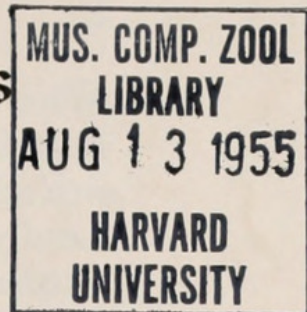


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## The North American Genus *Lioplax* in the Family Viviparidae<sup>2</sup>

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The genus *Lioplax* Troschel presents one of the most interesting distributional problems among our freshwater mollusks. The genus is limited to four species and each of these occupies a different area, the two northern species being completely isolated from each other and from the two southern species. The two southern species, though in nearly adjacent areas, do not occur in the same drainage systems and, in addition, are separated by the Escambia and Perdido Rivers in Florida and southern Alabama.

The occurrence of each species within its own distributional area is not continuous. Wide gaps occur between localities even in a single stream and in regions of apparently similar ecological conditions. Certainly, many more localities will be found where these various species occur than are indicated on our map. However, the present study is based upon most of the material in this genus contained in our largest museums, collections that represent better than a century of field work.

From the records we have available and the distributional pattern as shown on the map for *L. sulculosa* Menke, it would appear that this species is beginning to invade the Great Lakes area. It has been found at the southern end of Green Bay,

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Wisconsin (Lake Michigan) and this, to our knowledge, is the only Great Lakes record.

R. E. Call (1894, p. 137) states that *L. cyclostomaformis* Lea is locally very abundant and we found *Lioplax pilsbryi* Walker exceedingly common at nearly all stations in the Chipola River, Florida during our collecting this past summer (1954). We also found the same species fairly common in the Suwannee River near Oldtown, Dixie County, Florida. It was found along the margins of the rivers, usually in mud and muddy sand.

Call also states that *L. cyclostomaformis* Lea was found in considerable numbers in mud under large flat rocks. This is a most unusual ecological station for a member of this family. Other genera such as *Viviparus* and *Campeloma* are usually in exposed situations, though both *Campeloma* and *Viviparus* will often exist on very soft bottoms occasionally buried an inch or two below the surface. We found *Campeloma geniculum* Conrad buried in two inches of sand and mud in the Flint River, Georgia, and most abundant about the roots of aquatic vegetation.

In its shell morphology *Lioplax* is close to the genus *Campeloma* Rafinesque, differing usually by having a carina at the whorl periphery, rather finely developed sculpture and a well defined sigmoid outer margin to the aperture when seen in profile. The operculum is different from that of *Campeloma*, having the nucleus subcentral and being paucispiral in its early stage, then having concentric growth lines developed during the later stages in its life. In *Campeloma* the nucleus is submarginal (parietal margin) and continuously concentric throughout the life of the animal. The embryonic shell of *Lioplax* differs markedly from *Campeloma* by being strongly shouldered, usually having fine spiral sculpture and by having the first nuclear whorl extending above the second. *Campeloma* is without the whorl shoulder and sculpture and has the first one and one half whorls in a single plane.

According to the list of Fossil Non-marine Mollusca of North America by J. Henderson (1935, p. 15), *Lioplax* first appeared in the Cretaceous, and other species have been recorded from the Oligocene and the Miocene. No new fossil forms have been recorded later than the Miocene. Very careful consideration should be given all fossils that have been placed in the



genus *Lioplax*. The characters which differentiate this genus from *Campeloma* Rafinesque are the position of the nucleus in the operculum, and to a lesser degree, the radula, and the fine sculpture on the surface of the shell. This leaves little in the way of positive characters for the certain generic determination of any fossil member of the group.

Dall (1890) described a *Lioplax floridana* from the Lower Miocene Silex Beds, Ballast Point, Tampa, Florida, which in our opinion is not a *Lioplax*. It may be the young stage of some bulimoid, but the specimen is so fragmentary it is impossible to place it with any degree of certainty.

#### ACKNOWLEDGMENTS

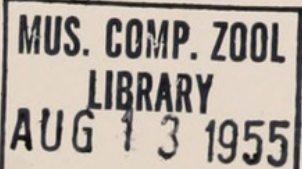
We are deeply indebted to several friends for the loan of material used in this study, and we wish to thank the following for their interest and cooperation: H. D. Athearn, Cleveland, Tennessee; L. A. Fraser and Robert Nero, University of Wisconsin; R. A. Heilman, Lebanon, Pennsylvania; M. K. Jacobson, Rockaway Beach, New York; Winnie McGlamery, University of Alabama; J. J. Parodiz, Carnegie Museum, Pittsburgh; H. A. Pilsbry, Academy of Natural Sciences, Philadelphia; H. A. Rehder, United States National Museum; Henry vander Schalie, University of Michigan; and F. V. Weir, American Museum of Natural History, New York.

#### Genus *Lioplax* Troschel

*Lioplax* Troschel 1857, Das Gebiss der Schnecken, Berlin **1**, p. 100, pl. 7, fig. 5 (type species, *Paludina* (*Lioplax*) *subcarinata* Say, monotypic).

*Haldemania* Tryon 1862, Proceedings Academy Natural Sciences Philadelphia, p. 451 (type species, *Vivipara subcarinata* Say, monotypic).

Shell subglobose to moderately attenuate with strongly convex whorls which are generally shouldered and usually have a carina at the whorl periphery. This carina is well marked on the early whorls. Color a light to dark olivaceous-green. There is generally present a fine microscopic sculpture which gives the surface a very fine granular appearance. The shells are usually imperforate and the outer lip when seen in profile is sigmoid in outline. Periostracum usually present. Operculum chitinous, usually dark horn in color, subelliptical in outline, paucispiral in its early stage and then concentric. Nucleus





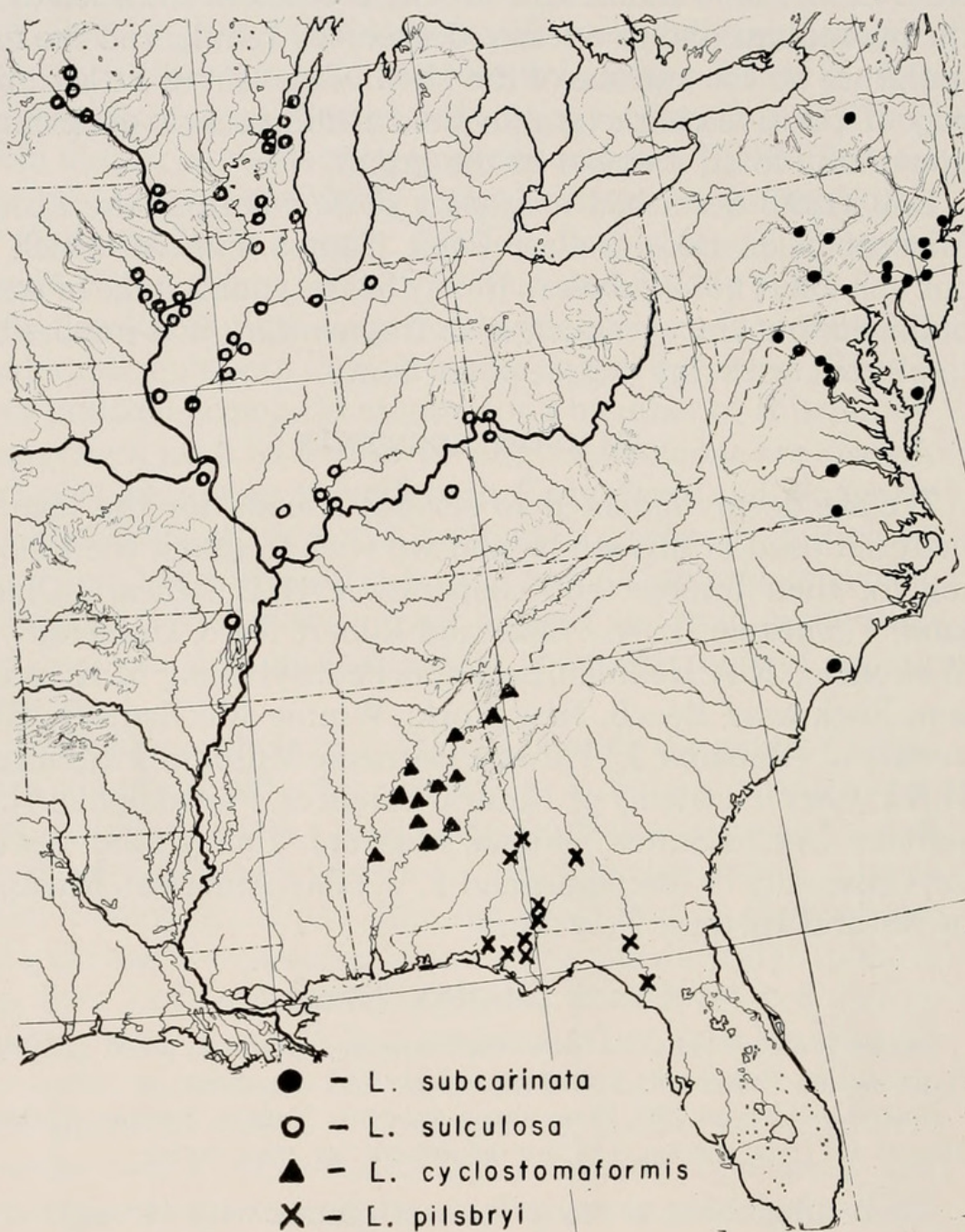


Plate 1

Distribution of the genus *Lioplax*.

The collections made of *Lioplax pilsbryi* Walker during 1954 are not indicated on the plate above as this was engraved before this trip was contemplated. However, the only major addition would be the two stations on the Ocklock-onee River which would appear a little to the left of center between the Appalachicola System and the Suwanee River on the above plate.



subcentral. The embryonic shell at the time of birth consists of two and one half to three whorls. It is strongly shouldered and is sculptured with a series of very fine spiral threads. The radula is quite similar to that of *Campeloma* differing only in minor points. According to Baker (1928, p. 48) the genitalia are somewhat different from those of both *Campeloma* and *Viviparus*.

Type species, *Paludina (Lioplax) subcarinata* Say, monotypic.

### ***Lioplax sulculosa* Menke**

Plate 3, figs. 4-5

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

*Lioplax subcarinata wisconsinensis* Baker 1928, Wisconsin Geological and Natural History Survey, Bull. **70**, pt. 1, p. 50, pl. 3, figs. 1-9 (Fox River, Brown Co., Wisconsin).

*Lioplax subcarinata occidentalis* Pilsbry 1935, Nautilus **48**, p. 143 (Cincinnati, Ohio).

*Description.* Shell reaching about 23 mm. in length, rather thin in structure, spire somewhat extended, finely umbilicate, with the early whorls and occasionally the later whorls carinate. Color generally a pale olivaceous-green. Whorls 6, convex with generally a well-defined shoulder. Spire somewhat extended and produced at an angle of about  $55^{\circ}$ . Aperture subcircular to ovate with the outer lip thin; inner lip composed of a rather thickened callus on the parietal wall. Columella short and arched. Umbilicus small, occasionally covered by the reflection of the inner lip. Suture well impressed. Sculpture consisting of a well developed carina which occasionally occurs on the body whorl. Microscopic sculpture consisting of very fine thread-like spiral lines which frequently have a beaded appearance. These are crossed by fine growth lines. Operculum with the nucleus subcentral. Periostracum olivaceous-green in color, generally thin and usually persistent.

length	width	whorls	
22.5 mm.	17.0 mm.	6	Ohio River, Cincinnati, Ohio
22.5	13.0	6	Kishwaukee River, Winnebago, Co., Illinois
21.5	14.0	6	Bank Lick Creek, Kentucky
20.0	12.8	6	Ohio River, Cincinnati, Ohio
19.5	13.0	6	" " " "



*Types.* The location of the type of *Paludina sulculosa* Menke is unknown. The type locality is Cincinnati, Ohio. The holotype of *L. s. occidentalis* Pilsbry is in the Academy of Natural Sciences, Philadelphia, no. 123539, from Cincinnati, Ohio. The holotype of *L. subcarinata wisconsinensis* Baker is in the Zoological Museum, University of Wisconsin, Madison, Wisconsin, no. 437. The type locality is Fox River, Brown Co., Wisconsin. Several paratypes are in the University of Wisconsin from the Fox River and other nearby localities. A single paratype is in the Museum of Comparative Zoölogy, no. 189660, from Lake Butte des Morts, Winnebago County, Wisconsin.

*Remarks.* We have now but three localities for this species from south of the Ohio River. In eastern Wisconsin, in the vicinity of Green Bay, this species presents the only record for the Great Lakes-St. Lawrence drainage system. It would appear that this species is probably slowly extending its range and that eventually it may occupy a larger area in the Great Lakes system. We cannot in any way discover differences between Baker's subspecies *wisconsinensis* and the typical *sulculosa*. It appears to us that there was no reason whatsoever for the name *occidentalis* Pilsbry replacing *sulculosa* Menke. This name was introduced by Pilsbry only on the supposition that there may have been a mistake in locality assignment by Beschke who had sent shells to Menke from both Philadelphia and Cincinnati. Menke's very brief description would fit either *sulculosa* or *subcarinata*. However, if such a name change in the future is thought necessary Baker's *wisconsinensis* would have priority.

See remarks under *Lioplax subcarinata* Say.

*Range.* This species ranges from northwestern Wisconsin and eastern Minnesota south to northeastern Arkansas and east to southwestern Ohio.

*Specimens examined.* MINNESOTA: St. Croix River, 9 miles east of Rock Creek, Pine Co. (USNM); Lake Pepin, Goodhue Co. (C. Dawley). WISCONSIN: Lake Michigan, Green Bay, Brown Co. (Univ. of Michigan); Lake Butte des Morts, Winnebago Co.; Winnebago Lake, near Oshkosh, Winnebago Co. (both



Univ. of Wisconsin); Wisconsin River, Prairie du Sac, Sauk Co. (Univ. of Michigan); St. Croix River, Hudson, St. Croix Co. (M.K.Jacobson); Prairie du Chien, Crawford Co. (USNM); Mississippi River, Lynxville, Crawford Co. (Univ. of Michigan). IOWA: Iowa River, Iowa City, Johnson Co. (USNM); Red Cedar River, Cedar Rapids, Linn Co.; Mississippi River, Davenport, Scott Co.; Mississippi River, Muscatine, Muscatine Co. (all MCZ; USNM). MISSOURI: Meramec River, Kirkwood, St. Louis Co. (MCZ); St. Louis, St. Louis Co. (USNM). ARKANSAS: St. Francis River, Greenway, Clay Co. (USNM). ILLINOIS: Mississippi River, Mercer Co. (USNM); Pope Creek, Mercer Co. (MCZ); Kishwaukee River, Winnebago Co. (MCZ; Univ. of Alabama); Illinois and Mississippi Canal, LaSalle Co. (M. K. Jacobson); Wabash River, Mount Carmel, Wabash Co. (MCZ); Little Wabash River, Carmi, White Co.; Lake Meredosia, Meredosia, Morgan Co. (both Univ. of Alabama). INDIANA: Lake Maxinkuckee, Marshall Co. (very old specimens, possibly extinct now) (USNM); Wabash River, Grand Chains, and Big Creek, Solitude, both Posey Co. (both Univ. of Alabama); LaPorte, LaPorte Co. (USNM); Ohio River, 2½ miles below Lawrenceburg, Dearborn Co. (MCZ). OHIO: Ohio River, Sedansville, Hamilton Co. (USNM); Ohio River, Cincinnati, Hamilton Co. (MCZ; USNM; Carnegie Museum). KENTUCKY: Licking River; Bank Lick Creek, 6 miles S. of Covington, Kenton Co.; Beech Fork, Salt River, 1 mile S. of Bardstown, Nelson Co. (all MCZ).

***Lioplax subcarinata* Say**

Plate 4, figs. 1-3

*Limnaea subcarinata* Say 1816, British Encyclopedia, American edition by William Nicholson, 1st edition **2** [4] [p. 17], pl. 1, fig. 7 (Delaware River, Pennsylvania).

*Paludina bicarinata* 'Say' Potiez and Michaud 1836, Galerie des Mollusques, Paris **1**, p. 249, pl. 25, figs. 17-18 (La Delaware, rivière de l'Amérique Septentrionale).

*Description.* Shell reaching about 21 mm. in length, rather thin in structure, spire somewhat extended, finely umbilicate and having the early whorls carinate. Color generally a pale brownish- to olivaceous-green. Whorls 6, convex and with a narrow shoulder. Spire somewhat extended and produced at



## Plate 2

Young of *Lioplax* and *Campeloma*

Figs. 1-2. *Lioplax sulculosa* Menke, Davenport, Iowa. Fig. 1. Young at time of birth. Fig. 2. A less developed young with angled whorls, taken from the same parent.

Fig. 3. *Lioplax subcarinata* Say, Delaware River, Pennsylvania.

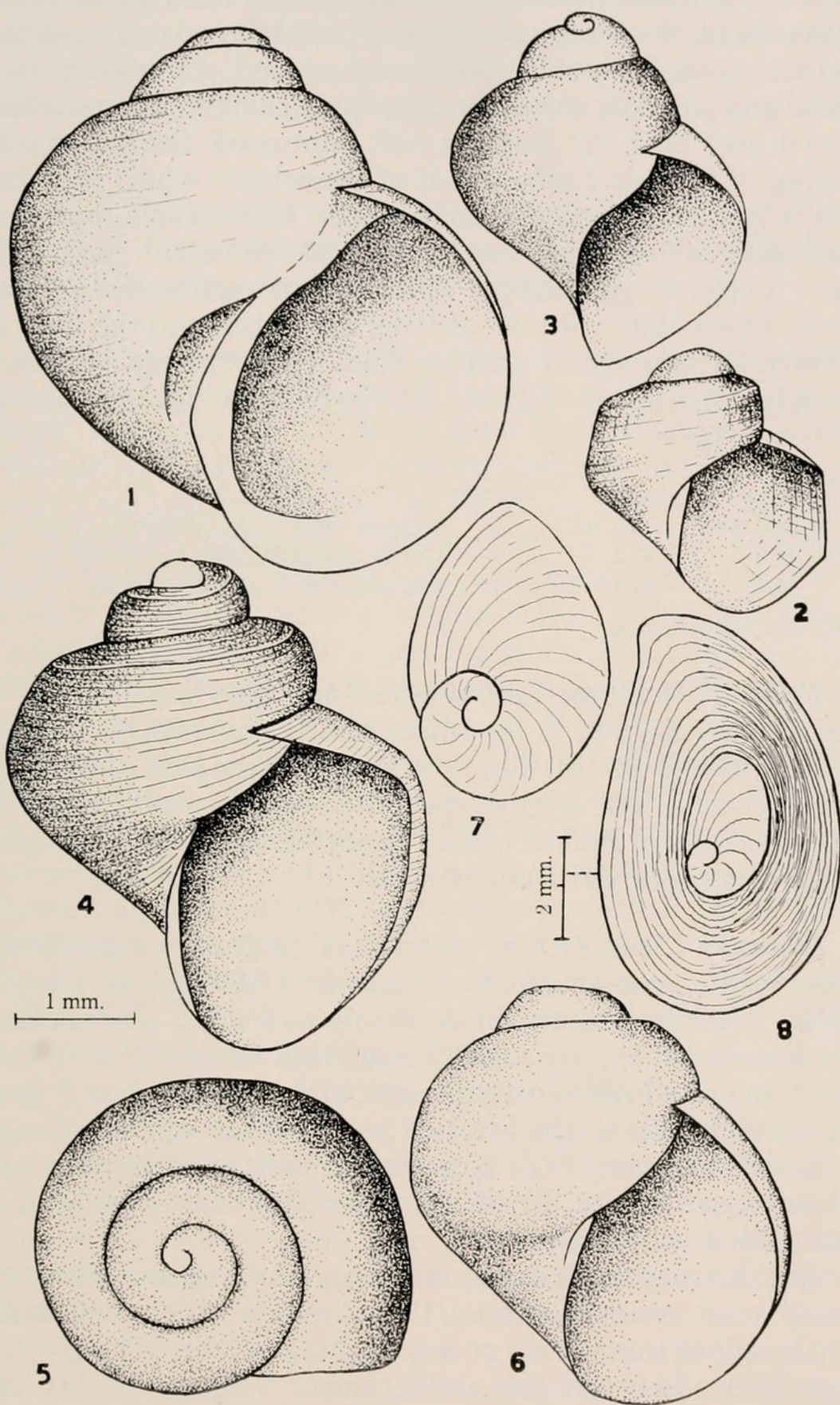
Fig. 4. *Lioplax pilsbryi* Walker, Chipola River, Jackson County, Florida.

Figs. 5-6. *Campeloma decisum* Say, Middle Saranac Lake, New York. Fig. 5. Apex view to show the first whorl which cannot be seen in the apertural view. Fig. 6. Apertural view.

Figs. 7-8. Operculum of *Lioplax sulculosa* Menke from Davenport, Iowa. Fig. 7. A paucispiral operculum from an unborn specimen. Fig. 8. Operculum from an adult specimen to show the later concentric growth.

All of the specimens figured except fig. 8, were obtained as unborn young. All figures except fig. 8 are based on the 1 millimeter scale at fig. 4.







an angle of about  $47^{\circ}$ . Aperture subcircular with the outer lip thin and the inner lip consisting of a thickened callus on the parietal wall. Columella short and arched. Umbilicus very small and partially to nearly completely covered by the reflection of the inner lip. Sutures well impressed. Sculpture consisting of a single carina on all of the whorls which becomes much less defined on the body whorl. Microscopic sculpture consisting of very fine thread-like spiral lines which frequently have a beaded appearance. These are crossed by fine growth lines. Operculum with the nucleus subcentral and the lines of growth in paucispiral arrangement. Periostracum thin and usually adhering throughout life, except on the first one or two whorls.

length	width	whorls	
21.5 mm.	13.0 mm.	6	Pennsylvania Canal, Columbia, Penna.
17.0	10.8	6	Outlet of Cedar Lake, Litchfield, N.Y.
15.8	10.0	4*	Lectotype of <i>L. subcarinata</i> Say

\* Early whorls missing

*Types.* A lectotype, here selected, and three paratypes of *L. subcarinata* Say are in the Museum of Comparative Zoölogy, no. 189709 and 187164. The type locality is the Delaware River, Pennsylvania. The original specimens were probably collected in the vicinity of Philadelphia, Pennsylvania. These type specimens were received from Mrs. Say.

*Remarks.* This eastern species of *Lioplax* is exceedingly close in its relationship to *L. sulculosa* Menke, the western form. Their characters differ mainly in degree. The shells of *L. subcarinata* Say are usually somewhat thinner and are proportionately a little more attenuate. It appears also that *Lioplax subcarinata* Say on the average is somewhat smaller, though selected examples of the largest specimens of both species are about equal in size. In addition, the umbilical opening of *L. sulculosa* is much larger.

The distribution is far from being uniform and there are many river systems between the extreme northern and southern localities from which no material is available. The greatest gap occurs between the southernmost Virginia locality and Lake Waccamaw in North Carolina. It is possible that in the



latter locality this northern species has persisted owing to the springs that feed the lake, keeping the water somewhat cooler during the warm summer months than the streams to the immediate north. This, however, needs actual proof from field observations.

*Range.* This species ranges from Cedar Lake near Litchfield, New York (upper Susquehanna drainage) south to Lake Waccamaw, Columbus County, North Carolina.

*Specimens examined.* NEW YORK: Outlet of Cedar Lake, Litchfield, Herkimer Co. (MCZ). PENNSYLVANIA: Perkiomen Creek, Montgomery Co.; West Branch, Susquehanna River, Williamsport, Lycoming Co. (both Carnegie Mus.); Pennsylvania Canal, Columbia Co. (MCZ); Juniata River, Perry Co. (R. Heilman); Columbia, Lancaster Co. (USNM); Delaware River, Holmesberg, near Philadelphia; Delaware River, Philadelphia; Canal Manayunk, Philadelphia; Schuylkill River, Philadelphia; Schuylkill River, Phoenixville, Chester Co. (all MCZ). NEW JERSEY: Old Reservoir, Arlington, Hudson Co. (MCZ); Delaware-Raritan Canal, near Princeton, Mercer Co. (Carnegie Mus.); Raritan River (USNM); Delaware River, Florence, Burlington Co. (Carnegie Mus.); Delaware River, Burlington, Burlington Co. (USNM); Outlet of Crystal Lake, Roebling, Burlington Co. (H. D. Athearn); Delaware River, Pavonia, Camden Co. (MCZ). MARYLAND: Canal, Great Falls, Montgomery Co. (MCZ; USNM); Above Cabin John (C. & O. Canal), Montgomery Co.; Anssawango Creek, Snow Hill, Worcester Co.; Poplar Point, Anacostia, Washington, D.C.; (all USNM); WEST VIRGINIA: Potomac River, Harpers Ferry, Jefferson Co. (MCZ), VIRGINIA: Swift Creek, Chesterfield Co. (Carnegie Mus.); Potomac River, Great Falls, Fairfax Co. (USNM); Potomac River, 4 miles north of Great Falls, Fairfax Co. (MCZ; USNM); Potomac River, Mount Vernon, Fairfax Co. (MCZ). NORTH CAROLINA: Turkey Creek, near Wilmington, Brunswick Co.; Lake Waccamaw, Columbus Co. (both USNM).



## Plate 3

Fig. 1. *Lioplax pilsbryi* Walker, Chipola River, Florida. Lectotype (1.8x).

Fig. 2. *Lioplax elliottii* Lea (= *L. cyclostomaformis* Lea), Oothkalooga Creek, Georgia. Lectotype (1.8x).

Fig. 3. *Lioplax cyclostomaformis* Lea, Coosa River, Alabama. Lectotype (2x).

Fig. 4. *Lioplax sulculosa* Menke, Ohio River, Cincinnati, Ohio (2x).

Fig. 5. *Lioplax subcarinata wisconsinensis* Baker (= *L. sulculosa* Menke), Winnebago Lake, near Oshkosh, Wisconsin. Lectotype (2x).

Fig. 6. *Lioplax pilsbryi choctawhatchensis* Vanatta (= *L. pilsbryi* Walker), Horseshoe Lake, Choctawhatchee River, Florida. Lectotype (2x).

Fig. 7. *Campeloma decampi* Binney, Decatur, Alabama. Lectotype (1.8x).

Fig. 8. *Campeloma spillmannii* Lea (= *C. decampi* Binney) Jackson Co., Alabama. Lectotype (1.8x).







**Lioplax cyclostomaformis** Lea

Plate 3, figs. 2-3

*Paludina cyclostomaformis* Lea 1841, Proceedings American Philosophical Society **2**, p. 83 (Coosa River, Alabama).

*Paludina cyclostomatiformis* Lea 1844, Transactions American Philosophical Society **9**, p. 23 (Coosa River, Alabama); *ibid.* 1848, Observations on the Genus Unio, Philadelphia **4**, p. 23.

*Paludina contorta* 'Shuttleworth' Küster 1852, Conchylien Cabinet (2) **1**, pt. 21a, p. 20, pl. 4, figs. 7-9 (Alabama).

*Paludina elliottii* Lea 1858, Proceedings Academy Natural Sciences Philadelphia, p. 166 (Oothkalooga Creek [Oothkalooga], Georgia).

*Description.* Shell reaching about 28 mm. in length, rather solid in structure, spire extended, imperforate and often slightly carinated on the early whorls. Color light to dark olivaceous-green with the interior of the aperture somewhat bluish. Whorls seven, usually strongly convex and generally with a well-defined shoulder. Spire extended and produced at an angle of about  $32^{\circ}$ . Aperture subovate to subquadrate with the outer lip thin and the inner lip consisting of a rather moderate callus. The outer lip in profile is moderately sigmoid. Shell generally imperforate though occasional specimens show a little chink under the parietal callus. Sculpture consisting of a moderate carina on the early whorls though not present on the body whorl. Microscopic sculpture consisting of very fine spiral beaded threads. These are crossed by fine growth lines. Operculum with a subcentral nucleus. Periostracum rather heavy and generally colored a rather dark olivaceous-green.

length	width	whorls	
28 mm.	16.0 mm.	7	Oothkalooga Creek, Georgia (lectotype of <i>L. elliottii</i> Lea)
21	11.6	5*	Coosa River, Alabama (lectotype of <i>L. cyclostomaformis</i> Lea)
23	13.8	5*	Cahaba River, near Gurnee, Shelby County, Alabama

\* Apex corroded

*Types.* The lectotype, here selected, of *Paludina cyclostomaformis* Lea, is in the United States National Museum, no. 106307 from the Coosa River, Alabama. The lectotype, here selected, of *Paludina elliottii* Lea is also in the United States National Museum, no. 106260 from Oothkalooga Creek, Bar-



tow County, Georgia. Paratypes of the latter are in the Museum of Comparative Zoölogy. The whereabouts of the type specimens of *Paludina contorta* Küster is unknown to us.

*Remarks.* This species is confined entirely to the vast Alabama River system in Alabama and Georgia. In this species the whorls are less shouldered than in the other three members of the genus; they are only occasionally carinated and then only on the early whorls. The shell is proportionately narrower and the spire more straight-sided.

The lectotype of *Paludina elliottii* Lea is an exceptionally fine and large specimen of this species.

*Range.* Coosa-Alabama-Tombigbee River system from northwest Georgia, south to Selma, Dallas County on the Alabama River and Big Prairie Creek, Marengo County on the Tombigbee River in Alabama.

*Specimens examined.* GEORGIA: Oothkalooga Creek, Bartow County (MCZ; USNM); Coahulla Creek, 6 miles east of Dalton, Whitefield Co.; Armuchee Creek, 5 miles north of Rome, Floyd Co. (both Univ. of Alabama). ALABAMA: Valley Creek, Toadvine, Jefferson Co. (Univ. of Alabama); Black Warrior River, Jefferson Co. (MCZ; Univ. of Alabama); Little Cahaba<sup>1</sup> Creek, Jefferson Co. (Univ. of Alabama); Cahaba River at Gurnee, Shelby Co. (MCZ; Carnegie Mus.; USNM); Cahaba River, Lilly Shoals, Bibb Co. (MCZ; Univ. of Alabama); Cahaba River, Piper, Bibb Co. (Univ. of Alabama); Little Wills Creek, Attalla, Etowah Co. (Carnegie Mus.; Univ. of Ala.); Choccolocco Creek, 3 miles south of Lincoln, Talladega Co. (MCZ); Yellowleaf Creek, near Wilsonville, Shelby Co. (MCZ; Carnegie Mus.); Yellowleaf Creek, Shelby Co. (Univ. of Alabama); Coosa River, Weduska Shoals, Shelby Co. (USNM; Carnegie Mus.; Univ. of Alabama); Coosa River, Wetumka, Elmore Co. (MCZ; Univ. of Alabama); Alabama River, Selma, Dallas Co. (MCZ; USNM). Big Prairie Creek, Marengo Co. (USNM).

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<sup>1</sup> Also called Cahawba.



***Lioplax pilsbryi* Walker**

Plate 3, figs. 1 and 6

*Lioplax pilsbryi* Walker 1905, Nautilus **18**, p. 133, pl. 9, figs. 1-3 (Chipola River, Florida).

*Lioplax pilsbryi choctawhatchensis* Vanatta 1935, Nautilus **49**, p. 66 (Horseshoe Lake, Choctawhatchee River, Washington Co., Florida).

*Description.* Shell reaching about 28 mm. in length, rather solid in structure, the spire somewhat extended, imperforate and usually carinated, particularly on the early whorls. Color light olivaceous-green to blackish-green with the interior of the aperture bluish-green. Whorls seven, usually moderately to strongly convex and with a well pronounced shoulder. Spire somewhat extended and produced at an angle of about  $50^{\circ}$ . Aperture subcircular to ovate with the outer lip thin; the inner lip composed of a thickened callus. The outer lip in profile is strongly sigmoid. Generally imperforate. Suture deeply impressed. Sculpture consisting of a well developed carina, usually high up on the whorl forming the shoulder. On the body whorl the carina has become well rounded. Microscopic sculpture consisting of fine spiral and somewhat beaded threads which are crossed by somewhat irregular, sigmoid growth lines. Operculum with a subcentral nucleus. Periostracum rather heavy and colored olivaceous-green to almost black.

length	width	whorls	
27.2 mm.	18 mm.	5 (apex corroded)	Lectotype
28.0	20	5 " "	Paratype
27.5	19	5 " "	Paratype

*Types.* The lectotype, here selected, of *Lioplax pilsbryi* Walker is in the Museum of Zoology, University of Michigan; paratypes are in the Museum of Comparative Zoölogy. The type locality as given by Walker is the Chipola River, Florida. We here restrict the type locality to the Chipola River, 2 miles east of Clarksville, Calhoun Co., Florida. The holotype of *L. p. choctawhatchensis* Vanatta is in the Academy of Natural Sciences, Philadelphia, no. 162240, from Horseshoe Lake, Choctawhatchee River, Washington County, Florida.



*Remarks.* This is the most distinctive member of the genus *Lioplax*. It is darker in color and has developed a rather broad and flattened whorl shoulder. It is completely imperforate and the sculpture generally is far more pronounced on the body whorl than in any other species.

*Lioplax pilsbryi* Walker reaches its greatest development in the Chipola River. It is exceedingly abundant at most stations that we investigated in this river. It appears to thrive best where there is a good admixture of sand, mud and decaying vegetation. Individuals of this species were rare and rather small at the stations where we found them in the Choctawhatchee and Ochlockonee Rivers. Here they were living in rather coarse sand with very little plant detritus.

It is quite possible that this species may occur in the Aucilla, Econfinia (Taylor Co.), Fenholloway and Steinhatchee Rivers, all in Florida. Our time in the field (1954) was limited and these rivers have not yet been investigated.

*Range.* This species ranges from the Choctawhatchee River east to the Suwannee River, Florida. In the Apalachicola system it extends north as far as Columbus, Georgia on the Chattahoochee and to the mouth of Gum Creek, Crisp County, Georgia, on the Flint River.

*Specimens examined.* ALABAMA: Uchee Creek, Russell Co. [Chattahoochee drainage] (USNM); Pea River, one half mile southwest of Geneva, Geneva Co. (MCZ; U of F). GEORGIA: Chattahoochee River, Columbus, Muscogee Co. (USNM); Flint River, mouth of Gum Creek, Crisp Co. (MCZ; U of M); Spring Creek, Reynoldsville, Seminole Co.; Spring Creek, 2½ miles south of Reynoldsville, Seminole Co.; Spring Creek near Brinson, Decatur Co. (all MCZ and U of F). FLORIDA: Choctawhatchee River, 8 miles west of Miller Cross Roads, Holmes Co. (MCZ; U of F); Choctawhatchee River, 1 mile west of Caryville, Holmes Co. (MCZ; U of F); Horseshoe Lake, Choctawhatchee River, Washington Co. (ANSP); Econfinia River<sup>1</sup>, Bay Co. (U of M); Big Creek, 8 miles west of Malone, Jackson Co. [Chipola drainage]; Chipola River, 1 mile north of Mariana,

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<sup>1</sup> This is not the Econfinia River, Taylor Co., Florida.



Jackson Co.; Chipola River, 3 miles south of Mariana, Jackson Co.; Chipola River, 1 mile west of Sink Creek, Jackson Co.; Chipola River,  $2\frac{1}{2}$  miles southeast of Chason, Calhoun Co.; Chipola River, about 2 miles east of Clarksville, Calhoun Co.; Chipola River, Scotts Ferry, Calhoun Co.; Dead Lake, Chipola River, 16 miles south of Clarksville, Calhoun Co.; Ochlockonee River, 8 miles west of Tallahassee, Leon Co.; Ochlockonee River,  $7\frac{1}{2}$  miles east of Hosford, Liberty Co.; Suwannee River at mouth of the Withlacoochee River, Madison Co.; Suwannee River, Ellaville, Madison Co.; Suwannee River, Oldtown, Dixie Co.; Suwannee River, Fannin Spring, Gilchrist Co. (all MCZ; U of F).

***Campeloma decampi* Binney**

Plate 3, figs. 7-8

*Melantho decampi* 'Currier' Binney 1865, Land and Freshwater Shells of North America, Part 3, p. 115, figs. 227-229 (Huntsville or Stevenson, Alabama).

*Paludina spillmanii* Lea 1867, Proceedings Academy of Natural Sciences Philadelphia, p. 81 (Jackson County, Alabama); Lea 1868, Journal Academy Natural Sciences Philadelphia **6**, p. 343, pl. 54, fig. 29; Lea 1868, Observations on the Genus Unio, Philadelphia **12**, p. 103, pl. 54, fig. 29.

This species has frequently been listed and named as a *Lioplax* only because many specimens have a faint microscopic sculpture that somewhat simulates that found on *Lioplax*, and also because young specimens occasionally show a slight carina which is seldom present in the adult. Many specimens have rather strongly developed axial growth ridges. These become worn and show up as axial stripes. However, both the shell characters and that of the operculum are definitely those of *Campeloma*. We include it here only to aid in a clarification of the problem.

The type locality given by Binney as recorded in the synonymy above is apparently an error as we have a specimen from the original series from W. H. DeCamp which was sent to J. G. Anthony and carries these data:

"*Melantho decampii* Currier

Loc. Decatur, Alabama

The only one I have except my cabinet specimens or I would send you more (only about 15 found)."



We add below the localities from which we have seen material. So far these localities are all in Alabama and all north of the Tennessee River. The species is not a common one and because of its fine sculpture and rather remarkable tapered and pointed spire it is relatively easy to identify.

*Paludina spillmannii* Lea from Jackson County, Alabama is this same species.

*Types.* The lectotype of *Melantho decampi* Binney (here selected) is in the Museum of Comparative Zoölogy, no. 189656.<sup>1</sup> Paratypes are in the Museum of Comparative Zoölogy and the United States National Museum. The type locality is Decatur, Alabama. The lectotype of *Paludina spillmannii* Lea (here selected) is in the United States National Museum, no. 121433, from Jackson County, Alabama. Additional paratypes are in the United States National Museum and the Museum of Comparative Zoölogy.

*Specimens examined.* ALABAMA: Bass and Swan Lakes, Decatur, Limestone County (USNM); Decatur, Limestone County (USNM; MCZ); Piney Creek, near Mooresville, Limestone County; Outlet of Byrd Spring Lake, 5 miles south of Huntsville, Madison County; Byrd Spring Lake, 5 miles south of Huntsville, Madison County; Brim Spring, Huntsville, Madison County (all MCZ); Jackson County (MCZ; USNM).

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<sup>1</sup> Figure 229 in Binney's report given above.





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