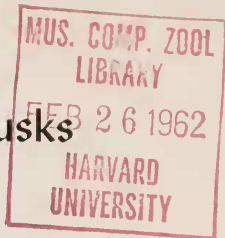


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A Catalogue of the Viviparidae of North America with Notes on the Distribution of *Viviparus georgianus* Lea

By WILLIAM J. CLENCH

The following catalogue is a list of genera and species in the Family Viviparidae for North America. The single Cuban species included is the only Recent species in the Americas which exists outside of North America.

Prashad (1928) has given an excellent review of this family, both recent and fossil, from a world standpoint.

No Recent species in this family are known from South or Central America. Two fossil species have been described, *Paludina araucaria* Philippi from the Tertiary of Chili and *Viviparus wichmanni* Duello-Juardo from the Upper Cretaceous of the Rio Negro area of Argentina.

In North America, various species in this family occur in rivers which drain into the Atlantic from northeast Mexico to the St. Lawrence River. Two oriental species, *V. malleatus* Reeve and *V. japonicus* v. Mts., were introduced into California prior to 1900 and have now become widespread, particularly in the north central and northeastern states.

The fossil history of this family in North America is rather extensive and it extends back at least to the Lower Cretaceous and possibly the Upper Jurassic (see Henderson, J., 1935). With few exceptions the fossil record centers in the region of the Rocky Mountains and the western plains from New Mexico north into northern Alberta.

It is questionable whether *Lioplax andersoniana* Hannibal (1912, p. 196) from the Eocene of Tesla, California is a *Lioplax*. It appears to be a smooth form of *Goniobasis*.

This present study brings together in one report all of the names employed in this important family of North American freshwater mollusks. Other than the genus *Lioplax*, no attempt has been made to monograph any genus in this family in North America since that of Tryon in 1870.

ACKNOWLEDGMENTS

I am most grateful to several curators for their kindness in loaning material in this family for this study. They are: R.T. Abbott, Juan Parodiz, Alan Solem, Ernest Roscoe, Arthur Clarke, Byron Leonard, Henry van der Schalie and H.A. Rehder. I am indebted to my colleagues, Merrill Champion, Richard Johnson and Ruth Turner for reading the manuscript and also for aid in many other ways.

ABBREVIATIONS

ANSP	Academy of Natural Sciences of Philadelphia
CM	Carnegie Museum
CNHM	Chicago Natural History Museum
MCZ	Museum of Comparative Zoology
NMC	National Museum of Canada
U of K	University of Kansas
U of M	University of Michigan
USNM	United States National Museum

***Viviparus georgianus* Lea**

Plate 44; Plate 45, figs. 1-2; Plate 46, fig. 3

Lymnaea vivipara 'Linne' Say 1817, Nicholson's Encyclopedia 2: [seventeenth page], pl. 2, fig. 5 (no locality given); non Linné 1758.

Paludina georgiana Lea 1834, Trans. American Philosophical Soc. (n.s.) 5: 116, pl. 19, fig. 85 (Hopeton, near Darien, Georgia).*

Paludina linearis 'Valenciennes' Küster 1852, Conchylien-Cabinet (2) 1, pt. 21, p. 19, pl. 4, fig. 4 (Simpson Creek Lake, East Florida).

Vivipara haldemanniana 'Shuttleworth' Frauenfeld 1862, Verh. K. K. Zool. Bot. Gesell. Wien, p. 1162 (Black Creek [Clay Co.] East Florida).

* Hopeton or Hopeton's Landing was about 10 to 15 miles up the Altamaha River from Darien, Georgia. This was a plantation landing and, like many others, was used when the larger rivers were the main source of transportation. Most place names of this type have long since disappeared.

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Vivipara contectoides W.G. Binney 1865, Smithsonian Misc. Collections, 100:144, pt. 3, p. 23, text figures 41-44 (Florida).

Vivipara georgiana fasciata Tryon 1870, Monograph of the Freshwater Univalve Mollusca of the United States, Philadelphia, p. 17 (no locality given [Florida]).

Vivipara georgiana altior Pilsbry 1862, Nautilus 5:142 (aboriginal shell heap, left bank Hitchen's Creek, near entrance of St. Johns River into Lake George, Florida).

Vivipara georgiana limnothuma Pilsbry 1895, Nautilus 8:116 (aboriginal shell-field, Hitchen's Creek [near entrance to St. Johns River into Lake George] and 2 fathoms, Lake George [Florida]).

Viviparus walkeri Pilsbry and Johnson 1912, Nautilus 26:48, pl. 3, figs. 6-7 (Juniper Creek, Lake Co., Florida).

Viviparus contectoides impolitus Pilsbry 1916, Nautilus 30:41 (in marsh, Paint Rock River, Jackson Co., Alabama).

Viviparus contectoides compactus Pilsbry 1916, Nautilus 30:42 (Dougherty, Georgia); non *compactus* Kobelt 1906.

Viviparus contectoides limi Pilsbry 1918, Nautilus 32:71 [new name for *V. compactus* Pilsbry 1916; non Kobelt 1906].

Viviparus contectoides goodrichi Archer 1933, Nautilus 47:19, pl. 3, figs. 1-3 (spring-fed stream, tributary of the Chipola River, 5 miles NE of Marianna, Jackson Co., Florida).

Description. Shell subglobose in outline and varying in size, large specimens reaching about 44 mm. (about $1\frac{3}{4}$ inches) in length, imperforate or with a narrow slitlike umbilicus. Usually rather thin in structure, but strong and smooth. Color yellowish or olivaceous green to dark brownish green, banded or uniform in color. Banded specimens usually have four dark reddish-brown bands about evenly spaced. Whorls 4 to 5, strongly convex and generally with a slight shoulder. Spire somewhat extended and produced at an angle of from 50° to 65° . Aperture ovate to subcircular. Outer lip thin, parietal lip consisting of a thickened glaze. Columella narrow and arched. Suture deeply indented. Sculpture consisting only of fine growth lines. Young specimens with a few spiral threads which eventually disappear as they grow older. Operculum corneous, thin, with concentric growth lines and a submarginal nucleus.

length	width	
44 mm.	35 mm.	Holotype, <i>V. goodrichi</i> Archer
26	19.5	Holotype, <i>V. georgianus</i> Lea
26	21	Lectotype, <i>V. limi</i> Pilsbry
33	21.5	Lectotype, <i>V. contectoides</i> Binney

Types. The holotype of *V. georgianus* Lea is in the United States National Museum, No. 106252. Type specimens of Tryon and Pilsbry are in the Academy of Natural Sciences, Philadelphia. The holotype of *V. contectoides goodrichi* Archer is in the Museum of Comparative Zoology. I do not know where the type specimens of *Paludina linearis* Küster and *Vivipara hal-demanniana* Frauenfeld are located.

The lectotype of *V. contectoides* Binney here selected is in the Museum of Comparative Zoology, No. 74393, from Florida. This is the specimen which was figured (page 23, no. 41) in Binney's Monograph. His substitute figure on p. 113 (fig. 224) was to show the four colored bands. His fig. 41 only shows three bands though the specimen does have four bands.

The statement that the European *V. viviparus* Linné has three bands and the North American *V. georgianus* Lea always has four bands is not true. Three-banded specimens of *V. georgianus* are rare but do exist in certain populations such as in the large series we obtained in the Richelieu River, 2 miles south of Iberville, Quebec. It is the lowermost band which may be absent. In other populations this band is frequently weak and even interrupted. Rarely all four bands are lacking.

Remarks. As far as can now be determined, the original distributional pattern of *V. georgianus* was from north central Florida, Georgia, Alabama and north, mainly in the Mississippi River system, to Illinois and northwest Indiana. It has invaded Ohio, Michigan, Wisconsin, Virginia, Pennsylvania, New York, New Jersey, New England and Quebec since 1867, the earliest dated record which we have been able to locate. In 1860 James Lewis* of Mohawk, New York published a

* James Lewis was a dentist who had resided in Mohawk, Herkimer Co., New York. He was an avid amateur conchologist and did much collecting in the area of central New York. His first collection was destroyed by fire but with the help of his friends and his own energy he shortly brought together an even larger collection. This collection was eventually bought by Bryant Walker of Detroit, Michigan and later went to the Museum of Zoology, University of Michigan. His very large duplicate series was purchased by A.E. Gray of Watertown, Mass. and later was given to the Museum of Comparative Zoology. Most, if not all, of the material Lewis obtained from eastern Tennessee was collected by Annie Law of Maryville, Tennessee. Somewhere in his letters or writings he stated that for every tooth he pulled at \$1.00 each he could pay Annie a dollar a day to collect shells for him.

Miss Annie Law was the daughter of a school teacher in Maryville, Tennes-

catalogue of the mollusks of that area. This *Viviparus* was not mentioned. In a copy of this catalogue which we have is a hand-written note by Lewis, stating "Deposited over 200 *Vivipara contectoides* (W.G.B.) in the Canal and River, Nov. 1867." Unfortunately, he made no mention from where he obtained the original 200 specimens of this species.

DeKay in 1843 in his Natural History of New York, lists *Paludina georgiana* Lea as "extra limital" which would indicate that no specimens of *V. georgianus* had been seen by him from anywhere within the state limits of New York at that time.

The first record for New England was published by C.W. Johnson (1916, p. 72). Specimens were collected in the pond in the Boston Public Gardens. A little later several colonies were obtained in areas near Boston and later from localities elsewhere in New England.

No specimens of any species of *Viviparus* were recorded by Winslow (1926, p. 18) for Michigan. It is possible that the few records which we now have from Michigan were introduced since 1926. It is important to realize that the mollusks from Michigan have been and still are better known than for any other state in the middle west. The state has had a long history of active collectors since 1839 when Dr. Abram Sagar published the first list of 76 species of Michigan mollusca.

Sterki, in his list of Ohio mollusca (1907) makes no mention of this species in Ohio. In the addition to this list (1914) he states: "A specimen is said to have been found in Sandusky Bay." We have not seen this specimen.

We have seen one large lot of *V. georgianus* from Cincinnati and two small lots from Covington, Kentucky which is opposite and across the Ohio River from Cincinnati. There are no specimens of this species in J.G. Anthony's collection, which is now in our possession. Anthony lived for many years in Cincinnati and should have found this species had it been there in 1850.

see. During the War between the States she was a dispatch rider for the South and thus became familiar with much of the mountainous country of southeastern Tennessee. After the war she collected quantities of land and freshwater mollusks which were sold or exchanged. Much of this material went to James Lewis and to John G. Anthony of Cincinnati who later became the first custodian of Mollusks at the Museum of Comparative Zoology.

A single specimen was recorded as *V. contectoides* by C.H. Chadwick (1906) from the Kinnikinnick River in Milwaukee Co., Wisconsin and Mr. Ernest Roscoe of the Chicago Natural History Museum has sent us specimens from Sunset Lake, Waupaca Co.

The most recent published record is that of E.L. Bousfield (1955) from several localities in the St. Lawrence River, all in Quebec Province. These he recorded as *Viviparus viviparus* Linné, believing the specimens to have been introduced from Europe. We have seen these specimens and they are *V. georgianus* Lea. We have also collected a large series of *V. georgianus* from the Richelieu River near Iberville, Quebec.

Probably most of the present records from Michigan, Ohio and east of these states have been chance introductions from the contents of discarded aquaria. *Viviparus* make excellent aquarium snails as they feed on the algae and thus aid in keeping the aquarium clean. This may also explain the spotted distribution of the oriental snails, *Viviparus malleatus* Reeve and *V. japonicus* v. Martens throughout many of the north-eastern states.

Specimens examined.

GREAT LAKES-ST. LAWRENCE RIVER SYSTEM

LAKE MICHIGAN DRAINAGE. *Wisconsin*: Sunset Lake, Waupaca, Waupaca Co. (CNHM). *Illinois*: Chicago River, Chicago; Wolf Lake; Calumet River, Chicago; Washington Park, Chicago, all Cooke Co. (all MCZ). Owosso, Shiawassee Co. (U of M). LAKE ERIE DRAINAGE. *New York*: Lake Erie, Dunkirk, Chautauqua Co. (MCZ); Oatka Creek, LeRoy, Genesee Co. (U of M); Lime Lake, Cattaraugus Co. (MCZ). LAKE ONTARIO DRAINAGE. *Ontario*: Green Bay, Hinchinbrook Twp. Frontenac Co. (NMC). *New York*: Silver Lake, 2 miles S of Perry, Wyoming Co.; Cazenovia Lake, Cazenovia, Madison Co. (all MCZ); Lower South Bay, Lake Oneida, Madison Co. (CM). LAKE CHAMPLAIN DRAINAGE. *Vermont*: Lake Bomoseen, Bomoseen, Rutland Co.; *Quebec*: Richelieu River, 2 miles S of Iberville (MCZ). ST. LAWRENCE RIVER DRAINAGE. *New York*: Claton, Jefferson Co. (MCZ). *Quebec*: Isle d'Orleans, St. Michel; St. Vallier (both MCZ); Montmagny West (NMC).

MYSTIC, CHARLES AND NEPONSET RIVER SYSTEMS

Massachusetts: Fresh Pond and Little Fresh Pond, Middlesex Co. (MCZ); Muddy River, Fenway, Boston; Pond, Public Gardens, Boston; Sargent's Pond, Brookline, all Suffolk Co.; Houghton's Pond, Milton, Norfolk Co. (all MCZ).

CONNECTICUT RIVER SYSTEM

Massachusetts: Forest Park, Springfield, Hampden Co. (S.L.H. Fuller).

HOUSATONIC RIVER SYSTEM

Connecticut: Lake Waramaug, Washington, Litchfield Co. (MCZ).

HUDSON RIVER SYSTEM

New York: Erie Canal, Frankfort and Mohawk, both Herkimer Co.; Amsterdam, Montgomery Co.; Glen Lake, Glen's Falls, Warren Co.; Lake Central Park; Prospect Park, Brooklyn, both New York Co. (all MCZ).

DELAWARE RIVER SYSTEM

New Jersey: Riverton, Burlington Co. (MCZ). *Pennsylvania:* Fairmont Park, Philadelphia (ANSP).

POTOMAC RIVER SYSTEM

Maryland: Potomac River, Great Falls and Chesapeake and Ohio Canal below lock at Seneca, both Montgomery Co. (both MCZ); Potomac River, Washington, D.C. (MCZ). *Virginia:* Hunter's Point near Alexandria; Little Hunting Creek, Potomac River, Mt. Vernon, all Fairfax Co. (all USNM).

ALTAMAHA RIVER SYSTEM

ALTAMAHA RIVER DRAINAGE. *Georgia:* Altamaha River, near Darien, McIntosh Co. (MCZ). OCMULGEE RIVER DRAINAGE. Oscewickee Springs, 10 miles S of Abbeville, Wilcox Co. (MCZ).

ST. JOHNS RIVER SYSTEM

Florida: Lake Jessup; Wekiva River, 15 miles NW of Winter Park; Lake Monroe; all Seminole Co.; Benson Springs; Lake Woodruff; Spring Garden Creek, near DeLeon Springs; all Vo-

usia Co.; Silver Springs; Oklawaha River, 2 miles E of Orange Springs; both Marion Co.; Silver Springs, Lake George; Lake George; both Putnam Co.; Juniper Creek; Alexander Spring Run; both Lake Co. (all MCZ).

WITHLACOOCHEE RIVER SYSTEM *

Florida: Withlacoochee River, 9 miles N of Dare City, Pasco Co.; Withlacoochee River, near Dunnellon, Marion Co. (both MCZ).

SUWANNEE RIVER SYSTEM

SANTA FE RIVER DRAINAGE. *Florida*: Poe Springs, Santa Fe River, 3 miles S of High Springs, Santa Fe River, High Springs; both Alachua Co.; Ichucknee River below the main spring, Columbia Co. (all MCZ). **WITHLACOOCHEE RIVER DRAINAGE.**

Georgia: Withlacoochee River, Olympia, Lowndes Co., Florida; Withlacoochee River, Blue Springs, Madison Co. (both MCZ).

SUWANNEE RIVER DRAINAGE. *Florida*: Suwannee River, Ellaville; Suwannee River at mouth of Withlacoochee River, both Madison Co.; Suwannee River below the mouth of Santa Fe River, Gilchrist Co.; Suwannee River, Oldtown, Dixie Co. (all MCZ).

STEINHATCHEE RIVER SYSTEM

Florida: Steinhatchee River, 9 miles E of Salem, Taylor Co. (MCZ).

OCHLOCKONEE RIVER SYSTEM

Florida: Lake Talquin, 1 mile NE of power plant, Leon Co. (MCZ).

APALACHICOLA RIVER SYSTEM

FLINT RIVER DRAINAGE. *Georgia*: Kiokee Creek, 15 miles SE of Dawson, Terrell Co.; Creek 6 miles W of Albany, Dougherty Co.; Keels Creek, 2.3 miles S of Leary, Calhoun Co.; Spring

* There are two rivers in Florida by this name. The northernmost has its origin in Fort Worth Co., Georgia and flows south to join the Suwannee River at Ellaville in Madison Co., Florida. The second Withlacoochee has its origin in northern Polk Co., Florida and flows northwest, entering the Gulf of Mexico about 15 miles southeast of Cedar Keys, Florida.

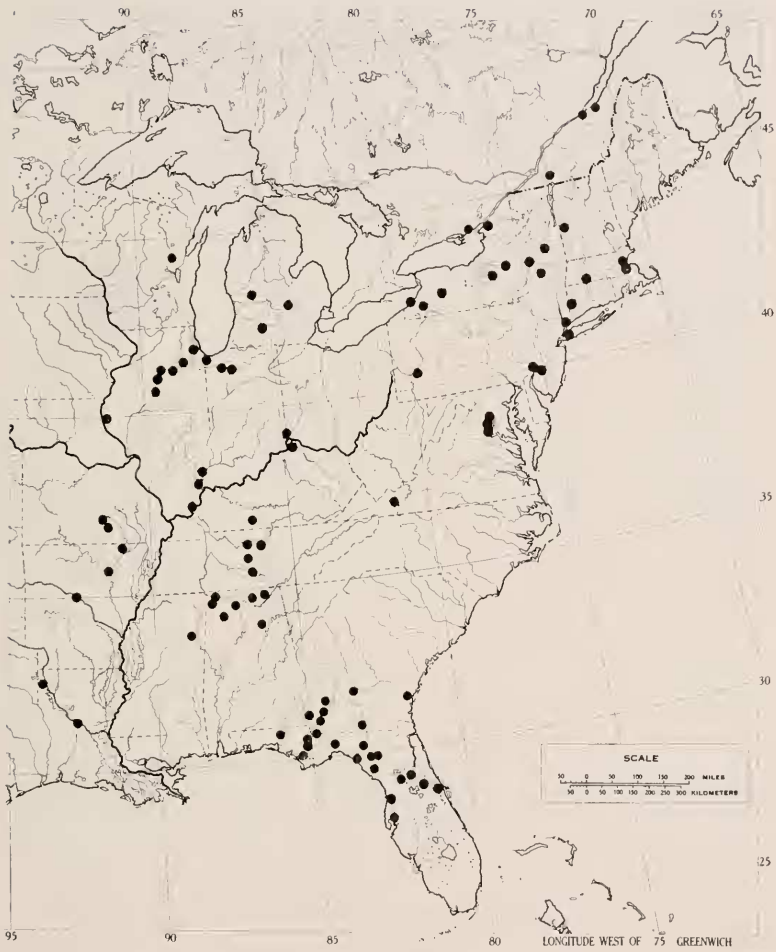


Plate 44

Viviparus georgianus Lea.

Present distribution of *V. georgianus* Lea based upon specimens examined.

Creek, Colquitt, Miller Co.; Spring Creek, Reynoldsville, Seminole Co.; Spring Creek, near Brinson; Four Mile Creek, 3 miles SW of Bainbridge; Paul Clark Spring, $2\frac{1}{2}$ miles W of Recovery; Sealeys Spring, 5 miles NW of Recovery; Shackelford Spring, 3 miles NW of Recovery; Blue Spring, $7\frac{1}{2}$ miles W of Recovery; all Decatur Co. (all MCZ). **CHIPOLA RIVER DRAINAGE.** *Florida:* Reedy Creek, 6 miles W of Malone; Big Creek, 8 miles W of Malone; 5 miles NE of Marianna; Chipola River, $5\frac{1}{2}$ miles West of Greenwood; all Jackson Co.; Chipola River, 2 miles E of Clarksville; Chipola River, Scotts Ferry; Dead Lake, Chipola Park; all Calhoun Co. (all MCZ).

CHOCTAWHATCHEE RIVER SYSTEM

Florida: Holmes Creek, 3 miles E of Bonifay, Holmes Co. (MCZ).

COOSA RIVER SYSTEM

COOSA RIVER DRAINAGE. *Alabama:* Big Canoe Creek, 7 miles ENE of Ashville; Rock Creek, Henry's Mill, $9\frac{1}{2}$ miles NE of Ashville, both St. Clair Co. (both H. Athearn). **BLACK WARRIOR DRAINAGE.** *Alabama:* West Fork, Sipsey River, 4 miles W of Grayson, Winston Co. (H. Athearn). **TOMBIGBEE RIVER DRAINAGE.** *Mississippi:* Tibbee, Clay Co. (USNM).

MISSISSIPPI RIVER SYSTEM

MISSISSIPPI RIVER DRAINAGE. *Illinois:* Quincy, Adams Co. (MCZ). **ILLINOIS RIVER DRAINAGE.** *Indiana:* Bass Lake, Starke Co. (MCZ). *Illinois:* Des Plaines River, Cook Co.; Kankakee River, Kankakee Co.; Morris, Grundy Co.; canal at Utica and Illinois Rivers, Peru, both LaSalle Co.; Lake Senachwine, Putnam Co.; Peoria Lake, Peoria Co. (all MCZ). **WHITE RIVER DRAINAGE.** *Missouri:* Current River; Jack Forks; Spring Valley Branch, all Shannon Co. (all MCZ and U of K). *Arkansas:* New Port, Jackson Co. (MCZ); Spring River, Black Rock, Lawrence Co. (USNM). **ARKANSAS RIVER DRAINAGE.** Fourche, Perry Co. (USNM and U of K). **RED RIVER DRAINAGE.** *Louisiana:* Frierson's Mill, DeSoto Parish; Alexandria, Rapides Parish (both USNM). **WABASH RIVER DRAINAGE.** *Indiana:* Lake Maxinkuckee, Culver, Marshall Co.; Tippecanoe River, 5 miles SW of Pulaski, Pulaski Co. (both U of M); Foot's gravepond, Gibson Co. (CM); Wabash River at old dam, S of New Har-

mony, Posey Co. (U of M). *Illinois*: Mt. Carmel, Wabash Co.; Little Fox River, White Co. (both MCZ). KANAWHA RIVER DRAINAGE. *Virginia*: Fish Hatchery, Wytheville, Wythe Co. (USNM). GREEN RIVER DRAINAGE. *Kentucky*: Bowling Green, Warren Co. (U of M). CUMBERLAND RIVER DRAINAGE. *Tennessee*: Lebanon, Wilson Co. (USNM); Cumberland River, Nashville, Davidson Co. (U of M); Stone's River; Murphreesboro, Rutherford Co. (MCZ and ANSP). TENNESSEE RIVER DRAINAGE: *Alabama*: pond, Paint Rock River, Jackson Co.; outlet, Brym Spring, Huntsville; Byrd Spring Lake, 5 miles S of Huntsville; Flint River, 7 miles W of New Hope, all Madison Co.; Swan Lake; Flint Creek, 3 miles NW of Hartsville and Tennessee Rivers, Decatur, all Morgan Co.; Swan Creek, 5 miles N of Decatur and 1 mile S of Athens, both Limestone Co.; ditch near Mussel Shoals Canal, Lauderdale Co.; creek near Great Spring, Tusculumbia, Colbert Co. (all MCZ). *Tennessee*: Shelbyville, Bedford Co. (MCZ). OHIO RIVER DRAINAGE. *Pennsylvania*: Pittsburgh, Allegheny Co. (CM). *Ohio*: Cincinnati, Hamilton Co. (CM); Newton, Hamilton Co. (U of M). *Kentucky*: Covington, Kenton Co. (CM). *Illinois*: Ohio River, Elizabethtown, Hardin Co. (MCZ).

Tulotoma Haldeman

Tulotoma Haldeman 1840, Supplement to a Monograph of the Freshwater Univalve Mollusca of the United States, Philadelphia, p. 2.

Tylotoma 'Haldeman' Fischer 1885, Manuel de Conchyliologie, p. 734 [emendation for *Tulotoma Haldeman*].

Type species, *Paludina magnifica* Conrad, subsequent designation, Walker 1918, Univ. of Michigan, Mus. of Zool., Misc. Publication no 6, p. 26.

Tulotoma magnifica Conrad

Plate 45, fig. 4; Plate 46, fig. 4

Paludina magnifica Conrad 1834 (May), New Fresh Water Shells of the United States, Philadelphia, p. 48, pl. 8, fig. 4 (Alabama River, Claiborne, Alabama).

Paludina bimonilifera Lea 1834 (Sept.), Trans. American Phil. Soc. (N.S.) 5:58, pl. 19, fig. 71; 1834, Observations on the Genus Unio 1:170, pl. 19, fig. 71 (Alabama River, Alabama).

Paludina angulata Lea 1841, Proc. American Phil. Soc. 2:83; 1841, Trans.

American Phil. Soc. 9:22; 1848, Observations on the Genus *Unio* 4:22 (Coosa River, Alabama).

Paludina coosaensis Lea 1841, Proc. American Phil. Soc. 2:83; 1841, Trans. American Phil. Soc. 9:23; 1848, Observations on the Genus *Unio* 4:23 (Coosa River, Alabama).

Remarks. *Tulotoma magnifica* is limited to the Coosa-Alabama River system in Alabama. This species prefers rocks and rock ledges and at one time probably lived throughout much of this river system wherever suitable conditions occurred. Heavy silting in this river during the past century has killed most of the populations of this species. Dr. van der Schalie and I failed to find it at Claiborne in 1933, at the type locality where Conrad found it "occurring in vast abundance on the masses of calcareous rock, which have fallen from the strata above into the Alabama River at Claiborne."

It is impossible to say that its former distribution included the large tributaries of the Coosa-Alabama system, that is, the Tombigbee and Black Warrior Rivers. Specimens of *Tulotoma magnifica* have been found in Indian burial sites at Moundville on the Black Warrior, but these burial sites also contained *Io fluviialis* Say, a genus occurring only in the Tennessee River system from Bridgeport, Alabama and north into its various tributaries. These Moundville specimens of *Tulotoma* may well have been items of trade as was the case with *Io*.

Specimens examined. *Alabama:* Big Canoe Creek, 9½ miles NE of Ashville, St. Clair Co. (H.D. Athearn); Coosa River, Fort William Shoals; Choccolocco Creek, 1 mile NW of Eureka, both Taladega Co. (both MCZ); Coosa River, mouth of Yellow River, Chilton Co. (MCZ); Coosa River, Wetumka, Elmore Co. (MCZ); Alabama River, Claiborne, Monroe Co. (MCZ).

Catalogue of the North American Viviparidae

Family VIVIPARIDAE

Shell medium to large (10 to 15 mm.), globose to globose-turbinata, imperforate to subimperforate, green to greenish-black in color and banded or unicolored. Operculum corneous. Respiration by means of gills.

Some recent members of this family are found on all continents other than Central and South America.

The specific and subgeneric names in this catalogue are arranged alphabetically under the genera to which they are now known to belong.

Key to the Genera of the Viviparidae *

1. Operculum wholly concentric 3
2. Operculum with a subspiral nucleus *Lioplax*
3. Reflected apices of the lateral teeth of radula
simple *Campeloma*
4. Reflected apices of the lateral teeth of radula
denticulate 5
5. Inner margin of the operculum simple *Viviparus*
6. Inner margin of the operculum reflected, forming
an elevated marginal fold *Tulotoma*

Campeloma Rafinesque

Plate 45, fig. 6; Plate 46, fig. 2

? *Ambloxis* Rafinesque 1818, American Monthly Magazine 3:355 (*A. eburnea* Raf. and *A. ventricosa* Raf. [both are nomina nuda]).

Campeloma Rafinesque 1819, Jour. de Physique de Chimie d'Histoire Naturelle, Paris, 88:423 (type species, *C. crassula* Raf., monotypic).

Melantho Bowditch 1822, Elements of Conchology, Paris, p. 27, pl. 6, fig. 15 (no locality given and no species cited).

Amblostoma Rafinesque 1865 [in] Binney, Land and Freshwater Shells of North America, pt. 3. Smithsonian Misc. Collections, No. 144, p. 46 [is a synonym of *Ambloxis* Raf. with the same type species. *A. eburnea* Raf. 1865, subsequent designation Pilsbry 1917].

Lymnulus Rafinesque 1865 [in] Binney, *ibid.* p. 46. [Is a synonym of *Ambloxis* Raf. with the same type species *A. eburnea* Raf. 1865, subsequent designation, Pilsbry 1917.]

Remarks. I fail to understand why Pilsbry (1917, p. 113) attempted to substitute *Ambloxis* Raf. 1818 for *Campeloma* Raf. 1819. Both genera are poorly defined. Rafinesque gave two names, *eburnea* Raf. and *ventricosa* Raf. under *Ambloxis*, both of which are nomina nuda. Under *Campeloma*, Rafinesque at least defined the species *crassula*, though in very limited terms, but I think sufficient to be recognized as a *Campeloma*.

* Modified after Walker, 1918, p. 24, for North America.

Plate 45

Radulae

Fig. 1. *Viviparus georgianus* Lea, Glen Lake, Glens Falls, New York.

Fig. 2. *Viviparus georgianus* Lea, Chipola River, Scotts Ferry, Calhoun Co., Florida.

Fig. 3. *Viviparus intertextus* Say, Little Ochoopee River, 2 miles N of Kite, Johnson Co., Georgia.

Fig. 4. *Tulotoma magnifica* Conrad, Coosa River, Wetumpka, Elmore Co., Alabama.

Fig. 5. *Lioplax pilsbryi* Walker, Chipola River, 2 miles E of Clarksville, Florida.

Fig. 6. *Campeloma lima* Anthony. Ochwalkee Creek, 2 miles E of Glenwood, Montgomery Co., Georgia.

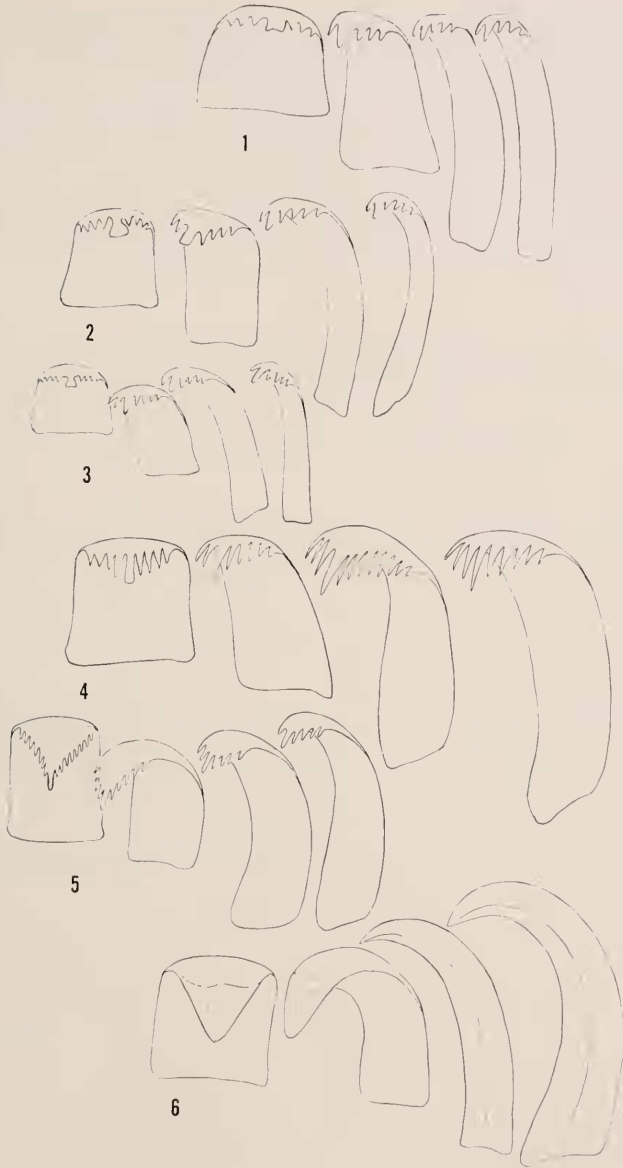


Plate 45

In the next paragraph Pilsbry completely reversed his logic by stating "*Omphiscola* Raf., No species mentioned. Under opinion 46 of the International Commission, no type can be selected for this genus, since no species 'can be recognized from the original generic publication.'" This is exactly true for *Ambloxis* as the two names mentioned are nomina nuda.

The generic name *Campeloma* has been in general use for nearly one hundred years, while *Ambloxis* has never been used, other than casually mentioned as being possibly the same as *Campeloma*.

In 1865, W.G. Binney published portions of Rafinesque's manuscript "Conchologia Ohioensis." Two crude figures are reproduced (figs. 91 and 92). Binney states: "I find rough figures of *Melantho decisa* under the name of *Ambloxis*, *Amblostoma*, or *Lymnulus major* Rafinesque or *Lymnea eburna* Rafinesque. All these names are given and I find it impossible to decide which was the one finally fixed upon or to decipher more of the description than the following: 'Whorls 5, last very large, form obtuse oval, aperture obtuse oval, lip thickened within, columella covered with callus (Rafinesque).'"

Through the kindness of Dr. A.H. Clarke we have what may prove to be the most northern record for *Campeloma*. Specimens of *C. decisum* Say were collected by Dr. Clarke in August 1960 in the Bousquet River (Ottawa-St. Lawrence River System) approximately 20 miles east of Rouyn, Quebec (approximately 48° N; 70° W). No specimens of *Campeloma* were found in streams draining into Hudson Bay.

The genus *Campeloma* is widespread in North America from the Mississippi River system east to the Atlantic States and north into Ontario and Quebec.

It occurs in lakes, rivers and small streams, usually buried an inch or more in sand or mud, sometimes in great numbers. The various species feed on detritus, mainly on dead plant material and occasionally on dead animal matter. All species are ovoviviparous.

On a specific level, probably few genera among our North American freshwater mollusks are in a more confused state. The answer to this condition is fairly simple, as there are but few morphological characters upon which specific differentiation can be made and these few characters differ only in de-

gree. As a consequence it has been easier to add a "new species" rather than attempt to fit a given series of specimens under an older name.

When a large series is studied and an attempt made to group the individual lots by river systems a specific pattern does emerge. This may be a realistic rather than a completely biological approach to this problem but some semblance of order can be made by this approach. In this way, at least, a host of names, many in present use, can be relegated to the synonymy of older names.

brevispirum F.C. Baker, **Campeloma**: 1928, Bull. 70, pt. 1, Wisconsin Geological and Natural History Survey, p. 74, pl. 5, figs. 13-18 (Mirror Lake, Sauk Co., Wisconsin). [Holotype, Univ. of Wisconsin 4573.]

coarctata 'Lea' Binney, **Melantho**: 1865, Land and Freshwater Shells of North America, pt. 3, Smithsonian Misc. Collections, no. 144, p. 52, fig. 106. [Is *C. exilis* Anthony.]

coarctata Lea, **Paludina**: 1843, Proc. American Phil. Soc. 2:243; 1844, Trans. American Phil. Soc. 9:30; 1848, Observations on the Genus Unio 4:30 (Alabama). [Is *C. regulare* Lea. Types USNM 106311.]

compressa 'Lewis' Binney, **Paludina**: 1865, Land and Fresh-Water Shells of North America, pt. 3, Smithsonian Misc. Collections, no. 144, p. 53 (Jackson, Mississippi). [Nomen nudum.]

cornea Valenciennes, **Paludina**: 1827 [in] Humboldt and Bonpland, Recueil D'Observation de Zoologie 2:255 (Delaware River). [Is *C. decisum* Say.]

crassa Deshayes, **Ampullaria**: 1830, Encyclopédie Méthodique 2:32 (Ohio and most of the North American rivers). [Is *C. crassula* Raf.]

crassula Rafinesque, **Campeloma**: 1819, Journal de Physique de Chimie d'Histoire Naturelle, Paris 88:423 (The Ohio).

decampi 'Currier' Binney, **Melantho**: 1865, American Jour. Conchology 1: 49, pl. 7, fig. 1 (Huntsville or Stevenson, Alabama [Decatur, Alabama]). [See Clench and Turner 1955. Lectotype MCZ 189656, paratypes MCZ and USNM.]

decapitata Anthony, **Paludina**: 1860, Proc. Acad. Nat. Sci. Philadelphia, p. 71 (Tennessee). [The original label of Anthony has only a question mark for the locality. The specimen appears to be identical to a young *Campeloma regulare* Lea from the Coosa River system in Alabama. [Holotype MCZ 161888.]

decisa Say, **Limnaea**: 1816, Nicholson's Encyclopedia, ed. 1 [no pagination], pl. 2, fig. 6 [Delaware River?].

dissecisa DeKay, **Paludina**: 1843, Zoology of New York 5:84, pl. 6, figs. 131a-b, pl. 7, fig. 134 (New York State). [Emendation for *decisa* Say.]

- dissimilis** Wood, **Helix**: 1828, Index Testaceologicus, Supplement, p. 21, pl. 7, fig. 18a (no locality given). [Is *C. decisum* Say.]
- eburnea** Rafinesque, **Ambloxis**: 1818, American Monthly Magazine **3**:355 (Ohio River). [Nomen nudum.]
- eburnea** Rafinesque, **Lymnaea**: 1865 [in] W.G. Binney, Land and Fresh-Water Shells of North America, pt. 3. Smithsonian Misc. Collections, no. 144, p. 45, fig. 92 (Ohio River). [Is *C. crassula* Raf.]
- exilis** Anthony, **Paludina**: 1860, Proc. Acad. Nat. Sci. Philadelphia, 71 (Mississippi). [Holotype MCZ 161885.]
- fecunda** Lewis, **Melantho**: 1868, American Jour. Conchology **4**:135 (Ohio). [Nomen nudum.]
- flava** 'Currier' Walker, **Campeloma decisum**: 1893, Nautilus **6**:138 (Long Lake, Grand Traverse Co., Michigan). [Nomen nudum.]
- floridense** Call, **Campeloma**: 1886, Bull. Washburn College Laboratory **1**: 159, pl. 6, fig. 7 (Florida [Wekiva River, Orange Co.]). [See Clench and Turner 1956, p. 116. Lectotype MCZ 189592.]
- genicula** Conrad, **Paludina**: 1834, New Fresh Water Shells of the United States, Philadelphia, p. 48, pl. 8, fig. 3 (Flint River, Georgia). [Holotype ANSP 29199.]
- geniculiforme** Pilsbry, **Campeloma rufum**: 1916, Nautilus **30**:42 (Dooly Co., Georgia). [Is *C. geniculum* Conrad. Holotype ANSP 122782.]
- gibba** Currier, **Melantho**: 1867, American Jour. Conchology **3**:112, pl. 6, fig. 3 (Grattan, Michigan). [Types ANSP.]
- heros** DeKay, **Paludina**: 1843, Zoology of New York **5**:85, pl. 7, figs. 132a-b (Walcott Creek, Wayne Co., New York). [Is *C. decisum* Say.]
- heterostropha** Kirtland, **Paludina**: 1838, Second Annual Report on the Geological Survey of the State of Ohio, Columbus, p. 200 (Mahoning River, Trumbull Co., Ohio) [nomen nudum]; Kirkland [in] Tappan 1839, The American Jour. Science and Arts **35**:269, pl. 3, fig. 2 (Mill and Yellow Creeks, Mahoning River, Ohio). [Is *C. crassula* Raf.]
- humerosa** Anthony, **Paludina**: 1860, Proc. Acad. Nat. Sci. Philadelphia, p. 71 (Alabama [Tennessee River]). [Is *Lithasia verrucosa* Raf. Holotype MCZ 72332.]
- incrassata** Lea, **Paludina**: 1842 [1843], Proc. American Phil. Soc. **2**:243; 1844, Trans. American Phil. Soc. **9**:30; 1848, Observations on the Genus Unio **4**:30 (Alabama). [Is *C. regulare* Lea. Types USNM 106308.]
- integra** Say, **Paludina**: 1821, Jour. Acad. Nat. Sci. Philadelphia **2**:174 (Inhabits waters of the Missouri).
- leptum** Mattox, **Campeloma**: 1940, Nautilus **54**:12, pl. 1, figs. 1-3 (Mill pond near St. Thomas, Ontario). [Paratypes MCZ 144538; ANSP 176688.]
- lewisii** Walker, **Campeloma**: 1915, Nautilus **28**:126, pl. 5, fig. 3 (Yallahusha River, Grenada, Mississippi). [Is *C. exile* Anthony.]

- lima** Anthony, **Paludina**: 1860, Proc. Acad. Nat. Sci. Philadelphia, p. 70 (South Carolina). [Holotype MCZ 161887.]
- limosa** 'Say' Valenciennes, **Paludina**: 1827 [in] Humboldt and Bonpland, Recueil D'Observation de Zoologie **2**:253 (no locality given). [Is *C. decisum* Say.]
- major** Rafinesque, **Lymnulus**: 1865 [in] W.G. Binney, Land and Fresh-Water Shells of North America. pt. 3. Smithsonian Misc. Collections No. 144, p. 42: 46. [Nomen nudum.]
- melanostoma** 'Currier' Walker, **Campeloma decisa**: 1893, Nautilus **6**:138 (Grattan, Michigan). [Nomen nudum.]
- melanostoma** 'Currier' Walker, **Melantho decisa**: 1879, Jour. of Conch. **2**: 332. [Nomen nudum.]
- meridionale** Pilsbry, **Campeloma rufum**: 1916, Nautilus **30**:42 (Little Sugar Creek; Crozier's Branch, Cabarras Co., North Carolina). [Is *C. lima* Anthony. Holotype ANSP 122781.]
- microstoma** Kirtland, **Paludina**: 1838, Second Annual Report on the Geological Survey of the State of Ohio, Columbus, p. 200 (Ohio). [Nomen nudum.]
- milesii** Lea, **Paludina**: 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 156; 1866, Jour. Acad. Nat. Sci. Philadelphia **6**:184, pl. 24, fig. 144; 1866, Observations on the Genus Unio **1**:140, pl. 24, fig. 144 (Branch Lake, Antrim Co., Michigan). [Types USNM 106149.]
- nolani** Tryon, **Vivipara**: 1870, Monograph of the Fresh-Water Univalve Mollusca of the United States, Philadelphia, p. 25, pl. 12, figs. 10-11 (Coosa River, Alabama). [Is *C. regulare* Lea.]
- obesa** Lewis, **Melantho**: 1868, American Jour. Conchology **4**:134 (Ohio Canal, Columbus, Ohio). [Nomen nudum.]
- obesa** 'Lewis' Tryon, **Vivipara**: 1870, Monograph of the Freshwater Univalve Mollusca of the United States, Philadelphia, p. 25, pl. 13, fig. 6 (Ohio, Michigan, western New York). [Is *C. crassula* Raf.]
- obesum** 'Lewis' Binney, **Paludina**: 1865, Land and Fresh-Water Shells of North America, pt. 3. Smithsonian Misc. Collections No. 144, p. 47, text fig. 95 (Mohawk, New York, Ohio and Michigan). [Is *C. crassula* Raf.]
- ovularis** Menke, **Melania**: 1830, Synopsis Methodica Molluscorum, 2nd. ed., p. 134 (Cincinnati, Ohio). [Is *C. crassula* Raf.]
- ponderosa** Say, **Paludina**: 1821, Jour. Acad. Nat. Sci. Philadelphia **2**:173 (Ohio River). [Is *C. crassula* Raf.]
- regularis** Lea, **Paludina**: 1841, Proc. American Phil. Soc. **2**:34; 1844, Trans. American Phil. Soc. **9**:13; 1848, Observations on the Genus Unio **4**:13 (Ohio? [Coosa River, Alabama]). [Types USNM 118409.]
- rufa** Haldeman, **Paludina**: 1841, Monograph of the Freshwater Univalve Mollusca of the United States, Philadelphia, p. 3 of cover of no. 3, pl. 3, fig. 1 (Ohio). [Is *C. crassula* Raf. Holotype ANSP 8492.]

- spillmanii** Lea, **Paludina**: 1867, Proc. Acad. Nat. Sci. Philadelphia, p. 61; 1868, Jour. Acad. Nat. Sci. Philadelphia **6**:343, pl. 54, fig. 29, 1868, Observations on the Genus Unio **12**:103, pl. 54, fig. 29 (Jackson Co., Alabama). [Is *C. decampi* Binney. See Clench and Turner 1955, p. 18. Lectotype USNM 121433, paratypes USNM and MCZ.]
- subsolida** Anthony, **Paludina**: 1844, Proc. Acad. Nat. Sci. Philadelphia **2**: 161 (Ohio). [Nomen nudum.]; 1860, Proc. Acad. Nat. Sci. Philadelphia, p. 71 (Illinois). [Is *C. crassula* Raf. Holotype MCZ 161882.]
- tannum** Mattox, **Campeloma**: 1940, Nautilus **54**:15, pl. 1, figs. 4-6 (Speed River, near Hespeler, Ontario). [Paratypes MCZ 144537; ANSP 176687.]
- ventricosa** Rafinesque, **Ambloxis**: 1818, American Monthly Magazine **3**: 355 (Ohio River). [Nomen nudum.]
- ventricosa** Rafinesque, **Lymnula**: 1865 [in] W.G. Binney, Land and Fresh-Water Shells of North America, pt. 3. Smithsonian Misc. Collections, no.144. p. 45, fig. 91 (Ohio River). [Is *C. crassula* Raf.]

Lioplax Troschel*

Plate 45, fig. 5; Plate 46, fig. 1

See Clench and Turner 1955, in this series, **2**:1-20 for a monographic study of this genus. We here list, however, the species and their synonyms.

- bicarinata** 'Say' Potiez and Michaud, **Paludina**: 1836, Galerie des Mollusques, Paris, **1**:249, pl. 25, figs. 17-18 (La Delaware, rivière de l'Amérique septentrionale). [Is *L. subcarinata* Say.]
- choctawhatchensis** Vanatta, **Lioplax pilsbryi**: 1935, Nautilus **49**:66, Horseshoe Lake, Choctawhatchee River, Washington Co., Florida). [Is *L. pilsbryi* Walker. Holotype ANSP 162240.]
- contorta** 'Shuttleworth' Küster, **Paludina**: 1852, Conchylien-Cabinet (2) **1**: pt. 21a, p. 20, pl. 4, figs. 7-9 (Alabama). [Is *L. cyclostomaformis* Lea.]
- cyclostomaformis** Lea, **Paludina**: 1841, Proc. American Phil. Soc. **2**:83 (Coosa River, Alabama). [Lectotype USNM 106307.]
- cyclostomatiformis** Lea, **Paludina**: 1844, Trans. American Phil. Soc. **9**:23 (Coosa River, Alabama). [Is an emendation for *cyclostomaformis* Lea.]
- elliottii** Lea, **Paludina**: 1858, Proc. Acad. Nat. Sci., Philadelphia, p. 106 (Othcalooga [Oothkalooga] Creek, Bartow Co., Georgia). [Is *L. cyclostomaformis* Lea. Lectotype USNM 106260, paratypes USNM and MCZ.]
- occidentalis** Pilsbry, **Lioplax subcarinata**: 1935, Nautilus **48**:143 (Cincinnati, Ohio). [Is *L. sulculosa* Menke. Holotype ANSP 123539, paratype MCZ.]
- pilsbryi** Walker, **Lioplax**: 1905, Nautilus **18**:133, pl. 9, figs. 1-3 (Chipola River, Florida). [Lectotype Univ. of Michigan, paratypes MCZ.]

* See page 288 also.

subcarinata Say, **Limnaea**: 1817, British Encyclopedia, American Edition by William Nicholson, 1st ed. **2** [4:17], pl. 1, fig. 7 (Delaware River, Pennsylvania). [Lectotype MCZ 189709.]

sulculosa Menke, **Paludina**: 1828, Synopsis Methodica Molluscorum, p. 80 (Ohio River, Cincinnati, Ohio).

wisconsinensis F.C. Baker, **Lioplax subcarinata**: 1928, Bull. 70, pt. 1, Wisconsin Geological and Natural History Survey, p. 50, pl. 3, figs. 1-9 (Fox River, Brown Co., Wisconsin). [Is *L. sulculosa* Menke. Holotype Univ. of Wisconsin 437.]

Tulotoma *Conrad*

Plate 45, fig. 4; Plate 46, fig. 4

See page 271 of present study for remarks on this genus.

angulata Lea, **Paludina**: 1841, Proc. American Phil. Soc. **2**:83, 1841, Trans. American Phil. Soc. **9**:22; 1848, Observations on the Genus *Unio* **4**:22 (Coosa River, Alabama). [Is *T. magnifica* Conrad. Types USNM 121075.]

bimonilifera Lea, **Paludina**: 1834 [Sept.] Trans. American Phil. Soc. (N.S.) **5**:58, pl. 19, fig. 71; 1834, Observations on the Genus *Unio* **1**:170, pl. 19, fig. 71. (Alabama River, Alabama). [Is *T. magnifica* Conrad. Types USNM 106263.]

coosaensis Lea, **Paludina**. 1841, Proc. American Phil. Soc. **2**:83, 1841, Trans. American Phil. Soc. **9**:23; 1848, Observations on the Genus *Unio* **4**:23 (Coosa River, Alabama). [Is a young specimen of *T. magnifica* Conrad. Types USNM 117818.]

magnifica Conrad, **Paludina**: 1834 [May], New Fresh Water Shells of the United States, Philadelphia, p. 48, pl. 8, fig. 4 (Alabama River, Claiborne, Alabama).

Viviparus *Denys de Montfort*

Plate 45, figs. 1-3; Plate 46, fig. 3

Viviparus Denys de Montfort 1810, Conchyliologie Systématique **2**:247 [type species, *V. fluviatorum* Mont. (= *Helix vivipara* Linné) original designation].

Paludina Lamarck 1812 [in] Férussac, Ann. du Muséum d'Hist. Nat. Paris **19**:253 [type species, *Helix vivipara* Linné].*

Vivipara J. Sowerby 1813, Mineral Conchy. **1**:75.

Viviparella Rafinesque 1815, Analyse de la Nature, Palerme, p. 144 [a substitute name for *Viviparus*. Type species, *Helix vivipara* Linné, subsequent designation, Pilsbry 1917].

The genus *Viviparus* is found on portions of all continents other than Central and South America, though fossil species

* *Paludina* Lamarck has been used as a generic name for species in the four genera of North America Viviparidae. The type species, *Helix vivipara* Linné, limits it as a synonym of *Viviparus* Montfort, both having the same type species.

are recorded for South America. In North America, various species occur in drainage systems of the Gulf States and north to the St. Lawrence River System. No recent species occurs on the Pacific slope other than *V. malleatus* Reeve and *V. japonicus* v. Martens, both having been introduced from the Orient.

Most species in this genus prefer quiet waters of lakes, ponds, sluggish streams and rivers where there is a muddy substrate and plant cover. Their more restricted ecological requirements make the various species far less abundant than *Campelema* which has a much wider ecologic range. *Viviparus*, however, can be exceedingly abundant where the proper conditions exist.

altior Pilsbry, **Vivipara georgiana**: 1892, Nautilus **5**:142 (aboriginal shell heap, left bank Hitchen's Creek, near entrance of St. Johns River into Lake George, Florida). [Is *V. georgianus* Lea. See Clench and Turner 1956, p. 109. Holotype ANSP and paratypes MCZ 78391.]

bermondiana d'Orbigny, **Paludina**: 1842 [in] Ramon de la Sagra, Hist. de L'Ile de Cuba, Mollusques **2**:7, pl. 10, fig. 5 (Cuba. [Rio Hanábana, Cienega de Zapata, Las Villas]).

Callina Hannibal [subgenus]: 1912, Proc. Malac. Soc. London **10**:193, non Lowe 1855 (type species, *Paludina intertexta* Say).

Callinina Thiele: 1931, Handbuch der Systematischen weichtierkunde **1**:747 (index) [new name for *Callina* Hannibal 1912, non Lowe 1855].

carinata Valenciennes, **Paludina**: 1827 [in] Humboldt and Bonpland, Recueil D'Observations de Zoologie **2**:252, pl. 56, figs. 2a-b (Mexico); non Swainson 1822; Menke 1829. [This is a synonym of *V. costatus* Quoy and Gaimard from northern Celebes, Indonesia. See v. Martens 1890, p. 426.]

contectum Millet, **Cyclostoma**: 1813, Moll. Maine et Loire, p. 5. [Is a synonym of *V. viviparus* (Linné). North American references to this species are misidentifications for *V. georgianus* Lea.]

Cipangopaludina Hannibal [subgenus]: 1912, Proc. Malac. Soc. London **10**: 194 (type species, *Paludina malleata* Reeve).

compactus Pilsbry, **Viviparus contectoides**: 1916, Nautilus **30**:42 (Dougherty [Co?] Georgia, also Chetachee Creek, Alabama). [Is *V. georgianus* Lea, Clench and Turner 1956, p. 109; non *V. compactus* Kobelt 1906. Holotype ANSP 27731.]

contectoides Binney, **Vivipara**: 1865, Smithsonian Misc. Collections No. 144, pt. 3, p. 23. figs. 41-44; 224 (Florida, Georgia, South Carolina, Alabama, Arkansas, Missouri, Illinois, Indiana and Michigan). [Lectotype MCZ 74393. Paratypes USNM 27756.]

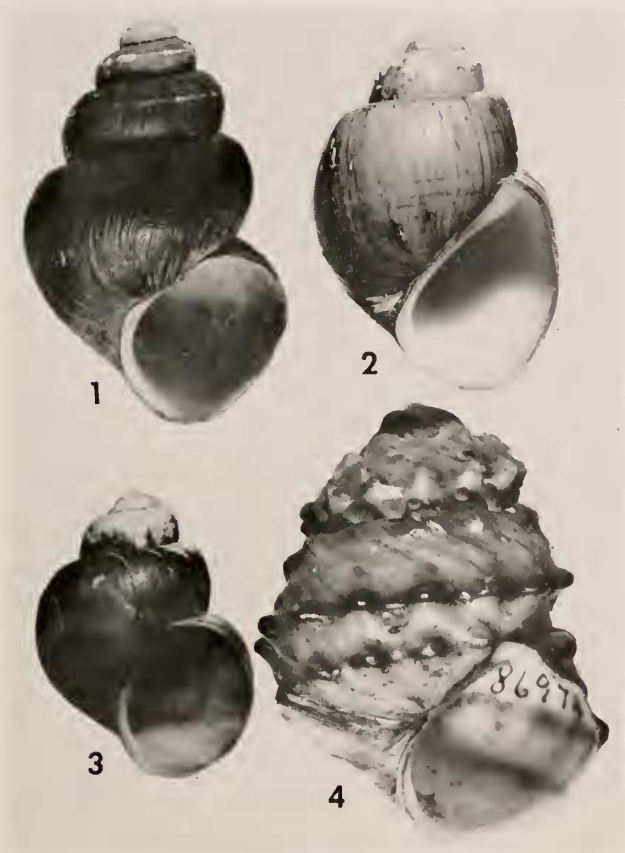


Plate 46

Fig. 1. *Lioplax pilsbryi* Walker, Chipola River, Florida, Lectotype, Univ. of Michigan (1.8 \times).

Fig. 2. *Campeloma geniculum* Conrad, Flint River, Bainbridge, Decatur Co., Georgia. MCZ no. 190336 (1.4 \times).

Fig. 3. *Viviparus georgianus* Lea, Hopeton, near Darien, McIntosh Co., Georgia. Lectotype USNM no. 106252 (1.4 \times).

Fig. 4. *Tulotoma magna* Conrad, Alabama River, Claiborne, Monroe Co., Alabama. MCZ no. 86974 (about 2 \times).

- georgiana** Lea, **Paludina**: 1834, Trans. American Phil. Soc. (NS) **5**:116, pl. 19, fig. 85 (Hopeton, near Darien, Georgia). [Holotype USNM 106252, paratype MCZ 186792.]
- goodrichi** Archer, **Viviparus contectoides**: 1933, Nautilus **47**:19, pl. 3, figs. 1-3 (spring-fed stream, tributary of the Chipola River, 5 miles NE of Marianna, Jackson Co., Florida). [Is *V. georgiana* Lea, Clench and Turner 1956, p. 109. Holotype MCZ 92432.]
- fasciata** Tryon, **Vivipara georgiana**: 1870, Monograph of the Fresh-Water Univalve Mollusca of the United States, Philadelphia, p. 17 (no locality given [Florida]). [Is *V. georgianus* Lea.]
- haldemanniana** 'Shuttleworth' Frauenfeld, **Vivipara**: 1862, Verh. K.K.Zool. Bot. Gesell. Wien, p. 1162 (Black Creek [Clay Co.], east Florida). [Is *V. georgianus* Lea.]
- haleanus** 'Lea' Walker, **Viviparus**: 1918, Mus. of Zool., Univ. of Michigan, Misc. Publications No. 6, p. 125. [Error for *V. haleianus* Lea.]
- haleiana** Lea, **Paludina**: 1845, Proc. American Phil. Soc. **4**:167; 1848, Trans. American Phil. Soc. **10**:96, pl. 9, fig. 58; 1848, Observations on the Genus Unio **4**:70, pl. 9, fig. 58 (Alexandria, Louisiana). [Is *V. intertextus* Say. Types USNM 106256.]
- illinoisensis** Baker, **Viviparus intertextus**: 1928, Wisconsin Geological and Natural History Survey, Bull. 70, pt. 1, p. 38, pl. 2, figs. 18-21 (Illinois River, Havana, Illinois). [Holotype Univ. of Illinois Z18025.]
- impolitus** Pilsbry, **Viviparus contectoides**: 1916, Nautilus **30**:41 (in marsh, Paint Rock River, Jackson Co., Alabama). [Is *V. georgianus* Lea. Holotype ANSP 66701.]
- inornata** Binney, **Vivipara**: 1865, American Jour. Conchology **1**:49, pl. 7, fig. 1 (near Chopatilo, Mexico [probably NE Mexico]). [Lectotype MCZ 234704; Paratypes USNM 9168.]
- intertextus** Say, **Paludina**: 1829, New Harmony Disseminator of Useful Knowledge **2**:244 (marshes near New Orleans and on bank of Carondelet Canal, Louisiana).
- japonica** v. Martens, **Paludina**: 1860, Malakozoologische Blätter **7**:44 (Japan). [Introduced into North America.]
- limi** Pilsbry, **Viviparus contectoides**: 1918, Nautilus **32**:71. [New name for *V. contectoides compactus* Pilsbry 1916; non Kobelt 1906. Is *V. georgianus* Lea, Clench and Turner 1956, p. 109.]
- limnothuma** Pilsbry, **Vivipara georgiana**: 1895, Nautilus **8**:116 (aboriginal shell-field, Hitchen's Creek [near entrance of St. Johns River into Lake George] and 2 fathoms, Lake George [Florida]). [Is *V. georgianus* Lea.]
- linearis** 'Valenciennes' Küster, **Paludina**: 1852, Conchylien-Cabinet (2) **1**: pt. 21, p. 19, pl. 4, fig. 4 (Simpson Creek Lake, east Florida). [Error for *lineata* Val.]

- lineata** Valenciennes, **Paludina**: 1827 [in] Humboldt and Bonpland, Recueil D'Observation de Zoologie **2**:256 (Lake Erie). [According to Potiez and Michaud (1838, p. 245) this species is a synonym of *Paludina bengalensis* Lamarck from Bengal, India.]
- malleata** Reeve, **Paludina**: 1863, Conchologia Iconica **14**: *Paludina*, pl. 5, fig. 25 (Japan). [Introduced into North America.]
- multicarinata** Haldeman, **Paludina**: 1842, Mono. Freshwater Univalve Shells of North America, Philadelphia, pt. 4, p. 4 of cover. [New name for *P. carinata* Val. 1827; non Swainson 1822; Menke 1829.]
- multilineata** Say, **Paludina**: 1829, New Harmony Disseminator of Useful Knowledge **2**:245 (St. Johns River, Florida). [Nomen nudum, as a synonym of *P. elongata* (= *V. bengalensis* Lamarck); non *P. multilineata* Meek and Hayden 1866. [Is *V. bengalensis* Lam. from Bengal, India. See Morrison and Pilsbry 1953, Nautilus **67**:56-61; Clench 1955, Nautilus **68**:107.]
- subpurpurea** Say, **Paludina**: 1829, New Harmony Disseminator of Useful Knowledge **2**:245 (Fox River, an arm of the Wabash [White Co., Illinois]).
- texana** Tryon, **Vivipara**: 1862, Proc. Acad. Nat. Sci., Philadelphia, p. 451 (Texas). [Is *V. subpurpureus* Say. Holotype ANSP 27714.]
- transversa** Say, **Paludina**: 1829, New Harmony Disseminator of Useful Knowledge **2**:244 (near New Orleans). [Is *V. intertextus* Say.]
- troostiana** Lea, **Paludina**: 1841, Proc. American Phil. Soc. **2**:34 (Tennessee); 1844, Trans. American Phil. Soc. **9**:14; 1848, Observations on the Genus Unio **4**:14. [Is a young *V. intertextus* Say. Types USNM 121119.]
- vivipara** Linné, **Paludina** or **Helix**: [This is a European species. North American references to this species are to *V. georgianus* Lea.]
- walkeri** Pilsbry and Johnson, **Viviparus**: 1912, Nautilus **26**:48, pl. 3, figs. 6-7 (Juniper Creek, Lake Co., Florida). [Is *V. georgianus* Lea. Holotype ANSP 70053.]
- waltoni** Tryon, **Viviparus**: 1866, American Jour. Conchology **2**:108, pl. 10, fig. 2 (St. Johns River, Florida). [Is *V. georgianus wareanus* Küster. Holotype ANSP].
- wareana** 'Shuttleworth' Küster, **Paludina**: 1852, Conchylien-Cabinet (2) **1**: pt. 21, p. 21, pl. 4, figs. 10-11 (Ostflorida im Ware-See [Lake Weir, Marion Co., Florida]).

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