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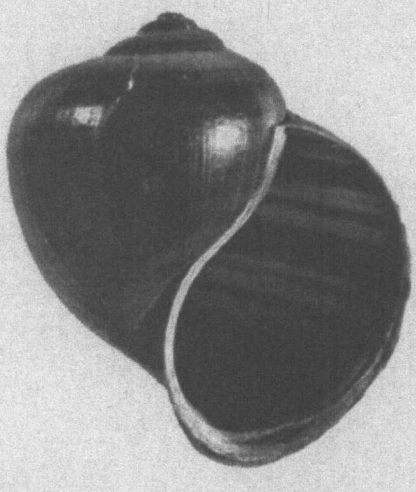
AN IDENTIFICATION MANUAL FOR THE FRESHWATER SNAILS OF FLORIDA

Fred G. Thompson



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Fred G. Thompson

WALKERANA

TO
HOWARD WALLACE CAMPBELL
1935-1981

PREFACE

My fieldwork relating to this manual began thirty-five years ago. During that time many friends and acquaintances have aided me in the arduous but enjoyable task of exploring Florida's waterways in search of obscure and elusive creatures. Space does not permit including the names of all who deserve and have my thanks. But I want to acknowledge especially the help of several persons who have contributed extensive time and effort. Steven P. Christman, Elizabeth L. Mihalcik and Charlotte M. Porter and the late Howard W. Campbell provided assistance with field work in Florida and many other places in the southeast states. Richard Franz, Florida Museum of Natural History, during his continuing explorations for Crustacea, has discovered a number of rare and novel snail species. This manual would be less useful were it not for the excellent illustrations produced by Lauren Keswick (LK), Wendy Zomlefer (WZ) and Barbara Harmon (BH). Photographs were produced with the assistance of Donna Born Drake.

I wish to express my gratitude to John B. Burch and Melisa D. Ricketts for their assistance relating to many aspects in the production of this manual. Charlotte M. Porter helped devise vernacular names for these and other North American freshwater gastropods. Liath Appleton helped with assembling illustrations and editing of the manuscript.

The text preparation and illustrations for the first edition of this manual (1984) were produced by the STAR Grant 79-032 provided by the State University System of Florida. The second edition was aided by funds provided by the Florida Department of Environmental Protection. I am grateful to J. Scott Dailey of the State University System of Florida and to Landon T. Ross of the State of Florida Department of Environmental Protection, who promoted these projects.

CONTENTS

INTRODUCTION

The aquatic snail fauna of the southeastern United States has long been recognized for its richness and diversity. Throughout the 19th and 20th centuries, malacologists made frequent field trips to explore river systems that were poorly known and to revisit others that were renowned for their rich and unique assemblages of species. The focus of most investigations was on rivers farther north, and little attention was given to the Florida fauna. Until recently the entire knowledge of the Florida freshwater snail fauna was based on miscellaneous papers dealing with single species, groups of closely related species, or single river systems. In 1965 Clench & Turner published a survey of the fauna from the Suwannee River west to the Escambia River. The study was a landmark contribution to the malacology of the Southeast, and it summarized the known fauna of western Florida. It also was the first adequately illustrated fauna summary published on the Southeast. Since then a great amount of fieldwork has taken place throughout Florida, and many additions to the fauna have come to light. Some were range extensions for species long known to occur in adjacent areas. Others were new taxa not found in earlier surveys.

It became increasingly important to provide a manual on the freshwater snails of Florida for many reasons. There are no references that cover the entire state; those available cover only parts of the state or parts of the fauna. Our knowledge of the snail fauna has increased greatly during recent years, and a summary of this information is desirable to facilitate other kinds of studies. The bioeconomic importance of snails to environmental issues has become increasingly relevant because of the degradation of Florida waterways that is accompanying economic development. The first edition of *The Freshwater Snails of Florida: A Manual for Identification,* was published in 1984. It was well received and served the interests and needs of many people. As was expected, further work on the systematics of the southeastern freshwater fauna created the need for this revision.

Vernacular names used in this publication are consistent with the standardized list of vernacular names for North American freshwater snails recently derived by the Council of Systematic Malacologists (Turgeon *et al.,* 1998). Vernacular names are given only to species. All subspecies of a given species have the same common name, as is consistent with the procedure used by the American Fisheries Society for fishes and by other societies for other classes of animals.

This manual recognizes 113 species and subspecies as occurring in Florida, and the list will increase with time.

The manual deals only with genera that occur in fresh water. It is presented in the form of a key supplemented with figures and habitat information to facilitate identification. It should be remembered that it is only a key. Occasionally it may be necessary to turn to other references to make an identification with a greater degree of certainty. It should also be remembered that many groups have not been studied sufficiently, and the reader may have material that adds to or contradicts previously recorded data. It is hoped that this manual will stimulate other biologists to contribute to our knowledge of Florida freshwater mollusks. The reader will discover how very little we know about any genus occurring in Florida.

PREPARING SPECIMENS FOR IDENTIFICATION

A principal difficulty encountered in the identification of snail specimens arises from improper methods used to prepare them. Adequate preservation begins when the specimens are collected. Live snails for shell studies should be preserved in 70% alcohol. Never preserve shell specimens in formalin. Formalin will corrode the shell and thereby eliminate color, delicate sculpture, and the periostracum. Formalin does not even serve as a good fixative or preservative for long-term anatomical studies. After a few years in storage glandular tissues in the female reproductive system deteriorate, and the process gradually spreads to destroy all but the terminal genital structures. It matters not that the specimens are stored in 70% alcohol after having been fixed in formalin. The deterioration process is not reversible. This is particularly so in the Pulmonata. However, formalin is an excellent fixative for short-term preservation.

It is important to save some specimens for anatomical studies. This is essential in the case of the Hydrobiidae. Live field samples should be divided into two groups, one to be preserved for shells, the other to be preserved for anatomical specimens. The latter are placed in a small container filled with pond water. Do not use tap water since copper ions from the plumbing system may contaminate the tap water and kill the snails prematurely. Scatter a few granulated menthol crystals on the water surface and allow the container to sit for 10-15 hours, at which time the snails should be extended from the shell and insensitive to probing with a needle. A little practice may be necessary to perfect this relaxing procedure. Specimens then are

placed in a fixative such as 10% formalin or Bouin's Solution. The fixative may damage the shell, but that is unimportant for anatomical purposes. After the snails have been in the fixative for a few minutes to several hours, depending on their size, they should be rinsed in water and transferred to 70% ethyl alcohol. The radula can be studied by dissecting out the buccal mass and macerating it in clorox or sodium hydroxide. The radula is then thoroughly rinsed in distilled water, stained, and mounted on a microscope slide.

Shell specimens should be cleaned and air-dried. Some shells may be heavily encrusted with mineral deposit and algae, which may obscure details of the sculpture and color. Dipping them in a dilute solution of oxalic acid and gently scrubbing them with a fine brush can clean such specimens. The shells should be rinsed frequently in tap water during the cleaning process to prevent etching by the acid. After the shells are thoroughly rinsed, they can be air-dried in cardboard trays. The bodies of large snails, such as viviparids and pilids, should be pulled from the shell. Opercula should be glued to cotton plugs and replaced within the aperture.

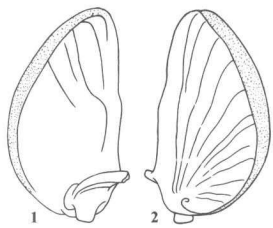
Small- or medium-sized snails need to be identified with the aid of a binocular dissecting microscope that is equipped with an ocular micrometer calibrated to 0.1 mm accuracy so that precise measurements can be made. Opercula of minute snails can be studied most easily by removing them from the animal and viewing them with transmitted light.

KEY TO THE IDENTIFICATION OF THE FRESHWATER SNAILS OF FLORIDA

1a Aperture of shell closed by an operculum (snail must be collected live because the operculum is lost soon after death). Mantle cavity with gill on dorsal surface. Subclass PROSOBRANCHIA 2

1b Aperture non-operculate; mantle cavity modified into a lung. Subclass PULMONATA ..... 59 [p. 62]

2a Operculum calcareous with two pegs on inner surface (Figs. 1, 2). Aperture relatively large with fine, uneven, serrate denticles along parietal wall (Fig. 3). Family **NERITIDAE** .... **(olive nerite)** *Neritina usnea* (Röding 1798)



FIGS. 1-2. Operculum of *Neritina usnea.* FIG. 1. Inner view. FIG. 2. Exterior view.

The only freshwater neritid in Florida. Height 15-20 mm; width 14-19 mm. Shell solid, relatively heavy, dark green with numerous, narrow black stripes. Widely distributed in brackish water in the Caribbean and Gulf of Mexico region. Invades freshwater zone in lower parts of some rivers. Found in Florida along both coasts. This species was generally listed as *Neritina reclivata* (Say 1822) in previous literature. The name is a junior synonym of *Neritina usnea.*

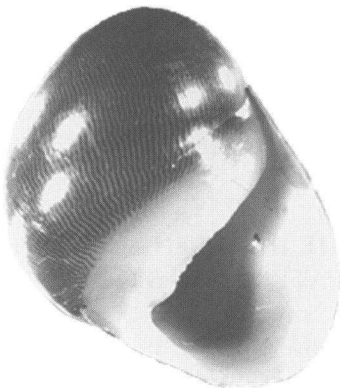
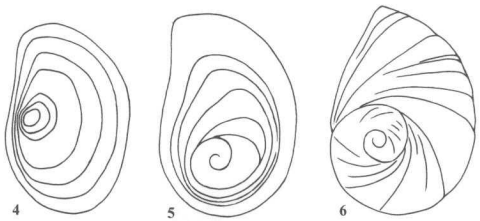


FIG. 3. Shell of *Neritina usnea.*

2b Operculum corneous, without pegs on inner or outer surface. Aperture without serrate denticles on parietal wall..... 3

3a Operculum with concentric growth rings around nucleus (Figs. 4, 5). Shell medium to large (12-75 mm). Superfamily VIVIPAROIDEA..... 4 [p. 5]

3b Operculum spiral, consisting of two or more rapidly increasing whorls (Fig. 6). Shell usually small to medium (2-25 mm) 14



FIGS. 4-6. Opercula. FIG. 4. Concentric. FIG. 5. Concentric with spiral nucleus *(Lioplax)*. FIG. 6. Spiral.

4a Umbilicus of shell perforated or broadly open. Spire depressed, much less than height of aperture, occasionally planular (Figs. 7-9). Aperture relatively ample (Figs. 10-12). In some genera, eggs are deposited above the water in dry clusters on stems, trees, walls, etc. In others they are deposited in the water in gelatinous clusters. Males with penis at anterior right corner of mantle cavity. Family PILIDAE 5

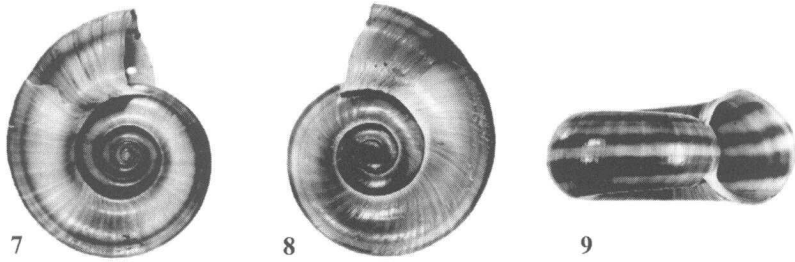
4b Umbilicus of shell closed. Spire usually about equal to or greater than height of aperture (Figs. 17-29). Females with live embryos in brood pouch in mantle; males with right eye stalk modified as a penis. Family VIVIPARIDAE ..... 7 [p. 8]

5 Family **PILIDAE** 5a

Medium- to large-sized tropical freshwater snails. One species occurs naturally in Florida, and three others have been introduced. The family contains many genera and numerous species in South America, Central America, Mexico, Africa and Southeast Asia. Frequently the shells of pilids and viviparids are very similar. The shell characters given above for separating the families apply only to Florida species. The primary differences between the two families are based on soft anatomy. Pilids occasionally are referred to as AMPULLARIIDAE. AMPULLARIIDAE is based on the genus name *Ampullaria* Lamarck 1799, which has as a type species *Helix ampullacea* Linnaeus 1759. The name *Ampullaria* is predated by *Pila* Röding 1798, which also has as the type *Helix ampullacea*. Thus, *Ampullaria* is not an available scientific name. *Pila* is a tropical Old World genus that has a calcified operculum. Most New World genera have corneas opercula.

5a Shell planispiral, adults large, 35-50 mm (Figs. 7-9) .... **(goldenhorn marisa)** *Marisa cornuarietis* (Linnaeus 1758)

introduced from northern South America into South Florida canals, marshes, and ponds. Currently known in Florida from Palm Beach, Broward, Dade, and Monroe counties. The eggs are laid in gelatinous clusters in the water.



FIGS. 7-9. Apertural, umbilical and apertural views of the shells of *Marisa cornuarietis.*

5b Shell oval in shape. Genus *Pomacea* 6

6 *Pomacea* Perry 1810 ..... 6a

A tropical American genus that is widely distributed from Argentina north to Tamaulipas, Mexico, and also occurs in the West Indies, the Windward Islands, Jamaica, Cuba and Florida. *Pomacea paludosa,* a native Florida species, apparently reached its present range via northern Mexico and the gulf coastal plains during a warmer geologic interval. It is most closely related to *P. flagellate* of eastern Mexico and not to other Cuban or Jamaican species.

Pomacea contains over 150 species, some of which are very large and colorful. They are favorite items in the aquarium trade, and occasionally various species are introduced into Florida waters. *Pomacea bridgesi, P. canaliculata* and *Marisa cornuarietis* are the only members of the family that have become established in Florida through human introduction.

6a Whorls of spire pointed and scalariform (steplike with nearly flat shoulders and deep sutures). Apical whorls raised to form a point on top of spire. Adult shells about 40-60 mm high (Fig. 10) ..... **(spiketopped applesnail)** *Pomacea bridgesi* (Reeve 1856)

A South American species introduced into South Florida in Monroe, Dade, Broward, Palm Beach and Pinellas Counties. Generally the shell is greenish with darker and lighter bands.

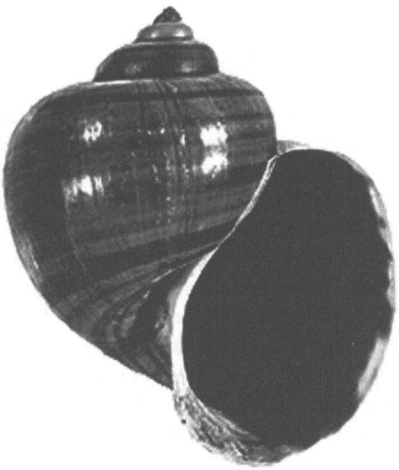


FIG. 10. *Pomacea bridgesi.*

6b Apical whorls pointed and raised, but not scalariform. Shell large, 80-100 mm wide. Suture deeply impressed, forming a channel. Umbilicus wide (Fig. 11) .... **(channeled applesnail)** *Pomacea canaliculata* (Lamark 1822)

This is another South American species that has been introduced into canals and ditches in southeast Florida (Thompson, 1997).

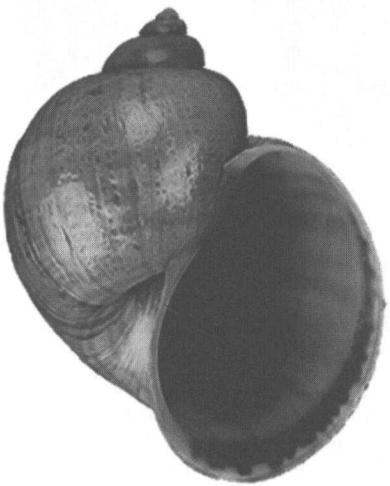
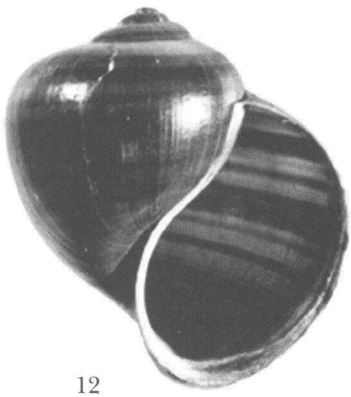


FIG. 11. *Pomacea canaliculata.*

6c Whorls of spire strongly arched or rounded. Apical whorls bluntly rounded and not conspicuously elevated. Adult shells about 40-

70 mm high (Fig. 12) .....
..... **(Florida applesnail)** *Pomacea paludosa* (Say 1829)

Widely distributed throughout the Florida peninsula and occurring sporadically west of the Suwannee River to the Choctawhatchee River. The Florida Applesnail occurs in Cuba. It is found in Georgia in isolated springs along the Flint and Ocmulgee rivers and is introduced in Covington County, Alabama, in a small reservoir artificially heated by industrial wastewater. Otherwise the species is not able to survive the lower winter temperatures that occur along the northern tier of Florida counties and northward. It has been introduced extensively into Pacific islands and southeast Asia, where it is raised for human consumption. The species has existed continuously in the Florida peninsula since the Pliocene. A small, reddish, thick-shelled form with a wider umbilicus, which occurs in Dade and Broward counties, has been named as a distinct species, *Pomacea miamiensis* (Pilsbry 1899) (Fig. 13). Its taxonomic status is uncertain.



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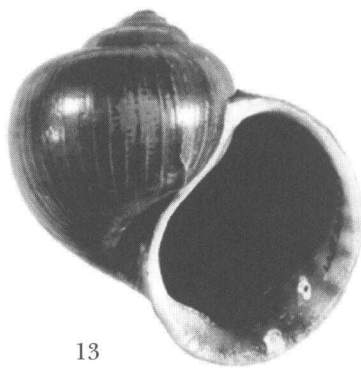

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FIGS. 12-13. Shells of *Pomacea*. FIG. 12. *P. paludosa*. FIG. 13. *P. miamiensis*.

7 Family **VIVIPARIDAE** 7a

Medium to large freshwater snails found on all continents except South America. The family attains its greatest diversity in Southeast Asia. Two subfamilies occur in North America. The SUBFAMILY LIOPLACINAE is endemic and includes *Campeloma, Lioplax* and *Tulotoma*. The subfamily VIVIPARINAE is widely distributed throughout Asia and eastern North America. It is represented in North America by *Viviparus*. Various species of *Cipangopaludina* also have been introduced from the Orient into North America. One species, *C. chinensis malleata* (Reeve 1863) (Fig. 14), was introduced into a fishpond in St.

Petersburg about 1921 and into Orlando about 1940. The current status of these introductions is not known.

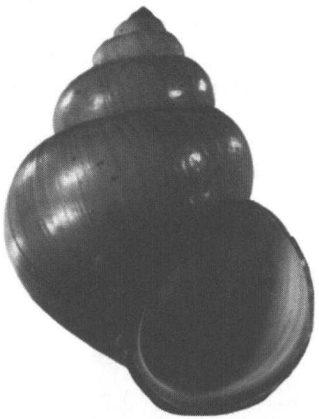
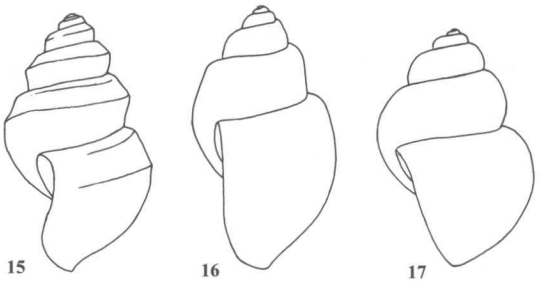


FIG. 14. *Cipangopaludina chinensis malleata.*

7a Nucleus of operculum spiral and then surrounded by concentric growth rings (Fig. 5). Outer lip of aperture strongly sinuous in lateral profile (Fig. 15). Genus *Lioplax* Troschel 1856 8

7b Operculum constructed entirely of concentric rings (Fig. 4). Outer lip of aperture nearly straight in lateral profile (Figs. 16, 17) .... 9 [p. 11]



FIGS. 15-17.

8 Genus *Lioplax* Troschel 1856 ..... 8a

A single species consisting of two highly variable subspecies occurs in Florida. Three other species occur farther north.

8a Shell larger, reaching a maximum diameter of 18 mm. Spiral angulation on whorls sharp and prominent in juveniles, usually becom-

ing convex-rounded or smooth on last whorl in adults. Prominent minor spiral sculpture along periphery. Outer lip strongly sinuous. Newborn young about 4.5 mm in diameter (this can be determined by removing juveniles from brood pouch). Height of shell about 23-26 mm (Figs. 15, 18) .....
..... **(Choctaw lioplax)** *Lioplax pilsbryi pilsbryi* Walker 1905

Confined to the Chipola River, and small streams along the west side of the Apalachicola River.

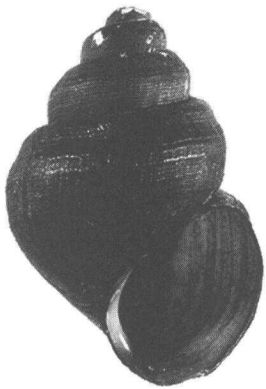
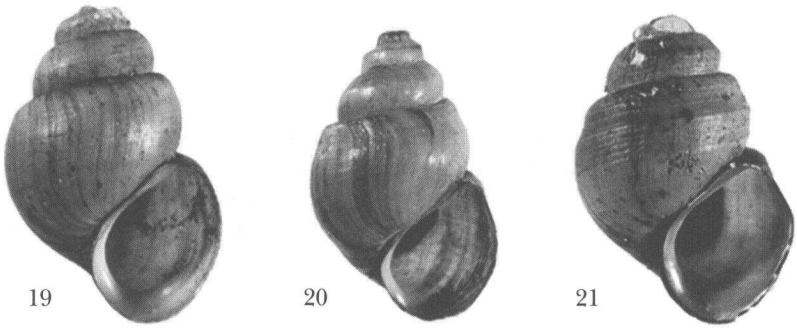


FIG. 18. *Lioplax pilsbryi pilsbryi.*

8b Shell smaller, reaching a maximum diameter of 13 mm. Spiral angulation on last whorl obsolete or bluntly rounded and forming a shallow sulcus below shoulder of last whorl. Minor spiral sculpture weak or absent. Outer lip less sinuous. Newborn young about 3 mm in diameter. Height of shell about 14-16 mm; width, 10-12 mm (Figs. 19-21) .....
(Choctaw lioplax) *Lioplax pilsbryi choctawhatchensis* Vanatta 1935

Found in the Escambia, Yellow, Choctawhatchee (Fig. 19), Chattahoochee, Flint, Ochlockonee (Fig. 20) and Suwannee Rivers (Fig. 21) and their tributaries in Florida, Alabama and Georgia. The populations from the Ochlockonee and Yellow rivers were named as a distinct species *(Lioplax talquinensis* Vail 1979b) on the basis that they have a distinct sulcus on the last whorl causing the aperture to be pinched above (Fig. 20). Populations from other rivers lack the sulcus and have a more broadly open aperture (Fig. 19). The examination of large series of specimens from the Choctawhatchee, Yellow, Ochlockonee and Suwannee rivers and Holmes Creek show that these distinctions are inconsistent.



FIGS. 19-21. Shells of *Lioplax pilsbryi choctawhatchensis.*

9a Shell thick and solid; whorls weakly convex or flattened (Figs. 16, 22-28). Shell unicolor, never banded. Genus *Campeloma* Rafinesque 1819 10

9b Shell generally thin but strong; whorls of spire strongly convex with deep suture (Figs. 17, 29-32), shell usually banded in Florida forms. Genus *Viviparus* Montfort 1810 ..... 13 [p. 13]

10 Genus *Campeloma* Rafinesque 1819 ..... 10a

Moderately large, thick-shelled operculate snails. Some species are dioecious with a normal representation of males and females. In others, some or all populations may be parthenogenetic, consisting only of females, or they may have a disproportionately small number of males. In parthenogenetic organisms each population is inbred in the strictest genetic sense, and frequently a population will have minor characteristics that distinguish it from others. There is no consensus in systematic biology on how to treat these forms. The criterion of inbreeding for defining species cannot be applied, and other objective criteria have not yet been established.

In Florida four types of *Campeloma* have been recognized. *Campeloma geniculum* (Conrad 1834) is readily recognized by its obese, solid shell; it usually has a normal proportion of males in its populations, although some populations are apomictic parthenogens. The other three forms, *C. limum* (Anthony 1860), *C. floridense* Call 1866 and *C. parthenum* Vail 1979, are exclusively apomictic parthenogens and have been separated on the basis of aperture coloration, embryonic shell coloration, and contour of the outer lip (Vail 1979a). The coloration of the aperture and the embryonic shell is not consistent within single population samples, and the contour of the outer lip is highly variable within single drain-

age systems and with the age of the specimens examined. In view of the inconsistency of these shell characters, these three forms may represent only a single species, *Campeloma limum,* which is distributed from the Escambia River system of Florida and Alabama east and north into North Carolina and Virginia. More data based on many population samples from throughout this range will be necessary before the validity of the three forms can be determined. For the purpose of completeness, the three parthenogenetic forms and *C. geniculum* are included in the key.

10a Shell obese and ponderous. Spire short and compact, about 0.5-0.7 times height of aperture in mature specimens, proportionally longer in juveniles (Fig. 22) ..... **(ovate campeloma)** *Campeloma geniculum* (Conrad 1834)

Height of adult shell about 22-26 mm; width about 16-19 mm. Abundant from the Suwannee River system west through Florida, southern Georgia and Alabama to the Escambia River system.

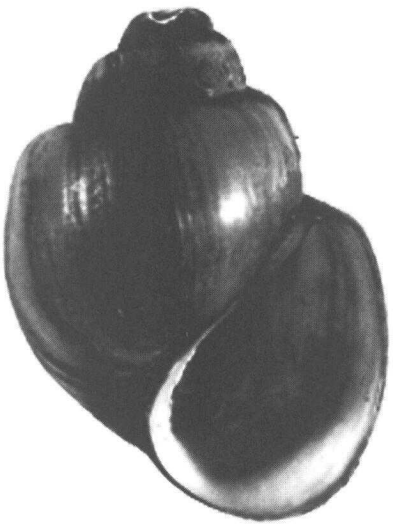


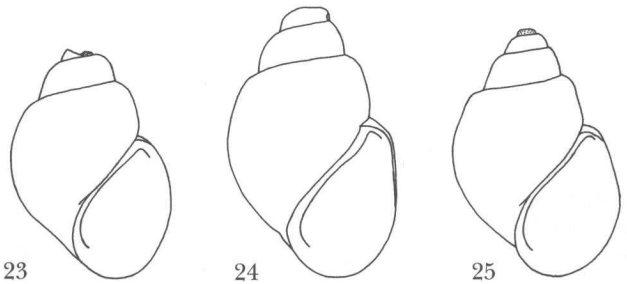
FIG. 22. *Campeloma geniculum.*

10b Shell more slender and attenuate; spire more elongate in adults, about 0.7-1.0 times height of aperture 11

11a Interior of adult aperture with brownish tinge. Newborn shells brown. Outer lip continuously rounded (Figs. 23, 26) .....

(purple-throated campeloma) *Campeloma floridense* Call 1886

Height of adult shell about 23-27 mm; width about 15-20 mm. Confined to the St. Johns River system and the upper part of the Santa Fe River in Florida. The brown tinge of the aperture is absent in many specimens.



FIGS. 23-25. Shells of *Campeloma*. FIG. 23. *C. floridense*. FIG. 24. *C. parthenum*. FIG. 25. *C. limum*.

11b Interior of aperture livid white. Newborn shells white. Outer lip partially flattened in adults 12

12a Outer lip nearly straight and parallel to axis of shell in adults (Fig. 24, 27) .... **(maiden campeloma)** *Campeloma parthenum* Vail 1979

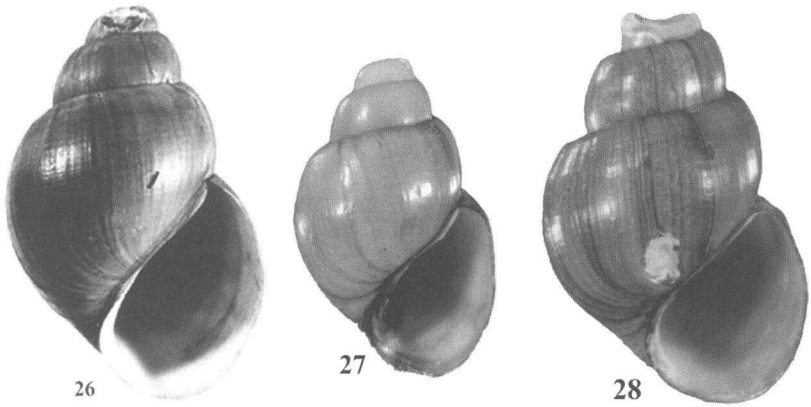
Height of adult shell about 23-27 mm, width about 16-19 mm. Reported from the Ochlockonee River and its tributaries in Florida. Similar specimens are found in the Conecuh and Pea rivers in southern Alabama.

12b Outer lip straightened just below shoulder; straightened portion lying at an angle to axis of shell (Figs. 16, 25, 28) .... **(file campeloma)** *Campeloma limum* (Anthony 1860)

Height of adult shell about 25-32 mm; width about 17-19 mm. Populations with these characteristics are found from the upper tributaries of the Escambia, Choctawhatchee, Suwannee and St. Mary's river systems in Alabama, Georgia and northeast Florida, and north along the Atlantic coast to North Carolina and Virginia.

13 Genus *Viviparus* Montfort 1810

Medium- to large-sized, globose, freshwater snails that usually live in silty or mud-bottomed streams, ponds, lakes, and marshes. These snails are more tolerant to pollution and stagnation than are *Campeloma* and *Lioplax,* and they thrive in aquatic environments that are too adverse for most other genera. Two species are included in the key. One, *Viviparus intertextus,* has not been recorded from Florida, but it occurs in immediately adjacent river systems in Alabama and Georgia and may be anticipated in the northern tier of Florida counties. The second species, *V. georgianus,* is widely distributed and is found in most freshwater habitats in Florida.



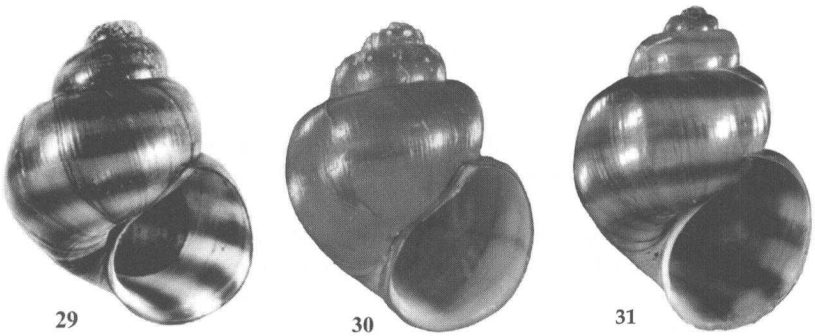
FIGS. 26-28. Shells of *Campeloma.* FIG. 26. *C. floridense.* FIG. 27. *C. parthenum.* FIG. 28. *C. limum.*

13a Shell ovate in shape, about 1.2-1.5 times as high as wide. Shell relatively thick (Figs. 16, 29) .... **(banded mysterysnail)** *Viviparus georgianus* (Lea 1834)

Adult shells about 20-45 mm high and about 18-36 mm wide exist in locally isolated populations and inhabit a wide diversity of aquatic environments. Populations are highly variable in banding patterns and in size of individuals, although each population tends to be uniform in its characteristics. As a consequence, 14 subspecies names have been proposed for various Florida forms based upon color and shell obesity. No geographic patterns of distribution exist that permit recognition of them as subspecies. They are regarded as variations of *Viviparus georgianus* without taxonomic significance, although some populations may differ strikingly from others.

Viviparus georgianus is distributed from Palm Beach County north and west to the Choctawhatchee River and in portions of the Apalachicola River, Suwannee River and Altamaha River systems

in Georgia. From there the range is disjunct. The snail is widely distributed from Louisiana and northern Alabama north to the Great Lakes region and the St. Lawrence River. Clench (1962), Clench & Fuller (1965), and Clench & Turner (1956) discuss the snail's taxonomy and distribution. Katoh & Foltz (1993) recognize three distinct species on the basis of biochemical data (*Viviparus georgianus* Lea 1834, *Viviparus goodrichi* Archer 1933, and *Viviparus limi* Pilsbry 1918). Taxonomic problems remain unresolved in the use of these names. *Viviparus goodrichi* (Fig. 30) occurs in the Choctawhatchee River system east to the Apalachicola River. The species called *Viviparus limi* (Fig. 31) is endemic to the Ochloconee River. However, the name *Viviparus limi* is based on specimen from the Flint River, a tributary of the Apalachicola. The taxonomic and nomeclatorial status of the name *limi* will depend on study of populations from near Albany, Georgia, the type locality of *Viviparus limi*.



FIGS. 29-31. Shells of *Viviparus*. FIG. 29. *V. georgianus*. FIG. 30. *V. goodrichi*. FIG. 31. *V. limi*.

13b Shell globose with a relatively depressed spire; about 1.0-1.2 times as high as wide. Suture of whorls more deeply impressed than in previous species. Shell relatively thin. Color uniform olive-green, never banded (Fig. 32) .... **(rotund mysterysnail)** *Viviparus intertextus* (Say 1829)

Height of adult shell about 20-30 mm; width about 20-25 mm. Distributed from east Texas and throughout the Mississippi River east to the Alabama River with disjunct populations in the Altamaha River system in Georgia and elsewhere into South Carolina. *Viviparus intertextus* is replaced in this disjunct area by *Viviparus georgianus*. It may occur in west Florida.

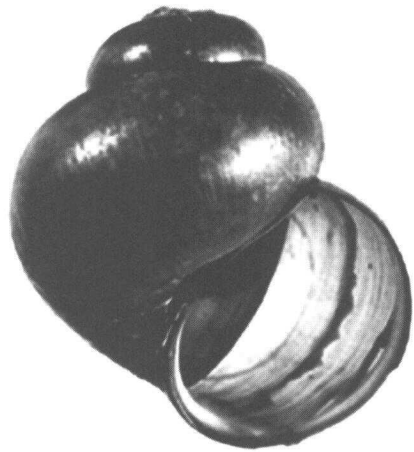
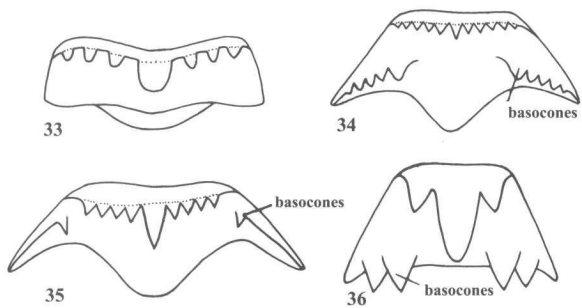


FIG. 32. *Viviparus intertextus.*

14a Shell elongate-conical; 10-40 mm long in adult specimens; apex of spire usually eroded; shell with 8-12 whorls (except in eroded specimens); shell usually strongly sculptured with spiral and/or vertical ribs and threads (except in *Elimia dickinsoni*); central tooth of radula without basal or lateral cusps (Fig. 33); males without copulatory structures. Superfamily CERITHIOIDEA ..... 15 [p. 17]

14b Shell variable in shape, elongate to globose; usually not more than 5 mm in length; apex of spire seldom eroded (except in *Somatogyrus*); 4-6 whorls; shell smooth (except in *Pyrgophorus* and *Tryonia*); central tooth of radula with basal cusps (Figs. 34, 35) (*Pomatiopsis*, Fig. 36); males with a copulatory appendage, a penis (Fig. 37), which is important for generic and specific diagnosis. (The penis is normally recurved into the mantle cavity, except during mating. Superfamily RISSOOIDEA ..... 24 [p. 29]



FIGS. 33-36. Central radular teeth of rissooidean snails. FIG. 33. Central tooth of radula without basal cusps. FIGS. 34, 35, 36. Central tooth of radula with basal cusps.

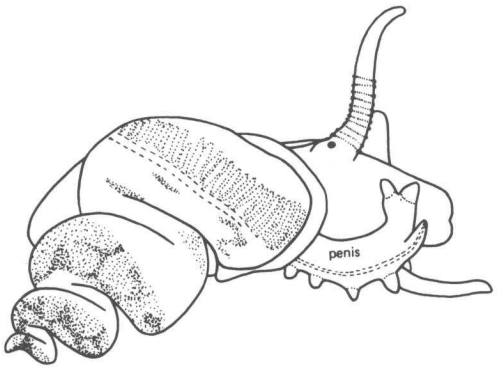
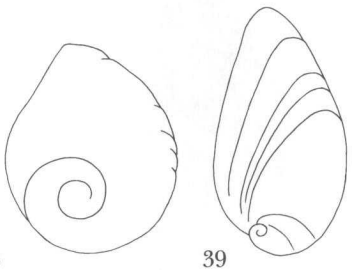


FIG. 37. Male rissooidean snail.

15a Operculum paleomelanian, with a large sub-centrally located nucleus (Fig. 38). (This character separates only the genera under consideration; genera from other areas of the world do not conform to this distinction.) Females with an egg-laying groove or sinus on right side of foot; eggs deposited on substrate. Family PLEUROCERIDAE ..... 18 [p. 20]

15b Operculum neomelanian, with a small, rapidly expanding nucleus located near the basal margin (Fig. 39). Primarily parthenogenetic; females viviparous with young snails in a brood pouch in neck. Family THIARIDAE 16



38 39

FIGS. 38-39. Pleurocerid opercula. FIG. 38. Paleomelanian operculum. FIG. 39. Neomelanian operculum.

16 **THIARIDAE** 16a

Thiarids are found in tropical and subtropical regions of the world. Most inhabit fresh water, but some also occur in brackish water. The greatest diversity of genera and species is in the Indo-Australian region. Endemic New World genera occur in Cuba, Jamaica

and northern South America. Three species in Florida were introduced from Southeast Asia. Two, *Melanoides tuberculatus* and *Tarebia granifera,* are medically important because they can serve as first intermediate host for the human lung fluke, *Paragonimus westermani.* Thiarids are ecologically significant because they tend to replace native snails where they are introduced and because of their abundance. In 1976 I found *Melanoides tuberculatus* in the St. Johns River, with population densities of 10,000/sq. m.

16a Shell sculptured with prominent nodes overlapping suture and forming crenulations. Base of last whorl with prominent spiral ridges. Shell unicolor brown, never mottled with reddish spots. Shell about 0.38-0.41 times as wide as high and about 20-27 mm long. Sides of spire concave in outline (Fig. 40) .... **(quilted melania)** *Tarebia granifera* (Lamarck 1822)

Abundant in some springs and small streams in Florida. Some authors identify this species as *Tarebia lateritia* (Lea 1850). Considerable variation in obesity and sculpture rugosity exists between different populations, and there is disagreement as to how many species occur in Florida.

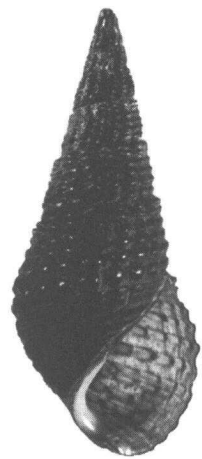


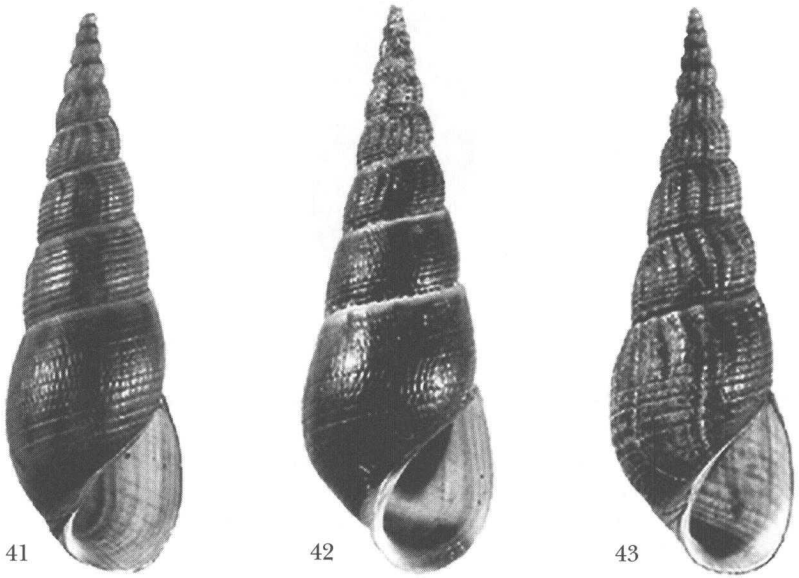
FIG. 40. *Tarebia granifera.*

16b Shell sculptured with fine spiral striations, and in some cases curved axial ribs. Suture simple, not crenulated. Shell usually marked with red or rust-colored spots, flames, or bands (most apparent on juvenile specimens). Shell more slender, about 0.30-0.35 times as wide as high. Sides of spire straight-sided in outline. Genus

Melanoides Oliver 1904 17

17a Shell sculptured with vertical, weakly curved ribs and much finer spiral striations. Prominent vertical ribs on middle and upper whorls. Base of shell with dark red spiral band. Shell light brown and frequently mottled with rust-colored spots that may form a spiral row below the suture. Attains a length of about 30-36 mm (Figs. 41-43) .....
..... **(red-rimmed melania)** *Melanoides tuberculatus* (Müller 1774)

Widely introduced throughout the state. Most commonly found in rivers, streams, canals and springs.



41 42 43

FIGS. 41-43. Shells of *Melanoides tuberculatus.*

17b Shell sculptured with fine spiral threads. Fine vertical ribs present on uppermost whorls. Base of shell usually without spiral band. Shell olive-green with vertical reddish flames and spots. Attains a length of 30-40 mm (Fig. 44) .....
..... **(fawn melania)** *Melanoides turriculus* (Lea 1862)

A Philippine snail that has been introduced into springs and spring-fed streams in Florida and Texas. *Melanoides tuberculatus* and *M.*

turricula may be ecological variations of a single species. In Florida, the two types are ecologically segregated; *M. tuberculatus* is generally found in quieter, eutrophic, turbid habitats; *M. turriculus* is found in cleaner oligotrophic springs and streams.

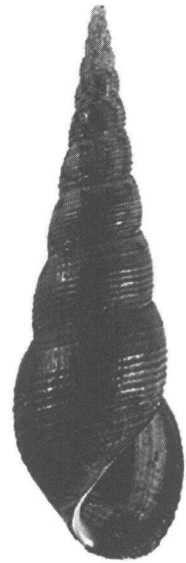


FIG. 44. *Melanoides turriculus.*

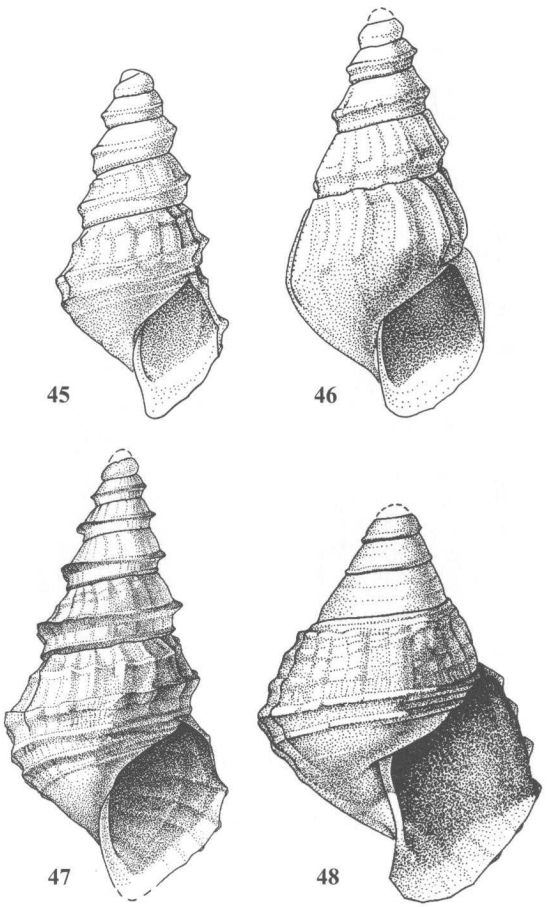
18 **PLEUROCERIDAE** 18a

This family contains twelve genera in North America. Additional genera occur in the Orient, Southeast Asia, Africa and South America. Only *Elimia* is found in Florida. Over 500 species of *Elimia* have been described, all on the basis of shell characters. Many have been synonymized, some deservedly so, some undeservingly so. Biochemical studies show that in *Elimia,* shell characters are conservative indicators of genetic divergence (Chambers, 1980; Dillon & Davis, 1980; Mihalcik, in press). Overshadowing this genetic divergence are frequent examples of convergent evolution of similar shell characters among distantly related species. This causes problems in species identification and yield an undermeasure of the actual number of species that exist in nature. Fortunately in Florida, the species are relatively easy to distinguish.

18a Last whorl of adult shell smooth or with growth striations, but

not with ribs and spiral chords 19

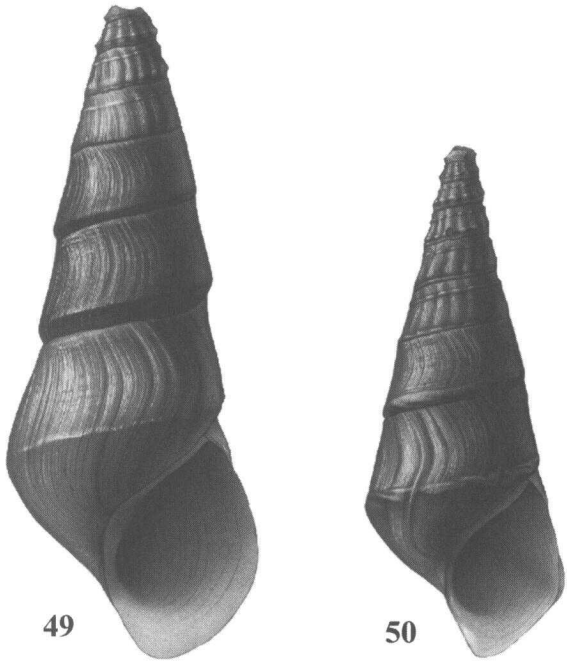
18b Shell with prominent ribs and spiral chords on all whorls ... 22



FIGS. 45-48. Embryonic and early juvenile shells of *Elimia*.

19a Earlier whorls of adult shell with vertical ribs and spiral chords. Sides of spire straight in lateral profile. Last few whorls in large adults scalariform with a prominent peripheral angle. Embryonic shell with fine vertical ribs and a heavy spiral chord on periphery and two basal spiral chords (Fig. 45). Adult large, about 23-27 mm long (Figs. 49, 50) .....
..... **(stately elimia)** *Elimia dickinsoni* (Clench & Turner 1956)

Confined to small creeks in the upper part of the Choctawhatchee River. Named for Joshua C. Dickinson, Jr. (1916-), former director of the Florida Museum of Natural History.



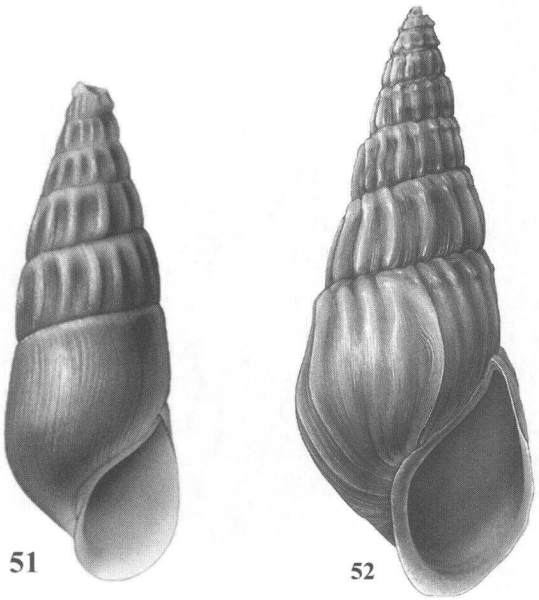
FIGS. 49-50. *Elimia dickinsoni.*

19b Earlier whorls of adult shell with heavy vertical ribs crossed by knobby folds or a strong spiral chord; sides of spire straight or weakly convex in lateral profile; embryonic shell with a single spiral chord on periphery and heavy vertical ribs, but without basal spiral chord (Fig. 46) 20

20a Spire of adults with heavy vertical ribs; unicolor dark brown; usually less than 18 mm long (Figs. 51, 52) .... **(graphite elimia)** *Elimia curvicostata* (Reeve 1860)

Distributed from the lower part of the Apalachicola River system in Georgia and Florida west to the Chipola River system in Florida and Alabama. This snail primarily inhabits smaller streams

and tributaries and also occurs in subterranean aquifers in Washington County. This species is listed as *Elimia curvicostata* (Reeve 1860), but that name may apply to a different species-group in the Tennessee River system, in which case it will be replaced with *Elimia densicostata* (Reeve 1860).



FIGS. 51-52. *Elimia curvicostata.*

20b Spire of adults without distinct vertical ribs 21

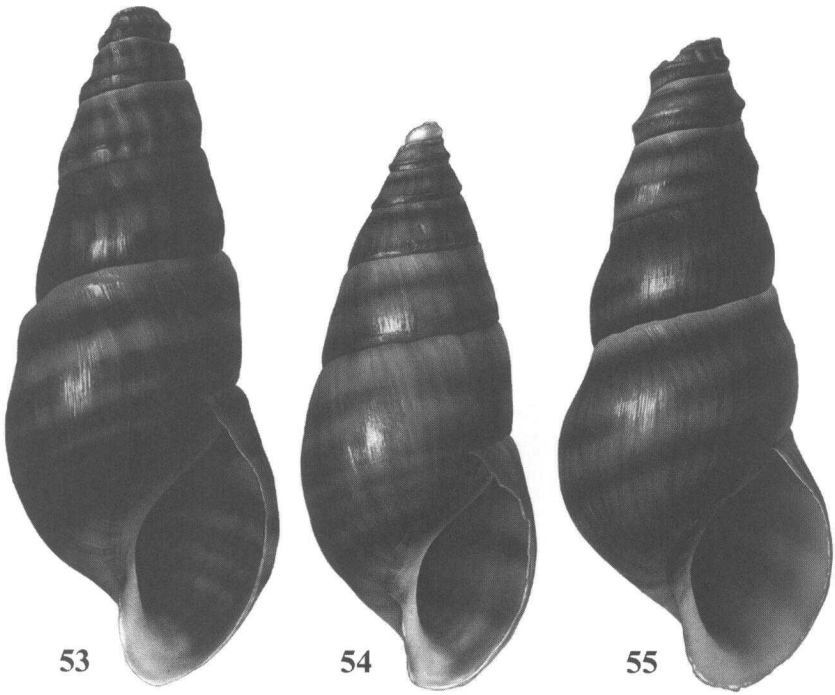
21a Shell brightly banded and with large, wide and wavy vertical folds; robust, usually 21-25 mm long (Fig. 53) .... **(Choctawhatchee elimia)** *Elimia* sp.

Widely distributed in the Choctawhatchee River system as far south as the Florida border. Not yet reported in Florida.

21b Shell with or without bright bands; with low wavy growth wrinkles; large but not robust, 23-28 mm long. (Fig. 54) .... **(Escambia elimia)** *Elimia* sp.

Found in the main stream of the Conecuh River and some of its

larger tributaries in Conecuh, Covington and Escambia Counties, Alabama. It may occur in the Conecuh River in Santa Rosa County, Florida.



FIGS. 53-55. Shells of *Elimia* species. FIG. 53. Choctawhatchee elimia. FIG. 54. Escambia elimia. FIG. 55. Dented elimia.

21c Shell with or without bands; slender; Suture deeply impressed; upper whorls with a strongly carinate periphery (Fig, 55) .... **(dented elimia)** *Elimia taitiana* (Lea 1841)

Known from small streams in the Alabama River system in Sumpter, Marengo, Monroe and Wilcox Counties, and from small streams in the Escambia River system in Conecuh and Escambia Counties, Alabama. Not reported from Florida, but it may occur in small stream in Escambia and Santa Rosa Counties, Florida.

22a Shell with spiral chords or spirally arranged series of nodes ... 23

22b Shell with strong vertical ribs on spire; spiral chords vestigial, confined to spiral series of knobs on top of vertical ribs; adults

small, about 13-16 mm long (Fig. 56) .....
..... **(goblin elimia)** *Elimia vanhyningiana* (Goodrich 1921)

Confined to Rock Springs, Orange County; Alexander Springs and Seminole Springs, Lake County. Named after O. C. Van Hyning, founder of the Florida State Museum (Florida Museum of Natural History).

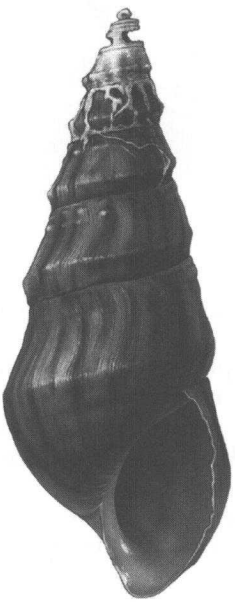


FIG. 56. *Elimia vanhyningiana.*

23a Shell unicolor, with distinct vertical sculpture in addition to strong spiral sculpture. Embryonic shell with strong peripheral spiral chord that continues onto following whorls (Fig. 47) 24

23b Shell with darker colored spiral chords that may be smooth or wavy. Vertical sculpture reduced to irregularly spaced and uneven growth striations or low undulating ribs. Embryonic shell smooth, without spiral chords (Fig. 48). Rather stocky, adult about 15-20 mm long (Fig. 57) .....
..... **(black-crested elimia)** *Elimia albanyensis* (Lea 1864)

A shoal species living in shallow water flowing over rock substrates. In Florida confined to the shoal immediately below the Jim Woodruff Dam on the Apalachicola River. Also found in Georgia in the Flint River and it's tributaries near Albany and downstream.

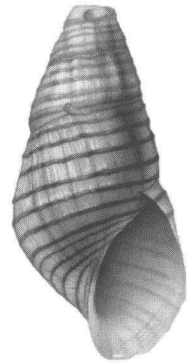


FIG. 57. *Elimia albanyensis.*

24a Sculpture above periphery of whorls consisting of nodes arranged in vertical and spiral rows. Shell short and stocky. Adult size small, about 12-16 mm long (Fig. 58) .....
..... **(knobby elimia)** *Elimia athearni* (Clench & Turner 1956)

Occurs naturally in the Chipola River in Jackson and Calhoun counties and introduced into the Santa Fe River system, Columbia County. Frequently found with *E. floridensis.* When the two occur together, *E. athearni* usually inhabits rocks, while *E. floridensis* inhabits woody objects and the sandy substrata. Named after Herbert D. Athearn of Cleveland, Tennessee, an ardent collector of mollusks who has added greatly to the knowledge of the southeastern freshwater fauna though his collecting efforts.

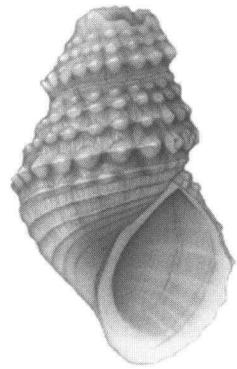


FIG. 58. *Elimia athearni.*

24b Sculpture above periphery of whorls consisting of sharp spiral chords and distinct vertical ribs; shell attenuate 25

25a Whorls straight-sided, not scalariform; suture hardly distinct; aperture terminating at periphery of last whorl; vertical ribs weaker and closely spaced; adult size about 25-30 mm long (Fig. 59) .... **(slackwater elimia)** *Elimia clenchi* (Goodrich 1924)

Confined to the Choctawhatchee River system in Florida and adjacent Alabama. Frequently found in quiet water on a silty substrate. Named after William J. Clench, a scholar of malacology.

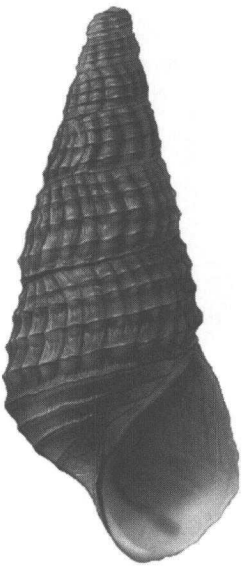


FIG. 59. *Elimia clenchi.*

25b Whorls of spire weakly scalariform, causing the suture to be deeply incised. Aperture terminating below periphery of body whorl. Vertical ribs relatively strong and more widely spaced 26

26a Vertical ribs smooth along the periphery, strongly developed (Fig. 60) ..... **(Waccasassa elimia)** *Elimia floridensis* ssp.

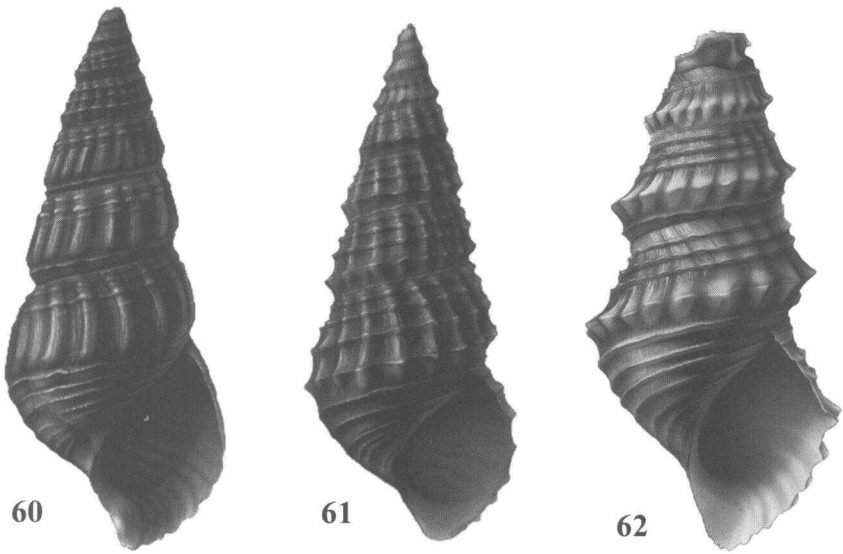
Confined to the Waccasassa River, Levy County.

26b Vertical ribs serrate along the periphery 27

27a Vertical ribs strongly developed, crossed by nearly equal sized spiral threads that form low spines where they cross the ribs, adults about

20-25 mm long (Fig. 61) .....
..... **(rasp elimia)** *Elimia floridensis* (Reeve 1860)

Distributed from the Chipola River east and south to the Manatee River and St. Johns Rivers systeems in central Florida. Some populations are quite distinct in sculpture, and more than one species may be involved. Six forms have been named as different species. The typical form is illustrated.



FIGS. 60-62. Shells of *Elimia*. FIG. 60. *E. floridensis* ssp. FIG. 61. *E. f. floridensis*. FIG. 62. Spring elimia.

27b Vertical ribs reduced in size, but with bold spines at the periphery; spiral threads above periphery relatively weak; adults up to 35 mm long (Fig. 62) ..... **(spring elimia)** *Elimia* sp.

Confined to Holmes Creek, and headwater springs of the Chipola River, Florida.

28a Central tooth of radula with long basocones along base (Fig. 36). Amphibious; moves by step-like mode of progression (Fig. 63). Family **POMATIOPSIDAE** .....
..... **(slender walker)** *Pomatiopsis lapidaria* (Say 1817)

The family Pomatiopsidae is found in Australia, Southeast Asia, southern Africa and North and South America. *Pomatiopsis lapidaria* is

the only species that occurs in Florida. Shell elongate-conical, consisting of about seven strongly convex whorls, sculptured with fine growth striations; spiral sculpture absent; peristome complete around aperture; adults about 6-7 mm long. Distributed from the Great Lakes region south to Virginia along the east coast and through Alabama to Florida. Found in Florida only in the Apalachicola River system. Amphibious, lives on damp ground and along seepages among dead leaves, sticks and rocks.

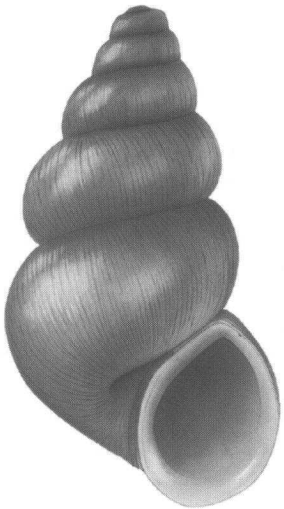


FIG. 63. *Pomatiopsis lapidaria.*

28b Central tooth of radula with basocones located on fore or lateral wing of tooth (Figs. 34, 35). Aquatic; moves by gliding motion. Shell of various shapes and sculpture. Family HYDROBIIDAE 29

29 **HYDROBIIDAE** 29a

Hydrobiids are small- to medium-sized operculate snails that live primarily in brackish and fresh water. The HYDROBIIDAE include over 200 genera and approximately 1000 species; most have monotonously simple, conical or depressed-conical shells that are nearly devoid of taxonomically useful characteristics. Essentially identical shells occur repeatedly among unrelated genera and subfamilies. Evolution has proceeded primarily through reproductive and trophic specializations. Important diagnostic characteristics for subfamilies, genera, and species are found in the female reproductive system, the male reproductive organ (the penis), and modifications of the

radular teeth. The shell is secondarily useful for identification, but only when supplemented with anatomical information.

The author has attempted to simplify the key to include the minimum anatomical data needed for accurate identification. In the event that only shell specimens are available, picture-matching may be necessary to eliminate some choices in the couplets. Identification should conform with all data in the key and with geographic distributions. Only genera that enter fresh water are treated. (Two brackish-water genera, *Onobops* and *Heleobops,* that are common in Florida are omitted.) Critical Florida references are Hershler & Thompson, 1992; Thompson 1968, 1969; Thompson & Hershler, 1991.

Most freshwater hydrobiids in the eastern United States are annual species; that is, they complete their life cycles in one year. Some that are endemic to Florida springs live in environments with nearly constant temperatures and apparently reproduce continuously throughout the year. Other species deposit eggs during the period March through May, at which time the adults die and immature forms dominate the population through August or September. Many samples of hydrobiids collected during the period of May through September are not identifiable because only immature forms are present, and important diagnostic characteristics have not yet developed.

29a Shell globose with a short depressed spire; body whorl ample; umbilicus closed 30

29b Shell conical or cylindrical-conical in shape; spire elevated; body whorl not disproportionately voluminous; umbilicus closed or open 32

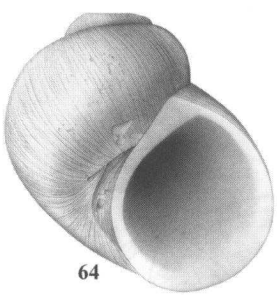
30a Columellar margin of aperture not flat-faced. Apex usually entire. Penis with large terminal lobe on left side and small appendage-like flagellum on right side (Fig. 68); lobe and flagellum with various patterns of dermal glands. Central tooth of radula with basocones located on reflected margin of tooth (Fig. 35). Subfamily NYMPHOPHILINAE (in part) ..... 48 [p. 44]

30b Columellar margin of aperture wide, flat-faced; apex of spire usually eroded; apical whorls, when present, with minute spiral striations, central tooth of radula with basocones located on ridged surface of tooth (Fig. 34); penis flattened, blade-like (Fig. 67). Subfamily LITHOGLYPHINAE (*Somatogyrus*) 31

31 *Somatogyrus* Gill 1863 ..... 31a

31a Adult shell about 4-5 mm high; umbilicus wide; columellar margin of the aperture concave in outline (Fig. 64) .....
(Gulf Coast pebblesnail) *Somatogyrus walkerianus* (Aldrich 1905)

Found in western Florida and southern Alabama from the Choctawhatchee River system West to the Escambia River. This species inhabits silt and fine sand in quiet zones along the sides of larger rivers and streams.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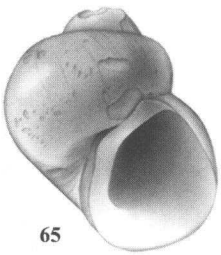
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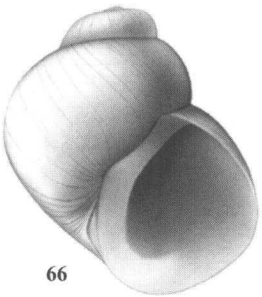
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FIGS. 64-66. Shells of *Somatogyrus*. FIG. 64. *S. walkerianus*. FIG. 65. Choctawhatchee pebblesnail. FIG. 66. Apalachi pebblesnail.

31b Adult shell small, less than 3 mm high; umbilicus narrow but not occluded by the columellar lip; columellar margin of the aperture weakly concave (Fig. 65). .....
..... **(Choctawhatchee pebblesnail)** *Somatogyrus* sp.

Found on rock outcrops in the Pea and Choctawhatchee Rivers in Geneva Co. Alabama. Not yet recorded from Florida.

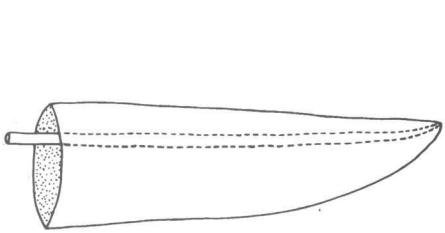
31c Adult shells small, less than 3 mm high; umbilicus closed by the reflected columellar lip; columellar margin of the aperture nearly straight, barely convex (Fig. 66) .....
.....**(apalachi pebblesnail)** *Somatogyrus* sp.

Known only from the shoals below Jim Woodruff Dam on the Apalachicola River, where it occurs on the limestone substrate.

32a Penis of males with papillae along sides (Figs. 69, 70) 33

32b Penis with a large terminal lobe on the left side and a smaller appendix-like flagellum on the right side. Lobe and flagellum with various patterns of dermal glands (Fig. 68). Subfamily NYMPHOPHILINAE ..... 48 [p. 44]

This subfamily includes about 15 North American and European genera (Thompson 1979). It is characterized by the lobed shape and glandular patterns of the penis. Evolution has occurred through reproductive specialization, with each genus and most species having distinctive patterns of dermal glands. In many instances identifications are difficult without properly preserved specimens.



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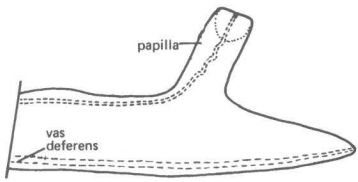

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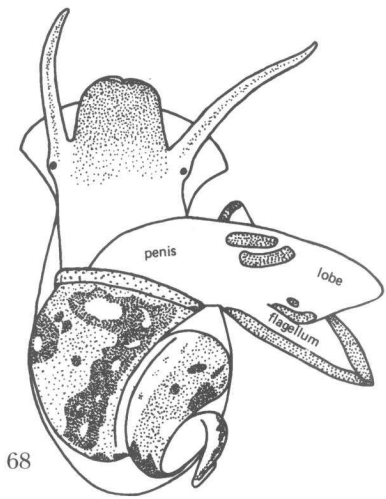

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FIGS. 67-69. Penial characteristics of hydrobiid snails. FIG. 67. Penis of *Somatogyrus* (without appendages) [Lithoglyphinae]. FIG. 68. Penial characteristics of the Nymphophilinae. FIG. 69. Penis with a side papilla [Amnicolinae].

33a Penis with a single papilla along left margin (Fig. 69). Papilla with a duct that leads to a blind caecum in nape of snail. Vas deferens independent of blind caecum and its duct. Subfamily AMNICOLINAE ..... 64 [p. 58]

This subfamily includes three North American genera, *Amnicola, Dasyscias* and *Lyogyrus,* and the European genus *Marstoniopsis.*

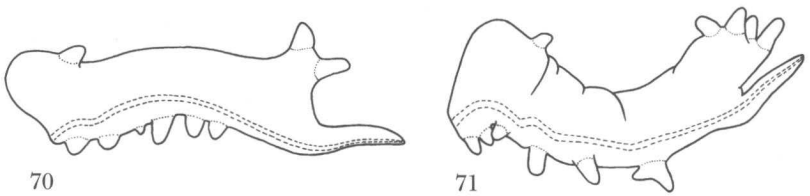
33b Penis with papillae along both margins, or right margin only (papillae absent in some Aphaostracon). Vas deferens the only duct present in penis (Fig. 70). Subfamily COCHLIONINAE .... 34 [p. 33]

The Cochliopinae consist of about 35 genera that are found in North

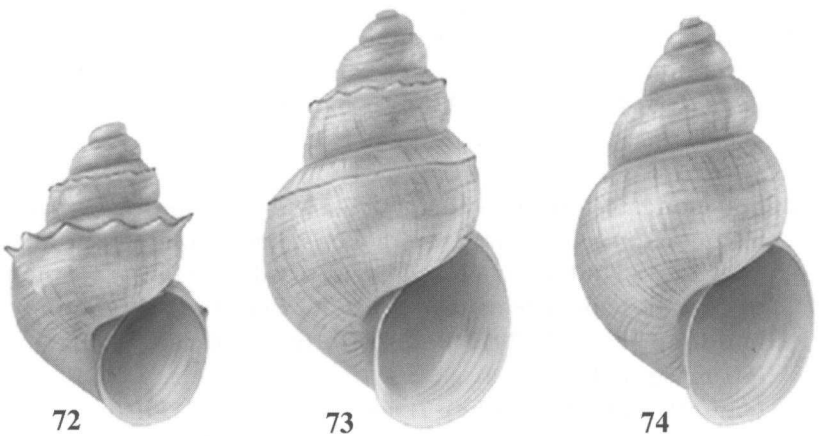
America, South America, west Africa and Mediterranean Europe (Hershler & Thompson, 1992). Previously the subfamily was referred to as LITTORIDININAE.

34a Shell usually with raised spiral threads around periphery, the uppermost thread frequently with conical or triangular spines (Figs. 72-74). Female ovoviviparous with about 50 embryos in uterus; embryos clearly evident through clean shells. Penis with 3-7 papillae along right margin and a projection with 1-4 papillae near end on left side (Figs. 70, 71) .....
.. **(serrated crownsnail)** *Pyrgophorus platyrachis* Thompson 1968

Shell elongate-conical with 5-6 whorls. Spire straight-sided. Suture deeply impressed. Color brown or olivaceous. Peristome complete around aperture. Length of female shell 3-5 mm. Sexually dimorphic in size; males about half as large as females. Found in brackish and fresh water throughout the southern quarter of the Florida peninsula. Abundant on aquatic vegetation.



FIGS. 70-71. Penes of *Pyrgophorus platyrachis*.

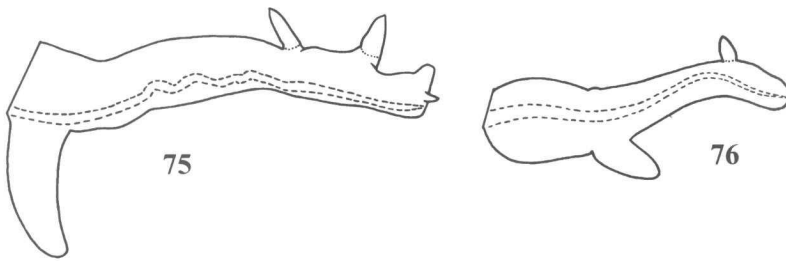


FIGS. 72-74. Examples of shell variation in *Pyrgophorus platyrachis*.

34b Shell without conical spines, although spiral threads may be present. Penis with different arrangement of papillae than above. Females ovoviviparous or oviparous 35

35a Shell elongate, thin, transparent, grayish. Suture deeply impressed. Female ovoviviparous with about 15 large embryos in uterus. Penis with large papilla on right margin near base and one or two papillae on left margin near distal end (Figs. 75, 76). Shell sexually dimorphic in size, males about one-third as long as females. Genus *Tryonia* Stimpson 1865..... 36

This genus was referred to as *Hyalopyrgus* in the previous edition. The name is a junior synonym of *Tryonia*.

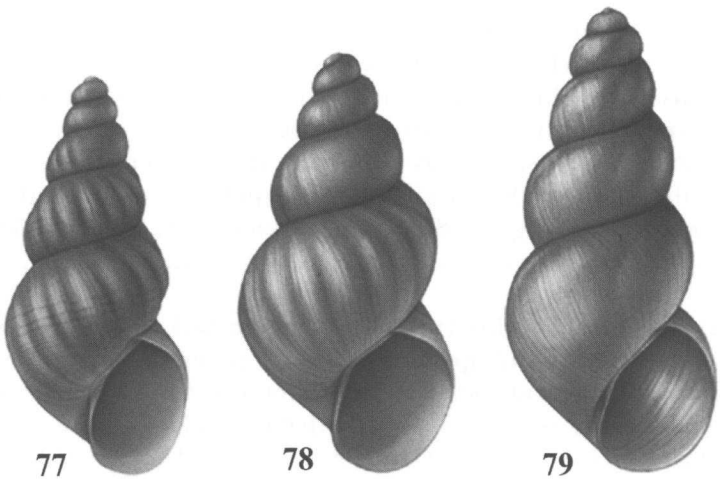


FIGS. 75-76. Penes of *Tryonia*. Left. *T. aequicostata*. Right. *T. brevissimus*.

35b Shell variable in shape. Female oviparous, never with embryos in uterus. Penis without a conspicuously enlarged papilla near right base, although other papillae usually are present 37

36a Shell elongate-conical, with about 5-7 whorls. Aperture broadly in contact with preceding whorl. Peristome incomplete around aperture. Umbilicus closed or narrowly perforate. Spiral or costate sculpture usually present. Female shell about 4-6 mm long (Figs. 77-79). Penis with two or three papillae on left margin (Fig. 75) ..... **(smooth-ribbed hydrobe)** *Tryonia aequicostata* (Pilsbry 1889)

Widely distributed in the central part of the Florida peninsula in rivers, springs and lakes.



FIGS. 77-79. Shell variation in *Tryonia aequicostata.*

36b Shell cylindric-conical with 4.5-5.0 whorls. Aperture free from, or only in slight contact with, preceding whorl. Peristome complete around aperture. Umbilicus open. Shell sculpture with incremental striations only. Female shell about 3.5-4.0 mm long (Fig. 80). Penis with one papilla on left margin (Fig. 76) .... **(regal hydrobe)** *Tryonia brevissimus* (Pilsbry 1890)

Restricted to a small area in the central part of the Florida peninsula where it is found in marshy lakes and rivers.

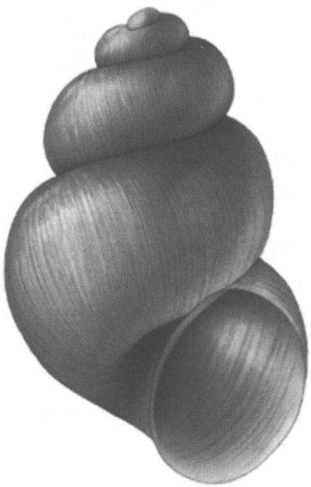
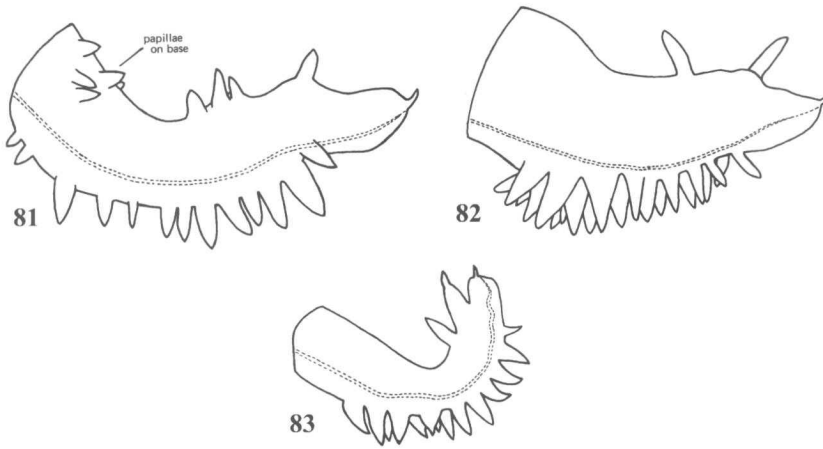


FIG. 80. *Tryonia brevissimus.*

37a Shell conical, olivaceous in color. Peristome incomplete around aperture. Whorls flat-sided with suture weakly impressed. Sculptured with fine incremental striations and a few fine spiral striations (difficult to distinguish except with transmitted light). Sexes not conspicuously dimorphic in size. Penis with 7-50 papillae along right margin and 1-4 papillae along distal third of left margin (Figs. 81-83). Genus *Littoridinops* Pilsbry 1952..... 38

37b Shell conical or cylindric-conical; light to dark brown. Peristome complete around aperture. Whorls generally arched. Spiral sculpture absent. Sexes strongly dimorphic in size, males about half as long as females. Penis with 0-6 papillae confined to right margin (Figs. 89-91). Genus *Aphaostracon* Thompson 1968 .... 40 [p. 39]



FIGS. 81-83. Penes of *Littoridinops*. FIG. 81. *L. tenuipes*. FIG. 82. *L. palustris*. FIG. 83. *L. monroensis*.

38a Penis with 3-10 small papillae around base and 7-15 papillae along right margin in a single row (Fig. 81). Sides of spire slightly convex. Parietal margin of operculum concave (Fig. 85). Shell with a brownish hue. Shell with 5.0-6.5 whorls; about 3-5 mm long (Fig. 84) .... **(henscomb hydrobe)** *Littoridinops tenuipes* (Couper 1844)

Found in fresh and brackish water along the Atlantic coast of Florida north to the New England states.

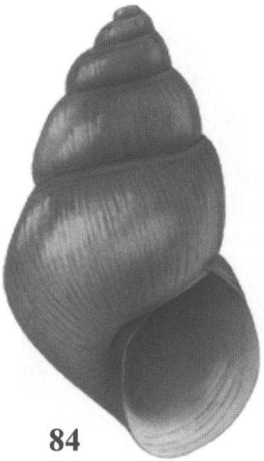
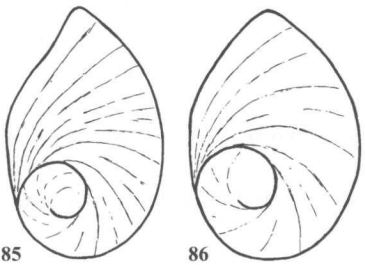


FIG. 84. *Littoridinops tenuipes.*



FIGS. 85-86. Opercula of *Littoridinops.* FIG. 85. *L. palustris.* FIG. 86. *L. monroensis.*

38b Penis without papillae around base 39

39a Penis with 17-50 papillae along right margin arranged in 3-5 rows (Fig. 82). Parietal margin of operculum slightly convex in outline (Fig. 86). Shell highly variable in shape; freshwater forms olivaceous or brown; adults with about 4.5-6.0 whorls; about 3.5-4.5 mm long (Fig. 87) .....
(cockscomb hydrobe) *Littoridinops monroensis* (Frauenfeld 1863)

Widely distributed in brackish marshes and streams from Georgia to Mississippi. Enters fresh water in Florida throughout the St. Johns River. An extremely variable species in which most variations occur in brackish habitats. The freshwater populations are conservative in shell characteristics.

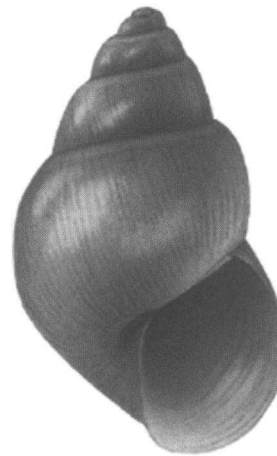


FIG. 87. *Littoridinops monroensis.*

39b Penis with 5-15 papillae along right margin arranged in 1-2 rows (Fig. 82). Parietal margin of operculum convex. Shell olive-colored; spire straight-sided. Shell with 5.6-6.8 whorls; about 3.2-4.5 mm long (Fig. 88) .... **(bantam hydrobe)** *Littoridinops palustris* Thompson 1968

Confined to brackish marshes from Tampa Bay north and west to Mobile Bay.

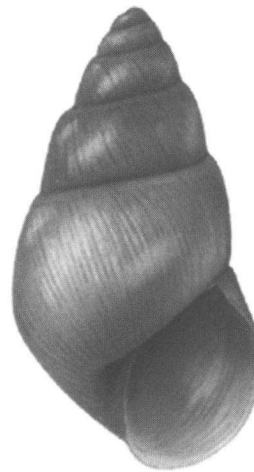
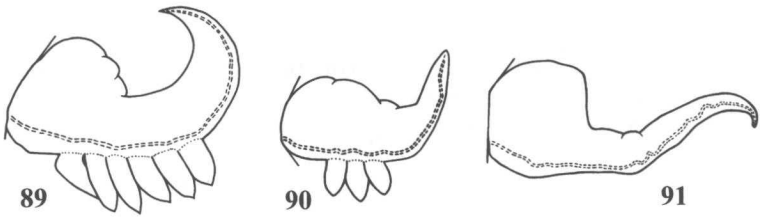


FIG. 88. *Litoridinops palustris.*

40a Penis with papillae along right margin (Figs. 89, 90) 41



FIGS. 89-91. Penes of *Aphaostracon*. FIG. 89. *A. pycnum*. FIG. 90. *A. xynoelictum*. FIG. 91. *A. chalarogyrus*.

40b Penis simple, elongate-conical, without papillae (Fig. 91) 42

41a Penis with 1-2 papillae 44

41b Penis with 3-5 papillae 46

42a Shell squat, compact, cylindric-conical in shape, thick and opaque. About 4.2-4.6 weakly arched whorls with a weakly impressed suture. Aperture comma-shaped, tightly appressed against preceding whorl. Length of shell about 2.2-2.8 mm long (Fig. 92) .... **(dense hydrobe)** *Aphaostracon pycnum* Thompson 1968

Endemic to Alexander Spring Run, Ocala National Forest, Lake County.

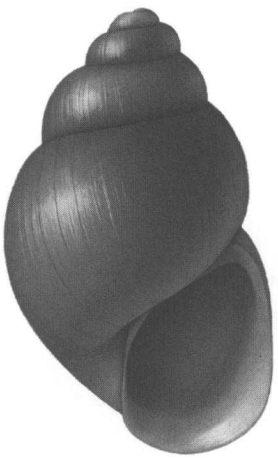


FIG. 92. *Aphaostracon pycnum*.

42b Shell conical with strongly arched whorls and a deeply impressed suture 43

43a Shell translucent. Body whorl inflated. Aperture elliptical and loosely attached to or slightly separated from preceding whorl; 4.5-4.9 whorls. Length of shell 2.6-3.0 mm (Fig. 93) .....
(Clifton Spring hydrobe) *Aphaostracon theiocrenetum* Thompson 1968

Endemic to Clifton Springs on the south shore of Lake Jessup, Seminole County.

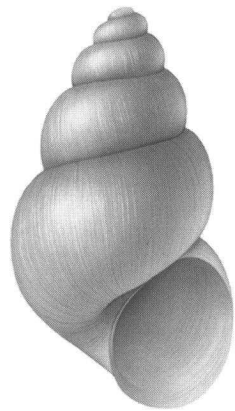


FIG. 93. *Aphaostracon theiocrenetum.*

43b Shell very thin, fragile, transparent. Aperture elliptical and usually attached to preceding whorl; 4.1-4.5 whorls present. Length of shell 2.0-2.4 mm (Fig. 94) .....
..... **(Blue Spring hydrobe)** *Aphaostracon asthenes* Thompson 1968

Endemic to Blue Springs, Volusia County.

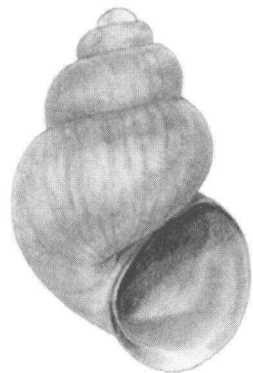


FIG. 94. *Aphaostracon asthenes.*

44a Shell narrow, terrete or cylindric-conical with a moderately impressed suture. Aperture broadly attached to preceding whorl across parietal wall. Whorls 4.6-5.3. Length of shell 2.4-3.4 mm (Fig. 95) .... **(slough hydrobe)** *Aphaostracon rhadinum* Thompson 1968

Abundant along the northern third of the St. Johns River system.

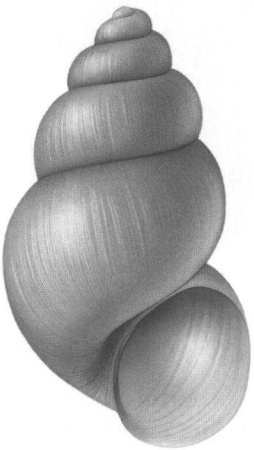
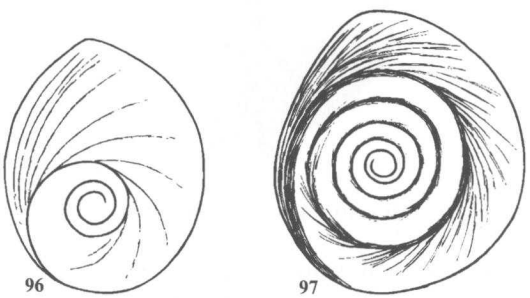


FIG. 95. *Aphaostracon rhadinum.*

44b Shell conical to elongate-conical; whorls 4.0-4.5 with a deeply impressed suture. Aperture narrowly in contact or free from preceding whorl 45

45a Shell conical to ovate-conical. Aperture broadly elliptical. Operculum with about 3 whorls (Fig. 96). Length of shell 2.0-2.4 mm (Fig. 98) ..... **(Suwannee hydrobe)** *Aphaostracon hypohyalinum* Thompson 1968



FIGS. 96-97. Opercula of *Aphaostracon.* FIG. 96. *A. hypohyalinum.* FIG. 97. *A. monas.*

Occurs in a small area in north-central Florida from the Suwannee River system west to small streams in Wakulla County.

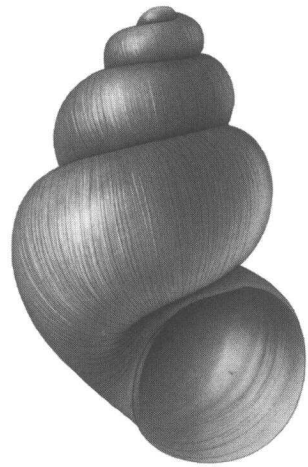


FIG. 98. *Aphaostracon hypohyalinum.*

45b Shell elongate-conical. Aperture broadly ovate. Operculum with about six slowly expanding whorls (Fig. 97). Length of shell 2.2-2.6 mm (Fig. 99) .... **(Wekiwa hydrobe)** *Aphaostracon monas* (Pilsbry 1899)

Endemic to Wekiwa Springs, Orange County.

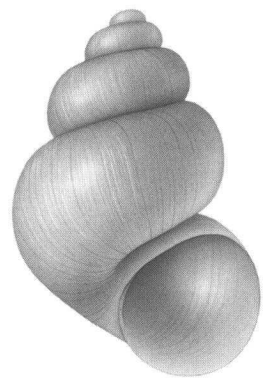


FIG. 99. *Aphaostracon monas.*

46a Shell cylindric-conical, solid opaque; 4.5-4.9 moderately rounded whorls. Aperture ovate; broadly attached to preceding whorl. Length of shell 2.1-2.8 mm (Fig. 100) ..... **(thick-shelled hydrobe)** *Aphaostracon pachynotum* Thompson 1968

Found along the southeastern half of the Florida peninsula from the St. Johns River south to Dade County.

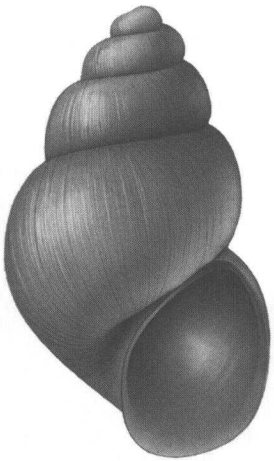


FIG. 100. *Aphaostracon pachynotum.*

46b Shell conical; thin and transparent; 4.0-4.5 strongly arched whorls. Aperture loosely attached to or widely separated from preceding whorl 42

47a Aperture loosely attached to or slightly free from preceding whorl. Length of shell 2.0-2.5 mm (Fig. 101). Penis with 3 papillae along right margin (Fig. 90) .....
(Fenney Spring hydrobe) *Aphaostracon xynoelictum* Thompson 1968

Endemic to Fenney Springs, 2 miles east of Coleman, Sumter County.

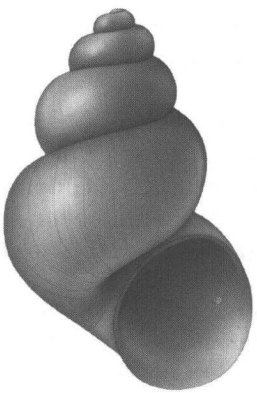
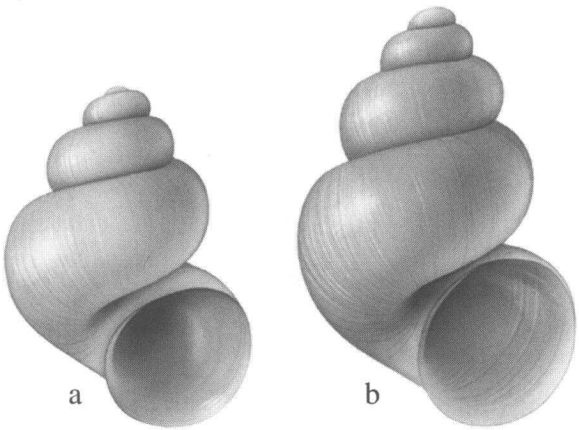


FIG. 101. *Aphaostracon xynoelictum.*

47b Aperture widely separated from preceding whorl. Length of shell 3.0-4.0 mm (Fig. 102a, 102b). Penis with 4-6 papillae along right margin (Fig. 89) .....
(freemouth hydrobe) *Aphaostracon chalarogyrus* Thompson 1968

Endemic to Magnesia Springs, 3.7 miles west of Hawthorne, Alachua County.



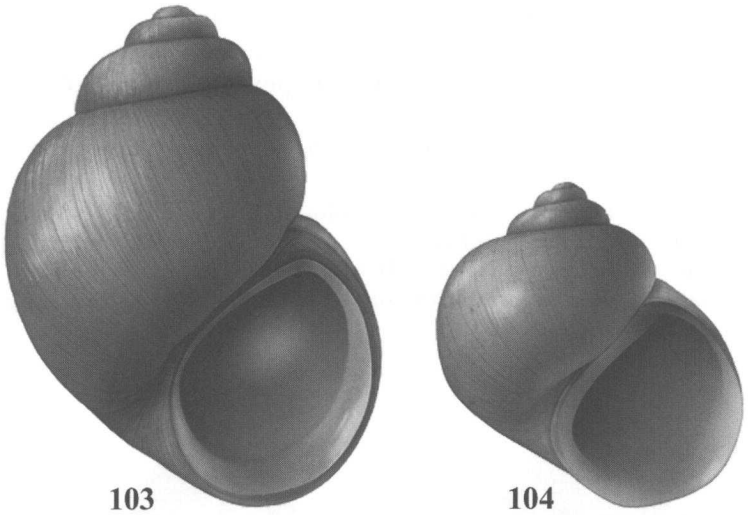
FIGS. 102 a, b. *Aphaostracon chalarogyrus.* ***a,*** *male;* ***b,*** *female.*

48a Shell globose or tear-shaped. Umbilicus closed 49

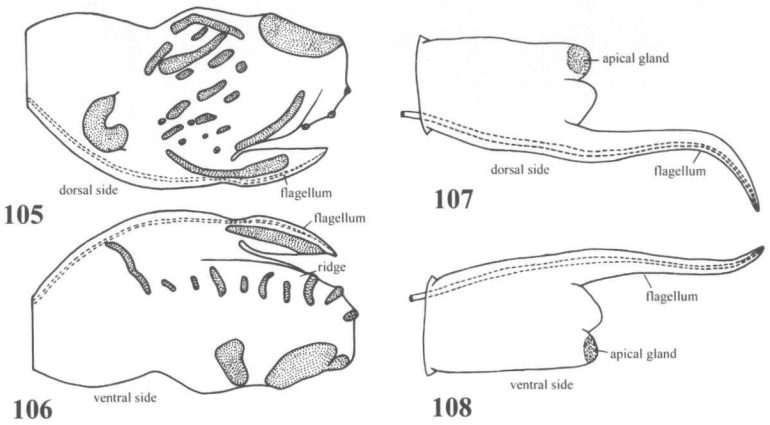
48b Shell conical or cylindric-conical. Umbilicus open, although very narrow in some species; occasionally closed 50

49a Shell medium-sized or large; 5.4-7.5 mm long; thick and opaque; ovate or globose; apical whorls depressed; sides of spire rounded; body whorl conspicuously enlarged, ample, rapidly descending to aperture along last half whorl. Columellar margin of aperture very thick but not reflected over umbilical area (Fig. 103). Outer lip straight in lateral profiles. Penis with a small blade-like flagellum along right margin and a heavy mid-ventral ridge that bears 8-11 narrow transverse dermal glands; other glands present on terminal lobe and flagellum (Figs. 105, 106) .....
..... **(alligator siltsnail)** *Notogillia wetherbyi* (Dall 1885)

Widely distributed throughout the northern half of the Florida peninsula north to the Suwannee River and also in southern Alabama and western Florida in the Choctawhatchee River system. A second species, *Notogillia sathon* Thompson, (satyr siltsnail) (Fig. 104), occurs in the Ocmulgee River system in Georgia.



FIGS. 103-104. Shells of *Notogillia*. FIG. 103. *N. wetherbyi*. FIG. 104. *N. sathon*.

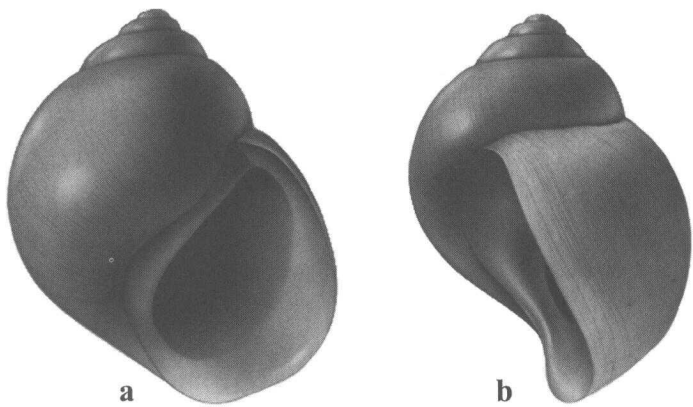


FIGS. 105-108. Penes of Nymphophilinae. FIGS. 105, 106. *Notogillia wetherbyi*. FIGS. 107, 108. *Rhapinema dacryon*.

49b Shell medium-sized, 3.0-3.8 mm long; thinner, translucent or transparent in life; tear-shaped; spire raised and nearly straight-sided, pointed; body whorl less conspicuously enlarged, not descending to aperture along last half whorl. Columellar margin of

aperture wide, rounded in front like a spindle. Outer lip of aperture arched forward (Figs. 109a, 109b). Penis with a very long slender flagellum that extends beyond terminal lobe. A single glandular crest present on apex of terminal lobe (Figs. 107, 108) .... **(teardrop snail)** *Rhapinema dacryon* Thompson 1969

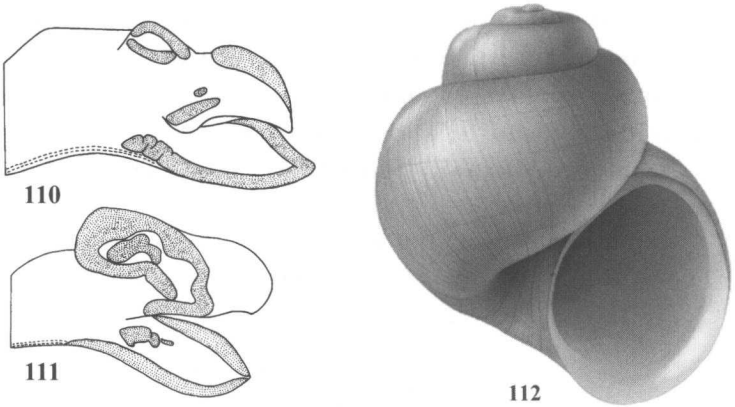
A monotypic genus confined to the Chipola River and Holmes Creek in Jackson, Holmes and Washington counties, Florida, and tributaries of the lower Chattahoochee and Flint rivers in southeastern Alabama and southwestern Georgia. Found in quiet water among aquatic plants.



FIGS. 109a, b. *Rhapinema dacryon.*

50a Mantle richly marked with reddish-brown blotches and spots. Terminal lobe of penis slender. Penis with a large, blade-like flagellum with continuous heavy dermal glands along each side (Figs. 110, 111, 68). Genus *Spilochlamys* Thompson 1968 ..... 51 [p. 47]

This genus contains three species. Two occur in Florida. One species, *Spilochlamys turgida* Thompson 1969, the pumpkin siltsnail, (Fig. 112), occurs in the Ocmulgee River system in Georgia. The genus is difficult to diagnose by shell characters because the three species are very dissimilar. *Spilochlamys* is most similar to the next genus, *Cincinnatia,* from which its shell usually differs by having a more deeply impressed suture, more strongly shouldered whorls, and a wider umbilical perforation.



FIGS. 110-111. Penes of *Spilochlamys*. FIG. 110. *S. gravis*. FIG. 111. *S. conica*. FIG. 112. *Spilochlamys turgida*.

50b Mantle spotted with black, shaded or unmarked; terminal lobe of penis with complex crests that cause it to look like an animal's head; flagellum slender, with scattered and discontinuous glands along edge (Figs. 115, 116). Genus *Cincinnatia* Pilsbry 1891 ...52 [p. 48]

51a Umbilicus narrow, without a strong circum-umbilical ridge, outer lip without a callus on inner surface. Penis as illustrated (Fig. 111). Shell with about 4.5-5.0 whorls; about 3.0-4.8 mm long (Fig. 113) ..... **(conical siltsnail)** *Spilochlamys conica* Thompson 1968

Found in springs and spring-fed streams in north-central Florida from the Withlacoochee north and west to the Choctawhatchee River system.

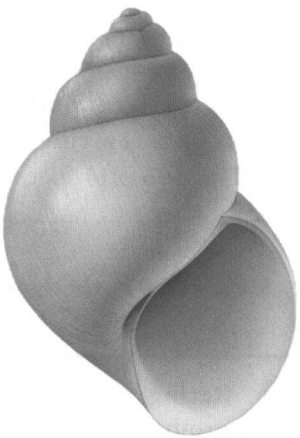


FIG. 113. *Spilochlamys conica*.

51b Umbilicus widely perforate, accentuated by a strong circumumbilical keel. Outer lip of aperture with a thick callus on inner surface. Penis as illustrated (Fig. 110). Shell with 4.4-5.0 whorls; about 3.7-5.2 mm long. (Fig. 114) ... ... **(armored siltsnail)** *Spilochlamys gravis* Thompson 1968

Confined to north-central Florida in the St. Johns drainage system from near Palatka south to the Wekiwa River.

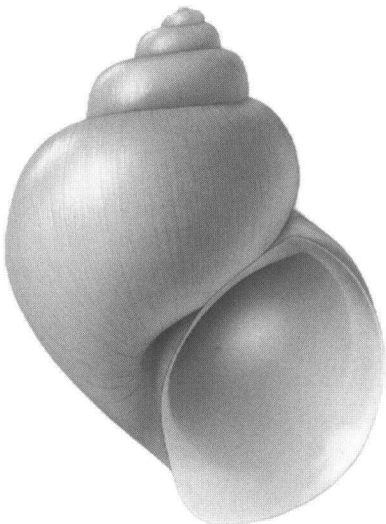
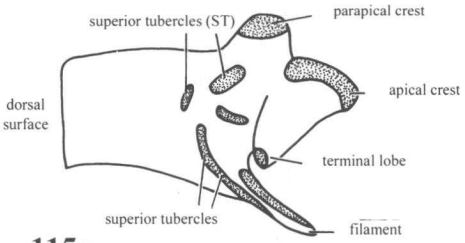


FIG. 114. *Spilochlamys gravis.*

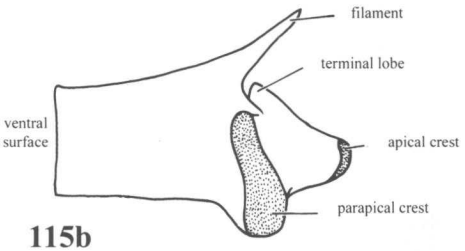
52a Penis with a few simple scattered superior tubercles on outer surface; parapical crest on a low ridge; accessory crest and inferior crest absent (Fig. 115a, 115b). *Cincinnatia floridana* group ..... 53 [p. 50]

This group contains six species in the Florida peninsula.

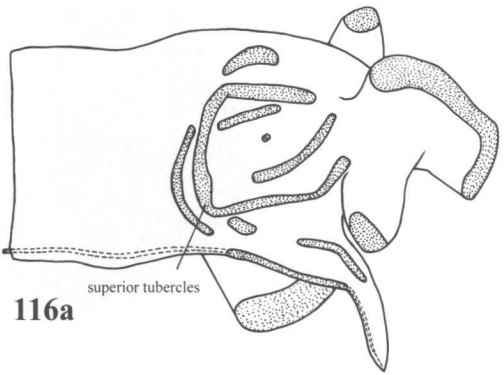
FIGS. 115a, b - 116a, b. (facing page). Penes of *Cincinnatia.* FIGS. 115a, b. *C. floridana* group. FIGS. 116a, b. *C. vanhyningi* group.



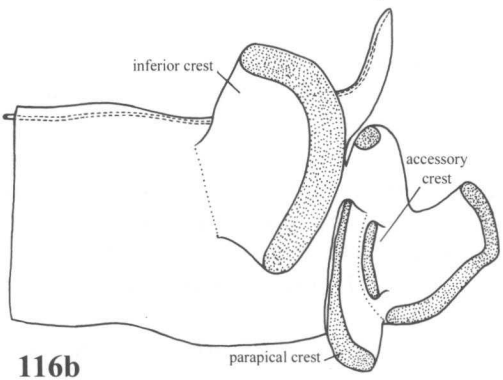
115a



115b



116a



116b

52b Penis with some superior tubercles fused into a U-shaped crest; parapical crest raised on a fleshy pedicel; accessory crest and inferior crest usually present (Fig. 116a, 116b). *Cincinnatia vanhyningi* group ..... 58 [p. 54]

A group of seven species confined to the St. Johns drainage system. Important diagnostic features occur in the arrangement of glands on the penis.

53a Spire long, 1.3-1.7 times length of aperture, convex in outline; shell relatively large and nearly cylindrical; 4.0-4.9 mm long; whorls 5.0-5.7, strongly rounded with a deeply impressed suture (Fig. 117) ..... **(crystal siltsnail)** *Cincinnatia helicogyra* Thompson 1968

Endemic to springs and a spring-fed lagoon at Crystal River, Citrus County.

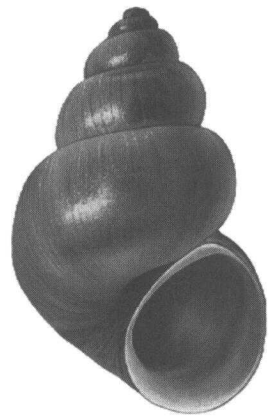


FIG. 117. *Cincinnatia helicogyra.*

53b Spire shorter, conical, 0.7-1.3 times length of aperture, nearly straight-sided in outline, suture of whorls weakly or moderately impressed 54

54a Shell minute, 2.0-2.3 mm long; thin and transparent; spire 0.7-1.1 times length of aperture; flagellum lacking glandular crests. shell with 3.9-4.2 whorls (Fig. 118) .... **(Ichetucknee siltsnail)** *Cincinnatia mica* Thompson 1968

Confined to a small spring along the west bank of the Ichetucknee River, about one mile northeast of US Highway 27, Suwannee County.

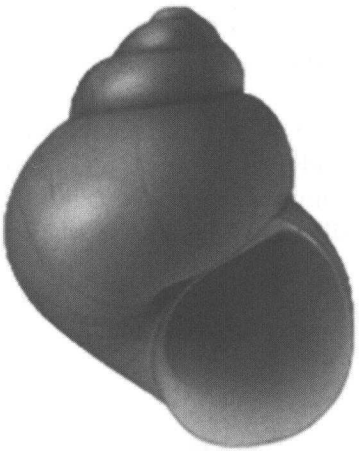


FIG. 118. *Cincinnatia mica.*

54b Shell larger, thicker, and opaque; spire 0.9-1.3 times length of aperture; with more than 4.2 whorls; penis flagellum with glandular crests 55

55a Shell medium-sized, 2.8-3.5 mm long; spire 0.9 - 1.1 times length of aperture; shell with 4.2-4.7 whorls (Fig. 119) .... **(hyacinth siltsnail)** *Cincinnatia floridana* (Frauenfeld 1863)

Found throughout the northern half of the Florida peninsula from Hillsborough and Orange counties north to the Suwannee River. Replaced along the northern half of the St. Johns River by the *vanhyningi* species group.

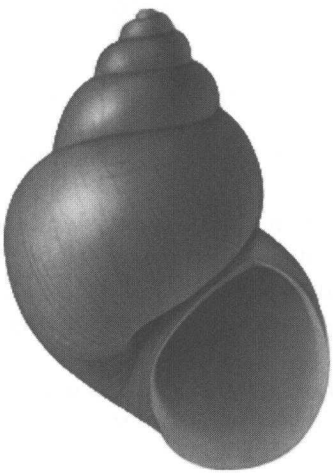


FIG.119. *Cincinnatia floridana.*

55b Shell moderately large, 3.7-4.5 mm long; spire 1.00-1.35 times length of aperture; shell with 4.8-5.4 whorls 56

56a Aperture broadly ovate in shape; parietal wall weakly in contact or solute from body whorl; whorls more prominently arched and with a deeper impressed suture. (Fig. 120) .... **(enterprise siltsnail)** *Cincinnatia monroensis* (Dall 1885)

Known only from Benson's Mineral Spring near Enterprise, Volusia County. Presently thought to be extinct.

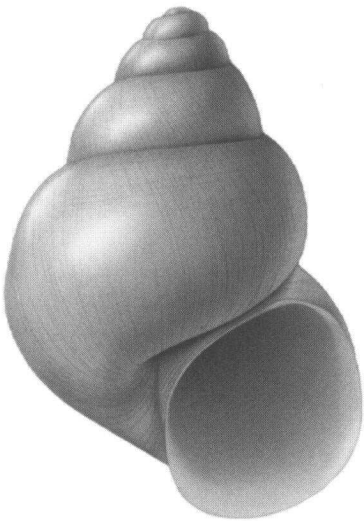


FIG. 120. *Cincinnatia monroensis.*

56b Aperture elliptical or trapezoidal in shape 57

57a Aperture elliptical in shape; spire slenderer and slightly convex in outline; suture moderately impressed suture; parapical crest reduced in size. (Fig. 121) .... **(flatwood siltsnail)** *Cincinnatia* sp.

Found in Glen Branch, about 0.5 miles south of the national forest Road 539, Ocala National Forest, Lake County. The type locality is reached where a hiking trail crosses the slough formed by the creek. The snail lives on dead leaves, debris and in silt.

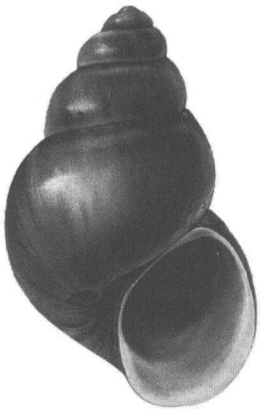


FIG. 121. Flatwood siltsnail.

57b Aperture trapezoidal in shape; spire more robust, straight sided; with a shallower suture; parapical crest large (Fig. 122) .... **(Alexander siltsnail)** *Cincinnatia* sp.

Occurs in Alexander Spring Run, Ocala National Forest, Lake Co., Florida. The shell is very similar to that of *Cincinnatia petrifons,* which is in a different species group by virtue of the glandular pattern on the verge. Also, the Alexander siltsnail has an operculum of the type described in 58b. The operculum of *C. petrifons* is differentiated in 58a.

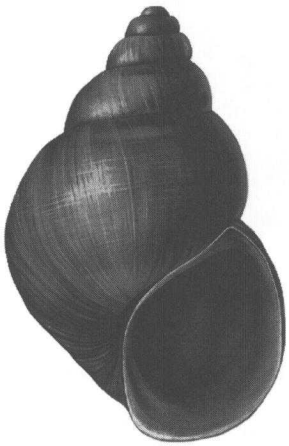
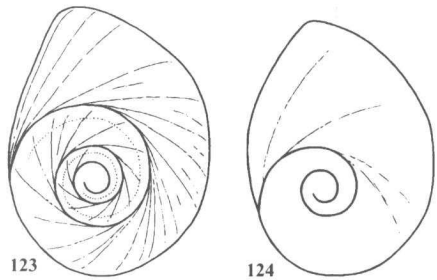


FIG. 122. Alexander siltsnail.

58a Operculum nearly multispiral with four large, slowly expanding whorls (Fig. 123) 59

58b Operculum paucispiral, with about three rapidly expanding whorls (Fig. 124) 60



FIGS. 123-124. Opercula of *Cincinnatia.*

59a Shell small, about 3.0-3.5 mm long; adult with 4.4-4.8 whorl; lower corner of aperture tending to be angulate with fluted channel (Fig. 125); accessory crest absent on penis..... ..... **(Seminole siltsnail)** *Cincinnatia vanhyningi* (Vanatta 1934)

Confined to Seminole Spring, 3.4 miles northeast of Sorrento, Lake County.

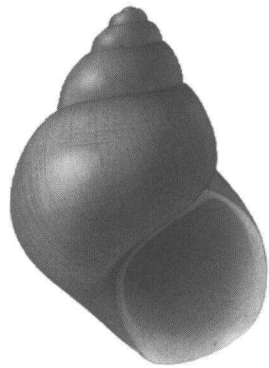


FIG. 125. *Cincinnatia vanhyningi.*

59b Shell large, 3.7-4.5 mm long; adults with 4.6-5.3 whorls; lower corner of aperture slightly extended forward as a weak, tongue-like projection (Fig. 126); accessory crest present on penis .... . **(Rock Springs siltsnail)** *Cincinnatia petrifons* Thompson 1968

Endemic to Rock Springs, 6.5 miles north of Apopka, Orange County, Florida.

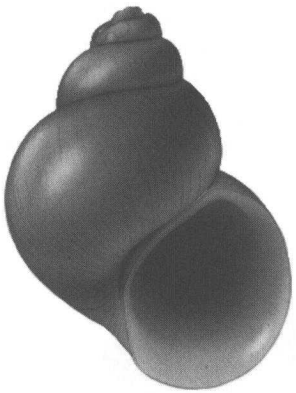


FIG. 126. *Cincinnatia petrifons.*

60a Shell minute, 2.4-2.7 mm long; adults with 3.9-4.2 whorls; spire short, 0.8-1.1 times height of aperture (Fig. 127); superior tubercles on penis arranged in oblique longitudinal series .... **(pygmy siltsnail)** *Cincinnatia parva* Thompson 1968

Endemic to Blue Springs, Volusia County.

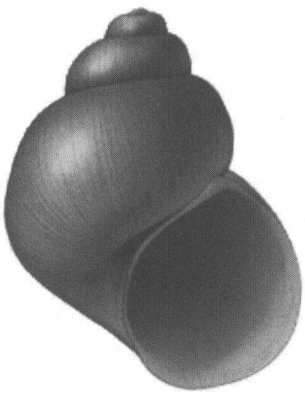


FIG. 127. *Cincinnatia parva.*

60b Shell larger, 2.8-4.6 mm long; adults with 4.0-4.9 whorls; spire longer, 0.9-1.3 times height of aperture; superior tubercles not

arranged in oblique longitudinal series 61

61a Shell large, 4.0-4.6 mm long; thick and opaque. Whorls globose, with a deeply impressed suture. Penis with two or more longitudinal crests within U-shaped superior tubercle (Fig. 128) ... . **(ponderous siltsnail)** *Cincinnatia ponderosa* Thompson 1968

Endemic to Sanlando Springs, Seminole County.

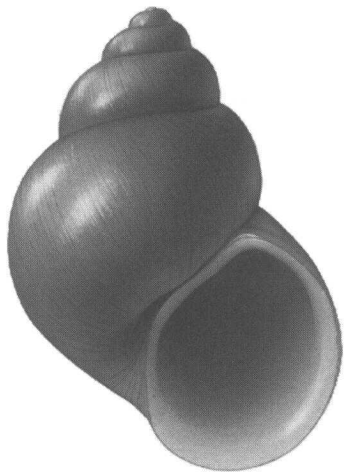


FIG. 128. *Cincinnatia ponderosa.*

61b Shell 2.8-3.7 mm long. Thin and translucent or transparent. U-shaped superior crest not enclosing longitudinal crests..... 62

62a Shell conical, spire moderatly high. Suture relatively deep. Whorls of spire rounded. Penis with invaginated cave-like pit within U-shaped superior tubercles 63

62b Shell elongate conical, spire high. Suture relatively shallow. Whorls of spire less rounded. Penis with superior tubercles forming a vague broken loop; invaginated cave-like pit absent. Parapical crest of verge greatly enlarged. Penis filament white. (Fig. 129) ..... **(creek siltsnail)** *Cincinnatia fraterna* Thompson 1968

Found in small creeks along the east side of the St. Johns River from Palatka north and in some streams of Putnam County.

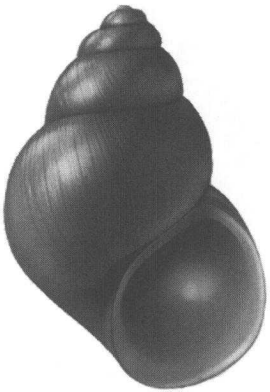


FIG. 129. *Cincinnatia fraterna.*

63a Penis with a dense pattern of superior tubercles. Inferior crest absent. Accessory crest present. Penis filament white. (Fig. 130) .. .. **(Wekia siltsnail)** *Cincinnatia wekiwae* Thompson 1968

Endemic to Wekiwa Springs, Seminole County.

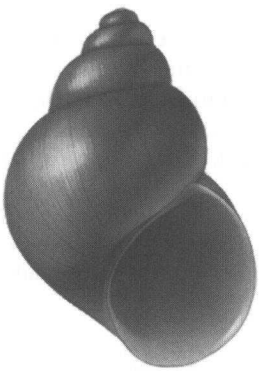


FIG. 130. *Cincinnatia wekiwae.*

63b Dorsal surface of penis with a few elongate superior tubercles that form a weakly defined U-shaped pattern. Accessory crest absent. Inferior rest usually present. Penis filament black. (Fig. 131) .... **(Green Cove Springsnail)** *Cincinnatia* sp.

Endemic to Green Cove Spring Run, in the municipality of Green Cove Springs, Clay Co. The shell is strikingly similar to *Cincinnatia wekiwae.* No constat difference between the two species is apparent in the shell. They are separated geographically by a distance of about 75 miles.

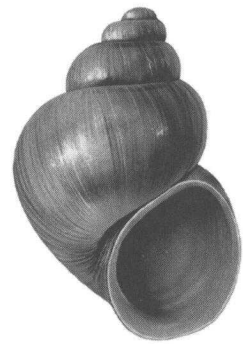


FIG. 131. Green Cove Springsnail.

64a Shell small, 2.0-2.8 mm long. Nuclear whorl slightly protruding, 0.29-0.41 mm in diameter transverse to initial suture. Mantle diffusely pigmented or unpigmented 65

64b Shell larger, 2.2-4.8 mm long. Nuclear whorl flattened, 0.41-0.48 mm in diameter transverse to initial suture. Mantle mottled with black spots and blotches. Genus *Amnicola* Gould 1841 ..... 66 [p. 59]

65a Shell smooth. Conical with relatively slender whorls. Widely umbilicate. Basal lip of peristome deeply receded. Nuclear whorl 0.29-0.33 mm in diameter. Mantle diffusely pigmented with melanophores (Fig. 132) .....
..... **(indented duskysnail)** *Lyogyrus retromargo* Thompson 1968

Known from a narrow zone across the neck of Florida peninsula. The extent of distribution north and west of there is not yet determined. Commonly found in quiet water among dead leaves and vegetation.

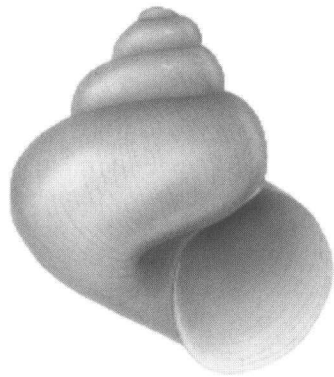
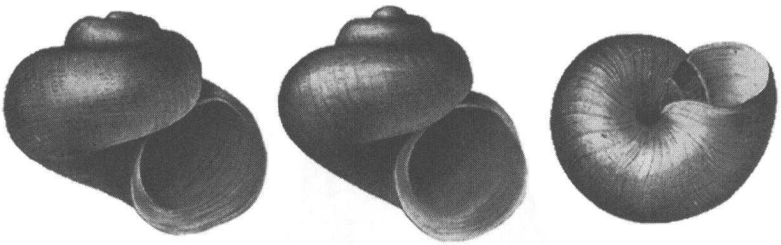


FIG. 132. *Lyogyrus retromargo.*

Lyogyrus Gill 1863 consists of two subgenera, *Lyogyrus* s.s. with eight species, and *Spirogyrus* with a single species confined to south-central Georgia. The latter, (cobble sprite) *Lyogyrus (Spirogyrus) latus* Thompson & Hershler 1991, occurs under flat rocks and wood. It is found in the Ocmulgee River and in the lower Flint River system. It may occur in Florida (Fig. 133).



FIGS. 133. Apertural and umbilical views of the shell of *Lyogyrus (Spirogyrus) latus.*

65b Shell shaggy with numerous spiral fimbriations that are broken into synchronized tufts. Conical with relatively obese whorls. Narrowly umbilicate. Nuclear whorl 0.41 mm in diameter transverse to initial suture. Transparent white (134) .....
(shaggy ghostsnail) *Dasyscias franzi* Thompson & Hershler 1991

A montotypic genus known only from a subterranean stream at Blue Spring Cave, Washington County. The species is named for Richard Franz, who accompanied me on field trips over many years.

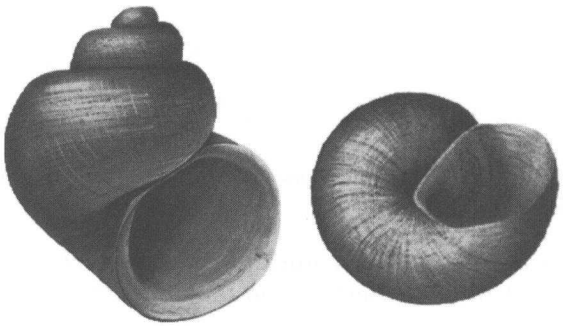


FIG. 134. Apertural and umbilical views of *Dasyscias franzi.*

66a Shell conical, thick, opaque. Umbilical perforation wide, 1/6 to 1/8 diameter of shell. Whorls 3.8-4.3. Incremental striations

intensified near nucleus and umbilicus. Aperture rhomboid; baso-columellar angle extended as slight tonguelike projection; basal lip broadly but shallowly indented (Fig. 135) .....
(squaremouth amnicola) *Amnicola rhombostoma* Thompson 1968

Confined to small creeks and streams along the west side of the St. Johns River in Clay and Putnam counties.

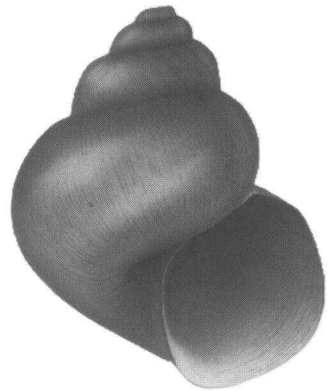
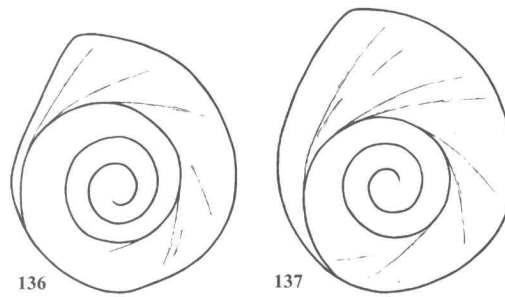


FIG. 135. *Amnicola rhombostoma.*



FIGS. 136-137. Opercula of *Amnicola dalli.* FIG. 136. *A.d. dalli.* FIG. 137. *A.d. johnsoni.*

66b Shell conical or globose-conical; thin, translucent, occasionally opaque. Umbilical perforation narrow, 1/8-1/10 diameter of shell. Whorls 3.0-4.0. Incremental striations uniformly weak. Aperture ovate; baso-columellar angle not extended; basal lip not indented. (**peninsula amnicola**) *Amnicola dalli* ssp 67

67a Operculum tightly coiled with four slowly expanding whorls (Figs.

136, 138) ..... *Amnicola dalli dalli* (Pilsbry & Beacher 1892)

Widely distributed in springs and streams in northern Florida from the St. Johns River system west to Leon County. It intergrades extensively with the following subspecies.

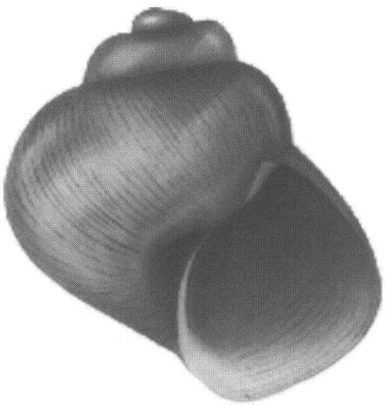


FIG. 138. *Amnicola dalli dalli.*

67b Operculum loosely coiled, with 3.75 large whorls, the outer one expanding more rapidly than the others (Figs. 137, 139) .... *Amnicola dalli johnsoni* Pilsbry 1899

Found throughout the middle third of Florida peninsula. Most commonly found in sand-bottomed lakes and streams.

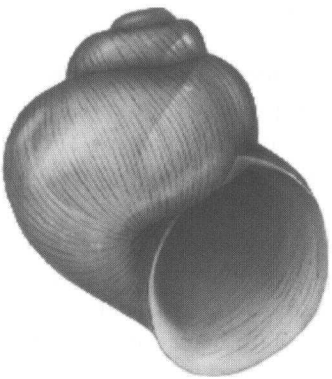


FIG. 139. *Amnicola dalli johnsoni.*

68 Subclass PULMONATA 68a

68a Shell cap-shaped or limpet-like with a wide, open aperture forming base of shell (Figs. 197-209). Family ANCYLIDAE .... 88 [p. 78]

68b Shell coiled 69

69a Shell planular or disc-shaped; spire flat when raised above succeeding whorls (Figs. 159-196). Family PLANORBIDAE .... 78 [p. 71]

69b Shell elongate with pointed conical spire 70

70a Shell coiled to the right, with the aperture on the right side (Figs. 140-146). Family LYMNAEIDAE 71

70b Shell coiled to the left, with the aperture on the left side (Figs.147-158). Family PHYSIDAE ..... 73 [p. 64]

71 **LYMNAEIDAE** 71a

Lymnaeids are a nearly cosmopolitan family of freshwater snails. They achieve their greatest diversity in genera and species in temperate North America. The lymnaeid fauna of the southeast is particularly depauperate compared to more northern and western regions of the continent. Only three widely distributed species occur in Florida.

71a Aperture large, oval, much more than half the length of shell. Sculpture consisting of distinct spiral striations and threads superimposed on growth striations (Fig. 140) .... **(mimic pondsnail)** *Pseudosuccinea columella* (Say 1825)

Widespread throughout Florida. An amphibious species that is particularly common on mats of floating vegetation such as hyacinths and water-lettuce. Occasional specimens have a long, slender apex. These have been named *Pseudosuccinea columella casta* (Lea 1841).

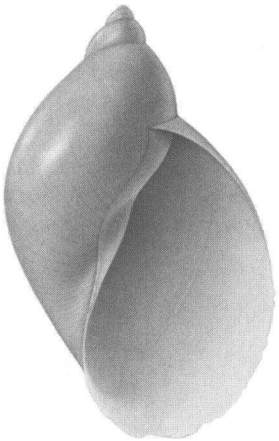


FIG. 140. *Pseudosuccinea columella.*

71b Aperture relatively shorter, about half or less the length of the shell. Sculpture consisting of incremental striations only 72

72a Aperture narrow, about half as wide as high. Whorls shouldered above near suture (Fig. 143). Body whorl compressed (Fig. 141). Radula with tricuspid lateral teeth (Fig. 145) .... **(rock fossaria)** *Fossaria modicella* (Say 1825)

Sparse in occurrence throughout the northern half of the Florida peninsula and panhandle. Primarily aquatic. Most commonly found on algae-covered rocks and logs.

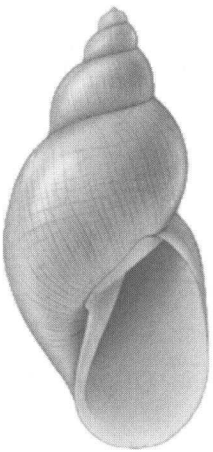


FIG. 141. *Fossaria modicella.*

72b Aperture oval, about 0.75 times as wide as high. Whorls uniformly rounded, not flattened above (Fig.144). Body whorl rounded (Fig. 142). Radula with bicuspid lateral teeth (Fig. 146) .... **(carib fossaria)** *Fossaria cubensis* (Pfeiffer 1839)

Generally common throughout Florida. Most frequently found in small streams and ditches. An amphibious species that usually occurs on damp soil among vegetation along the edge of the water.

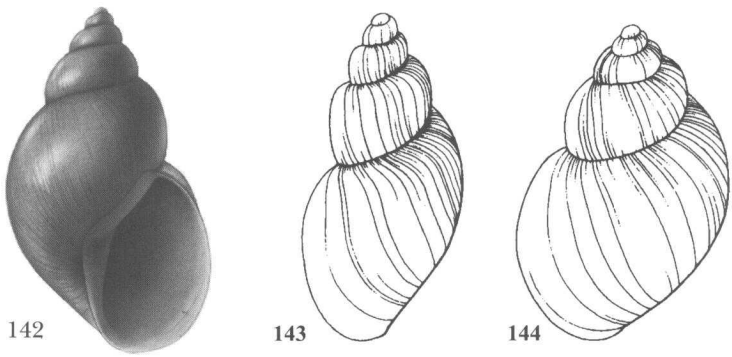
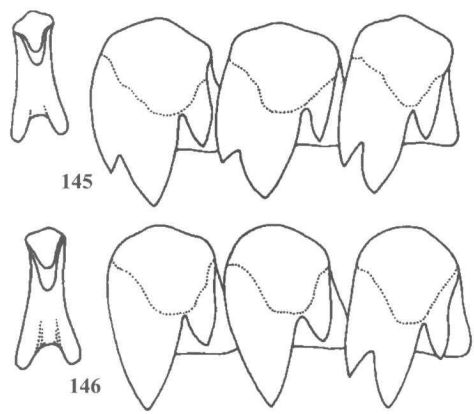


FIG. 142. *Fossaria cubensis.* FIGS. 143, 144. Dorsal views of *Fossaria* shells. FIG. 143. *F. modicella.* FIG. 144. *F. cubensis.*



FIGS. 145-146. Radular teeth. FIG. 145. *Fossaria modicella.* FIG. 146. *Fossaria cubensis.*

73 **PHYSIDAE** 73a

Most North American species of PHYSIDAE are placed in *Physella* Haldeman 1843, based on characteristics of their reproductive anatomy. There is disagreement whether *Physella* should be treated as a subgenus of *Physa* or as a separate genus. Burch & Tottenham (1980: 181-194) illustrates the North American species and summarizes their distributions. The reader may be troubled by the imprecise shell characteristics that are used in the key. Physid species have similar and superficially featureless, variable shells. Definitive identifications may require anatomical dissections.

73a Apex very short, only slightly raised above body whorl. Size small to medium, 8-12 mm in length. Sculpture consisting of axial striations only (Fig.147) ..... **(low-dome physa)** *Physella bermudezi* (Aguayo 1935)

Known from the Everglades region of south Florida, where it also occurs in Pleistocene fossil deposits. It also occurs in Cuba.

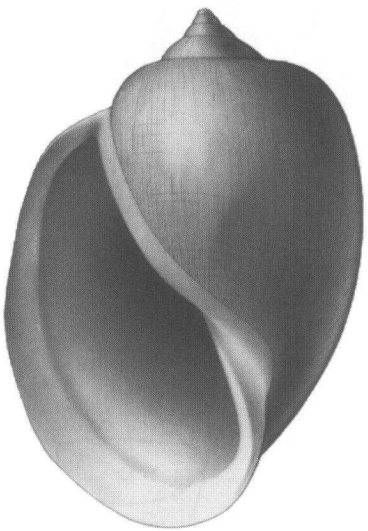


FIG. 147. *Physella bermudezi.*

73b Apex proportionally longer, about 0.3-0.5 times length of shell 74

74a Shell elliptical-ovate in shape. Apex distinctly convex in outline. Shell usually opaque in adults, with a dark red callus inside the

lip (Fig. 148) ... **(tadpole physa)** *Physella gyrina aurea* (Lea 1838)

Widely distributed in the southeastern United States. In the Florida panhandle it occurs in river systems that drain south from Georgia and Alabama. Recorded as *Physa crocata* (Lea) by Clench & Turner (1956).

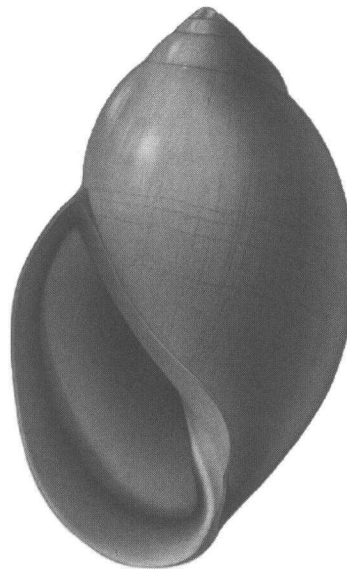
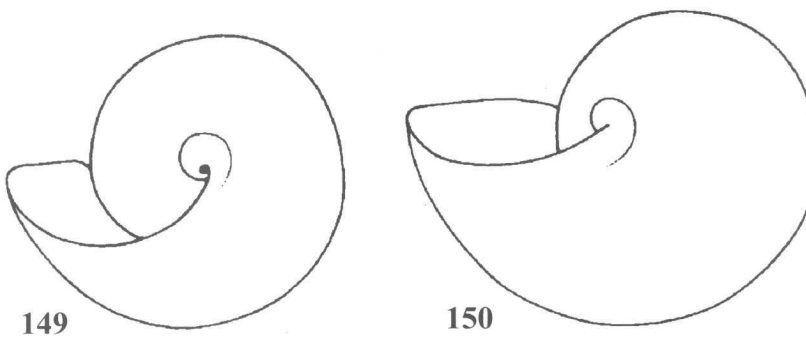


FIG. 148. *Physella gyrina aurea.*

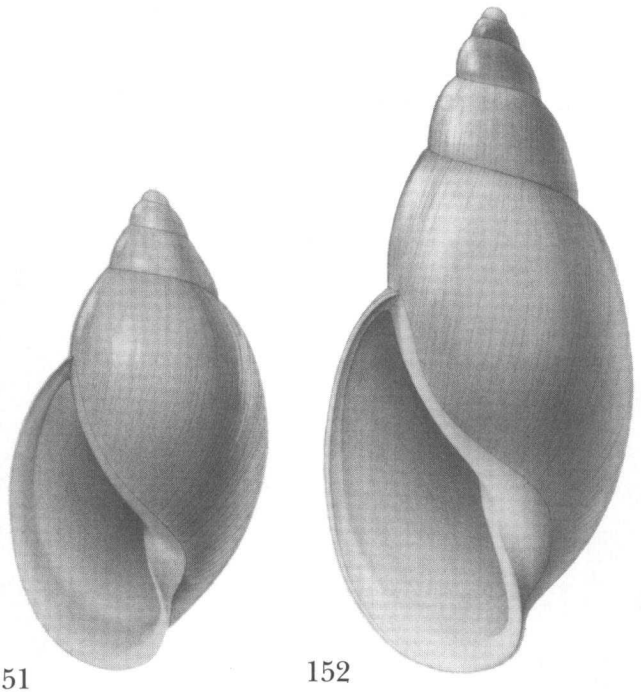


FIGS. 149-150. Basal views of *Physella hendersoni.* FIG. 149. *P. hendersoni.* FIG. 150. *P.h. hendersoni.*

74b Shell generally elliptical in outline. Apex nearly straight-sided or concave in outline. Shell transparent or opaque. Inside of lip with or without a reddish callus but callus never dark red in color 75

75a Shell slender, attenuate. Apex about 0.4-0.5 times length of shell. Suture weakly impressed. Base of shell open when viewed from below, showing most of preceding whorl due to curved basal lip (Fig. 149). Surface smooth, glossy, striations when present very weak. Amber to milky white in color (Figs. 151, 152) ..... **(bayou physa)** *Physella hendersoni* ssp.

Widely distributed in southeastern United States from Virginia to Mississippi and throughout Florida.



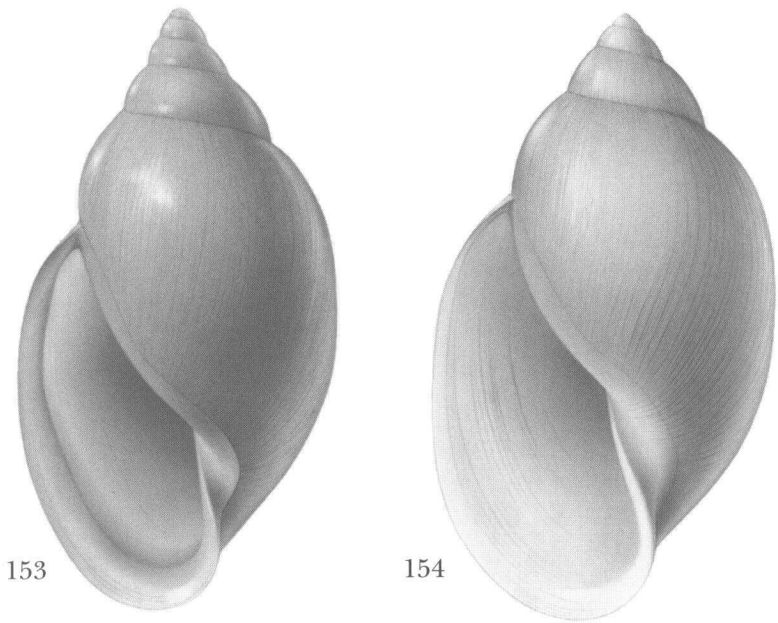
151 152

FIGS. 151-152. *Physella hendersoni* ssp.

75b Apex less than 0.4 times length of shell. Suture more deeply impressed. Base of shell when viewed from below showing about half of preceding whorl due to straight basal lip (Fig. 150). Sculpture variable. Color of fresh shell never milky white 76

76a Shell usually large, about 12-16 mm long. Generally with distinct axial and spiral striations. Brownish-yellow in color (Fig. 153) ..... **(bayou physa)** *Physella h. hendersoni* (Clench 1925)

Widely distributed in the southeastern United States and occurs throughout peninsular Florida. Two forms exist in addition to the attenuate subspecies cited above. The typical form (Fig. 152) has a rounded last whorl and a shallower suture. The second form has a flattened body whorl so that the sides of the last whorl and aperture are nearly parallel, and the suture is more deeply impressed. This second form is an ecological variation of *Physella hendersoni* and has been given a subspecific name, *Physella hendersoni arioma* (Clench 1925) (Fig. 154).

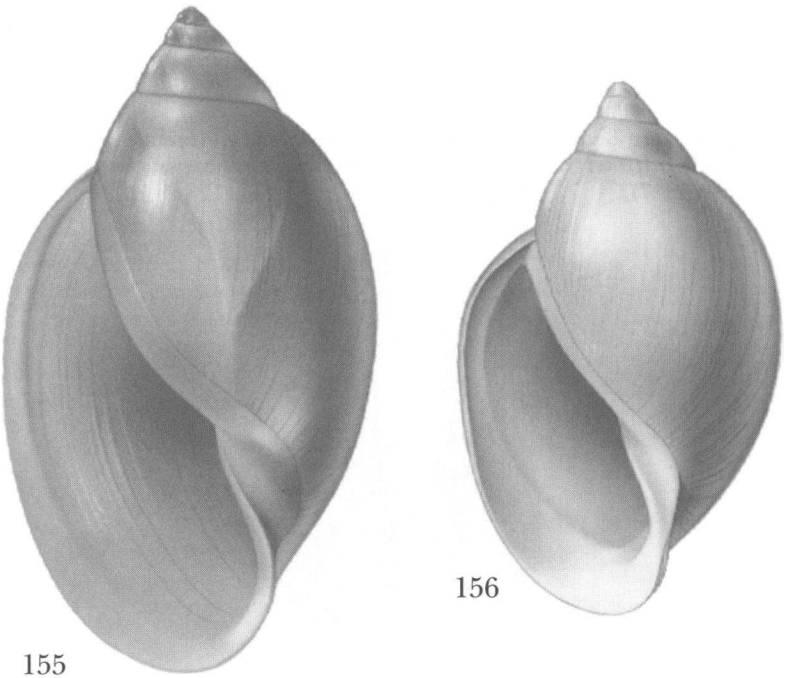


FIGS. 153-154. *Physella hendersoni.* FIG. 153. *P.h. hendersoni.* FIG. 154. *P.h. arioma.*

76b Shell smaller, generally less than 12 mm long. Spiral sculpture absent. Shell transparent or translucent. Gray to brownish-yellow in color 77

77a Shell elliptical in shape. Suture not as deeply impressed as in 77b. Last whorl not shouldered (Figs. 155, 156) .... **(carib physa)** *Physella cubensis* (Pfeiffer 1839)

Two subspecies are recognized. *Physella cubensis cubensis* has a relatively short apex (Figs. 155, 156). It is widely distributed in the West Indies, Central America, and northern South America, and it occurs throughout Florida and the adjacent areas of Alabama and Georgia. It occurred in Florida during the late Pleistocene. *Physella cubensis peninsulare* (Pilsbry 1889) has a more elongate apex (Fig. 157). It occurs throughout the Florida peninsula, and also in the West Indies, Mexico and Central America.



FIGS. 155-156. *Physella cubensis cubensis.*

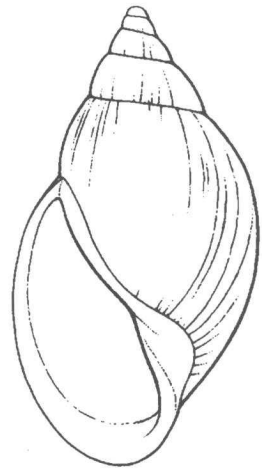


FIG. 157. *Physella cubensis peninsulare.*

77b Shell usually squarish or rectangular in shape. Suture more deeply impressed than in 77a. Last whorl distinctly shouldered. Texture dull. Axial striations distinct (Fig. 158) .... **(pewter physa)** *Physella heterostropha pomila* (Conrad 1834)

Widely distributed in the southeastern United States and found throughout Florida. It intergrades farther north with *Physella heterostropha heterostropha* (Say 1817).

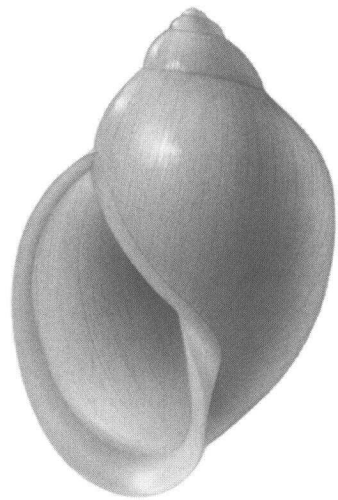


FIG. 158. *Physella heterostropha pomila.*

78 **PLANORBIDAE** 78a

Planorbid snails are restricted to fresh water and occur worldwide, being found on all continental landmasses and many oceanic islands. Most species are disc-shaped or planular, as is implied by the name PLANORBIDAE. The basic shell morphology of PLANORBIDAE is left-handed or sinistral (Figs. 180-193). Many species are secondarily modified to be right-handed or pseudodextral (Figs. 159-179). The family contains numerous genera and species, some of which are important medically as intermediate hosts for trematode parasites. Genera that serve as intermediate hosts for schistosomatid trematodes have been studied extensively. Most other genera have received relatively minor attention, and their systematics are in flux. Few of the North American species have been studied to the extent that their taxonomy, geographic distributions, life histories, and ecology are documented. The planorbid fauna of the southeastern states is poorly known. The following key includes all of the species that occur in Florida and some that occur in Alabama, Georgia and South Carolina.

78a Size small, discoidal, adults seldom exceeding 4 mm in width . 79

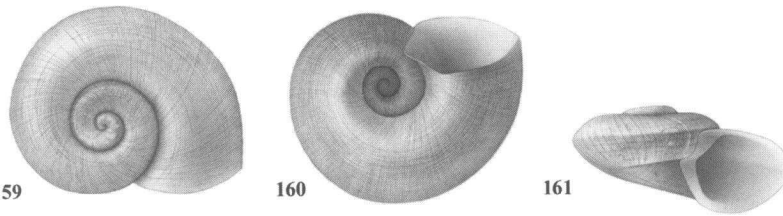
78b Size larger, adults 7 mm or more in width. Shell usually planispiral, but two species may have a flat-topped, elevated spire 83

79a Shell keeled or strongly angular at the periphery (Figs. 161, 164, 167). Weak spiral striations present on top of growth striations (Figs. 159, 162, 165). Shell with three whorls. Umbilicus narrow (Figs. 160, 163, 166) 80

79b Shell rounded at the periphery (Figs. 170, 173). Spiral sculpture faint or absent (Figs. 169, 172). Shell with 3-4 whorls. Umbilicus variable 82

80a Body whorl relatively narrow, not conspicuously enlarging near aperture (Fig. 159). Apex of shell slightly convex in outline. Body whorl strongly keeled as though pinched at the periphery (Figs. 159-161) .. **(marsh sprite)** *Micromenetus brogniartianus* (Lea 1842)

Micromenetus brogniartianus is known in Florida only from marshy habitats within the Chipola River basin in Jackson County and the Wacissa River basin in Jefferson County. Most frequently encountered on dead leaves and submerged vegetation in quiet water. This species was listed in the previous edition as *Micromenetus alabamensis* (Pilsbry 1895), which is a junior synonym of *M. brogniartianus.*

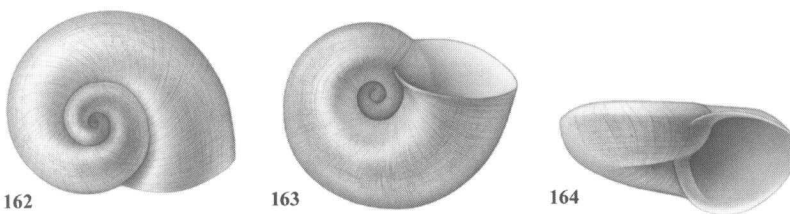


FIGS. 159-161. Three views of the shell of *Micromenetus brogniartianus*. FIG. 159. Dorsal (umbilical) view. FIG. 160. Ventral (inverted spire) view. FIG. 161. Apertural view.

80b Body whorl relatively rapidly expanding in diameter (Fig. 162). Aperture enlarged (dilated). Apex of shell flat, though it may be raised above the periphery of the last whorl (Figs. 164, 167). Periphery variable 81

81a Periphery of last whorl bluntly angular, lying below plane of apex (Figs. 162-164) ..... **(bugle sprite)** *Micromenetus d. dilatus* (Gould 1841)

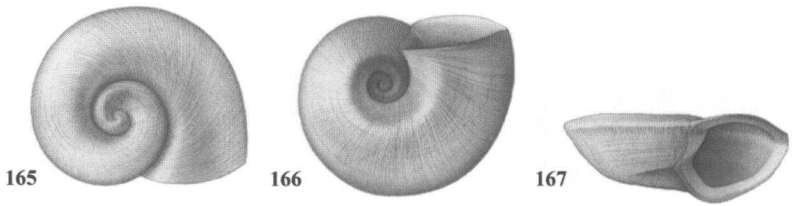
Micromenetus dilatatus dilatatus is widely distributed in northern Florida, and northward. Frequent on stones, gravel, submerged sticks, and vegetation in streams, springs, and lakes. This form intergrades with *Micromenetus dilatatus avus* in northern Florida. It occurs with *Micromenetus floridensis* and *Micromenetus brogniartianus* without showing intergradation.



FIGS. 162-164. *Micromenetus dilatatus dilatatus*. FIG. 162. Dorsal (umbilical) view. FIG. 163. Ventral (inverted spire) view. FIG. 164. Apertural view.

81b Body whorl angular. Last whorl flattened above. Apex suppressed to form a nearly flat plane with the peripheral angle (Figs.165-167) ... . *Micromenetus dilatatus avus* (Pilsbry 1905)

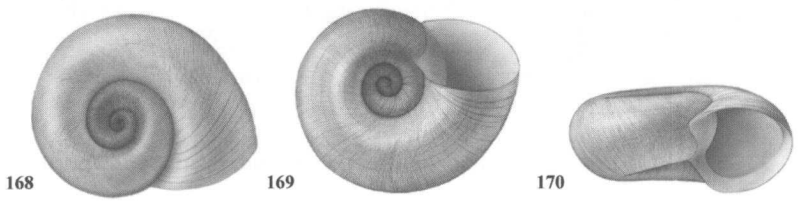
Found throughout the Florida peninsula in all major freshwater habitats, and in Haiti, Jamaica and Panama (Thompson, 1983). This subspecies was first described from the Pliocene Caloosahatchee Formation in southern Florida.



FIGS. 165-167. *Micromenetus dilatatus avus,* dorsal, ventral and apertural views.

82a Shell dark brown. Umbilicus narrow, deep (Fig. 169). Body whorl uniformly rounded peripherally (Fig. 170). Aperture moderately oblique. Shell sculptured with very fine, uniformly spaced axial threads (Figs.168-170). Marginal teeth of radula spatulate and bearing 8-10 weakly differentiated cusps .... **(penny sprite)** *Micromenetus floridensis* (Baker 1945)

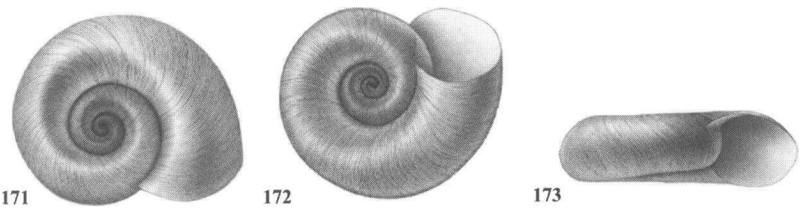
Widely but sparsely distributed in Florida. Most frequently in marshy habitats along streams. This snail was described by Baker (1945) as a subspecies of *Micromenetus dilatatus.* The two are recognized as distinct species because they occur syntopically and without intergradation in the Suwannee River system.



FIGS. 168-170. *Micromenetus floridensis,* dorsal, ventral and apertural views.

82b Shell grayish-white. Umbilicus broad, shallow (Fig. 172). Periphery of body whorl below middle, side of whorl flattened and sloping toward apex (Fig. 173). Aperture strongly oblique. Shell nearly smooth, sculptured with irregularly spaced incremental striations (Figs.171-173). Marginal teeth of radula trapezoidal with well-differentiated cusps ..... **(ash gyro)** *Gyraulus parvus* (Say 1817)

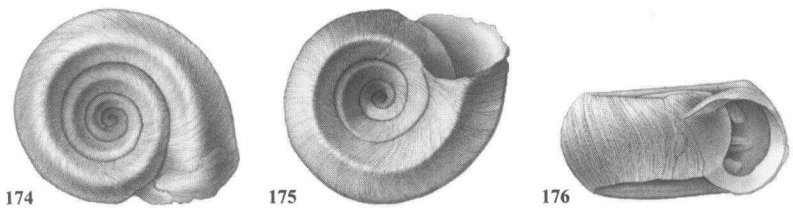
Found throughout most of North America. It is abundant on aquatic vegetation.



FIGS. 171-173. *Gyraulus parvus,* dorsal, ventral and apertural views.

83a Adults with six teeth in aperture, two on the parietal wall and four on the palatal wall. Apical whorls depressed; body whorl obtusely angular above and sharply carinated around funnel-shaped umbilicus. Lip of adult shell usually with a thick crest externally and an internal callus. Adults about 6-8 mm wide (Figs. 174-176) ... **(thick-lipped rams-horn)** *Planorbula armigera wheatleyi* (Lea 1858)

Known only from southeastern Alabama and the Chipola River, Jackson County, Florida. Nothing is recorded about its ecology.

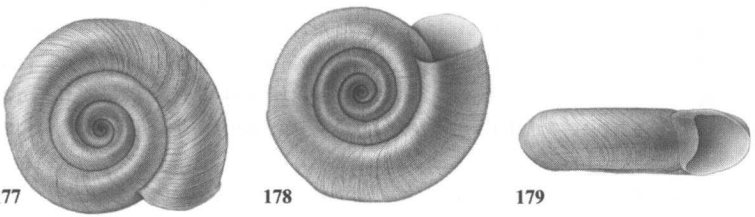


FIGS. 174-176. *Planorbula armigera wheatleyi,* dorsal, ventral and apertural views.

83b Adult shell without lamella on interior walls of aperture 84

84a Shell discoidal, grayish-white in color; transparent when fresh. Shell nearly smooth, sculptured with irregular growth striations. Adults with about 5 whorls, and 10-13 mm wide (Figs.177-179) .... **(ghost rams-horn)** *Biomphalaria havanensis* (Pfeiffer 1839)

Common in ditches and ponds in southeast Florida from Brevard and Okeechobee Counties south to Monroe County. Widely distributed in the West Indies and Central America. Generally found in oligotrophic habitats on vegetation.

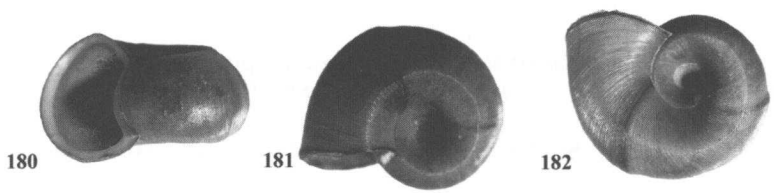


FIGS. 177-179. *Biomphalaria havanensis,* dorsal, ventral and apertural views.

84b Shell usually corpulent, brown or green, generally opaque, but occasionally translucent in juveniles 85

85a Shell distinctly carinated above and below; both apex and base funnel-shaped. Sculpture consisting of fine incremental threads, and spiral striations that may become obsolete at maturity. Adults 9-15 mm wide (Figs. 180-182) .....
(two-ridged rams-horn) *Helisoma anceps anceps* (Menke 1839)

Widely distributed over North America but uncommon in the southeastern states. It has been found only once in Florida, in Holmes County. Seventeen subspecies are listed by Baker (1945). The Florida specimens are typical *H.a. anceps,* though smaller than usual. Specimens from southern Georgia intergrade between the typical subspecies *anceps* and the subspecies *eucosmius* (Bartsch 1908) described from Lake Waccamaw, North Carolina.

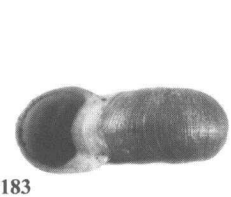


FIGS. 180-182. *Helisoma anceps anceps,* apertural, inverted spire and umbilical views.

85b Whorls rounded, not carinate above; occasionally angular below. Apex of shell flat-topped, but sunken below periphery of last whorl. Base of shell regularly expanding, not funnel-shaped 86

86a Shell dull. Sculptured with regularly spaced, fine, incremental threads and spiral striations; spiral striations evident only on base of whorls in some specimens. Apex flat with narrow thread-like keel. One to several dark growth-rest varixes usually present on last whorl. Adults about 15-18 mm wide with about 5.5 whorls (Figs. 183-185) .....
(marsh rams-horn) *Planorbella trivolvis intertexta* (Sowerby 1878)

Widely distributed throughout the Florida Peninsula and extending northeast along the coastal plain to southeastern North Carolina. In western Florida it intergrades with *Planorbella trivolvis lenta* (Say 1834) (Figs. 186-188).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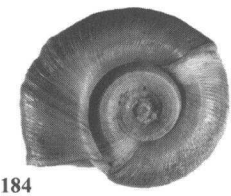
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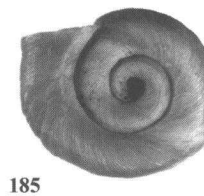
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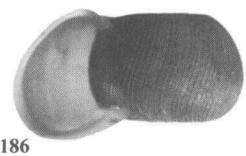
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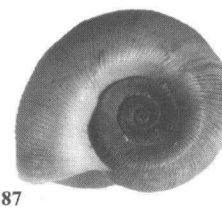
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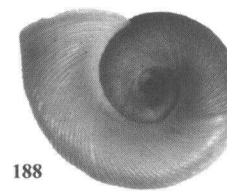
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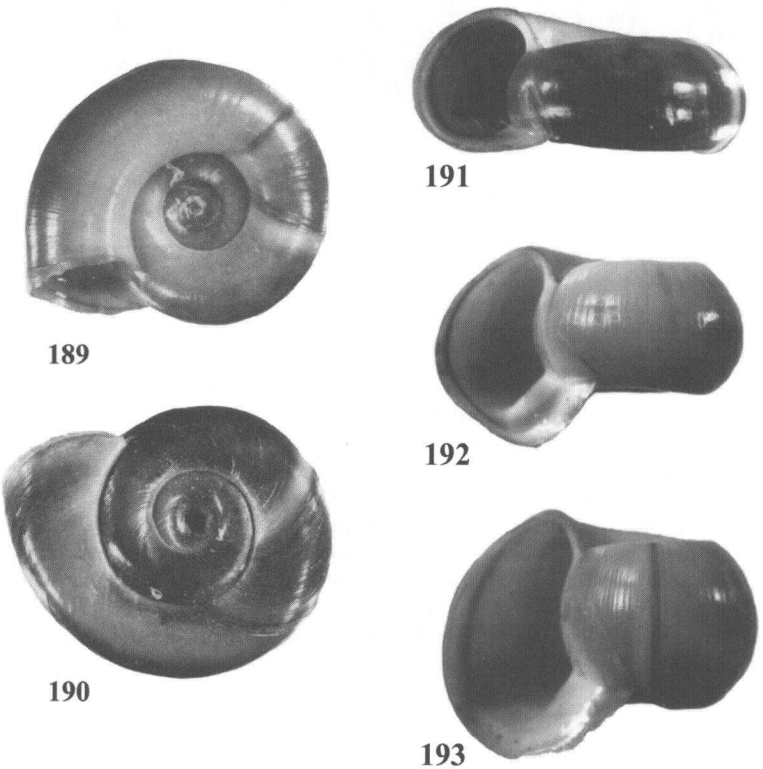
FIGS. 183-188. *Planorbella trivolvis,* apertural, spire and umbilical views. FIGS. 183-185. *P.t. intertexta.* FIGS. 186-188. *P.t. lenta.*

86b Shell glossy. Surface smooth or dented with hammer marks... 87

87a Shape highly variable, usually disc-shaped but some specimens with flat-topped raised spire. Lower margin of aperture advanced beyond upper margin so that plane of aperture slopes posteriorly when viewed from the side (Figs. 189-193) .....
..... **(seminole rams-horn)** *Planorbella duryi* (Weatherby 1879)

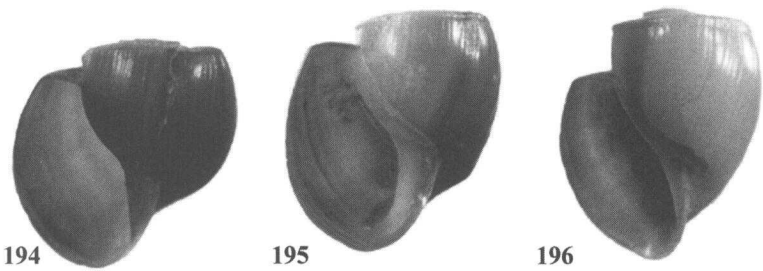
This species is endemic to the Florida peninsula, occurring northwest as far as Taylor County. Introduced widely into other areas in North America, tropical America, Asia, the Pacific Islands and Africa. The species is highly variable in size and shape, and six subspecies have been described (Pilsbry, 1934).



FIGS. 189-193. *Planorbella duryi.* FIG. 189. Inverted spire. FIG. 190. Umbilical view. FIGS. 191-193. Apertural views.

87b Spire raised and flat-topped. Lower margin of aperture not advanced beyond upper margin. Plane of aperture nearly vertical when viewed from the side. Size smaller than last species, seldom exceeding 10 mm in width (Figs. 194-196) .... **(mesa rams-horn)** *Planorbella scalaris* (Jay 1839)

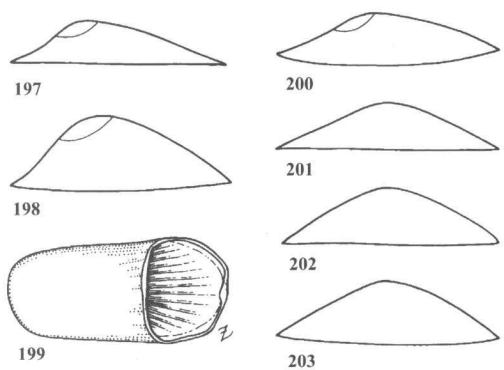
Endemic in Florida where it is found in marshes and lakes in the central and southern part of the peninsula.



FIGS. 194-196. Apertural views of *Planorbella scalaris.*

88 **ANCYLIDAE** 88a

Ancylid gastropods are small, fragile limpets found in most freshwater habitats. All freshwater limpets in the southeast belong to this family. Other families occur elsewhere in North America and in other continents. Little is known about these animals, and diverse opinions exist as to how many species are recognizable. Many North American species were described near the turn of the century by Walker (1918). Basch (1963) revised the classification and recognized only 12 species. However, this appears to be an over reduction, and several southern species were synonymized that appear worthy of recognition. Six species are known to occur in Florida. They are variable in their shell characteristics, and some samples may be difficult to identify. The following key is modified from Basch (1963). It is essential that clean specimens be examined under proper lighting to observe diagnostic sculpture characteristics.



FIGS. 197-203. Ancylid shells. FIG. 197. *Ferrissia mcneili.* FIG. 198. *Ferrissia hendersoni.* FIG. 199. Ventral view of a septate shell. FIG. 200. *Hebetoncylus excentricus.* FIG. 201. *Laevapex peninsulae.* FIG. 202. *Laevapex fuscus.* FIG. 203. *Laevapex diaphanus.*

88a Shell usually elevated, but variable. Apex with fine radial striations (Figs. 204-207), often eroded in older specimens. Peristome narrow to broadly ovate. Aperture usually open; occasionally with a horizontal, shelf-like septum closing posterior part (Fig. 199). Genus *Ferrissia* Walker 1903 89

88b Shell depressed. Apex smooth, with no trace of radial striations (Fig. 208, 209), although radial striations may be present on other areas of shell. Peristome ovate to subcircular. Aperture never with a septum ..... 90 [p. 80]

89a Shell thin, fragile, very much depressed, less than 0.25 times as high as long. Color often glossy reddish brown. Apex fairly prominent as a rounded knob in the right posterior quadrant (Figs. 197, 204). Length of shell up to 5 mm.....
..... **(hood ancylid)** *Ferrissia mcneili* Walker 1925

Confined to small creeks in the area around Mobile Bay east to the Apalachicola River system.

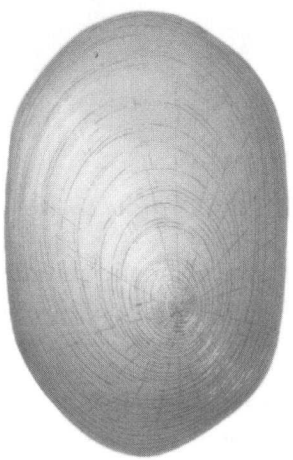


FIG. 204. *Ferrissia mcneili,* dorsal view.

89b Shell moderately elevated, over 0.25 times as high as long. Apex in the posterior right third, domelike and evenly rounded. Adults about 2-3 mm long (Figs. 198, 205) .....
..... **(blackwater ancylid)** *Ferrissia hendersoni* Walker 1908

Basch (1963) refers to this form as a subspecies of *Ferrissia fragilis* (Tyron 1863). Its apical characters appear to be sufficiently distinct from the northern *F. fragilis* to deserve specific recognition. Known from the southeastern coastal plains of North Carolina, South Carolina, Georgia and Florida. Found in ditches, ponds, and quiet backwaters in streams and lakes. It commonly occurs on stems of aquatic plants, dead leaves, and sticks. Some specimens form a partial septum in the middle of the shell (Fig. 199), apparently in response to seasonal drying of their habitats.

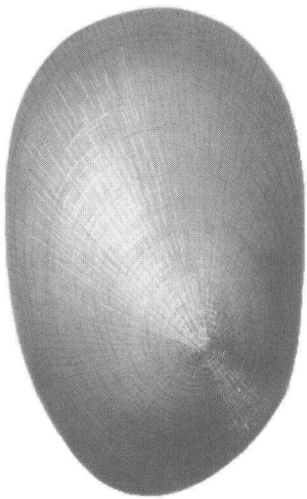


FIG. 205. *Ferrissia hendersoni.*

90a Apex very obtuse, almost in the middle of the shell. Radial striations present or absent. Genus *Laevapex* Walker 1903 91

90b Apex subacute, distinctly eccentric to the right of the midline. Radial striations present on shell but not on apex. Average length about 4 mm (Figs. 200, 206) .... **(excentric ancylid)** *Hebetoncylus excentricus* (Morelet 1851)

A monotypic genus widely deployed in Middle America, extending northward into southeastern Texas and the southeastern coastal plains. Commonly found on dead wood, leaves, plant stems, bottles and cans.

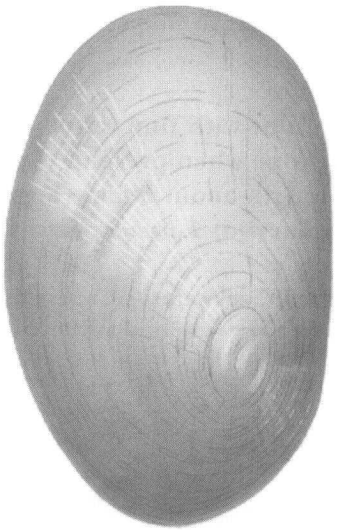


FIG. 206. *Hebetoncylus excentricus.*

91a Shell elongate. Radial riblets on entire surface of shell except apex. Apex slightly behind and slightly to the right of midline. Adults about 5 mm long (Figs. 201, 207) .....
(peninsula ancylid) *Laevapex peninsulae* (Pilsbry & Johnson 1903)

Known only from the Florida peninsula south and east of the Suwannee River system.

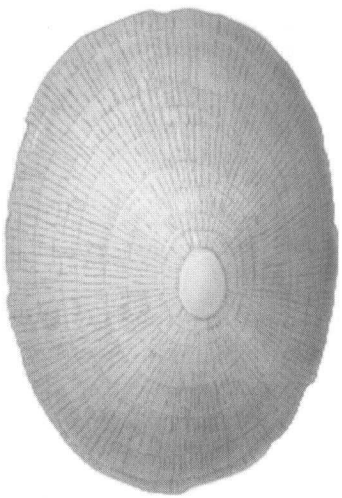


FIG. 207. *Laevapex peninsulae.*

91b Shell ovate or subcircular in shape, smooth or with radial sculpture localized anteriorly 92

92a Shell ovate, smooth or with fine raised riblets; riblets usually on the anterior slope when present. Apex behind center of shell. Average length about 5 mm (Figs. 202, 208) .... **(dusky ancylid)** *Laevapex fuscus* (C.B. Adams 1841)

Usually found in still backwaters of rivers and lakes living on dead leaves and stems. Widely distributed in eastern North America.

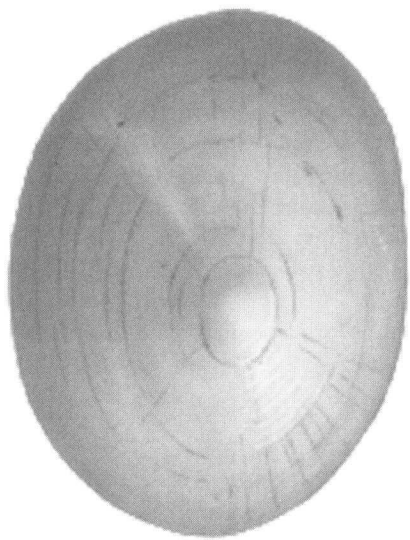


FIG. 208. *Laevapex fuscus.*

92b Shell subcircular, smooth, often encrusted with dark material. Apex in about middle of shell. Average length about 5.5 mm (Figs. 203, 209) .... **(cymbal ancylid)** *Laevapex diaphanus* (Haldeman 1841)

Occurs on rocks, cans, bottles, and sticks in slow-flowing streams in western parts of Florida and northward.

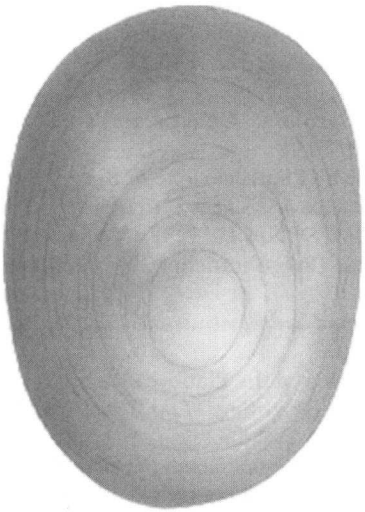


FIG. 209. *Laevapex diaphanus.*

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INDEX TO COMMON NAMES

INDEX TO SCIENTIFIC NAMES