRODUCTION

The present paper is a report on a collection of land snail shells from the Rocky Mountain region of British Columbia and Alberta, submitted to the writer by the Victoria Memorial Museum, Canada. The entire Museum collection from this region is here considered, although it appears that an appreciable part of it has already been examined or even reported upon by other authors. For the sake of completeness, as well as because the re-scrutiny of these old determinations has resulted in bringing some interesting points to light, it seems desirable to include all these species along with the more novel items in the report in hand. For instance, it appears that certain of the specimens were submitted by J. F. Whiteaves to Dr. Victor Sterki some years ago, and the labels which Dr. Whiteaves afterwards attached to them were consequently based upon Dr. Sterki's determinations. It is interesting to note that in spite of the great advances which have recently taken place in our understanding of the western land snails, the present writer is still able to concur in most of the identifications so made. In a few instances our more complete present-day knowledge makes possible something of a revision.

It will be noted that the bulk of the material is from but two sources—the collection made by J. B. Tyrrell, while acting as assistant to G. M. Dawson during his Rocky Mountain explorations of July and August, 1883, and that made by J. Macoun in 1885.

The molluscan fauna of the great area commonly known as the Canadian Rockies has been very insufficiently elucidated. In fact it still remains essentially a virgin field. The most important previous publications dealing with the terrestrial mollusks are the short papers of Dawson (1875), Taylor (1893, 1895, 1895a), and Vanatta (1906), together with the more general work of Dall (1905). It is hoped that the present paper may be in a small way an incitative to an extension of the list. Its chief value must lie in this and in the bearing possessed by some of its data upon certain problems of distribution. However, one species, *Gonyodiscus shimckii*, is for the first time¹ reported as living, and one subspecies, *Oreohelix strigosa canadica*, is described as new.

¹ At least in the form of its typical subspecies.

The writer is under obligation to the authorities of the Victoria Memorial Museum not only for the privilege of working over the material, but for the preparation of the excellent photographs utilized as illustrations. He must further acknowledge his indebtedness to Frits Johansen, of Ottawa, for much help in tracing lost material, items of literature, and stray data. Acknowledgment is likewise due J. B. Tyrrell of Toronto for certain specific information concerning the specimens collected by him.

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(*Helix limitaris* n. sp. described from Waterton lake, Rocky mts.)
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1899. "Notes on a Few Northwest American Land Snails." Proceedings Academy Natural Sciences Philadelphia, 1899, pp. 314-315, text f.1-3, 1899.
(Describes *Vertigo gouldii lagganensis* var. nov. and records *Pupa decora* from Laggan, Alberta.)
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(Records and figures *Vertigo modesta* from Laggan, Alberta.)
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(Records fourteen species of terrestrial mollusks from Laggan, Alberta.)
1895. "The Present Condition of Canadian Conchology." *Ottawa Naturalist*, vol. 8, pp. 143-159, Feb., 1895.
(Contains a valuable bibliography.)
- 1895a. "The Land and Freshwater Shells of Alberta." *Ottawa Naturalist*, vol. 9, pp. 173-178, Dec., 1895.
(Records *Vertigo ovata* and *Pupa simplex* from Laggan, and *Conulus fulvus*, *Patula striatella*, and *Succinea avara* from near Macleod and Little Bow river, Alberta.)
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(Records twelve species of terrestrial mollusks from Field, B.C., and five from Banff, Alberta.)
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(Records *Vertigo modesta* from Kananaskis, Alberta, and *Sphyradium edentulum* from Kananaskis, Alberta, and near Tobacco plains, B.C.)
1906. "Notes on Some Land and Fresh Water Shells from British Columbia." *Ottawa Naturalist*, vol. 20, pp. 115-119, Sept., 1906.
(Records *Polygyra ptycophora* from Crowsnest pass and Trail, B.C.)

NOTES ON THE SPECIES REPRESENTED

Polygyra ptycophora (A. D. Brown 1870)

1870. *Helix ptycophora* Brown,—*Journ. de Conch.*, (3), vol. 10, p. 392 (teste Binney).
1885. *Arionta townsendiana* var. *ptycophora* Binney,—*Man. Am. Landsh.*, pp. 128, 129, f. 102.
1897. *Polygyra townsendiana ptycophora* Pilsbry,—*Nautilus*, vol. 11, p. 94 (merely catalogued).
1905. *Polygyra ptycophora* Dall,—*Land and Freshwater Moll. Alaska*, p. 25 (brief note).
1906. *Polygyra ptycophora* Whiteaves,—*Ottawa Nat.*, vol. 20, p. 119 (recorded from Crowsnest pass and Trail, B.C.).

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
9	Crowsnest pass, Elk river, B.C.....	J. B. Tyrrell.....	July 14, 1883....	2869

The specimens belong to a compact, rather narrowly umbilicated race of *ptycophora*, not as large as most Idaho and Washington shells, but notably larger than such Montana specimens as the writer has seen. They are evidently the ones which have already been reported by Whiteaves (1906, p. 119).

Oreohelix cooperi limitaris (Dawson 1875)

Plate I, figures 1-5

1875. *Helix limitaris* Dawson,—Rep. Geol. Brit. N. Am. Boundary Comm., p. 347.
 1885. *Patula strigosa* var., immature, Binney,—Man. Am. Landsh., p. 261 (reprints Dawson's description).
 1895. *Patula strigosa* var. Taylor,—Ottawa Nat., vol. 9, p. 173 (brief note).
 1898. *Pyramidula solitaria limitaris* Pilsbry,—Nautilus, vol. 11, p. 140 (merely catalogued).
 1905. *Pyramidula solitaria* var. *limitaris* Dall,—Land and Freshwater Moll. Alaska, p. 49.
 1916. *Oreohelix strigosa limitaris* Pilsbry,—Proc. Acad. Nat. Sci. Phila., 1916, p. 353 (merely catalogued).
 1919. *Oreohelix cooperi limitaris* Berry,—Proc. Acad. Nat. Sci. Phila., 1919, pp. 196, 201.

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
7	Waterton lake, Alberta.....	J. B. Tyrrell.....	Aug. 25, 1883....	2881
3	“ “	“ “	“ 25, 1883....	3144

Description. The shell is of only moderate size, fairly elevated, with an obtuse apex. The spiral sculpture is obsolete below, and on the upper surface of the whorls is only moderately developed, being much broken and interrupted by the very coarse and irregular lines of growth. The periphery is obtusely angular in front, becoming rounded or but faintly subangular on the forward part of the last whorl. The umbilicus is deep and narrow, contained in the diameter seven to eight times, its circular outline but little interfered with by the slightly reflexed inner lip.

The colour of the somewhat dehiscent periostracum is a deep rusty brown, irregularly clouded with brownish cream and slaty tones, and with two conspicuous, encircling, seal brown bands, one on the shoulder, the other just below the periphery, with sometimes a lighter and less distinct band interpolated between them, or one or more similar secondary bands on the basal part of the shell, and there is sometimes one just below the suture.

The embryonic shell seems essentially similar to that of *O. c. apiarium* as described (cf. Berry, 1919, p. 200, f. 1), but is smaller, the spiral sculpture is weaker, and the axial riblets stronger and more regular.

Measurements

Cat. No.	2881	2881	2881	3144	3144 immat.	2881 immat.	2881 immat.	3144 juv.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Maximum diameter.....	17.2 ¹	17.3	16.4	16.3	15.4	15.3	14.8	12.4
Minimum diameter.....	15.3	15.0	14.6	14.2	13.7	13.7	12.5	11.3
Diameter umbilicus.....	2.0	2.2	2.4	2.6	2.2	2.4	1.8	1.7
Altitude.....	14.1	13.2	13.0	12.3	11.7	11.0	11.0	9.2
Number of whorls.....	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{2}{3}$	5 $\frac{1}{2}$	5 $\frac{2}{3}$	5 $\frac{1}{2}$	5 $\frac{1}{4}$	5

¹ Lip broken.

Remarks The whereabouts of Dawson's original material of his *Helix limitaris*, or even the certainty of its existence, is unknown. Although the original description is very good it was unaccompanied by a figure, and there has been much speculation as to the exact systematic position of the species. The writer had always supposed the type to be in the collection of the Geological Survey at Ottawa but Mr. Johansen, who has been to considerable trouble in the matter, states that he has been quite unable to locate it there, and he met with only negative results in all attempts to push the quest further. Information has been obtained that the type is not in the British Museum, nor in the Redpath Museum of McGill University, nor in any of the other collections in Canada or the United States where it has been thought worth while to make inquiry.

The loss of the type material is not, however, so disastrous as it might be, since the Survey possesses other specimens as herein described, collected by J. B. Tyrrell of Toronto, who was assistant to Dr. Dawson on a subsequent exploration of the same region, and who writes (*in litt.*) that they were obtained from the same general locality and most probably from the identical swamp where Dawson collected the originals.¹ Likewise Mr. Johansen has ascertained that there are five specimens of "*Helix limitaris* Dawson," collected by the North American Boundary Commission, in the British Museum.

The accord of the present specimens with the original description is reasonably complete throughout, and hence the writer's description given above may be taken as merely amplifying that of Dawson. The number of whorls, however, seems usually slightly more than he states (5 $\frac{1}{2}$), so his specimens would not appear to have been entirely characteristic with respect to this detail.

¹ "Dr. Dawson found very few specimens of this species near the shore of Waterton lake in 1874, when he was geologist on the British-North American Boundary Commission In 1883 I was acting as assistant to Dr. Dawson in his exploration of that portion of the Rocky mountains lying between the Forty-ninth parallel and the Bow river. Dr. Dawson did most of the geological work himself and my duties that year were largely topographical, but at the same time I attended to the collection of plants and some small mollusks and Crustaceans. On the evening of August 24 we all camped at the north end of the southern and larger of the two parts of Waterton lake, and that evening I found near the shore some specimens of '*Physa lordi*.'

"The next morning, namely August 25, Dr. Dawson went westward with the pack animals up the South Kootenay pass, while I went round a short way to a swampy piece of land where, around rotten logs, I found several specimens of '*Helix limitaris*,' these doubtless being the ones which are now in the museum of the Geological Survey at Ottawa. I believe that I collected these specimens on the same swamp on which Dr. Dawson had collected his specimens nine years before." (J. B. Tyrrell, *in litt.*, Sept. 17, 1918.)

Limitaris has had rather a checkered history in the literature, as the synonymy shows, but it is a characteristic *Oreohelix*, and its near connexion with the widespread *cooperi*-series seems self-evident. Within this series, the *O. c. apiarium*, recently described (Berry 1919, p. 198) from the Pacific side of the divide in Glacier National park, not many miles south of the type locality of *limitaris*, is easily the nearest of the named subspecies. The two are in fact very close, and it is entirely possible that the investigation of material from a wider range of localities may show that it is impracticable to draw any arbitrary line between them. The lots so far seen, however, are readily separable upon grounds already outlined in a former publication.¹

***Oreohelix cooperi* (W. G. Binney), vars.**

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
1	Moyie, B.C.....	W. Brodie.....	July 27, 1916...	3034
4	Elk river, Crownsnest pass, B.C.....	J. B. Tyrrell.....	" 14, 1883...	2880
3	Wigwam river, East Kootenay dist., B.C.....	J. B. Tyrrell.....	" 28, 1883...	2879

The three miscellaneous lots of *Oreohelix* here listed are all plainly referable to the general *cooperi* concourse, but it is doubtful whether the discovery of more complete material will show all to be referable to the same subspecies. The three specimens from Wigwam river in particular have an aspect all their own, but as only one of the three is a reasonably fresh shell, it appears inadvisable further to encumber the literature in their behalf. The Moyie shell is altogether different, resembling some of the shells from the writer's Station V on the east side of the divide in Glacier National park, Montana, more than it does any other race of *cooperi* of which the writer is cognizant.

***Oreohelix strigosa canadica* new subspecies**

Plate I, figures 6-7

Description. The shell is of moderate size, broadly conical, with an obtuse apex. The surface is rather strongly *satiny*, but roughened by the irregular, coarse, and very crowded lines of growth. Spiral sculpture is represented by a few obscure and intermittent traces on the upper surface of the whorls, becoming wholly obsolete below. The periphery is strongly subangular, quite acutely so up to the body whorl, but becoming more obtuse near the aperture. The umbilicus is wide and well-like, contained about six times in the diameter of the shell, its interior visible to the apex, and its circular outline but little discommoded by the slight reflection of the inner lip. The outer lip is thickened and bevelled a little, but not reflexed.

¹ Op. cit., p. 201.

The ground colour of the shell is white, tending toward pale greyish vinaceous, with specks and mottlings of cacao brown and brownish vinaceous, the whole merging to sorghum brown on the apex. There are weak traces of three major brownish-vinaceous bands, and several basal minor ones, the uppermost of the former being traceable well up the spire.

The embryonic shell is sculptured by weak radial wrinkles, which gradually develop into a fine, rather irregular ribbing, but any spiral sculpture originally present is eroded to the merest trace in the specimen seen.

Measurements. Maximum diameter of type, 19.1; minimum diameter, 16.2; altitude, 11.5; diameter of umbilicus, 3.5 mm.; number of whorls, 5½.

Type: Victoria Memorial Museum Collection, Cat. No. 2882.

Type Locality: Columbia River valley, west of Rocky mountains, Donald Station, B. C.; (J. B. Tyrrell, Sept. 21, 1883?); 1 specimen.

Remarks. This demure mountain snail is of plain appearance, offers no very striking peculiarities, and yet seems incapable of reference to any of the races or subspecies heretofore recognized. The shell characters seem about as conclusive as such things can be in *Oreohelix*, that it belongs to the typical group of *O. strigosa*, and here possibly closer to Hemphill's *parma* from northern Washington than to anything else. From the latter it is readily distinguishable, however, by its much narrower umbilicus and smaller size.

In any event the shell is of interest as carrying the *strigosa*-group of *Oreohelix* north of the United States border for the first time. The typical *strigosa* is said to come from the "Interior of Oregon", but its various subspecies extend south through Idaho, Utah, and Colorado, to Arizona and New Mexico. It is very doubtful whether the *O. alpina* of Elrod, from the Mission range, Montana, belongs in the same species-series. In fact specimens neither of the true *strigosa* nor of any of its subspecies seem yet to have been discovered in Montana. They have been so reported several times, but seem generally referable to some form of *cooperi*.

Definite record in the matter seems to be lost, but there is reason to believe that the unique specimen of *canadica* was collected by J. B. Tyrrell, who visited Donald, September 21, 1883.

Gonyodiscus cronkhitei (Newcomb 1865)

1865. *Helix cronkhitei* Newcomb,—Proc. Cal. Acad. Nat. Sci., vol. 3, p. 180.
1866. *Patula cronkheitei* Tyron,—Am. Jour. Conch., vol. 2, p. 263.
1885. *Patula striatella* (pars) Binney,—Man. Am. Landsh., p. 70, f. 30.
1893. *Patula striatella* Taylor,—Nautilus, vol. 7, pp. 86 (recorded from Laggan, Alberta).
1895. *Patula striatella* Taylor,—Ottawa Nat., vol. 9, pp. 176, 177 (recorded from Macleod and Little Bow river, Alberta).
1898. *Pyramidula striatella* (pars) and *P. striatella cronkhitei* Pilsbry,—Nautilus, vol. 11, p. 141.

1898. *Pyramidula (striatella) cronkhitei* Pilsbry, Nautilus, vol. 12, pp. 85-86.
1905. *Pyramidula cronkhitei* Dall,—Land and Freshwater Moll. Alaska, pp. 9, 50.

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
1	Wigwam river, B.C.....	J. B. Tyrrell.....	July 25, 1883...	2878
3	Swamp near Waterton lake, B.C.....	".....	Aug. 28, 1883...	2877
10	Waterton lake, B.C.....	".....	" 25, 1883...	2876
17	Morley, Alberta.....	J. Macoun.....	1885...	2934
99	Kananaskis, Alberta.....	".....	1885...	ex-2937

Dall (1905, p. 50) referred all his Albertan and British Columbian montane forms to *striatella* (= *anthonyi* Pilsbry), his British Columbian coastal forms to *cronkhitei*. Vanatta (1906, p. 95) likewise has reported *anthonyi* from Field and Banff. Nevertheless, since it is difficult to detect dependable differences, other than perhaps their rather consistently smaller size, between the shells from the Canadian Rockies and those from Montana, Colorado, and other more southern localities which are usually referred without much question to *cronkhitei*, it is probably advisable for the present to call them all *cronkhitei* s.s., rather than attempt their reference to the eastern subspecies, *anthonyi*. When even so competent an authority as Pilsbry has within a few years allocated the same Arizona shells to both *anthonyi* and *cronkhitei*, a less experienced student is not likely to feel infallible. The truth is, we do not know the real boundaries of the distributional areas of either form, or even whether any clear-cut limits either in shell characters or in distribution actually exist. Thorough and critical study of an abundance of material will alone enable the precise identification of particular specimens. The following table briefly summarizes the results of a comparison of specimens from various localities with material of *anthonyi* from Unity, Maine.

Locality	Size	Shell	Whorls	Umbilicus	Sculpture
1 Cincinnati, Ohio.....	Similar to Maine shells	Somewhat higher	More like western shells	Similar to Maine shells	Similar to Maine shells
2 Kananaskis, Alta....	"	"	More rounded, less carinate, and angled at middle instead of almost on shoulder, but less so than in No. 6	Narrower.....	Finer and closer, but fairly regu- lar
3 Waterton lake, Alta.	"	"	More rounded, less carinate, and angled at middle instead of almost on shoulder	"	Weaker and less regular but not so much as in No. 6
4 Sta. XIV, Glacier National park, Mont.	A little larger	Higher.....	"	"	Almost as in Maine shells
5 Winnecook, Mont....	Much larger..	Somewhat higher	"	"	Weaker and less regular
6 Susanville, Cal.....	A little larger	Higher	"	"	"
7 Bluff Lake, San Ber- nardino mts., Cal.	Much larger...	Somewhat higher	"	"	"

If *G. cronkhitei cronkhitei* is a valid western subspecies, it appears, on the average, to be larger than *anthonyi*, and more elevated, to have more rounded, and less carinate whorls, the aperture rounded and slightly angled near the middle, the sculpture less sharp and heavy and more irregular, the umbilicus averaging narrower, the colour often very dark, and the surface usually more lustrous.

Watson¹ has recently advanced evidence which would seem practically conclusive in effecting the immediate removal of *Pyramidula* (as typified by the European species *rupestris* Draparnaud) from the melange of forms with which it generally has been associated, to a position in systematic proximity to *Vallonia*, *Acanthinula*, and the *Pupillidæ*. As not one of the numerous American species which have commonly been referred here falls under typical *Pyramidula* as thus newly defined, it is necessary to align them with another group or else to elevate one or more of the subgenera containing them to full generic rank. The adoption of the latter alternative in the present instance results in the rehabilitation of *Gonyodiscus* Fitzinger, 1833.

¹ Proc. Malac., Soc. London, vol. 14, p. 6 and ff.

Gonyodiscus shimekii (Pilsbry 1890)

Plate I, figure 8

1890. *Zonites shimekii* Pilsbry,—Nautilus, vol. 4, p. 3.
 1890. *Zonites shimekii* Pilsbry,—Proc. Acad. Nat. Sci. Phila., 1890, p. 297, pl. 5, f. 9-11.
 1891. *Zonites shimekii* Pilsbry,—Nautilus, vol. 5, p. 39, pl. 2, f. 9-11.
 1898. *Zonitoides shimekii* Pilsbry,—Nautilus, vol. 11, p. 131 (merely catalogued).
 1901. *Pyramidula shimekii* Shimek,—Bull. Lab. Nat. Hist. State Univ. Iowa, vol. 5, p. 139.

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
225	Kananaskis, Alberta.....	J. Macoun.....	1885	2937

It is a considerable surprise to find this species, heretofore known in the living state only by the subspecies *cockerelli* Pilsbry—which is an inhabitant of the southern Rockies—flourishing so far north and in such numbers, especially since neither it nor *cockerelli* has yet been encountered in Montana, whereas typical *shimekii* was originally described as a fossil from the Iowa Loess. The writer has had no opportunity of examining any Iowa *shimekii*, but upon comparison with *cockerelli* from Elorado, Colorado, sent him by Junius Henderson, the Albertan shells prove to run a little larger, are lighter and greyer in colour, are more robust, and seem thicker shelled, and the axial ribs on the upper surface of the whorls are more even, more sharply cut, and probably more numerous. Examples of *cockerelli* from Colfax county, New Mexico, collected by Ashmun, are rather different in appearance from either the Coloradan or Albertan shells. The possibility was considered that the Canadian specimens represent a new subspecies, but, firstly, there seemed too little comparative material available to render such an opinion safe, and secondly, it was thought possible that a similar relation might exist between the Albertan race and the typical Loess form to that suggested by Pilsbry (1916, p. 357) for *Oreohelix cooperi stantoni* (Dall) of southwestern Saskatchewan and the Loess *O. c. iowensis* (Pilsbry). Thereupon a few of the present specimens were sent to Dr. Pilsbry, with the request that he compare them directly with the types of both *shimekii* and *cockerelli*. He replied (November 24, 1920) as follows: "The *P. shimekii* from Canada are about intermediate between typical *shimekii* and *cockerelli*. The last should have a noticeably wider umbilicus. In your shells the umbilicus is equal to that of the most openly umbilicate of the original *shimekii*. The distinction of the race *cockerelli* is probably of doubtful expediency, though usually it is more depressed and more open beneath." It, therefore, seems reasonable to refer the Albertan race outright to *shimekii*, whether or not one follows Shimek (op. cit., pp. 140-143) in reducing *cockerelli* to the synonymy.

Mixed in the same lot with these specimens were a considerable number of *G. cronkhitei* of all ages and sizes, but even down to the very small ones the present species was fairly easy to separate out by reason of its narrower and steeper walled umbilicus, nearly smooth base, and finely, rather than coarsely, ribbed upper surface. *Shimekii* is also lighter in colour and distinctly larger when adult.

Helicella (Retinella) hammonis (Strøm 1765)

1765. *Helix hammonis* Strøm,—Trond. Selsk. Skr., vol. 3, p. 435, pl. 6, f. 16 (teste Taylor).
 1805. *Helix nitidula* var. β Draparnaud,—Hist. moll. France, p. 117, pl. 8, f. 21-22 (teste Taylor).
 1830. *Helix radiatula* Alder,—Trans. Nat. Hist. Soc. N. Durh. etc., vol. 1, p. 38, No. 30 (teste Taylor).
 1830. *Helix radiatula* Alder,—Cat. Test. Newcastle upon Tyne, p. 12, No. 50 (teste Dall).
 ?1830. *Helix viridula* Menke,—Syn. Meth., ed. 2, p. 127 (teste Binney).
 1841. *Helix electrina* Gould,—Inv. Mass., p. 183, f. 111.
 1864. *Hyalina electrina* Morse,—Jour. Portl. Soc. Nat. Hist., vol. 1, p. 13, text f. 23, pl. 6, f. 24.
 1869. *Hyalina viridula* Binney and Bland,—Land and Freshwater Sh. N. Am., I, p. 34, f. 41-43.
 1884. *Hyalina pellucida* Lehnert,—Sci. Rec., vol. 2, p. 172 (teste Dall).
 1885. *Zonites viridulus* Binney,—Man. Am. Landsh., pp. 23, 27, 28, 32, 36, 57, 64, 201, 202, 203, 223, 478, f. 21-22.
 1893. *Hyalina radiatula* Taylor,—Nautilus, vol. 7, pl. 86 (recorded from Laggan, Alberta).
 1897. *Hyalinia hammonis* Westerlund,—Syn. Moll. Extram., p. 34 (teste Taylor).
 1898. *Vitrea hammonis* Pilsbry,—Nautilus, vol. 11, p. 129.
 1905. *Vitrea radiatula* Dall,—Land and Freshwater Moll. Alaska, pp. 8, 14, 38.
 1906. *Vitrea hammonis* Walker,—Moll. Mich., I, p. 477, f. 42 (after Binney).
 1906. *Vitrea hammonis* Vanatta,—Nautilus, vol. 20, p. 95 (recorded from Field, B.C.).
 1908. *Hyalinia radiatula* Taylor,—Land and Freshwater Moll. Brit. Isles, p. 87, text f. 129-134, 145, pl. 2, 4th fig.
 1908. *Hyalinia radiatula electrina* Taylor,—id., p. 97, text f. 139-145.
 1921. *Helicella (Retinella) radiatula* Gude and Woodward,—Proc. Malac. Land., vol. 14, pp. 177, 185.

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
15	Kananaskis, Alberta.....	J. Macoun.....	1885	2933
1	Waterton lake, Alberta.....	J. B. Tyrrell.....	1883	2875
3	Morley, Alberta.....	J. Macoun.....	1885	ex-2932

It is thought best to include a considerable fragment of the very involved synonymy of this species because agreement is far from general as to the correct name and for lack of the essential literature the author is not in a position to form an intelligent opinion of his own. The name *hammonis* is chosen chiefly in deference to the authority of Pilsbry and Vanatta. The generic name is that adopted by Gude and Woodward, the most recent writers on the subject.

The Kananaskis specimens are rather small for the species. The Waterton Lake specimen is somewhat reminiscent of *P. binneyana*, which has been found nearby in Montana, but has the narrower umbilicus of *hammonis*.

Zonitoides arborea (Say 1817)

1817. *Helix arboreus* Say,—Nicholson's Encycl., 1st Am. Ed., pl. 4, f. 4.
 1841. *Helix arborea* Gould,—Inv. Mass., p. 182, f. 110.
 1864. *Helix breweri* Newcomb,—Proc. Cal. Acad. Nat. Sci., vol. 3, p. 118.
 1864. *Hyalina arborea* Morse,—Jour. Portl. Soc. Nat. Hist., vol. 1, p. 14, text f. 28, pl. 6, f. 29.
 1869. *Hyalina arborea* Binney and Bland,—Land and Freshwater Sh. N. Am., I, p. 33, f. 38-40.
 1885. *Zonites arboreus* Binney,—Man. Am. Landsh., pp. 19, 23, 30, 31, 32, 35, 57, 61, 65, 179, 201, 202, 203, 356, 388, 478, f. 13-14, 211, 214.
 1893. *Hyalina arborea* Taylor,—Nautilus, vol. 7, p. 86 (recorded from Laggan, Alberta).
 1898. *Zonitoides arboreus* Pilsbry,—Nautilus, vol. 11, p. 131 (merely catalogued).
 1905. *Zonitoides arboreus* Dall,—Land and Freshwater Moll. Alaska, pp. 8, 14, 42.
 1906. *Zonitoides arborea* Vanatta,—Nautilus, vol. 20, p. 95 (recorded from Field, B.C.).
 1906. *Zonitoides arborea* Walker,—Moll. Mich., I, pp. 483, 484, f. 55, 56, 58 (after Binney).

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
31	Morley, Alberta.....	J. Macoun.....	1885	2932
13	Kananaskis, Alberta.....	".....	1885	ex-2937
7	Waterton lake, Alberta.....	J. B. Tyrrell.....	Aug. 25, 1883....	2874

Petasina fulva alaskensis (Pilsbry 1899)

1885. *Zonites (Conulus) fulvus* Binney (pars),—Man. Am. Landsh., pp. 20, 23, 25, 27, 28, 32, 36, 57, 67, 201, 203, 354, 479.
 1893. *Conulus fulvus* Taylor,—Nautilus, vol. 7, p. 86 (recorded from Laggan, Alberta).

1895. *Conulus fulvus* Taylor,—Ottawa Nat., vol. 9, pp. 176, 177 (recorded from near Macleod and Little Bow river, Alberta).
 1899. *Conulus fulvus alaskensis* Pilsbry,—Nautilus, vol. 12, p. 116.
 1905. *Euconulus trochiformis* (pars) Dall,—Land and Freshwater Moll. Alaska, pp. 8, 40.
 1905. *Euconulus trochiformis* var. *alaskensis* Dall,—id., p. 41.
 1906. *Euconulus fulvus* Vanatta,—Nautilus, vol. 20, p. 95 (recorded from Field, B.C., and Banff, Alberta).
 1910. *Euconulus fulvus alaskensis* Pilsbry and Ferriss,—Proc. Acad. Nat. Sci. Phila., 1910, p. 131, text f. 26 A-C.
 1919. *Euconulus fulvus alaskensis* Berry,—Proc. Acad. Nat. Sci. Phila., 1919, pp. 196, 199, 202.
 1921. *Petasina fulva* Gude and Woodward,—Proc. Malac. Soc. Land., vol. 14, p. 177.

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
2	Morley, Alberta.....	J. Macoun.....	1885	ex-2932
80	Kananaskis, Alberta.....	".....	1885	2928
11	Bow river, Alberta.....	J. B. Tyrrell.....	Sept. 28, 1883..	2871
4	Waterton lake, Alberta.....	".....	1883	2870

Some writers are beginning to show a tendency to call all *P. fulva* from the Rocky Mountain area and westward, *P. f. alaskensis*, and the writer being persistently unable (cf. Berry, 1920, p. 202) to distinguish definitely two nameable subspecies from the region in question must follow their lead. Specimens from several localities, chiefly Californian, kindly named by Mr. E. G. Vanatta, have been insufficient to elucidate the matter. There is the same need of critical overhauling of the North American snails of the *fulva*-group as exists in the case of *Gonyodiscus cronkhitei*.

Vertigo modesta (Say 1824)

1824. *Pupa modesta* Say,—Long's 2d Exped., II, Appendix, p. 259, pl. 15, f. 5.
 1847. *Pupa decora* Gould,—Proc. Bost. Soc. Nat. Hist., vol. 2, p. 263, f.
 1869. *Pupa (Pupilla) decora* Binney and Bland,—Land and Freshwater Sh. N. Am., I, p. 237, f. 410.
 1885. *Pupa (Pupilla) decora* Binney,—Man. Am. Landsh., pp. 27, 59, 189, 335, 483, f. 189.
 1893. *Pupa hoppii* Taylor,—Nautilus, vol. 7, pp. 85, 86 (recorded from Laggan, Alberta).
 1898. *Pupa (Nearctula) decora* Pilsbry,—Nautilus, vol. 11, p. 119 (merely catalogued).
 1898. *Pupa (Nearctula) hoppii* Pilsbry (pars),—Nautilus, vol. 11, p. 119 (recorded from Laggan, Alberta).

1899. *Pupa decora* Pilsbry,—Proc. Acad. Nat. Sci. Phila., 1899, p. 315 (recorded from Laggan, Alberta).
 1900. *Vertigo modesta* Pilsbry and Vanatta,—Proc. Acad. Nat. Sci. Phila., 1900, pp. 598, 600, 609, pl. 23, f. 2, 3, 6.
 1905. *Vertigo modesta* Dall,—Land and Freshwater Moll. Alaska, pp. 8, 29.
 1905. *Vertigo modesta* Whiteaves,—Ottawa Nat. vol., 19, p. 171 (recorded from Kananaskis, Alberta).
 1906. *Vertigo modesta* Vanatta,—Nautilus, vol. 20, p. 95 (recorded from Field, B.C., and Banff, Alberta).
 1919. *Vertigo modesta* Pilsbry,—Man. Conch., (2), vol. pp. 25, 76, 122, 123, text f. 1-2, pl. 10, f. 1-2.

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
29	Entrance to Rocky mts., Kananaskis, Alta.	J. Macoun.....	1885	2915
? 4	Kananaskis, Alberta.....	".....	1885	2918

These shells show almost invariably but three teeth—the parietal, columellar, and lower palatal, with the upper palatal represented if at all only by a very small tooth or a mere trace. No angular lamella was noted in the case of any of the specimens cleaned, in this particular differing from the race of *V. modesta* found in Glacier National park, Montana, which are mainly of the *parietalis* type (Berry, 1919, p. 204). Similarly toothed shells from the two lots are quite closely alike, however. The same specimens seem already to have been recorded in print by Whiteaves (1905, p. 171).

Columella alticola (Ingersoll 1875)

1875. *Pupilla alticola* Ingersoll,—U.S. Geol. Surv. Terr., Bull. 1, p. 128.
 1876. *Pupilla alticola* Ingersoll,—8th Ann. Rept. Hayden Surv., p. 391, fig.
 1885. *Pupa alticola* Binney,—Man. Am. Landsh., pp. 59, 174, f. 166.
 1893. *Pupa alticola* Taylor,—Nautilus, vol. 7, p. 86 (recorded from Laggan, Alberta).
 ?1895. *Pupa simplex* Taylor,—Ottawa Nat., vol. 9, pp. 174, 177 (recorded from Laggan, Alberta).
 1905. *Sphyradium edentulum* Whiteaves,—Ottawa Nat., vol. 19, p. 171 (recorded from Tobacco plains, B.C., and Kananaskis, Alberta).
 ?1906. *Sphyradium edentulum* Vanatta,—Nautilus, vol. 20, p. 95 (recorded from Field, B.C., and Banff, Alberta).
 1907. *Sphyradium edentulum* (pars) Henderson,—Univ. Colo. Studies, vol. 4, pp. 91, 177.
 1911. *Sphyradium alticolum* Hanna,—Proc. U.S. Nat. Mus., vol. 41, pp. 372 373, f. 2.

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
21	Entrance to Rocky mts., Kananaskis, Alta.	J. Macoun.....	1885	2914
16	Kananaskis, Alberta.....	".....	1885	2916
? 4	Swamp on Tobacco plains, Kootenay River valley, B.C.....	J. B. Tyrrell.....	1883	2868

The present determination of these specimens has kindly been confirmed by Dr. G. Dallas Hanna of the California Academy of Sciences, who writes (*in litt.*, November 2, 1920), "I consider your identifications correct in every case. The specimens have been compared with material from England, Norway, Maine, Alaska, and Pleistocene fossils from Kansas and Iowa. Those from the Tobacco plains locality approach the Alaska forms, which I consider a new species, but they are not quite mature and therefore not entirely comparable. The Alaska specimens are heavier and more obese, as shown by the following measurements:"

Species	Locality	Length in mm.	Diameter in mm.
<i>C. edentula</i>	England.....	1.96	1.12
<i>C. alticola</i>	Kananaskis, Alberta.....	2.48	1.42
".....	Tobacco plains, B.C.....	2.38	1.45
<i>C., sp.</i>	Unalaska.....	2.84	1.60

All the present specimens have been recorded by Whiteaves (1905, p. 171) as *Sphyradium edentulum* (Draparnaud).

Punctum pygmæum (Draparnaud 1801)

1801. *Helix pygmæa* Draparnaud,—Tabl. Moll., p. 93 (teste Taylor).
 1805. *Helix pygmæa* Draparnaud,—Hist. Moll., p. 114, pl. 8, f. 8-10 (teste Dall).
 1841. *Helix minutissima* Lea,—Proc. Am. Philos. Soc., vol. 2, p. 82.
 1844. *Helix minutissima* Lea,—Trans. Am. Philos. Soc., vol. 9, p. 17.
 1864. *Punctum minutissimum* Morse,—Jour. Portl. Soc. Nat. Hist., vol. 1, p. 27, text f. 69-70, pl. 8, f. 71.
 1885. *Microphysa pygmæa* Binney,—Man. Am. Landsh., pp. 57, 71, 482, f. 31-33.
 1898. *Punctum pygmæum* Pilsbry,—Nautilus, vol. 11, p. 142 (merely catalogued).
 1905. *Punctum pygmæum* Dall,—Land and Freshwater Moll. Alaska, pp. 9, 53.
 1909. *Punctum pygmæum* Taylor,—Mon. Land and Freshwater Moll. Brit. Isles, p. 157, f. 215-219 (European form).
 1909. *Punctum pygmæum minutissimum* Taylor,—id., p. 161, f. 220-223 (American form).

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
1	Kananaskis, Alberta.....	J. Macoun.....	1885	2917

The specimen is fully as large as Glacier Park *californicum*, but is lighter in colour, the striæ are finer, it has a full half whorl more ($4\frac{1}{4}$), the whorls are much narrower, especially as seen from the base, and the umbilicus is conspicuously wider and more funnel-shaped. Specimens of *Pygmæum* from Unity, Maine, are in more complete accord, but have rather coarser sculpture, a half whorl less, and are only about two-thirds as large. Some Ohio *pygmæum* at hand are even smaller than the Maine ones, are much flatter than the Albertan shell, and have nothing like so tremendous an umbilicus, but to judge from the measurements of specimens of this species given by Walker and others, both these last two lots may be below the average in size. The habitat is very far removed from the nearest prior record of *pygmæum*, and it may be that the peculiarities noted, if borne out in further material, are sufficient to justify some manner of separate recognition for the race. The specimen was previously examined by Dr. Sterki who determined it to be *P. pygmæum*. Its more important measurements are:

Major diameter.....	1.6 mm.
Lesser diameter.....	1.4 "
Altitude.....	1.0 "
Diameter umbilicus.....	0.48 "

Succinea avara Say 1824

1824. *Succinea avara* Say,—App. Long Exped., p. 260, pl. 15, f. 6.
 1885. *Succinea avara* Binney,—Man. Am. Landsh., pp. 31-33, 36, 59, 337, 339, 497, f. 366, 369.
 1893. *Succinea avara* Taylor,—Nautilus, vol. 7, p. 86 (recorded from Laggan, Alberta).
 1895. *Succinea avara* Taylor,—Ottawa Nat., vol. 9, pp. 176, 177 (recorded from near Macleod and Little Bow river, Alberta).
 1906. *Succinea avara* Vanatta,—Nautilus, vol. 20, p. 95 (recorded from Field, B.C.).

Material Examined

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
6	Swamp, Kananaskis, Alberta.....	J. Macoun.....	1885	2938
1	Mossy marsh, North Fork Oldman river, Alberta.....	J. B. Tyrrell.....	Aug. 10, 1883....	2883

Succinea sp.*Material Examined*

No. of spec.	Locality	Collector	Date	Geol. Surv. Cat. No.
6	Swamp, Kananaskis, Alberta.....	J. Macoun.....	1885	2985
2	Swamp, Tobacco plains, Kootenay River valley, B.C.....	J. B. Tyrrell.....	Sept. 1, 1883...	2884
2	Upper Columbia river, B.C.....	".....	Oct. 13, 1883..	2885

It is impossible to refer these small *retusa*-like *Succineas* with any degree of certainty to any of the described species, but without the animals—which writers are now generally agreed must constitute the main reliance in working out of the prevailing chaos in this group—it would, probably, not be in the interest of science to describe them as new. The specimens from west of the Rockies are in poor condition; hence it is by no means certain that all the lots listed are referable to the same species. The western *Succineas* are very poorly understood and many of them are, therefore, in a state of supreme confusion in the literature. They need competent revision badly. All the present specimens were labelled "*Succinea ovalis* Gould" by Dr. Whiteaves.

PLATE I

Figures 1-3. *Oreohelix cooperi limitaris* (Dawson). Series of three specimens from Waterton lake, Alberta; natural size. (Geol. Surv., Can., Cat. No. 2881.)

Figure 4. *Oreohelix cooperi limitaris* (Dawson). Immature specimen from Waterton lake, Alberta; natural size. (Geol. Surv., Can., Cat. No. 3144.)

Figure 5. *Oreohelix cooperi limitaris* (Dawson). Specimen shown in Figure 1; x 2.

Figure 6. *Oreohelix strigosa canadica* n. subsp. The type specimen from Donald, B.C.; natural size. (Geol. Surv., Can., Cat. No. 2882.)

Figure 7. *Oreohelix strigosa canadica* n. subsp. Same specimen; x 2.

Figure 8. *Gonyodiscus shimekii* (Pilsbry). Specimen from Kananaskis, Alberta; x 6. (Geol. Surv., Can., Cat. No. 2937.)



Fig. 1



Fig. 4a



Fig. 2



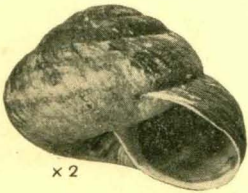
Fig. 4b



Fig. 3



Fig. 4c

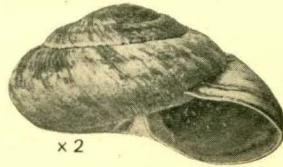


x 2

Fig. 5



Fig. 6a



x 2

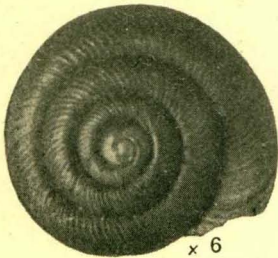
Fig. 7



Fig. 6b



Fig. 6c

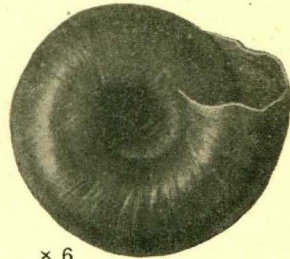


x 6

Fig. 8a



Fig. 8b



x 6

Fig. 8c