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A Descriptive Catalog
OF
THE MOLLUSCA OF UTAH

BY

RALPH V. CHAMBERLIN

AND

DAVID T. JONES

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Preface

In the preparation of this bulletin an effort has been made to bring together what was previously known of recent Utah mollusks and to incorporate with this the results of the authors' special studies. The form of presentation has been determined by the fact that, in the first place, the paper is intended to serve as a basis for further scientific work and, in the second place, to serve as a reference text for teachers of zoology in Utah colleges and high schools and as an aid to amateur collectors. The article is based primarily upon a study of upward of one thousand sets of shells collected during the year 1927 and a lesser number collected during 1928, all of which are now deposited in the Zoological Museum of the University of Utah. Trips totaling approximately three thousand miles, within the borders of the state, were taken to secure these specimens. An accompanying map is given to facilitate reference to the principal localities visited or referred to. Such Utah material as is contained in the Dr. Orson Howard collection, also deposited in the University, has been included; but that collection is largely of fresh-water bivalves from all parts of the United States.

In most cases identifications have been checked by comparison with reliably determined specimens from other localities. In this connection the cooperation of other students of the group is appreciated and credited where possible. We are particularly indebted to Professor Junius Henderson, curator of the Museum at the University of Colorado and a veteran student of the mollusca of the Rocky Mountain states, whose interest and courtesy have been unflinching. The point of departure for the study was necessarily his "Mollusca of Colorado, Utah, Montana and Wyoming" (1924). The "previous locality" records for the species herein listed are for the most part as compiled by him in that paper. Others to whom we are obligated for assistance on special problems or on special groups are the following: Dr. H. A. Pilsbry, of the Academy of Natural Sciences of Philadelphia; Dr. V. Sterki, of the Carnegie Museum; Mr. F. C. Baker, of the Zoological Museum of the University of Illinois, whose recent valuable work on fresh-water mollusca has been freely used; Mr. Wm. J. Clench, of the Museum of Comparative Zoology of Harvard University; and Mr. C. W. Johnson of the Boston Society of Natural History, who aided in bibliographical matters during a visit of the senior author to Boston. Dr. V. M. Tanner loaned material from the La Sal Mts. Mr. A. M. Woodbury, now of this institution, supplied notes on the molluscan fauna of Zion National Park and submitted material from that region identified by Dr. Bryant Walker of Detroit. The assistance and interest of various students in our zoology classes is appreciated and credit is given hereafter in specific

instances, but special mention must be made here of Elmer Berry, who has given constant and enthusiastic aid in field and laboratory. The general form of the paper has been influenced by Call's "Mollusca of Indiana."

We are conscious that the attempt to catalog the Mollusca of the state has the usual defects of such initial undertakings; and an important object has been to stimulate collecting and intensive study of special problems by calling attention to the needed lines of work. We have felt that the utility of the paper would be best served by a presentation in which the easily observed characters of the shell are used, so far as possible, while at the same time reflecting some of the important systematic changes based on an increasing knowledge of the anatomy of the animal itself due to such students of the group as Pilsbry, H. B. and F. C. Baker, and Walker. Additions to or corrections of data in this bulletin will be welcome, as will also notes from teachers and others who use it as to places where difficulty is encountered in using the keys or otherwise. Specimens from localities not herein listed are desired. These may be sent to the Zoological Museum, University of Utah, and should be accompanied by a record giving (1) the locality from which the material was secured; (2) the date when collected; (3) the name of the collector; and (4) the name of the donor where it differs from that of the collector. Directions for collecting and preserving are given in an early section of the bulletin.

RALPH V. CHAMBERLIN.

DAVID TRACY JONES.

University of Utah,
Salt Lake City, Utah,
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THE MOLLUSCA OF UTAH*

Introduction

THE FAUNAL RELATIONS OF THE MOLLUSCA OF UTAH

A few words concerning the distributional relations of Utah snails will help the student to orient and appreciate the significance of the species now within the borders of Utah, and to correlate Utah studies with those of other states.

North America may be divided into the following molluscan provinces:**

NORTHERN PROVINCES:

- I. Pacific province.
- II. Intermountain province.
- III. Eastern province.

SOUTHERN PROVINCES:

- I. Mexican province.
- II. Lower California province.
- III. West Indian province.

The Mexican province runs into Central America which might by some authorities be considered a separate province. The northern limits of the Mexican province are determined by climate alone, but most of the species end somewhere near the southern border of the United States. The lower California province is quite distinct. It continues northward into southern California, almost to San Diego. Its peculiarities in many cases seem to link it with Central American and South American regions. In this article, we are concerned chiefly with the northern provinces, which are outlined below:

I. Pacific Province.

1. **BOUNDARIES:** From San Diego, California, into Alaska, between the Sierra Nevada-Cascade Mountain System and the Pacific Ocean.
2. **DIVISIONS:**
 - a. *Oregonian region.*—This comprises all of the Pacific province north of Humboldt Bay, California.
 - b. *Californian region.*—The southern part of the Pacific province from Humboldt Bay, south to San Diego, California.

*Publication of *The Biological Survey of Utah*, No. 1.

**Binney, 1885; Henderson, 1924; Tiedstrom, Ivar, *Flora of Utah and Nevada*, Contrib. U. S. Nat. Herbarium, Vol. 25, 1925; Keep, 1911.

3. CHARACTERISTIC GENERA AND SPECIES:

The old genus *Epiphragmophora*, now split up into *Monadenia* and other genera.

Genus *Ariolimax*.

Anceyia lansingi (Bland).

Goniobasis plicifera (Lea).

Haplotrema sportella (Gould).

4. ORIGIN OF FAUNA: Unknown. Evidently comparatively recent. The fauna has appeared as the Pacific has withdrawn from this region during Mesozoic and Cenozoic times. Some hold the theory that this fauna is an offshoot of Asiatic fauna that has migrated to its present position by way of an Alaskan land connection. Binney, 1885, thinks that the secret of its origin lies buried under the Pacific Ocean, as it runs out in all directions.

II. Intermountain (Central or Great Basin) Province.

1. BOUNDARIES: From Mexico almost to Canada, between the Rocky Mountains on the east and the Sierra Nevada-Cascade System on the west.

2. CHARACTERISTIC GENERA AND SPECIES:

Genus *Oreohelix*.

Microphysula ingersolli (Bland).

Valvata utahensis (Call).

Paludestrina longinqua Gould.

3. ORIGIN OF FAUNA: The land forms probably were established sooner than those in the Eastern province. This region may have been a post-glacial dispersion center for such forms as *Cincinnatiensis* (Anthony) and the Oreohelices. The freshwater forms in many cases can be traced directly back to forms living in old Lake Bonneville in Pleistocene times; and probably a continuation of the molluscan fauna will be found traceable continuously, back to the vast inland lakes of the Rocky Mountain region, which existed in Tertiary times,* and, perhaps, according to existing evidence, to even earlier times. In these lakes which "for magnitude have now no equal on the earth," such fresh water forms as the Lymnaeids continued to live and develop before they migrated in Pliocene and Pleistocene times, eastward and westward as the elevation of new Pleistocene times eastward and westward as the elevation of new land in these directions made possible the existence of suitable fresh water bodies.

III. Eastern Province.

1. BOUNDARIES: Includes all of North America east of the Rockies and north of Mexico.

2. DIVISIONS:

- a. *Northern region*: Greenland, Northern Alaska, all of Canada, New England, and southward east of the Appalachians to Chesapeake Bay.

*For a summary of this matter, and detailed references see W. M. Davis, "The Fresh Water Tertiary Formations of the Rocky Mountain Regions," Proc. Amer. Acad. Arts and Sci., 35, 1900, p. 345, et seq.

- b. *Interior region*: Canadian boundary to the alluvial regions of Gulf coast states from Rocky Mountains to Appalachians.
- c. *Southern region*: Peninsula of Florida with adjacent islands, alluvial regions of Atlantic and Gulf coasts.

3. CHARACTERISTIC GENERA AND SPECIES:

The genus *Polygyra*.

Succinea ovalis Say.

Pyramidula perspectiva (Say).

Helicodiscus parallelus (Say).

4. *ORIGIN*: Many forms similar to the present have lived in this region in pre-glacial times, and are found in post-Pleiocene deposits along the Ohio and Mississippi Rivers. These were probably redistributed from the southland, where the ice-sheet did not extend. The fauna has many affinities with European and Asiatic fauna. The Cumberland River region is a region rich in fresh water mussels, both in number of individuals and in number of species, and seems to be a likely center of their distribution.

The intermountain province, centering in Utah, in addition to the above characteristics, also lacks the genus *Polygyra*, common in the eastern province and represented also in the Pacific province. The fresh water mussels are also very sparingly represented. Certain circumpolar species of snails such as *Stagnicola palustris* (Müller), forms, *Aplexa hypnorum* (L.), *Vallonia pulchella* (Müller), and *Cochlicopa lubrica* (Müller) are represented, and also many others that range over the entire country, as *Helisoma trivolvis* (Say) and *Zonitoides arborea* (Say). *Vitrina alaskana* Dall, *Euconulus fulvus alaskensis* (Pilsbry) and possibly some of the smaller *Vertigos* and *Pupillas* have come southward into Utah along the mountain ranges. *Pupilla syngenes* and *Pupilla syngenes dextroversa*, however, seem to have entered from the south. *Succinea avara* is possessed in common with the eastern province. *Carinifex newberryi* (Lea) and the *Fluminicolae* are found in both Intermountain and Pacific provinces. The slug *Agriolimax agrestis* (L), common throughout the country, comes from Europe.

There seems to be little correlation between the plant belts as given by Tiedstrom, and the molluscan regions. The Rocky Mountains seem to be less a barrier to mollusca than the Sierra-Cascade system, due probably to the extreme change in humidity on the opposite slopes of the latter.

A division into regions representing the natural drainage areas separated by divides is advantageous or necessary in the study of the aquatic forms such as the Lymnaeidae.* There are some eighteen river systems or areas in North America as a whole, namely: (1) Labradorian; (2) Canadian; (3) Hudsonian; (4) Mackenzian; (5) Yukonian; (6) Alaskan; (7) Columbian; (8) Coloradoan; (9) Great

*Cf. Dall, Mollusca of the Harriman Alaskan Expedition, 1905, p. 1; and Baker, Lymnaeidae of North America, 1911, p. 56.

Basin; (10) Californian; (11) Rio Grandian; (12) Upper Mississippian; (13) Lower Mississippian; (14) Carolinian; (15) Nova Scotian; (16) Central American; (17) West Indian; and (18) Greenlandian. Of these regions Utah at present includes portions of two, the Coloradoan and the Great Basin. A former relation to the Columbian drainage system through the Snake River, which for a time furnished an outlet for the waters of Lake Bonneville, must also be considered, as it is quite likely that through this channel there entered the Great Basin area such forms as *Lymnaea stagnalis jugularis*, *Stagnicola palustris* (forms), *S. caperata*, and *Fossaria obrussa*.*

SOME PROBLEMS PRESENTED IN THE FIELD OF UTAH MOLLUSCA

Much remains to be done upon the molluscan fauna of Utah by way of more careful and extensive exploration. Some sections of the state are at present still scarcely known conchologically, as particularly in the cases of various more or less widely isolated mountain ranges in the western and southern parts of the state. The portion best known is naturally that immediately east and south of the Great Salt Lake and that adjacent to the main highway to St. George as shown by the localities indicated on the accompanying map. The effort to clear up questions connected with some early records has not yet been successful because of indefiniteness of the original authors as to the localities and of errors in identification. Thus we do not know just what is *Sphaerium mormonicum* Sowerby or typical *Oreohelix haydeni* (Gabb). The accumulation of material from many localities may make it possible to solve these and other similarly unanswered taxonomic questions.

Until ample material from many localities has been collected and studied it will be difficult to treat adequately, e. g., the genus *Physella*, which in itself presents a problem that is only beginning to clear up. This genus presents great difficulties to the systematist. The shells are extremely variable in form and structure, making it unsafe in probably the majority of cases to identify species from one or two specimens as was attempted, with resulting nomenclatural confusion, by most earlier workers. While, it is true, as Baker says, that if a series of shells be large enough and includes age variations, a species may usually be accurately placed, full clarification of the taxonomy of the group will come only with a knowledge of the radula and of features of the soft anatomy of all forms.

In fact, the study of the comparative anatomy of the soft parts of most groups of mollusks in connection with their taxonomy is rapidly becoming indispensable and in Utah is a practically untouched field. The recent advances in the classification of the Lymnaeidae have been made from such study; and the study of the Utah members

*Cf. Baker, op cit. p. 75.

of the family from this point of view must be carried out before questions of detailed relationships can be settled. Until such time we shall not be sure of the validity or significance of various "forms" recognized by authors on the basis of shell alone. Work on the soft parts would seem to be even more urgently needed and more promising in the difficult family Sphaeriidae, on which much remains to be done in this state. With adequate work on this basis, undoubtedly many distinct kinds in the several genera of this family will be discriminated where these are now overlooked or merged with other species. The family Planorbiidae also promises important results from detailed anatomical study and comparison of its members. What a study of the soft parts means in the accurate discrimination of species as well as in the adequate definition of higher groups of the land mollusks has been conspicuously shown by the work of Pilsbry.

A more detailed knowledge of the composition and distribution of the molluscan fauna of the Great Basin will be of importance for an understanding of the various problems connected with the phenomena of climatic variations and cycles and the more recent geological and "climatological history" of the region. With reference to this application of the subject, Professor Henderson (1924), writes: "The Pleistocene and recent expansions and contractions of lakes in the southwestern United States and other parts of the world have been much investigated, with no agreement as to the cause or causes of changes of climate of which such expansions and contractions are the results. The vital importance of climatic cycles in the history of mankind, the migrations of races and the development of civilizations, is also under discussion, opening new problems and new methods of investigation. Especially in the arid southwest is the climatic factor of transcendent importance in the settlement of the region, as well as in the investigation of the ancient cultures represented by the extensive ruins of the now thinly populated areas. Any evidence bearing upon the problem of climatic fluctuations should be recorded, as it may eventually become useful. An examination of comparatively recent deposits along the shores and in the beds of ephemeral lakes, and a comparison of the fossil shells with those of the living faunas of the region, may prove worth while. During dry seasons the water in many such lakes entirely disappears, because of excessive evaporation. Manifestly a large aquatic fauna can become established in such a lake only during a very long moist cycle. Some species of *Lymnaea* and *Physa* may exist for some months in wet mud, but cannot survive when the mud is thoroughly dry."

And again: "A more thorough knowledge of the present distribution of mollusks also has a bearing upon the subject of climatic fluctuations, and should be more carefully studied. For example, the great Pleistocene expansion of Great Salt Lake into what is known

by geologists as ancient Lake Bonneville, and consequent overflow of its basin at the northern border, temporarily connected Bear River with the Columbia River drainage, through a body of fresh water. This connection is reflected to some extent in the molluscan faunas of the two systems."

The whole problem of the changes in the molluscan fauna accompanying the fluctuations in Lake Bonneville and its final reduction to the present remnant is a promising one. Professor Bohumil Shimek, at the Okoboji Lake region in Iowa, made an interesting study of the molluscan fauna of numerous deep kettle-holes in the vicinity of the lakes. He found that isolation had left each with its peculiar molluscan fauna. In a number of other regions, such as Pennsylvania and Wisconsin, which have been intensively studied by specialists, it has been shown that each stream and lake, according to size and other features, has faunal peculiarities of its own. The mollusks of the different types show definite peculiarities in the different environments. Such mass variations, the so-called ecological varieties, remain to be determined, described, and properly indicated for Utah.

The various lesser lakes and ponds left over a wide area, both near and remote from Great Salt Lake, following the retreat of Lake Bonneville invite intensive study on the effects of isolation here, since many of these bodies of water, as well as the streams whose faunas are effectively separated at their mouths by the Salt Lake, support mollusks or have done so until comparatively recent times.

There is involved here also the effect of increasing salinity which at a certain degree in some places resulted in extermination of the mollusca inhabiting them. Here in a graded series of lakes and pools Nature presents a row of natural tests tubes, each an experiment that has lasted, it may be, over centuries. These experiments merit careful recording and interpretation.

For ecological studies, in fact, Utah presents a field unsurpassed. The problems of the effect of increasing salinity and of the effect of temperature in the case of pools connected with the numerous hot springs of the region are of deep biological interest. The extreme variation of *Stagnicola palustris* noted hereafter under the discussion of that species will necessitate study as to its causes and experimental testing as to heritability. That one cause of the variation may be connected with rapid evaporation or lowering of the reservoir otherwise, and perhaps with some degree of accompanying alkalinity, is suggested by the following quotation from Dall, (1905): "The existence of fresh water shells in lakes and ponds where the water, through evaporation, is becoming more alkaline has been shown to be accompanied in the lake-beds of the Great Basin of the western United States, by a tendency to solidification, thickening, and corruga-

tion or ribbing of the shells, regardless of their systematic relations. This goes on until alkalinity becomes so great that molluscan life is no longer possible. We find in the fresh water Pliocene beds in Utah, *Lymnaea*, *Pompholyx*, *Carinifex*, *Physa*, and *Planorbis*, exhibiting these changes as we ascend in the beds, until the latter become barren of life. To these modifications we probably owe such forms as *Polyrhytis*, *Pleurolimnaea*, *Vorticifex*, etc. I have shown in another place, (Proc. Acad. Sci. Phila. for 1896, pp. 406-426) how such factors may be supposed to act in the case of land shells exposed to alkaline dust on tropical islands such as the Galapagos. While such changes are the result of the direct action of the environment on the individual, and not hereditary or evolutionary, it is nevertheless convenient to recognize the results in the systematic arrangement of the species."

Bear Lake shells have a slate gray color and are harder and more resistant to weathering than the commonly chalky white Utah Lake shells, though on the west shore of Utah Lake we have found some similarly darkened shells. This darker color may be due to some mineral in the water of Bear Lake. Shell lines well up on the hillside above the road between Garden City and Lakota Resort contained grayish *Carinifex newberryi* in as excellent a state of preservation as down on the beach, though it must have been ages since the water line was that high. Chemical analysis of the water of Bear Lake might give some hint or an analysis of the shells themselves might lead to a solution of the problem. The complicating factor of the age of the shells will enter in for Sterki claims they are fossils of Pleistocene age or later. We are rather inclined to this view, since we did not find any of these blue shells with living animals in them, and they seem more or less weathered in spite of the preservation of details. Occasionally chalky shells are washed up and forms corresponding to these blue shells may possibly live in the lake at present. Bear Lake is a deep lake and wave action would be less likely to bring forms up from the bottom. There is the same question as to whether the new form, *Carinifex atopus*, discussed later, has become extinct. Dredging should be done.

While, as Dall indicates in the passage above quoted, many of the variations related to environmental peculiarities are not hereditary, there is ample ground for believing that some hereditary variations are induced by environmental changes and play a role in the evolutionary process. Certainly the environment does largely control the course of evolution in setting the conditions to which organisms to survive must adapt themselves. Utah is very advantageously situated for a fruitful series of studies on the relations of the environmental evolution to organic evolution.

As a background for such studies the habitat relations of the living species must be carefully determined. In Utah this is a virgin

field. Such investigations must deal not only with inorganic environment but with the interrelations with other organisms, with the place of each species in the complex web of the organic world, its nutritive relations and enemies, its parasites, its reproductive processes and periods, its longevity, and developmental stages, involving in the case of some of the bivalves the determination of fish or fishes that are the natural hosts of the larvae, etc.

Ecological problems link naturally with those as to the historic derivation of the existing types; and, while fossil forms in general are outside the range of the present survey, attention may be called to the fact that this field in Utah is a very rich one which must be cultivated before various problems relating to the living forms can be fully understood. The promise of rich data in this region will be sufficiently clear from what has been said above and from the remarks under "Intermountain province" in the preceding section.

HINTS ON COLLECTING AND PRESERVING MOLLUSCA

Success in searching for living snails and other mollusks increases as the collector acquires knowledge of the various habitats of these animals. In general those sections of the country that are dry and sandy, such as many in which pines and other conifers abound, yield but poor collecting, while highly favorable conditions are afforded in the moist loamy soil of limestone regions. Limestone formations are notably favorable for land species, but also it is found that "waters deficient in lime do not produce shells as perfect nor in as great numbers as waters charged with that earth."

Land snails are most commonly to be found in wooded regions along streams, or mountain sides having a northern exposure, and in general in localities which are adapted to retain moisture. In such places the snails may be found during the daytime concealed under fallen logs, pieces of bark or stones, and under leaves and in tufts of moss and grass. Sifting leaves in such localities is often fruitful in securing small forms. Some small forms tend to gather under pieces of wood or other objects in swampy places, close to the water of ponds or streams or in other places that are commonly moist throughout the season. The large western land snails belonging to the genus *Oreohelix* are to be looked for especially in the rock slides at the bases of limestone cliffs.

Various aquatic snails are found in lakes, ponds, rivers, ditches and other bodies of water where they are readily enough detected floating at the surface, crawling over the bottom or attached to aquatic plants or other submerged objects. Practically every permanent body of water has mollusks varying according to the nature of the body. Most species prefer shallow water and are easily taken. Some small forms attach themselves commonly to watercress or

other submerged plants where they may be detected after withdrawing the plants from the water. Fewer forms occur at considerable depths and are to be secured only by special means, such as by use of dredges, though the shells of these are likely to be washed ashore at times along with the others. As already pointed out it is still doubtful whether *Carinifex*, shells of which are so common about Bear Lake, may have living representatives in the Lake.

Of the bivalve mollusks one group of several genera, constituting the family Sphaeriidae, consists of small species which never much exceed half an inch in length and are commonly much smaller. These forms normally occur just beneath the surface of the mud in streams, lakes and ponds, more especially where the water is shallow. They often abound in our shallow mountain lakes and in the waters of springs. These forms and some others are best secured by means of a fine meshed sieve, to which a handle of any desired length may be attached. The loose mud of the bottom may be scooped up in this and then washed out by shaking back and forth, a procedure that will leave the shells behind in the sieve along with other small mud-frequenting forms such as the Amnicolidae.

The larger bivalves, such as our species of *Anodonta* and *Margaritana*, are less easily secured. These forms bury themselves in sand, gravel or mud with only the edge of the shell exposed. When located, they may be dislodged by means of tongs, rake or special hook operated from a boat, but the most effective procedure is to wade in for them.

The small land snails and such aquatic forms as the Sphaeriidae are best dropped at once into vials of 70 per cent alcohol, but the larger forms, both land and aquatic, should be placed in small boxes or other receptacles until they can be specially killed and the shells cleaned. In the case of aquatic species, bivalves as well as univalves, this is easily accomplished by dropping them in hot or boiling water for a short time, when the soft parts are readily pulled out by means of forceps. The shells are then rinsed off in water. The soft parts are easily removed from aquatic forms, however, after preservation for a day or two in diluted alcohol. The bivalves when cleaned are then tied together or wrapped in cloth or newspaper until the ligament dries so as to prevent gaping of the valves. The thin shells of *Anodonta* tend to crack when dried rapidly. This may be prevented by dipping the shells within a few hours after cleaning in a solution of sodium chloride or by coating them with vaseline or varnish to insure more even contraction.

In the case of land forms the procedure in cleaning must be carried out more carefully. It is important to scald them in boiling water just the right length of time and the margin of safety is not great. The ordinary land snails require from 30 to 60 seconds. Only

a few should be treated at a time so that the bodies of these may be drawn out while still hot. If under-scalded the "anatomies" cling to the shell; if over-treated or cold before drawn, the liver, which extends into the smaller coils, is almost sure to break off, remaining in the shell and decomposing or sometimes staining the shell. As the soft parts are of importance in the technical classification of some forms, e. g., the species of *Oreohelix*, it is advisable to preserve several of each species taken by putting them first in 50 per cent alcohol for 24 hours and then preserving permanently in 70 per cent alcohol; but it is commonly better to use 25 per cent alcohol for a day or so before transferring to the 50 per cent grade. It is always well to keep some of the shells with the corresponding anatomies to prevent possible mixing of labels. Formalin should not be used for the permanent preservation of shells as it destroys them in the course of time. After pulling the soft parts the interior of the shells should be rinsed out with a suitable syringe. A small piece of cloth or of sponge held with forceps or fastened to the end of a piece of wire may be used for removing mucus, etc., from the inner surface of the shells. The exterior may be cleaned with a soft brush and incrustations may be removed with oxalic or hydrochloric acid applied with a brush. Shells should be dried in the air but not in direct sunlight.

A NATURAL CLASSIFICATION OF UTAH MOLLUSCA TO THE GENERA

Phylum **MOLLUSCA**: Animals characterized by having an unsegmented body, usually covered by an integument known as the mantle. A larval shell gland is present, from which a shell is secreted, though not always permanently retained. A single foot for locomotion is usually well developed.

Class **LAMELLIBRANCHIATA** Blainville (Pelecypoda Goldfuss): bilaterally symmetrical, acephalous mollusks, with a bi-valve shell, and no radula.

Order **Prionodesmacea** Dall: The shell structure of this order is ordinarily nacreous and prismatic.

Section **Schizodonta** Steinmann (emend.): Shells with heavy, amorphous, variable teeth often divided into cardinal and lateral elements.

Superfamily **Naiadacea** Menke: Equivalve shells with a conspicuous epidermis and an external ligament. Foot normally long, compressed, and keeled.

Family **UNIONIDAE** Fleming: Fresh-water mussels. Periostracum typically dark-colored. Young called glochidia. Byssus present in the glochidia, obsolete in adult.

Sub-family **ANODONTINAE** Ortmann: Shell often thin, more or less elongate, color of epidermis generally bright, and with color markings, sculpture of the beak double-looped or concentric, hinge teeth reduced or absent.

Genus *Anodonta* Lamarck; Hinge edentulous, nacre dull, shell often winged posteriorly.

Family MARGARITANIDAE Ortmann: Shell elongate; sculpture of beak concentric, hinge teeth imperfect, epidermis blackish.

Genus *Margaritana* Schumacher: Shell often kidney-shaped in outline, beaks low.

Order **Teleodermacea** Dall: Shell structure porcellanous, or obscurely prismatic, never nacreous.

Superfamily **Cyrenacea** Tryon: Lateral teeth normally one or two, cardinals three or less.

Family SPHAERIIDAE Dall: Cardinal teeth usually two in each valve, laterals distinct. Ligament feeble and short.

Genus *Sphaerium* Scopoli: Beaks subcentral, shell oval, nepeonic valves not distinct in adult, cardinal teeth double in the right, single in the left.

Genus *Musculium* Link: Beaks subcentral, nepeonic valves inflated, separated from the adult growth by a distinct sulcus.

Genus *Pisidium* C. Pfeiffer: Shell inequilateral, beaks terminal.

Class **GASTROPODA** Cuvier: Mollusks with a distinct head, usually soled foot, and undivided mantle, shell if present univalve, usually spiral, though sometimes conical.

Subclass **EUTHYNEURA** Spengel: Gastropods in which the visceral nerve commissures are not crossed, but form a simple loop; hermaphroditic; shell spiral, low conic, vestigial, or absent; operculum generally wanting. Radula with teeth generally multiserial.

Order **Pulmonata** Cuvier: Gill cavity is transformed into a lung, for breathing free air. Mainly terrestrial or fresh-water forms.

Sub-order **Stylommatophora** A. Schmidt: Land snails. Tentacles usually four, the eyes borne on the extremities of the two longer ones.

Superfamily **Holopoda** Pilsbry: No longitudinal grooves above the margins of the foot, jaw present, teeth quadrate.

Family **HELICIDAE** Keferstein: Shell, depressed, globose or oval, and elevated.

Genus *Vallonia* Risso: Shell umbilicated, depressed, often small. Peristome reflexed.

Genus *Oreohelix* Pilsbry: Large shells, peristome not reflexed, separated from other Helices by characteristics of the reproductive organs. Utah forms often with color bands.

THE MOLLUSCA OF UTAH

Genus *Microphysula* (Cockerell) Pilsbry: Small shells. Shell clear, smooth, glassy, discoidal, with flat or very low spire of closely coiled whorls; aperture deeply lunate.

Family PUPILLIDAE Turton: Shell more or less cylindrical with obtuse summit: pupiform.

Genus *Pupoides* Pfeiffer: Shells elongate and tapering, aperture with no denticles or at most with but one or two.

Genus *Pupilla* Leach: Shell cylindrical, from 1 to 3 apertural denticles, sometimes all absent, outer lip regularly rounded or at most sinuous. Body whorl of less diameter or of the same diameter as the last whorl of the spire, all whorls evenly colored.

Genus *Vertigo* Müller: Usually 6 or more apertural denticles, outer lip distinctly indented above the middle.

Genus *Columella* Westerlund: From 1 to 3 apertural denticles, sometimes all absent, body whorl distinctly bulging, light brown in color with apex much lighter, sometimes white, peristome thin, no callus deposits.

Family ACHATINIDAE Pilsbry: Shell more or less conical, apically acute; shell thick; apex of 5 or more whorls, spire high.

Genus *Cochlicopa* Ferussac: Lip acute, shell polished, dextral.

Superfamily Aulacopoda Pilsbry: Foot with longitudinal grooves above and parallel with its lateral margins.

Family ZONITIDAE Pfeiffer: Shell usually smooth and with simple lip; marginal teeth of the radula thorn-like; foot margin wide; jaw rather smooth with a median projection; Utah forms without transverse ribs.

Genus *Vitina* Draparnaud: Shell small, translucent, with a short spire and a very large body whorl, greenish in color.

Genus *Ogaridiscus* gen. nov.: Shell pellucid umbilicus, narrow, perforate; whorls gradually increasing in size.

Genus *Vitrea* Fitzinger: Shell transparent or yellowish, umbilicate or non-umbilicate, whorls rapidly increasing in size.

Genus *Euconulus* Reinhardt: Spire elevated, shell conical, whorls gradually increasing in size.

Genus *Zonitoides* Lehmann: Spire low, whorls gradually increasing in size.

Family LIMACIDAE Lamarck: Shell absent or rudimentary; dentition and jaw as in the Zonitidae.

Genus *Agriolimax* Moersch: Small slugs; body keeled behind and unspotted or irregularly spotted.

Genus *Limax* Linnaeus: Very large slugs; lateral bands or rows of spots on mantle.

Family ENDODONTIDAE Pilsbry: Shell rib-sculptured and with coloring in all Utah forms. Jaw with a median projection.

Genus *Gonyodiscus* Fitzinger: Shell over 4 mm. in diameter; shell clear in young, gray or blackish in old.

Genus *Helicodiscus* Morse: Shell 3.5 mm. or more in diameter, whorls almost equally visible above and below, growth lines crossed by parallel spiral lines.

Genus *Punctum* Morse: Shell under 2 mm. in diameter and golden in color.

Superfamily **Elasmognatha** Moersch: Jaw with a strong squarish process of attachment above.

Family SUCCINEIDAE Albers: Shell thin, ovate, consisting of a few whorls.

Genus *Succinea* Draparnaud: Shell amber-colored, translucent, with a short, acute spire and a large body whorl.

Suborder **Basommatophora** A. Schmidt: Water snails bearing a single pair of tentacles, with eyes at base of these; shell always present.

Superfamily **Limnophila**: Living in fresh, or, more rarely, in brackish water; teguments smooth; genital orifices separated, the male orifice near tentacle, the female at base of neck; jaw simple or composed of three pieces.

Family LYMNAEIDAE Keferstein: Shell thin, normally dextral, spire usually elongate.

Genus *Lymnaea* Lamarck: Spire elongated, as long as or longer than aperture. Shell large, body whorl wide, much inflated, horn color, spire acute.

Genus *Stagnicola* Leach: Shell small or of medium size; body whorl usually rather solid, compressed or slightly inflated; spire as long as or a trifle longer than aperture; surface with distinct spiral sculpture; columella twisted or plicate.

THE MOLLUSCA OF UTAH

Genus *Fossaria* Westerlund: Similar to *Stagnicola* but surface without distinct spiral sculpture and the columella smooth.

Genus *Polyrhytis* Meek: Shell with well-marked longitudinal folds or ribs; spire broadly acute, mostly shorter than aperture; columella twisted.

Family PLANORBIDAE H. and A. Adams: Spire turreted or discoidal; shell dextral or sinistral.

Genus *Helisoma* Swainson: Shell large, sinistral, with deep umbilicus and sunken spire.

Genus *Menetus* Adams: Shell small, dextral, depressed or lenticular, acutely carinate on the periphery. The spiral whorls not much depressed.

Genus *Gyraulus* J. de Charpentier: Shell small, dextral; much depressed, with periphery more rounded or obtusely angulated, its whorls fully exposed above and below.

Family POMPHOLIGIDAE Dall: Spire raised or turreted.

Genus *Carinifex* W. G. Binney: Shell either depressed globular, or with spire distinctly turreted. Aperture triangular in shape; inner lip slightly reflexed near junction with shell.

Family PHYSIDAE Dall: Shell sinistral, oval, glossy; aperture large; columella twisted or simple.

Genus *Physella* Haldeman: Shell sinistral, often glossy. Utah forms have the spire varying from low conical to nearly flat. Spire normally acute, and usually small in proportion to body whorl.

Genus *Aplexa* Fleming: Shell narrow; highly polished, acutely conical, body whorl smaller in proportion to spire than in Genus *Physella*.

Family ANCYLIDAE Dall: Shell limpet-shaped; conical, not spiral, or with apex recurved.

Subfamily FERRISSINAE Walker: Shell small, thin, broadly ovate to oblong; apex more or less posterior and eccentric. Jaw, segmented in plates.

Genus *Ferrissia* Walker: Shell never septate; conic, elevated, apex radially striate.

Subclass **STREPTONEURA** Spengel: Gastropods in which the visceral commissures are crossed, producing an 8-shaped loop; sexes separate; heart behind the gill; a shell almost always developed, and with few exceptions provided with an operculum.

Order *Pectinibranchia* Cuvier: Right cervical gill pectinate, very large and usually transposed to the left side, owing to torsion of the body; the left gill atrophied. Heart with but one auricle. Shell coiled in a more or less elevated spiral, rarely cup- or cap-shaped.

Suborder *Platypoda* Lamarck: Foot typically developed, not modified into a fin.

Superfamily *Taenioglossa* Bouvier: Teeth of radula seven in each transverse row. Mainly holostomate forms, but some genera have deeply notched apertures.

Family *AMNICOLIDAE* Tryon: Shell turbinate to turreted, small, usually thin, and either smooth, longitudinally ribbed or spirally keeled. Aperture ovate; operculum horny or calcareous, spiral or concentric.

Subfamily *AMNICOLINAE* Gill: Shell small, spiral, dextral, subglobose to elongate, thin; imperforate or umbilicate; columella and parietal wall not callously thickened; operculum corneous, paucispiral. Foot simple; central tooth of radula with several denticles.

Genus *Amnicola* Gould and Haldemann: Shell small, ovate-conic to elongate, spire subacute; central tooth of radula with tongue-shaped projection from base; basal teeth two; lateral teeth with rounded basal lobe; apex of shell flattened.

Genus *Cincinnatia* Pilsbry: Whorls well rounded, sutures deeply impressed, base widely umbilicated; central tooth without tongue-shaped projection; one basal tooth; no lobe on base of lateral tooth.

Genus *Paludestrina* d'Orbigny: Shell similar to *Amnicola* but more slender and elongated. Central tooth with but one basal denticle on each side, and without the tongue-shaped process of *Amnicola*.

Subfamily *LITHOGLYPHINAE* Fischer: Shell small, spiral, dextral, spire short, body whorl large, forming most of the shell; columella usually callously thickened; operculum corneous, subspiral. Foot simple; central tooth of radula with several basal denticles.

Genus *Fluminicola* Stimpson: Shell heavy, shape from near globose to low conic.

Family *VALVATIDAE* Gray: Shell small, spiral, dextral, turbinate or subdiscoidal. Whorls rounded or carinated; aperture entire, circular; lip simple, sharp; operculum orbicular.

Genus *Valvata* Müller. With characters of the family.

ARTIFICIAL KEY TO GENERA OF RECENT UTAH MOLLUSCA

1. Shell absent, or rudimentary (in the latter case concealed).
 2. Small slugs, spots absent or irregular. . . . Genus *Agriolimax*, p. 104
 - 2.* Very large slugs; with lateral bands or rows of spots.
Genus *Limax*, p. 103
- 1.* Shell present.
 3. Shell bivalve.
 4. Shell large, over 24 mm. in length.
 5. Shell thin, without teeth. Genus *Anodonta*, p. 22.
 - 5.* Shell heavy, nacre usually purple, cardinal teeth well developed, lateral teeth incompletely developed. . . . Genus *Margaritana*, p. 28.
 - 4.* Shell under 24 mm. in length.
 6. Inner lining nacreous. *Young of Anodonta or Margaritana*, pp. 22 or 28 (see above.)
 - 6.* No nacreous layer.
 7. Beaks terminal, two halves of a valve not symmetrical, usually small (6-8 mm. in length). Genus *Pisidium*, p. 138.
 - 7.* Beaks subcentral (almost central), two halves of a valve nearly symmetrical.
 8. Nepeonic valves inflated, separated from adult growth by a distinct sulcus (these nepeonic valves will appear as distinct little caps on the umbo), shell often thin and fragile, hinge teeth usually weak. Genus *Musculium*, p. 34.
 - 8.* Nepeonic valves not separated from the rest of the shell by a sulcus, shell thick, adults large (usually over 10 mm.), hinge teeth usually stout. Genus *Sphaerium*, p. 31.
 3. Shell univalve.
 9. Shell not coiled, but consisting of a pyramidal cap.
Genus *Ferrissia*, p. 170
 - 9.* Shell coiled.
 10. Shell sharply carinated (ridged) below, causing the umbilicus to be deep and funnel-shaped, whorls usually shouldered or terraced above the periphery.
 11. Shell small, diameter near 5 mm., height 5 mm., aperture sharp edged and circular. (Check: operculum present.)
Valvata utahensis, in part, p. 183
 - 11.* Shell with aperture triangular, size large. (The sharply carinated young of *Oreohelix* may come out here also.) Genus *Carinifex*.
Genus *Carinifex*, p. 155
 - 10.* Shell not sharply carinated around the umbilicus.
 12. Shell discoidal, whorls coiled in one plane or nearly so. The young of *Oreohelix* should be watched for at this point.)
 13. Whorls increasing gradually in size, size small or large.
 14. Whorls not equally visible above and below, closely coiled, shell clear and glossy. Genus *Microphysula*, p. 74
 - 14.* Whorls almost equally visible above and below.

15. Whorls with microscopic spiral striae. Height of aperture greater than width. Diameter 3-5 mm. Terrestrial.
Genus *Helicodiscus*, p. 111
- 15.* Whorls with spirally revolving striae absent or faint. Height of aperture usually equal to or less than width of aperture. Aquatic.
16. Shell large, sinistral, with deep umbilicus and sunken spire. Genus *Helisoma*, p. 145
- 16.* Shell small, dextral, the periphery mostly angulate or carinate.
17. Shell much depressed, lenticular, acutely carinate on the periphery. Genus *Menetus*, p. 149
- 17.* Shell less depressed, not lenticular, the periphery rounded or obtusely angulate. Genus *Gyraulus*, p. 151
- 13.* Whorls increasing rapidly, size small.
18. Whorls almost equally visible from both sides, i.e., a broad umbilicus; shell small, under 4 mm. in diameter, usually opaque, shell heavy. Genus *Gyraulus* (in part), p. 151
- 18.* Umbilicus narrow, if present at all, shell thin and glossy.
19. No umbilicus, very fragile, transparent, greenish, glassy, 3 whorls, the last composing most of the shell, peristome thin often membranous, aperture large, obliquely and roundly ovate. Genus *Vitrina*, p. 92
- 19.* Shell firm, often clear, umbilicus present, but only deeply indented, in some cases perforate; whorls 4-6 mm.
20. Whorls rapidly increasing, the last one conspicuously large. Genus *Vitrea*, p. 94
- 20.* Whorls increasing gradually and evenly.
Genus *Ogaridiscus*, p. 96
- 12.* Shell with spire showing above body whorl, spire low to high.
21. Shell normally sinistral (left-handed). (Abnormal specimens are rare).
22. Shell wide, spire short, bluntly conical, last whorl large, more or less inflated, height 8 to 25 mm., width 6 to 12 mm.
Genus *Physella*, p. 158
- 22.* Shell narrow, highly polished, spire elevated, acutely conical, aperture narrow, last whorl not much inflated, height 10-17 mm. Genus *Aplewa*, p. 167
- 21.* Shell normally dextral (right-handed).
23. Body whorl very large, spire usually small in proportion, 2-4 whorls.
24. Height equal to or greater than diameter.
25. Shell heavy, subglobose, no umbilicus.
Genus *Fluminicola*, p. 179
- 25.* Shell thin, aperture ovate.

26. Shell translucent or transparent, horn colored, columella not reflected, no umbilicus, aperture often flaring.
Genus *Succinea* (in part), p. 114
- 26.* Shell generally opaque, columella reflected, columellar callus closing the umbilicus or leaving a narrow open chink.
27. Shell very large, horn color, body whorl wide, spire elongated, acute. . . . Genus *Lymnaea*, p. 122
- 27.* Shell small or medium size, usually rather solid.
28. Shell with well-marked longitudinal folds or ribs; spire broadly acute, mostly shorter than aperture; columella twisted. . . . Genus *Polyrhytis*, p. 143
- 28.* Shell with no such well-marked longitudinal ribs, or folds; spire as long as, or longer than the aperture.
29. Columella twisted or plicate; surface with distinct spiral sculpture. . . . Genus *Stagnicola*, p. 126
- 29.* Columella smooth; surface without distinct spiral sculpture. . . . Genus *Fossaria*, p. 136
- 24.* Height less than diameter, spire slightly elevated above body whorl, small, under 8 mm. in diameter.
Go back to 18*.
- 23.* Body whorl proportionate to whorls of spire.
30. Shells with peristome of lip noticeably everted or strongly reflected, small, under 5 mm. in greatest measurement.
31. Spire low, height less than diameter. Often transversely ribbed. . . . Genus *Vallonia*, p. 47
- 31.* Spire high, height greater than diameter, small, height less than 5 mm., diameter less than 3 mm.
32. Shell elongate and tapering. Aperture with no denticles or at most with but 1 or 2. Genus *Pupoides*, p. 76
- 32.* Shell cylindrical.
33. From 1 to 3 apertural denticles, sometimes all absent, outer lip regularly rounded or at most sinuous.
34. Body whorl of less diameter, or of the same diameter as the last whorl of the spire. All whorls evenly colored. . . . Genus *Pupilla*, p. 77
- 34.* Body whorl distinctly bulging. Light brown in color with apex much lighter, sometimes white, peristome thin, no callus deposit.
Genus *Columella*, p. 88
- 33.* Usually 6 or more apertural denticles, outer lip distinctly indented above the middle.
Genus *Veritgo*, p. 85

- 30.* Shells with peristome of lip not reflected, though callus may be present on the columellar margin.
35. Height equal to, or greater than diameter.
36. Shell thin, size small to large, aperture ovate.
37. Shells translucent or transparent, horn colored, columella not reflected.
38. Aperture obliquely ovate and large.
Genus *Succinea* (in part), p. 114
- 38.* Aperture vertically ovate, shell elongate.
Genus *Cochlicopa*, p. 90
- 37.* Shell generally opaque, columella reflected, columellar callus closing the umbilicus or leaving a narrow chink. Go back to 27*.
- 36.* Shell thick, size small, under 8 mm. in height, peristome continuous, umbilicate or rimate (chink-like umbilicus).
39. Broadly conic, outer lip thin.
40. 3 to 4 mm. in diameter, height 4 to 5 mm.
41. Shell with apex of shell flattened; central tooth of radula with tongue-shaped projection from base.
Genus *Ammicola*, p. 172
- 41.* Shell with spire more elongate, suture deeply impressed; central tooth with no tongue-shaped projection from base. Genus *Cincinnatia*, p. 175
- 40.* Diameter 5 mm., height 5 mm., whorls shouldered.
Genus *Valvata* (in part), p. 182
- 39.* Shell elongate-ovate, more slender, spire more elevated; outer lip thickened or reflected (operculate).
Genus *Paludestrina*, p. 176
- 35.* Height usually less than greatest diameter.
42. Shell sub-conical (slant height equal to basal diameter).
43. Umbilical region indented but imperforate. Diameter 4 mm., height 3 mm.; amber colored.
Genus *Euconulus* (in part), p. 98
- 43.* Umbilicus fairly broad.
Shell minute, diameter 1 to 2 mm., height 0.5 to 1.5 mm.
Genus *Punctum*, p. 112
- 44.* Shells mostly 12 mm. or more in diameter. Often with spiral color bands. . Genus *Oreohelix*, p. 52.
- 42.* Spire depressed, but slightly elevated.
45. Widely umbilicated.
46. Less than 7 mm. in diameter.
47. Shell with transverse ribs. Color dark horn, or dark brown, dull. . Genus *Gonyodiscus*, p. 107
- 47.* Shell smooth.

48. Shell carinated, shouldered.
Genus *Oreohelix*, juv., p. 52
48. Shell non-carinate.
49. Aperture oval, whorls partly clasping.
Genus *Zonitoides* (in part), p. 100
- 49.* Aperture circular, peristome entire.
Genus *Valvata* (in part), p. 182
- 46.* Large shells, usually over 12 mm. in diameter. Color bands often present. . . . Genus *Oreohelix*, p. 52
- 45.* Shell narrowly umbilicate or imperforate.
50. Shell narrowly umbilicate, epidermis usually shining. . . . Genus *Zonitoides* (in part), p. 100
- 50.* Shell with indented but imperforate umbilicus.
Genus *Euconulus* (in part), p. 98

Descriptive Catalog

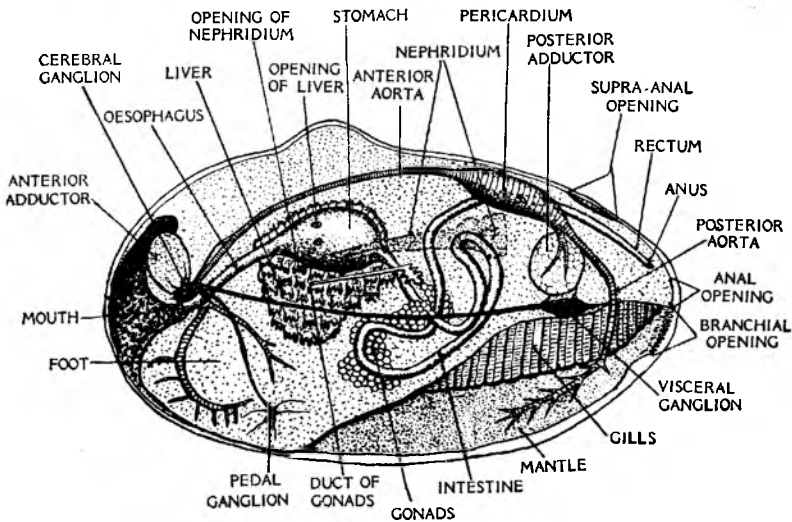
PHYLUM MOLLUSCA

Class **LAMELLIBRANCHIATA** BLAINVILLE

(PELECYPODA Goldfuss)

Family **ANODONTIDAE** Ortmann

Shell from very heavy to thin, conspicuously nacreous; equivalve; variable in size; more or less elongated, never round; epidermis commonly brightly colored and with color markings; beaks usually with the sculpturing double-looped or concentric, often very heavy; cardinal and lateral teeth either present or wholly absent, but always showing a tendency toward reduction; sexual differences in the shell only rarely evident. Supra-anal opening well separated from the anal; branchial opening well defined, no papillae in front of it on edge of mantle; marsupium formed by outer gills; water tubes in the gravid female divided longitudinally into three tubes, with only the middle one serving as an ovisac.

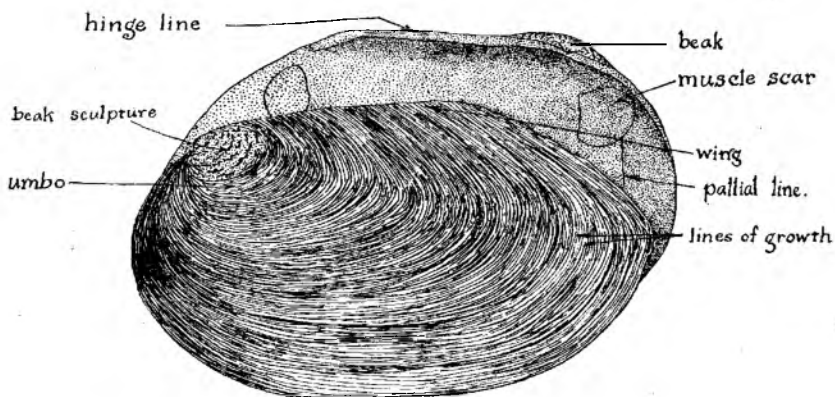


DIAGRAMMATIC LONGITUDINAL SECTION
OF ANODONTA (AFTER BAKER)

Fig. 1

As in the Margaritanidae the eggs hatch in the marsupium (outer gills) into larval forms termed glochidia. The glochidia are semi-circular or triangular, with a hook on the middle of the ventral margin of each valve. The glochidia, after escaping from the gills, with few exceptions attach themselves to the skin of fishes in which they encyst themselves and complete their development.

The family is represented in Utah by four species of the typical genus *Anodonta*.



Anodonta oregonensis Lea - (fossil)
Bear Lake Utah ————— = 1 cm.

斯

Fig. 2

Genus **ANODONTA** Lamarck

Shells ovate or elliptical, thin, inflated, often moderately winged posteriorly; surface mostly smooth and shiny; nacre dull; beak small, its sculpture of more or less parallel ridges which are mostly somewhat double-looped. Hinge without teeth, regularly curved; ligament external, linear muscle areas faint. Gills free from the abdominal sac from half to their entire length. Eggs received throughout the gill, the marsupium when filled forming a thick liver-colored pad. Anal opening not fringed; the branchial opening fringed or papillose. Super-anal opening generally small, widely separated from the anal.

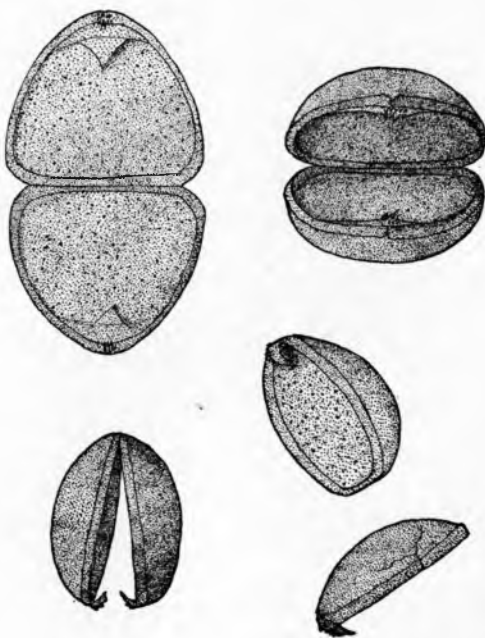
Genotype.—*Mytilus cygneus* Linnaeus.

KEY TO SPECIES

- a. Wing low, shell usually elongate.
 - b. Beak sculpture of fine ridges, parallel to the hinge line, typically produced posteriorly into a biangulate, though not sharply pointed, posterior margin. *Anodonta oregonensis* Lea.
 - bb. Beak sculpture of strong ridges, somewhat double looped; shell thinner than preceding. *Anodonta californiensis* Lea.
- aa. Wing high, well-developed, angular; shell usually shorter in proportion to length. Beak sculpture of fine, corrugated, somewhat double looped ridges.
 - c. Anterior margin rounded, posterior margin of wing nearly straight. *Anodonta nuttalliana* Lea.
 - cc. Anterior margin truncate, posterior margin of wing noticeably incurved. *Anodonta wahlmetensis* Lea

Discussion. — The Anodontas receive their scientific name (*ano*-without, *donta*-teeth) because they lack the teeth which the heavier shelled mussels usually possess. The common name floater is applied because recently dead shells float, since the light shell is unable to sink the bloated anatomy within.

Various Mississippi river species of this genus, disliked by the pearl button men, for they are useless in button manufacturing, have received such common names as "slopbucket" (*A. corpulenta* (Cooper)) and "paper shells" (*A. imbecillis* (Say) and *A. suborbicula* (Say)). *Anodonta grandis* (Say), the common form in the central states, with *Anodonta cygnea* Linnaeus, the common European species, have monopolized the greater part of the scientific liter-



Fig

Glochidial valves of
Anodonta oregonensis Lea
 Davis Co., Utah — = 1/15mm.

Fig. 3

ature on this group. *Anodonta imbecillis* is one of the few mussels known to develop without parasitism. (Coker, 1917-18.)

The *Anodontas* seem to prefer mud bottoms, though they are sometimes found in sand. They do not usually thrive in aquaria, unless there be a current. *A. oregonensis*, however has done very well in aquaria in our laboratory. The shells vary in thickness according to the lime-content of the water.

Anodonta oregonensis Lea

THE OREGON FLOATER

Anodonta oregonensis Lea, *Tr. Am. Phil. Soc.*, VI, 1838, p. 80, pl. XXI, fig. 67.

Utah Localities.—

Previous records: Sevier River, (Yarrow 1875). Utah Lake, (Ingersoll, 1877).

Duplicate records: Salt Lake Valley—One complete shell, a fine specimen. (U. of U. Zoo. Mus., No. 117.) Dr. Orson Howard collection.

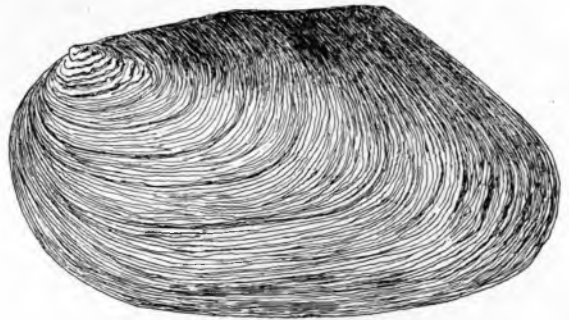
Utah Lake near Spanish Fork—One broken valve. (U. of U. Zoo. Mus., No. 972.)

New records: Bear Lake, west side, in Utah. (Many smaller dark-colored specimens. No fresh shells. Probably all Pleistocene fossils. U. of U. Zoo. Mus., No. 1260.)

Farmington Canyon, Davis County, 1928. Living specimens secured from state fair exhibit. (U. of U. Zoo. Mus., No. 1685.)

Shell long elliptical, inequilateral, moderately strong, scarcely inflated, with rather low, somewhat corrugated beaks, their sculpture consisting of fine, somewhat corrugated bars running generally parallel with the hinge line; dorsal side nearly straight; dorsal wing slightly developed, angled and obliquely truncate behind; posterior ridge low, faintly double and ending in a feeble biangulation behind about on the median line; surface smooth, pale greenish-yellow or yellowish-green, often banded with darker color and showing the rest periods, shining; nacre bluish-white, sometimes tinged with purplish, usually thicker in front.

Length 114, height 57, diameter 35 mm.



Anodonta oregonensis Lea Ag

Bear Lake, Utah — = 1/4 in

Length 94, height 50, diameter 30 mm. (C. T. Simpson, 1914).

Range.—Northern California, Oregon, British Columbia, eastward to Great Salt Lake, Utah. (Dall). It extends northward to Alaska.

Type locality.—Wahlamat River near its junction with the Columbia.

Discussion.—Living specimens from Davis County when placed in Mr. Berry's aquarium in October, 1928, released numerous glochidia which attached themselves to the Mexican Sword-Tail (*Xyphophorus helleri*) in which they encysted. They also would attach for a time to the Gold-fish and to *Macropodus viridiauratus* but soon dropped off from these without encysting. Other glochidia were shed in an aquarium in the University laboratory in November and again in December. (See Fig. 3).

Anodonta californiensis Lea

THE CALIFORNIA FLOATER

Anodonta californiensis Lea, *Tr. Am. Phil. Soc.*, X, 1852, p. 286, pl. XXV, fig. 47.

Utah Localities.—

Previous record: California east to Utah and Arizona (Simpson, 1914).

Shell very thin, irregularly obovate, subcompressed, its greatest inflation being a little in front of the middle; posterior ridge low, rounded; in front of the ridge the shell is decidedly compressed; dorsal wing considerably developed, angulate behind; post-dorsal slope somewhat truncate; beaks low but sharp, rising above the dorsal line, with a number of rather strong ridges, which nearly follow the growth lines but sometimes are feebly, doubly looped; surface nearly smooth; epidermis shining, greenish or pale olive green, ashy or pale brownish in the umbonal region, with two or three green rays on the posterior slope; nacre whitish, flesh colored or lurid purplish, a little thicker in front, soft textured and shining.

Length 75, height 40, diameter 18 mm.

Length 55, height 33, diameter 17 mm. (Simpson).

Type locality.—Rio Colorado, Cal.

Range.—California east to Utah and Arizona.

Discussion.—This form, which may be only a variety of *nuttalliana* is said to be similar to *oregonensis*, but with thinner shell and a beak sculpture of strong ridges somewhat double looped. We have not recognized it in material known to us.

Anodonta nuttalliana Lea

NUTTAL'S HIGH-WINGED FLOATER

Anodonta nuttalliana Lea, *Trans. Am. Phil. Soc.*, VI, 1838, p. 77, pl. XX, fig. 62

Utah Localities.—

Previous records: Near Salt Lake City (Call 1884).

Quarternary fossil, abundant on Sevier Desert, Utah (Call 1884).

(In both of the records above the species is questionable, because *A. californiensis* and *A. wahlametensis* were included in the synonymy.)

Granite (Henderson 1924).

New records: Utah Lake near Spanish Fork. (U. of U. Zoo. Mus., No. 970. Fresh shells.)

Utah Lake, near Provo. (U. of U. Zoo. Mus., No. 537. One fresh shell.)

Junction, in old trout pond south of town, Piute County. (U. of U. Zoo. Mus., No. 992. Fresh shells but none living. One young shell from this locality is in No. 1110.)

Bear Lake, in Rich County, west and south shores. (U. of U. Zoo. Mus., No. 1261. Old, bluish, worn shells, found along with *A. oregonensis* from the same locality.)

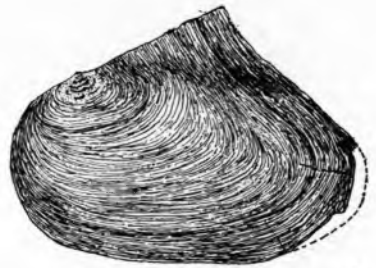
Davis County, Farmington Canyon. Fresh shells secured from state fish and game commissioner.

Shell typically subrhomboid, a little narrow in front, thin, convex, with a well developed post-dorsal wing, which meets the truncation of the posterior slope with a decided angle; posterior ridge scarcely developed though the shell is generally full in this region; beaks compressed, low, but beginning in a sharp prodissoconch, their sculptures consisting of numerous fine, corrugated, concentric ridges; surface with irregular growth lines; epidermis yellowish-green, ashy or lead-color, scarcely shining, seldom having feeble rays; nacre bluish-white, rather dull, sometimes a little iridescent behind.

Length 70, height 47, diameter 27 mm. (Simpson, 1914.)

Type locality.—Wahlamat River near its junction with the Columbia.

Range.—Washington to California; east to Utah.



Anodonta nuttalliana Lea
Utah Lake ————— = 1 in.

Fig. 5

Anodonta wahlametensis Lea

THE CURVED-WINGED FLOATER

Anodonta wahlametensis Lea, *Trans. Am. Phil. Soc.*, VI, 1838, p. 78, pl. XX, fig. 64.

Utah Localities.—

Previous record: Utah Lake (Henderson and Daniels, 1917).

Duplicate record: Utah Lake near Spanish Fork. One fresh valve found. (U. of U. Zoo. Mus., No. 971.)

Shell variable in form, irregularly obovate, ovate or rhomboid, generally rather strong, scarcely inflated, quite inequilateral, dorsal wing well produced, angular behind; dorsal slope excavately truncated, the truncation ending below in a generally upturned, rounded point at or above the median line; beaks low and compressed but pointed, their sculpture consisting of numerous, somewhat doubly-looped ridges; surface irregularly concentrically striate, somewhat ridged; epidermis olive or brownish, often rough but occasionally shining; nacre bluish-white, occasionally tinted with lurid purple, rather dull, thicker in front.

Length 87, height 62, diameter 27 mm.

Length 87, height 55, diameter 27 mm.
(Simpson, 1914)

Type locality.—Wahlamat River near its junction with the Columbia.

Range.—Washington, south to southern California; east to Utah.



Anodonta wahlametensis Lea

Utah Lake — $\frac{1}{4}$ in

Fig. 6

Family MARGARITANIDAE Ortmann

In this family the shells are heavy and large, elongated; the hinge has the pseudocardinal teeth distinctly developed, though sometimes reduced, while the laterals are often imperfect or wholly lacking; beak with sculpture concentric; epidermis blackish. No supra-anal opening developed; branchial and anal openings poorly defined, the anal not closed above; gills without water-tubes or these incomplete, and with scattered interlamellar connections which may form irregular rows; marsupium formed by both inner and outer gills. The small semicircular larvae (glochidia) have no distinct hooks.

This family is represented in Utah by only a single genus and species, *Margaritana margaritifera* Linnaeus. Coker (1917-18) states that this is the principal pearl-bearing mussel of Europe and New England. Fresh-water mussels and marine clams often produce pearls of considerable value. These pearls are produced by secretions of the mantle around some irritating, foreign object, such as a grain of sand. Cooking destroys the value of these pearls. The finest of our natural pearls are produced by the pelecypods of the Persian Gulf.

Fresh-water mussels with this quality of shell, but of different species, are used extensively in the Mississippi Valley in the manufacture of pearl buttons. So extensive has this industry become that the Federal Government has had to control mussel fishing to prevent extinction of some species. The U. S. Fisheries Bureau is trying to propagate mussels artificially to restock favorable rivers. Coker (1917-18, see bibliography) has a very interesting illustrated article on the mussel industry. Our fresh-water forms called mussels, are not usually eaten by man, as are the marine clams. Mussels purify the water of our streams by using as food the small organic particles suspended therein.

Genus MARGARITANA Schumacher

THE PEARL-BEARERS

Shell large, oblong and usually arcuate, rounded in front; beak low, epidermis brown or black to olivaceous, concentrically striate. Hinge with a single pseudo-cardinal tooth on the right valve which is erect and grooved at its apex, and two teeth on left valve, these teeth sometimes reduced to tubercles; lateral teeth short, often reduced or absent. Beaks low, with a few coarse, parallel ridges following the growth lines, the cavity of the beaks rather shallow.

Genotype.—*Mya margaritifera* Linnaeus.

Discussion.—Utah has only one species as listed below. The genus is characterized by the elongate, reniform shell, and the incomplete hinge teeth. *Margaritana monodonta* (Say), the spectacle case.

inhabits the Ohio, Cumberland, and Tennessee Rivers. It is very much larger than the Utah species.

Margaritana margaritifera Linnaeus

THE RIVER PEARL MUSSEL

Mya margaritifera Lister, *Historiae Animalium Anglicae, Appendix*, 1685, pl. 1, fig. 1; *Historiae Conchyliorum*, 1685, pl. XCLIX, fig. 4; *Linnaeus, Systema Nat.*, 10th ed., I, 1758, p. 671.

Margaritana margaritifera Schumacher, *Essai d'un nouveau Systeme des Habitation. des vers Testaces*, I, 1817, p. 124, pl. X, fig. 4.

Utah Localities.—

Previous records: Streams near Salt Lake City (Call, 1884).

Semi-fossil in Bonneville Lake beds (Quaternary) of Utah, especially in Sevier Desert (Call, 1884).

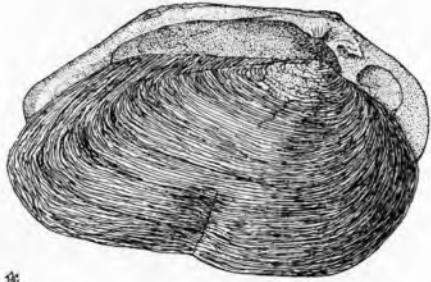
Salt River and Salt Lake City (Walker, 1910) (Henderson and Daniels, 1917).

East Canyon, near Salt Lake City (Henderson, 1924).

Duplicate records: Big Cottonwood Creek, Salt Lake Co., (Dr. Orson Howard's collection, U. of U. Zoo. Mus., No. 59).

Beaver Creek in Parley's Canyon near Salt Lake City. One living specimen caught by a Mr. Lewis on a fishhook, Jul. 4, 1927.

Shell large, much elongated, usually arcuate, rounded before and somewhat so behind, rather solid, inequilateral, not inflated; beaks low, not inflated, their sculpture consisting of longitudinal ridges, which are sometimes a little broken; posterior ridge moderate or low, often having a wide radial depression above it, and ending below the median line, sometimes in a point, in old shells in a rounded termination; surface with rude growth lines; epidermis thick, blackish or brownish, often subshining; left valve with two stumpy pseudocardinals; right valve with one pseudocardinal; laterals generally wanting; beak cavities not deep; muscle scars impressed, the anterior rough, the posterior elliptical; nacre lurid, bluish-white, whitish, purplish or purple, generally showing pits where the mantle is attached, often having dark blotches.



✎

Margaritana margaritifera (Linn.)

Big Cottonwood Creek, Salt Lake Co.

Dr. Orson Howard Collection — $\frac{1}{4}$ in.

Fig. 7

Length 152, height 65, diameter 40 mm.

Length 122, height 60, diameter 38 mm.

Length 110, height 54, diameter 35 mm. (Simpson).

Range.—All Europe except the southernmost portion; northern Asia; Japan; northern North America; Iceland. Its southern limit seems to be about north latitude 40°. It appears to be entirely circum-boreal, except that so far as known, it is missing in the central part of the North American continent. Wetherby has suggested that it may have been destroyed in this region by the ice of the glacial epoch. It is found in the Upper Missouri and in Canada, New York, and the New England states. (Simpson, 1900)

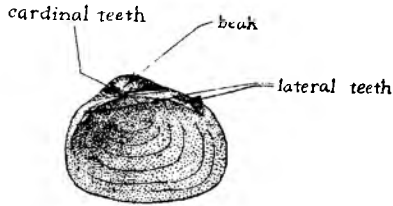
Discussion.—This is the only heavy shelled, fresh-water mussel in Utah.

The Utah specimens of *Margaritana margaritifera* are smaller than given as typical above. Those in the Howard Collection average 8 cm. in length, 4.5 cm. in height, and 2.25 cm. in width. Simpson (1900) regards varieties of this species as unworthy of a varietal name. Dall (1905) recognizes *falcata* (Gould) as a variety of the present species characterized by its purple nacre which is often extremely rich and beautiful, though in old cabinet specimens often much faded. This is a Pacific type noted as occurring from California (Plumas Co. at 7,400 ft. elevation, and Sacramento River) northward to Vancouver and Alaska, and also found in Montana on the headwaters of the Missouri River but not known from below Fort Benton. Much importance attaches to any further data on the distribution of this form.

Family SPHAERIIDAE Dall

Shells thin and small, ours being less than 25 mm. in length; sub-orbicular to oval or somewhat triangular; ligament external, short and weak; epidermis thick, horny, horn-colored or yellow to more or less green; cardinals usually two in each valve, two anterior and two posterior laterals on right valve and one anterior and one posterior on the left valve; distinct pallial line with or without a small inflection or sinus. Mantle open anteriorly, its margins plain; siphons either one or two, their orifices usually smooth; gills two on each side, large, unequal; monoecious, the eggs hatched in the inner pair of gills; foot large, elongate, narrow and grooved, byssiferous when young.

A family of numerous species which are restricted to fresh or brackish water. Their distribution is world-wide. They prefer the shallow water of small ponds and streams and abound in some of our mountain lakes, but they also occur on the bottoms of deep lakes. Adults ordinarily bury themselves in the bottom, which may be of all kinds.—gravel, sand, clay or mud. The active young are often found crawling over plants to which they attach themselves by the byssal threads. It is believed that their food is largely minute organisms, especially the diatoms. Most forms are believed to be short-lived, though we lack accurate data as to this. Most of those living in ponds that dry up during part of the year probably die in the dry season, a few surviving in the mud. The breeding season probably continues through most of the year. They are of some economic importance in constituting a considerable percentage of the food of various fishes. Much remains to be learned of the habits and ecological relations of these small bivalves.



Sphaerium sp. (fossil)

Bear Lake, Utah.

Fig. 8

Genus **SPHAERIUM** Scopoli

THE LARGE SEED-SHELLS

Shell thin, oval, with anterior end shorter, more or less inflated, nearly equilateral, with beaks subcentral; the nepeonic shell passing into the adult without distinct demarcation; the surface smooth or concentrically striate or sulcate; teeth all small, the laterals two on right valve, single on the left, the cardinals distinct, two on left valve and one on the right. Siphons united proximally but double at free end.

Genotype.—*Tellina cornea* Linnaeus.

Discussion.—These small bivalves are widely distributed over the globe but seem to be more abundant in the northern hemisphere than elsewhere. They inhabit both streams and lakes and other still waters. They are less abundant and more restricted in distribution than species of *Pisidium*, though similar in habits to the latter. "The animal of *Sphaerium* has a broad foot capable of considerable extension; it uses it either to bore holes in the mud, in which it sinks the posterior portion of the shell, or as a means of locomotion. The syphonal tube is double and very retractile; it is often white like the foot, but at times it is colored." (Prime)

In searching for a common name we chanced on Call's statement (1898) that the Indiana boys called the members of the Sphaeriidae "seed-shells." The name seems to be very apt considering the size and shape, especially of the Pisidia.

These are often incorrectly considered as immature fresh-water mussels. They differ from the mussels in many respects. This group, the Sphaeriidae, have lateral or hinge teeth both anterior and posterior to the cardinals. When hinge teeth are present in our recent fresh-water mussels they are usually posterior to the cardinals. The cardinal teeth occur immediately beneath the beak in the family Sphaeriidae, whereas in mussels they are farther removed. The shell structure is porcellanous instead of prismatic, and no nacreous layer is produced. The outer layer is called epidermis instead of periostracum, as in mussels. (See Textbook of Paleontology, Zittel, Vol. 1, p. 360, Order Teleodsmacea, and pp. 397-398, Families Cyrenidae and Sphaeriidae.)

Sphaerium pilsbryanum Sterki

PILSBRY'S SEED-SHELL

Sphaerium pilsbryanum Sterki, *Naut.*, XXII, 1909, p. 141.

Utah Localities.—

Previous records: As *Sphaerium sulcatum* (Lam.) probably referable to *Sphaerium pilsbryanum*, Utah Lake (Ingersoll, 1877).

As *Sphaerium dentatum* (Hald.) probably referable to *S. pilsbryanum*, Utah Lake, where it attains great size; Utah Lake, near Lehi, (Call, 1886); post-Bonneville fossil on Sevier Desert; dredgings from Great Salt Lake near mouth of Jordan River (Call, 1884).

Bear Lake, fossil. (Sterki, 1909, 1916.)

Utah Lake, recent. (Sterki, 1916.)

Trenton, Utah. (Henderson and Daniels, 1916.)*

*Henderson in a recent letter says he has only two dead valves of *S. pilsbryanum* from Trenton, Utah. "The Bear Lake and Utah Lake records of the species are based entirely on Sterki's original description and a subsequent publication by him. He says our material from the north end of Bear Lake is not *pilsbryanum* but does not specifically name it."

Duplicate records: Utah Lake at Provo. Probably juvenile, U. of U. Zoo. Mus., No. 545 and No. 547, adult, No. 544; most specimens badly worn and chalky.

Utah Lake at Geneva Resort, near Pleasant Grove. Worn specimens. (U. of U. Zoo. Mus., Lot 2, No. 289.)

Bear Lake, west and south shore. Juvenile, No. 1283. (U. of U. Zoo. Mus., adult No. 1443, No. 1440, No. 1284; many of these are of blue color, and extremely hard.)

New records: South Tremonton, Boxelder Co. Apparently fresh shells, though none with living animals (Melba Turner, U. of U. Zoo. Mus., No. 633.)

Near Wellsville. Living, none over 9.5 mm. in length, these appearing rather too rhomboidal for *S. pilsbryanum*, though the immature shells from series in other localities tend to assume this shape. (U. of U. Zoo. Mus., No. 1411.)

Shell large, ventricose, somewhat equilateral, margins rounded, umbo very prominent, beaks inconspicuous, approximate. Hinge line nearly straight. One cardinal tooth. Laterals well developed. Lines of growth comparatively prominent. Sulcations often occur on the umbo and on young shells of weathered specimens, sometimes coarse enough in the latter case to be corrugations, i. e. they can be seen on the inside, also. Epidermis olive green in living specimens. The largest specimens were taken from Bear Lake. These averaged 20 mm. in length, 17 mm. in greatest height, and 12 mm. in greatest thickness.

Type locality.—Bear Lake, Utah.

Range.—There is no evidence that this species ranges beyond the Bear River Valley in Utah and Idaho, and Utah Lake, Utah.

Discussion.—Sterki regards the blue colored shells from the Bear Lake vicinity as fossil, Pleistocene or later. We found no living specimens of this form at Bear Lake. This species is second in abundance on the shores of Bear Lake, *Carinifex newberryi* (Lea) alone exceeding it.



Sphaerium pilsbryanum Sterki.

Bear Lake, Utah — = $\frac{1}{8}$ in.

Fig. 9

Sphaerium mormonicum Sowerby

Sphaerium mormonicum Sowerby, *Conch. Icon.*, XX, p. 44, 1878.

Sphaerium mormonicum Sterki, *Ann. Carnegie Mus.*, X, 1916, p. 439.

Utah Localities.—

Previous record: Great Salt Lake (Sowerby).

Shell solid, rather square, nearly smooth, high, subequilateral, horny, banded and lineated with brown; bluish within, banded; sides very obtusely truncated; umboes rounded, obtuse, dorsal margin short on each side, scarcely sloped.

Hab. Great Salt Lake.

Broader and more solid than the European *Sph. rivularis*. (Sowerby, 1878)

Discussion.—It seems impossible that this form should live in the Lake; and it may be that by Great Salt Lake is meant "Great Salt Lake City" as it was sometimes designated in early days. It is possible that when this problem is solved, *Sphaerium mormonicum* will prove to be a small, rhomboid, juvenile of *Sphaerium pilsbryanum*, such as Call dredged near the mouth of the Jordan River. The shells are washed down into the Lake by the Jordan, the Bear and other rivers. More evidence is needed before a definite conclusion can be drawn.

Genus **MUSCULIUM** Link

THE CAPPED SEED-SHELLS

Shell thin, suborbicular or oblong, smooth, shining, striae very fine and delicate; beaks usually calyculate; cardinal teeth minute, sometimes obsolete. Siphons united for the greater part of their length.

Genotype.—*Tellina lacustris* Müller.

Discussion.—Most species of the family Sphaeriidae are very variable, this making their study complex and difficult. Of *Musculium*, especially, as Dr. Sterki says in a recent letter, "there are almost endless forms, some of which cannot be readily referred to any of the established species, and thus it is also difficult to define and confine exactly some of the species." The partly grown specimens are especially likely to give difficulty. The shells in this genus differ from those in *Sphaerium* in being thin and fragile and, commonly, transparent.

Our specimens have been referred to the three species indicated below by Dr. Sterki, *uintaense* being a fourth species and not taken by us.

Musculium raymondi (J. G. Cooper)

Sphaerium raymondi Cooper, *Proc. Col. Acad. Sci.* (2), III, 1892, p. 74, pl. 1, figs. 1 to 8.

Musculium raymondi Sterki, *Ann. Carnegie Mus.*, X, 1916, p. 444.

Utah Localities.—

New record: Salamander Lake, north fork of Provo Canyon, two miles above Alpine Camp, R. V. Chamberlin col. (U. of U. Zoo. Mus., No. 739, "a small form and probably not full-grown. This may not be specifically distinct from *ryckholti*." (Sterki).)

Adult shell ovate trigonal, nearly equilateral, much inflated, the greatest convexity near the middle, fragile, translucent; beak central, slightly turned forward, very strongly calyculate; margin forming a subovate outline, the anterior obtusely rounded, posterior usually obliquely subtruncate; base curved equally with hinge margin, the edges of valves meeting at an angle of about 80°, not flattened nor spreading laterally; the anterior very little lower than posterior, but slightly sharper. Divergence of upper margins from umbonal apex, 80° to 90°. Color pale pearl-gray, sometimes iridescent, often with a narrow yellowish marginal band; epidermis tinged olive, wearing off in adult, surface smooth, shining; growth lines very faint, inside of shell white. Younger shell more oval, beaks less prominent, the calycles in shells not half grown being everted when seen from end of shell, instead of inverted. Fry oblong oval, much compressed, its valves very distinctly seen in calycles of adult. Soft parts yellowish, tinted with red, the colors visible through shell. Length, 0.30 to 0.34 in.; height, 0.26 to 0.30; diameter 0.16 to 0.21. Fry 0.05 to 0.06 long; 0.04 to 0.05 high; 0.025 to 0.035 thick. (Cooper).

Musculium truncatum Linsley

Cyclas truncata Linsley, *Am. Jour. Sci.*, VI, 1848, p. 234, fig. 3.

Musculium truncatum Sterki, *Cat.*, 1916, p. 441.

Utah Locality.—

New record: South Cottonwood, Salt Lake Co., in a pond, mud bottom, R. V. Chamberlin col. (U. of U. Zoo. Mus., No. 756. A form of the species, the latter itself "common in the Great Lakes region."—Sterki.)

Shell rhombic-orbicular, thin, fragile, somewhat inflated, inequilateral, pellucid; dorsal margin nearly straight, ventral margin slightly convex; anterior end rounded, angled above; posterior end sharply, obliquely truncated; beaks well raised above the dorsal margin, calyculate; surface with many close-set, fine lines of growth; color light greenish horn; scutum and scutellum well marked.

Hinge line but slightly curved, narrow, slight; cardinal of right valve heavy, anterior part thin, straight in some specimens, curved

and enlarged in others; the lower part of the cusp enlarged and often emarginate; a deep pit below the cusp; in section, the postero-ventral part of the cardinal higher than the antero-dorsal part; upper cardinal in left valve, long, narrow, high, slightly curved, and sometimes enlarged at lower end; cardinal in lower part pyramidal, thick, erect; laterals rather long, straight, lamellar; cavity of beaks shallow, nacre light blue. Length from 6.5 to 8 mm.; diameter, 3.8 to 4.4 mm.; height, from 5.6 to 6.5 mm. The length, however, may be as much as 12.7 mm. with height 11.5 mm. (Baker).

Type locality.—Connecticut.

Range.—United States west to Utah, but most common from New York to Illinois.

Discussion.—A form apparently preferring running streams under stones, with mud or sandy bottoms. The shores of some dried-up ponds "paved with these shells."

Musculium uintaense (Call)

THE UINTA SEED-SHELL

Sphaerium uintaense Call, *Proc. Dav. Acad. Nat. Sci.*, V, 1886, p. 8, fig. 4.

Musculium uintaense Sterki, *Ann Carnegie Mus.*, X., 1916, p. 445.

Utah Locality.—

Previous record: Lake in Uinta Mts., Alt. 10,500 ft., (Call, 1886). (Sterki, 1916).

Shell thin, small, globose, ventricose, slightly inequilateral, posterior and anterior margins well rounded, very slightly produced posteriorly, umbones large, subcalyate, full, rounded, dark, retaining embryonic shell, approximate; basal margin rounded, thus giving a circular outline to the shell; epidermis shining, dark straw or olive colored, striate, light yellowish on basal margin; cardinal teeth microscopic, slightly in advance of the middle region of the umbones, not widely separating, lateral teeth small, short, somewhat upcurved.

Viewed in profile from in front, the point of junction of lower portion of valves with the embryonic shell appears as a well-marked obtuse angle.

Length, 4.76 mm.; diameter, 4.02 mm.; number of specimens, eight.



Musculium sp.

So. Cottonwood, Murray, Utah

_____ = 1 cm.

Fig. 10

Habitat and Station.—A lake in Uinta Mountains, Utah, at an elevation of 10,500 ft. The specimens were communicated by Prof. Orson Howard of Salt Lake City, and were collected by him in August, 1885.

Discussion.—This species is remarkable for its small size, all the specimens seen being mature, and one with fry, and for the great elevation at which it occurred. This is by far the greatest hypsometric range recorded for any lamellibranch. The lake is snow-fed, and therefore its normal temperature must be far below that of waters in which the Corbiculidae occur. Its extreme fragility, and small size, it is believed, must be coordinated with these features of its environment. Specimens are in the collection of Professor O. Howard and of the writer. (Call)



Fig.

Musculium uintaense (Call)

After Call — = 1 mm.

Fig. 11

of Professor O. Howard

Genus **PISIDIUM** Pfeiffer

THE SMALL SEED-SHELLS OR PILL-CLAMS

Shell small, rounded, oval or obliquely cuneiform; inequilateral, anterior side longer; beaks terminal; cardinal teeth one in the right valve and two in the left, situated immediately under the beaks; laterals elongated, lamelliform, double in the right, single in the left valve; ligament on the shorter (posterior) side, internal. Animal with a single siphon, the anal, which is small, the branchial siphon represented by the branchial cleft.

Genotype.—*Tellina amnica* Müller.

Discussion.—A very difficult genus which few conchologists have seriously studied. A thorough study of the group on the basis of anatomy will no doubt reveal various species not here recognized. The construction of keys for the species of this group has not proved practicable on the basis of characters now in use. The tabulation below will facilitate the separation of our three most common species as we recognize them, although it is quite possible that these groups may prove to be composite.

In the *Pisidia* the beaks are placed posteriorly, while in the *Sphaeria* they are placed slightly anteriorly. It is well to remember

this in checking specimens with descriptions, else right and left sides will be confused. "The habits and mode of living of the species of these two genera (*Pisidium* and *Sphaerium*) are very much the same. They are found buried an inch or more in the mud under water, or else attached to the roots or stems of aquatic plants."

PARTIAL KEY TO SPECIES

- a. Shell triangular, very much drawn up in the region of the beaks, inflated in adults, wing-shaped appendage on the summits of the umbones, shell solid, cardinal teeth often conspicuous, the two sets of lateral teeth set at right angles to each other. *Pisidium compressum*.
- aa. Shell subovate, thick or thin, cardinal teeth small and inconspicuous.
 - b. Hinge line nearly straight, shell thin, lateral teeth small and their ventral terminations inconspicuous. Epidermis variable, but usually light straw color. *Pisidium abditum*.
 - bb. Hinge line curved, lateral teeth strong and short, their ventral terminations being extremely conspicuous. Shell often shorter than the preceding. *Pisidium variabile*.

"Their mode of breeding is much the same, both ejecting the young when sufficiently mature, which up to that time they carry between the folds of the gills. Pfeiffer supposes the *Pisidium* to breed by throwing out eggs, but I myself found young in the shells of *Pisidium*.

"The most appropriate time for collecting *Pisidium* in the North, would seem to be from the middle of April to the early part of July—the season during which they breed; some species, however, such as *P. variabile*, I have found at all seasons, even in winter; others such as *P. ventricosum* are seldom found but in the early summer. Live specimens may be preserved for examination, for some time, if the water is kept sufficiently fresh. On the application of water, slightly warmed, they exhibit great activity, extending their syphonal tube and foot. They not only crawl on the sides of the vessels, in which they are confined, but also on the under surface of the water. They are very similar in some of their movements to certain species of fluviatile Gasteropods.

"The genus *Pisidium* is very abundantly distributed over both sections of this continent; and while the species of America are entirely distinct as such from those found elsewhere, their forms present, in nearly every instance, great analogies with those of the species of Europe and of Asia." (Prime)

Pisidium abditum Haldeman

THE FRAGILE SEED-SHELL

Pisidium abditum Haldeman, *Proc. Acad. Nat. Sci. Phil.*, I, 1841, p. 53; Baker, *Moll. Wisc.*, pt. II, 1928, p. 406.

Utah Localities.—

Previous records: Beaver (Yarrow, 1875); City Creek, near Salt Lake City (Call, 1884).

New records: Flowing well by roadside, north of Parowan, Iron Co., plentiful; the lateral teeth on this form very inconspicuous. (U. of U. Zoo. Mus., No. 1009.)

Logan Canyon, eight miles from mouth, a very small form, 2 mm. in length, epidermis dull brown, teeth resembling *P. abditum*, may be juvenile. (U. of U. Zoo. Mus., No. 1365.)

Strawberry Reservoir, Wasatch Co., J. Hansen col. (U. of U. Zoo. Mus., No. 1536.)

Emigration Canyon, near mouth, Salt Lake City. One typical valve. (U. of U. Zoo. Mus., No. 905.)

American Fork Canyon, spring at Camp Timpanogos, several specimens, yellow to white epidermis, average smaller than usual. (U. of U. Zoo. Mus., No. 741.)

Ogden, canal in city limits, the lateral teeth extremely developed, one valve only. (U. of U. Zoo. Mus., No. 864.)

Logan, Ballard Springs, near Providence, several specimens, straw-colored epidermis. (U. of U. Zoo. Mus., No. 1450.)

Fish Lake, marsh at north end, occurring with *P. variabile*. (U. of U. Zoo. Mus., Lot 2, No. 309.) Sedgy shore, same locality. (Lot 2, No. 344.) Spring at edge of Fish Lake, west shore. (No. 831.)

Provo Canyon, North Fork at Aspen Grove, one specimen complete and one valve. (U. of U. Mus., No. 922.) South of Junction, old trout pond, one immature specimen. (U. of U. Zoo. Mus., No. 1106.)

Parley's Canyon, near head, southeast of Salt Lake City, a few small specimens. (U. of U. Zoo. Mus., No. 1336.) Lamb's Canyon, collected by Elmer Berry. (No. 961.)

Between Leeds and St. George, in stream by roadside, epidermis from olive green to straw yellow. (U. of U. Zoo. Mus., No. 1082.)

Big Cottonwood Canyon, Salt Lake Co., lake at head of Mill F, a few grayish specimens. (U. of U. Zoo. Mus., Lot 2, No. 216.)

Stream above Glenwood, six miles from Richfield, on the Fish Lake road, epidermis a light buff color. (U. of U. Zoo. Mus., No. 828.)

Moab, mature specimens. (U. of U. Zoo. Mus., No. 1632.) South of Colorado River, several juvenile specimens. (No. 1640.) Occuring with *Pisidium variabile* Prime, three specimens. (No. 1629.)

Torrey, one small specimen. (U. of U. Zoo. Mus., No. 1666.)

Shell of good size, inflated, rather high, beaks slightly posterior, prominent but not much elevated, well rounded; scutum and scutellum well marked; dorsal margin rather long, curved; ventral margin broadly curved; anterior margin long, rounded, the end about midway of the margin; posterior end roundly truncated but without angles to the dorsal or ventral margins; surface finely irregularly striated, not polished, but shining; color corneous or grayish, rarely yellowish, often rosy or pinkish; shell moderately thick; nacre whitish. Hinge rather stout, plate wide; cardinal of right valve large, thick, usually curved, enlarged at the posterior end, where it may also be deeply cleft, emarginate, or simply rounded; the anterior end may also be enlarged; upper cardinal of left valve large, thick, slightly curved, reaching to the base of the hinge plate; lower cardinal very thick, rounded, usually rather short; laterals small, short, not much elevated; cavity of beaks not very deep. Length from 3 to 3.5 mm.; height 2.4 to 3 mm.; diameter 1.9 to 3 mm. (Baker).

Type locality.—Pennsylvania.

Range.—A species common in the northeastern United States and ranging westward to Utah. Possibly the same as the European *P. fontinale* Pfeiffer.

Discussion.—A variable species which has been much confused through the inclusion of other forms with it. Its varieties have often been described as separate species. In Utah it often occurs in unexpected places, as at the flowing well by the roadside north of Parowan as recorded above. It may generally be recognized by its rounded-oval form, the small depressed beaks and the rather heavy hinge teeth.

Pisidium compressum Prime

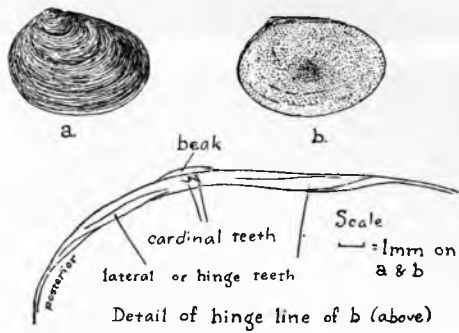
THE TRIANGLE SEED-SHELL

Pisidium compressum Prime *Bost. Proc.*, IV, 1851, 164.

Utah Localities.—

Previous record: Utah Lake (Call, 1884; and Henderson and Daniels, 1917.)

Duplicate record: Utah Lake at Provo, two right valves, heavy, weathered, but characteristic. (U. of U. Zoo. Mus., No. 546.)



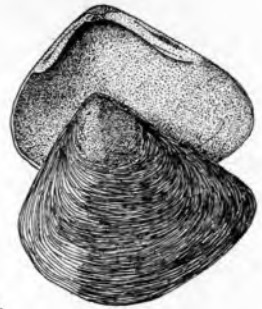
Pisidium abdutum Haldeman.

Flowing well, N of Parowan Utah

Fig. 12

- New records:* Near Wellsville, epidermis ranging from gray to reddish brown. (U. of U. Zoo. Mus. No. 1409.)
- Logan, Blacksmith Fork below Ballard Springs, one weathered right valve. (U. of U. Zoo. Mus., No. 1315.)
- Richfield, ditch from city springs. The hinge on these specimens more rounded, not so sharply angular as on typical specimens, epidermis gray or weathered. U. of U. Zoo. Mus., No. 824.)
- Bear Lake, west side, on beach, one right valve, rather too young for identification with certainty, weathered. (U. of U. Zoo. Mus., No. 1278.)
- Stream above Glenwood, six miles from Richfield on the Fish Lake road, one specimen. (U. of U. Zoo. Mus., No. 949.)
- Big Cottonwood Canyon, Salt Lake Co., lake at head of Mill F, one specimen, epidermis gray. (U. of U. Zoo. Mus., No. 950.)
- Silver Lake, Big Cottonwood Canyon, one specimen, umbones reddish-brown, margin gray. (U. of U. Zoo. Mus., No. 951.)
- Rich County, in mud deposits along stream, 5 miles from Evanston, Wyoming, weathered fossils from apparently recent deposits, three valves. (U. of U. Zoo. Mus., No. 1352.)
- South of Junction, old trout pond, one specimen. (U. of U. Zoo. Mus., No. 1189.)

Shell small, solid, inflated, very inequipartite, oblique, trigonal; anterior end rounded; posterior end roundly truncated; dorsal and ventral margins curved; scutum and scutellum not well marked; beaks elevated, compressed, placed near the posterior end, with well marked appendages, umbonal slopes rounded; surface shining, with well marked lines of growth; color yellowish, darker in older specimens. Hinge plate rather solid, wide; cardinal in right valve, narrow, curved, slightly enlarged at both ends in some specimens, and in all at the lower posterior end near the base of the hinge plate; upper cardinal in left valve narrow, long, curved; lower cardinal very large, rounded, usually occupying the greater part of the cardinal area; the pits between and below the cardinals are very deep; laterals rather strong, elevated, somewhat curved, rather short; cavity of the beaks deep; nacre bluish, sometimes with a white zone bordering the valve. Length from 3.1 to 3.5 mm.; height 3 to 3.5 mm.; diameter, 2.3 to 2.5 mm.



Pisidium compressum Prime
Wellsville, Utah. — 1 mm

Fig. 13

Type locality.—Massachusetts (at Fresh Pond, Cambridge).

Range.—North America, but apparently commoner in the East than in the West.

Discussion.—This species is most commonly taken in creeks and rivers. As with most species of the genus exact data on the ecological relations are lacking. This species, though perfectly distinct and well characterized, is subject to much variation; its very oblique shape is constant; in fulness it is subject to much change, some old specimens being remarkably obese; the young are generally more elongated and more compressed.

“As typical is accepted the common river and creek form; beaks high, narrow, with well developed appendages, above which there are small flattened or even impressed smooth areas, usually with more or less distinct radial lines; balance of the surface with rather coarse, sharp, regular, concentric striae, dull, with microscopic wrinkles, color whitish to grayish, and often there are marginal zones of straw to yellow color, with more shallow, irregular striae, more or less shining; shell and hinge stout, with whitish nacre.” (Sterki).

“The animal is remarkable for its liveliness. It is found sparingly during the spring, and not at all in winter. It inhabits both running and still water, and buries itself somewhat in the mud.” (Prime).

***Psidium huachucanum* Pilsbry and Ferriss**

Psidium abditum huachucanum Pilsbry and Ferriss, *Proc. Acad. Nat. Sci. Phil.*, 1906, p. 173.

Utah Locality.—

Previous record: Morgan (Henderson and Daniels, 1917).

The shell is quite inflated, dark brownish-olive, irregularly striate and marked with several conspicuous dark growth-arrest streaks, very inequilateral, the beaks low and near anterior end. Anterior end abruptly truncate, posterior end produced and rounded. Hinge rather narrow, the lateral teeth in the right valve single, short and high, triangular; in the left double. Length 5.1; altitude 4.3; diameter 3.4 mm. (Pilsbry and Ferriss, 1906).

Type locality.—The type specimens were taken in Can Canyon, Reef, Cochise Co., Arizona in February, 1904.

Discussion.—The authors remark that about half the shells are more compressed than those described as typical, one measuring, length 4.1; altitude 3.4; diameter 2 mm. However, the very inequilateral, anteriorly truncate outline and low beaks are characteristic of both the obese and compressed forms. Henderson's records (1924) are from altitudes 7,500 to 10,850 feet. If we have collected it, it may be in our records of *P. abditum* with which it seems to be most closely allied.

Pisidium marci Sterki

Pisidium marci Sterki, *Naut.*, XXIII, 1909, p. 42.

Utah Localities.—

Previous records: Mt. Leidy (Sterki, 1909) at 10,000 feet.

Several stations in Colorado and Utah (Sterki, 1923).

Rather small, well inflated, high, slightly inequipartite and oblique, with outlines well rounded; superior margin, short, straight, with a rounded angle at its posterior end and a very slightly marked one at the anterior; posterior and inferior margins forming one regular, nearly circular curve, super-anterior slope slightly marked; beaks little posterior, large, somewhat flattened, prominent; surface shining, with median, fine irregular striae and several distinct lines of growth, the upper one marking off the nepeonic muscle (as in *Musculium*); color straw to yellowish horn, with slightly marked lighter and darker zones; hinge short, rather slight but well formed, with a short ligament, plate narrow, cardinal teeth somewhat curved; the right one moderately long, its posterior part thicker and grooved; left anterior very short, "high", abrupt, thin, the posterior almost longitudinal, twice as long as the anterior, less "high", slightly thicker and grooved in its posterior part; lateral cusps short, pointed, the outer ones of the cusps short, pointed, the outer ones of the right valve small but distinct, not pointed. Length 3.5 mm.; altitude 3.4 mm.; diameter 2.5 mm. (Sterki, 1909).

Type locality.—Mt. Leidy, Utah, at 10,000 feet elevation. Taken in a stagnant pond by Marcus H. Dall, in 1905.

Pisidium variable Prime

Pisidium variable Prime, *Bost. Proc.* IV, 1851, 163.

Utah Localities.—

Previous records: As "Near *P. variable*," Utah Lake (Henderson and Daniels, 1917), but "Sterki does not consider the Utah material as typical."

New records: Lake Navajo, near Cedar Breaks. (U. of U. Zoo. Mus., No. 1123.) Two specimens only, one very interesting, a hole bored in one beak, and what appeared to be a number of young shells of this species inside, material all returned to vial: (No. 1049), same locality, one specimen, probably a juvenile of this species.

Silver Lake, Big Cottonwood Canyon, several specimens, Epidermis straw colored, along with *P. compressum*. (U. of U. Zoo. Mus., No. 683. also No. 685.)

Big Cottonwood Canyon, lake at head of Mill F., weathered specimens. (No. 701.)

Logan, Blacksmith Fork, below Ballard Springs, epidermis yellow. (No. 1406.)

Provo Canyon, North Fork, a few weathered specimens. (No. 933.)

Fish Lake, toward north end, a few specimens, mostly small. (No. 836.) Also several specimens from swamp at north end. (U. of U. Zoo. Mus., No. 852.)

Three miles from Brigham in canyon between Logan and Brigham, several specimens, purplish brown in color, rich purple inside, lateral teeth well developed, more lamellate than in normal form, beaks lower than in typical *variable* and probably will prove to be a different form when given intensive study, average length 4 mm. (U. of U. Zoo. Mus., No. 1460.)

Three-mile Creek, detour between Wanship and Salt Lake City, typical, a fine lot. (No. 1369.)

Ogden, pond along roadside, just out of city limits, on the Salt Lake City road, one specimen (dissected). (U. of U. Zoo. Mus., No. 873.)

Cane Springs* near Central, Washington Co., col. by V. M. Tanner, others by A. M. Woodbury. (U. of U. Zoo. Mus., No. 1479.)

Corner Canyon, Draper, Salt Lake Co., yellow in color, but with comparatively heavy shell. (U. of U. Zoo. Mus., No. 952.)

Sterling, reservoir south of the town, by spring, short grayish-green shells. (No. 1119.)

Fruita, a very few small specimens. (U. of U. Zoo. Mus., No. 1614.)

Moab, three specimens, occurring with *Pisidium abditum* Hald. (U. of U. Zoo. Mus., No. 1629B.)

Shell large for the genus, solid, inflated, oblique; umbones elevated, full rounded; all margins rounded, the anterior end rather pointed; scutellum and scutum not well marked; surface shining, marked by rather heavy, regular growth lines; color varying from light yellow or straw color to greenish or brownish, with a zone of lighter color near the ventral margin; in some specimens several zones may be present, while in others the zone is hardly visible. Hinge rather narrow, moderately strong; cardinal of right valve varying from long, narrow to wide, distinctly curved, enlarged, usually at both ends; the anterior end may be almost parallel with the hinge plate or it may be bent downward to near the ventral margin of the plate; the tooth may be simple and regularly curved or it may be markedly arched; there is a deep pit beneath the cardinal; upper car-

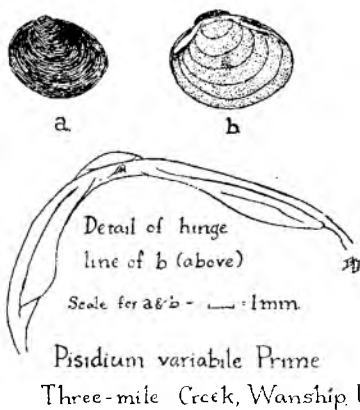


Fig. 14

*Sterki has recently identified specimens from this locality as *P. concinnulum* Sterki; but we do not at present find grounds for separating them from *P. variable*.

dinal of left valve long, almost straight or, rarely, curved, reaching to near the base of the plate; lower cardinal large, pyramidal or rounded, with a deep pit above it; laterals thin, not much elevated, the anterior rather long, the posterior short; cavity of the beaks deep; nacre bluish-white. Length from 3.5 to 3.9 mm.; height 3 to 3.2 mm.; diameter 2.5 mm.

Type locality.—Massachusetts (at Fresh Pond, Cambridge).

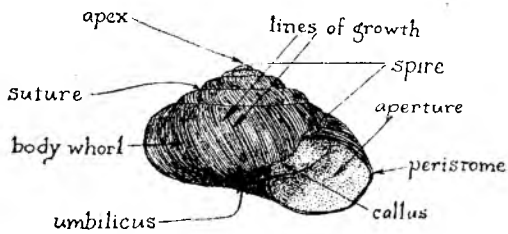
Range.—New England to Utah but apparently absent from the Southern States.

Discussion.—Prime (1867) reports this animal as being remarkable for its want of activity. Externally it resembles *abditum* with which it is often associated in Utah. Baker notes of this species that the beaks are placed nearer the center of the dorsal margin than in most species and that the shape is more oval than oblique.

CLASS GASTROPODA

Family HELICIDAE Keferstein

Shell spiral, subglobular; the whorls from 5 to 7, the last whorl much larger than the others; umbilicus either covered or open; aperture either smooth, without teeth, or with teeth; lip expanded, reflected. Jaw finely striate or ribbed, sulcate or plicate; radula with central teeth tricuspid, the laterals bicuspid or tricuspid. Foot completely retractile, without marginal grooves. Ureter reflexed.



Oreohelix strigosa tooelensis H&D

Tooele Utah ————— = 1 cm.

Fig. 15

A large family embracing several thousand species. It is represented in Utah by three genera of which *Oreohelix* includes our largest and most characteristic land forms.

Genus VALLONIA Risso

THE MIDGETS

Shell minute, diaphanous, more or less depressed, consisting of 3 or 4 rounded whorls; sculpture usually of fine transverse striae or ribs but sometimes smooth; umbilicus open; aperture subcircular, oblique; lip widened, reflected, usually white, less often transparent or colored.

Genotype.—*V. pulchella* (Müller).

KEY TO SPECIES

- a. Shell rather solid, light horn-colored, nearly smooth; peristome reflected and white. *Vallonia pulchella*
- aa. Shell thin, nearly white, with fine, sharp ribs.
 - b. Aperture circular.
 - c. Large, diameter 2.7 mm., lip narrowly reflected. *Vallonia albula*.
 - cc. Small, diameter 2 mm. (rare). *Vallonia parvula*.
 - bb. Aperture rather transverse elliptical or oval.
 - d. Diameter 2.6 mm., last whorl somewhat descending to the aperture, lip thick, white, broadly reflected. *Vallonia gracilicosta*.
 - dd. Diameter 2.6 to 3.3 mm., lip thin, somewhat everted. *Vallonia cyclophorella*. (cf. Henderson.)

Discussion.—The Vallonias live in damp places under leaves and stones in woodland areas. They can be identified in the field easily with the aid of a lens by means of the reflected peristome about the aperture, as they are the only small, low-spired snails in Utah that possess this. All of our species except *Vallonia pulchella* have prominent ribs encircling the whorls. This is one of the genera where the young can not be readily classified, since the classification depends on the reflected peristome and the shape of the aperture, both of which are formed at maturity.

Vallonia pulchella (Müller)

THE SMOOTH MIDGET

Helix pulchella Müller, *Verm. Terr.* II, p. 30, 1774.

Helix (Subgenus *Vallonia*) *pulchella* Binney and Bland, 1869, *Pulmonata geophila*, p. 157.

Utah Localities.—

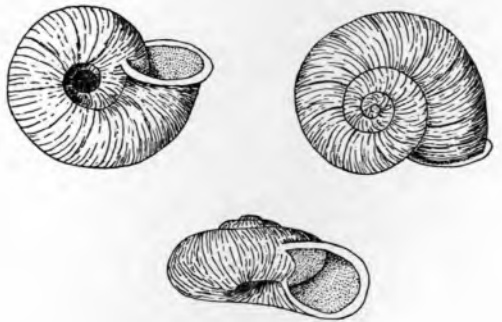
Previous record: American Fork Canyon (Ingersoll, 1877), but may “belong elsewhere.”

New records: Ogden, canal near Ogden River in the city, one shell only found. (U. of U. Zoo. Mus., No. 862.)

Glenwood, by old mill in the town. lines of growth showing, no ribs. (U. of U. Zoo. Mus., No. 953.)

Moab, Grand Co. (U. of U. Zoo. Mus., No. 1623.)

Shell widely umbilicated, depressed, slightly convex above, thin and transparent; epidermis colorless; whorls four, very minutely striated, the last large and spreading at the aperture like a trumpet; aperture obicular, a little dilated; peristome much thickened, white reflected, making nearly a continuous circle, ends approaching; umbilicus large, exhibiting all the volutions. Greater diameter 3 mm., lesser diameter 2.5 mm.; height 1.5 mm. (Binney and Bland).



Vallonia pulchella (Müller)

Ogden, Utah ————— = $\frac{1}{16}$ in.

Fig. 16

Range.—Europe; North Africa; southern and western Siberia to the Amur; Maderia; the Azores; eastern North America from Manitoba to Florida and Montana to Nova Scotia.

Manitoba, at Winnipeg and Pembina; north to the Saskatchewan (Richardson). Introduced in California.

Discussion.—This is regarded as an introduced species in this state. It has probably been brought in from the east with imported trees.

Vallonia albula Sterki

THE WHITE MIDGET

Vallonia albula Sterki, *Proc. Acad. Nat. Sci. Phil.*, 1893, p. 263, pl. VIII.

Utah Localities.—

Previous records: Devil's Slide (Henderson, 1924.)
South of Bear Lake (Henderson, 1924.)

New records: Emigration Canyon, one specimen, much weathered. (U. of U. Zoo. Mus., No. 581.)

Ogden Canyon, at mouth. (U. of U. Zoo. Mus., No. 591.) And one-half mile below mouth. (No. 869.)

City Creek Canyon, Stepping Stone Spring, Rotary Park. (U. of U. Zoo. Mus., No. 674; No. 783.)

Big Cottonwood Canyon, Mill D branch, two immature specimens, sifted out of leaves, species questionable. (U. of U. Zoo. Mus., No. 693.)
Rollway Flat, same canyon. (No. 708.)

American Fork Canyon, North Fork, Camp Timpanogos, three immature specimens, species questionable. (U. of U. Zoo. Mus., No. 743.)

Provo Canyon, 2 miles below Alpine Camp. (U. of U. Zoo. Mus., No. 750.) North Fork, same canyon, Alpine Camp in Aspen Grove, immature. No. 927 and No. 938.)

Glenwood, one specimen. (U. of U. Zoo. Mus., No. 849.)

Moroni, just south of town. (U. of U. Zoo. Mus., No. 1029.)

Garfield Co., Panguitch Creek (South Fork of Sevier River), near Spry Station, specimens very much weathered, some immature species questionable. (U. of U. Zoo. Mus., No. 1072.)

Lamb's Canyon, Elmer Berry col., juvenile, ribs more closely crowded than usual, species questionable.

Between Marysvale and Richfield. (U. of U. Zoo. Mus., No. 1133.)

Head of Cedar Canyon, Cedar City. (U. of U. Zoo. Mus., No. 1140.)
Near head of same canyon. (No. 1163.) Ten miles from mouth. No. 1149.)

Fillmore Canyon. (No. 1159.)

Rich Co., in mud deposits along stream, 5 miles from Evanston, Wyo., weathered, costae still showing sharply in some specimens. (U. of U. Zoo. Mus., No. 1354.)

Logan Canyon, near divide. (U. of U. Zoo. Mus., No. 1357.) And 2 specimens, weathered. (No. 1361.)

West of Bear Lake, camp grounds along Lake north of Garden City. (U. of U. Zoo. Mus., No. 1384.)

Provo, one immature specimen, species questionable, submitted by V. M. Tanner.

Verdure, San Juan Co. (U. of U. Zoo. Mus., No. 1588.)

Torrey, one identifiable fragment. (U. of U. Zoo. Mus., No. 1664.)

Comparatively large, 2.7 mm. in diameter, shell thin, nearly white, often transparent, with fine sharp ribs encircling whorls. Lip narrowly reflected, usually transparent, though sometimes slightly thickened and white. The circular aperture, taken with the costae or ribs characterize the shell. Animal usually immaculately white.

Range.—Eastern Canada to British Columbia, south to Colorado and Utah.

Discussion.—*Vallonia albula* is our commonest midget shell. It is a terrestrial air-

breathing species, living in damp places, under rocks and leaves. In dry seasons they often close their apertures, by sealing the same fast to a leaf with mucus. Because of this habit they are often dispersed by the wind blowing the leaves.

In specimens observed by us, the ribs seem to be more regular and not so obliquely set as on *V. gracilicosta*.

Vallonia gracilicosta Reinhardt

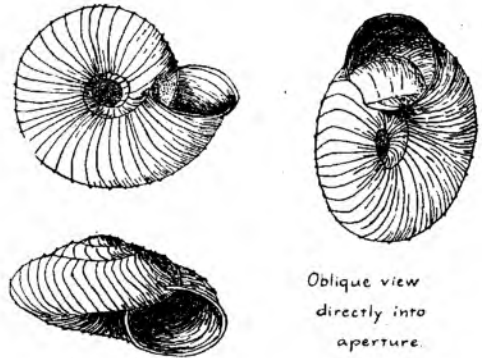
THE GRACEFULLY-RIBBED MIDGET

Vallonia gracilicosta Reinhardt, *Sitzungsbericht der Ges. Naturf. Freunde zu Berlin*, 1883, No. 3, p. 42.

Utah Localities.—

Previous records: Logan Canyon. (Sterki, 1892.)

Logan Canyon and Devil's Slide. (Henderson and Daniels, 1916.)



Oblique view
directly into
aperture.

Vallonia albula Sterki.

Moroni, Utah. ————— = $\frac{1}{16}$ in.

Fig. 17

New records: Cedar Canyon, Cedar City, 10 miles from mouth. (U. of U. Zoo. Mus., No. 1192.) Near head of same canyon, one specimen. (No. 1191.)

Kamas, Beaver Creek Region. (U. of U. Zoo. Mus., No. 641.)

Junction, reservoir on Sevier River, two specimens. (U. of U. Zoo. Mus., No. 1041.)

Bear Lake, west shore, camp ground north of Garden City, one weathered specimen. (U. of U. Zoo. Mus., No. 1391.)

Garfield Co., Panguitch Creek (South Fork of Sevier River), near Spry Station. (U. of U. Zoo. Mus., No. 1071.)

Zion National Park. (A. M. Woodbury.)

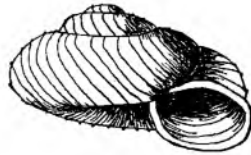
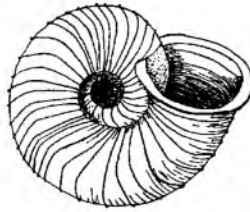
Verdure, San Juan Co. (No. 1609.)

Fruita, Wayne Co. (No. 1618.)

Shell of medium size, diameter 2.6 mm., thin, often transparent, or nearly white, sculptured with fine, sharp, oblique ribs. Last whorl somewhat descending to the aperture, lips thick, white, broadly reflected. Aperture rather transversely elliptical or oval.

Range.—Rocky Mountain region, westward and northward from the upper Missouri, Arizona to Dakota.

Discussion.—This species occurs commonly with the other Vallonias in Utah, and has similar habits. Our material has been checked with specimens furnished by Professor Henderson from Aspen, Colorado. (U. of U. Zoo. Mus., Lot 4, No. 9.)



⊠

Vallonia gracilicosta Reinh.

Near Junction, Utah — $\frac{1}{2}$ in.

Fig. 18

Vallonia cyclophorella Ancey

THE MIDGET

Utah Localities.—

Previous records: Utah. (Sterki, 1892.)

Bear River below Cache Junction. (Henderson and Daniels, 1916.) Including record of *V. sonorana* Pilsbry.

Eureka. (Henderson and Daniels, 1917.)

New records: Bear Lake, camp ground on west shore, north of Garden City, one specimen. (U. of U. Zoo. Mus., No. 1469.)

Between Marysvale and Richfield, three specimens. (U. of U. Zoo. Mus., No. 1190.)

Beaver Canyon, brownish in color. (U. of U. Zoo. Mus., No. 1181.)

Cedar Canyon, 10 miles from mouth, two specimens. (U. of U. Zoo. Mus., No. 1193.)

Big Cottonwood Canyon, Mill D branch, sifted out from leaves, two specimens, one a good *cyclophorella*, the other might be rather referred to *V. parvula* Sterki than to this species. (U. of U. Zoo. Mus., No. 955.)

City Creek Canyon, Stepping Stone Spring, Rotary Park, one specimen. (U. of U. Zoo. Mus., No. 957.)

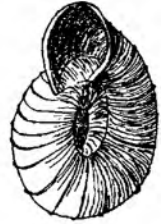
Provo Canyon, 2 miles below Alpine Camp, two specimens. (U. of U. Zoo. Mus., No. 956.)

Ogden Canyon, gulch opposite the Hermitage, one specimen. (U. of U. Zoo. Mus., No. 797.)

Vallonia cyclophorella Ancey is characterized by its comparatively large size (2.6 to 3.3 mm. in diameter), the thin, somewhat everted lips, the oval shaped aperture, and the possession of fine, sharp ribs. The shell varies from transparent to brownish, being more often brownish. This species has a tendency, like *V. gracilicosta*, to depress the last whorl and to set the aperture obliquely to the horizontal plane of the whorls, making the aperture inferior. The inner ventral termination of the peristome of this species, as shown in the figure, is back of the dorsal termination due to the obliquity of the aperture.

Range.—Arizona to Idaho, Washington to Montana.

Discussion.—Our specimens were compared with material from Hesis, Colorado, 9,000 feet. (U. of U. Zoo. Mus., No. 1207.)



Oblique view directly into aperture. *M*

Vallonia cyclophorella
Ancey.
W. shore of Bear Lake
in Utah.
 $\frac{1}{2}$ in. = _____

Fig. 19

Genus **OREOHELIX** Pilsbry

THE LARGE LAND SNAILS

Shells compact, large, mostly 12 mm. and upwards in diameter, wider than high, from depressed or discoidal to pyramidal, with from 4 to 6 whorls which may be either rounded or carinate, the whorls of young shells ordinarily showing a peripheral carina, and also commonly differing otherwise from the later ones in a spiral sculpturing; umbilicus present; aperture from rounded to obliquely oval or angu-

lar; lip not reflected, smooth not dentate. Often with spiral color bands on nuclear whorls which may continue to aperture. Reproduction viviparous.

Genotype.—*Helix strigosa* Gould.

KEY TO SPECIES

- a. Shell without spiral ribs.
 - b. Rugose with irregular wrinkles that continue well-pronounced around to the umbilicus; shell subglobose, size small but variable, color bands exceedingly variable or wanting. *Oreohelix peripherica* and varieties.
 - bb. Somewhat smoother, umbilical region free from transverse wrinkles.
 - c. Spire elevated, but less globose, larger.
 - d. Usually several color bands below periphery in addition to those on or above the periphery, bands sometimes coalescing into solid color zones. *Oreohelix cooperi* and varieties.
 - dd. Color bands obsolete on later whorls. *Oreohelix rugosa*.
 - cc. Shells like *O. cooperi*, but spire depressed.
 - e. Size large, no color bands on base of shell, but bands on and above periphery usually extending to the aperture. *Oreohelix strigosa* and varieties.
 - ee. Very small, spire depressed, diameter 9 to 10 mm., height 5 to 6 mm., sculpture of fine, sharp, transverse striae crossed by indistinct spiral lines, periphery angular or bluntly carinate. *Oreohelix eurekensis*.
 - aa. Shell bearing sharp, spiral ribs typically strong but more often nearly obsolete, spire depressed or elevated. *Oreohelix haydeni* and varieties.

Discussion.—The genus *Oreohelix* was described by Pilsbry in 1904 for certain forms that at different times had previously gone under the generic names *Helix*, *Patula*, and *Pyramidula*. It is the characteristic snail of Utah, being found living in all parts where there is moisture enough to support them; and their bleached shells are found over the dry mountain sides even up to the summits strewing the paths of fatal migrations from the moist canyons and crannies in the rocks, during some rainy season.

“It is a very difficult genus to study, because of the fact that the various species are exceedingly variable in form, color, and sculpture. Many of the forms are very local in distribution, though *cooperi* and *depressa* are widely distributed. I have discussed their distribution and habits to some extent elsewhere (Proc. Malac. Soc. London, XIII, 1918, pp. 21-24). Small, flourishing colonies where the environment is favorable are often separated by vast stretches of country wholly unfavorable to such creatures. Much of the variation

is probably due to the direct influence of the environment upon the individuals, and is not of taxonomic importance. Many of the described varieties or forms are based upon abnormal individuals within normal colonies. It is not at all uncommon to find a colony in which those individuals living under the best cover are large and robust, while those at the edges where cover is scant are dwarfed. The environment seems to react upon color and sculpture. A favorite habitat is the edge of limestone talus composed of medium sized angular rocks, free from soil but overhung with bushes that protect the spaces between the rocks from excessive evaporation. I have found colonies also in granite and quartzite talus, but usually where limestone occurs up the slopes. Some of the finest colonies, however, have been found quite away from rock slides and ledges, under shrubbery and small trees, usually where the soil is quite calcareous. On Grand Mesa, Colorado, we noted them several times on the trunk of aspens ten feet or more from the ground, which is very unusual. The species are all viviparous and herbivorous. In captivity they eat lettuce and other herbage, cornmeal, etc. I have occasionally found them in their native habitat feeding upon green leaves, but as a general thing when active I have found them upon dead leaves and decaying wood, from which fact I infer that they feed largely upon minute fungi and perhaps the bacteria of decay, though this has not yet been demonstrated because of lack of facilities for making examinations in the field. Specimens examined in the laboratory had evidently evacuated their stomachs in the process of killing in the field, so were empty." (Henderson).

The true classification of the genus *Oreohelix* is based on characteristics of the soft anatomy, especially the genitalia, as shown by Pilsbry (1916), from whom the following quotation is taken: "The division of *Oreohelix* into 'transversely ribbed', 'smooth or striate', and 'longitudinally ribbed' groups by Hemphill and Binney is a division of convenience in the identification of specimens, but it has no relation to the affinities of the species. Because this article was planned with the identification of specimens primarily in view, this convenient plan was followed. In the subsequent treatment of species the term form is used in a loose sense. While every effort has been made to give the most recent ranking of the form, yet some not-easily-identifiable species have been placed as forms under species having more outstanding characteristics. This seems to be consistent with scientific accuracy, yet giving the amateur a chance to enjoy collecting and classifying his own material."

Range.—The genus is almost confined to the western mountain region of the United States, but there is one species in southern As-

siniboia and one near the southern boundary of Alberta. Formerly one species extended eastward to eastern Iowa. Southward the genus practically reaches the Mexican boundary, in the Big Hachet Mountains of New Mexico and the Huachuchas of Arizona; and it will probably be found below the boundary. An outlying species on Catalina Island, California, is widely remote from its kindred, among alien associates.

Oreohelix cooperi (W. G. Binney)

COOPER'S LAND SNAIL

Helix cooperi, W. G. Binney, Proc. Acad. Nat. Sci. Phila., 1858, 118.

Oreohelix cooperi form *typica* Pilsbry, Proc. Acad. Nat. Sci. Phila., LXVIII, 1916, p. 353.

Utah Localities.—

Previous records: Eureka, alive above 6,000 feet, a small form. Henderson has kindly sent us material from this locality. (U. of U. Zoo. Mus., No. 1208.)*

Tucker. (Henderson, 1924.)

Garfield. (Henderson, 1924.)

New records: Laketown, canyon east of town, near mouth, a good set secured, averages slightly larger, but otherwise is very similar to the dwarf form from Eureka, no color bands ventrally, markings variable, but no blurring or patches. (U. of U. Zoo. Mus., No. 1267 (anatomy) and No. 1268.) No. 1270 the anatomy and shell of a peculiar specimen from No. 1267 that had the aperture constricted.

Zion National Park, The Grotto, and several other points, comparatively low spired, resembling *Oreohelix strigosa depressa*, but Dr. Pilsbry identifies them as *O. cooperi*, some having very good color markings ventrally around the umbilicus (U. of U. Zoo. Mus., No. 1025, and No. 1018), with distinctive signs of this species; 2 shells and anatomies, one showing umbilical color band (No. 1019); three specimens that show distinct bands around the umbilicus (No. 1484, No. 1026, and No. 1096 (juvenile)).

Big Cottonwood Canyon, ridge above Twin Lakes, large forms similar to the specimens from Grand Valley, Colo.; color in splotches between bands. (U. of U. Zoo. Mus., No. 682.)

Parley's Canyon, at head of canyon, Summit Co., very large forms, comparatively high spired, showing some evidences of color patches, similar to the Bennington Canyon, Idaho, material of No. 1253), some specimens with large, dark reddish brown patches on upper side of whorls, same locality, anatomy preserved. (U. of U. Zoo. Mus., No. 1254.)

*Professor Henderson sent us the following material: *Oreohelix cooperi* from north of Grand Valley Colorado, a large form, some high-spined, a few banded beneath, bands broad, some blurring and zonation of color (No. 1209); *Oreohelix cooperi* from Bennington Canyon, Idaho, color bands comparatively thin, some high spired, very few color bands showing on base of shell, size large, color patches and blurring of lines very slight (No. 1210); dwarf form of *Oreohelix cooperi* from Eureka, small, spire often high, lines of growth prominent dorsally, banding fine, no banding ventrally (No. 1208).

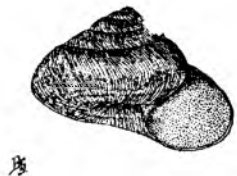
Lamb's Canyon, off Parley's Canyon, large, high spired forms without color markings, suggesting weathered shells, the decaying anatomy was found in some, may have the same relation to *cooperi* that *tooelensis* has to *O. strigosa depressa*. U. of U. Zoo. Mus., No. 959.)

Bear Lake, west shore, drift materials washed up on beach, two specimens, one large and high spired, faded, the other a medium sized specimen, exhibiting a fine, broad color band covering very nearly the whole dorsal part of the whorls. (U. of U. Zoo. Mus., No. 1271.) One small specimen and anatomy from camp ground, north of Garden City, near lake shore, one color band about the umbilicus. (U. of U. Zoo. Mus., No. 1383.)

Utah Lake at Provo, drift material, high spired forms, faded and weathered, but evidently *cooperi*. (U. of U. Zoo. Mus., No. 958.) Utah Lake at Spanish Fork, drift material, fine broad color patches on some specimens, band dorsally and also around the umbilicus on some, most of the shells high spired. (U. of U. Zoo. Mus., No. 1196.)

Fillmore Canyon, Fillmore, sutures not impressed. One subglobose specimen, 16 mm. in greatest diameter with a broad chestnut band extending out from the suture to a blackish brown line just above the periphery. A whitish peripheral band 1 mm. wide followed by a sub-peripheral chestnut band of mottled intensity which is 4 mm. wide and sharply margined ventrally, leaving a broad, clear-cut, white band around the umbilicus. Lines of growth prominent and finely beaded on and below the periphery under the lens. This specimen makes one think that Lot 3, No. 66, reported as *O. s. depressa*, may be *O. cooperi* with no distinguishing features. The same may be true of some of the *O. strigosa depressa* material from Cedar Canyon. On the other hand this specimen in coloration resembles to a certain extent some forms of *O. peripherica*. (U. of U. Zoo. Mus., No. 1034.)

Shell umbilicated; elevated, globose; solid, coarse and rough with oblique incremental striae intersected with delicate spiral lines; color white, variously marked with a single narrow band, or a broader longitudinal and spiral patches of reddish brown; suture impressed; spire elevated; whorls five, convex, the last rounded, very delicately deflected at the aperture; umbilicus moderate, pervious, one-fifth the greater diameter of the shell; aperture very oblique, circular; peristome simple, thickened, with its extremities very nearly approached, and joined by a heavy white callus, that of the columella reflected. Greater diameter 20 mm., lesser diameter 16 mm.; height 13 mm. (Binney and Bland.) Usually several color bands below periphery in addition to those on and above periphery, bands sometimes coalescing into solid color zones.



Oreohelix cooperi (Binney)
Utah Lake. — = $\frac{1}{4}$ in.

Fig. 20

Range.—Iowa (fossil); Black Hills, S. D.; Assiniboia, Idaho, Utah, Colorado, and New Mexico.

Type locality.—Black Hills, South Dakota.

Discussion.—It is next to impossible to tell an ordinarily marked shell of *Oreohelix cooperi* from one of *O. strigosa depressa* by features of the shell alone. In any colony of *O. cooperi*, however, there are individuals that usually give away the secret of the identity of the colony by having some of the distinctive *cooperi* features mentioned above.

An examination of the anatomy by an expert is necessary to settle the question in dubious cases. Pilsbry (1916) differentiates the two species in that *O. cooperi* has the internally costate part of the penis longer than the papillose part, while *O. strigosa* and *O. peripherica* have the costate part shorter than the papillose part. An examination of the anatomies is a matter requiring too much technique and comparison for the ordinary student.

Oreohelix cooperi seems to prefer high altitudes to the low, while *O. strigosa depressa* inhabits both valley and high altitudes up to the timber line. In our collecting we have found shells of this species quite numerous along the shores of Utah Lake and Bear Lake where they had washed down from higher altitudes.

The varieties and forms of *O. cooperi* had not been described till Pilsbry (1916) listed them. Henderson lists the following additional forms, none of which are within the borders of Utah, so far as present knowledge is concerned:

1. Form *maxima* Pilsbry, Grand Canyon, near Cokeville, Uinta Co., Wyo., and Yellowstone National Park.
2. Form *obscura* Henderson, color form, White Creek Canyon, east of Shell, Wyo.
3. Subspecies *apiarum* Berry, Glacier National Park, Mont.
4. Subspecies *berryi* Pilsbry, Swimming Woman Creek, Big Snow Mts., Fergus Co., or Mussersshell Co., Mont.

The Utah material collected has not been separated as to forms, though a few may be recognizable from descriptions of specimens herein given.

Oreohelix rugosa (Hemphill)

Patula strigosa var. *rugosa* Hemphill, *Naut.*, IV, 1890, p. 16.

Oreohelix rugosa Henderson and Daniels, Proc. Acad. Nat. Sci. Phil., LXVIII, 1916.

Utah Localities.—

Previous records: (New)* Brigham City. (Hemphill, 1890.)

West of Clarkston. (Henderson and Daniels.)

Near Brigham City. (Pilsbry, 1916.)

*Probably a misprint for "near".

Shell umbilicated, elevated or globosely depressed, of a dull brown ash color; surface rough, covered with coarse irregular oblique striae, and microscopic revolving lines; whorls 5, convex, with or without one or two narrow faint revolving bands. In most of the specimens the bands are obsolete; spire elevated, obtusely conical; suture well impressed; umbilicus large, deep; aperture nearly round, lip simple, thickened, its terminations approaching and joined by a thin callus. Height of largest specimen $\frac{3}{4}$ inch, greatest diameter 1 inch. Height of the smallest specimen $\frac{1}{2}$ inch, greater diameter $\frac{3}{4}$ inch. (Hemphill).

Type locality.—Near Brigham City.

Range.—Known only from northern Utah.

Discussion.—The status of this species is not secure. We did not take it in our collecting. Henderson (1916) reports it as variable but not intergrading. "In its adolescent state the lip is very thin or easily broken, and on the surface of the adult shells these fractures give it a rough and uneven appearance." (Hemphill)

Oreohelix peripherica (Ancey)

THE WRINKLED LAND SNAIL

Helix idahoensis Newcomb, var. *peripherica* Ancey, *Le Naturaliste*, IV, 1881, p. 403.

Oreohelix peripherica Pilsbry, *Naut.* XXVII, 1913, 53-54.

Utah Localities.—

Previous records: As *Patula cooperi*, "strong ribbed variety", Bear River. (Ancey, 1882.) (Ingersoll, 1874.)

Box Elder Co. (Hemphill, 1886.)

Banks of Bear River, north of Brigham City. (Hemphill, 1886.)

North Ogden Canyon. (Henderson and Daniels, 1916.)

Various stations in Cache Junction and Wheelon district, south of Trenton.

Newton, Morgan and Smithfield. (Henderson and Daniels, (1917.)

Duplicate record: Boxelder Co., at South Tremonton, specimen small, irregular ridges come over to umbilical region, color bands present around the umbilicus, a good example of form *albofasciata*, greatest diameter 12 mm., spire low. (U. of U. Zoo. Mus., No. 587.)

"A second variety of this species, with the same shape as the first one (which was *O. idahoensis*), but with a more open umbilicus, ornamented on the periphery with two narrow brown lines, the lower one being more decidedly marked, and provided with ribs, close, irregular and little in relief. It so closely resembles the shape of *Helix (Anguispira) cooperi* W. G. Binney, that I think it might well be an hybrid

displaying the characteristics of the *Helix idahoensis* and *cooperi*. It measures 9 mm. in height and 14 mm. in diameter, and comes from Utah. As to form and color it looks much like *Helix cooperi* (No. 136) of Binney and Bland's Land and Freshwater Shells of North America, but it has ribs, while the latter has none. I propose to name this interesting variety *Helix idahoensis* Newcomb var. *peripherica*. (Ancey)

Range.—Northern Utah, Bear River Valley, and Ogden vicinity.

Type locality.—"Utah."

Discussion.—In Idaho there occurs *Oreohelix idahoensis* (Newcomb) characterized by having the whorls ornamented with very strong, oblique ribs, 20 or 30 on the last whorl, these running in the general direction of the lines of growth. When Ancey named the specimen of *Oreohelix peripherica*, he regarded this species as a hybrid between *O. idahoensis* and *O. cooperi* (the latter then confused with *O. strigosa depressa*), but now *peripherica* is regarded as a huge protean species, representing all degrees of intergradation between the *Oreohelix idahoensis* and *Oreohelix strigosa depressa*, for Pilsbry (1916) says that the anatomy of *O. peripherica* does not differ materially from that of *O. strigosa depressa* and *O. haydeni*. In *O. peripherica* the wrinkles are not prominent enough to be definite ribs and are irregular. It is a small shell and variable with regard to banding and size.

From the literature the following is gathered as to the different forms:

1. *binneyi* (Hemphill)—A plain, white form with barely a suggestion of color bands. The extreme of *albofasciata*.
2. *castanea* (Hemphill)—A chestnut-colored form.
3. *albofasciata* (Hemphill)—A color form with a dark band 3 to 4 mm. wide just below the suture, then a white peripheral band of about the same width, a dark band below the periphery varying from 1 to 4 mm., the lower margin of this band often producing a clouded effect, a broad white band around the umbilicus. (Henderson and Daniels.)
4. *multicostata* (Hemphill) (and *gouldi* (Hemphill))—Names applied to the many-ribbed forms. Henderson and Daniels, 1916, advise dropping *gouldi* and retaining the prior term *multicostata* as a subspecies for many-ribbed forms. *Gouldi* and *multicostata* were separated on the difference in number of ribs.

Two subspecies of *O. peripherica* follow.

Oreohelix peripherica newcombi (Hemphill)

NEWCOMB'S WRINKLED LAND SNAIL

Patula strigosa var. *newcombi*, Binney, *Man. Am. Land Shells*, 1885, Appendix, p. 481, (no description).

Patula strigosa var. *newcombi*, Hemphill, in Binney, *Terr. Air-breathing Moll.*, V, 2nd Suppl., 1886, pp. 27, 32, pl. 2, fig. 8.

Oreohelix peripherica newcombi Henderson and Daniels, *Proc. Acad. Nat. Sci. Phila.*, LXVIII, 1916.

Utah Localities.—

Previous records: Ogden and Box Elder Canyon. (Binney, 1885.)
Near Ogden. (Binney, 1886.)

For discussion see under *O. peripherica wasatchensis*.

Range.—Local in Utah.

Oreohelix peripherica wasatchensis (Hemphill)

THE WASATCH WRINKLED LAND SNAIL

Patula strigosa var. *wasatchensis*, Hemphill, in Binney, *Terr. Air-breathing Moll.*, V, 2nd Suppl., 1886, pp. 27, 34, pl. 2.

Oreohelix peripherica wasatchensis, Pilsbry, *Proc. Acad. Nat. Sci. Phila.*, LXVIII, 1916, pp. 353, 357.

Utah Localities.—

Previous records: Ogden. (Hemphill, 1886, and Henderson and Daniels, 1917.)

Near Ogden. (Pilsbry, 1892.)

Duplicate record: Near mouth of Ogden Canyon, one specimen, probably *O. p. wasatchensis*, showing slight ridges ventrally. (Hemphill.)*

We were much disappointed at being unable to find good *peripherica* here and below the mouth of the canyon where Henderson and Daniels reported finding it. On a special trip to Ogden especially to secure it, we worked the Ogden River from one-half mile up the canyon down to the city of Ogden. Those nearest approaching this form were found near the mouth of the canyon, but other material could not be differentiated from *O. strigosa depressa*. U. of U. Zoo. Mus., No. 771.)

Patula strigosa var. *newcombi* was named without description by Binney in 1885 (*Man. Amer. L. Shells*, p. 481), designating U. S. Nat. Mus., Nos. 39,023 and 39,025 to 39,038, from "near Ogden", "Wasatch Mountains", and "Box Elder Canyon". In his Second Suppl. *Terr. Moll.*, 1886, he figured and briefly described it, hence the name is valid only from that date. The descriptions and figures indicate much fewer and more widely spaced ribs than any of our material from that region. *O. wasatchensis* (Hemphill) may connect up with *peripherica* as a subspecies, though *newcombi*, but it is doubtful, and until that problem can be investigated it would seem better to consider it a full species.

In 1917 Henderson and Daniels found an intergrading series between typical *wasatchensis* and *peripherica* from other localities when they again visited the Ogden locality.

From the above and the figures in Henderson 1924, we take it that *O. p. wasatchensis* has less prominent and probably more numerous ribs than *O. p. newcombi*. This would throw our specimen in the former. However, it has not the high spire.

Pilsbry reports that the genitalia of *wasatchensis* and *peripherica* agree.

Type locality.—Known only from near the mouth of Ogden Canyon. In the original description Hemphill says: "This pretty and interesting shell I found among quartzite boulders, in crevices sufficiently large to afford cool and moist retreats during the active summer season and safe places for hibernating during the cold months. This shell seems to be confined in its range to a very limited area, for I did not find a single specimen, either dead or alive, outside of a little plat containing an acre of ground."

***Oreohelix strigosa depressa* (Cockerell)**

THE VARIABLE LAND SNAIL

Patula strigosa cooperi var. *depressa*, Cockerell, *Naut.*, III, 1890, p. 102.

Oreohelix strigosa depressa, Henderson, *University Col. Studies*, IV, 1907, p. 168.

Utah Localities.—

Previous records (under various names): Weber Canyon. (Gabb, 1869.)
Beaver. (Ingersoll, 1874.)

Box Elder Canyon, Salt Lake City, 25 miles from Salt Lake City, Oquirrh Mts., Weber Canyon, Logan Canyon, Provo, Ogden, Bear River. (Binney, 1885.)

Uinta and Wasatch Mts., Park City. (Stearns, 1891.)

Fillmore Canyon. (Yarrow, 1875.)

Near Salt Lake City. (Hemphill, 1890.)

Near Logan. (Hemphill, 1890.)

Provo, reversed shell. (Binney, 1885.)

Zion Canyon. (Vanatta, 1921.)

Gulch southeast of Tooele, Rock Canyon (east of Provo), Emigration Canyon (near Salt Lake City), Ogden Canyon, Canyon north of Brigham, gulch south of Logan, Dry Canyon (near Salt Lake City). (Henderson and Daniels, 1916.)

North Fork of Logan Canyon, Providence Canyon, below Devil's Slide, Ogden Canyon, northeast of Springville, Pinyon Mts., northeast of Eureka, Red Butte Canyon and City Creek Canyon (both near Salt Lake City). (Henderson and Daniels, 1916 and 1917.)

Tucker, Provo Canyon, Polar Mesa (Grand Co.), and Mt. Timpanogos (near Provo). (Henderson, 1924.)

In addition the rejected records of *O. cooperi* in Henderson, 1924 probably belong here, though there is no way of verifying this.

Duplicate records: Fillmore Canyon. (U. of U. Zoo. Mus., No. 999 and No. 1035.) Juvenile (No. 1002), but these may be *O. cooperi* as noted under Fillmore Canyon record of *O. cooperi*.

Logan Canyon, five miles from mouth, form *major*. (U. of U. Zoo. Mus., No. 1266.) Two miles from mouth, the strongly banded form of which Henderson and Daniels speak in their 1917 article, p. 64. (U. of U. Zoo. Mus., No. 1269 and No. 1381.) Juveniles in No. 1340.

Dry Canyon, Salt Lake City, at fork, the rejected form *carnea*... (U. of U. Zoo. Mus., Nos. 502, 504, 506, and juvenile, No. 861.)

Ogden Canyon, in side canyon at Pine View Lodge, form major. (U. of U. Zoo. Mus., Nos. 567, 519, 620, juveniles, No. 656 and 665.) One-fourth mile below power dam, and one-half mile below Pine View Lodge, in depression along side of road with form *gabbiana* of *O. haydeni oquirrhensis*. (U. of U. Zoo. Mus., No. 566, intergrades No. 565.) Gulch opposite the Hermitage. (U. of U. Zoo. Mus., No. 569 and 855, juveniles, No. 794.) One-half mile from mouth of canyon. (No. 586.) At mouth of canyon, some on limestone slides, some not. (Nos. 588, 769, 770, 776.) Wildwood Resort. (No. 528.)

City Creek Canyon, Salt Lake City, near spillway above first reservoir. (U. of U. Zoo. Mus., No. 535.) One and one-half miles from mouth. (No. 666 and No. 668 a and b.) Two and one-half miles from mouth. (No. 167.) Rotary Park, 1 mile below Stepping Stone Spring. (Nos. 669, and 762.) Stepping Stone Spring. (Nos. 678 and 777.) One-half mile below Stepping Stone Spring. (No. 760.)

Ogden, along Ogden River in city. (U. of U. Zoo. Mus., No. 723, juvenile, No. 897.)

Provo Canyon, North Fork, 2 miles below Alpine Camp. (U. of U. Zoo. Mus., Nos. 727 and 728.) Base of limestone cliff, north side of Provo Canyon, above Vivian Park. Nos. 732 and 740.)

New records: Cedar Canyon, Cedar City, 10 miles from mouth, weathered. (U. of U. Zoo. Mus., No. 1011; juvenile, Nos. 1146 and 973. These possibly *O. cooperi* with no identifying markings.)

La Sal Mts., 10,000 feet, Mt. Tukuhiyivatz, collected by V. M. Tanner, spire low, two reddish brown color bands on periphery, diameter variable, three specimens. (U. of U. Zoo. Mus., No. 1470.)

Bear Lake, camp grounds north of Garden City, one immature specimen, may be *cooperi*. (U. of U. Zoo. Mus., No. 1387.) Canyon west of Lakota Resort, near Idaho border, one immature specimen, may be *cooperi*. (No. 1395.)

Between Brigham and Logan, 7 miles up canyon, one weathered specimen. (U. of U. Zoo. Mus., No. 1420.)

Bountiful, an unbanded form, collected by W. Gertsch and O. Robinson, Mar. 10, 1927, the first appearance of snail activity this year. (U. of U. Zoo. Mus., Nos. 505 and 536.)

Utah Lake, drift material, at Spanish Fork. (U. of U. Zoo. Mus., No. 1194.) At Provo. (No. 517.)

Mill Creek Canyon, Salt Lake City, 2 miles from mouth, quartzite rock, south side, may be *cooperi*. (U. of U. Zoo. Mus., No. 522.) Mill Creek, collected by Clark Chase. (No. 560.) Porter's Fork on quartzite rock. (No. 761.)

Lake Point, near Garfield. (U. of U. Zoo. Mus., No. 582.)

Kamas, Beaver Creek region, Summit Co. (U. of U. Zoo. Mus., No. 584.)

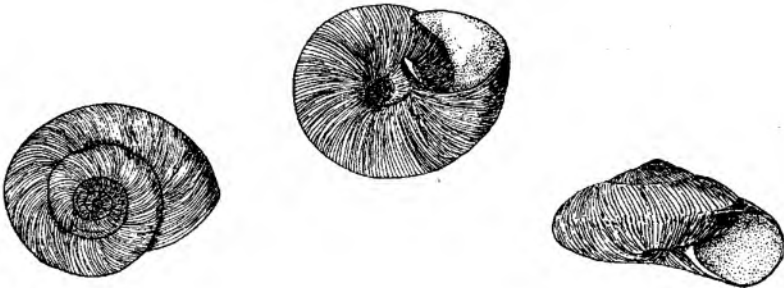
Woodland, Summit Co. (U. of E. Zoo. Mus., No. 585.)

Eureka, canyon east of town, badly weathered and species questionable. (U. of U. Zoo. Mus., No. 1546.)

Big Cottonwood Canyon, Mill B, flat at side of road. (U. of U. Zoo. Mus., No. 679.) Ridge above Twin Lakes. (No. 681.)

American Fork Canyon, one mile above Timpanogos Cave, north side. (U. of U. Zoo. Mus., Nos. 726 and 730; juvenile, No. 946.) One-half mile above Timpanogos Cave, south side. (No. 731.) Toward head of North branch. (No. 733.) (Nos. 929, 930 and 931.)

Stansbury Mts., Fisher's Pass, Species questionable, small and carinated. (U. of U. Zoo. Mus., No. 157. Henderson thinks this possibly new.) Same mountains, near old Timpi. (No. 1549, identified as *O. s. depressa* by Henderson.) South end of range, Station 3. (No. 1548, also identified as *O. s. depressa* by Henderson.)



Oreohelix strigosa depressa (Cockerell)



_____ = 1 in.

Bountiful, Utah.

Fig. 21

This snail, Utah's commonest land species, varies greatly in size, elevation of spire, and coloration. It is characterized by the almost circular aperture, obliquely set, the deflection and the carination of the body whorl at its commencement, the ashy gray or rusty brown color above, fading beneath, lines of growth more evident above than below, a broad deep umbilicus, and an acute peristome partially reflexed on the ventral termination. Whorls five. Numerous color bands unequal in size and distance may be present, usually on the upper side and the periphery. The specimen figured did not have these.

Type locality.—Near Durango, Colorado.

Range.—Southern Idaho to northern Arizona, Colorado and New Mexico.

Discussion.—The following forms have been found in Utah, subspecies being described separately hereafter:

1. Unbanded—Several dozen of these were collected by Willis Gertsch and Ortel Robinson on the bank south of the brickyard at Bountiful, Utah, as listed above. None of these showed any signs of banding.
2. Form *major* Cockerell—A size form often measuring over 1¼ inches in greatest diameter. Found in Ogden Canyon at Pine View

Lodge, as recorded above, and at other points. This form seems to occur far up the canyons where there is the optimum of moisture and foliage. They are strongly banded, the bands being unusually wide and dark. They tend to have low spires.

3. Form *carnea* (Hemphill)—The very variable form found in Dry Canyon at Salt Lake City. They vary from unbanded to strongly banded, the bands are usually narrow. This form is now regarded as synonymous with *depressa*. See discussion.
4. Form *albida* (Hemphill)—Near Logan, Utah. Henderson and Daniels found some resembling this form in the first gulch south of Logan. (Henderson and Daniels, 1916, p. 335.) Probably not a valid form.

The anatomy of typical *Oreohelix strigosa* (Gould) is unknown, since we have yet to discover the typical form (Pilsbry). "Probably all or nearly all of Hemphill's Utah records of *O. strigosa* (Gould) should be referred to this subspecies. This is true of the material labeled *strigosa* in Clapp's Hemphill collection." (Henderson and Daniels, 1916, p. 323.) "True *strigosa* is confined to the northwest, the subspecies *depressa* replacing it to the eastward and southward." (Henderson, 1924, p. 114.)

To Henderson and Daniels belong the credit of stabilizing the present name in Utah. *Oreohelix strigosa* was described by Gould from the "Interior of Oregon," from a locality that is at present unknown. Hemphill in the meantime described several forms among which was var. *carnea* from near Salt Lake City. Cockerell during the same year described var. *depressa* from near Durango, Colorado. Henderson and Daniels (1916) carefully compared the two varieties from various Utah localities, sending Pilsbry the anatomies. Pilsbry reported that the form *carnea* is identical with *depressa* anatomically. Henderson and Daniels' comments on the Dry Canyon material give the key to the solution:

Oreohelix strigosa depressa (Ckll.) "var. *carnea* (Hemphill); *Patula strigosa* var. *carnea* Hemphill, *Nautilus*, IV, 15, 1890. Binney, 4th Suppl. to 5th Vol. *Terr. Moll. U. S.*, p. 174, 1892.

Station 43, Dry Canyon, about a mile from the University of Utah, near Salt Lake City, in scrub oak and mountain maple thickets on limestone, visited by Henderson in company with William McArthur. This form was found abundantly here, the color bands faint or wanting on most examples, but quite strong on a few. On an average the specimens have a higher spire than typical *depressa*, but many of them are well depressed. The description of *depressa* appeared in the same magazine in January, 1890, the reference to Binney's description seeming to make it a good description, thus antedating *carnea* by five months. *O. var. carnea* is not a well marked variety, and the question of making it a subspecies, or a mere color variety, or rejecting the name altogether, may be purely a matter of opinion, but it is not quite typical *depressa*.

Hemphill records "typical *strigosa* and *cooperi*, both large and small," from near Salt Lake City.

In more recent publications the name *depressa* has been used instead of *carnea*. Unless in the future unknown anatomical differences should be discovered, necessitating the resurrection of the term *carnea*, the Utah name is satisfactorily settled as *O. strigosa depressa* (Cockerell), the earlier name. If anatomical work should ever be done on this form, it would be well to mention "*carnea*" as a form name under *O. s. depressa* to guard against possible differences in Colorado forms.

***Oreohelix strigosa tooelensis* Henderson and Daniels**

THE WHITE-SHELLED LAND SNAIL

Oreohelix strigosa depressa form *tooelensis* Henderson and Daniels, *Proc. Acad. Nat. Sci. Phila.*, LXVIII, 1916, p. 323.

Oreohelix strigosa tooelensis Henderson and Daniels, Henderson, *Mollusca of Colorado, Utah, etc.*, U. of Col. Studies, Vol. XIII, No. 2, 1924, p. 121.

Utah Localities.—

Previous record: Northeast of Tooele, several stations. (Henderson and Daniels, 1916.)

Duplicate record: Gullies and canyons north of Tooele smelter, Oquirrh Mts., type locality. (U. of U. Zoo. Mus., Nos. 570, 571, 572, 573, 574, and 575. None found living.)

New locality: Gulch north of Mill Creek Canyon, Salt Lake City, collected by R. V. Chamberlin, two anatomies secured. (U. of U. Zoo. Mus., Nos. 616, 617 and 618.)

This form differs from *depressa* chiefly in the color, which is almost invariably a dead, chalky white in all the material from three colonies northeast of Tooele, giving the specimens the appearance of dead, weathered shells, in this respect quite unlike the colonies of *depressa* from southeast of Tooele and elsewhere. Shell depressed (in a few examples quite elevated); whorls 5 to 5½, convex; suture well impressed; spiral striae minute; transverse sculpture slightly less pronounced than in typical *depressa*, especially below; color bands narrow, sometimes strongly marked, but usually rather faint or wanting, one barely below and the other well above the periphery, strong on immature examples; first embryonic whorl smooth, second and third minutely transversely striate, with numerous spiral striae rippling the transverse sculpture above and below and increasing in strength with the growth of the whorls. Type in the University of Colorado Museum, greater diameter 19 mm., lesser diameter 16.5 mm., altitude 11.5 mm. Co-type, in Academy of Natural Sciences of Philadelphia, greater diameter 19.6 mm., lesser 16.5 mm., altitude 13.5 mm. This form also slightly differs from typical *depressa* in anatomy, according to Dr. Pilsbry, but this is a variable feature. The presence sporadically of white examples in *depressa* and other colonies of *Oreohelix* belong-

ing to the *strigosa* group, even though not the dead white which characterizes this form, makes it inadvisable to give this subspecific rank, notwithstanding the fact that the color in these colonies is constant, unless other differences are found which are also constant. Abundant at stations 7, 8, 9, and 10 in small gulches about six miles northeast of Tooele, north of the smelter, under grass and other vegetation about limestone ledges. Four sinistral specimens were found. (Henderson.)

Type locality.—Northeast of Tooele.

Range.—The localities in Utah given above.

Discussion.—Members of the colony found near Mill Creek Canyon were living under practically the same environmental conditions as those at the type locality.

***Oreohelix strigosa fragilis* (Hemphill)**

THE FRAGILE LAND SNAIL

Patula strigosa var. *fragilis* Hemphill, *Naut.*, IV, 1890, p. 17.

Oreohelix strigosa fragilis Henderson and Daniels, *Proc. Acad. Nat. Sci. Phila.*, LXVIII, 1916, p. 336.

Utah Localities.—

Previous records: Praeter Gulch, east of Webster, southeast of Franklin, Idaho. (Henderson and Daniels, 1916.)

High Creek Canyon, northeast of Webster.

Shell umbilicated, elevated or globosely depressed, translucent, thin, fragile, somewhat shining, of a dark horn color, surface covered by fine oblique striae; whorls 5, convex, the last descending in front, and striped by two dark chestnut bands one above and the other below the periphery; suture well impressed; aperture oblique; lip simple, thickened, umbilicus moderate, deep, partially covered by the reflected lip at the columella. Height of the largest specimen 9/16 inch, greatest diameter 7/8 inch, lesser diameter, 3/4 inch.

A very thin and almost transparent variety of the very variable *strigosa*. By its peculiar shade it is very evident that the animal has drawn largely from the red sandstone for the material to build its shell. (Hemphill.)

Type locality.—“Near Franklin, Idaho, among Red Sandstone.”

Range.—Vicinity of Franklin, Idaho, and across the border into Utah.

Discussion.—“This subspecies is closely allied to *depressa*, but differs slightly in anatomy, in the translucency and fragility of the shell, and in the narrowing of the umbilicus by the reflected base of

the columella. One might be led to suspect that the fragility of the shell is due to lack of lime, from the fact that Hemphill's material came from sandstone and our station 39 from quartzite, but the snails from station 38, in a limestone habitat, are also fragile, though to a less degree, while *depressa* from quartzite slides are not fragile. The station 39 shells are so fragile that many of them were broken in carrying them in the bags until we found time to clean them, a thing which did not happen with any other *Oreohelices* we collected, and they were not subjected to as hard usage as some. Indeed, it was the fact that they broke so easily that attracted our attention in the field to the probability that we had Hemphill's *fragilis* which neither of us had seen before." (Henderson and Daniels.)

***Oreohelix strigosa buttoni* (Hemphill)**

Patula strigosa var. *buttoni* Hemphill, in Binney, *Terrestrial Air-breathing Moll.*, V, 3rd Suppl., 1890, p. 220.

Oreohelix strigosa buttoni, Henderson and Daniels, *Proc. Acad. Nat. Sci. Phila.*, LXVIII, 1916, p. 327.

Utah Localities.—

Previous records: Box Elder Co. (Hemphill, 1890.)

Taylor Canyon (near Ogden); below Gateway (Weber Canyon; Box Elder Co. (near Ogden).

Duplicate record: Pine View Lodge, Ogden Canyon, in a lot of *O. strigosa depressa* form *major*, one found possessing the columellar tooth characteristic of this form. (U. of U. Zoo. Mus., Lot. 2, No. 118. Species questioned.

This form is sometimes, though not always, characterized by a tooth on the columellar margin of the aperture.

Type locality.—Box Elder County.

Range.—Northern Utah.

Discussion.—Pilsbry reports the genitalia the same as in *O. s. depressa* and *O. s. tooelensis*. It is probably a form of the former.

***Oreohelix haydeni* (Gabb)**

HAYDEN'S LAND SNAIL

Helix haydeni Gabb, *Am. Journ. Conch.*, V, 1869, p. 24, pl. 8, fig. 1.

Oreohelix haydeni Pilsbry, *Naut.*, XXVI, 1912, p. 89.

Utah Localities.—

Previous records: Weber Canyon. (Gabb, 1869.)

Wasatch Mts. (Wheeler Expedition.) (Pilsbry, 1912.)

Weber Canyon. (Pilsbry, 1912.)

The typical form of this species is known only from the type lot.

See localities of subspecies under their respective heads.

New records for O. haydeni (Gabb) varieties:

Fillmore Canyon, found washed down in creek, lines of growth weathered away, two specimens, both partially broken, specimen 1, though low spired, probably referable to *O. h. corrugata*, though transverse ribs are only on the body whorl near the aperture; specimen 2 very evidently *O. h. wasatchensis* typical form. (U. of U. Zoo. Mus., Lot 3, No. 63.) A collection of intergrading *haydeni* material from the same locality all referable to the various forms of *O. h. wasatchensis* as all are sharply keeled, but if keeled forms are included in *O. h. hybrida* some of these might fall there. (Lot 3, No. 64.)

The Gabb's original figure shows a shell bearing spiral ribs, typically strong, above and below. Spire high, whorls of spire ribbed. Description of original lot in U. S. Nat. Mus. by Bartsch indicates whorls rounded, keels subequal, peripheral keel not distinct, a distinct channel below the suture.

Type locality.—"Webber" (Weber) Canyon. Type lot in U. S. Nat. Mus.

Range.—Weber Canyon is the only place where the type form has been taken.

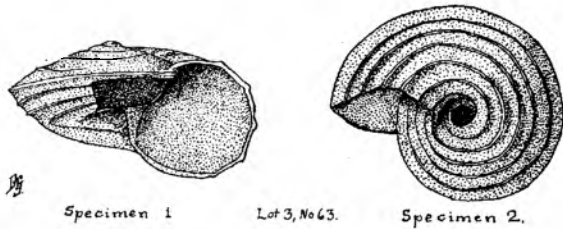
KEY TO SUBSPECIES AND FORMS OF *O. haydeni*

- a. Transverse ribs present in addition to spiral or longitudinal ribs, giving shell a knobby appearance. *O. h. corrugata*.
- aa. Transverse ribs not present.
 - b. Spiral ribs prominent.
 - c. Spiral ribs subequal, whorls rounded, shell not keeled, a distinct channel below the suture. *O. haydeni*.
 - cc. Peripheral rib more prominent than rest, forming a keel, peristome often continuous.
 - d. Ribs very prominent, usually 4 above periphery, and from 4 to 7 below. *O. h. wasatchensis*, typical form.
 - dd. Ribs less prominent, keel sharp and prominent, spiral riblets, between the ribs visible under a lens, aperture often depressed.
 - O. h. wasatchensis* form *gabbiana* (in part).
 - bb. Spiral ribs visible only under lens.
 - e. Shell keeled.
 - f. Keel sharp. *O. h. wasatchensis* form *gabbiana* (in part).
 - ff. Keel almost obsolete, ribs barely if at all differentiated from riblets. *O. h. wasatchensis* form *utahensis* (often thrown in under *O. h. hybrida*).
 - ee. Not keeled, ribs barely if at all differentiated from spiral riblets.
 - O. h. hybrida*.

Discussion.—"O. *haydeni* does not differ from O. *strigosa depressa* in any important or diagnostic characters of the genitalia or dentition, but the features of the shell seem quite sufficient to give it specific rank.

The typical form, from Weber Canyon in the Wasatch

Range has not been collected alive so far as I know. The forms examined agree pretty closely in soft anatomy." (Pilsbry, 1916.)



Oreohelix haydeni (Gabb) varieties.
Fillmore Canyon, Utah — = $\frac{1}{8}$ in.

Fig. 22

Oreohelix haydeni oquirrhensis (Hemphill)

THE OQUIRRH MOUNTAIN INTEGRADE

Patula strigosa var. *oquirrhensis* Hemphill in Binney, *Terr. Air-breathing Moll.* V, 2nd Suppl., 1886, pp. 27, 30, 34, pl. 2, fig. 2.

Patula strigosa var. *gabbiana* Hemphill in Binney, *Terr. Air-breathing Moll.* V, 2nd Suppl., 1886, pp. 27, 30, 34, pl. 2, fig. 9.

Patula strigosa var. *utahensis* Hemphill in Binney, *Terr. Air-breathing Moll.* V, 2nd Suppl., 1886, pp. 27, 30, 33 (not including Binney's description on p 33 or the figure cited by him).

Oreohelix hemphilli Newcomb (in part Utah records).

Oreohelia bruneri Ancey.

Oreohelix haydeni oquirrhensis Pilsbry, *Naat.*, XXIX, 1916, p. 141. Here Pilsbry acting under his right as first reviser, selects *oquirrhensis* as the species name, synonymizing Hemphill's typical *haydeni* and *hemphilli* records with it. He gave *gabbiana* and *utahensis* as probable synonyms, but Henderson and Daniels, 1917, p. 80, reduce *gabbiana* to a form name and recommend dropping *utahensis*. Henderson, 1924, says, "It may be by some considered convenient to retain the names *utahensis* and *gabbiana* for convenience, but if so they should not be given sub-specific rank."

Utah Localities.—

Previous records: Oquirrh Mts. (Binney, 1878.)

Near Salt Lake City. (Pilsbry, 1898.)

Oquirrh Mts., forms typical *oquirrhensis*, *gabbiana* and *utahensis*. (Henderson and Daniels, 1916, 1917.) Two points in 1916, Oquirrh Mts., southwest of Garfield, southeast of Black Rock and Morris, same vicinity, 30 live specimens secured; one live specimen found in 1917.

Zion Canyon, Zion National Park. (Vanatta, 1921.)

Devil's Slide, form *gabbiana*. Henderson and Daniels, 1917.)

Duplicate record: Lake Point, near Garfield, Oquirrh Mts southwest of Black Rock, form *gabbiana*. This is near the type locality. A few dead shells along with *O. strigosa depressa*. (U. of U. Zoo. Mus., No. 583.)

New records: Ogden Canyon, form *gabbiana* (Hemphill), One-fourth mile below power dam, one-half mile below Pine View Lodge, depression along north side of road, several specimens, one anatomy of extreme specimen, several intergrading with the *O. strigosa depressa*. (U. of U. Zoo. Mus., Nos. 563 and 564; intergrades No. 565.)

Big Cottonwood Canyon, form *gabbiana*, Mill B, flat at side of road, with *O. strigosa depressa*. (U. of U. Zoo. Mus., No. 680.)

Skull Valley, Tooele Co., cliff one mile from south end of Stansbury Mts. (U. of U. Zoo. Mus., No. 1547, identified by Henderson as *O. haydeni gabbiana* (Hemphill).).

Any material intergrading between *O. strigosa depressa* and *O. haydeni* should be placed in this group which is a protean type representing complete integradation. It is characterized by having a compound spiral structure of ribs and riblets of the *haydeni* type from which it is separated by having the shell keeled.

Type locality. — Oquirrh Mountains, Utah, near Garfield.

Range.—Utah.

Discussion.—The following description of forms of this subspecies was compiled from Henderson and Daniels, 1917:

Form typical *oquirrhensis*. Robust shell, with strong revolving ribs, whorls angular rather than rounded, peripheral keel or carina larger and more prominent than others. In specimens previously found there is no distinct channel below the suture as in typical *haydeni*. Ribs below sharply keeled periphery vary in number from 4 to 7, and are usually somewhat unequal in prominence or spacing or both. Above the keel there are usually 4 ribs, sometimes only 3.

Form *gabbiana* (Hemphill). Type locality—Oquirrh Mts., probably nearly east of Morris, near Garfield. Less robust, periphery compressed into a distinct keel, with less pronounced, weak, and sometimes obsolete ribs. Primary spirals usually visible to the unaided eye, secondaries visible under a lens. It has distinctly the two series of spiral characteristics of the *haydeni* group—a few ribs with intercalated riblets.

This is a strong carinated form, otherwise resembling Hamphill's variety *hybrida*, from Logan. In the best specimens the revolving riblets may be seen with the naked eye, with revolving threads in the interspaces visible under a lens, the intersections of these riblets and



Oreohelix haydeni oquirrhensis (Hemph)
Form *gabbiana* (Hemph) — = $\frac{1}{4}$ in.
Ogden Canyon, Utah.

Fig. 23

threads with the irregular transverse riblets give to it a knobbed appearance as seen under the lens. This sculpture is characteristic of the *haydeni* group. The primary revolving riblets, six or eight in number, are rather regularly spaced, especially below. Most of our specimens are under 16 mm. in diameter, but the largest one measured is 22 mm., and has two rather strong color bands, one barely below and the other very well above the periphery.

Form *utahensis* (Hemphill). Type locality—region of the subspecies, “detached pile of rocks,” “at foot of the mountain.” Smoother than *gabbiana*, with less pronounced keel. Hemphill in a letter to Binney said, “This has the form of *hemphilli* (Hemphill’s *hemphilli* now synonymized with *O. h. oquirrhensis*), but is destitute of the revolving ridges of *haydeni*. The specimens were all constant in sculpturing, but varied very much in size and somewhat in form.”

Henderson and Daniels took some where the periphery is not pinched into a keel, but we cannot see how these could be separated from *O. h. hybrida*. Spire high, or low, spiral sculpture weaker than *gabbiana*, in most specimens the microscopic riblets are crowded and subequal instead of a few strong ribs with intercalated riblets. However, in a few examples the compound spiral structure is distinctly present, thus forming a series grading into the form *gabbiana*. This form is “destitute of the revolving ribs (not of the riblets) of *haydeni*.”

It is recommended that this form name be dropped. In our collections this material has not been separated from *O. s. depressa*. See also comments under *O. h. hybrida*.

The form *gabbiana* appeared very distinct in the field. In Ogden Canyon, it was found associated with *O. strigosa depressa*. No specimens of typical *oquirrhensis* were found in these colonies, although Henderson and Daniels found *gabbiana* grading with typical *oquirrhensis* in the Oquirrh Mountains. Our material from Fillmore Canyon seems to grade from *utahensis* to *oquirrhensis*, but it was washed down in the creek bed. Collections made by us at the type locality and by Dr. Chamberlin in Big Cottonwood Canyon show no signs of typical *wasatchensis*. Henderson and Daniels at Logan found no sharply ribbed forms, but only *hybrida* and *utahensis*. Thus it seems that forms intermediate between *O. s. depressa* and *O. h. gabbiana* can be offshoots of isolated colonies of the former.

Recently (Pilsbry, 1916, Proc. Acad. Nat. Sci. Phila.) a new form, *O. haydeni mixta* Pilsbry, was described from Glenwood Springs, Colorado. As it is very similar to *O. h. wasatchensis*, form *gabbiana*, all previous *gabbiana* records in Colorado were synonymized with it. This should not confuse Utah collectors, who should continue to use the term *gabbiana*. Pilsbry states that the Colorado form, *mixta*, differs in the following respects: The embryonic shell of *O. h. gabbiana* has stronger spirals both above and below near the end of the last embryonic whorl; its periphery is less pinched out, and it is less depressed. The adult *gabbiana* is usually more strongly angular or keeled.

Oreohelix haydeni corrugata Henderson and Daniels

THE CORRUGATED LAND SNAIL

Oreohelix haydeni corrugata Henderson and Daniels, *Proc. Acad. Nat. Sci. Phila.*, LXVIII, 1916, p. 337, pl. 17, fig. 1.

Utah Localities.—

Previous record: Southeast of Webster. (Henderson and Daniels, 1916.)

New localities: See under *O. haydeni*.

Shell rather globose; spire elevated, one or two examples tabulate; whorls 5 to 5½, ample, convex, last one scarcely carinated at the periphery on elevated specimens; spiral sculpture strong, closely resembling that of typical *haydeni* and the subspecies *betheli*, consisting of an average of about 13 strong, sharp ridges (in a few examples scarcely stronger than the riblets), the interspaces much broader and occupied by from 3 to 6 spiral riblets or threads; numerous crowded, irregular, transverse, riblets and growth lines roughen the shell and give to the spiral ridges and riblets a knobbed appearance under a lens; color pinkish-white to white, first two or three whorls dark horn-color; altitude of type in U. of C. Mus., 14 mm.; greater diameter, 18 mm.; lesser diameter, 15.7 mm.; cotype in collection of L. E. Daniels, 13 mm.; greater diameter, 18.5 mm.; lesser diameter, 16 mm.; cotype in Mus. Acad. Nat. Sci. Phila., altitude, 14 mm.; diameter, 19.7 mm.; umbilicus deep and very narrow, almost cylindrical, exhibiting whorls to the apex. The shell is more globose, the whorls of greater caliber and the umbilicus much narrower than in typical *haydeni*, and typical *betheli* is even more depressed and widely umbilicated. (Original description.)

Type locality.—“Station 40, a small mountain of Paleozoic limestone nearly isolated from the main chain, south of west from Station 39, and southeast of Webster, Utah, under the shrub *Kunzia tridentata* and coarse-leaved herbaceous plants, and in one place in a small rock slide. Abundant. This subspecies forms another exception to Hemphill's observations concerning the geographic dividing line between the transversely-ribbed and longitudinally-ribbed forms.” (Binney's 2nd Suppl. Terr. Moll., p. 31, 1886.)

Range.—Near Webster, Utah, and possibly at Fillmore Canyon, Utah.

Oreohelix haydeni hybrida (Hemphill)

THE SPIRALLY-THREADED SNAIL

Patula strigosa var. *hybrida*, Hemphill, *Naut.*, IV, 1890, p. 17.

Oreohelix haydeni hybrida Henderson and Daniels, *Proc. Acad. Nat. Sci. Phila.*, LXVIII, 1916, pp. 324, 335, pl. 15, fig. 4.

Utah Localities.—

Previous records: Near Logan. (Hemphill, 1886, 1890.)

Near Logan. (Henderson and Daniels, 1916.)

Deweyville and Devil's Slide. (Henderson and Daniels, 1917.)

Garden City and Devil's Slide. (Pilsbry, 1916.)

New records: See discussion below and records under *O. haydeni*.

Discussion.—"The variety of *strigosa* just assuming the *haydeni* sculpturing." Ribs microscopic. Keeled or not keeled. If the form *utahensis* be kept under *O. h. wasatchensis* it can be separated from this form only by restricting this species to the non-keeled variety. Henderson advises dropping *utahensis* and in his collecting has included keeled forms here. Undoubtedly many specimens of this variety have not been separated from our *O. strigosa depressa* material.

Type locality.—Near Logan, Utah.

Range.—Northern Utah and southern Idaho.

Oreohelix eurekaensis Henderson and Daniels

THE EUREKA LAND SNAIL

Oreohelix hemphilli eurekaensis, Henderson and Daniels, *Proc. Acad. Nat. Sci. Phila.*, LXVIII, 1916, p. 321, pl. 15, figs. 7 and 8.

Oreohelix eurekaensis, Pilsbry, *Nautilus*, XXXI, 1918, pp. 94, 95.

Utah Locality.—

Previous record: Eureka. (Henderson and Daniels, 1916, 1917.)

Shell small, sublenticular; spire slightly elevated; whorls $4\frac{1}{2}$ to $4\frac{3}{4}$, strongly carinated at the periphery, the carina having a tendency to disappear toward the aperture of adults; whorls well rounded above, sloping roundly in to the suture so as to form an excavated suture, and on the other hand sloping flatly to the periphery; transverse sculpture well marked, irregular; spiral sculpture consists, in the type, of 6 minute, beaded lines below the periphery, with very indistinct lines in the interspaces and in the edge of the umbilicus; similar sculpture above, but not so well defined nor so plainly of two grades; on the cotypes the lines are not so well defined and not so plainly of the two grades below; umbilicus wide, exhibiting all the volutions; apical whorls brown, very dark brown in the type, chang-

ing to dirty white on the last whorl; two very obscure dark spiral bands, one above, the other barely below the periphery. Type, in the U. of C. Mus., greater diameter, 9.7mm.; lesser diameter, 8.8 mm., altitude, 5.5 mm. Cotype, in Acad. Nat. Sci. Phila., greater diameter, 9.3 mm.; lesser diameter, 8.5 mm.; altitude, 6.5 mm. (Original description.)

Type locality.—"On the north side of Godiva Mountain, in Eureka, Utah, on a slope of Paleozoic limestone, under shrubs and other vegetation, no good rock slides exposed. Seven specimens, all dead shells, associated with *O. cooperi* (small form). The type and cotypes are adults, and one specimen in L. E. Daniels' collection probably fully adult but with the peristome partly broken away." The dwarf form of *cooperi* in this locality is stated to average uniformly 14.5 mm.

Range.—Known only from Eureka, Utah.

Genus **MICROPHYSULA** (Cockerell) Pilsbry

Shell clear, smooth, glassy, discoidal, with flat or very low spire of closely coiled whorls, the last embryonic whorl with microscopic spiral lines; aperture deeply lunate. (Pilsbry.)

Genotype.—*Helix ingersolli* Bland.

Discussion.—In recent years *M. ingersolli* has commonly been included under *Thysanophora*. In establishing *Microphysula* Dr. Pilsbry says: "While this genus resembles *Thysanophora* and *Hojeda* somewhat, the differences in details of the reproductive organs, dentition and kidney seem quite enough for generic distinction. Moreover the discoidal, close-whorled, clear and glossy shell is rather characteristic and the zonal distribution is wholly diverse."

Microphysula ingersolli (Bland)

THE MANY-WHORLED SNAIL

Helix ingersolli, Bland, Ann. N. Y. Lyc. Hist., XI, 1876, pp. 150,151.

Microphysa ingersolli convexior Ancey, 1877.

Patula (Thysanophora) ingersolli Cockerell, *Naut.*, III, 1890, p. 103.

Thysanophora ingersolli Pilsbry, *Man. Conch.*, 2nd Ser., IX, 1894, pp. 55, 57.

Utah Localities.—

Previous records: American Fork Canyon. (Ingersoll, 1877.)

Summit Canyon (Mt. Nebo). (Ingersoll, 1877.)

Ogden. (Binney, 1878.)

Logan Canyon. (Binney, 1886.)

Ogden and Logan Canyons. (Henderson and Daniels, 1916, confirming above.)

Logan. (Henderson and Daniels, 1916.)

Duplicate records: Ogden Canyon, one-half mile below dam. (U. of U. Zoo. Mus., No. 267.) Gulch opposite the Hermitage. (Nos. 857 and 796.) Pine View Lodge. (Nos. 660 and 661.)

American Fork Canyon, one mile above Timpanogos Cave, weathered. (U. of U. Zoo. Mus., No. 943.)

New records: La Sal Mts., Mt. Tukuhnikivatz, one specimen collected by V. M. Tanner. (U. of U. Zoo. Mus., No. 1481.)

Big Cottonwood Canyon, Mill D branch. (U. of U. Zoo. Mus., Nos. 954 and 692.) Rollway Flat in same canyon. (No. 704.)

Fillmore Canyon. (U. of U. Zoo. Mus., Nos. 1004 and 1158.)

Provo Canyon, North Fork, Alpine Camp. (U. of U. Zoo. Mus., No. 923.) Two miles below Alpine Camp. (No. 751.)

Beaver Canyon. (U. of U. Zoo. Mus., No. 1179.)

Zion Canyon. (A. M. Woodbury reports that Dr. Pilsbry found *Microphysula ingersolli* there during his 1927 visit. Mr. Woodbury has failed to find it since. We found none in our collections from this locality.)

Parley's Canyon, in Lamb's Canyon. (U. of U. Zoo. Mus., No. 963.)

Kamas, Beaver Creek region. (U. of U. Zoo. Mus., No. 642.)

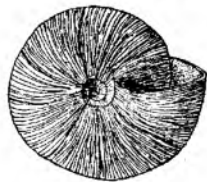
Cedar Canyon, ten miles from mouth of canyon. (U. of U. Zoo. Mus., No. 1148.)

City Creek Canyon, at Stepping Stone Spring. (U. of U. Zoo. Mus., Nos. 676 and 779.)

This snail may be recognized by the great number of whorls, usually six or more in adults, and by the flat or almost flat spire. As each successive whorl embraces the preceding one, it covers up the latter in part dorsally, thus giving the appearance of very small, parallel whorls in the spire and a comparatively large body whorl. Aperture lunate. Umbilicus very narrow, but perforate. Whorls squarish. Lines of growth very fine. Shell often transparent; white when weathered. Animal often white. Greatest diameter 4.3 mm., height 2 mm. Habitat, under leaves in canyons. Common in moist places.

Type locality.—Colorado.

Range.—Montana, Idaho, Utah, Colorado, New Mexico.

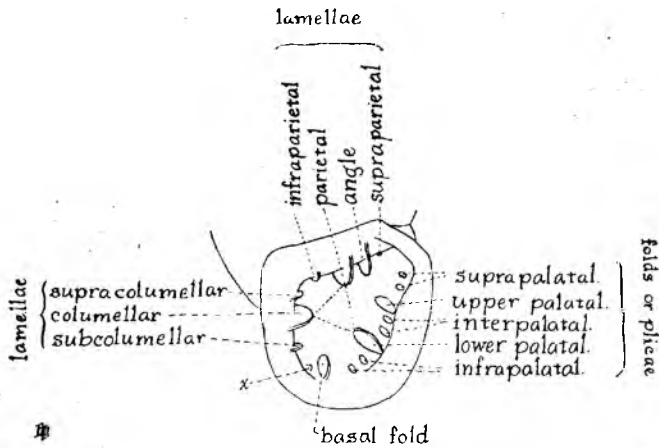


Microphysula ingersolli (Bland)
Salt Lake City, Utah.—1 mm

Family PUPILLIDAE Turton

In this family the shells are small, often minute, proportionately high, from conical to nearly cylindrical with apex obtuse or blunt, of many whorls (5-9); aperture rounded, small, with or without teeth, sometimes plicate; lip more or less reflected; umbilicus not covered. Jaw smooth or striate. Ureter straight.

This large family of small snails, which live under decaying leaves and other vegetable matter, is of world-wide distribution. Eleven species, included in four genera, are at present known to occur within our limits.



Nomenclature of pupoid teeth (after Pilsbry & Vanatta)

Fig. 25

Genus PUPOIDES Pfeiffer

TAPERING PLAIN-MARGINED SNAILS

Shells very small, slender, subcylindrical or fusiform, of many whorls (6-7), smooth and shining, the striae of growth scarcely apparent; aperture rounded oval; lip thickened and reflected, edentulous.

Genotype.—*P. marginatus* (Say).

A genus distributed over the entire world exclusive of Europe. Of the three known North American species, one occurs in Utah.

Pupoides marginatus (Say)

THE PLAIN-MARGINED SNAIL

Cyclostoma marginata, Say, *Journ. Acad. Nat. Sci. Phila.*, II, 172, (1821).

Utah Locality.—

New record: Zion National Park, A. M. Woodbury, collector, very rare, two specimens only found. (One of these U. of U. Zoo. Mus., No. 1496.)

Shell fusiform, regularly diminishing in volume from the body-whorl to the apex, smooth; epidermis brownish horn-color; whorls 6, very convex, striae of growth hardly apparent; suture well impressed; aperture lateral, rounded-oval; peristome white, rather broadly reflected, lined with white callus, its right termination strongly curved; umbilicus perforated. Length, $5\frac{1}{2}$ mm.; diameter, 2- $2\frac{1}{2}$ mm.; aperture, $1\frac{2}{3}$ mm. long. (Binney, 1885, as *Pupa fallax*, a synonym.)

Range. — United States, east of the Rocky Mountains.

Discussion.—The callus on the specimen taken was transparent and hardly evident. It compared favorably with *Pupoides marginatus* from Iowa. *Pupilla hordaceus* (Gabb) was also considered, but this shell is too tapering for that species, and there is no evidence of tecth as that species sometimes possesses.

Mr. Woodbury in reporting this snail says, "This snail is apparently very rare in the Park. In three seasons of casual collecting, I have found two shells only, and at the time of collecting, I did not distinguish them from either *Cochlicopa* or *Pupilla* and consequently do not know whether they were collected at the Public Camp Ground, the Grotto, Weeping Rock, or the Court of the Patriarchs."

Genus PUPILLA Leach

THE FEW-TOOTHED COLUMNAR SNAILS

Shells minute, less than 5 mm. in height, subovate or conical, the apex obtuse; with impressed sutures; smooth, corneous and somewhat shining; aperture rounded, armed with 1 to 3 denticles or with none; lip expanded, slightly reflected, rounded on outer side. All four tentacles present.

Genotype.—*Pupilla apertura* Barn.



Pupoides marginatus (Say)

Zion National Park, Utah

— = 1 mm

Fig. 26

KEY TO SPECIES

This key will not identify the young. Shells must have the lip added to be identifiable.

a. No denticles.

b. Diameter approximately one-half of length. . . . *Pupilla hebes*.

bb. Diameter often more than one-half of length.

c. Not constricted near body whorl. Shell dextral.

Pupilla blandi (edentulous).

cc. Constricted at body whorl, spire more or less club shaped. Shell dextral or sinistral.

d. Sinistral. *Pupilla syngenes* (edentulous).

dd. Dextral. *Pupilla syngenes dextroversa* (edentulous).

aa. Denticles present.

e. Small, length slightly over 2 mm. *Pupilla stoneri*.

ee. Larger, one or more teeth on the upper margin of aperture.

f. Tooth also on lower margin. *Pupilla muscorum*.

ff. Tooth not on lower margin (may be within on lower wall).

g. Tooth on columella, and one within on lower wall.

Pupilla blandi.

gg. No teeth on columella or lower wall.

h. Shell sinistral. *Pupilla syngenes*.

hh. Shell dextral. *Pupilla syngenes dextroversa*.

***Pupilla muscorum* (Linnaeus)**

THE TWO-TOOTHED SNAIL

Turbo muscorum Linnaeus, *Syst., Nat.*, Ed. X, p. 767, 1758.

Pupilla badia Morse, *Journ. Portland Soc. N. Hist.*, I, p. 37, figs. 89-91, pl. X, fig. 92, 1864.

Utah Locality.—

Previous record: American Fork Canyon. (Ingersoll, 1877.)

Shell perforate, cylindrical, subfusiform, obtuse at both extremities; epidermis dark chestnut color, or bay; whorls six to seven, rounded, the anterior four of about equal diameter; suture deep; aperture lateral, nearly circular, small, its diameter equal to two-thirds the diameter of the last whorl, a thin testaceous deposit forming a thickened margin internally, sometimes bearing an obtuse tubercle; upon the parietal wall a single tubercle; transverse margin subreflected; lip slightly reflected. Length, 4 mm.; breadth, 1½ mm. (Binney and Bland.)



Pupilla muscorum (L)
From Henderson 1924.

Fig. 27

Range.—Europe; in America, New England and Canada; Anticosti; the northern United States as far west as Montana, Alpine (8,000-9,000 feet) in Colorado, Utah, and Nevada; northward in British America, Laggan, Alberta; Anuk, Alaska. (Dall, 1905.)

Discussion.—We failed to take this species. A form known as *Xerobia* Pilsbry, commonly ranked as a subspecies, is reported to be the common form in Colorado.

Pupilla blandi Morse

BLAND'S SNAIL

Pupilla blandi Morse, Ann. N. Y. Lyc., VIII, 211, fig. 8, Nov., 1865.

Utah Localities.—

Previous records: Summit Canyon, Mt. Nebo. (Ingersoll, 1877.)

Ogden and Wasatch Mts. (Binney, 1886.)

Near Tooele; below Cache Junction; Logan Canyon; Ogden; Salina; Devil's Slide; and Eureka. (Henderson and Daniels, 1916 and 1917.)

Duplicate records: (Ogden Canyon, one-fourth mile below power dam. (U. of U. Zoo. Mus., No. 767.)

Logan Canyon, near divide. (U. of U. Zoo. Mus., Nos. 1358 and 1359.)
Five miles from mouth. (Nos. 1303 and 1327.)

New records: Bear Lake, west shore, camp ground north of Garden City. (U. of U. Zoo. Mus., No. 1386.)

City Creek Canyon, Stepping Stone Spring. (U. of U. Zoo. Mus., Nos. 673 and 781.)

Divide between Provo Canyon and American Fork Canyon. (U. of U. Zoo. Mus., No. 747.)

Provo Canyon, Two miles below Alpine Camp. (U. of U. Zoo. Mus., No. 752.)

Rich County, in mud deposits along stream, five miles from Evanston, Wyo., material poor. (U. of U. Zoo. Mus., No. 1351.)

Big Cottonwood Canyon, Mill D branch. (U. of U. Zoo. Mus., No. 695.)
Rollway Flat, same canyon. (No. 711.)

Kamas, Beaver Creek region, Summit Co. (U. of U. Zoo. Mus., No. 643.)

Moroni, south of town. (U. of U. Zoo. Mus., Nos. 1027 and 1113.)

Parley's Canyon, in Lamb's Canyon branch. (U. of U. Zoo. Mus., No. 960.)

Cedar Canyon, toward head of canyon. (U. of U. Zoo. Mus., No. 1168.)
Ten miles from mouth of canyon, teeth not well developed. (No. 1150.)

Panguitch Creek (South Fork of Sevier River), near Spry Station, material broken. (U. of U. Zoo. Mus., No. 1070.)

Shell rimate, ovate cylindrical, delicately striated, opaque, light brown; apex obtuse, nucleus with microscopic granulations; suture well defined; whorls six, subconvex, the last ascending at the aperture, rapidly expanding, with an external whitish callus, between

which and the peristome there is a deep constriction; aperture small, nearly circular, with three obtuse teeth of about equal size, one on the parietal margin, one on the columellar margin, and the third far within and at the base of the aperture; peristome subreflected, the margins joined by a thin callus. Length .13 inch, breadth .06 inch, (Morse.)

Range.—Upper Missouri, Rocky Mountains; New Mexico to Colorado; Canada; Red Deer, Alberta.

Type locality.—Ft. Berthold, in drift on Missouri River.

Discussion.—From our collecting we have no doubt that the variation of this form causes it to pass for others. Some colonies may have only a few individuals with the full dentition, though in most cases they run typically uniform. The one figured is perhaps shorter than the average. *Pupilla blandi* is found under leaves in moist places in timbered regions.

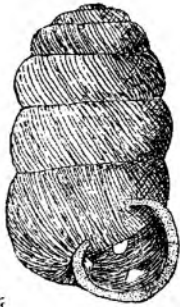


Fig. 28
Pupilla blandi Morse
Moroni, Utah — = $\frac{1}{2}$ mm.

Fig. 28



Pupilla hebes (Ancey)
From Henderson 1924
— = 1mm. 卍

Fig. 29

Pupilla hebes (Ancey)

THE PLAIN COLUMNAR SNAIL

Pupilla hebes, Pilsbry, *Manual Conch.*, 2nd Ser., XXVI, 1921, pp. 164-166.

Utah Localities.—

Previous record: San Juan Co. (Pilsbry, 1921.)

New records: Bear Lake, west shore, camp ground north of Garden City, species questioned and may be edentulous *P. blandi*, though Henderson reports this species from across the line near St. Charles, Idaho. (U. of U. Zoo. Mus., No. 1385.)

Beaver Canyon, species questioned for this locality. (U. of U. Zoo. Mus., No. 1176.)

Discussion.—*Pupilla hebes* is a much shorter form than *P. blandi*, and has the aperture without teeth.

Pupilla syngenes (Pilsbry)

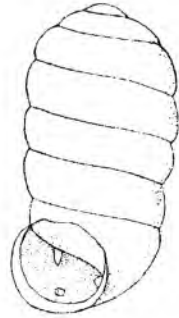
THE LEFT-HANDED COLUMNAR SNAIL

Pupa syngenes Pilsbry, *Nautilus* IV., p. 3, May, 1890.

Utah Locality.—

New record: Zion National Park, collected by A. M. Woodbury. (U. of U. Zoo. Mus., No. 1493.)

Shell sinistral, cylindrical but somewhat wider above, blunt at each end; light brown, whitish toward the apex; surface shining delicately obliquely striate; apex large, obtuse; suture impressed; whorls 8, the last one compressed and flattened around the lower outer portion, its last third ascending on the next earlier whorl and elevated into a high rounded ridge or crest a short distance behind the outer lip; aperture slightly oblique; truncate oval in form; the outer lip narrowly expanded; basal and columellar margins broader; about the middle of the parietal wall, or nearest the upper end there is a small parietal lamella; far within there may be seen a blunt, columellar lamella; and some specimens exhibit far within the outer lip the trace of an inferior or lower palatal fold. (Pilsbry.)



Pupilla syngenes Pilsbry
Zion National Park, Utah.

— = 1mm. B.J.

Fig. 30

Range.—Arizona, Montana, New Mexico, southern Utah.

Type locality.—This sinistral species was based on specimens from Arizona, the exact location unknown. (Pilsbry & Ferriss, 1911.)

Discussion.—“This is a very small snail and hard to find. I have to date located only one pure colony at the Saddle Nook between the Great Organ and Angel’s Landing, although a couple of shells of this left handed spiral were found in a colony of the right handed spiral form (*P. s. dextroversa*) at the public camp ground. I have not yet discovered the feeding ground of the living snails, but have found the shells under a grape vine among the dry leaves in a comparatively dry situation away from any proximity to water.” (A. M. Woodbury.)

***Pupilla syngenes dextroversa* (Pilsbry and Vanatta)**

THE REVERSED SNAIL

Pupa syngenes Pilsbry form *dextroversa* Pilsbry and Vanatta, *Proc. Acad. Nat. Sci. Phila.*, 1900, p. 606.

Utah Localities.—

New records: Zion National Park, collected by A. M. Woodbury. (U. of U. Zoo. Mus., No. 1492.)

Lofgren, A. M. Woodbury col., two specimens, one broken in examination.

Verdure. (U. of U. Zoo. Mus., No. 1608.) Torrey. (No. 1663.) Fruita. No. 1610.) Collected by Berry.

Form *dextroversa* Pilsbry and Vanatta (n. f.) is dextral, with 8½-9 whorls. San Rafael, N. M., collected by Rev. E. H. Ashmun. Eighty-seven per cent of the specimens taken at this locality were of the dextral form. (Pilsbry and Vanatta.)

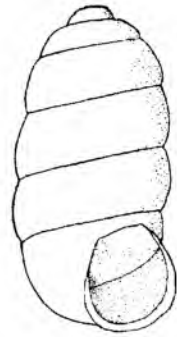
Pilsbry and Ferriss, 1911, after discussing *P. syngenes*, gives the following:

"*P. s. dextroversa* is subcylindric, a little wider near the upper end. The last whorl is flattened laterally, with a strong rounded crest and a deep constriction behind the lip, which is thin and very narrowly expanded. The parietal lamella is slightly over one-fourth of a whorl long; the columellar lamella small and deeply immersed and the lower parietal nodule well developed or weak, but invariably present in adult shells. The size varies. (Length 4 mm., diameter 1.7 mm., whorls 9; length 3 mm., diameter 1.6 mm., whorls 7½.) . . . The specimens from San Rafael and Holbrook are mirror images of the sinistral *P. syngenes* found with them."

Range.—Colorado, Arizona, New Mexico, southern Utah.

Type locality.—San Rafael, N. M., collected by E. H. Ashmun.

Discussion.—A. M. Woodbury says the following of this subspecies in Zion Park: "To date I have found shells of this subspecies only at the public camp ground under an ash tree over which grape vines were climbing. Its habitat is practically the same as *P. syngenes* and it is reported that colonies of the two often live together."



Pupilla syngenes dextroversa P&V.
Zion National Park, Utah — ½mm.

Fig. 31

Pilsbry and Ferriss, 1911, regard this species as more primitive than *P. syngenes*: "In *Pupilla* it is obvious that dextral forms are the more primitive, the sinistral forms derived from them. *P. syngenes dextroversa*, therefore, perpetuates the original stock of the species, of which *P. syngenes* is a divergent branch."

Pupilla stoneri sp. nov.

STONER'S SNAIL

Shell minute, rimately subperforate, subcylindrical, finely striated, polished, whorls five gradually increasing in size, sutures deep, peristome reflected but thin, the columellar margin being most broadly reflected, external margin of peristome slightly arcuate laterally and almost shouldered apically. Aperture armed with denticles, parietal, one lamelliform, strongly developed, slightly twisted, well within the aperture. This one extends more than half way across the aperture, columellar tooth well developed, situated on the fold of the reflected columellar margin. The labrum well within the aperture is produced into three well defined, plicae or folds—a basal, an upper palatal, a lower palatal, and an imperfectly developed fourth fold back of the parietal tooth.



Pupilla stoneri sp. nov.
Cedar Canyon, Utah. — = $\frac{1}{2}$ mm.

Fig. 32

The holotype is a weathered gray. Length 2.1 mm., basal diameter 1 mm. Type locality—Cedar Canyon, about ten miles from the mouth. Cedar City region, Utah. The holotype is No. 1053, University of Utah, Zoology Museum.

Paratype 1 is a rich horn-brown. It has the parietal tooth less lamelliform, and the upper and lower palatals and fold back of the parietal tooth very strongly developed while the basal fold is lacking. The peristome on this specimen is continuous. Paratype 1 is in the personal collection of David T. Jones.

Paratype 2, horn-colored, somewhat weathered on body whorl. Teeth almost as in holotype except parietal tooth is not as long. Upper and lower palatals weakly developed, other folds lacking. Peristome not continuous. This specimen shows the sinuous outer margin far better than the holotype or Paratype 1.

Paratype 3, horn-colored, striations showing nicely on early whorls. Teeth developed as in Paratype 2. Upper and lower palatals and the fold back of the parietal tooth fairly well developed. Sinuous outer margin well developed.

Paratype 4, horn-colored, peristome continuous, lamellar teeth short, columellar tooth especially. Lower palatal well developed, others lacking. Five whorls. Outer margin of peristome slightly sinuous. To be sent to the Academy of Natural Sciences of Philadelphia.

Specimen 1, weathered white, peristome continuous but worn on the lateral or outer margin. Lamellar teeth well developed, lower palatal fold only developed. Outer margin nearly straight as in holotype. Specimen was accidentally destroyed.

Specimen 2 shows teeth, but shell is badly weathered, and aperture is partially filled with mud. (U. of U. Zoo. Mus., No. 1154.)

Type locality.—Cedar Canyon, Cedar City region. This set was collected about ten miles from the mouth of the canyon.

Discussion.—The seven specimens of *Pupilla stoneri* were found in a collection from Cedar Canyon, approximately ten miles from the mouth of the canyon, on the south side, near a tributary stream that had very high banks. It was found under leaves and under stones along with *Pupilla blandi* Morse, from which it is easily separable on account of its minute size.

It most nearly resembles *Vertigo californica* (Rowell), differing chiefly in having a slightly sinuous outer margin on the peristome, and often a greater number of labral denticles.

A form known as *Vertigo californica* (Rowell) was listed from Colorado but these records are now thrown under *Vertigo concinnula* (Cockerell). The latter according to the figure in Henderson, 1924, p. 139, is very different from *P. stoneri* in having lamellate labral denticles on the margin, whereas *P. stoneri* has them non-lamellate, more numerous, and situated farther back in the aperture.

Pupilla rowelli (Newcomb) differs in having the labral denticles fewer in number and situated within the aperture on the edge of the peristome, whereas *P. stoneri* has all labral denticles except the first far back from the fold of the peristome. The labral denticles on *P. stoneri* more nearly resemble those on the eastern form *Vertigo bollesiana* Morse, except that they are not lamellate.

Vertigo gouldi (Binney) also deserves consideration. Some varieties of that form have the labral teeth situated back from the margin of the peristome. The transverse margin is more developed in this shell than in *P. stoneri*, and the latter shows no evidence of the second tooth on the apical margin of the aperture. *Vertigo gouldi* is also being eliminated from the Colorado list, being an eastern species.

As the labral denticles of *Pupilla stoneri* are situated so far back that only the first could be counted marginal, (thus with the parietal and columellar teeth equalling three apertural denticles) it seems to belong in the genus *Pupilla*. The indentation of the outer lip of the peristome in this species is not great enough to make it a characteristic *Vertigo*.

Genus **VERTIGO** Müller

THE MANY-TOOTHED COLUMNAR SNAILS

Shell minute, much higher than wide, in ours less than 5 mm. high, subcylindrical, ovate or conical, the whorls from 4 to 6; aperture irregular, multidentate, the denticles from 4 to 7, peristome expanded, the rim white, outer lip straight or indented above middle. With only two tentacles, the anterior (or inferior) pair being absent. Jaw wrinkled longitudinally or smooth, subrostrate in middle.

Genotype.—*V. pusilla* Müller.

KEY TO SPECIES

- a. Parietal, columellar, lower palatal and upper palatal teeth equally or about equally developed.
 - b. Denticles on or near margin, forming somewhat of a cross. Length $1\frac{1}{2}$ mm.; diameter 1 mm. *Vertigo coloradensis*.
 - bb. Denticles farther within margin. Length 2 mm. *Vertigo concinnula*.
- aa. Denticles unequally developed, shell slightly longer than the preceding.
 - c. Upper and lower palatal, set within aperture and small; shell robust. *Vertigo modesta corpulenta*.
 - cc. Upper and lower palatal denticles unusually developed, extending more than one-half way across aperture. Shell less robust than *V. m. corpulenta*. *Vertigo modesta parietalis*.

Vertigo modesta corpulenta (Morse)

THE CHUBBY SNAIL

Isthmia corpulenta, Morse, *Ann. N. Y. Lyc.*, VIII, 210, fig. 7 (Nov., 1865).

Vertigo modesta corpulenta, Pilsbry and Vanatta, *Proc. Acad. Nat. Sci. Phila.*, 1900, pp. 601, 609, pl. 23, fig. 7.

Utah Localities.—

Previous record: Ogden Canyon. (Binney, 1886.)

New records: Provo Canyon, North Fork at Aspen Grove, swampy ground, Collected by R. V. Chamberin. (U. of U. Zoo. Mus., No. 939.)

Shell rimate, perforate, elongate, ovate, finely striated, polished, translucent, dark olive brown; apex round, obtuse; whorls four, convex, tumid, wider at the base; aperture large, sub-circular, with four obese teeth, one on the parietal margin, one on the columellar margin, and two on the labrum; peristome slightly thickened and reflected. Length .10 inch, breadth .06 inch. (Morse.)

Type locality.—Little Valley, Washoe Co., Nevada; on east slope of Sierra Nevada, 6,500 feet above the sea.



Vertigo modesta corpulenta (Morse)

— = $\frac{1}{2}$ mm Provo Canyon, Utah.

Fig. 33

Range of *V. modesta*, including *corpulenta* and *parietalis*.—North America from New England to California and northward. Loess of Iowa.

***Vertigo modesta parietalis* (Ancey)**

THE LONG-TOOTHED SNAIL

Pupa corpulenta var. *parietalis* Ancey, *Conch. Béch.*, II, 1887, p. 80.

Vertigo modesta parietalis, Pilsbry and Vanatta, *Proc. Acad. Nat. Sci. Phila.*, 1900, pp. 601, 609, pl. 23, fig. 1.

Utah Locality.—

Previous record: Ogden Canyon. (Ancey, 1887.)

Shape somewhat more obese than *V. modesta*; whorls about five; teeth five, the angle lamella being developed. This form is intermediate between *modesta* and *corpulenta* in contour and size. It may be a case of dimorphism rather than a true variety, as it occurs in some places with four-toothed shells, and with the fifth lamella in various stages of development in apparent adults, as in the Dyea Valley. (Pilsbry and Vanatta.)

Type locality.—Ogden Canyon, Utah.

Range.—See *V. modesta corpulenta*.

Discussion.—Pilsbry and Vanatta, in the above-mentioned article say that Hemphill collected it from Ogden Canyon with *corpulenta*. The relation of *parietalis* to *corpulenta* should be worked out in the field.

***Vertigo coloradensis* (Cockerell)**

THE COLORADO COLUMNAR SNAIL

Pupa coloradensis Cockerell, *Jour. Conch.*, LV, 1889, p. 63.

Vertigo coloradensis Sterki, *Nautilus*, VI, 1892, p. 5.

Vertigo columbiana var. *utahensis* Sterki, op. cit., 1892.

Utah Localities.—

Previous records: Utah. (Sterki, 1892.)

Box Elder Canyon. (Pilsbury and Vanatta, 1900.)

New records: Between Blanding and Verdure, one specimen apparently weathered, palatal folds undeveloped, length 1½ mm. (U. of U. Zoo. Mus., No. 1592, Apr. 17, 1928.)

Verdure, weathered, with only columellar and parietal teeth showing, length 1¾ mm.; probably this species though nearer *P. stoneri* sp. n. in size, but sutures of latter much more deeply impressed and with more complete dentition. (U. of U. Zoo. Mus., No. 1602.)



Vertigo modesta parietalis (Ancey)
From Henderson 1924.

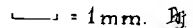
— = 1 mm. 

Fig. 34

Shell brown, shiny, thinnish, translucent enough to show teeth through (body whorl) from outside, striate, especially on the penultimate whorl. Outline oblong-oval, barrel-shaped, apex blunt. Whorls four. Aperture pyriform. Peristome brown, thick, continuous by a well-marked callus on parietal wall. Outer lip not constricted; a crest is indicated behind peristome, but not well developed. The teeth within the aperture are brown, one long one on parietal wall, one on columellar, and two, the lower one largest, on outer wall. Length $1\frac{1}{2}$ mm., diameter 1 mm. (Pilsbry and Vanatta.)

Type locality.—Near Swift Creek, Center Co., Col.

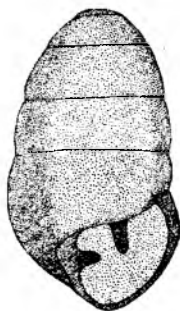
Range.—The only records at hand show this form to be confined to high elevations in Colorado and Utah.

Discussion.—The only Utah records we have of this shell have recently been synonymized with this species. Sterki in *Nautilus*, VI, 1892, p. 5, mentions *Vertigo columbiana* var. *utahensis* in Utah, but does not describe it. A brief descriptive comparison and measurements for *Vertigo columbiana utahensis* (Sterki MS., n. var.) is given by Pilsbry and Vanatta in *Proc. Acad. Nat. Sci. Phila.*, 1900, pp. 603, 609, with Box Elder Canyon, Utah, as the locality. Pilsbry in the *Manual of Conchology*, Second Series, XXV, 1920, says *utahensis* is an exact synonym of *coloradensis* and is not connected with *columbiana*. Thus the matter rests. Records of both Colorado and Utah forms are so meager, that future developments must await more extensive collecting in both old and new localities.



Vertigo coloradensis (Cockerell)
From Pilsbry & Vanatta 1900.

Fig. 35



Vertigo coloradensis (Ckrl.)
(Dentition imperfect)
Between Blanding & Verdure.

— = $\frac{1}{4}$ mm. *Utah*

Fig. 36

***Vertigo concinnula* Cockerell**

Vertigo concinnula Cockerell, *Nautilus*, 10, 1897, p. 135.

Utah Locality.—

New records: Lamb's Canyon, collected by Elmer G. Berry, August 11, 1928. (U. of U. Zoo. Mus., No. 1751.)

Big Cottonwood Canyon, collected by W. Gertsch, May 20, 1928. (U. of U. Zoo. Mus., No. 1684.)

Chestnut brown, shining, whorls five, upper three tapering to a blunt apex, last ascending toward aperture as in *Pupilla blandi*, one short entering parietal tooth, a smaller one to right and nearer upper angle, a strong entering columellar lamella, two long folds within outer lip, lower one the larger, height 2 mm., width 1.1 mm. (Henderson.)

Type locality.—Colorado, at higher elevations.

Range.—Colorado, New Mexico, and Utah.



Vertigo concinnula (Ckll)

Salt Lake City, Utah

— 1 mm

Fig. 37

Genus **COLUMELLA** Westerlund

HIGH ALTITUDE SNAILS

Shell very small, cylindrical, apex obtuse, the height in ours under 4 mm., whorls numerous and rounded, sutures distinct; aperture relatively large, edentulous; lip simple.

Genotype.—*C. edentula* (Draparnaud).

Columella alticola (Ingersoll)

THE HIGH ALTITUDE COLUMNAR SNAIL

Pupilla alticola Ingersoll, 8th Ann. Rept. Hayd. Survey (for 1874), p. 391, text figs.

Columella alticola Pilsbry, *Nautilus*, XXVI, 1912, p. 60.

Utah Locality.—

Previous record: Wasatch Mts. (Binney, 1878.)

Shell between 2.50 mm. and 3.50 mm. in height, long and cylindrical. Light brown in color with the apex much lighter, sometimes white. Spire elevated and with the apex obtusely pointed. Whorls 7 to 8, well rounded on the face and with the sutures well impressed. The last whorl in adult shells is of greater diameter than the one preceding it, while the next three above it are of about equal size; this expansion of the last whorl makes the shell slightly unsymmetrical. Peristome thin and acute,



Columella alticola (Ingersoll)

From Henderson 1924.

— 1 mm.

Fig. 38

without callus, thickenings or indentations in the palatal wall. Lines of growth weak and oblique; apex smooth. Aperture larger in proportion to the shell than in either *Sphyradium hastata* or *S. edentulum*; entirely without teeth or lamellae. The umbilicus is very slightly perforate.

Height 3.33 mm., diameter 1.74 mm.

Height 2.81 mm., diameter 1.11 mm.

Height 2.70 mm., diameter 1.14 mm.

This species is found at various places as a fossil in the Pleistocene and Loess deposits of the Mississippi Valley. It is also found in several states of the Rocky Mountain region at the present time; i. e., Utah, Colorado, and Wyoming.

Its abundance in the Pleistocene beds of Long Island, Phillips County, Kansas, shows that at one time this was a very common shell. Many specimens were found there in 1910 by Mr. Johnston and the junior writer. They were associated with *S. hastata* and other Pupillidae which are at the present time apparently extinct.

The species can not be confused with any other United States land mollusk. The much greater height of the shell and the greater number of whorls shows it at once to be distinct from *S. edentulum*. (Hanna, 1912.)

Family ACIATINIDAE Pilsbry

In this family the shell is moderately thick, more or less elongate, conical; without umbilicus; aperture smooth, large, rounded or oval; peristome sharp, simple. Columella generally truncated at the base. Jaw thin, median projection small.

A family embracing upwards of 200 species, but represented in Utah by only a single genus and species.

Genus COCHLICOPA Ferussac

THE FUSIFORM SNAILS

Shell oval oblong, subfusiform, or narrowly conical, the width being much less than the height, the height in ours not exceeding 6 mm.; smooth and glossy; no umbilicus; the aperture round to elliptic oblong. Jaw a little arched with a median projection but lacking ribs.

Genotype.—*C. lubrica* (Müller).

Cochlicopa lubrica (Müller)

Helix lubrica Müller, *Verm. Hist.*, I, 104, 1774.

Utah Localities.—

Previous records: Weber Canyon. (Dall, 1897.)

New records: Between Marysvale and Richfield, Sevier Co. U. of U. Zoo. Mus., No. 1132.)

Fillmore Canyon. (U. of U. Zoo. Mus., Nos. 1005 and 1155.)

Zion National Park, The Grotto. (U. of U. Zoo. Mus., No. 1100.)

Zion Park, collected by A. M. Woodbury. (No. 1490.)

Beaver Canyon. (U. of U. Zoo. Mus., No. 1173.)

Cane Springs, near Central. (U. of U. Zoo. Mus., No. 1480.)

Cedar Canyon, ten miles from mouth of canyon. (U. of U. Zoo. Mus., No. 1147.)

Utah Lake, at Provo, with drift. (U. of U. Zoo. Mus., No. 533.)

Verdure, San Juan Co., E. Berry col. (U. of U. Zoo. Mus., No. 1620.)

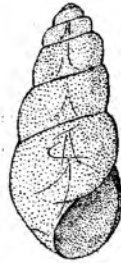
Between Verdure and Blanding. (U. of U. Zoo. Mus., Nos. 1583 and 1594.)

Shell small, thin, transparent, oblong-oval; epidermis smoky horn-color; smooth, very bright and shining; whorls five or six, somewhat rounded, the last equalling two-fifths the shell's length, rounded at the base; apex obtuse; suture somewhat impressed; aperture lateral, oval, its plane nearly parallel with the axis of the shell; peristome simple, thickened, often slightly rufous; umbilicus imperforate; columella obsoletely truncated at base. Length 6 mm., diameter $2\frac{1}{2}$ mm.; aperture $2\frac{1}{2}$ mm. long, $\frac{1}{2}$ mm. wide. (Binney and Bland, 1867, under the synonymous name *Cionella subcylindrica* Linn.)

Range.—Europe, North Africa and Asia Minor; Siberia, Kamchatka, most of North America. Lake Superior region; Red River of the North, Lake of the Woods and Turtle Mt., Manitoba; Moose Factory. English River, Keewatin; Laggan and Red Deer in Alberta; Nanaimo and Victoria, British Columbia; Point Barrow and Yukon Caley, Alaska; Avacha Bay. Kamchatka. (Dall, 1905.)

Discussion.—“This well known shell is one of the most emphatically circumpolar in existence and considering its immense geographical and climatic range, its resistance to the factors which make for variation is very remarkable.” (Dall, 1905.)

A direct comparison of the Utah material with specimens of *Cochlicopa lubrica* from Cambridge, Mass., and with similar specimens from Iowa Lakeside Laboratory, Milford, Iowa, collected by Dr. Bohumil Shimek shows that the Utah specimens tend to run slightly larger, though individual shells from Massachusetts equalled the Utah shells in length. The Utah shells that we collected did not have as high a polish as either Iowa or Massachusetts material. The Iowa material showed very fine, almost imperceptible striations, which were not evident on shells from Massachusetts or Utah. The peristome of the Utah shells were not thickened so much as those of the eastern forms.



Cochlicopa lubrica (Müller)
Sevier County Utah ♂
— = 1 mm.

Fig. 39

Family ZONITIDAE Pfeiffer

In members of this family the shell is small, delicately thin, and more or less transparent; usually with umbilicus; commonly depressed, but with the spire more or less distinctly elevated above the last whorl; lip characteristically thin, acute, not reflected.

Most readily distinguished from the Helicidae by the thin margin of the aperture.

These small forms occur in such places as under damp decaying leaves and wood. Seven species in five genera are known from Utah.

Genus **VITRINA** Draparnaud

THE GLASSY SNAILS

Shell small, not wholly enclosing animal, very thin and shining, transparent, often of vitreous appearance; no umbilicus; spire short, composed of 2 or three whorls of which the last is large; aperture large, lunate or rounded lip thin, frequently membranous.

Body elongate. Tentacles very short. Respiratory opening in mantle is farther back than usual in, e. g. *Limax*. No mucus genital glands and no dart sac.

Genotype.—*Helix purtris* Linnaeus.

Vitrina alaskana Dall

THE GLASSY ALASKA SNAIL

Vitrina alaskana Dall, *Harriman Alaska Expedition*, Vol. XIII, 1910, p. 37.

Utah Localities.—

Previous records: St. George. (Binney, 1878.) Logan Canyon; Weber Canyon; Salt Lake City. (Binney, 1886.)

Summit Canyon; Mt. Nebo. (Ingersoll, 1877.)

Near Tooele; Taylor Canyon; Near Ogden; Below Wheelon; East of Webster; Mouth of Logan Canyon; North Fork of Logan Canyon; North of Logan; Southeast of Logan; Northeast of Deweyville; Ogden; Below Devil's Slide. (Henderson and Daniels, 1917.)

Duplicate records: Ogden, in city. (U. of U. Zoo. Mus., Nos. 892, 554, 854, and 860.)

Logan Canyon, 5 miles from mouth. (U. of U. Zoo. Mus., No. 1372.)

Just over summit of divide. (No. 1377.) Two miles from mouth. (No. 1343.) Near Power plant at mouth of canyon. (No. 1344.)

City Creek Canyon, one and one-half miles from mouth. (U. of U. Zoo. Mus., 774.) Two and one-half miles from mouth. (No. 800.) Stepping Stone Spring. (Nos. 677 and 784.)

Ogden Canyon, gulch opposite the Hermitage. (U. of U. Zoo. Mus., No. 765.) Pine View Lodge. (Nos. 659 and 662.) One-fourth mile below power dam. (No. 765.) At mouth of Canyon. (No. 589.)

Emigration Canyon, near mouth. U. of U. Zoo. Mus., No. 580.)

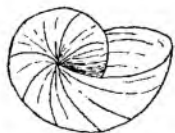
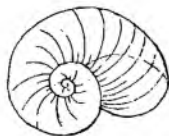
Big Cottonwood Canyon, Rollway Flat. (U. of U. Zoo. Mus., No. 703.) Mill D. (No. 697.)

- New records:* Bear Lake, west shore. (U. of U. Zoo. Mus., Nos. 1394 and 1464.) Camp ground on west shore north of Garden City. (No. 1388.) North of Garden City. (No. 1425.)
- Fillmore Canyon. (U. of U. Zoo. Mus., Nos. 1001 and 1156.)
- Parley's Canyon, in Lamb's Canyon branch. (U. of U. Zoo. Mus., No. 964.) Near Head of Parley's Canyon. (No. 1337.)
- Zion National Park. (U. of U. Zoo. Mus., No. 1092.) And some collected by A. M. Woodbury. (No. 1485.) The Grotto. (No. 1099.)
- Verdure, San Juan Co. U. of U. Zoo. Mus., Nos. 1587 and 1604.)
- Between Verdure and Blanding. (U. of U. Zoo. Mus., Nos. 1585 and 1596.)
- Fruita. (U. of U. Zoo. Mus., No. 1613.)
- Between Marysvale and Richfield. (U. of U. Zoo. Mus., No. 1131.)
- Cedar Canyon, near head. (U. of U. Zoo. Mus., Nos. 1139 and 1161.) Ten miles from mouth. (No. 1151.)
- Beaver Canyon. (U. of U. Zoo. Mus., Nos. 1175 and 1177.)
- Between Brigham and Logan. (U. of U. Zoo. Mus., Nos. 1421 and 1335.)
- Provo Canyon, North Fork at Aspen Grove. (U. of U. Zoo. Mus., No. 937.)
- Kamas, Beaver Creek Region, Summit Co. (U. of U. Zoo. Mus., No. 638.)
- About one-half mile below the mouth of Ogden Canyon. (U. of U. Zoo. Mus., No. 867.)
- Divide between North Fork of Provo Canyon, and American Fork Canyon. (U. of U. Zoo. Mus., No. 745.)
- American Fork Canyon, one mile above Timpanogos Cave. (U. of U. Zoo. Mus., No. 944.)
- Fish Lake. (U. of U. Zoo. Mus., No. 833.)

Shell moderately depressed, smooth, shining, pellucid, greenish-white; whorls three, the last composing most of the shell; suture very finely margined; aperture large, obliquely and roundly ovate; lip thin, columella arched. Diameter 5 mm., axis 2 mm. (Newcomb.)

Range.—At considerable altitudes, New Mexico, Utah, Colorado, central California, north to Alaska. (Dall, 1905.)

Discussion.—*Vitrina alaskana* Dall, shares with *Oreohelix strigosa depressa* (Cockerell) the distinction of being the most widely distributed and most abundant snail in Utah. Specimens of *Vitrina alaskana* from Dry Canyon are often so membranous that they collapse when touched. We have seen the shells so membranous that they could be dented without breaking.



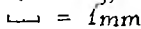

Vitrina alaskana Dall
Salt Lake City, Utah.  = 1mm. 

Fig. 40

Genus **VITREA** Fitzinger**THE SMALL LEAF SNAILS**

Shell smooth or nearly so, shining, small, of 4 to 6 whorls; depressed or somewhat discoidal; spire more or less distinctly elevated above the last whorl, the whorls increasing rapidly in size; aperture obliquely lunate; lip not reflected. Shell light brown to whitish, pellucid to opaque, glossy.

Genotype.—*V. diaphana* (Studer).

KEY TO SPECIES

- a. Umbilicus indented, not perforate, whorls very rapidly enlarging, animal usually yellow. *V. indentata*.
 aa. Umbilicus narrow, but perforate. *V. indentata umbilicata*.

Vitrea indentata (Say)**THE INDENTED LEAF SNAIL**

Helix indentata Say, *Journ. Acad.* II, 372 (1882).

Polita indentata Vanatta, *Naut.* XXVIV, 1921, p. 140.

Utah Localities.—

Previous records: Salt Lake City. (Binney, 1882.)

Zion National Park, fossil in limestone. (Vanatta, 1921.)

Emigration Canyon, near Salt Lake City, as *Zonites whitneyi* (Newcomb) (Binney, 1886.)

Duplicate records: Salt Lake City, Dry Canyon. (U. of U. Zoo. Mus., Nos. 555 and 859.)

Big Cottonwood Canyon west of Silver Lake at Brighton. (U. of U. Zoo. Mus., No. 714.) Same canyon at Rollway Flat. (No. 709.) Same canyon near Twin Lakes. (No. 691.)

City Creek Canyon at Stepping Stone Spring. (U. of U. Zoo. Mus., No. 782.) Two and one-half miles from mouth. (No. 799.)

Mill Creek Canyon, two miles from mouth. (U. of U. Zoo. Mus., No. 525.)

New records: Zion National Park, living. (U. of U. Zoo. Mus., Nos. 1099 and 1486.)

Bear Lake, west side. (U. of U. Zoo. Mus., No. 1563.)

Provo Canyon, North Fork. (U. of U. Zoo. Mus., No. 934.) North Fork, Alpine Camp. (No. 928.)

Fillmore Canyon. (U. of U. Zoo. Mus., Nos. 1003 and 1157.)

Between Marysville and Richfield. (U. of U. Zoo. Mus., No. 1128.)

Cedar Canyon. (U. of U. Zoo. Mus., No. 1164.)

Laketown, canyon west of the town. (U. of U. Zoo. Mus., No. 1396.)

Logan Canyon, power plant at mouth of canyon. (U. of U. Zoo. Mus., No. 1347.) Five miles from mouth. (No. 1305.) Two miles from mouth. (No. 1341.) Eight miles from mouth. (No. 1366.)

Beaver Canyon. (U. of U. Zoo. Mus., No. 1174.)

Divide between Provo Canyon and American Fork Canyon. (U. of U. Zoo. Mus., No. 744.)

Ogden Canyon, Pine View Lodge. (U. of U. Zoo. Mus., Nos. 653 and 664.)

Verdure. (U. of U. Zoo. Mus., No. 1621.)

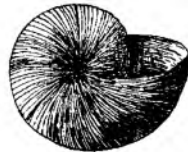
Between Verdure and Blanding. (U. of U. Zoo. Mus., Nos. 1584 and 1597.)

Shell subperforated, flattened, thin, pellucid; epidermis highly polished, corneous; whorls rather more than four, rapidly enlarging, with regular, sub-equidistant, radiating, impressed lines which on the body whorl extend to the center of the base, outer whorl expanding towards the aperture; suture well impressed; aperture rather large, transverse; peristome simple, acute, very thin, at its inferior extremity terminating at the center of the base of the shell; umbilicus none, but the umbilical region is indented. Greater diameter 5 mm., lesser diameter 4.5 mm; height 2.5 mm. (Binney and Bland.)

Range.—United States, Canada, Maine to Florida, Manitoba to Texas, westward to Utah; St. Domingo, Porto Rico.

Discussion.—This interesting little snail can easily be recognized by the very rapidly increasing whorls. The animal is yellow and covers the lower part of the shell so thoroughly, even when retracted in alcohol, that the indented umbilicus can not usually be seen till the animal is pulled. It has the habit of "glueing" itself to the leaves even more tenaciously than *Vallonia albula*, hence is scattered by the wind as they are. We have often broken the fragile shells trying to dislodge them from leaves.

The variation of this species has introduced much confusion in our records, as well as causing specimens with slightly open umbilicus to be separately named. Two of these varietal forms follow.



Vitrea indentata (Say)

Salt Lake City — 1mm

Fig. 41

Vitrea indentata umbilicata (Singley) Cockerell

Vitrea indentata umbilicata Cockerell, Nautilus, XII, p. 120, Feb., 1899.

Polita indentata umbilicata Henderson, Mollusca of Colorado, Utah, etc., p. 145, 1924.

Utah Locality.—

Previous record: Southeast of Tooele. (Henderson and Daniels, 1916.)

Discussion.—This Sonoran race differs from *indentata* by its distinctly perforate axis and larger average size, yet the perforation varies so much in size in specimens from the Carolinian zone that I would not myself have named the Southwestern form. The name is ill-chosen since the shells are not “umbilicate”, as that term is technically used, but “perforate”. (Pilsbry and Ferriss.)

Genus **OGARIDISCUS**,* gen. nov.

Shell small, fragile, pellucid, smooth and shining, depressed and nearly discoidal; umbilicus narrow, perforate; whorls 5-6, increasing regularly and evenly; aperture lunate, the lip simple and thin, not reflected. The animal when extended remarkably slender and elongate, the posterior tentacles long but the anterior ones short. Mantle not reflected, wholly included. Animal white or colorless.

Genotype.—*Hyalina subrupicola* Dall.

Discussion.—In a letter concerning this form Dr. Pilsbry has assured us that “It is quite distinct from all other western zonitids known.” It cannot be included in *Polita* as now restricted; and, while it might be best to retain it tentatively in *Vitrea*, the peculiarities in the form of body and tentacles seem to us to justify generic separation even pending detailed study of the anatomy.

Ogaridiscus subrupicola (Dall)

CLINTON CAVE SNAIL

Hyalina subrupicola Dall, in Packard, Bull. Hayden Surv. III, 1877, p. 163.

Polita subrupicola Henderson, Mollusca of Colorado, etc., 1924, p. 145.

Utah Localities.—

Previous record: Clinton's Cave, half mile east of Clinton's Hotel, Lake Point, Great Salt Lake.

Duplicate record: Clinton's Cave. E. Berry and E. L. Miner col., living. (U. of U. Zoo. Mus., No. 1562.) Also Berry, Gertsch and Chamberlin. No. 1752.)

This little shell is best described by a comparison of its various characteristics with those of *H. indentata* Say, as given by Dr. Binney in his Land and Fresh-Water Shells of the United States (Part I, p. 35).

*From Gosiute Indian *Ogarri*, name of the Oquirrh Mts., and meaning literally “wood or brush mountains,” and *discus*.

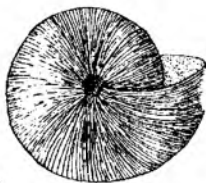
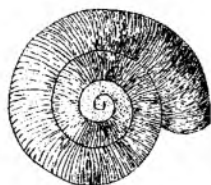
H. subrupicola, while exhibiting radiating lines of growth, some of which are more conspicuous than others, does not show any such well-marked grooves or indentations as are figured by Morse (Land Shells of Maine) in *indentata*, and which form its most striking character. The former has five and a half whorls, with a greatest diameter in the largest specimen of .14 inch, while *indentata* has but little more than four, with a diameter of .20 inch. The former is perfectly pellucid, while the latter has a peculiar whitish, spermaceti-like luster. *H. subrupicola* has the last whorl smaller proportionately than *indentata* and in fact the increment of the whorls in the former is much more regular and even. The umbilicus in both is precisely similar.

The animal of *subrupicola* varies from whitish to slaty; the granules of the upper surface of the foot are remarkably coarse and well marked. The tentacles are, as contracted in alcohol, hardly perceptible; the eye peduncles are, from the same cause, not extended, but appear to be as usual in the genus, and to possess normal ocular bulbs. The office filled by these, however, being quite as much to the blindness of most cave animals does not apply in the case of the *Helicidae*. With the exception of *H. indentata*, this species does not seem very near to any of the described American species and is totally dissimilar to *Ammonitella gatesii*, J. G. Cooper, a remarkable form found in caves in Calaveras County, California. Habitat, cave in Utah. Collected by Dr. A. S. Packard, Jr., of Dr. Hayden's Survey.

It may be noted that *H. indentata* does not appear to have been collected west of the Rocky Mountains. (Dall, as *Hyalina subrupicola*, article in Bull. U. S. Geol. and Geog. Survey of Terr., III, 1877, p. 163.

Type locality.—Clinton's Cave, Utah.

Discussion.—This species was secured by Packard and described by Dall in 1877 from Clinton's Cave near the once famous Garfield Beach on Great Salt Lake. After Saltair was built Garfield Beach fell into obscurity, and the cave was forgotten. The cave is east from Lake Point Station, immediately up the slope from the place where the road now crosses the railroad tracks. The opening can be seen from the road, but is inconspicuous. The entrance opens to the north, and is high enough for a man to enter easily. Elmer Berry and Ernest Miner were delegated to search anew for the *Polita* taken by Packard, and were successful. They se-



M
Ogaridiscus subrupicola (Dall)
Clinton's Cave, Utah — 1mm.

Fig. 42

cured a few living specimens. The shell of one of these specimens is figured. We secured other specimens later, but they are scarce.

Tryon (1886) in *The Manual of Conchology*, in speaking of *indentata*, says, "A variety occurs with the umbilical region narrowly perforated. *H. subrupicola* Dall is a synonym." However, the present form is decidedly diverse from *indentata* and there is no longer excuse for associating them so closely.

Genus **EUCONULUS** Reinhardt

THE CONICAL LEAF SNAILS

Shell thin and shining; small, in ours not exceeding 4 mm. in diameter; the spire elevated, composed of 5 or 6 whorls; umbilicus either absent or very narrow. Shells amber or horn colored.

Genotype.—*Conulus fulvus* Müller.

Euconulus fulvus alaskensis (Pilsbry)

Conulus fulvus alaskensis Pilsbry, *Nautilus*, XII, Feb., 1899, p. 116.

Utah Localities.—

Previous records: American Fork Canyon, and Summit Canyon, Mt. Nebo. (Ingersoll, 1877.)

Logan; Devil's Slide; Lehi. (Henderson and Daniels, 1917.)

Near Salt Lake City. (Henderson, 1924.)

Duplicate records: American Fork Canyon, one mile above Timpanogos Cave. (U. of U. Zoo. Mus., No. 958.) Spring at Timpanogos. (No. 742.)

Logan Canyon, five miles from mouth. (U. of U. Zoo. Mus., Nos. 1309 and 1375.) Power plant at mouth of canyon. (No. 1345.)

Big Cottonwood Canyon, near Twin Lakes. (U. of U. Zoo. Mus., No. 1895.) Rollway Flat. (No. 707.) Mill D branch. (No. 696.) Brighton, west of Silver Lake. (No. 715.)

New records: Canyon east of Laketown, near the divide. (U. of U. Zoo. Mus., No. 1130.)

Provo Canyon, North Fork, Aspen Grove. (U. of U. Zoo. Mus., No. 941.) Alpine Camp in Aspen Grove. (No. 926.)

Zion National Park. (U. of U. Zoo. Mus., No. 1089.) Collected by A. M. Woodbury. (No. 1489.)

Beaver Canyon. (U. of U. Zoo. Mus., No. 1178.)

Kamas, Beaver Creek region, Summit Co. (U. of U. Zoo. Mus., No. 636.)

Cedar Canyon, toward head of canyon. (U. of U. Zoo. Mus., No. 1169.) Ten miles from mouth. (No. 1152.)

Fillmore Canyon. (U. of U. Zoo. Mus., No. 1160.)

Bear Lake, west shore, canyon opposite Lakota resort. (U. of U. Zoo. Mus., No. 1462.)

Ogden Canyon, Pine View Lodge. (U. of U. Zoo. Mus., No. 655.)

Eight miles north of Monticello, April 15, 1928, in very dry leaves. (U. of U. Zoo. Mus., No. 1660, several specimens.)

Fruita. (U. of U. Zoo. Mus., No. 1616, one specimen only, destroyed in mails.)

Between Blanding and Verdure. (U. of U. Zoo. Mus., No. 1598, April 7, 1928.)

Verdure. (U. of U. Zoo. Mus., No. 1605, several specimens.)

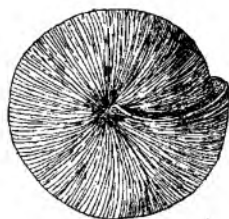
Shell smooth and shining, light yellowish in color; 3 mm. high and 4 mm. in diameter; color of animal black; circum-polar; entire country; very common.

E. fulvus alaskensis differs from *fulvus* chiefly by having about one whorl less in shells of similar size. On the first whorl the radial striae begin at the first fourth, and are about as close as on the rest of the shell. There are no spiral striae on the first or later whorls. The last whorl has 90 to 105 striae in 1 mm. *E. f. alaskensis* was described from the Dyea Valley, Alaska. It is also before us from Petropavlovst, Kamchatka, collected by Dr. William H. Dall. It extends southward in the Rocky

Mountains to the Chiricahua and the Huachuca ranges in southern Arizona, chiefly at high elevations. (Pilsbry and Ferriss.)

Discussion.—This snail is easily recognizable by its conical shape and shining color. *E. f. alaskensis* has from 4 to 5 whorls, whereas the eastern *fulvus* has 6 or more usually. Our form has the umbilicus indented, but not perforate. This snail is usually more or less solitary in habit. It is found under leaves.

During the collecting and identifying, especial attention was given to watching for *Strobilops labyrinthica* (Say), a species often confused with *E. fulvus* farther east. None of the former have been found.



Al

Euconulus fulvus alaskensis Pilsbry.
American Fork Canyon, Utah. — = 1/2 mm

Fig. 43

Genus **ZONITOIDES** Lehmann

THE YELLOW LEAF SNAILS

Shell smooth or nearly so, shining; small, in ours not exceeding 7 mm. in diameter; spire depressed, whorls increasing slowly in size, umbilicus wide; aperture large, without teeth. Shell amber colored to white. Genital mucus glands and long dart sac present.

Genotype.—*Z. nitida* (Müller).

KEY TO SPECIES

- a. Diameter 7.5 mm., umbilicus comparatively broad. (Check: Animal black, living at water's edge.) *Zonitoides nitida*.
 aa. Diameter 5 mm. or under (Check: Animal with head and neck black, rest of body white) *Zonitoides arborea*.

Zonitoides nitida (Müller)

THE BLACK-BODIED LEAF SNAIL

Helix nitida Müller, Hist. Verm., II, 32, etc.

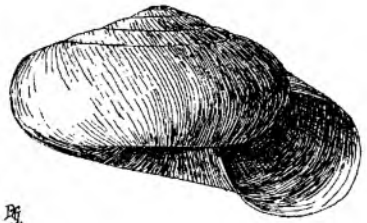
Zonitoides nitidus Pilsbry, Class. Cat., p. 27, 1898.

Utah Localities.—

New records: Ogden, in city, a canal not far from Ogden River. (U. of U. Zoo. Mus., Lot 2, No. 361.)

Logan, Blacksmith Fork below Ballard Springs. (U. of U. Zoo. Mus., No. 1263.)

Shell orbicular, depressed, moderately convex above and concave below, thin, shining, uniform brownish horn-color, with delicate striae of growth; whorls five or more, convex, separated by a deeply impressed suture, the outer one disproportionately large, somewhat declining as it approaches the aperture, and obtusely angular at the periphery, beneath excavated around a broad, crateriform umbilicus, in which the whorls are displayed to the apex; aperture oblique, lunate; peristome simple, its basal margin arcuate. Greater diameter $7\frac{1}{2}$ mm., lesser diameter 6 mm.; height $3\frac{2}{3}$ mm. (Binney and Bland, 1869, as *Hyalina nitida* Müller.)



Zonitoides nitida (Müller)
 Logan, Utah. — = 1 mm.

Fig. 44

Range.—Holarctic. Europe, northern United States, British America, Alaska, Japan.

This species has been found so widely spread that it cannot reasonably longer be regarded as merely a European emigrant. (Dall, 1905.)

Discussion.—This species is reported for the first time from this state. Outside of size, this shell is very difficult to distinguish from *Zonitoides arborea*, but the color of the animal and the habitat are unmistakable. In both cases they were found on the moist banks of streams at the water's edge, and all animals in both sets were observed to be entirely black, unlike *Z. arborea* in the same region. The shells were further compared with specimens of *Zonitoides arborea* from Eliza Lake, Mercer Co., Ill., (U. of U. Zoo. Mus., Lot 6, No 5), and of *Zonitoides nitida* (Müll.) from Akron, Ohio. (U. of U. Zoo. Mus., Lot 6, No. 6.)

There is a previous record of *Z. nitida* (Müller) from Nevada cited by Walker, 1916.

Zonitoides arborea (Say)

THE TREE SNAIL

Helix arborea Say, Nich. Encyc., pl. IV, f. 4.

Zonitoides arboreus Dall, Harriman Alaska Expedition, Vol. 13, p. 42.

Zonitoides arborea Baker, Nautilus, XXVIII, 1914, p. 9.

Utah Localities.—

Previous records: American Fork Canyon. (Ingersoll, 1877.)

Summit Canyon, Mt. Nebo. (Ingersoll, 1877.)

Provo; Weber Canyon; Near Salt Lake City; Southeast of Tooele; Below Wheelon; North Fork of Logan Canyon; Devil's Slide; and Lehi. (Henderson and Daniels, 1916 and 1917.)

Duplicate records: American Fork Canyon, one mile above Timpanogos Cave. (U. of U. Zoo. Mus., No. 947.)

Logan Canyon, just over the summit. (U. of U. Zoo. Mus., No. 1378.)

Two miles from mouth. (No. 1339.) Five miles from mouth. (No. 1308.) Near divide. (No. 1363.)

City Creek Canyon, two and one-half miles from mouth. (U. of U. Zoo. Mus., No. 798.)

Big Cottonwood Canyon, Mill D branch. (U. of U. Zoo. Mus., Nos. 698 and 965.) Rollway Flat. (No. 710.)

Mill Creek Canyon, two miles from mouth. (U. of U. Zoo. Mus., Lot 2, No. 23.)

Emigration Canyon, near mouth. (U. of U. Zoo. Mus., No. 906.)

New records: (U. of U. Zoo. Mus., No. 1483.)

Junction, Utah, reservoir on the Sevier River, partially weathered. (U. of U. Zoo. Mus., No. 1042.)

Provo Canyon, Alpine Camp. (U. of U. Zoo. Mus., No. 925.) North Fork at Aspen Grove, young. (No. 935.) Aspen Grove, two miles below Alpine Camp. (No. 749.)

Kamas, Beaver Creek region, Summit Co. (U. of U. Zoo. Mus., No. 635.)

- Bear Lake, west side. (U. of U. Zoo. Mus., Nos. 1382 and 1389; juvenile, (Nos. 1390 and 1424.)
- Between Marysvale and Richfield. (U. of U. Zoo. Mus., No. 1129.)
- Beaver Canyon. (U. of U. Zoo. Mus., Nos. 1171 and 1197.)
- Zion National Park. (U. of U. Zoo. Mus., Nos. 1103, 1095, 1491 and 1494.)
- Tooele, two miles up gully north of smelter, near spring. (U. of U. Zoo. Mus., Nos. 576 and 967.)
- Ballard Springs, near town of Providence. (U. of U. Zoo. Mus., No. 1452.)
- Union, South Tremonton, Boxelder Co. (U. of U. Zoo. Mus., No. 612.)
- Utah Lake, with drift material near Saratoga. (U. of U. Zoo. Mus., No. 890.)
- Provo. (U. of U. Zoo. Mus., No. 549.)
- Fish Lake. (U. of U. Zoo. Mus., No. 832.)
- Ogden, in city. (U. of U. Zoo. Mus., No. 894.) Ogden Canyon. (No. 592.) Pine View Lodge, in Ogden Canyon. (No. 654.)
- Panguitch Creek, South Fork of Sevier River, near Spry Station. (U. of U. Zoo. Mus., No. 1075.)
- Verdure. (U. of U. Zoo. Mus., Nos. 1606 and 1586.)
- Mt. Tukuhtnikivatz, La Sal Mts. (V. M. Tanner col.)
- Between Verdure and Blanding. (U. of U. Zoo. Mus., No. 1595.)
- Moab. (U. of U. Zoo. Mus., Nos. 1601, 1625 and 1534.)
- Fruita. (U. of U. Zoo. Mus., No. 1617.)
- Bluff. (U. of U. Zoo. Mus., No. 1654.)
- Divide between Provo Canyon and American Fork Canyon. (U. of U. Zoo. Mus., No. 748.)

Shell umbilicated, depressed, very slightly convex, thin, pellucid; epidermis amber-colored, smooth, shining; whorls 4 to 5, with very minute, oblique striae, apparent when viewed with microscope; aperture transversely rounded, peristome thin, acute; umbilical region indented; umbilicus moderate, well developed, round, and deep. Greater diameter 5 mm., lesser diameter $4 \frac{1}{3}$ mm.; height $2 \frac{3}{4}$ mm. (Binney and Bland.)



♂

Zonitoides arborea (Say)

Salt Lake City — = 1mm

Fig. 45

Range.—North America generally and Japan.

Discussion.—“This species competes with *Vitrina alaskana* for the honor of being the most generally distributed snail of the region. Both are found from the base of the foothills nearly to the timberline, wherever the conditions are favorable to land snails.” (Henderson, 1924.)

Family LIMACIDAE Lamarck

This family embraces the naked snails, or slugs, in which there is no external shell, or one but partially exposed, though a flat non-spiral calcareous plate or rudimentary shell concealed under the mantle and covering the respiratory cavity is present, this sometimes reduces to granules. Body tapering, elongate; foot either with or without a caudal mucus pore; mantle not extending caudad of middle of body; jaw arcuate, with a projection on inferior margin, without ribs.

Of several hundred known species of slugs, only about a half dozen are known to occur in the United States. The three Utah species belong to the genera *Agriolimax* and *Limax*. Two of the species are European forms, now widely introduced in this country; namely, *A. agrestis* and *L. maximus*.

Genus **LIMAX** Linnaeus

THE BANDED SLUGS

Large slugs in which the body is tapered and keeled behind and terminates in a point; mantle shield-like; respiratory orifice at right hinder border. Jaw with ends blunt. Body with lateral bands or serially arranged spots.

Genotype.—*Limax maximus* Linnaeus.

Only one species of this genus is known to occur in Utah, this being *L. maximus* Linnaeus, a European form.

Limax maximus Linnaeus

THE GIANT SLUG

Utah Locality.—

New record: East Mill Creek, south of Salt Lake City, taken at edge of stream on estate of David Neff. (R. V. Chamberlin col.)

A very large form in which the body is gray marked with longitudinal rows of spots alternating with stripes of black, the mantle bearing spots or blotches and not banded. Length up to 16 cm. or more.



Limax maximus Linnaeus
Mill Creek, Utah

— = 1 in.

Range.—An European species now also established locally in various parts of the United States.

Discussion.—This slug has not been reported from Utah previously, although it has been recorded from greenhouses and out-of-doors as well in Colorado (Boulder), and seems to be well established at some places in California and in the Eastern states.

Genus **AGRIOLIMAX** Moersch

THE PLAIN SLUGS

Mostly small terrestrial slugs in which the shell is entirely hidden; the body keeled behind the mantle; jaw with ends blunt. Body without lateral bands; either irregularly spotted or without spots. Secreting a colorless or else milky mucus by means of which they may suspend themselves.

Genotype.—*A. agrestis* (Linnaeus).

KEY TO SPECIES

- a. Sheath of eye peduncles indicated by black lines extending backward from their base under the edge of the mantle, white ring around breathing pore, tubercles on dorsal side outlined with black, mucus milky.
Agriolimax agrestis.
- aa. Sheath of eye peduncles not visible except when peduncles are withdrawn, breathing pore not circumscribed by white band though it may be whitish within, whole dorsal region usually blackish, mucus watery.
Agriolimax campestris.

Agriolimax agrestis (Linnaeus)

THE EUROPEAN SLUG

Limax agrestis Linnaeus, *Syst. Nat.* ed. X, p. 652, 1758.

Utah Localities.—

New records: Ogden, along Ogden River in City. (U. of U. Zoo. Mus., No. 902.)

Salt Lake City, Mount Olivet Cemetery Reservoir.

City Creek Canyon, Rotary Park. (U. of U. Zoo. Mus., Nos. 670 and 671.)

Westminster College Campus, collected by Edward Lowrance. (U. of U. Zoo. Mus., No. 598.)

Ballard Springs near town of Providence. (U. of U. Zoo. Mus., No. 1454.)

Moab. (U. of U. Zoo. Mus., Nos. 1635, 1600, 1622 and 1638.)

Fruita. (U. of U. Zoo. Mus., No. 1611.)

Verdure. (U. of U. Zoo. Mus., Nos. 1590 and 1603.)

North of Blanding. (U. of U. Zoo. Mus., No. 1651.)

Surface of body covered with flat, irregular oblong, tubercles separated by a network of furrows or grooves, the tubercles varying in color from whitish though yellow to amber-color and brown, the grooves forming a network of darker lines; the tentacles and eye peduncles darker, often blackish; the mantle sometimes nettled with a paler color; base of foot and border of respiratory pore whitish; mucus milky. Body elongate, acute at caudal and keeled posteriorly, the foot narrow. Eye-peduncles cylindrical, about one-eighth the length of the body, the tentacles very short. Usually about 25 mm. long but may attain a length of 50 mm.



Agriolimax agrestis (L.)
Salt Lake City. — $\frac{1}{8}$ in. ♂

Fig. 47

Range.—A European species now widely established in the United States and other parts of the world.

Discussion.—This slug has never been reported from Utah before, but is practically dominant in Salt Lake City and Ogden. It has become established in some canyons near the cities where trees have been planted and parks formed, and occurs at various stations in a section of the state as remote as San Juan County. This slug is very destructive to plant life, and has long ago become a pest in the east. Gardeners in Salt Lake City during the past few years have been troubled with them.

When contracted this slug is much more arched dorsally than *A. campestris*. The milky secretion test as given in the key should be observed in the natural state, as *A. campestris* will give off a whitish fluid when placed in strong alcohol. *A. agrestis* under similar conditions will give off a great amount, but the difference is not so sharply marked as between watery and milky secretions given off under natural conditions.

Agriolimax campestris (Binney)

THE NATIVE SLUG

Limax campestris Binney, *Proc. Bos. Soc.*, 1841, p. 52.

Utah Localities.—

Previous records: Near Salt Lake City. (Ingersoll, 1877 and 1886.)

Summit Canyon; Mt. Nebo; Ogden Canyon. (Henderson and Daniels 1916.)

Logan. (Henderson, 1924.)

Duplicate records: Salt Lake City, Westminster College Campus, collected by Edward Lowrance. (U. of U. Zoo. Mus., No. 597.)

Ogden, along Ogden River in city. (U. of U. Zoo. Mus., No. 899.)

Big Cottonwood Canyon, near Silver Lake. (U. of U. Zoo. Mus., No. 684.) Brighton, west of Silver Lake. (No. 713.)

Logan, pond one mile south of city. (U. of U. Zoo. Mus., No. 1293.)

Logan Canyon, five miles from mouth. (U. of U. Zoo. Mus., No. 1304.)

Blacksmith Fork below Ballard Springs, same canyon. (No. 1400.)

New records: Zion National Park. (U. of U. Zoo. Mus., Nos. 1094, 1098, 1101 and 1488; unusually uniform in coloration.)

Cedar Canyon, Cedar City, toward head of canyon. (U. of U. Zoo. Mus., No. 1162.)

Price. (U. of U. Zoo. Mus., No. 1646.)

Color uniform, commonly grayish or amber, occasionally black, without spots or markings, the anterior end smoky; mucus watery. Body elongated, terminating in a very short carina at its posterior extremity; mantle oval, with fine concentric lines; dorsum covered with prominent tubercles but these not flattened; foot narrow. Length about 25 mm.



Agriolimax campestris (Binney)

Salt Lake City. ——— = 1/4 in. ♀

Fig. 48

Range.—Common in eastern and central United States and in California.

Discussion.—This is the common slug of the canyons. It is usually found on leaves and plants along the damp places formed by the small rills from springs.

Family ENDODONTIDAE

A family of small or minute snails in which the shell is usually depressed, or sometimes more or less conically elevated, widely umbilicated, and transversely ribbed; lip thin, not expanded or reflected, in most cases edentulous.

Of these small forms, which are of brown color or with brownish markings, five kinds, representing three genera, occur in Utah. The minute *Punctum pygmaeum* is our smallest snail.

Genus **GONYODISCUS** Fitzinger

THE DARK LEAF SNAILS

Shells small, in ours under 7 mm. in diameter, depressed and widely umbilicated; transversely ribbed; the whorls slowly increasing in size; lip not everted or reflected; dark, horn-colored or brown.

Genotype.—*Helix solaris* Menke.

KEY TO SPECIES

a. Ribs developed, continuing over on ventral side.

b. Aperture and last whorl well rounded. *Gonyodiscus cronkhitei*.

bb. Aperture and last whorl flattened above. *Gonyodiscus cronkhitei anthonyi*.

aa. Ribs nearly obsolete, especially below. *Gonyodiscus shimeki cockerelli*.

Gonyodiscus cronkhitei (Newcomb)

CRONKHITE'S SNAIL

Helix cronkhitei Newcomb, *Proc. Cal. Acad. Sci.*, III, 180 (1865).

Gonyodiscus cronkhitei Berry, *Vic. Mem. Mus. Bull.* 36, 1922, p. 8-9.

Utah Localities.—

Previous records: Deception Lake and Crocodile Lake, near Kanab. (Pilsbry and Ferriss, 1911.)

Fossil in limestone, Zion National Park. (Vanatta, 1921.)

New records: Cedar Canyon, near head of canyon. (U. of U. Zoo. Mus., No. 1138.)

Zion National Park, living. (U. of U. Zoo. Mus., Nos., 1390 and 1105.)

Same park, collected by A. M. Woodbury. (No. 1497.)

Between Marysvale and Richfield. (U. of U. Zoo. Mus., No. 989.)

Ogden, between mouth of canyon and city. (U. of U. Zoo. Mus., No. 868.) Pine view Lodge. (No. 658.)

City Creek Canyon, near Salt Lake City. (U. of U. Zoo. Mus., No. 778, found near Stepping Stone Spring.)

Beaver Canyon. (U. of U. Zoo. Mus., No. 1172.)

Bear Lake, west side, canyon opposite Lakota Resort. (U. of U. Zoo. Mus., No. 1461.)

Utah Lake, in drift material. (U. of U. Zoo. Mus., No. 550.)

Verdure. (U. of U. Zoo. Mus., No. 1607.)

Fruita. (U. of U. Zoo. Mus., No. 1612.)

Shell openly umbilicate, depressed, yellowish horn-color, under the glass regularly rib-striated; spire depressed, a little convex, suture wide and deep; whorls four, rather cylindrical; umbilicus large, indistinctly perspective, aperture rounded; lip simple, acute, margins approximating.

A few specimens were obtained by Mr. Gabb of the State Geological Survey in Klamath Valley, which were collected jointly by himself and Dr. Cronkhite, U. S. Army. (Original description as *Helix cronkhitei*.)

Type locality.—Klamath Valley, Oregon.

Range.—Utah, Montana, Nevada, California, Oregon, and northward.

Discussion.—This species is characterized by having oblique transverse ribs well developed and a well rounded aperture and body whorl. This snail is present at Salt Lake City and in the northern part of the state, but we could not but notice how much more abundant it is farther south. The subspecies *anthonyi* displaces it to a great extent in northern Utah.

Gonyodiscus cronkhitei anthonyi (Pilsbry)

ANTHONY'S SNAIL

Helix striatella Anthony, *Boston Journ. of Nat. Hist.*, III, p. 278, pl. 3, fig. 2, 1840. Not *Helix striatella* Rang, 1831.

Pyramidula cronkhitei anthonyi Pilsbry, n. n., Pilsbry and Ferriss, *Mollusca of the Southwestern States*, II, *Proc. Acad. Nat. Sci. Phil.*, Vol. 58, p. 153.

Utah Localities.—

Previous records: Ogden Canyon. (Binney, 1886.)

American Fork Canyon; Summit Canyon; Mt. Nebo. (Ingersoll, 1877.)

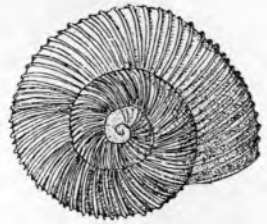
Gulch southeast of Tooele. (Henderson and Daniels, 1916.)

Ogden Canyon; North Fork of Logan Canyon; Mouth of Logan Canyon; Below Devil's Slide. (Henderson and Daniels, 1916-1917.)

City Creek Canyon. (Henderson, 1924.)

Duplicate records: City Creek Canyon, one and one-half miles from mouth. (U. of U. Zoo. Mus., No. 775.) Two and one-half miles from mouth. (No. 801.) Stepping Stone Spring. (Nos. 675 and 780.) Rotary Park. (No. 672.)

American Fork Canyon, one mile above Timpanogos Cave. (U. of U. Zoo. Mus., No. 945.)




Gonyodiscus
cronkhitei (Newcomb)
Zion National Park, Utah
— = 1 mm. 

Fig. 49

Ogden Canyon, gulch opposite the Hermitage. (U. of U. Zoo. Mus., No. 856.) One-fourth mile below power dam. (No. 766.) Pine View Lodge. (Nos. 657 and 663.) At mouth of canyon. (No. 590.)

Logan Canyon, two miles from mouth. (U. of U. Zoo. Mus., No. 1342.) Five miles from mouth. (No. 1310.) Near divide. (No. 1360.) Near power plant at mouth of canyon. (No. 1346.)

New records: Ballard Springs, near Providence. (U. of U. Zoo. Mus., No. 1451.) Blacksmith Fork below Ballard Springs. (Nos. 1316 and 1399.)

Provo Canyon, North Fork, Alpine Camp. (U. of U. Zoo. Mus., No. 924.) North Fork, Aspen Grove. (No. 936.)

Cedar Canyon, towards head. (U. of U. Zoo. Mus., No. 1167.)

Ogden, in city. (U. of U. Zoo. Mus., No. 526.)

Panguitch Creek, South Fork of Sevier River, near Spry Station. (U. of U. Zoo. Mus., No. 1073.)

Between Marysvale and Richfield, Sevier Co. (U. of U. Zoo. Mus., No. 988.)

Glenwood. (U. of U. Zoo. Mus., No. 848.)

Junction, reservoir on Sevier River. (U. of U. Zoo. Mus., No. 1044.)

Moroni, south of town. (U. of U. Zoo. Mus., No. 1031.)

Big Cottonwood Canyon, Rollway Flat. (U. of U. Zoo. Mus., No. 706.)

Salt Lake City, Mt. Olivet Cemetery Reservoir. (U. of U. Zoo. Mus., No. 607.)

Verdure. (U. of U. Zoo. Mus., No. 1591.)

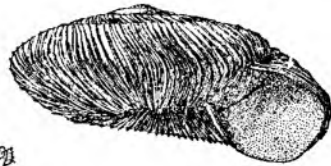
This shell, well known under the preoccupied name *H. striatella* Anth., has typically a rounded periphery and a moderately developed oblique and sigmoid rib-striae, 4 or 5 in the space of a mm. on the front of the last whorl of the periphery. There are $3\frac{1}{2}$ to $3\frac{3}{4}$ whorls. Altitude 2.7 mm., diameter 5.25 mm.

In my (Pilsbry's) opinion the widespread Eastern race is not specifically distinct from *Helix cronkhitei* Newc., of northern California, etc., of which specimens from Dr. Newcomb are before me, but it evidently requires separation as a subspecies. (Pilsbry and Ferriss.)

Type locality.—Fairmount Park, Philadelphia.

Range.—Widespread in the United States. It occurs in Maine, Idaho, Utah, Colorado, Pennsylvania and elsewhere.

Discussion.—"The typical *cronkhitei* has a well rounded last whorl. In *anthonyi* there is a certain compression above and below the periphery, though the latter is not angular." (Pilsbry.) This is the common form at Salt Lake City.



Gonyodiscus cronkhitei anthonyi Pilsbry
Salt Lake City, Utah ——— = 1 mm

Fig. 50

Gonyodiscus shimeki cockerelli (Pilsbry)

Pyramidula cockerelli Pilsbry, *Naut.*, XII, 1898, p. 85.

Gonyodiscus shimekii cockerelli Berry, *Vic. Mem. Mus., Bull.*, No. 36, 1922, p. 10.

Utah Localities.—

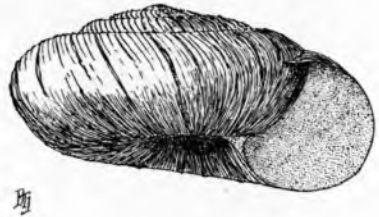
New records: Mt. Tukuhnikivatz, V. M. Tanner, very fine specimens. (3 in U. of U. Zoo Mus., No. 1482.)

Logan Canyon five miles from mouth, one specimen approaching this form. (U. of U. Zoo. Mus., No. 1374.)

Beaver Canyon, 1 specimen. (U. of U. Zoo. Mus., No. 1170.)

Panguitch Creek, south Fork of Sevier River, near Spry Station, one weathered specimen that had washed downstream. (U. of U. Zoo. Mus., No. 1074.)

Shell having the general shape of *P. striatella*; thin, greenish, more or less streaked and dotted with yellow; a little shining, very irregularly wrinkle-striate, some specimens unequally ribbed in places above and at the margin of the umbilicus. Spire convex, the first whorl a little protruding. Whorls $4 \frac{1}{5}$, the first whitish-corneous and glabrous when unworn, the rest convex, regularly widening, separated by a deep suture; last whorl obtusely angular at the periphery in front, becoming rounded on its whorls, its width contained about 3.7 times in that of the shell. Aperture oblique, rounded, the penultimate whorl cutting out a segment of about one-fourth the whole circle of the thin and simple peristome; the greatest diameter of aperture contained about 2.4 times in that of the shell. Altitude 2.8 mm., diameter 5.5 mm. (specimen from New Mexico). Altitude 3.2 mm., diameter 6.5 mm. (specimen from Colorado). (Pilsbry.)



Gonyodiscus shimeki cockerelli (Pilsbry)
Beaver Canyon, Utah. — 1 mm

Fig. 51

Type localities.—Labelle, Taos Co., New Mexico, and Custer and Saguache Co., Colorado.

Discussion.—The present form is distinguished by the ribs which are characteristically weak above and nearly obsolete below. It is a high-altitude form, occurring usually above 8,000 feet. This is probably the reason for its not having been taken by previous collectors in Utah. It was formerly confused with *G. cronkhitei* Newc., but the latter form is very strongly ribbed.

Genus **HELICODISCUS** Morse

Mantle posterior, thin, simple; shell discoidal, widely umbilicated; aperture with several pairs of tubercles at intervals within, on the inner surface of the outer whorl; peristome simple. (Baker.)

Genotype.—*H. lineatus* (Say.)

Of our forms resembling most *Microphysula ingersolli* from which distinguishable by the wide open umbilicus.

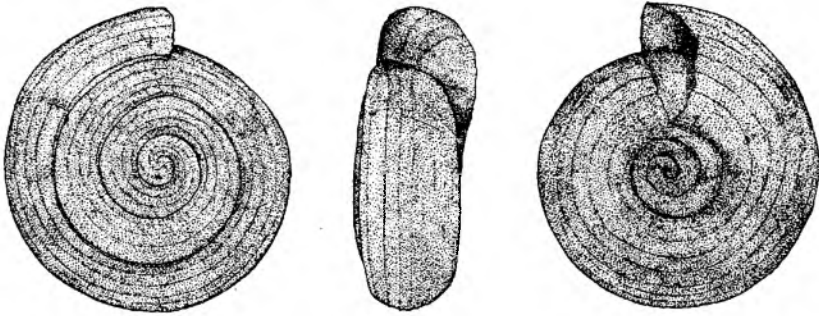
Helicodiscus eigenmanni Pilsbry

Helicodiscus eigenmanni Pilsbry, *Nautilus*, XIV, 1900.

Utah Localities.—

New records: Between Blanding and Verdure, one shell, a pale yellow in color, immature, diameter slightly over 3 mm., $3\frac{1}{2}$ whorls. Spiral ridges clearly showing as in figure. (U. of U. Zoo. Mus., No. 1593, April 17, 1928.)

Verdure, two shells, both weathered, the larger with aperture broken and apparently immature; 2.8 mm. in greatest diameter, $3\frac{1}{2}$ whorls. Spiral lines weathered; specimen may be toothed though fragility and small size of the shell did not permit of cleaning far within the aperture. Second shell juvenile, $2\frac{1}{4}$ whorls, aperture broken, spiral ribbing very evident. (U. of U. Zoo. Mus., No. 1589, April 18, 1928.)



Helicodiscus eigenmanni Pilsbry
Between Blanding & Verdure, Utah

———— = 1 mm 房

Fig. 52

Shell similar to *H. parallelus*, but attaining a much greater size, the umbilicus much smaller in comparison with the diameter of the shell. Whorls $4\frac{3}{4}$ to 5, strongly lirate spirally. Aperture more lunate, embracing more of the preceding whorl, usually armed with a pair

of small teeth within, as in *H. parallelus*. Umbilicus rather deep and cup-shaped. Height 1.9 mm., diameter 4.8 mm. Umbilicus 2 mm. wide. (Pilsbry.)

Type locality.—Texas, in Beaver Cave, near San Marcos.

Range.—Texas, Colorado, and Utah.

Discussion.—A discoidal form in which the apex is scarcely or not at all elevated above the last whorl. Whorls slowly increasing in size. The whorls are almost equally visible above and below, the growth lines crossed by parallel spiral lines. The Utah shells here listed are juvenile, as shown by lack of mature tubercles within the aperture and by the lesser number of whorls (under four). The large size of these excludes the possibility of their being *H. parallelus*. Also, the whorls are of greater diameter than in the latter species, and the umbilicus if matured would apparently be narrower.

Genus PUNCTUM Morse

THE DOT SNAILS

Shell minute, depressed, or with spire rather elevated; umbilicus open; aperture large, lip thin and edentulous; jaw composed of 16 to 19 separate quadrate plates. Of the half-dozen known North American species, one occurs in Utah.

Genotype.—*Helix pygmaea* Lea.

Punctum pygmaeum (Draparnaud)

THE PIGMY SNAIL

Helix pygmaea Draparnaud, *Hist. Moll.*, p. 114, pl. VIII, figs. 8, 9, 10, 1805.

Punctum pygmaeum Pilsbry, *Class. Cat. Am. Land. Sh.*, p. 33, 1898.

Utah Localities.—

New records: Kamas. (U. of U. Zoo. Mus., No. 577, Melba Turner.)

Moroni, south of town, in leaves and rotten wood. (U. of U. Zoo. Mus., No. 1028.)

Big Cottonwood Canyon, Mill F, in quaking aspen leaves. (U. of U. Zoo. Mus., No. 689.) Rollway Flat. (No. 705.) Mill D branch. (No. 694.)

Provo Canyon, North Fork. Aspen Grove, swampy ground. (U. of U. Zoo. Mus., No. 940.)

Logan Canyon, five miles from Logan. (U. of U. Zoo. Mus., Lot 7, No. 74.) Near divide. (No. 1362.)

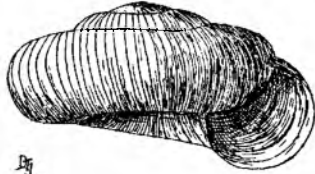
Parley's Canyon, in Lamb's Canyon branch. (No. 1753.)

Shell umbilicated, subglobose, reddish horn-color, shining, marked with strong transverse striae and microscopic revolving lines, both most prominent near the umbilicus, whorls four, convex, gradually increasing, the last broadly umbilicated; aperture subcircular, oblique,

peristome simple, acute, its columellar extremity subreflected. Greater diameter $1\frac{1}{2}$ mm., height 1 mm. (Binney and Bland, 1869, as *P. minutissimum* Lea, a synonym.)

Range.—United States generally; Quebec, Manitoba; Victoria; Vancouver Island. Europe. (Dall, 1905.)

Discussion.—This form, never previously reported from the state, is Utah's smallest snail. Its habitat is indicated above among records. Our Utah specimens are a rich red gold color, very beautiful under a lens. In collecting a form as small and delicate as this, moisten a straw and touch the shell. The shell will cling to the straw and can be transferred to the vial. Never use steel forceps, no matter how fine. Our forms average about 1.25 mm. in diameter.



♂

Punctum pygmaeum Draparnaud
Salt Lake City. ——— = $\frac{1}{2}$ mm

Fig. 53

Family SUCCINEIDAE Albers

Snails having very thin, transparent, more or less oval shells of few whorls; the last whorl and its aperture proportionately very large. Anterior tentacles either slightly developed or wholly wanting; jaw arcuate, with a nearly square median plate projecting upward, striated or ridges on its concave edge. Lingual teeth in curving transverse rows, the median tricuspid, the laterals bicuspid.

Of this family only *Succinea*, represented by six forms, is known to occur within our range.

Genus SUCCINEA Draparnaud

THE SWAMP OR AMBER SNAILS

Shell oval, transparent and fragile; the aperture oval with outer lip thin and not reflected; spire short, with whorls few and rapidly increasing in size.

Animal large relatively to the shell; foot broad, tentacles short and thick with anterior (inferior) pair inconspicuous. Ureter reflexed.

Genotype.—*S. putris* Linnaeus.

PARTIAL KEY TO SPECIES

- a. Shell shaped like *Lymnaea obrussa*, but orange and the aperture more oval.
S. avara (in part).
- aa. Shell not especially *Lymnaei* form.
 - b. Shells large, 2 cm. in length.
 - c. Shell white or pink.
 - d. Shell white. *S. sillimani*.
 - dd. Shell pinkish and very elongate. *S. hawkinsi*.
 - cc. Shell rich reddish orange. *S. haydeni* (in part).
 - bb. Shell smaller, under 1½ cm. in length.
 - d. Shell white. follow *c* above.
 - dd. Shell not white.
 - e. Shell rich orange.
 - f. Aperture obliquely flaring. *S. avara* (in part)
 - ff. Aperture more nearly vertical, gracefully sinuous.
S. haydeni (in part).
 - ee. Shell pinkish yellow. *S. rusticana*.

The student will find difficulty in using a key on the Succineas as differences between species often seems to be less than variability within certain species.

Discussion.—Succineas live along moist shores, on reeds in swamps, and on floating material. The animal cannot protect itself because most of the shell is composed of the body whorl with the large open aperture. The shells of Succineas are very fragile. Suc-

can be pulled soon after without boiling. It is better to handle Succineas with the fingers rather than with forceps, as the latter often break the aperture of the shell.

Succinea nuttaliana Lea

Succinea nuttaliana Lea, *Proc. Am. Phil. Soc.*, II, 32 (1841).

Utah Localities.—

Previous records: Warm Springs, near Salt Lake City; Utah Lake. (Ingersoll, 1874.)

Discussion.—"I doubt whether any of these records except for Montana should stand. . . . Probably the Colorado records of *nuttaliana* should be at least in part referred to *retusa*, and the Utah records to *haydeni*." (Henderson.)

Succinea nuttaliana Lea (U. of U. Zoo. Mus., Lot 6, No. 26), from Alameda Co., California, appear very similar to our *S. haydeni*. We find no Succineas from Warm Springs in the Orson Howard collection. The Succineas taken from Liberty Park and Mt. Olivet Cemetery Reservoir, Salt Lake City, are not *nuttaliana*, but *haydeni*. *S. haydeni* has a much more sinuous curve on the flaring aperture, and is more highly colored.

Succinea hawkinsi Baird

HAWKINS' SWAMP SNAIL

Succinea hawkinsi Baird, *Proc. Zoo. Soc.*, 1863, 68.

Utah Localities.—

Previous record: Kanab Wash, southern Utah. (Ferriss, 1910.)

Shell elongate-obovate, thin, pellucid, shining, undulately striated, pinkish, within pearly; spire acute; whorls four, convex, the last equalling two-thirds the shell's length; suture impressed; aperture oval, effuse below. Length $\frac{3}{4}$ mm., lateral $\frac{1}{3}$ inch.

This shell is of an elegant form, and of pinkish color, with the interior of a pearly lustre. It is smooth and shining, but marked with waved striae of lines of growth. It resembles very much in figure the *Succinea pfeifferi* of Europe, but is of still more elegant shape, and of a brighter hue.

I have named it after Lieut.-Col. Hawkins, R. E., Commissioner of the British North American Boundary Commission. (Baird.)

Type locality.—Lake Osoyoos, British Columbia. (Brit. Mus.)

Range.—Oregon, California, Washington, and British Columbia. (Dall, 1905.)

Discussion.—We have three fine specimens from Hagerman, Idaho, sent by Clench. (U. of U. Zoo. Mus., No. 1250), but we have not seen anything so elongate in any of our collections.

Succinea haydeni Binney

HAYDEN'S SWAMP SNAIL

Succinea haydeni W. G. Binney, *Proc. Acad. Nat. Sci. Phila.*, X, 114 (May, 1858).

Utah Localities.—

- Previous records:* Salt Lake City. (Binney, 1885.)
Springville; Utah Lake; Salt Lake City. (Henderson and Daniels, 1917.)
- Duplicate record:* Salt Lake City, Mt. Olivet Cemetery Reservoir, along with a distinctly different form, probably *sillimani*. (U. of U. Zoo. Mus., No. 918.)
- New records:* Ogden, pond on Salt Lake City road just out of city. (U. of U. Zoo. Mus., No. 874.)
Near Ogden River in city. (U. of U. Zoo. Mus., Nos. 722 and 912.)
Logan, pond one mile south of city. (U. of U. Zoo. Mus., No. 1289.)
Blacksmith Fork, below Ballard Springs. (Nos. 1320 and 1398.) Ballard Springs. (No. 1453.)
Utah Lake near Saratoga. (U. of U. Zoo. Mus., No. 518.)
Provo. (U. of U. Zoo. Mus., No. 539.)
Sterling, reservoir south of town. (U. of U. Zoo. Mus., No. 1118.)
Between Marysvale and Richfield, Sevier Co. (U. of U. Zoo. Mus., No. 984.)
Marysvale, swamp near town. (U. of U. Zoo. Mus., Nos. 982 and 1058.)
Glenwood, near Richfield. (U. of U. Zoo. Mus., Nos. 805, 842 and 850.)
Bear Lake, north of Garden City. (U. of U. Zoo. Mus., No. 1420.)
Laketown, swamp south side of road, one mile west of town, juvenile. (U. of U. Zoo. Mus., No. 1414.)
Randolph, stream as one approaches town from the north. (U. of U. Zoo. Mus., No. 1427.)

Shell elongate, oval, thin, shining, amber-colored; spire short, acute; whorls three, convex, the last marked with the wrinkles of growth, and irregular, heavy spiral furrows; suture moderate; columella covered lightly with callus, and allowing all the interior whorls to be seen from below the apex; aperture oblique, oval, five-sevenths the length of the shell, the lower portion of its margin considerably expanded. Length 21 mm., diameter 9 mm. (Binney and Bland, 1869.)

Range.—Idaho, Utah, east to perhaps Gunnison, Colorado.

Discussion.—This is our common swamp species, with bright orange shell. The color of the shell does not show while the animal is in it, as it is so transparent that the organs show through.



Succinea haydeni Binney
Logan, Utah — 1mm

Fig. 54

Succinea grosvenori Lea

THE TWISTED SNAIL

Succinea grosvenori Lea, *Proc. Acad. Nat. Sci. Phil.*, 1864, 109.

Utah Localities.—

Previous records: Utah. (Ingersoll, 1874. Cockerell says Ancey examined Ingersoll's material and pronounced most of it *avara*.)

Eastern Utah. (Yarrow, 1875.)

New records: Moab. (U. of U. Zoo. Mus., Nos. 1626 and 1637.)

Blanding. (U. of U. Zoo. Mus., No. 1599.)

Between Blanding and Verdure. (U. of U. Zoo. Mus., Nos. 1647 and 1649.)

Shell obliquely ovate, striate, somewhat transparent, straw-yellow, and thin; spire exerted; sutures very much impressed; whorls four, convex; aperture nearly round, and rather large; outer lip expanded; columella bent in and twisted. Diameter .32 inch, length .51 inch. Santa Rita Valley, Kansas, and Alexandria, Louisiana. (Binney and Bland.)

Range.—Louisiana, Kansas, Colorado, Utah, Montana, Idaho, Dakota, and Idaho to New Mexico.

Succinea avara Say

THE VARIABLE SWAMP SNAIL

Succinea avara Say, *Long's Exped.*, II, 260, pl. XV, fig. 6 (1882).

Utah Localities.—

Previous records: Antelope Valley. (Ferriss, 1910.)

Ogden Canyon. (Henderson and Daniels, 1916.)

Logan, Charleston, Eureka. (Henderson and Daniels, 1917.)

Zion National Park, fossil in limestone. (Vanatta, 1921.)

East of Morris, and Black (both on shore of Great Salt Lake, near Garfield), Newton. (Henderson, 1924.)

New records: Bear Lake, west side. (U. of U. Zoo. Mus., No. 1286.)

Big Cottonwood Canyon, small specimens. (U. of U. Zoo. Mus., No. 712.)

Bryce Canyon, collected by V. M. Tanner, lymnoid. (U. of U. Zoo. Mus., No. 942.)

Marysvale, swamp near town. (U. of U. Zoo. Mus., Nos. 981, 1059 and 1142.)

Zion National Park, lymnoid, living. (U. of U. Zoo. Mus., Nos. 1088 and 1102.) Collected by A. M. Woodbury. (No. 1487.)

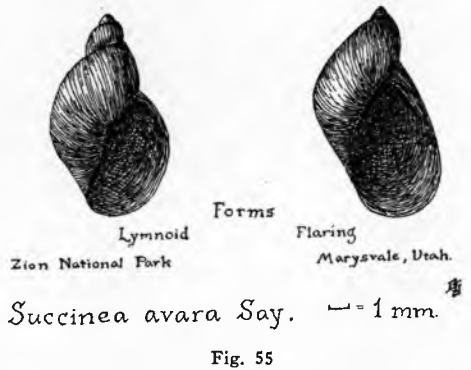
Cedar Canyon, toward head of canyon. (U. of U. Zoo. Mus., No. 1165.)

Ogden, along Ogden River, type with flaring aperture, anatomies coal black. (U. of U. Zoo. Mus., No. 911.)

Between Marysvale and Richfield. (U. of U. Zoo. Mus., No. 983.)

- Logan Canyon, five miles from mouth. (U. of U. Zoo. Mus., No. 1324 and 1325.) Puzzling small form. (No. 1302.)
- Rich Co., five miles from Evanston, Wyo., in mud deposits. (U. of U. Zoo. Mus., No. 1350.)
- Provo Canyon, North Fork, small specimens. (U. of U. Zoo. Mus., No. 932.)
- Emigration Canyon. (U. of U. Zoo. Mus., No. 954.)
- Panguitch Creek (South Fork of Sevier River), near Spry Station. (U. of U. Zoo. Mus., No. 1075.)
- Stansbury Mts., south end, Station 2 on side of mountain. (U. of U. Zoo. Mus., No. 1550, R. V. Chamberlin col.; identified by Henderson, "Large examples.")
- Eureka, canyon east of town, on hillside. (U. of U. Zoo. Mus., No. 1554, R. V. Chamberlin col.)
- Fruita. (U. of U. Zoo. Mus., No. 1615.)
- Moab. (U. of U. Zoo. Mus., Nos. 1628 and 1636.)
- Salina. (U. of U. Zoo. Mus., No. 1662.)

Shell rather small, very thin and fragile, straw-colored, rosy, amber-colored or greenish; periostracum shining, or presenting minute hairy processes in the young; whorls three, very convex, separated by a deep suture; last whorl rather large, not much expanded; spire very prominent, acute; aperture ovate, rounded at both extremities, about half as long as the shell. Extreme length about 6 mm. (Binney and Bland, 1869.)



Range.—North America, common, often under wet logs.

Discussion.—The description above is of the lymnoid form. We have in Utah, also, a form with a flaring aperture. We have good examples of the former from Kent, Michigan (U. of U. Zoo. Mus., Lot 6, No. 24), and of the latter from Loma, Colorado (Lot 6, No. 200), both furnished by the M. C. Z., though they did not differentiate the forms by the names above.

Succinea oregonensis Lea

THE OREGON SWAMP SNAIL

Succinea oregonensis Lea, *Proc. Am. Phil. Soc.*, II, 32 (1841).

Utah Localities.—

Previous records: Utah. (Pilsbry, 1898.)

Oquirrh Mts. (Henderson and Daniels, 1917.)

As *S. oregonensis gabbi* Tryon. (Pilsbry, 1898.)

Shell elongate ovate, thin, of a somewhat saffron-yellow color, rather coarsely though obtusely and distinctly striated transversely; spire with two and a half or three well-rounded whorls, separated by a distinct suture, the last whorl seven-eighths the length of the shell; aperture two-thirds the length of the shell, strictly ovate, one-third longer than broad; columella arcuate, but not folded, a thin white callus of considerable extent covering it. Length $6\frac{1}{4}$ mm.; greatest lateral diameter $3\frac{1}{8}$ mm., least diameter $2\frac{1}{2}$ mm. (Binney and Bland.)

Range.—California, Oregon, Washington, and British Columbia. (Dall, 1905.)

Discussion.—This form is so similar to *S. rusticana* that, if it be in our collections, it has not been recognized. We have a check set of *S. oregonensis* from San Francisco, Co., California.

Succinea rusticana Gould

Succinea rusticana Gould, *Proc. Boston, Soc. Nat. Hist.*, II, 187 (Dec., 1846).

Utah Localities.—

Previous records: Logan, and Devil's Slide. (Henderson and Daniels, 1917.)

New record: Bear Lake, west shore. (U. of U. Zoo. Mus., No. 1392.)

Checks very nicely with No. 1205 which are check specimens of this species from Montpelier, Idaho, sent by Henderson, and identified by Vanatta; this record close to Henderson and Daniels' (1917) record from St. Charles, Idaho.

Shell elongate, ovate conical, rather large, thin and fragile, pale greenish horn-color, surface rude and without lustre, coarsely and irregularly marked by the lines of growth; spire acute, of three or more moderately convex whorls, separated by a well-impressed suture, the last whorl large and long, narrowing towards the base; body portion of the face of the shell moderately large; aperture ovate, three-fourths the length of the shell; fold of the columella distinct. Length of axis $12\frac{1}{2}$ mm., breadth $6\frac{1}{4}$ mm. (Binney and Bland.)



Succinea rusticana Gould

Bear Lake, Utah — = 1mm

Fig. 56

Range.—Tulare Valley, California, north to British Columbia, and eastward to Idaho and Utah.

Succinea sillimani Bland

SILLIMAN'S SWAMP SNAIL

Succinea sillimani Bland, *Ann. N. Y. Lyc.*, VIII, 1865, p. 167, fig. 13.

Utah Localities.—

Previous record: Wasatch Mts. (Binney, 1885; impossible to confirm identification.)

New records: Salt Lake City, Mt. Olivet Cemetery. (U. of U. Zoo. Mus., No. 966.)

Shell oblong-ovate, thin, coarsely striate, shining, whitish, spire short, acute; whorls three, convex; suture impressed; aperture oblique, elongate-oval, angular above, effuse at the base; columella slightly arcuate, with a thin thread-like thickening above. Longitude 20 mm.; diameter $8\frac{1}{2}$ mm.; aperture 13 mm. long, 6 mm. broad in middle.

Type locality.—Humboldt Lake, Nevada.

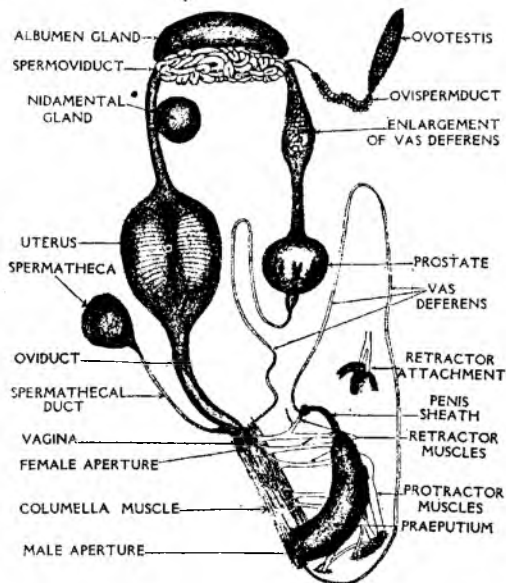
Range.—Uncertain.

Discussion.—These large white forms were found in Mt. Olivet Cemetery reservoir living in the same situation as the orange-shelled *S. haydeni*. While the difference between the shells is very striking, it is hard to detect until the animal is pulled. It lives on the cat-tails that grow along the east side of the reservoir in a small overflowed region. They are too large to be *S. rusticana*, also too white to check with specimens of that species from Idaho, mentioned above under *S. rusticana*. In our opinion this is the true *S. sillimani* but the matter can be fully cleared only by comparison with shells from the type locality.

Family LYMNAEIDAE Keferstein

In this family the shell, normally dextral, rarely sinistral, mostly with a prominent spire, thin and ordinarily horn-colored; the aperture large, simple and rounded, the outer lip acute, with an oblique white fold on the columella entirely or partially covering the umbilicus; shell covered with a corneous periostracum or epidermis. Radula bearing numerous subquadrate teeth in transverse rows of which the centrals are minute and unicuspid and the lateral ones bi- or tri- cuspid, the marginals serrated. Foot short, wide and rounded; tentacles flat, triangular, the eyes upon their inner base. Kidneys wide, short, pear-shaped. Genitalia on right side; male organ with distinct penis and penis-sac. Body striated, not granulose as in the Helicidae.

These are fresh-water forms occurring commonly in ponds and streams in all parts of the world though most abundant in temperate regions. They feed upon aquatic plants. Most forms come to the surface at intervals to take in the free air and may often be seen gliding on the surface with shells downward. About 15 living species and subspecies, together with minor forms are known to occur in Utah. These are commonly found attached to aquatic plants or in the mud or ooze at the bottoms of our ponds, lakes and streams.



Genitalia of *Lymnaea stagnalis jugularis* (after Baker)

The genus *Lymnaea* in the old sense embraced a number of natural, well-defined groups, some of which have recently been recognized by F. C. Baker* as genera. Four of these, *Lymnaea*, *Fossaria*, *Stagnicola*, and *Polyrhytis*, are reported in Utah.

Genus **LYMNAEA** Lamarck

Shell ovately oblong or elongated, generally thin and brittle; spire more or less attenuated; last whorl expanded; peristome thin, somewhat flaring, without internal varical thickening; aperture ovate or oblong-ovate, sometimes rounded; axis gyrate, forming a sharp ascending columellar plait; no true umbilicus, but there is occasionally a very small chink; columellar callus closely appressed to the body of the last whorl, forming a wide deposit; surface marked by numerous fine impressed spiral lines and close-set longitudinal growth lines, forming a finely decussated pattern; a horny periostracum or epidermis is present.

Animal with a short, wide, rounded foot; head with the usual bilobed vela area; surface of body fine striated, presenting a smooth appearance; tentacles, eyes and other characters as in the family. (Baker, 1928, which see for details of jaws, radula and genitalia.)

Genotype.—*Lymnaea stagnalis* Linnaeus.

Range.—Holarctic region.

Discussion.—In *Lymnaea* as now restricted are those species having "a bulb-shaped prostate and distinct bicuspid lateral teeth without typical tricuspid intermediate teeth. The first lateral may be tricuspid in certain individuals of the typical *Lymnaeas*. In these characteristics these species differ from all other species of the family. The shells are usually more or less thin and brittle, and the aperture varies from long and narrow to roundly ovate or even patulous."

The Utah forms herein recognized may be separated by means of the following key.

KEY TO SPECIES AND SUBSPECIES

a. Length near 12 mm.

b. Shell elongate, acutely conical, growth lines faint, aperture large, half the length of the shell, suture not well impressed, shell resembling a young *L. stagnalis jugularis*. *L. lepida*.

aa. Length more than 24 mm.

b. Shell proportionately very elongate, narrower, its last whorl and aperture rounded; length from 32 to 45 mm. *L. stagnalis wasatchensis*.

bb. Very large, the last whorl more flat and sided, larger, the aperture longer; height from 40 to 57 mm. *L. stagnalis jugularis*.

**Lymnaeidae* of North America, 1911; and *Fresh Water Mollusca* of Wisconsin 1928, part 1, page 194.

Lymnaea stagnalis jugularis Say

THE LARGE STAGNANT POND SNAIL

Lymnaea jugularis Say, *Art Conchology Nich. Encyc.*, I, 1817.

Lymnaea appressa Say, *Journ. Acad. Nat. Sci.*, II, 168 (1818).

Lymnaea stagnalis appressa (Say) Binney, *Land and Fresh-Water Shells of North America*, *Smith. Misc. Col.*, 143, 1867, p. 25.

Lymnaea stagnalis jugularis Baker, *Moll. Wisconsin*, I, p. 198, 1928.

Utah Localities.—

Previous records: Southern Utah. (Ingersoll, 1874.)

Utah Lake and Spring Lake. (Ingersoll, 1874.)

Utah Lake and Spring Lake. (Ingersoll, 1877.)

Utah Lake, Panguitch Lake, ditches near Salt Lake City. (Yarrow, 1875.)

Semi-fossil in Sevier Desert; living near Salt Lake City; living in Utah Lake at American Fork. (Call, 1884.)

White Marl, Utah. (Gilbert, cited in Baker, 1911.)

Salt Lake City; Utah Lake. (Henderson and Daniels, 1917.)

Duplicate records: Utah Lake at Provo. (U. of U. Zoo. Mus., No. 514.)

Near Spanish Fork. (U. of U. Zoo. Mus., No. 591.)

Shell large, elongate, somewhat fusiform, thin; color yellowish or brownish horn, sometimes blackish; surface shining; lines of growth rather coarse, crossed by distinct impressed spiral lines; nuclear whorls $1\frac{1}{4}$, smooth but texture resembling satin finish, shining; whorls 7, the early ones not rapidly increasing in diameter, the body whorl more rapidly expanding; all spire whorls very flat-sided, longer than wide, the body whorl more rounded; spire long, acutely pointed, usually more than half as long as the entire shell; sutures distinct, sometimes impressed; aperture ovate, sometimes somewhat dilated above, rounded below; the outer border usually well rounded; outer lip thin, acute; parietal wall with a thin callus which is appressed to the umbilical region, either completely closing the umbilicus or leaving a small chink; pillar of the columella gyrate, forming a heavy, oblique, ascending plait. Length from 31.5 to 53 mm.; diameter from 13.4 to 22 mm. Length of aperture from 16 to 25.5 mm.; diameter from 8.5 to 13.5 mm.



Lymnaea stagnalis jugularis
Say
Laketown, Utah. — $\frac{1}{4}$ in.

Fig. 58

Animal light or dark horn colored, tinged with bluish on the foot; tentacles triangular, flat, rather long and tapering; foot short and wide, truncated before and roundly pointed behind. (Baker, 1928, which see for details of genitalia, jaws and radula.)

Type locality.—Precise location not given by Say.

Range.—North America from Utah, Colorado and Illinois, etc., north to the Arctic Ocean.

Discussion.—This fine snail, is the largest member of the family occurring in America. It is recognizable readily from its large shell, large aperture, together with its yellowish or horn-color. *Stagnalis* sens str., well known in Europe, the Caucasus and northern Asia, apparently occurs on this continent only in Alaska. It is replaced by varieties here of which *jugularis* is the most important. It occurs in the more stagnant parts of rivers as well as in swamps.

Lymnaea stagnalis wasatchensis Hemphill

THE WASATCH STAGNANT POND SNAIL

Lymnaea stagnalis wasatchensis Hemphill, in Baker, *Lymnaeidae North America*, 1911, p. 152, pl. 20, fig. 10-12.

Utah Localities.—

Previous records: Panguitch Lake. (Yarrow, 1875.)

Logan; Salt Lake City; Panguitch Lake; 25 miles north of Salt Lake City; Tooele Co. (Hemphill in Baker, 1911.)

Logan; Salt Lake City; Ballard Springs, Logan. (Henderson and Daniels, 1917.)

New records: Laketown, swamp one mile west of town on north side of road. (U. of U. Zoo. Mus., Nos. 1255, 1266, 1257 and 1438.)

Black Swamp, west of Salt Lake City. (U. of U. Zoo. Mus., No. 1670.)

Shell much elongated, narrow, thin; color light yellowish horn; surface with the characteristic sculpture of *stagnalis*; whorls $6\frac{1}{2}$, flatly rounded, increasing slowly in size; last whorl small, generally not inflated, but well rounded; spire very long, acutely pointed, occupying more than half the length of the shell; sutures well marked, aperture small, roundly ovate; inner lip appressed tightly to the parietal wall and to the columellar region; there is no umbilical chink; axis with a strong plait as in *stagnalis jugularis*. Length 32.5 to 45 mm.; breadth from 14 to 20 mm. Length of aperture 15 to 22 mm.; breadth 9.5 to 13 mm. (Baker.)

Type locality.—Near Salt Lake City.

Range.—Utah and Northwestern America (Washington, Alberta, Mackenzie).

Discussion.—The chief characteristics of this subspecies, as pointed out by Baker, are its long tapering spire, its roundly ovate aperture, and the general rotundity of the first whorl. In contrast with this, *jugularis* has more flat-sided whorls. Examples of this form were found conjugating on rushes just below the water line in an old swamp near Laketown, July 3, 1927, by Elmer G. Berry.

Lymnaea lepida Gould

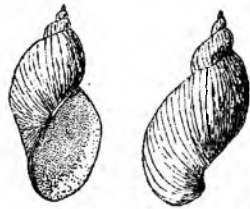
THE GRACEFUL POND SNAIL

Lymnaea lepida Gould, *Proc. Boston S. N. H.*, II, 211, (1847).

Utah Localities.—

New record: Bear Lake, west side. (U. of U. Zoo. Mus., No. 1274; intergrades, No. 1276.)

Shell very fragile, elongate, very acutely conical, subumbilicate, pale horn-color; whorls five, oblique, moderately convex, forming an acuminate spire; suture moderately impressed; surface smooth and shining, lines of growth faint, and when examined by a magnifier they are found to be rendered somewhat zigzag by distant, revolving furrows, which cross them. Aperture large and expanded, nearly semicircular, half the length of the shell; outer lip expanded; columella having a very strongly marked sharp fold, and broadly covered with a thin callus, which not being closely appressed at the umbilical region, leaves a small chink. Length 12 mm.; breadth 5.25 to 6 mm.; length of aperture 6 mm.; width 2.75 mm.



Lymnaea lepida Gould

Bear Lake, Utah — $\frac{1}{4}$ in

Fig. 59

Type locality.—Lake Vancouver, Oregon.

Range.—Utah and Idaho to California and Washington (Columbia River drainage area.)

Discussion.—This species is scarce at Bear Lake and it is apparently a very rare species everywhere. In many respects the specimen obtained from Bear Lake has characteristics of *L. columella* Say, but the aperture conforms more nearly to *L. lepida*. Some specimens referred to this species have turned out to be the young of forms of *stagnalis*; and, in fact, it is by no means certain that fuller series will not show *lepida* to be based upon such young specimens or to be a dwarf variety of *stagnalis*. In the meanwhile the status of the species must remain in doubt.

Genus **STAGNICOLA** Leach

Radula with bicuspid lateral teeth and distinctly tricuspid intermediate teeth; prostate long-ovate or cylindrical; penis sheath as long as or a trifle shorter than praeputium; sarcobelum a small muscular ridge; retractor muscles of male organ two in number, insertion in columella muscle either jointly or but slightly separated; shell variable in both size and structure, more or less inflated, usually rather solid, spire as long as or a trifle longer than aperture, lip not normally continuous, surface with distinct spiral sculpture. (Baker.)

Genotype.—*Lymnaea palustris* (Müller),

Range.—Holarctic region.

KEY TO SUBGENERA AND SPECIES

- a. Shell small, spire and aperture about equal, surface somewhat hirsute, columella smooth, not plicate. Subgenus *Hinkleyia*.
 - b. With numerous, revolving, microscopic equidistant lines between the lines of growth, aperture short, broadly ovate, often red within. Length, 8-14 mm. *S. caperata*.
- aa. Shell of medium size, spire usually acute, body whorl compressed or slightly inflated, columella twisted or plicate. . . . Subgenus *Stagnicola s. s.*
 - b. Last whorl usually long and narrow, but varying to nearly globose with short, acute spire in some "forms," spire acute, usually low, surface malleated.
 - c. Color normally brownish. *S. palustris nuttalliana*.
 - cc. Color lighter, spermaceti-like; shell narrower, sculpture heavier. *S. sumassi*.
 - bb. Last whorl obese or globose; spire sharply pyramidal, whorls tightly coiled, longer than aperture which is round, not elongate-ovate. *S. palustris wyomingensis*.

In addition to the living forms listed in this key, an account is given farther on of the fossil species *S. bonnevillensis* because of its widespread occurrence in the region.

Stagnicola (Hinkleyia) caperata (Say)

THE MICROSCOPICALLY-LINED POND SNAIL

Lymnaeus caperatus Say, *New Harmony Diss.*, II, 230 (1829).

Limnaea caperata Haldeman, *Mon.*, 34, pl. XI, figs. 1-9 (1848).

Stagnicola caperata Baker, *Fresh Water Moll. Wisc.*, I, p. 260, pl. XVII, fig. 43-47, 1928.

Utah Localities.—

Previous record: Murray. (Henderson, 1924.)

New records: Juab, one mile south of station. (U. of U. Zoo. Mus., No. 1040.)

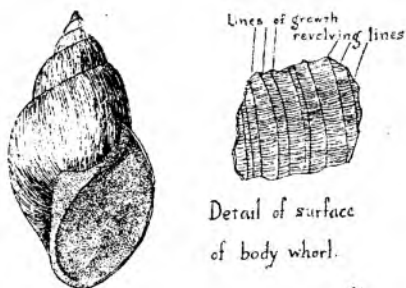
Salt Lake City, Mt. Olivet Cemetery Reservoir. (U. of U. Zoo. Mus., Nos. 599 and 608.)

St. George, canals from Virgin River, near Santa Clara Creek. (U. of U. Zoo. Mus., No. 1184.)

Moab. (U. of U. Zoo. Mus., No. 1661.)

Torrey. (U. of U. Zoo. Mus., No. 1665.)

Shell ovately-elongate, turreted, rather solid; color yellowish horn or brown, sometimes black; surface dull to shining; lines of growth very fine, crowded, irregular; shell encircled by numerous equidistant, heavily impressed spiral lines which give the shell a rather latticed or wavy appearance; these spiral lines appear at first to be elevated, this effect being caused by the epidermis standing erect in the otherwise impressed spiral lines; whorls 6 to $6\frac{1}{2}$, very



Stagnicola caperata (Say)

St. George, Utah — 1mm

Fig. 60

convex; spire acutely conic, generally longer than the aperture; nucleus consisting of one and one-third whorls . . . sculpture of satin finish and color generally deep wine or brown; sutures very heavily impressed; aperture ovate, its terminations more or less rounded, frequently reddish or purplish within; peristome thin, sharp, thickened by an internal rib, which is edged with dark purple; inner lip reflected over the umbilicus to form a wide, smooth, triangular expansion, without a columnar plait; parietal callus very thin; axis thickened but not twisted; umbilical chink opened, generally rather wide and deep. The surface of the shell is frequently marked by two, three or more rest periods, showing as heavy yellowish longitudinal bands; the spiral lines are so heavy that they may be plainly seen on the inner whorls of the shell when broken open. Length 9 to 13 mm.; width 5 to 6.2 mm.; length of aperture 4.2 to 6.2 mm., width 2.2 to 3.2 mm.

Animal black or bluish-black, lighter below and minutely flecked with small, whitish dots, which are scarcely visible except on top of head; head distinct; tentacles short, flat, triangular; foot short and wide, 8 mm. long and 3 mm. wide. The animal very rapid and decisive in its movements. Penis sheath about two-thirds as long as praeputium, the latter large and cylindrical; prostate large, ovately cylindrical, rounded at both ends. . . . The spermatheca small, rounded, with a long duct; oviduct very large, somewhat bulbous, the

lower narrow portion very short. . . . Jaw wide and rather high, the median swelling occupying about one-third of the width; ends rather bluntly rounded. Radula having central tooth with a rather broad, spade-shaped cusp; lateral teeth bicuspid. . . . intermediate teeth tricuspid. Over eighty-five rows of teeth. (Baker.)

Type locality.—Indiana, near Harmony.

Range.—Quebec and New England, west to Yukon Territory and south to California, Utah, Colorado, Indiana and Maryland.

Discussion.—This snail is one of the commonest Lymnaeids in the northern United States. It has the appearance of *F. obrussa*, with which it sometimes occurs. It is usually larger than *obrussa*, the sutures are not so deeply impressed, and its whorls have numerous equal, subequidistant, elevated, minute, revolving lines between the transverse lines. These are visible under a lens. *Stagnicola palustris* often presents spiral lines made up of regular accentuations of the lines of growth. Those not familiar with the microscopic lines of *S. palustris* should study the same, that they may not confuse the young of that species with *caperata*.

Half-grown specimens have often been identified erroneously as *umbilicata*.

Baker notes that this species "almost invariably occupies intermittent streams or small pools, ponds and ditches which dry up in the summer." In Illinois, at least, it is commonly found in association with *Aplexa hypnorum*. "The species hibernates to a greater degree than any of the other Lymnaeas, a fact attested by the many rest varices observed on the shell of large individuals. In these dry ponds living specimens may frequently be found by digging into the mud, leaves and other debris. In Wisconsin, *caperata* has been found almost invariably in small woodland pools which become dry in summer and fall, or in small streams which become wholly or partially dry."

Stagnicola palustris nuttalliana (Lea)

THE HEAVY-SPIRED POND SNAIL

Lymnaea nuttalliana Lea, *Proc. Am. Phil. Soc.*, II, p. 33, 1841.

Lymnophysa palustris var. *nuttalliana* Cooper, *Zoo.*, I, p. 196, 1890.

Lymnaea palustris nuttalliana Baker, *Moll. Chi. Area*, II, p. 276.

Lymnaea (*Stagnicola*) *palustris* Baker, *Lymnaeidae*, 1911.

Lymnaea haydeni, *reflexa*, *sumassi* and *proxima* (in part) as indicated below following the discussion.

Utah Localities.—

- Previous records:* Warm Springs near Salt Lake City. (Cooper, 1870.)
 Living and fossil throughout the Bonneville area. Common and unusually large on the Sevier Desert. (Call, 1884.)
 Sevier River; Sevier Lake; Panguitch Lake. (Tryon, 1873.)
 Utah Lake. (Ingersoll, 1877.)
 Uinta Mts., up to 10,000 feet. (Baker, 1911.)
- Duplicate records:* Utah Lake at Provo. (U. of U. Zoo. Mus., Nos. 530 and 531.)
 Near Saratoga. (U. of U. Zoo. Mus., No. 879.)
 Geneva Resort. (U. of U. Zoo. Mus., No. 788.)
 Inasmuch as the following records fall in the Bonneville area, they will in a sense repeat Call's record.
- New records:* Pleasant Grove, swamp east of Geneva Resort. (U. of U. Zoo. Mus., Nos. 507 and 508.)
 Ogden Canyon, near the city artesian wells. (U. of U. Zoo. Mus., No. 521.)
 South Tremonton, Boxelder Co., form *proxima* q. v. (U. of U. Zoo. Mus., No. 595.) South Tremonton, weathered, collected by Melba Turner. (U. of U. Zoo. Mus., No. 639.)
 Malad River, north of Garland. (U. of U. Zoo. Mus., No. 630.)
 Big Cottonwood Canyon, lake at head of Mill F. (U. of U. Zoo. Mus., Nos. 686, 699 and 702.)
 Logan, Blacksmith Fork below Ballard Springs. (U. of U. Zoo. Mus., Nos. 1319 and 1402, form *proxima* Lea.)
 Logan Canyon, five miles from mouth. (U. of U. Zoo. Mus., No. 1370.)
 Bear Lake, west side. (U. of U. Zoo. Mus., Nos. 1285 and 1466, form *proxima*.) South of Garden City. (No. 1332.) West shore. (No. 1323.)
 South of Ideal Beach at south end of lake, one with distinct *haydeni* characteristics, and also a distinct second growth of the body whorl. (No. 1298.)
 Murray (South Cottonwood). (U. of U. Zoo. Mus., No. 1652.)
 Peoa, Summit Co. (U. of U. Zoo. Mus., No. 648.)
 Woodland, Summit Co. (U. of U. Zoo. Mus., No. 649.)
 Kamas, Summit Co. (U. of U. Zoo. Mus., No. 649, collected by Melba Turner.)
 Laketown, swamp south side of road one mile west of town. (U. of U. Zoo. Mus., No. 1416.) Same locality, north side of road. (No. 1259.)
 Sterling, reservoir south of town. (U. of U. Zoo. Mus., Nos. 980, 1061, 975, 976, 979, 977 and 1062; intergrades No. 1065.)
 Lake Navajo, between Cedar Breaks and Panguitch. (U. of U. Zoo. Mus., Nos. 1050 and 1120.) Some showing *haydeni* characteristics. (No. 1054.)
 Glenwood. (U. of U. Zoo. Mus., No. 806.)
 Between Circleville and Junction. (U. of U. Zoo. Mus., No. 1066.)
 Rich Co., in mud deposits along stream, five miles from Evanston, Wyo.
 Fish Lake, marsh at north end of lake. (U. of U. Zoo. Mus., Nos. 810 and 845.) Fish Lake. (Nos. 803, 827 and 865.)

Panguitch, three miles north of town. (U. of U. Zoo. Mus., No. 1137.)

Provo Canyon, above Heber. (U. of U. Zoo. Mus., No. 900.)

Panguitch Creek (South Fork of Sevier River), near Spry Station. (U. of U. Zoo. Mus., No. 1079.)

Between Marysvale and Richfield. (U. of U. Zoo. Mus., No. 986.)

Richfield. (U. of U. Zoo. Mus., No. 1045.)

Juab, one mile south of station. (U. of U. Zoo. Mus., Nos. 1037 and 1085.) Showing *haydeni* characteristics. (Nos. 1038 and 1187.)

American Fork Canyon, Salamander Lake, two miles above Alpine Camp. (U. of U. Zoo. Mus., No. 735.)

Marysvale. (U. of U. Zoo. Mus., No. 1057.)

Charleston, Provo River. (U. of U. Zoo. Mus., No. 914.)

Strawberry Reservoir, J. Hansen col. (U. of U. Zoo. Mus., Nos. 1534 and 1541.)

Honeyville, Boxelder Co., Melba Turner.

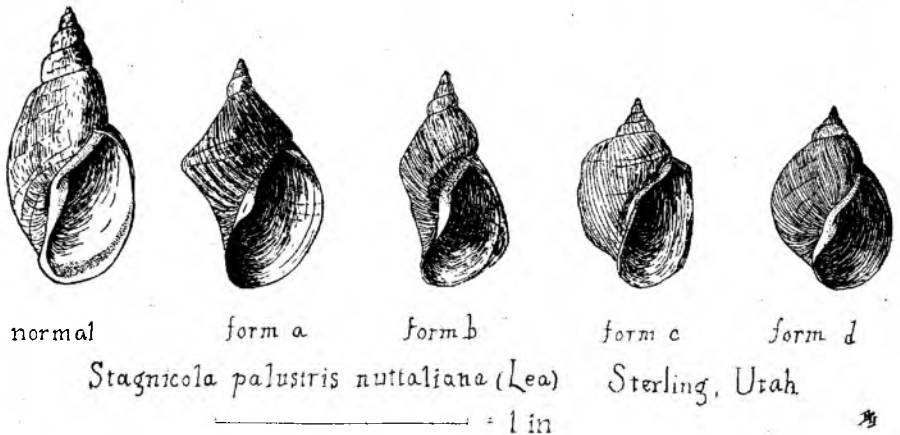


Fig. 61

Shell ovately conical, rather thin, striate, sub-diaphanous, pale brown, imperforate; spire rather short; apex red; sutures impressed; whorls six, convex; aperture ovate, inflated; banded within. Diameter .50 inch; length .95 inch.

A fine, rather robust species, rather resembling *L. elodes* (of authors, which is *palustris* forms), but shorter and more inflated and having a larger and more curved fold. The aperture is rather more than one-half the length of the shell, and is retuse at the lower part. Under the lens may be observed very minute revolving striae. The band within the aperture is removed from the edge of the lip, and is broad and brown. The lip is not reflected. (Lea.)

Type locality.—Oregon.

Range.—Oregon to Idaho, Wyoming, Utah and Colorado.

Discussion and description of forms.—Mr. F. C. Baker, who has devoted many years to the study of North American Lymnaeidae, has reached the conclusion that we do not have typical *S. palustris* in America, all specimens heretofore referred to the species really representing distinct systematic subspecies, varieties, or races. Most Lymnaeas of our part of the country heretofore referred to *palustris* and some of its forms are placed in *nuttalliana* as a race as indicated above. *Palustris* in general is very variable, but our form commonly maintains its general shape. However, at the reservoir south of Sterling, Utah, we found it twisted into many curious shapes, with any number of intergrades. Whether this be due to mutations or to other causes, we do not know. Dall (1905, p. 63), as quoted in the introduction, gives one probable reason for such variation, especially as to the great malleation of the shells.

Henderson (1924, p. 176) in discussing the *plexatus* variation of *Helisoma trivolvis*, which coils from the usual plane, brings in the possibility of parasitic organisms as a factor. His statement follows: "As to the cause of the distortion of his *plexata*, Ingersoll says: 'The bottom of the lake is, for the most part, rough conglomeritic rock, and it is in many places filled with heavy water plants, which may account for the peculiarities of the shell.' The 'conglomeritic' rock is probably latite and rhyolite, as that is the country rock of the region (St. Mary's Lake, Antelope Park, Mineral County, Colorado). I have found the distortion sporadic under widely varying conditions. Smartweed Lake, Los Lagos, and a lake at Cottonwood Pass are fairly cool and free from vegetation and alkali, the first and last named free from rock and Los Lagos rather rocky. Columbine Lake is so choked with vegetation that it will soon become a meadow as a result of the process which has transformed so many glacial lakes into grassy pastures. Round Butte Reservoir is on the plains, shallow, hot in summer and very strongly alkaline. Yet the proportion of distorted shells is about the same in all these lakes. If it were due to some general unfavorable condition, all or nearly all the shells at a given locality should be affected in the same way, but that does not seem to be the case except at St. Mary's Lake. This fact suggests possibly the work of some parasite or organism which might affect either a few individuals or a whole colony. Dr. Walker informs me that he has a set of *Campoloma* nearly all of which are deformed by some such cause, and recalls a published statement concerning a Swiss lake where all the Lymnaeas were deformed because of a Hydra that settled about the aperture and interfered with the normal action of the mantle in shell building, but at the end of the Hydra season the

Lymnaeas resumed normal form.* Whatever the cause, variation of *H. trivolvis* in this respect is more frequent and more pronounced in Colorado than anywhere else, so far as I know. The Utah shells we have are very much less subject to this variation, though varying in other directions, the most interesting being the very large (36 mm.) shells with strap-like whorls, published as *H. trivolvis binneyi* Tryon, which form in large series, grading into typical *trivolvis*."

The great variation of *Stagnicola palustris nuttalliana* near Sterling, Utah, will necessitate a study as to its cause. For the convenience of future workers the extreme variations which we found, are described as forms and figured. The types of these forms are on display in the Zoology Museum of the University of Utah.

Forms of *Stagnicola palustris nuttalliana* described from the reservoir south of Sterling, San Pete Co., Utah:

1. *Normal*: See description of species.
2. *Form a*: Characterized by having a low spire of $3\frac{1}{2}$ whorls, and a body whorl that is carinated or subcarinated and malleated. The under side of the body whorl at its commencement is distinctly concave. See accompanying figures for comparison with normal. Measure of type in U. of U. Zoo. Mus., No. 975; height $15/16$ inch; greater diameter $9/16$ inch; length of aperture $9/16$ inch. Animal in type, living when found. Measurement of a second specimen in U. of U. Zoo. Mus., No. 975: height $13/16$ inch; greatest diameter $7/16$ inch; length of aperture $\frac{1}{2}$ inch. Paratype has a spire resem-form b.
3. *Form b*: Characterized by the elongate, slender shape of the shell, the short spire and the downward flaring of the aperture. Body whorl not carinated at its commencement, but very abruptly and sharply curved below the middle near the aperture, thus deforming the aperture. Body whorl ridged with vertical ribs. Three or four faint longitudinal ribs are present. Spire with $3\frac{1}{2}$ whorls. Length of type in U. of U. Zoo. Mus., No. 976; height $13/16$ inch; greater diameter $7/16$ inch (including flaring of aperture); length of aperture $\frac{1}{2}$ inch. Animal living when taken. Specimen with less deformed aperture, No. 976. Animal also living when taken. A fine example that had apparently had an accident in which the flaring body whorl was broken, after which it had regenerated a part of a new body whorl within the old, broken aperture is in No. 979. Animal living when taken.
4. *Form c*: Characterized by an upper and a lower subcarination of body whorl, making the aperture nearly rectangular. The low spire has 4 whorls. One specimen only found, this is in the U. of U. Zoo. Mus., No. 977. Height $\frac{3}{4}$ inch; greatest diameter $7/16$ inch; length of aperture $\frac{1}{2}$ inch.

*A. H. Cooke in Cambridge Natural History III, Molluscs, p. 89: "Sometimes the production of a variety may be traced to the intrusion of some other organism. According to Brot, nine tenths of the *Lymnaea peregra* inhabiting a certain pond near Geneva, were, during one season, afflicted with a malformation of the base of the columella. This deformity coincided with the appearance, in the same waters, of extraordinary numbers of *Hydra viridis*. The next season, when the *Hydra* disappeared, the next generation of *Lymnaea* was found to have resumed its normal form."

5. *Form d*: Characterized by its rounded outlines, low spire and normal aperture. Body whorl malleated. Holotype in U. of U. Zoo. Mus., No. 1062. Length 11/16 inch; greatest diameter 7/16 inch; length of aperture 7/16 inch. Animal within but dried up when taken.

Stagnicola palustris haydeni (Lea)

Proc. Acad. Nat. Sci. Phila., 1858, p. 166.

A form found in the Yellowstone and Big Sioux and adjacent territory, especially Montana. Utah specimens resembling *haydeni* are probably abnormal *S. palustris* and are so listed above. (Dall, 1905, p. 77) says that the distinctions which have been relied on to separate *L. haydeni* Lea and *L. expansa* Haldeman are due to pathogenic mutations.

Stagnicola reflexa Say

Limneus reflexus Say, *Journ. Nat. Sci. Phila.*, II, 167 (1821).

Utah Locality.—

Limnaea reflexa Haldeman, *Mon.*, 26, pl. VIII, (1842).

Previous record: Utah. (Binney, 1867 (1865.))

Discussion.—This record is probably based on an incorrect determination. Sometimes in Utah elongate *Stagnicola palustris nuttalliana* approaches this form.

Stagnicola proxima Lea

Limnaea proxima Lea, *Proc. Acad. Nat. Sci. Phila.*, VIII, 80, (1856).

Utah Localities.—

Previous records: Near Salt Lake City; near Logan; Beaver City; Bear Lake; high up in Wasatch Mts. (Baker, 1911.)

Logan; Clarkeston; Devil's Slide; Morgan; Salt Lake City; Utah Lake. (Henderson and Daniels, 1917.)

Pool near Bear Lake; Ballard Spring near Logan; Paradise; Emigration Canyon. (Henderson, 1924.)

These are probably all records of *nuttalliana*.

Type locality.—California, San Antonio, Arroya.

Discussion.—F. C. Baker in a recent letter with reference to Utah forms of *Limnaca*, says: "*proxima* is very doubtful, all of the forms which I have seen that are true *proxima*, have been from the West Coast, mostly west of the Cascades." Henderson writes that "*proxima* is typically of different texture from the *palustris* group, with a more regularly coiled spire, and in Washington and British Columbia runs so close to *rowelli* as to almost defy differentiation."

Stagnicola traskii (Tryon)

Limnaea traskii Tryon, *Proc. Phila. Acad. Nat. Sci.*, 1863, 149, pl. I, fig. 13.

Limnaea (Stagnicola) traskii Baker, *Monog. Lymnaciadae*, p. 368, pl. XXXIX, figs. 6-10, 1911.

Utah Localities.—

Previous records: Ogden and Garfield. (Henderson and Daniels, 1917.)

Type locality.—California, mountain lake.

Range.—California north to Alberta and east to Wyoming and Utah. "A species characteristic of the Upper Austral Transition and Boreal (Canadian) life zones of the Californian, Coloradoan and Hudsonian regions. A careful search will doubtless fill the vacant territory between Wyoming, California and Alberta." (Baker.)

Discussion.—The occurrence of typical *traskii* in Utah is doubtful. True *traskii* "may be known by its short spire, very large, rotund body whorl and distinct umbilical chink." Henderson now refers specimens above listed on authority of himself and Daniels to *nuttalliana*.

Stagnicola palustris wyomingensis Baker

Stagnicola palustris wyomingensis Baker, *Nautilus*, XL, 1927, p. 84.

Utah Locality.—

Previous record: Near Wellsville. (Baker, 1927.)

Shell differing from typical *palustris* in being more scalariform, having a more obese body whorl, a longer and more acute spire, which is sharply pyramidal, and with more tightly coiled whorls, the spire being longer than the aperture, which is rounded, not elongate ovate. There is usually a distinct umbilical chink, which is absent or but feebly developed in typical *palustris*. Length 18.5 to 19.5 mm.; width 7.3 to 9.5 mm. Length of aperture 7.5 to 9 mm.; width 3.8 to 4.5 mm. (Baker.)

Type locality.—Slough 10 miles south of Lander, Wyoming.

Range.—Known only from the type locality and Wellsville, Utah (“apparently the same form”).

Discussion.—Baker says “The new variety will probably be found widely distributed in the mountain region of Wyoming, Utah, Montana and Colorado.” However, if we have taken it in our collecting we have not separated it from *nuttalliana*. “Its acute spire, short, rounded aperture and well rounded whorls will distinguish it. It has been identified as *proxima* Lea, but that species, while having a long, pointed spire, has flat-sided whorls and shallower sutures.”

Stagnicola sumassi (Baird)

Limnaea sumassi Baird, *Proc. Zoo. Soc. London*, 1863, p. 68.

Galba sumassi Baker, *Monog. Lymnaeidae*, 1911, p. 403, pl. XLI, figs. 11-17.

Utah Locality.—

Previous record: Echo Canyon, Summit Co. (Baker, 1911.)

Shell narrow, elongate, attenuated, fusiform in some specimens, varying from thin to rather solid; periostracum light, whitish horn, with two or three rest period bands; surface shining, lines of growth coarse and heavy, wrinkled and crowded about the aperture, crossed by very heavy impressed spiral lines; nuclear whorls rounded, smooth, dark brown color, in size about as in *catascopium*; whorls six, flatly rounded, slowly enlarging; last whorl somewhat flat-sided normally: spire rather long, pointed, a trifle longer than the aperture; sutures well impressed; aperture elongate-ovate, somewhat semi-lunate, a little effuse anteriorly; peristome thin, acute, bordered within by a narrow black band which marks a rest-varix; parietal wall with rather wide, thick callus; inner lip narrow, reflected, nearly or quite closing the umbilicus; the columella is inclined to be twisted and is marked by a heavy plait. Some specimens are somewhat malleated.

Length from 15.5 to 29 mm.; breadth 7.5 to 12.5 mm. Length of aperture 7.6 to 11.5 mm.; breadth 3.1 to 5.1 mm. (Baker.)

Type locality.—British Columbia, Sumass Prairie, Frazer River.

Range.—British Columbia to northern Utah.

Discussion.—“*Sumassi* doubtless occupies much of the territory between the two records cited, but it has been confused with *palustris*, *jacksoniensis* and other western species and the records cannot be relied upon. Only two lots have been seen which are authentic, the type lot and one from Echo Canyon, Utah.” (Baker.) The Echo Canyon specimens were compared with the types in the British Museum.

Stagnicola bonnevillensis (Call)

THE BONNEVILLE SNAIL (FOSSIL)

Limnophysa bonnevillensis Call, *U. S. Geog. Sur.*, Bul. 11, 1884, pp. 18, 24, 28, 48, pl. 6, figs. 10-13.

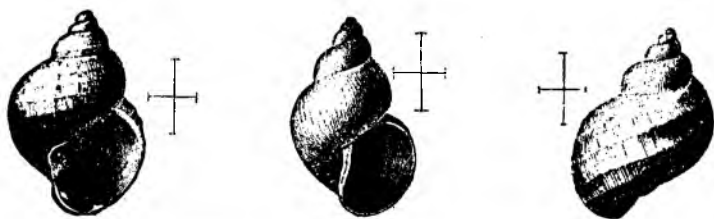
Limnaea bonnevillensis Stearns, *Proc. U. S. Nat. Mus.*, XXIV, 1901, p. 291.

Galba bonnevillensis Baker, *Monog. Lymnaeidae*, 1911, p. 105, pl. XVII, figs. 6-8.

Utah Localities.—

Previous records: Near Salt Lake City. (Hayden, 1870.)

Bonneville beds at Kelton; Bear Lake; Fish Spring Valley; Willow Springs; Sevier Lake; near Salt Lake City. (Call, 1884.)



Stagnicola bonnevillensis (Call) (After Call)

Fig. 62

Shell umbilicated, elongate, ventricose or bullate, somewhat solid, faintly striate and very minutely reticulated, below the suture the last whorl bearing faint longitudinal ridges or costae; spire elevated, acute, suture deeply impressed; whorls four to four and one-half, very much rounded, sometimes tending to geniculation above, the last whorl equal to three-fourths the whole length of the shell, rapidly increasing in size, much swollen, somewhat expanded at the base; columella somewhat plicate, slightly callous, regularly arcuate; columella and peristome continuous; peristome simple, margins joined by a heavy callous which is continuous and so reflexed as to partially close the umbilicus; aperture broadly ovate, often patulous;

equal to one-half the entire length of the shell, oblique, angled slightly behind.

The four largest specimens of the many in the collections give the following dimensions: Length 15.0 mm., breadth 7.8 mm.; length 11.0 mm., breadth 5.8 mm.; length 9.4 mm., breadth 5.2 mm.; length 18.5 mm., breadth 6.0 mm.

This shell resembles depauperate examples of *S. sumassi* Baird (var. *S. palustris* Müller), but differing in not presenting a decussate surface, and in the columella being less strongly plicate. The greater number of specimens are somewhat malleated, though occasionally quite smooth specimens occur which approach nearest to *L. desidiosa* Say. Many present a patulous aperture, in which respect they resemble specimens of the genus *radix* rather than true *Limnophysa*. The general outline of the specimens is that of *L. adelinae* Tryon. Collected abundantly by Mr. G. K. Gilbert in Upper Bonneville beds at Kelton, Utah. (Call.)

Type locality.—Bonneville beds, Kelton, Utah.

Range.—Lake Bonneville beds, Kelton, Utah and in beds of Lake Lahontan, Nevada (Humboldt Co., Rye Patch).

Discussion.—This is a fossil form, included because of its widespread occurrence in beds of old Lake Bonneville and the likelihood of its being taken by collectors in this region.

"*Bonnevillensis* is a peculiar little species bearing no particular resemblance to any recent species excepting, perhaps, certain forms of *catascopium*. Some specimens recall the recent *apicina*, although the spire is longer and the shell slenderer. . . . The form of the shell varies, in some individuals being long and somewhat scalariform, while in others it is short and quite globose. . . . The shells mentioned by Hayden as *catascopium* are also probably this species." (Baker.)

Genus **FOSSARIA** Westerlund

Shell small, turreted, spire usually pointed and as long as or longer than the aperture; without distinct spiral striation; axis not twisted, smooth, without a plait; inner lip reflected, forming a narrow, somewhat triangular expansion either rolled in toward the umbilical chink or standing erect and emarginating the umbilical chink, which may be narrowly open or quite deep and round. Superior jaw arched, about three times as wide as high, with a large rounded central projection. Penis sheath usually shorter than preputium, the latter without distinct sarcobelum, which is represented by an inconspicuous ridge; penis long, wide at upper part, narrow and elongated toward the end, simple; usually a single retractor muscle each for penis sheath and praeputium, inserted jointly or but slightly separated in the columellar muscle; sometimes the penis sheath re-

tractor is inserted in the retractor of the praeputium; prostate ovate, rounded at both ends; spermatheca rounded or pear-shaped. (Baker.)

Genotype.—*Buccinum truncatum* Müller.

Range.—Holarctic region.

Discussion.—In this genus are included the smaller lymnaeids such as *modicella* and *obrussa*, in which the lateral teeth of the radula are distinctly tricuspid. The shell is typically pointed, with axis round and inner lip triangular. (Baker.)

KEY TO SPECIES

- a. Whorls shouldered above.
- b. Whorls but slightly convex, often rudely faceted by a few coarse spiral semi-ridges, shell narrow, aperture usually narrow and half the length of the shell or more; height 8 to 17 mm. *F. obrussa.*
- aa. Whorls not shouldered above, rounded.
- b. Having more than 4 whorls.
- c. Spire broadly conic, usually as long as aperture, sutures not deeply impressed. *F. modicella.*
- cc. Spire acute, usually longer than aperture, turreted, sutures very deeply impressed.
- d. Body whorl well rounded, aperture roundly ovate, umbilicus round, deep, spire whorls rounded. *F. parva.*
- dd. Body whorl flatly rounded, aperture ovate, umbilicus a small chink, spire whorls flatly rounded, sutures not much impressed, length of shell 10 mm. or less. *F. modicella rustica.*
- b. Having less than 4 whorls. *Young of larger forms.*

Fossaria parva (Lea)

Limnaea parva Lea, *Proc. Am. Phil. Soc.*, II, 33 (1841).

Fossaria parva Baker, *Moll. Wisconsin*, I, p. 285 (1928).

Utah Localities.—

Previous record: Wheelon. (Henderson and Daniels, 1916, identified by Walker.)

New record: Moab. (U. of U. Zoo. Mus., No. 1641.)



Teeth of Radula of *Fossaria parva* (Lea) (After Baker)

Fig. 63

Shell small, rather solid, turreted, translucent; periostracum light horn or yellowish white, pellucid; surface shining, growth lines close set and well marked, sometimes elevated so as to roughen the surface

of the last whorl; spiral lines very fine or absent; whorls 5 to 5 and one-half, very convex, regularly increasing in size; nucleus of one and one-fourth whorls, smooth, with satin-finish sculpture; in outline the nucleus is rounded, the first whorl being very large; the sculpture of the shell begins very abruptly; spire elevated, forming an acute pyramid, generally longer than the aperture; sutures deeply impressed; aperture roundly and regularly elliptical, continuous in many specimens, a trifle effusive at the lower end; outer lip thin, sometimes developing a white deposit or varix a short distance from the edge; inner lip markedly and broadly reflected over the umbilicus, forming a broad even expansion; parietal callus well marked, thick; umbilical chink well marked, open, axis straight, not twisted, thickened by shelly deposit. Length from 4.5 to 9 mm.; diameter from 2.5 to 4.5 mm. Length of aperture from 1.5 to 3.8 mm.; diameter from .5 to 2 mm.

Animal with color blackish, very thickly dotted with fine white dots. The upper whorls are pinkish in the living animal, and the spotted mantle shows through the almost transparent shell. (Baker, 1928, which see for details of jaw, radula and genitalia.)

Type locality.—Cincinnati, Ohio.

Range.—From Connecticut and Maryland west through Kentucky to Oklahoma, New Mexico, Arizona and Utah.

Discussion.—"It is more slender than *modicella*, has a longer, more turreted spire, a more regularly elliptical aperture and a differently shaped inner lip, which is roundly and broadly reflected over the umbilicus." We have not recognized the form in our collecting, excepting in the specimen from Moab.

Fossaria modicella (Say)

Limnaea modicella Say, *J. A. N. Sc.*, V, 122 (1825).

Limnaea humilis modicella Say, Binney, *Land and Fresh-Water Shells of North America*, Part II, Smith Misc. col., 143, 1867, p. 63.

Fossaria modicella Baker, *Moll. Wisconsin*, I, 1928, p. 289, pl. XVI, fig. 8, and pl. XVIII, fig. b-10.

Utah Localities.—

Previous records: Warm Springs, near Salt Lake City. (Cooper, 1870.)
Kelton. (Stearns, 1893.)

Garden City; Morgan; Utah Lake. (Henderson and Daniels, 1917.)
Logan. (Col. by H. J. Pack, Henderson, 1924.)

Duplicate records: Bear Lake, swamp near south end of lake, south of Garden City. (U. of U. Zoo. Mus., No. 1419.) West shore, between Lakota and state line. (No. 1322.) West shore, living on beach. (No. 1279.)

Utah Lake near Saratoga. (U. of U. Zoo. Mus., No. 884.) At Provo. (No. 543.)

New records: Salt Lake City, Mt. Olivet Cemetery Reservoir. (U. of U. Zoo. Mus., No. 604.) Slough near airplane field, west of city. (No. 625.)

Dry Canyon. (U. of U. Zoo. Mus., No. 553.)

Big Cottonwood Canyon, below "the stairs". (U. of U. Zoo. Mus., No. 688.) Brighton, west of Silver Lake. (No. 716.)

Fish Lake, marsh at north end. (U. of U. Zoo. Mus., No. 853.)

Richfield, ditch from city springs. (U. of U. Zoo. Mus., No. 822.)

Wellsville, near town. (U. of U. Zoo. Mus., No. 1410.)

Three-Mile Creek on detour between Wanship and Salt Lake City. (U. of U. Zoo. Mus., No. 1367.)

Between Marysvale and Richfield. (U. of U. Zoo. Mus., No. 985.)

Rich Co., five miles from Evanston, Wyo., in mud deposits, bleached. (U. of U. Zoo. Mus., No. 1349.)

Glenwood, near Richfield. (U. of U. Zoo. Mus., No. 840.)

Crystal Hot Lakes, Salt Lake Co. (U. of U. Zoo. Mus., No. 556.)

Moroni, south of town. (U. of U. Zoo. Mus., No. 1030.)

At mill on road to Grantsville from Salt Lake City, just beyond fork of Tooele road. (U. of U. Zoo. Mus., No. 578.)

Logan Canyon, five miles from mouth. (U. of U. Zoo. Mus., No. 1306.)

Panguitch Creek (South Fork of Sevier River), near Spry Station. (U. of U. Zoo. Mus., No. 1077.)

Beaver. (U. of U. Zoo. Mus., No. 1007.)

Tremonton, Box Elder Co. (U. of U. Zoo. Mus., No. 593.)

Garland. (Melba Turner col.)

Torrey. (U. of U. Zoo. Mus., No. 1653.)

Shell of medium size, elongate-ovate or fusiform; periostracum light yellowish horn; surface shining, with distinct, rather coarse lines of growth and frequently very fine spiral lines; whorls $4\frac{1}{2}$ to 5, convex; the body whorl very large, flatly rounded spire generally short, broadly or acutely conic, sometimes dome-shaped; sutures well impressed; nuclear whorls $1\frac{1}{4}$, the first whorl very small, the second very large, the sculpture of the post-nuclear whorls beginning gradually; aperture ovate or elongate ovate, somewhat narrowed above; peristome thin; inner lip narrow, reflexed over the umbilical region, rolled over and appressed at the point of contact with the parietal wall, but standing more erect at the lower part; umbilical chink small narrow but distinct; axis smooth, forming an hour-glass shaped column. Length 7.1 to 10.5 mm.; di-



Fossaria modicella Say

Between Great Salt Lake & Tooele, Utah.

— = 1mm.

Fig. 64

iameter 4 to 5.5 mm. Aperture length 4 to 6 mm.; diameter 2.5 to 4 mm.

The animal and its genitalia and jaw as in *obrussa*. (Baker.)

Type Locality.—Oswego, Tioga Co., New York.

Range.—Eastern Canada (Quebec, Nova Scotia) to Manitoba and Vancouver Island, and south to New Jersey, Alabama, Texas, Arizona, and Southern California:

Discussion.—*Fossaria modicella* is our common form of pond snail. It has the sutures less deeply impressed than the young of *Fossaria obrussa*, which sometimes occur with it. This form "usually selects as a habitat a mud flat or a strip of muddy beach which is kept rather moist. It is also found in small pools, especially those that have a border of moss or much debris. It does not normally live in large bodies of water."

Fossaria modicella rustica (Lea)

Limnaea rustica Lea, *Proc. Am. Phil. Soc.*, II, 33 (1841).

Limnaea humilis rustica (Lea), Binney, *Land and Fresh-Water Shells of N. A.*, Part II, Smith. Misc. Col., 143, 1867, p. 63.

Fossaria modicella (Baker), *Moll. Wisconsin*, I, 1928, p. 291.

Utah Locality.—

Previous records: Deception Lake, Kanab, Kane Co. (Daniels and Ferriss.)

Shell small, elongated, subfusiform; periostracum light yellowish horn, darker in some specimens; surface shining; growth lines coarse, spiral lines absent or very faint; whorls 5 to 5½, convex, rather slowly increasing in diameter, the body whorl suddenly enlarging; spire long, very acute, generally a trifle longer than the aperture; nuclear whorls resembling those of *modicella*; sutures impressed; aperture usually narrowly elliptical; outer lip thin, sometimes with a varix; inner lip narrow, reflected, the lower part turned up, the upper part at its junction with the parietal wall impressed and flattened, forming a slight plait; umbilical chink usually very narrow, in some specimens nearly closed; axis as in *modicella*. Length 7.5 to 10 mm.; diameter 3.5 to 4.6 mm. Length of aperture 3.5 to 4.7 mm.; width 1.5 to 2.5 mm.

Animal, genitalia and jaw as in *modicella* (Baker).

Type Locality.—Poland, Ohio.

Range.—New York to Nebraska, New Mexico and Utah.

Discussion.—The habits are said to be similar to those of the species. The shell is characterized principally by its long, very acute spire and ovate aperture which will distinguish it from the forms of *modicella* sens str.

Fossaria obrussa (Say)

THE DEEP-SUTURED POND SNAIL

Lymnaea obrussa Say, *J. A. N. Sc.*, V, 123 (1825).

Fossaria obrussa Baker, *Moll. Wisconsin*, I, 1928, p. 293, pl. XV, fig. 14, and pl. XVIII, figs. 14-24.

Utah Localities.—

Previous records: Fossil near Salt Lake City (Hayden, 1870.)

Springs near Southeast shore of Utah Lake. (Ingersoll, 1877.)

Sevier Lake (Yarrow, 1875.)

Utah Lake, and South of Garden City. (Henderson and Daniels, 1917.)

Duplicate records: Bear Lake, living on beach, west shore, between Lakota and state line. (U. of U. Zoo. Mus., No. 1321.) Between Lakota Resort and Garden City. (No. 1468.) Pond south of Garden City. (No. 1333.) West shore of Bear Lake. (No. 1280.) Pond two miles south of Garden City. (No. 1294.) North of Garden City. (No. 1422.)

New records: Moab. (U. of U. Zoo. Mus., No. 1631.)

Fruita. (U. of U. Zoo. Mus., No. 1619.)

Fish Lake, west side, very thin and fragile. (U. of U. Zoo. Mus., No. 819.) Slough at south end. (No. 815.)

Logan, Blacksmith Fork below Ballard Springs. (U. of U. Zoo. Mus., No. 1318.) Pond one mile south of town. (No. 1291.) Ballard Springs. (No. 1456.) Logan Canyon, five miles from mouth. (No. 1371.)

Randolph, stream on road approaching town from north. (U. of U. Zoo. Mus., No. 1430.)

Between Brigham City and Logan. (Lot 7, No. 207.)

Laketown, swamp one mile west of town, on north side of road. (U. of U. Zoo. Mus., No. 1258.)

Rich Co., in mud deposits along stream, five miles from Evanston, Wyo. (U. of U. Zoo. Mus., No. 1356.)

Emery Station, Weber Canyon. (U. of U. Zoo. Mus., No. 1330.)

Parley's Canyon, in Lamb's Canyon. (U. of U. Zoo. Mus., No. 962.) Near head of Parley's Canyon. (No. 1338.)

Big Cottonwood Canyon, lake at head of Mill F. (U. of U. Zoo. Mus., No. 700; juvenile.)

Ogden, swamp just out of city on Salt Lake City road. (U. of U. Zoo. Mus., No. 878.) In city. (Nos. 720 and 893.)

Panguitch, three miles north of town. (U. of U. Zoo. Mus., No. 1135.) St. George and vicinity, identified by Walker. (U. of U. Zoo. Mus., and A. M. Woodbury col.)

Beaver. (U. of U. Zoo. Mus., No. 1126.)

Marysvale, swamp near town. (U. of U. Zoo. Mus., Nos. 1060 and 1144.)

Lake Navajo, between Cedar Breaks and Panguitch. (U. of U. Zoo. Mus., Nos. 1051 and 1121.)

Kamas, Summit Co. (U. of U. Zoo. Mus., No. 651, col. by Miss Turner.)

Provo Canyon, above Heber. (U. of U. Zoo. Mus., No. 901.) Above Vivian Park. (No. 755.)

Between Circleville and Junction. (U. of U. Zoo. Mus., No. 1067.)

Ogden Canyon, canal one-half mile from mouth. (U. of U. Zoo. Mus., No. 908.)

Juab, one mile south of station. (U. of U. Zoo. Mus., Nos. 1040 and 1188.)

Sterling, reservoir south of town. (U. of U. Zoo. Mus., Nos. 1064 and 1114.)

Bear River, seven miles west of Tremonton, "Little Mountain". (U. of U. Zoo. Mus., No. 596, collected by Melba Turner.)

Salt Lake City, Mt. Olivet Cemetery Reservoir. (U. of U. Zoo. Mus., Nos. 600, 601 and 610.) Near airplane field. (No. 620.)

Glenwood, near Richfield. (U. of U. Zoo. Mus., Nos. 808 and 841.)

Panguitch Creek, near Spry Station. (U. of U. Zoo. Mus., No. 1078.)

Shell subconic, pointed, oblong, rather thin, frequently somewhat inflated; periostracum generally light yellowish horn color; surface shining, covered with numerous coarse lines of growth; under a strong lens very fine spiral lines may be seen; whorls $5\frac{1}{2}$, rounded, somewhat shouldered, the shoulder being near the suture; the last whorl is very large, half the length of the entire shell, generally compressed but quite obese in some specimens; spire acute, sharply conical, nuclear whorls $1\frac{1}{2}$, resembling those of *parva* in outline and sculpture; sutures deeply indented; aperture very elongate-ovate, somewhat produced anteriorly; peristome thin, acute; inner lip reflected over the umbilical chink to form a thin, narrow expansion, which is usually appressed to the umbilical region, giving the axis a slight twist; parietal callus very thin; umbilical chink varying from distinctly open to scarcely observable; the surface of the shell is frequently malleated. Length 9.1 to 13 mm.; diameter, 4.5 to 6.1 mm. Length of aperture 5 to 7.2 mm.; diameter 2.1 to 4 mm.

Animal with a very small, more or less oblong foot, when viewed from the base, the anterior and posterior borders rounded; color dark gray or blackish, lighter below, sometimes yellowish; the whole surface dotted with whitish or yellowish, which is especially noticeable about the eyes; tentacles triangular, flat, short, more or less transparent; the black eyes are placed on prominences at the inner base of the tentacles. (Baker, 1928, which see for details of genitalia, jaw and radula).

Type Locality.—Harrowgate, Philadelphia Co., Pennsylvania.

Range.—Entirely across North America and from Canada, (MacKenzie Terr.) south to Arizona and Northern Mexico.



Fossaria obrussa Say
Beaver, Utah. — 1mm.

Fig. 65

Discussion.—This snail is characterized by its gibbous whorls, the sutures being deeply impressed. The epidermis is often a greenish yellow. “Typically, *obrussa* may be known by its pointed spire, compressed body whorl and elongated and shouldered aperture, which is also strongly effuse at the anterior end; the inner lip oppressed to the body whorl about the middle of the aperture.” The shell is larger and more elongated than in *modicella*, with the last whorl not so convex.

Genus **POLYRHYTIS** Meek

Shell with well-marked longitudinal folds or ribs; spire broadly acute, generally shorter than aperture; axis twisted; columella lip broadly expanded, obscuring the fold more or less; umbilical chink well marked.

Animal, jaw, radula and genitalia unknown. (Baker.)

Genotype.—*Lymnaea kingii* Meek.

Discussion.—The exact relationship of this genus cannot be known until the anatomy of *utahensis*, the only recent and living representative, is worked out. No other recent Lymnaeid possess the peculiar sculpture characteristics of this genus.

Call only says of the dentition of *utahensis* that it “differs from typical *R. ampla* Mighels very materially” without indicating in what manner.

Polyrhytis utahensis (Call)

THE UTAH RIBBED SNAIL

Radix ampla var. *utahensis* Call, *U. S. G. S.*, Bul. 11, 1884, pp. 19, 47-48, pl. 6, fig. 7-8.

Lymnaea utahensis Sterki, *Naut.*, XXII, 1909, p. 142.

Galba (Polyrhytis) utahensis Baker, *Lymnaeidae*, 1911, p. 458, pl. XXII, fig. 9-11, pl. XXIV, fig. 22-27.

Utah Localities.—

Previous records: Utah Lake. (Call, 1884.)

Utah Lake, near Lehi; Bear Lake, Rich Co.; Spring Lake. (Baker, 1911.)

Utah Lake. (Henderson and Daniels, 1917.)

Duplicate records: Utah Lake, near Spanish Fork. (U. of U. Zoo. Mus., Nos. 1013 and 1015.) Geneva Resort, near Pleasant Grove. (No. 786.) Near Saratoga. (No. 881.) At Provo. (No. 529.)

Bear Lake, west side. (U. of U. Zoo. Mus., Nos. 1273 and 1299.) South end approaching Laketown. (Nos. 1434 and 1447.)

New record: South Tremonton, Box Elder Co., apparently a dead shell washed down from Bear Lake, or possibly a fossil washed out.

“The relation of this species to the fauna of the ancient Lake Bonneville is not clearly known. There is reason to believe that it is a descendant of the Pliocene *Lymnaea kingii*. (Tertiary formation

of Cache Valley, Utah.) From the records it would seem that it is a new species evolved since the deposition of the Bonneville beds. Further study is needed to satisfactorily elucidate the relationship of this curious species."

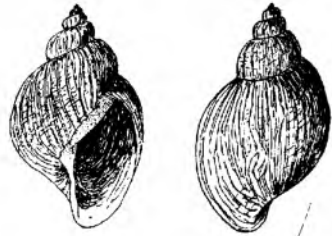
Shell globose, somewhat umbilicated, irregularly costate, light horn color, nearly pellucid; spire rather small, conical; whorls four to four and one-half, convex somewhat flattened above, giving rather a shouldered appearance to the whorls, rapidly increasing in size, the last whorl being inflated, with numerous rather marked transverse costae, minutely wrinkled; suture somewhat deep, regularly impressed;

aperture elongately ovate, effuse, approaching patulous, pearly white within; outer lip simple, the margin connected by a slight calcareous deposit; columella somewhat twisted, but straight in front. Dentition unpublished. Length of largest specimen 16.82 mm.; breadth 7.10 mm., with about the same ratio for corresponding measurements of aperture. (Call.)

Range.—Old Bonneville Lake Basin, Utah.

Type locality.—Utah Lake near Lehi, Utah.

Discussion.—The peculiar costae at once distinguish this species. The shells at Bear Lake showed in many cases the same bluish cast as the *S. pilsbryanum* and *Carinifex*, raising the question as to whether or not they are fossil there; but Call dredged living specimens from Utah Lake. Out of the material from Bear Lake, we have assorted a complete series of intergrades between *Stagnicola palustris nuttalliana* and *P. utahensis*, the *nuttalliana* being the typical form, not the *proxima*-like form which we found living on the shores there. The value of such a series, if it signifies anything at all, will be purely a matter of opinion.



Polyrrhytis utahensis (Call)


Fig. 66  = 1/2 in. Utah Lake

Fig. 66

Family PLANORBIDAE Adams

The shell in these forms is spiral with the whorls lying in the same plane and forming a flat or nearly flat disc; usually sinistral, but sometimes dextral. Animal with genital, excretory and pulmonary orifices on left side. Head with large vela area. Tentacles slender, filiform. Foot short and locomotion very slow. Radula with relatively few teeth in a horizontal row; median teeth bicuspid; the lateral teeth large, bicuspid or tricuspid; the marginals long, narrow, multicuspoid. Jaw composed of three pieces. Genitalia always consisting of a paraputium and a penis sheath in the male system; no epiphallus. Hemolymph red.

Seven species and subspecies in three genera represent this family in this state.

Genus **HELISOMA** Swainson

Shell large, ultra-sinistral, few whorled, the whorls carinate above and often below, and rapidly enlarging; base funicular; aperture suddenly expanding and thickened; shell carried perpendicularly, not at a sharp angle; umbilicus deep and spire sunken; penis sheath usually shorter than praeputium, the latter with a large gland and a long duct; penis without stylet; jaw with large superior and small lateral pieces; radula with tricuspid laterals, the base of attachment shorter than the cusps. (Baker, 1928, which see for details of internal anatomy, etc.)

Genotype.—*Planorbis bicarinatus* Sowerby.

Range.—North America.

Discussion.—This genus, including the large American planorbids, has in the past not been distinguished from the European *Planorbis* from which, however, it seems to be clearly distinct and may prove to merit subfamily rank.

The three forms known from Utah may be distinguished as follows:

KEY TO SUBSPECIES

a. Diameter mostly 15 to 30 mm., height mostly 8 to 15 mm.

b. Last whorl expanded at aperture. . . . *Helisoma trivolvis trivolvis*.
(If whorls are twisted out of plane, called *plexatus* variation.)

bb. Last whorl but little expanded, aperture more nearly circular.

H. trivolvis horni.

aa. Very large, diameter near 35 mm., height 20 mm., whorls strap-like.

H. trivolvis binneyi.

Helisoma trivolvis trivolvis (Say)

Planorbis trivolvis Say, *Nich. Ency.*, pl. II, fig. 2. (1817, 1818, 1819.)

Utah Localities.—

Previous records: Utah. (Probably *H. t. binneyi* (Tryon).) (Tryon, 1873.)
Ditches near Salt Lake City; Utah Lake; mud flats near sink of Sevier
River; Fillmore Lake; Panguitch Lake. (Yarrow, 1875.)
Utah Lake; Near Salt Lake City. (Stearns, 1881.)
Living in Utah, fossil near Salt Spring Creek and on Sevier Desert.
(Call, 1884.)

Ballard Springs near Logan. (Henderson, 1924.)

Duplicate records: Utah Lake at Provo. (U. of U. Zoo. Mus., No. 513.)
Geneva Resort near Pleasant Grove. (No. 793.) Near Saratoga.
(No. 880.) Near Spanish Fork. (No. 1020.)

New records: Junction, old trout pond south of town. (U. of U. Zoo.
Mus., Nos. 1022, 992 and 1109.)

Fish Lake. (U. of U. Mus., No. 802.) Juvenile, toward north end of
lake. (U. of U. Zoo. Mus., No. 837.) West side. (No. 813.)

Richfield, in city. (U. of U. Zoo. Mus., No. 1047.)

Glenwood. (U. of U. Zoo. Mus., No. 807.)

Bear Lake, west side, pond south of Garden City. (U. of U. Zoo. Mus.,
No. 1331.) Pond two miles south of Garden City. (No. 1296.)

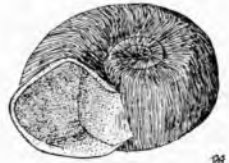
Logan, Blacksmith Fork, below Ballard Springs. (U. of U. Zoo. Mus.,
No. 1401.)

Provo Canyon, North Fork. (Lot 2, No. 235.)

Deweyville. (U. of U. Zoo. Mus., No. 594.)

Kaibab Forest, near Utah-Arizona line, collected by V. M. Tanner. (U.
of U. Zoo. Mus., No. 1472.)

Shell ultra-sinistral, discoidal, flat, carinate above, subcarinate below; color yellowish, brownish, or chestnut brown, surface shining; sculpture of coarse oblique, raised, more or less equidistant lines of growth; the immature shell of three whorls has distinct spiral impressed lines, but these disappear on the last whorl; whorls 4, discoidal, rounded on the periphery; spire flat, in the young perfectly flat, but in the adult sunk below the level of the last whorl but always exhibiting all the volutions; nucleus small, of about half a turn, granular or punctate in sculpture; the lines of growth beginning abruptly; sutures deep, v-shaped; base of shell indented, showing from two or three volutions, which are rounded and have very deep sutures between them; aperture broadly lunate, somewhat expanded below and with a V-shaped angle above; the aperture is exactly the height of the last part of the body whorl; outer lip acute, thin, rounded outward, often a little thickened on the inside and bordered



Planorbis trivolvis Say
Utah Lake. — = $\frac{1}{8}$ in

Fig. 67

within by a wide chocolate or yellowish band extending from one termination to the other; parietal wall with a thin callus; interior of aperture bluish-white or horn-colored; umbilicus narrow, deep, funnel-shaped. Length 6.2 to 19.5 mm.; diameter 10.4 to 32 mm. Length of aperture 6 to 14.5 mm.; diameter, 3 to 10.5 mm. (Baker.)

Type locality.—French Creek, near Lake Erie.

Range.—Atlantic coast to California and north to Alaska and arctic Canada.

Discussion.—This species, which is always found in quiet and commonly more or less stagnant water, is the type of Dall's subgenus *Pierosoma*.

Helisoma trivolvis plexatus (Ingersoll)

THE DISTORTED FLAT SNAIL

Utah Localities.—

Previous records: Marysvale; Logan. (Both *trivolvis* showing tendencies in this direction, Henderson, 1924.)

New records: Canals north of Salt Lake City. One specimen of the *bimneyi* variety showing distinct plexation of the body whorl (from No. 12), now on display at the U. of U. Zoo. Mus., collected by Dr. Orson Howard.

Aquarium of Elmer Berry, Salt Lake City:

Mr. Berry imported some normal *Helisoma trivolvis* from Ohio with aquatic plants in the fall of 1926. Eggs were probably spawned in November of that year. In early March an abnormal coiling was noticed and the four individuals exhibiting it were placed in an experiment jar in which six patches of spawn were seen from three to six days later. All eggs contained "nucleus" at first, but only three patches matured. All the young reared from these coiled normally. The most distorted specimen that was separated out in March, died August 1, 1927. It shows four whorls. The columella is especially thick and twisted practically filling the umbilicus. The surface of the body whorl is sculptured with coarse, spiral ridges in places, and heavy transverse lumps in another. One would never recognize this as *H. trivolvis*. The drawing of this specimen accompanies this description. The specimen is deposited in U. of U. Zoo. Mus., No. 968.

Description and discussion.—*Helisoma trivolvis plexatus* is a form in which the whorls coil abnormally out of plane. It is not a distinct subspecies, but only an occasional variation, occurring frequently in the natural state. The cause of the distortion is in dispute. Henderson (1924) thinks it is of pathological rather than biological significance, contrary to Stearn's opinion of Ingersoll's specimens.



Planorbis trivolvis plexatus.
(Ingersoll)
Aquarium of _____ = $\frac{1}{4}$ in.
Elmer Berry Salt Lake City, Utah

Fig. 68

"The specimens on which Mr. Ingersoll's species is based, were found by him, as stated, in a snow-fed pond of small size. The vacillations in plane of coil may be owing to interruption of growth by recurring periods of hibernation, the characters in the environment, mentioned by Mr. Ingersoll, affording a reasonable solution of the phenomena. Such ponds are subject to marked climatic contingencies; and in some years, their basins are nearly or quite dry—and again, fluctuations of temperature, according to the volume of water, which is an important factor, are far more critical in small ponds than in lakes or large bodies of water, where the extremes of temperature, as well as other conditions, are less variable or extreme."

***Helisoma trivolvis horni* (Tryon)**

Planorbis horni Tryon, *Am. J. of Con.*, I, 1865, p. 231, pl. 22, fig. 16.

Utah Localities.—

Previous records: Utah. (Ingersoll, 1874.)

West of Cache Junction and Newton town reservoir. (Henderson and Daniels, 1916 and 1917.)

Much like *H. trivolvis* except that the last whorl is but little expanded, and the aperture more nearly circular.

Type locality.—Fort Simpson, British America.

Range.—British Columbia south to California and Utah.

Discussion.—Dall thinks this is probably only a mutation or de-pauperate form of *subcrenatus* Carpenter, Oregon (Nuttall), which occurs in British Columbia west of the Cascades. In Utah it may be a variation of our *trivolvis*, with which Walker synonymizes it (1918, p. 104), but until the anatomies have been carefully compared, suppressing it will be premature.

***Helisoma trivolvis binneyi* (Tryon)**

Planorbis binneyi Tryon, *Am. Journ. Conch.*, III, p. 197, 1867.

Utah Localities.—

Previous records: Utah Lake; Spring Lake. (Ingersoll, 1874.)

West of Cache Junction; Newton town reservoir. (Henderson and Daniels, 1916 and 1917.)

Southeast of Murray; Poplar Grove (south of Salt Lake City); City Creek Canyon at Salt Lake City. (Henderson, 1924.)

Duplicate record: Utah Lake, at Provo, greatest diameter 38 mm., whorls strap-like. (U. of U. Zoo. Mus., No. 512.) Utah Lake near Spanish Fork, similar, greatest diameter 34 mm. (No. 1012.)

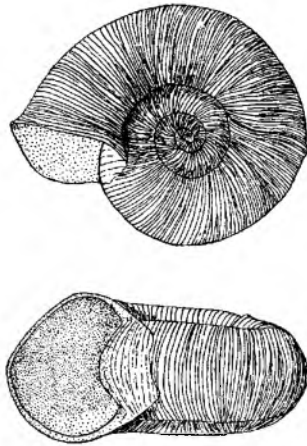
New records: Junction, old trout pond south of town, greatest diameter 30 mm., large strap-like whorls, often carinated above. (U. of U. Zoo. Mus., No. 993 and 1023.) Intergrades. (No. 994.)

Canals north of Salt Lake City, collected August, 1883, by Dr. Orson Howard, whorls rounded, not strap-like, though aperture is expanded. (U. of U. Zoo. Mus., No. 12.)

Salamander Lake, two miles above Alpine Camp, North Fork, Provo Canyon, greatest diameter 30 mm., whorls not strap-like, aperture enlarged more like *Helisoma antrosus* but not flaring, one specimen showing faulty articulation of whorls, although they are in the same plane. (U. of U. Zoo. Mus., No. 737.) Eggs of this species from this locality. (No. 738.)

These are much like *H. trivolvis* except for size and the whorls are sometimes strap-like. They live on the bottom of lakes in quite stagnant water. They apparently grade into *H. trivolvis* in this region, altho further investigation, may make it possible to separate the subspecies more sharply than now seems possible.

"As pointed out by Binney, this is quite distinguishable from any form of *trivolvis*; it differs from the true *corpulentus*, with which it was long confounded, in its sparser and less regular axial sculpture, larger and less campanulate aperture, and in the greater distance of the carina from the axis. Its whorls increase more rapidly than in *H. traskii* (Lca), or even *H. ammon* (Gould), and its sculpture is marked coarser and less regular than in either of the last two cited. It is not known north of British Columbia or east of the Rocky Mountains." (Dall, 1905.)



Helisoma trivolvis binneyi (Tryon)
Junction, Utah — = $\frac{1}{4}$ in. ♂

Fig. 69

Range.—West of the Rockies and east of the Cascade mountains on the Pacific slope, Oregon (Nuttall); Lewis or Snake River, Oregon; Clear Lake, Calif. In British Columbia in eastern Kootenai Lake, Lake Siniakwateen, and Osoyoos Lake. (Dall, 1905).

Genus **MENETUS** H. and A. Adams

Shell ultra-dextral, lenticular, with a small number of rapidly increasing whorls, the last partly enveloping the preceding whorls; apical whorls not much depressed; base with a narrow umbilicus, aperture oblique, lip sharp. Genitalia generally as in *Gyraulus*. Praeputium large, short, pyriform; penis sheath longer than praeputium,

enlarged toward the distal end; penis very long, narrow, the head enlarged and projecting into the praepitium; a single retractor muscle. Jaw and radula generally as in *Gyraulus*. (Baker).

Genotype.—*Planorbis opercularis* Gould.

Range.—America and eastern Asia.

Menetus exacuus Say

THE KEELED, DISCOID SNAIL

Planorbis exacuus Say, *Jour. Acad. Nat. Sc.*, II, 165 (1821).

Planorbis exacuus Henderson, *Univ. Col. Studies*, IX, 1912, p. 62 (part).

Menetus exacuus Baker, *Moll. Wisconsin*, I, 1928, p. 361, pl. XXIII, fig. 1-5.

Utah Localities.—

Previous records: Warm Springs Lake. (Call, 1884.)

Newton town reservoir. (Henderson and Daniels, 1917.)

New records: Fish Lake, R. V. Chamberlin col., plentiful toward north end. (U. of U. Zoo. Mus., Nos. 835 and 844.) Slough at south end. (No. 816.) West side. (No. 817.)

Utah Lake near Saratoga, one specimen. (U. of U. Zoo. Mus., No. 887.)
Comparatively rare in Utah Lake.

Shell ultra-dextral, very much depressed, with an acute periphery; color light horn varying to brownish, surface shining; sculpture of fine lines of growth, often slightly elevated, crossed by very fine spiral lines under the corneous epidermis; nucleus small, rounded, sculptured with fine spiral lines; whorls 4, rapidly increasing in diameter, sloping in a flatly-rounded curve to the acutely keeled periphery; spire very flat, all of the whorls in the same plane, or the apical whorls slightly sunken below the plane; sutures well impressed; base flatly convex; umbilicus rather narrow, deep, exhibiting all the volutions to the apex; aperture obliquely, obtusely triangular or ovate; outer lip thin, acute, the superior part very much produced beyond the inferior part and expanded near the periphery; outer lip a little thickened with callus on the inside; parietal wall with thin wash of callus. Length 1.5 to 2 mm.; diameter 4.5 to 6.2 mm. Length of aperture 1.2 to 1.5 mm.; diameter 2.3 to 2.5 mm.



Menetus exacuus Say
Fish Lake Utah — = 1mm.

Fig. 70

Animal with color blackish; foot short, rounded. (Baker, 1928, which see for details of genitalia, jaw and radula).

Type locality.—Lake Champlain.

Range.—North America from Atlantic Coast west to Utah and north to Alaska and Mackenzie River, south to New Mexico.

Discussion.—“This species has a number of varieties both in size and form. The typical shell is of a pale brownish horn color, with a somewhat glistening surface, rather rudely striated by the incremental lines, and with faint, almost microscopic, revolving striae. The form is lenticular, coming to an acute angle at the periphery. In 1863 I found in the vicinity of Marquette, Michigan, an unusually depressed brownish variety in which the peripheral keel was delicately serrate. In the northwestern part of its range the tendency is for the species to become whitish and of a larger size than the average New York or New England specimens.” (Dall, 1905.)

Genus **GYRAULUS** J. de Charpentier

Shell small, ultra-dextral, with few, rapidly increasing whorls, fully exposed above and below, with a nearly median periphery, obtusely angulated, or carinated. Genitalia with spermatheca on comparatively short duct; male system with a regularly cylindrical praeputium, shorter than penis sheath, which is greatly enlarged at distal end; a single retractor muscle attached to the distal end of the praeputium; without penial gland or duct; internally the praeputium is somewhat swollen and there is a large papilla surrounding the horny stylet of the penis, and below this a ring of muscular tissue contracting the diameter of the upper part of the praeputium (sarcobelum); penis very long, extending the whole length of the penis sheath, the stylet long and slender, the opening of the vas deferens being at the side just above the stylet. Jaw a horseshoe-shaped cartilage on edge of which are many horny plates, the two plates at the end of those of the shoe being larger and much longer than the others. Radula of few teeth in horizontal rows, the center tooth bicuspid and shaped as in *Helisoma*; laterals wide, with a base of attachment reaching much below the end of the reflected cusps, which are sharply triangular, the mesocone being longer than the side cusps; marginals narrower than laterals, the reflection short, the base of attachment very long, the ectocone splitting into several small cusps, the outer marginals being evenly multicuspid. Including the small planorbes in which the shell is carried almost flat and turned to the left, hence the ultra-dextral form of the shell. (Baker.)

Genotype.—*Planorbis hispidus* Drap.

Range.—World-wide.

KEY TO SPECIES

- a. Broadly and shallowly excavated below; diameter 5 to 6 mm., height 1.7 to 2.5 mm. *G. similaris*.
- aa. More deeply and narrowly umbilicate. Diameter 4 mm., height 1 mm.
- b.* Whorls more rapidly enlarging, umbilicus broader (cf. figs.). *G. vermicularis*.
- bb.* Whorls enlarging more slowly, umbilicus narrower. *G. parvus*.

Gyraulus parvus (Say)

Planorbis parvus Say, *Nich. Encyc.*, pl. 1, fig. 5 (1817, 1818, 1819).

Gyraulus parvus Baker, *Moll. Wisc.*, 1928, 1, p. 374.

Utah Localities.—

Previous records: Utah Lake. (Ingersoll, 1877.)

Fort Douglas. (Call, 1884.)

Wheelon, Salt Lake City; Garfield. (Henderson and Daniels, 1916.)

As *P. parvus*, Lehi and Morgan (Henderson and Daniels, 1917), but later identified by Walker with some hesitation as *P. circumstriatus* Tryon. (See Henderson, 1924, p. 179.)

New records: Between Marysville and Richfield, Sevier Co. (U. of U. Zoo. Mus., No. 987.)

Kamas, Summit Co., collected by Melba Turner. (U. of U. Zoo. Mus., No. 637.)

Garland, Boxelder Co.

Type locality.—Near Philadelphia (Delaware River).

Range.—United States east of the Rockies.

Discussion.—It is now generally supposed that *parvus* proper does not extend into our western states and we therefore do not include a description of the species. We have, however, a small form very similar that is difficult to place. As soon as a thorough revision of this group is made these records will likely be removed to other, possibly new, species. In the meantime, since the specimens are rare, it is desirable to have as many collected as possible as a basis for such future study. This form may be distinguished from *G. vermicularis*, our common form, by its whorls increasing in size less rapidly and by the narrower umbilicus.

Gyraulus similaris (Baker)

Planorbis similaris Baker, *Bull. Amer. Mus. Nat. Hist.*, XLI, 1917, pp. 529, 532-533.

Utah Locality.—

Previous record: Morgan. (Henderson, 1924.)

Shell thin, yellowish or brownish-horn; translucent in immature shells, opaque in adult shells; upper surface slightly concave in the middle, lower side concave; whorls 4, regularly increasing in diameter, rounded above and below; periphery rounded near the base of the shell, the body whorl sloping upward at an angle of 45 degrees in some specimens, and abruptly rounding into the base of the shell below; umbilicus very broad, not very deep, showing all the whorls; aperture ovate and oblique in the immature shell, round and parallel with the whorls in the adult shell; sculpture consisting only of fine growth lines; lip simple, not thickened within. Height, 2.5; greatest diameter, 6.2; aperture height, 2; diameter, 2 mm. Holotype. Height, 1.7; greatest diameter, 4.7; aperture height, 1.4; diameter, 1.5 mm. Paratype.

Similaris differs from *parvus*, which it somewhat resembles, in its larger size, rounder aperture, and the peculiar reamed-out appearance which is so characteristic of the lower surface of *parvus*. (Baker).

Type locality.—Smartweed Lake, altitude 8575 ft., Colorado.

Range.—Colorado, southern Idaho, and Utah.

Gyraulus vermicularis (Gould)

THE WORM-LIKE FLAT SNAIL

Planorbis vermicularis Gould, *Proc. Bost. Soc. Nat. Hist.*, II, 212 (1847).

Utah Localities.—

Previous records: Utah Lake. (Stearns, 1881.)

Newton town reservoir. (Henderson and Daniels, 1917.)

Provo. (Henderson and Daniels, 1917.)

Duplicate records: Utah Lake, near Saratoga. (U. of U. Zoo. Mus., No. 891.) Near Provo. (No. 541.)

New records: Junction, old trout pond south of town. (U. of U. Zoo. Mus., No. 1107.)

Lake Navajo. (U. of U. Zoo. Mus., Nos. 1048 and 1122.)

Salt Lake City, slough near airplane field. (U. of U. Zoo. Mus., No. 627.)

Glenwood. U. of U. Zoo. Mus., No. 843.)

Ogden, one-half mile below the mouth of Ogden Canyon. (U. of U. Zoo. Mus., No. 909.)

South Tremonton, Box Elder Co. (U. of U. Zoo. Mus., Nos. 613 and 631.)

Logan, Blacksmith Fork below Ballard Springs. (U. of U. Zoo. Mus., Nos. 1264, 1313 and 1405.) Pond one mile south of city. (No. 1292.) Ballard Springs. (No. 1457.)

Bear Lake, near south end approaching Laketown. (U. of U. Zoo. Mus., No. 1435.) Swamp near south end. (No. 1418.)

Randolph, on road approaching town from north. (U. of U. Zoo. Mus., No. 1426.)

Rich Co., five miles west of Evanston, Wyo., in mud deposits along stream. (U. of U. Zoo. Mus., No. 1348.)

Panguitch Creek (South Fork of the Sevier River), near Spry Station. (U. of U. Zoo. Mus., No. 1069.)

Crystal Hot Lakes, Salt Lake Co. (U. of U. Zoo. Mus., No. 559.)

Zion National Park, collected by A. M. Woodbury. (U. of U. Zoo. Mus., No. 1498.)

Three-Mile Creek, on detour between Wanship and Salt Lake City. (U. of U. Zoo. Mus., No. 1368.)

Laketown, swamp on south side of road west of Laketown. (U. of U. Zoo. Mus., No. 1415.)

Richfield, ditch from city springs. (U. of U. Zoo. Mus., No. 823.)

Strawberry Reservoir, collected by J. Hansen. (U. of U. Zoo. Mus., Nos. 1535 and 1539.)

Garland, Box Elder Co. (Melba Turner col.)

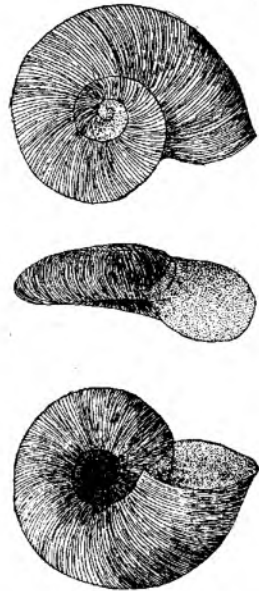
Price, Carbon Co. (U. of U. Zoo. Mus., No. 1658.)

Shell small, dome-shaped, minutely striated by growth, white (probably bleached by the liquor from which it was taken); whorls four, breadth and height about equal, the last one deflected near the aperture, rounded at periphery, tip depressed, suture very deep, the whorls sloping towards it; base cup-shaped, exhibiting all the whorls. Aperture exhibiting a very oblique section of a cylinder; lip embracing about one-half the height of the last whorl and joined by callus. Diameter one-fifth, height one-fifteenths inch. (Binney.)

Type locality.—Interior of Oregon.

Range.—British Columbia to northern California, eastward into Colorado.

Discussion.—This is our common species of small Planorbis. It is abundant in Utah Lake.



Gyraulus vermicularis Gould
Utah Lake —=1mm. 璣

Fig. 71

Family POMPHOLIGIDAE Dall

In the members of this family the shell is spiral and dextral with the spire more or less depressed or flattened above, the body whorl very large and the form mostly sub-globular. The tentacles are stout, of moderate length, cylindrical and slightly enlarged or globose at tips; eyes inserted near base of tentacles on inner side; foot rounded behind, short; jaw subcordate, undivided; teeth of radula in nearly transverse rows, the laterals broad, the median tooth bicuspid and small. Two species of the genus *Carinifex* represent this small family in Utah.

Genus **CARINIFEX** Binney

THE TERRACED SNAILS

Shell spiral, dextral, inflated, angular; spire terraced; whorls numerous, visible above, last whorl very large, broad above, rapidly attenuated below, umbilicus funnel shaped; aperture triangular, broad above, narrow below; inner lip slightly thickened; outer lip thin, acute, angular above, flexuose.

Animal sinistral, resembling *Helisoma*, but with much shorter tentacles; jaw single; radula similar to that of *Pompholyx*. (Walker, 1918).

Genotype.—*Planorbis newberryi* Lea.

KEY TO SPECIES

- a. Shell subglobose without whorls of spire terraced or with whorls of spire vertically terraced. *C. newberryi*.
aa. Shell elongate, whorls terraced, but lateral walls of whorls oblique, cutting under the carina. (Rare, known only from type specimen.) *C. atopus*.

Carinifex newberryi (Lea)

NEWBERRY'S SNAIL

Planorbis newberryi Lea, *Proc. Phila. Acad. Nat. Sci.*, 1858, 41.

Carinifex newberryi Binney, *Land and Fresh-Water Shells of N. A.*, Part 2, 1867 (1865), p. 74.

Utah Localities.—

Previous records: Shores of Sevier Lake. (Yarrow, 1875.)

Semi-fossil on mud flat, Utah Lake. (Ingersoll, 1877.)

Living in Utah Lake. (Call, 1884.)

Pleistocene or later, Bear Lake. (Sterki, 1909.)

Utah Lake, near Lehi. (Henderson and Daniels, 1917.)

Duplicate records: Bear Lake, west and south sides. (U. of U. Zoo. Mus., Nos. 1281, 1301, 1432, 1441 and 1444.) Much more scarce on the south shore than on the west. Extreme variations. (No. 1287.)

Utah Lake, near Saratoga. (U. of U. Zoo. Mus., No. 885.) The only high spired specimen we found at this lake was from near Saratoga. (No. 515.) At Provo. (No. 516.) At Geneva Resort, near Pleasant Grove. (No. 789.)

Shell light horn-colored, depressed, turreted, very minutely striated, above and below acutely carinated, broadly and deeply umbilicated, whorls five, flat; aperture large, light horn-colored, subtriangular. (Binney.)

Type locality. — Klamath Lake and Canoe Creek, California.

Range.—California to Utah.

Discussion. — This species is the dominant form at Bear Lake, but exhibits there in many cases the blue coloration that makes it seem probable that it is a fossil form. No living specimens were taken during our studies. In previous records it has been recorded living at Utah Lake.



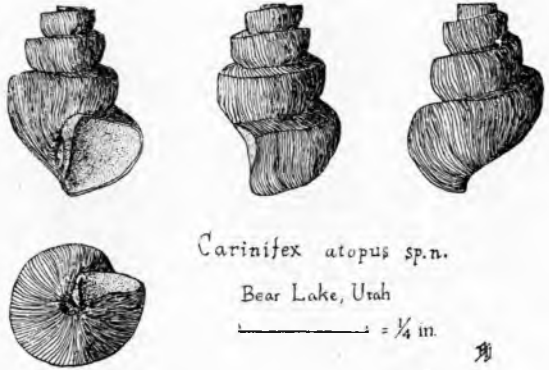
Variation of *Carinifex newberryi* (Lea)
at Bear Lake, Utah — = $\frac{1}{4}$ in. 卍

Fig. 72

Carinifex atopus sp. nov.

THE SINGULAR CARINFIFEX

Shell deep bluish-gray, hard, high-spired, terraced, carinated above and below, sides of whorls oblique not vertical thus cutting under each whorl to a sharply cut suture. Top of whorls almost flat, slightly sloping to periphery, except first whorl which slopes oppositely. Whorls five and one-half, apex sunken. Lines of



Carinifex atopus sp. n.

Bear Lake, Utah

———— = $\frac{1}{4}$ in. 卍

Fig. 73

growth very fine, but distinct; oblique and sinuous as in *Carinifex newberryi* (Lea), their oblique direction being shown chiefly on the flattened upper portion of the whorls. Aperture comparatively small, subtriangular, peristome continuous, columellar lip thickened and reflexed as in *C. newberryi*. Umbilicus much narrower than in that form, funnel-shaped because of the encircling carina, rimate but distinctly perforate. Aperture bluish within. Length 9 mm.; greatest diameter 7.5 mm.; aperture 4 mm. long.

Type.—Only one specimen known. (U. of U. Zoo. Mus., No. 1297.)

Type locality.—Bear Lake, west shore on beach near camp grounds north of Garden City. Shell was found in the shell line near the water's edge.

Discussion.—When we first found it, we took it to be a form of *Valvata utahensis* (Call), but after thorough study, we are satisfied it is a *Carinifex*, though very different in appearance from *C. newberryi*. The reasons for so placing it are, in the order of their importance:

1. The triangular shape of the aperture.
2. The reflexed columellar margin of the inner lip.
3. The direction of the lines of growth which resemble *C. newberryi*.
4. Carination above and below (as in both *V. utahensis* and *C. newberryi*.)
5. Terraced nature of the whorls.

It differs from *Carinifex newberryi* (Lea) in the following ways, given in the order of their importance:

1. Whorls of spire are cut under, leaving lateral walls oblique instead of vertical.
2. Umbilicus is much narrower.
3. Spire, proportionately higher than even extremely high-spined *C. newberryi*, found in the same locality.
4. Shell is smaller.

The old question comes up as to whether these Bear Lake shells that are bluish are recent or fossil. Dredging for living examples might solve the question. We have considered the possibility of this being a deformity, but that seems improbable. This is one of the neatest and most proportionately formed shells, except for the apical whorls, that we have taken.

Family PHYSIDAE Dall

In this family the shell is sinistral, thin, with spire usually acute, short to elevated, with the last whorl moderately to strongly inflated; aperture from large and oval to narrow; outer lip simple, acute.

Animal sinistral, the pulmonary, excretory and genital orifices on left side; the foot narrow, pointed behind; head distinct and lobed in the center; tentacles long and slender; eyes sessile at base of tentacles; vela area separated by constriction; mantle plain or with from few to many lobes and more or less reflected over shell; jaw single, arched, the face of the jaw commonly striated. Radula with teeth arranged in oblique rows; central tooth multicuspid; lateral and marginal teeth comb-like, usually with large and small cusps alternating and with a process at upper, inner angle.

A nearly cosmopolitan family absent, however, from South America. It is represented in the United States by about a score of species of which five occur in Utah, these falling in the genera *Aplexa*, *Physella*, and *Petrophysa*.

Genus **PHYSELLA** Haldeman

THE SINISTRAL POND SNAILS

Shell sinistral, oblong or elongate, more or less translucent, surface dull to shining, spire acute or depressed, usually shorter than the aperture, which is contracted above and rounded below; columella with an obscure plait or thickening which gradually merges with the callus of the parietal wall; outer lip sharp, often thickened internally by a vertical callus; the inner lip closely appressed to the columellar region, either completely closing the umbilical region, or, rarely, leaving a small chink or perforation; sculpture consisting of coarse or subobsolete spiral impressed lines. Animal in general as for family. Mantle modified on left side to form a large respiratory tube. Mantle reflected over shell only in parietal and columellar regions, a portion at each of these locations digitate or lobed. Jaw composed of a single plate, arched, and densely striated. Radula with teeth arranged in oblique rows, descending to the lateral border in a more or less sigmoid curve. (Baker, in part, 1928, which see for further details of internal anatomy.)

Genotype.—*Physa globosa* Haldeman.

Range.—North America, Mexico and West Indies.

KEY TO SPECIES

- a. Aperture large and elongate, body whorl sometimes shouldered, very variable. *P. utahensis*.
- aa. Aperture small.
- b. Shell often large, aperture more oval than *P. utahensis*. Whorls rarely shouldered. *P. ampullacea*, varieties.
- bb. Usually small, under 3/5 inch.
- c. Small, shining, elongate, 4 to 5 whorls, epidermis often showing color stripes, especially on bleached shell. *P. virgata*.

Discussion.—The species included in this genus have in the past been referred to *Physa*; but apparently the American species constitute a distinct and natural group. The type of *Physa* (*Bulla fontinalis* Linnaeus) has a “mantle which partly envelops the shell, not only on the parietal and columellar side, but on the outer lip area as well. The mantle of the left side extends well over the shell to the center of the dorsal side; the lower part is composed of one large lobe, while the upper part, which is digitate, covers the spire. The part of the mantle over the lip is digitate and extends well over this side of the shell. In the mantle of the American *Physae* the digitate mantle is reflected only over a small part of the parietal wall and columellar region, and the outer lip mantle edge is simply thickened and is not digitate or extended over the shell.” The members of *Physella* live under a great variety of conditions within the range indicated—from Arctic and high mountain regions to deserts and the low-lands of the tropics. This genus has recently begun to clear up in Utah. Clench has given a name to the Utah Lake form and the name *virgata* is becoming established for the small southern Utah form, but the latter may require further checking. We are convinced that other distinct species exist, which at present we are including under *ampullacea*. A form like *Physella gyrina* (Say) can be separated out with difficulty from the young of *P. ampullacea*. At various times it has been called *gyrina*, *elliptica*, *heterostropha*, and other names, but recent studies have restricted the range of these species, eliminating them from Utah. It will take more collecting and observation to separate this form with certainty and to describe its various phases.

***Physella ampullacea* Gould**

THE LARGE PHYSELLA

Physa bullata Gould, *Proc. Bost. Soc. Nat. Hist.*, V. 128 (1885).

Physa ampullacea Gould, in litt.

Utah Localities.—

Previous records: Salt Lake Basin. (Call, 1884.)

Newton town reservoir; Logan; Clarkston; Morgan. (Henderson and Daniels, 1917.)

Emigration Canyon, Salt Lake City. (Henderson, 1924.)

- As *Physa cooperi* var. *distinguenda*? north of Brigham; northeast of Newton. (Henderson and Daniels, 1916.)
- As *Physa crandalli* Baker, Devil's Slide; Provo. (Henderson and Daniels, 1917.)
- As *Physa elliptica* Lea? Provo; Beaver; Rush Lake; Virgin River. (Yarrow, 1875.) Warm Springs, near Salt Lake City. (Call, 1884.)
- As *Physa gyrina* Say, Salt Spring Creek, fossil. (Call, 1884.) Wheelon. (Henderson and Daniels, 1916.) The Greens and Deception Lake. (Pilsbry and Ferriss, 1911.)
- As *Physa heterostropha* Say, Sevier Lake. (Yarrow, 1875.) Semi-fossil on Sevier desert. (Call, 1884.)
- As *Physa lordi*, Baird, Sevier desert. (Call, 1884.) Utah Lake, south of Lehi. (Henderson and Daniels, 1917.)
- As *Physa saffordi* Lea? Salt Lake. (Cooper, 1869.) Utah. (Ingersoll, 1874.)
- As *Physa sayi* Tappan, Utah Lake. (Ingersoll, 1877.)
- Duplicate records:** Salt Lake City, Decker's Canal near Jordan River. (U. of U. Zoo. Mus., No. 866.) Red Butte Creek. (No. 919.) Mt. Olivet Cemetery Reservoir. (No. 606, a large form.) Same Locality, smaller. (Nos. 552 and 609.) Near airplane field. (No. 622.) Holliday. Cottonwood Creek. (No. 758.) Mouth of Little Cottonwood Canyon, identified by J. Henderson, (No. 1553.)
- Ogden, in city. (U. of U. Zoo. Mus., No. 896.) Same locality, exceedingly small specimen. (No. 725.) Ogden River. (Nos. 719 and 773.) Swamp near city. (No. 875.) Below Ogden Canyon, small. (Nos. 871, 877 and 907.)
- Beaver. (U. of U. Zoo. Mus., Nos. 1006 and 1127.)
- Logan, Backsmith Fork below Ballard Springs. (U. of U. Zoo. Mus., Nos. 1312, 1403 and 1455.) Near Logan. (No. 1288.)
- New localities:** Peoa, Summit Co., averaging over $\frac{1}{2}$ inch in length, thin, amber-colored shells. (U. of U. Zoo. Mus., No. 645.)
- Junction, old trout pond south of town, large shells resembling *P. utahensis* somewhat, but having as many as 2 red and white color bands around whorls. (U. of U. Zoo. Mus., Nos. 995, 996, 997, 1024 and 1108.)
- Reservoir on Sevier River. (U. of U. Zoo. Mus., No. 1043.)
- Murray, South Cottonwood. (U. of U. Zoo. Mus., No. 757, large, fragile, amber-colored shells.) Similar. (No. 652.)
- Big Cottonwood Canyon, below "The Stairs". (U. of U. Zoo. Mus., No. 687, small.)
- Juab, one mile south of town. (U. of U. Zoo. Mus., Nos. 1080 and 1086.) At Juab. (No. 1083.)
- Enterprise, collected by V. M. Tanner. (U. of U. Zoo. Mus., No. 1475.)
- Kamas, Summit Co., similar to the South Cottonwood specimens. (U. of U. Zoo. Mus., No. 650; small, No. 639.)
- Woodland, Summit Co. (U. of U. Zoo. Mus., No. 644.)
- Toquerville. (U. of U. Zoo. Mus., No. 1134.)
- Panguitch. (U. of U. Zoo. Mus., No. 1136.)
- Wasatch Station, near Weber Canyon. (U. of U. Zoo. Mus., No. 1334.)

- Between Circleville and Junction. (U. of U. Zoo. Mus., No. 1068.)
Richfield. (U. of U. Zoo. Mus., Nos. 1046 and 825.)
Lake Navajo, near Cedar Breaks. (U. of U. Zoo. Mus., Nos. 1124 and 1052.)
Emery Station, Weber Canyon. (U. of U. Zoo. Mus., No. 1328. a very *Aplexa*-like form; No. 1329.)
Rich Co., six miles from Evanston, Wyo. (U. of U. Zoo. Mus., No. 1413.) Five miles from Evanston. (No. 1373.)
Fillmore Canyon. (U. of U. Zoo. Mus., No. 1036.)
Wellsville, Cache Valley, minute forms. (U. of U. Zoo. Mus., Nos. 1380 and 1408.)
Fish Lake, small and very fragile. (U. of U. Zoo. Mus., No. 826.)
Three miles up canyon between Brigham and Logan. (U. of U. Zoo. Mus., No. 1458.)
Castle Rock, reservoir east of station, Summit Co. (U. of U. Zoo. Mus., No. 1417.)
Lynndyl. (U. of U. Zoo. Mus., No. 1476, a small form with 2 orange and white bands.)
Crystal Hot Lakes, Salt Lake Co., may be *Physella virgata*. (U. of U. Zoo. Mus., No. 558.)
Malad River, north of Garland. (U. of U. Zoo. Mus., No. 632.)
South Tremonton. (U. of U. Zoo. Mus., No. 628.)
Pleasant Grove, swamps east of Geneva, may be *P. utahensis*. Anatomies also saved. (U. of U. Zoo. Mus., Nos. 509 and 510.)
Moab, along Colorado River, collected by V. M. Tanner and James Kastchner. (U. of U. Zoo. Mus., No. 1477.)
Glenwood, small. (U. of U. Zoo. Mus., No. 838.) Large. (Nos. 809, 812 and 829.)
Three-Mile Creek, detour between Wanship and Salt Lake City. (U. of U. Zoo. Mus., No. 1428.)
Sterling, lake south of town, large, fragile. (U. of U. Zoo. Mus., No. 1063.) Smaller. (No. 1117.)
Provo Canyon, above Heber. (U. of U. Zoo. Mus., Nos. 910 and 913.) Near Charleston. (No. 915.) Vivian Park. (No. 754.)
Bear Lake. (U. of U. Zoo. Mus., No. 1448.) Between Lakota and Garden City. (No. 1467.) West side of lake. (No. 1282.)
Garfield City. (U. of U. Zoo. Mus., No. 764.)
Parowan, flowing well north of city, probably *P. virgata*. (U. of U. Zoo. Mus., No. 1008.)
Marysvale. (U. of U. Zoo. Mus., No. 1143.)
Garland, juvenile, submitted by Melba Turner and returned to her collection.
South Tremonton, Box Elder Co., submitted by Melba Turner and returned to her collection.
Strawberry Reservoir, collected by Mr. J. Hansen, resembling *Physella utahensis* Clench in some respects. (U. of U. Zoo. Mus., No. 1537.) Same locality, but varying more widely. (No. 1540.)
Moab. (U. of U. Zoo. Mus., Nos. 1624 and 1668.)

Shell large, ovate-ventricose, thin, fragile, shining, horn-colored; spire elevated, acute; whorls six, last one inflated; suture decidedly impressed; aperture broadly ovate, five-sixths the length of the shell; labrum thin, submargined with red; columella quite flexuous, covered with callus. Length 1, breadth 10/20 to 11/20 inch.

Distinguished by its large size, inflated form, and delicate structure; sometimes the form is somewhat cylindrical. It accords most nearly with Haldeman's plate iii, fig. 9, which was given him as *P. sayii* Tappan. It is much more delicate, and less polished than *P. heterostropha* Say, and the aperture is less elongated. (Gould.)

Type locality.—Oregon.

Range.—Oregon and Washington northward to Norton Sound and southeast to Utah.

Discussion.—Typical *ampullacea* is probably confined to the northwest. Some of the records above may belong to *Physella utahensis* Clench and others to *Physella virgata* Gould, as the *Physella* problem in Utah has never been cleared up. It is very difficult to separate the young of the large forms from the small forms. The collection above will serve as a basis for future investigation, which should be made when sufficient material is collected. We are satisfied, after seeing field conditions, that identification of small sets, even by responsible authorities, can never satisfactorily solve the problem.

Physella utahensis (Clench)

THE UTAH SINISTRAL POND SNAIL

Physa lordi utahensis Clench, *Occasional Papers of the Museum of Zoology, University of Michigan*, No. 161, May 27, 1925, p. 8.

Dr. Clench in a letter to Dr. Chamberlin says: "I described this as a subspecies of *P. lordi* Baird, but I have since considered this as rating full specific rank."

Utah Localities.—

Previous records: See Utah Lake records of *P. ampullacea*, and especially *Physa lordi* records.

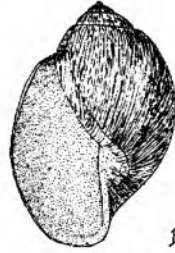
Duplicate records: Utah Lake near Spanish Fork. (U. of U. Zoo. Mus., No. 1021.) At Provo. (Nos. 532 and 534.) Near Saratoga. (No. 882.) Geneva Resort, near Pleasant Grove. (No. 785.)



Physella ampullacea Gould
Salt Lake City — = 1/2 cm.

Fig. 74

Shell sinistral, large, rhomboidal, slightly imperforate, slightly malleated, solid. Color light straw, varicose bands only slightly developed on a few individuals of type lot—not at all on the type. Whorls five, rounded. Spire slightly obtuse, nuclear whorl reddish. Aperture slightly elongate, columella margin straight. Lip not noticeably thickening in the type; six of the paratypes have a slight reddish brown callosity a little behind the lip margin. Columella straight, not twisted, rather wide. Suture rather deep, slightly indented. Sculpture coarse, vertical growth lines on all last three whorls, a few not regularly spaced, more prominent, especially so toward superior border of body whorl. Cross striae absent, a few coarse spiral lines on center of body whorl of type, but not on any of the paratypes. Length of type 31 mm.; width 21.5 mm.; length of aperture 22.5 mm.; width 11.5 mm. In the paratypes the length varies from 20.1 to 26.5 mm.



Physella utahensis Clench

Utah Lake — $\frac{1}{2}$ cm

Fig. 75

Remarks.—Henderson and Daniels (loc. cit.) used material from the type locality of this subspecies in making their analysis between the western and eastern forms of the supposed *P. lordi*. Miss Winslow also used this material in her comparison with the type lot of *P. lordi* and noted sufficient differences to warrant subspecific distinction for the Utah Lake *Physellas*.

The length of the aperture of *P. lordi utahensis* . . . does not represent the relationship to *P. lordi* quite as much as some of the paratypes, especially in the character of the spire. The specimens in the type lot, however, show an intergradation of the spire character, ranging from the obtuse spire of the type to that somewhat approaching *P. lordi*. . . . The shoulder is somewhat produced in 4 out of 39 paratypes of *utahensis*, but again this character does not approach the rounded shoulder of *P. lordi* or the sharply angled shoulder of *P. parkeri*. The specimens of *utahensis* agree with those of *lordi* in the rather straight and less twisted columella, as compared with the more twisted columella found in *P. parkeri*. A lot of specimens from New Mexico, contained in the collection of Dr. Bryant Walker, exhibits practically all of the characters of *P. lordi* with the exception of one specimen. This specimen can be referred to *P. lordi utahensis*. The remaining 6 specimens of this series are more or less constant in their characters. (Clench, 1925.)

Type locality.—Utah Lake, two miles south of Lehi, Utah.

Range.—Utah Lake, Utah, New Mexico.

Discussion.—The establishment of this species removed one of the difficulties of Utah conchology. The Utah Lake material is clearly different from many of the other larger *Physella* of the state. Attempts to synonymize it with *P. lordi* and with varieties of *ampullacea*, and other species, while commendable, were, nevertheless, more or less unsatisfactory and unconvincing. At the time of description Clench did not realize the wide variation in this form. In sending material to him, we selected extremes purposely to show this variation. In replying, he says, "This species is either very variable or else there are two or three species mixing or hybridizing in the lake. The type lot was more consistent as regards to general form than the material I am sent."

Physella virgata (Gould)

THE STRIPED PHYSELLA

Physa virgata Gould, *Proc. Bost. Soc. Nat. Hist.*, V, 128 (1855).

New records: Between Leeds and St. George. (U. of U. Zoo. Mus., No. 1125 and 1081; these small *Physellas* with a shining epidermis, striations appearing on the shell, especially after they become bleached; horn-colored during life, but after the animal dies the shell bleaches out to an ash color.)

St. George. (U. of U. Zoo. Mus., No. 1185, similar to the preceding.)
Pool north of St. George. (No. 1186, also A. M. Woodbury col.)

Parowan, flowing well north of city. (U. of U. Zoo. Mus., Nos. 1010 and 1182, similar to the St. George form.)

Enterprise, A. M. Woodbury col. (U. of U. Zoo. Mus.)

Washington, Washington Co., A. M. Woodbury col. (U. of U. Zoo. Mus.)

Cane Spring, near Central, V. M. Tanner col. (U. of U. Zoo. Mus., No. 1478, similar to the St. George form.)

Ivins and Santa Clara Bench Reservoir, A. M. Woodbury col. (U. of U. Zoo. Mus.)

Between Midway and St. George. (U. of U. Zoo. Mus., No. 1087, same as St. George form.)

Crystal Hot Lakes, Salt Lake Co., very similar if not identical with the St. George form.

Salt Lake City, slough near airplane field. (U. of U. Zoo. Mus., No. 624, similar to St. George form.)

Logan, pond one mile south of city. (U. of U. Zoo. Mus., No. 1290, a remarkably large form, measuring 7/16 inch in height, too large for *virgata*, we believe. It is marked with white stripes on the body whorl which can be detected while the animal is in the shell, but which show as broad to fine transverse bands of a whitish color when the snail is pulled and the shell is dried; delicate white spiral bands occur irregularly on the bodywhorl; the shell colored a horn brown; a marginal red band within the aperture; the callus folded over unusually far into the shell; spire high for a *Physella*; these shells easily separable from the *Physella ampullacea* with which they were taken, though they were of practically the same size; their shell

much more fragile than that of *ampullacea*; the white bands seem to be a deposit regularly laid down between the coarse ribs or lines of growth.)

Moab. (U. of U. Zoo. Mus., Nos. 1627, 1630, 1633, 1639, 1642 and 1644.)

Price. (U. of U. Zoo. Mus., Nos. 1657 and 1659.)

Bluff. (U. of U. Zoo. Mus., No. 1648.)

Shell moderate, solid, smooth, elongate-ovate, ash-colored with longitudinal olivaceous stripes; spire elevated, acute; whorls four to five, well separated; aperture lunate, two thirds the shell's length; columella moderately folded, but with a heavy callus, within yellowish-red. Length $2/5$, breadth $1/4$ inch.

Quite remarkable, as being the only species yet known which has variegated coloration. The stripes are found on some part of every shell, and many are prettily ornamented throughout. In size and proportions it may be compared with *P. microstoma*, Hald. (Gould.) (Binney.)

Type locality.—River Gila and near San Diego.

Range.—Records are at hand ranging from California to Colorado.

Genus **PETROPHYSA** Pilsbry

Differing from *Physella* in having the mantle not digitate and in having teeth of radula with large cusps few and the small interstitial cusps numerous.

Genotype.—*P. zionis* Pilsbry.

The only known species is the genotype.

Petrophysa zionis Pilsbry

Physa (Petrophysa) zionis Pilsbry, *Proc. Acad. Sci. Phil.*, LXXVII, 1926, p. 326, fig.1, and pl. XI, figs. 1-6.

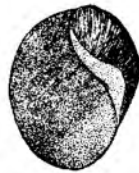
The shell is imperforate, thin, cinnamon colored, of a semi-ovate or nearly semi-globular shape, the spire very small and low. The last whorl is very much inflated, somewhat compressed around the upper part, with sculpture of minute, close delicate striae or growth lines. The aperture is nearly as long as the shell, very broadly ovate or somewhat piri-form. The outer lip is thin and sharp. The columella is very broad and straight in the middle, its face somewhat excavated or furrowed axially; becoming concave below. It is bounded on the right by a thin, rather wide, closely appressed callus.



Physella virgata Gould

Near Parowan, Utah — 1mm.

Fig. 76



Petrophysa zionis Pilsbry

Zion National Park, Utah

— = 2mm.

Fig. 77

Length 4.5 mm.; diameter 3.6 mm.; length of aperture 3.9 mm. Two and one-half whorls.

A second specimen has length 3.6 mm.; diameter 3.3 mm.; length of aperture 3.3 mm. Two and one-half whorls.

Type locality.—Zion National Park, Utah, the only known locality.

Discussion.—Dr. Pilsbry notes that the mantle is intensely black with a white border and adds to the description given above the following points of importance in regard to the animal itself:

1. There are no mantle digitations so far as could be detected in alcoholic specimens although such are conspicuous in alcoholic specimens of *Physa*. This is a feature of probably generic significance as already indicated.

2. The foot is broad, pointed behind.

3. The muzzle is very broad, emarginate in front.

4. "The tentacles, as contracted in alcohol, are cylindrical or slightly tapering, but very blunt at the ends, not conic or pointed as in other alcoholic *Physa* compared. This point also calls for examination in living specimens. The posterior basal processes of the tentacles are relatively larger than in *Physa ancillaria* and others compared. Eyes were not seen; if present the pigment spots must be very small."

5. While the teeth are distinctly physid, they are remarkable for the small number of large cusps and the multiplication of small interstitial ones. The short squarish central tooth has a broad reflection and five strong cusps. The laterals are rasbriform, the reflection bearing, e. g., four large and long cusps with group of small cusps in the intervals, most of the groups consisting of these cusps.

Pilsbry mentions the following points in respect to its ecology:

1. It lives not in the river, but on wet cliffs, coated with algae.

2. Although it is a pygmy species, much smaller than any *Physa* or *Physella* yet known, and peculiar for its small spire and relatively large last whorl and aperture, yet this dwarfing is not due to lack of lime, as lime is deposited on the cliff by the water.

3. 1600 foot cliffs shut out the sky.

4. "The short, broad contour and ample aperture of the shell of *Physa zionis* . . . are correlated with a relatively large and very broad foot, apparently adapted to afford the suction needed for secure foothold on the vertical substratum when flooded by heavy showers. The hemispherical shell, with evenly rounded surface and practically

no projecting spire, appears to be another adaptation to the same end. It is shaped like the Neritinae of rapid rocky streams, such as those of Fiji, and approaching the contour of *Ancylus* and other limpets.

"Except in the direction of the coil, *Physa zionis* has a striking resemblance to the Hawaiian *Erinna*, which inhabits mountain streams on rocks, and is probably an adaptive modification of *Lymnaea*. The convergence in shell characters of these two mollusks, one physid, the other limnaeid, is astonishing. *Physa globosa* Hald. found on submerged rocks in the Nolachuky River, is the nearest of our American species, but still very unlike *P. zionis*."

Dr. Pilsbry, in his original discussion states that "further collecting, keeping the shells of each colony separate, might possibly show that there are recognizable racial differences between snails of the more widely isolated colonies.

"Aside from the characters of shell and foot, which are apparently considered adaptations to life on a vertical plane, this *Physa* has several peculiarities, such as absence of mantle digitations and the arrangement of cusps on the teeth, which isolate it in a new subgenus or section, to be called *Petrophysa*."

On our visit to Zion Park, we collected from cliffs near the type colony and beyond. Mr. Woodbury reported that these spots had been stripped of snails by collectors on previous occasions, but that in a few days migration from above had soon renewed the supply. Evidently the snail is quite prolific. No eggs were observed.

Genus **APLEXA** Fleming

THE GLOSSY POND SNAILS

Shell sinistral, elongated, slender, smooth, shining; spire acute; lip simple, sharp, columella but slightly twisted.

Animal similar to that of *Physella*, but with the inner edge of the mantle simple, not digitate nor reflected over on the body whorl. (Walker, 1918.)

Genotype.—*Bulla hypnorum* Linnaeus.

Aplexa hypnorum (Linnaeus)

THE GLOSSY POND SNAIL

Bulla hypnorum Linnaeus, *Fauna Suecica*, ed. 1, No. 1303, 1746; *Syst. Nat.*, ed. X, p. 727, 1758.

Aplexus hypnorum Chenu, *Man. de Conch.*, 1, p. 481, fig. 3556, 1859.

Utah Localities.—

Previous records: Utah. (Ingersoll, 1874.)

Devil's Slide and Morgan. (Henderson and Daniels, 1917.)

New records: Ogden Canyon, near City Artesian Wells, the dominant form. (U. of U. Zoo. Mus., No. 520.)

Fish Lake, west side, apparently a dwarf form, or young, or possibly a very elongate form of *Physella*, such as we found near Emory Station. (See under *Physella ampullacea*.) This set from Fish Lake. (U. of U. Zoo. Mus., No. 820.)

Glenwood, a form similar to that from Fish Lake. (U. of U. Zoo. Mus., No. 839.)

Laketown, swamps west of town, large specimens, rare. (U. of U. Zoo. Mus., No. 1439.)

Garden City, pond two miles south of town, one large and a few small specimens. (U. of U. Zoo. Mus., No. 1295.)

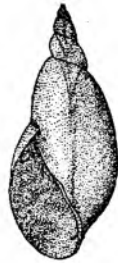
Salt Lake City, slough near airplane field, comparatively small. (U. of U. Zoo. Mus., No. 626.)

Shell of medium size, greatly elongated, thin, transparent, imperforate; color light brownish horn, often marked by narrow streaks, frequently with a glint of copper, surface polished, glistening; lines of growth scarcely visible with a lens, without any indication of spiral lines; whorls rather more than six, the last long, narrow, compressed; spire long and pointed, whorls rounded; nucleus rather larger, flatly rounded, partly embraced by the second whorl, below which part of the nucleus is sunken, smooth or but slightly punctate, corneus like the rest of the shell; sutures well impressed, bordered below by a narrow white zone; aperture of medium size, about half the length of the shell, narrowly elongated, the outer edge flattened, outer lip thin, regularly rounded from the body whorl, the lower part somewhat expanded, without internal callus; only a very thin wash of callus on the parietal wall; columella oblique, narrow, arched below, slightly twisted; the inner lip is tightly appressed to the umbilical region. Length to 16.3 mm.; diameter 3 to 6.5 mm. Length of aperture 3.2 to 8.6 mm.; diameter 1.2 to 3.3 mm.

Type locality.—Europe.

Range.—Northern Europe, Asia and North America across the northern United States west to the Cascade Mountains and north to Hudson Bay and Alaska.

Discussion.—This is one of the circumboreal species that “comes down the mountains” from the north into Utah and Colorado. It is also one of the species that is remarkable for its resistance to environmental influences, as it is so nearly the same in three continents that the attempt to find varietal differences has not proven successful.



Physella hypnorum (Linn)
Ogden Canyon, Utah.
— = 1 mm.

Fig. 78

It is easily recognized by its high spire, its sinistral coiling, and the extreme luster of the epidermis. The last has been a source of much amusement to us, as several visitors to the laboratory have insisted that to obtain such a luster, they surely must be varnished.

This species is quite eccentric in distribution, but where they occur they frequently "crowd out" the *Physellas*. At the Ogden Canyon locality, we found them dominant and associated with the *Lymnaeas*, but no *Physellas*.

Family ANCYLIDAE Dall

Shell patelliform or dextrally spiral, neritiform or planorbiform. Animal sinistral or dextral, with a large oval foot; tentacles short, blunt, cylindrical; eyes sessile at inner bases of tentacles; jaw in three parts or the whole segmented in plates; radula with the teeth arranged in rows nearly horizontal or slightly curved, the central tooth small, either unicuspid or bicuspid, the laterals bicuspid or comb-like, the marginals comb-like or sub-obsolete.

A single species represents this small family in Utah.

Genus **FERRISIA** Walker

Shell small and rather thin, ovate to oblong, conic, more or less elevated, apex eccentric and posterior, radially striate or smooth. Animal sinistral, attached to shell by three muscles and by a band of muscles marking free edge of the mantle; foot very large, long and wide; head wide, short, veliform as in *Lymnaea*; tentacles cylindrical, short; eyes on inner base of tentacles; jaws three in number; central tooth of radula long and narrow, reflected portion bicuspid, laterals, tricuspid, marginals cusped like laterals but outer, upper part of reflection with 2-5 accessory ectocones; teeth in almost parallel rows.

Genotype.—*Ancylus rivularis* Say.

Range.—Over most of the world, but lacking in Europe, Siberia, Nile Valley, Mexico and South America.

Ferrisia rivularis (Say)

Ancylus rivularis Say, *J. A. N. S.*, I, 25, Oct., 1819.

Ancylus rivularis Walker, *Nautilus*, XVIII, p. 25, pl. 1, figs. 1-10, 1904.

Ferrisia rivularis Walker, *Nautilus*, XVII, 1903, p. 45.

Utah Locality.—

New record: Utah Lake.

Shell ovate, moderately elevated, with a subacute apex, which is inclined toward the right side and with about one-third of the shell posterior to it. The anterior and dextral slopes are regularly but not strongly convex; the posterior slope quite concave immediately below the apex, but becoming nearly straight toward the peritreme; left slope nearly straight, sometimes slightly concave towards the apex. Lines of growth well marked but quite irregular, and there is more or less of a tendency to the radial rippling on the anterior slope so common in many species. Shell distinctly narrowed toward the posterior extremity, the greatest width being just in front of the apex. Some forms with apex less prominent and poster-

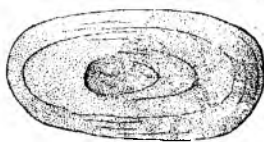
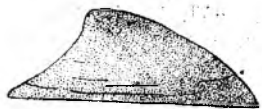
ior slope nearly straight. Length 4.75 to 7 mm.; breadth 3 to 4.33 mm.; height 1.5 to 2.75 mm. Western specimens apparently average larger than those from the eastern states. (Walker.)

Type locality.—Pennsylvania: Delaware and Susquehanna Rivers.

Range.—Northern United States, from Massachusetts west to Colorado, Wyoming and Utah.

Discussion.—These little depressed conical, pale corneous shells protect an animal that resembles a Lymnaea snail. They have short tentacles; the eyes are not at the ends of the tentacles but near their inner bases.

They were formerly believed to be confined to the states east of the Mississippi, but recent studies have recorded them in more westerly states. This is the first record of their occurrence in Utah.



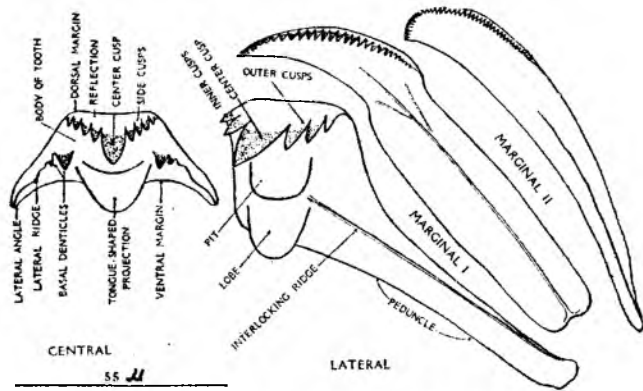
Ferrissia rivularis (Say)
Utah Lake, Utah ——— 1mm

Fig. 79

Family AMNICOLIDAE Tryon

Shell small, elongate and conical to globose, the spire pointed, dextral; umbilicus from open to narrow or closed; aperture entire, lip simple, usually acute; operculum present, horny or calcareous, concentric, spiral or subspiral, with or without spiral striae. Animal with long rostrum; tentacles cylindrical or tapering, long eyes at their outer base; foot oblong, anteriorly truncate, rounded behind; jaws two, pear-shaped, composed of small imbricated plates; radula with teeth 2-1-1-2 in slightly arcuate cross rows of which there are usually about 60; central tooth usually wider than high, with 7-11 denticles; laterals hatchet-shaped, reflection from few to many denticles; marginals falcate, the reflections multicuspoid. Oviparous.

A family of world-wide distribution. They live in fresh, brackish or marine water. As the accurate classification of these forms is based largely on such characters as those of the radula requiring study under high powers of the microscope, and on the structure of the genitalia, their study presents some difficulty. It is a large group represented in Utah by four genera and eight species.



TEETH OF RADULA OF *AMNICOLA LIMOSA*
PORATA (SAY) (AFTER BAKER)

Fig. 80

Genus **AMNICOLA** Gould and Haldeman

THE LAKE SHELLS

Shell small, oval-conic, rather short, spire subacute; whorls four to six, convex; aperture oval; peritreme continuous; lip simple, sharp; columella not thickened. Operculum thin, corneous, paucispiral.

Animal oviparous; central tooth of the radula multicuspid, with a tooth-shaped process from the middle of the anterior surface, reaching beyond the base, and with several basal denticles; laterals and marginals multicuspid. Verge short, bifid, with a globular base. (Walker, 1918.)

Type.—*Paludina limosa* Say.

Discussion.—*Amnicola limosa* is a common form in Utah Lake. But for habitat differences, it would be likely to be confused with *Paludestrina longinqua*.

Amnicola limosa (Say)

Paludina limosa Say, *Journ. Ac. Nat. Sc. Phil.*, I, 125 (1817).

Amnicola limosa Haldemann, *Non.*, 10, pl. 1, figs. 5 and 6 (1884).

Utah Localities.—

Previous records: Near Salt Lake City, fossil. (Hayden, 1870.)

Utah Lake; Spring Lake. (Putnam.) (Hayden and others, 1899.)

Kelton, fossil. (Stearns, 1893.)

Utah Lake. (Dall, 1905.)

• Utah Lake. (Henderson and Daniels, 1917.)

Duplicate records: Utah Lake, near Saratoga. (U. of U. Zoo. Mus., No. 888.) Geneva Resort, near Pleasant Grove. (No. 792.)

New records: Juab Station, Juab Co., one specimen. (U. of U. Zoo. Mus., No. 1000.)

Skull Valley, Tooele Co., spring at Josepa, R. V. Chamberlin, collector, may be fossil forms. (U. of U. Zoo. Mus., No. 1544.)

Shell conic, somewhat inflated, narrowly perforate; color light yellowish or dark horn, without color bands or marks; surface shining, lines of growth numerous, fine crowded; sutures deeply impressed; whorls four and one-half, more or less inflated; turbinate, regularly increasing, body whorl globose; spire wide, obtusely conic; apex flat-topped, the first (nuclear) whorl small, rounded, minutely granular and bordered by the second whorl, which begins to descend after making about one-fourth turn; aperture orbicularly-ovate, rounded below and but slightly angled above; peristome sharp, simple, a little thickened within; inner lip sharp, joining the parietal wall at the umbilical region but not appearing on the parietal wall which is without callus or the callus is very thin; base of shell rounded. Length from 3.5 to 4.1 mm.; width 3 to 3.4 mm. Length of aperture 2 to 2.3 mm.; width 1.5 to 1.6 mm.



Amnicola limosa (Say)
Utah Lake — 1mm

Fig. 81

Operculum horny, thin, subspiral, or about two and one-half whorls, almost straight on left margin, regularly rounded at base and on right side. Animal generally whitish or pinkish, a streak of dark brown extending down side of tentacles, a patch of brown between eyes, and black and brown markings on rostrum. Foot short, about three times as long as wide, rounded behind, auriculated before; tentacles slender, cylindrical, not tapering. (Baker.)

Type locality.—Pennsylvania, Delaware and Schuylkill Rivers.

Range.—New England states and New Jersey west to Utah and from Texas north to Manitoba.

Discussion.—This species occurs commonly in streams, rivers and more quiet bodies of water as well. It is a common form on muddy bottoms and on aquatic plants.

Amnicola deserta Pilsbry

THE DESERT SNAIL

Amnicola deserta Pilsbry, *Nautilus*, XXIX, 1916, p. 11.

Utah Locality.—

Previous record: Washington Co., type locality. (Pilsbry, 1916.)

The shell is very small, perforate, broadly ovate, corneous, translucent, thin; surface glossy, very minutely marked with delicate growth-lines. The outlines of the spire are convex, the apex somewhat pointed. Whorls three and one-half, strongly convex, the last more rapidly descending close to the aperture. The aperture is ovate, somewhat oblique, angular above. Peristome continuous and free from the preceding whorl. Length 2.4 mm.; diameter 1.7 mm.; longest axis of the aperture 1.25 mm. Length 2.2 mm.; diameter 1.6 mm. (Pilsbry.)

"This little shell resembles the larger *Bythinella palomasensis* from Lake Palomas in northern Chihuahua (*Nautilus*, IX, 68, Oct. 1895; Dall, Proc. U. S. Nat. Mus., XIX, 1897, p. 369, pl. 31, fig. 9). The present species is broader and evidently old individuals are smaller. The generic position is uncertain. As between a short *Paludestrina* and a long *Amnicola* there is little choice.

"Washington County is in the southwestern angle of Utah, drained by the Virgin River, flowing into the Colorado. The specimens are 'dead' shells, but not fossil, I think. According to the label, *Oreohelix strigosa* was found in the same place. The collector was not given for this or for the preceding.

"All of the adult specimens of *A. deserta* have the last whorl slightly free at the aperture. It is a senile form, probably extinct or on the verge of extinction. *Amnicolidae* lead a precarious existence in the arid states. The rivers do not afford suitable stations. They

have apparently never gained access to the small perennial streams of the higher mountains; and permanent springs and streams are so rare on the lower levels that the colonies are small, few and widely separated. The large proportion of extremely diminutive species in the arid region is remarkable. It may, perhaps, be looked upon as a permanent dwarfing due to unfavorable conditions. Figures of both species, (the other was *Ammicola neomexicana* from Socorro, New Mexico) have been prepared, to be published on a future plate." (Pilsbry.)

Discussion.—There are no available records of this form other than given in the original description and discussion reproduced above.

Genus **CINCINNATIA** Pilsbry

Shell large, whorls well rounded, sutures deeply impressed, base widely umbilicated. Animal generally as in *Ammicola*. Radula much smaller than that of the *Ammicola* or *Stimpsonia*; the central tooth two-thirds as wide and about half as high as wide, without the ventral tongue-shaped projection of *Ammicola*, the ventral margin being simply broadly lobed; lateral ridge with but one large denticulation, reflection low, denticulations 11, the center cusp three times the size of the side cusps, all long, sharp, spade-shaped; lateral teeth with reflection wide, rather low, and multicuspid, 4-5 cusps on inner side and 7-9 cusps on outer side of a large central cusp: first marginal falcate, reflection very wide, multicuspid; second marginal somewhat spoon-shaped, the reflection multicuspid, the cusps being very small. (Baker.)

Genotype.—*Paludina cincinnatiensis* Anthony.

Discussion.—This genus has generally been merged with *Ammicola*. From that genus it is separated chiefly on the basis of the very different radula. One species, the genotype, is known from Utah.

Cincinnatia cincinnatiensis (Anthony)

Paludina cincinnatiensis Anthony, *Bost. J. N. H.*, III, p. 279, pl. iii, fig. 3, Jan. 1840.)

Utah Localities.—

Previous records: Near Salt Lake City, fossil. (Hayden, 1870.)

Upper Bonneville beds, fossil. (Call, 1884.)

Lake Point. (Hemphill.) Terraces ('Bonneville.') Salt Lake. (Hayden.)

Sevier Lake Valley. (Wheeler Expedition.)

Clinton's Cave. (Packard, 1888.)

Duplicate record: Clinton's Cave, fossil. Bleached shells of this species were found in this cave by R. V. Chamberlin and D. T. Jones. (U. Mus., Nos. 561, 562 and 917.)

Shell of good size, umbilicated, rather solid; color ranging from greenish to yellowish brown, sometimes darker; surface smooth and shining, lines of growth well developed, crowded, rather coarse, sutures deeply impressed; nucleus very small, rounded, granular, brownish, well raised above the second whorl; spire broadly conic, elevated; whorls five to six, rapidly increasing in diameter, rounded, somewhat shouldered below the suture, the last somewhat loosely coiled so that the aperture is continuous and separated from the body whorl; aperture roundly ovate, narrowed above, bluish-white within; peristome continuous, simple, sharp, touching the body whorl only at the upper part for a short distance; base rounded, with a rounded deep umbilicus. Length 4.2 to 5.2 mm.; width 3.1 to 4 mm. Length of aperture 2 to 2.5 mm.; width 1.8 to 2 mm. (Baker.)

Type locality.—Cincinnati, Ohio, in a canal.

Range.—New York and Pennsylvania to Texas and Utah.

Discussion.—Probably this species is the largest of the family and is easily known by its size, "solid shell, elongated, conic spire with shouldered whorls, and deep umbilicus." So far as known this species is fossil in Utah, though living in the eastern states.

Genus PALUDESTRINA Orbigny

WATERCRESS SNAILS

Shell similar to *Amnicola*, but more slender and elongated. Central tooth with but one basal denticle on each side, and without tongue-shaped process of *Amnicola*. Verge bifid. (Walker, 1918.)

Genotype.—*Cyclostoma acutum* Drap.

KEY TO SPECIES

- a. Shell elongate, length 3/10, breadth 1/10 inch. Rare. . . . *P. protea*.
- aa. Shell more compact, length 1/8, breadth 1/10 inch, common on watercress about springs. Frequently greenish in color. . . . *P. longinqua*.

Paludestrina longinqua (Gould)

THE WATERCRESS SNAIL

Amnicola longinqua Gould, *Pr. Boston S. N. II.*, V, 130 (March, 1855).

Paludestrina longinqua Pilsbry, *Naut.*, XII, 1899, p. 122.

Utah Localities.—

Previous records: Lake Point, west of Garfield, living. (Call, 1884).

Weber Canyon; near Provo; near Brigham City; near Salt Lake City; Bear Lake; Utah Lake. (Pilsbry, 1899).

Clarkston; southeast of Tooele. (Henderson and Daniels, 1916.)

Devil's Slide; Morgan; Salina; Logan; Garfield; Utah Lake. (Henderson and Daniels, 1917.)

Duplicate records: Salt Lake City, Red Butte Creek. (U. of U. Zoo. Mus., No. 920.)

City Creek Canyon. (U. of U. Zoo. Mus., No. 760.)

Mill Creek Canyon. (U. of U. Zoo. Mus., No. 615.)

Emigration Canyon on watercress. (U. of U. Zoo. Mus., No. 903.)

Bear Lake, west shore, near spring on watercress. (U. of U. Zoo. Mus., Nos. 1275 and 1465.) South end approaching Laketown. (U. of U. Zoo. Mus., No. 1437.)

Logan, Blacksmith Fork below Ballard Spring. (U. of U. Zoo. Mus., No. 1311.)

New records: Logan Canyon, eight miles from mouth. (U. of U. Zoo. Mus., No. 1364.)

Richfield, ditch from city springs. (U. of U. Zoo. Mus., No. 821, Bleached, may be *Ammicola* sp.)

Beaver Canyon. (U. of U. Zoo. Mus., No. 1180.)

Ogden Canyon, on watercress, 100 yards west of Coldwater Canyon. (U. of U. Zoo. Mus., No. 898.) Just below mouth of canyon, on watercress. (No. 870.)

Provo Canyon, North Fork, in Aspen Grove, Alpine Camp. (U. of U. Zoo. Mus., Nos. 990, 1111 and 1474.)

Fragile specimen from reservoir on the Sevier River, near Junction. specimen crushed accidentally in filing.

Sterling, reservoir south of town, near spring, on watercress. (U. of U. Zoo. Mus., No. 1116.)

South Tremonton, Box Elder Co., collected by Melba Turner. (U. of U. Zoo. Mus., No. 634.)

Kamas, Summit Co., collected by Melba Turner. (U. of U. Zoo. Mus., No. 640.)

Garland, Box Elder Co., submitted by Melba Turner.

Stansbury Mts., Tooele Co., R. V. Chamberlin, collector, identified by J. Henderson. (U. of U. Zoo. Mus., No. 1543.)

Shell small, elongate-ovate, smooth; apex obtuse; whorls five, suture deep; aperture elliptical, rounded posteriorly; columella very arcuate, subperforate. Length one-eighth, breadth one-tenth inch.

In form it is much like *A. cincinnatiensis* Hald., or like *A. galbana*, or like miniature specimens of *Paludina ponderosa*. It has a bleached or chalky color, probably from exposure, like the other species found on the Cienaga Grande, a region which is immersed a portion of the time, and dry the remainder, and was once, apparently, an extensive marsh, or shallow lake. (Gould.) (From Binney.)



Paludestrina longinqua (Gould)
Kamas, Utah — Imm.

Fig. 82

Type locality.—Colorado Desert.

Range.—Largely confined to the Great Basin.

Discussion.—The common name, most suitable for this form in this state is the "watercress snail" for it is almost invariably found on watercress near the overflow of springs.

It is more scarce in the southern part of the state, due probably to dry climate there. We examined a great number of watercress patches between Beaver and St. George and found none.

Paludestrina protea (Gould)

THE CORNUCOPIA SNAIL

Amnicola protea Gould, *Proc. Bost. S. N. H.*, V, 129 (March, 1885).

Utah Localities.—

Previous records: Utah, reported as *Tryonia exigua?* two specimens. (Wheeler Exped.) (Tryon, 1873.)

Sevier Lake, on shore. (Yarrow, 1875.)

New records: Skull Valley, Tooele Co., spring at Josepa, R. V. Chamberlin, collector, many specimens. (U. of U. Zoo. Mus., No. 1545.)

Western Tooele Co., Salt Springs, collected by R. V. Chamberlin, identified by J. Henderson. Many specimens. (U. of U. Zoo. Mus., No. 1542.)

Shell elongate, slender, variable; whorls seven to eight, rounded, divided by a deep suture, simple or variously ornamented, and barred with revolving ridges and longitudinal folds; aperture ovate; lip continuous, simple, scarcely touching the penultimate whorl. Length of the largest specimen .3 inch; breadth .1 inch.

Peculiar from its large size and slender form, though differing greatly in its relative proportions. It differs from all others, in being variously sculptured with revolving ridges and longitudinal folds, like most *Melaniae*. It varies greatly also in the relative proportions of length and breadth. It is as slender as *Amnicola attenuata* Hald., and much larger. This appears to be the same shell as that subsequently described by Mr. Conrad, under the name of *Melania exigua*. (Gould.) From (Binney.)

Type locality.—Colorado Desert.

Range.—Great Basin, rare.



Paludestrina protea (Gould)
Western Tooele Co, Utah

— = 1mm

Fig. 83

Genus **FLUMINICOLA** Stimpson

THE FLOOD SHELLS

Shell spiral, dextral, obliquely ovate, thick, solid, smooth, imperforate; spire moderate, obtuse; aperture ovate; columella flattened, calloused; lip effuse and projecting anteriorly so that the peritreme is not continuously in the same plane; operculum corneous, sub-spiral.

Rostrum rather large; tentacles tapering, foot broad; central tooth of the radula with several basal denticles on each side; outer lateral teeth with a smaller number of denticles than the inner. Verge large, compressed, with a broad semicircular wing on the left side. (Walker.)

Genotype.—*Paludina nuttalliana* Lca.

KEY TO SPECIES

- a. Shell greater in height than in diameter, noticeably elongate, very heavy.
F. nuttalliana (probably not found in Utah.)
- aa. Shell nearly spherical.
- b. Mature shells 7-8 mm. in diameter, 8-10 mm. in height, coiling often loose and in whorls sometimes imperfectly articulated with preceding whorls, common in Utah in swift current of rivers. . . . *F. fusca*.
- bb. Mature shells 4-5 mm. in diameter, 5-6 mm. in height, color bright green, rare in Utah. *F. seminalis*.

Discussion.—This is a heavy shelled genus that likes the swift waters of rivers. It clings to the down-stream side of rocks in mountain torrents. Keep calls them flood shells, presumably because they become trapped in pools during subsiding floodwater, thus making them most conspicuous after floods. The genus is operculate.

Fluminicola seminalis (Hinds)

Paludina seminalis Hinds, *Voy. of the Sulphur*, p. 59, pl. XVI, fig. 22, 1844.

Fluminicola (Paludina) seminalis Binney, *Land and Fresh Water Shells of N. A.* Part III, Smith. Misc. Coll., 144, vol. 7, p. 90, 1865.

Utah Localities.—

Previous records: Salt Lake City. (Reid.) (Ingersoll, 1874.)

Utah Lake, south of Lehi. (Henderson and Daniels.) (See also, *F. nuttalliana* records under *F. fusca*.)

New records: Tooele Valley, a suite of shells collected by Dr. Orson Howard many years ago. (U. of U. Zoo. Mus., No. 40.) These are larger than our check specimens but come nearer resembling *F. seminalis* than anything we have seen in the state.)

Skull Valley, Tooele Co., first spring in valley, species doubtful. R. V. Chamberlin, collector. (U. of U. Zoo. Mus., No. 1552.)

Shell obtusely turreted, solid, horn colored, smooth; apex eroded; whorls four, aperture bluish, expanded. (Hinds.)

Type locality.—River Sacramento, California.

Range.—The range of the *Flumnicolas* is a matter of much discussion. This species probably ranges from California and Oregon, to Idaho and Utah.

Discussion.—*Flumnicola fusca* is our common flood shell. *F. seminalis* may also be present. In fact naturalists have always claimed there are two forms in Utah, but the problem has never been cleared up as to the correctness of the identification.

Flumnicola fusca (Haldeman)

THE UTAH FLOODSHELL

Leptoxis fusca Haldeman, *Mon. Lept.*, 4, p. iii, IV, figs. 83 and 84 (1847?).

Flumnicola fusca Binney, *Land and Fresh-Water Shells of N. A.*, III, Smith. Misc. Coll., 144, 1867, (1865), p. 92.)

Utah Localities.—

Previous records: Utah Lake; head of Green River. (Binney, 1865.)

Salt Lake City, fossil, and living in mountain streams. (Hayden, 1870.)

As *F. nuttalliana* (Lea), Warm Springs, near Salt Lake. (Cooper, 1870.*)

Kelton, semi-fossil. (Stearns, 1893.)

Utah Lake; Bear Lake; Malad River. (Pilsbry, 1899.)

Bear Lake, pleistocene or later. (Sterki, 1909.)

Kelton; Snowville; Ogden River (common); Utah Lake (abundant.) (Call, 1884.)

Utah Lake; Lehi. (Call, 1886.)

Ogden; Utah Lake; south of Lehi; slough north of Springville. (Henderson and Daniels, 1917.)

Duplicate records: Ogden River, near Ogden. (U. of U. Zoo. Mus., No. 772.)

Holliday, Cottonwood Creek. (U. of U. Zoo. Mus., No. 759.)

Bear Lake, south end. (U. of U. Zoo. Mus., Nos. 1433, 1445 and 1446.)

Beyond Ideal Beach, south end, going southeast. (Nos. 1300 and 1342.) West side. (No. 1277.)

Utah Lake, Geneva Resort, near Pleasant Grove. (U. of U. Zoo. Mus., No. 787.) Provo. (No. 548.) Saratoga. (No. 884.)

New records: Wellsville, near city. (U. of U. Zoo. Mus., No. 1412.)

Logan, Blacksmith Fork. (U. of U. Zoo. Mus., Nos. 1317, 1404, and (juvenile) No. 1265.)

Provo Canyon, above Vivian Park. (U. of U. Mus., No. 753.)

Near Charleston. (U. of U. Zoo. Mus., No. 916.)

Randolph, stream on road approaching town from north. (U. of U. Zoo. Mus., No. 1429.)

*"I suspect that all these references should be placed under *F. fusca* or *F. seminalis*." (Henderson.)

Glenwood, near Richfield, stream above town, juvenile. (U. of U. Zoo. Mus., No. 830.)

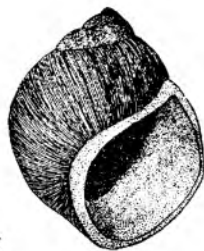
At mill on road to Grantsville from Salt Lake City, near fork of Tooele road. (U. of U. Zoo. Mus., No. 579.)

Shell subglobose, conic, smooth; spire loosened, with excoriated apex. Whorls subangular, forming posteriorly a slight projection on account of the labium turning abruptly at the suture, which is thus made conspicuous. Aperture rounded, posteriorly produced into a moderate angle. Columella thickened, somewhat concave, scarcely emarginate. Peritreme nearly uniform. Color reddish; labrum white. (Haldeman.)

Type locality. — "Inhabits Oregon Territory." (Binney.)

Range.—Oregon to Utah. (Binney.)

Discussion.—This is the common Utah *Fluminicola*. It is usually heavy shelled and subglobose. Sometimes the whorls do not show subangular as in the description. The epidermis varies from brown to green, but more often the animal covers its shell with mud and mineral matter which are so incrustated that they are very difficult to remove. The snails of this species live on rocks in swiftly running mountain streams. The apex sometimes has the earlier whorls of the spire eroded away, as is common with *Goniobasis plicifera* (Lea) of western Oregon rivers. See discussion under *Fluminicola seminalis* for relations of the *Fluminicolas* of Utah.



Fluminicola fusca (Haldeman)
Ogden River, Utah — = 1mm.

Fig. 84

Family VALVATIDAE Gray

In these forms the shell is depressed conical to almost discoidal, of few whorls; with a mostly green periostricum; umbilicus open; aperture circular; operculum present, circular and multispiral; muzzle produced; tentacles long and slender, eyes at outer base; ctenidia long and pectinated, partially exposed; teeth of radula broad, unciniate and denticulate. Hermaphroditic.

Fresh-water forms of the temperate region of the world. Two species of the genus *Valvata*, the only genus of the family, occur in Utah.

Genus **VALVATA** Müller

THE ROUND-MOUTHED SNAILS

Shell small, spiral, dextral, turbinate, or subdiscoidal; whorls rounded or carinated; aperture entire, circular; lip simple, sharp; operculum orbicular, multispiral, whorls with a thin elevated edge.

Animal dioecious; tentacles long, slender, cylindrical; eyes sessile on the internal bases of the tentacles; snout long; foot large, bilobed in front; gill external, plumose, protected by a long, slender, pallial appendage; verge exterior, placed on the right side, at the base of and below the tentacle; jaw two; lingual teeth multicuspid, no basal denticles on the central tooth. (Walker, 1918.)

Genotype.—*V. cristata* Müller.

KEY TO SPECIES

- a. Shell carinated, elongate. *Valvata utahensis*.
aa. Shell non-carinated, low-spined as a rule. *Valvata humeralis californica*.

Valvata humeralis californica Pilsbry

THE CALIFORNIA ROUND-MOUTHED SNAIL

Valvata humeralis californica Pilsbry, Naut., XXII, 1908, p. 82.

Utah Localities.—

Previous records: Near Salt Lake City. (Hemphill and Yarrow.)

Salt Lake City; Lake south of Lehi; north of Springville. (Henderson and Daniels, 1917.)

Duplicate records: Utah Lake, Geneva Resort near Pleasant Grove. (U. of U. Zoo. Mus., Lot 2, No. 288.) At Provo. (Lot 2, No. 41.)

New records: Lake Navajo, the dominant form. (U. of U. Zoo. Mus., No. 1050.)

Fish Lake, plentiful. (U. of U. Zoo. Mus., Nos. 845 and 834.) West side, plentiful. (No. 818.)

Rich Co., in mud deposits along stream, five miles from Evanston, Wyo. (U. of U. Zoo. Mus., Nos. 1353 and 1376.)

Garland, submitted by Melba Turner.

"Union", South Tremonton, Box Elder Co. (U. of U. Zoo. Mus., No. 614.)

South end of Bear Lake, approaching Laketown, three specimens, very rare. (U. of U. Zoo. Mus., No. 1436.)

Strawberry Reservoir, collected by J. Hansen. (U. of U. Zoo. Mus., No. 1538.)

The shell is much more depressed than *V. humeralis*, the last whorl descending less; whorls convex below the suture, not flattened there as *V. humeralis* is. Altitude 2.7 mm.; diameter 4 mm. Bear Lake, San Bernardino Mountains, California, collected by Mr. S. S. Berry. (Pilsbry.)

Type locality.—Bear Lake, San Bernardino Co., California.

Range.—Idaho and Utah to California.

Discussion.—This shell serves as material for the construction of caddis fly larval cases at Lake Navajo, Utah. Occasionally the larva uses a small *Lymnaea* or *Planorbis*, but often an entire case is composed of shells of *V. humeralis californica*. We found considerable variation in caddis fly cases over the state, collected in connection with our study of mollusca. Of course they represent many species. The collection is filed at the end of Molluscan Series No. 2, in the U. of U. Zoo. Mus.



Valvata humeralis californica Pilsbry
Utah Lake, Utah — = 1mm

Fig. 85

Valvata utahensis (Call)

THE UTAH ROUND-MOUTH SNAILS

Valvata sincera var. *utahensis* Call, *U. S. G. S.*, Bul. 11, 1884, pp. 22, 24, 25, 44, pl. 6, figs. 1-3, 1884.

Valvata utahensis Call, *Proc. Davenport Acad. Nat. Sci.*, V., 1886, p. 4, pl. 1, figs. 1-3.

Utah Localities.—

Previous records: Utah Lake. (Ingersoll, 1877.)

North end of Utah Lake, near Lehi. (Call, 1884.)

Sevier Desert, semi-fossil. (Call, 1884.)

Salt Lake City and Utah Lake south of Lehi. (Henderson and Daniels, 1917.)

Duplicate records: Utah Lake, near Saratoga. (U. of U. Zoo. Mus., No. 880.) At Provo. (No. 540.) Near Spanish Fork. (No. 1014.) This form is plentiful in Utah Lake; but in all our collecting we did not find a living specimen.

New records: Ballard Springs, near Providence, one low spired specimen (U. of U. Zoo. Mus., No. 1449.)

Bear Lake, south end, approaching Laketown. (U. of U. Zoo. Mus., No. 1431.) One specimen, the only one found in one day of collecting on the shores of Bear Lake.

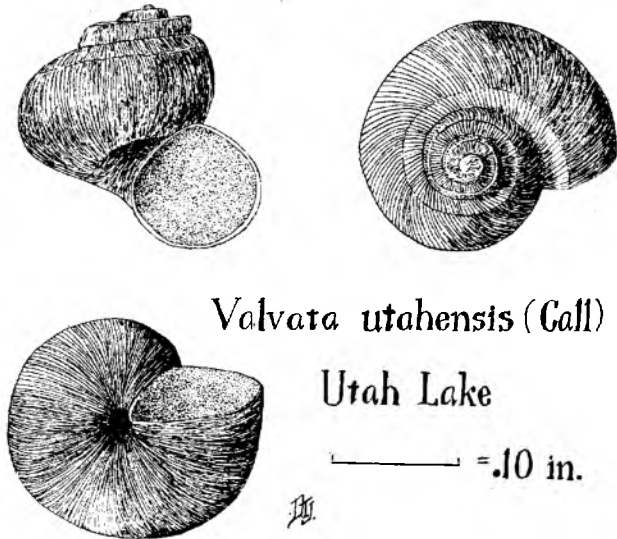


Fig. 86

Shell operculate, narrowly umbilicate, conical, with minute transverse striae, shining, somewhat pellucid, yellowish horn-color at apex, white below; spire obtusely elevated, flattened at tip; suture well impressed; whorls four, convex, regularly increasing, the uppermost ones with a single well-marked carina, which becomes obsolete on the last whorl; last whorl equals one-half the whole length of the shell; aperture circular slightly angled posteriorly; peristome simple, continuous, joined to the next whorl above by a very slight calcareous deposit; within white.

Operculum light horn color, corneous, spirally multi-volute, slightly produced posteriorly to conform to the shape of the aperture. Dentition unpublished. Length 4.80 mm.; breadth 3.20 mm. (Call.)

Type locality.—Utah Lake, near Lehi, not far from the headwaters of the Jordan River.

Range.—Bonneville Lake Basin.

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Glossary

- Aberrant.* Unusual; out of the ordinary or varying from the typical.
- Acephalous.* Without a head.
- Aculeate.* Very sharply pointed; spine-like.
- Acuminate.* Long and tapering.
- Afferent.* Bringing in, as applied, e. g., to vessels conveying contents inward.
- Alate.* Wing-like; winged.
- Amorphous.* Without definite form.
- Anastomosing.* Joining together.
- Anterior.* In front; toward the front end.
- Apertural.* Pertaining to the aperture, as in the case of the teeth of some shells.
- Aperture.* The opening of a shell.
- Apex.* The tip of a snail shell.
- Appressed.* Closely applied to.
- Approximate.* Near together.
- Arcuate.* Bowed or arched.
- Attenuated.* Long and slender; drawn out or tapering.
- Beak.* The apex or umbo of a bivalve shell.
- Biangulate.* Having two angles.
- Bicuspid.* With two points or cusps.
- Bifid.* Split or divided into two parts; with two ends.
- Bifurcate.* Having two branches.
- Bivalve.* Used of shells having two distinct and equivalent parts (Valves).
- Body whorl.* The large, lowest or last, whorl in snail shells.
- Branchial.* Pertaining to the gills; or to the ventral siphons in pelecypods.
- Bulbous.* Swollen or bulb-like.
- Bullate.* Having the surface covered with blister-like elevations.
- Byssiferous.* Attached by a byssus.
- Byssus.* Cuticular threads secreted by the foot of many pelecypods.
- Calcareous.* Consisting of lime carbonate.
- Callus.* A deposit of shelly matter, often as a thickening near the umbilicus in some snail shells.
- Calyculate.* Cup-like, as in case of the umbo when separated off by a distinct mark from the rest of the shell.
- Cardinal teeth.* The hinge teeth beneath the umbo in the shells of bivalves.
- Carina.* Keel.
- Carinate.* Keeled or ridged.
- Central teeth.* The teeth of the median longitudinal series on radula of mollusks.
- Columella.* The axis of a spiral snail shell.
- Columellar.* Upon or pertaining to the columella.
- Compressed.* Flattened laterally; pressed together.
- Concentric.* From or about the same center, as in the case of lines of growth on the valve of a pelecypod.
- Confluent.* Running together or into something else.

- Cordate*. Heart-shaped; triangular with corners of base rounded.
- Corneous*. Horn-like.
- Corrugated*. Roughened or wrinkled with alternate ridges and channels.
- Costate*. Having rib-like ridges; ribbed.
- Crateriform*. Like a shallow funnel or deep bowl.
- Ctenidium*. (*ctenidia*, pl.) The gill of mollusks.
- Cuneate, cuneiform*. Wedge-shaped, or elongate triangular.
- Dart sac*. A part of the genital tract in some pulmonate snails.
- Dentate*. With teeth.
- Decussate, decussated*. Crossing at an angle, X-like; with spiral and longitudinal lines crossing.
- Denticulate*. With small teeth.
- Depressed*. Flattened.
- Dextral*. Right-handed; having the opening on the right side.
- Diaphanous*. Transparent.
- Dilated*. Expanded in all directions.
- Dioecious*. Having the sexes in distinct individuals.
- Discoidal*. Shaped like a flat disc.
- Distal*. Farthest from object, body or point of attachment.
- Divergent, diverging*. Spreading apart from a common base, separating from each other.
- Eccentric*. Not in the center; arranged about a point not the center.
- Ecological*. Referring to relationships to other organisms and the environment.
- Ecology*. The science of relationship of organisms to each other and to the environment.
- Ectococone*. An outer cusp or cone on a tooth of a molluscan radula.
- Edentulous*. Without teeth or folds.
- Efferent*. Running or conveying contents outward.
- Effuse*. Aperture not whole behind, the lips separated by a gap or groove.
- Emarginate*. Obtusely notched.
- Endococone*. An inner cusp or cone on a tooth.
- Epiphallus*. A portion of the vas deferens which becomes modified into a tube-like organ and is continued beyond the apex of the penis; it frequently bears a blind duct, or flagellum.
- Equilateral*. With sides equal.
- Equipartite*. Divided equally; sides equal, as in bivalves where umbones are at center of valves.
- Equivalve*. Having valves of same size and form.
- Excurent*. Referring to the siphon which carries out the waste matter.
- Exserted*. Turned out or protruded.
- Everted*. Turned out or extruded.
- Faceted*. With small areas or faces; composed of facets.
- Falcate, falciform*. Convexly curved; sickle-shaped.
- Filiform*. Thread-like.
- Flexuose*. With a series of curves or turnings; alternately bent and straight or nearly so.
- Fusiform*. Spindle-shaped; thick in the middle and tapering toward each end.

- Geniculate.* Abruptly bent at an obtuse angle; bent knee-like.
- Geniculation.* An abrupt bending at an obtuse angle.
- Gibbous.* Much rounded, or spherical, as in the whorls of some snail shells.
- Globose.* Spherical; formed like a globe.
- Glochidium* (pl. *glochidia*). The larval form of Anodonta and related forms which commonly lives parasitically on fish.
- Gravid.* Having ovaries distended with young.
- Gular.* On or pertaining to the inner part of the aperture in snail shells.
- Gyrate.* Arranged in rings or convolutions; winding or coiling.
- Hemolymph.* The blood of molluscs.
- Hermaphroditic.* Having the two sexes united in one animal.
- Hirsute.* Covered with hairs,
- Holostomate.* Mouth or aperture entire.
- Hyaline.* Glassy, clear.
- Hypsometric.* Pertaining to the art of measuring elevations of mountains, etc.; pertaining to elevations.
- Imperforate.* Without umbilicus; not perforated.
- Impressed.* Marked by a furrow.
- Incurrent.* Referring to the siphon which brings in food materials in pelecypods.
- Inequilateral.* With one side differing in size and form from the other.
- Inequipartite.* With one end longer than the other as in some shells of pelecypods.
- Inflated.* Swollen or puffed up.
- Inflected.* Turned in, as in case of some teeth.
- Integument.* The outer cover of an animal.
- Keel.* A more or less sharp projection at the periphery.
- Keeled.* Bearing a keel; carinate.
- Labial.* Pertaining to the inner lip of a univalve shell.
- Labral.* Pertaining to the outer lip of a univalve shell.
- Lamella.* A thin plate or leaf-like process.
- Lamellar.* In the form of a thin plate.
- Lamellated.* Covered with lamellae or scales.
- Lamelliform.* Having the form of thin plates or scales.
- Lateral teeth.* The teeth each side of the centrals on radula; in pelecypods the hinge teeth anterior or posterior to the cardinals.
- Lenticular.* Shaped like a double convex lens.
- Ligament.* The elastic band joining the two valves of a pelecypod shell.
- Lunate.* Half moon-shaped.
- Mantle.* The fold of integument which secretes the shell in mollusks.
- Malleated.* Appearing as though hammered.
- Marginal teeth.* Teeth along margin of radula outside of the laterals.
- Marsupium.* A part of an animal, such as the gills in pelecypods, used as a brood-pouch.
- Mesocone.* The median cusp or cone on teeth of mollusks.

Multicuspid. With many points or cusps.

Multiserial. In many series.

Multispiral. Having many whorls or turns.

Nacre. The pearly or iridescent material on the interior of the shells of some mollusks.

Nacreous. Pearly or iridescent.

Nepeonic. The second stage of the developing shell, such as the glochidium of pelecypods.

Nucleus. The first part or beginning of a shell, as the apex in a gastropod and the umbo in pelecypods.

Oblique. Slanting, as the aperture of a shell when not parallel with the longitudinal axis.

Obsolete. Nearly absent; inconspicuous.

Obconic. Conic but with the point down.

Obese. Much distended.

Obtuse. With angle greater than a right angle.

Obovate. Inversely ovate; ovate but with the small end own.

Operculate. Bearing an operculum.

Operculum. A plate closing an opening such as the aperture of snail shells.

Orbicular. Round and flat.

Ovate. With an egg-shaped or oval outline.

Oviparous. Producing eggs that hatch after being laid.

Orisac. A pouch containing eggs or young.

Palatal. Situated on or pertaining to the outer lip. (See fig. 25.)

Pallial line. The line along which the mantle is attached to the shell in bivalves.

Papilla. A minute, soft projection.

Papillose. Pimpily; covered with dot-like elevations or pimples (papillae).

Parietal lip. The side of the aperture of a snail shell.

Patelliform. Plate- or cap-like.

Patulous. Open and spreading.

Paucispiral. Of few whorls or turns.

Pectinate. Comb-like, as in case of gills of mollusks.

Peduncle. A stem or stalk.

Penultimate. Next to the last, as the whorl next to body or last whorl in snail shells.

Pellucid. Transparent, used especially of objects that are colored.

Perforate, perforated. Axis or centre open or hollow.

Periostracum. The epidermal or surface covering of some shells.

Peripheral. Pertaining to outer surface or margin.

Periphery. The outer surface or circumference of a body.

Peristome. The outer lip of the aperture of a snail shell.

Peritreme. The circumference of the aperture of a snail shell; peristome.

Plicate. Plaited; folded like a fan.

Posterior. Behind; hinder or hindmost.

- Prodissoconch*. The embryonic shell.
- Proximal*. The nearest end; nearest body or point of original.
- Pseudocardinal*. False cardinal teeth.
- Pupiform*. Shaped like an ordinary insect pupa.
- Radula*. A band bearing calcareous teeth found in pharynx of most gastropods.
- Reflected, reflexed*. Bent angularly backward, as in the case of some teeth.
- Reticulate, reticulated*. In the form of a network.
- Retuse*. Ending in a broad shallow notch.
- Rhombic*. Four sides, with two opposite angles obtuse and two acute.
- Rhombic orbicular*. Between rhombic and orbicular in shape.
- Rhomboidal*. More or less rhombic in outline.
- Rimate*. Provided with a small hole or chink, as in referring to an umbilicus that is only narrowly open.
- Rostrate*. Produced like a beak or snout.
- Rugose*. Wrinkled; with irregular elevated lines.
- Scutellum*. The pinched part behind the ligament in Sphaeriids.
- Scutum*. The projecting or pinched part in front of the umbones in Sphaeriids
- Septate*. Divided by plates or septae.
- Sigmoid, sigmoidal*. Shaped like the Greek letter "sigma" or the English "S".
- Simple*. Without process, armature or other complication.
- Sinistral*. Left-handed; with the opening on the left side.
- Sinuuous*. Undulating; curving in and out.
- Sinus*. A curved indentation; an excavation; a curved break in a margin.
- Siphon*. The tube through which water enters or leaves the mantle cavity.
- Spire*. The part of a snail shell above the body whorl.
- Stria*. An impressed line.
- Striate*. Marked by impressed lines or striae.
- Subcalyculate*. Somewhat calyculate.
- Subconic, subconical*. Moderately conical.
- Subangular*. Moderately angular.
- Subcompressed*. Somewhat compressed.
- Subcentral*. Nearly central; toward the center.
- Subcordate*. Somewhat cordate or heart-shaped.
- Subcylindrical*. Somewhat cylindrical.
- Superanal*. Above the anus.
- Subequilateral*. Nearly equilateral.
- Subfusiform*. Somewhat fusiform.
- Subglobular*. Somewhat globular.
- Sublenticular*. Somewhat lenticular.
- Subobsolete*. Nearly obsolete; almost absent.
- Suborbicular*. Somewhat orbicular.
- Subovate*. Nearly ovate.
- Subreflected, subreflexed*. Somewhat reflected.
- Subrostrate*. Somewhat rostrate.

Sulcate. Grooved.

Sulcus. A longitudinal furrow.

Suture. A seam or impressed line indicating division of parts; a line of junction.

Transverse. Used of shells that are wider than high.

Tricuspid. With three cusps.

Trifid. Cleft into three parts or ends.

Trigonal. With three corners or angles; triangular.

Tripartite. Divided into three parts.

Truncate, truncated. With the ends cut off squarely.

Tumid. Swollen; puffed up.

Turbinate. Shaped like a top.

Turreted. Tower-like in form.

Umbilicate, umbilicated. Having an umbilicus or opening at base of shell.

Umbilicus. A cavity or depression at the base of a snail shell.

Umbo (pl. *umbones*). The protuberance above the hinge on the shell of pelecypods.

Uncinate. Hooked at the end.

Unicuspid. With a single cusp.

Univalve. With the shell composed of a single piece.

Ultra-dextral. Extremely dextral.

Ultra-sinistral. Extremely sinistral.

Varix (*varices* pl.). A mark or scar on the surface of a shell indicating a former position of the lip of an aperture which passes on with periodical growth.

Varicose. Prominent and tortuous; having varices.

Velum (*vela* pl.). A membranous integument, membrane.

Ventricose. Swollen or inuated on the lower or ventral side.

Vitreous. Resembling glass.

Viviparous. Bringing forth young alive.

Whirl. Old form for whorl.

Whorl. A single turn or volution of a gastropod shell.

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