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ANNOTATED DISTRIBUTION RECORDS FOR KENTUCKY MOLLUSCA

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COLLECTING STATIONS

In the annotated list which follows, the numbers of specimens collected at each locality are given first and the collecting station number follows in parentheses. All measurements are in millimeters.

1. December 9, 1968. Mile 18 to mile 14, Tennessee River, below Kentucky Dam, Marshall County.
2. June 1, 1968. Near (in, for aquatics) Cumberland River, Burnside, Pulaski County.
3. October 24, 1966. Eastern Kentucky University Dairy Farm Pond, Madison County.
4. April 1, 1967. Near mouth of Lulbegrud Creek, Clark County, Kentucky.
5. April 1, 1967. Low hill, 1 mile southeast of Mina, Clark County.
6. August 25, 1961. Big Bullskin Creek, 23 miles east of Louisville, U.S. Highway 60, Jefferson County.
7. August 3, 1961. Two miles west of Carrollton, Carroll County.
8. December 5, 1965. Turpin Creek, 3.3 miles west of Waco, Madison County.
9. April 23, 1967. Daniel Boone Church Camp, Jessamine County.
10. October 18, 1966. Flood plains of Million Creek, Tates Creek Road, 4.3 miles north of Richmond, Madison County.
11. June 10, 1968. Williams Bend, Buck Creek, Pulaski County.
12. November 27, 1965. Four and one-half miles southeast of Big Hill, State Highway 421, Rockcastle County.
13. October 8, 1966. Red River valley, 1.4 miles downstream from Hazel Green, Wolfe County.
14. July 13, 1966. Near Lake Reba spillway, 3 miles east of Richmond, Madison County.
15. March 28, 1966. Beneath Interstate Highway 75 bridge on Kentucky River, 10 miles north of Richmond, Madison County.
16. November 21, 1965. Boone Memorial Bridge, State Highway 277, Kentucky River bluffs, Clark County.
17. September 4, 1966. Silver Creek valley, 6 miles west of Richmond on Barnes Mill Road, Madison County.
18. October 14, 1965. Low hillside 1.5 miles west of Richmond on State Highway 52, Madison County.
19. December 22, 1965. Blue Grass Ordinance, Madison County.
20. August 4, 1964. Licking River at Butler, County Highway 609, Pendleton County.
21. March 11, 1966. Black Creek, 0.75 mile north of Clay City, Powell County.
22. May 7, 1966. Bluffs of Russell Branch of Big Sandy River, east side of Elk Horn City, Pike County.
23. August 22, 1966. Eagle Falls, Cumberland Falls State Park, McCreary County.
24. July 19, 1968. Cumberland River banks, Williamsburg, Whitley County.
25. March 16, 1966. Limestone outcrop on bluffs of Cumberland River, Cumberland Falls State Park, McCreary County.
26. June 19, 1968. Boonesborough State Park, Madison County.
27. July 3, 1968. Annville, Jackson County.
28. May 4, 1966. Berea Woods, near Caretaker's home, Berea, Madison County.
29. May 6, 1966. Pottertown, 8 miles northwest of New Concordia, Calloway County.

* Supported by Eastern Kentucky University faculty grants.

30. August, 1966. Base of Kentucky River bluffs on flood plains, near Interstate Highway 75 bridge, Fayette County.
31. July 29, 1967. Hillside, 5 miles west of Cumberland Falls, near Honeybee, McCreary County.
32. April 10, 1964. Kentucky River bluffs, Frankfort, Franklin County.
33. August 4, 1964. Flood plains of Licking River, four miles east of Butler on State Highway 609, Pendleton County.
34. December 4, 1966. Richmond Country Club, Madison County.
35. April 30, 1966. Camp Robinson Forest, Perry County.
36. October 8, 1966. Camp Bellsville, Taylor County.
37. April 10, 1966. Little Kentucky River, Bedford, Taylor County.
38. May 17, 1967. Levi Jackson State Park, State Highway 229, Laurel County.
39. August 22, 1966. Near Table Rock Fire tower, northeast boundary, Cumberland Falls State Park, Whitley County.
40. December 16, 1965. Canyon system, 5.5 miles southeast of Berea, Madison County.
41. December 20, 1965. Ravenna, 2 miles southeast of Irvine, Estill County.
42. July 19, 1968. Buck Creek crossing of State Highway 192, near Somerset, Pulaski County.
43. July 7, 1968. Underground valve housing, Crescent Springs, Kenton County.
44. October, 1964. Bluffs of Triplet Creek, 4 miles west of Morehead on State Highway 60, Rowan County.
45. September 20, 1966. Hillsides, intersection of Mountain Parkway and Powell-Clark County line, in Clark County.
46. March 16, 1966. Limestone outcrop overlooking Cumberland Falls, Cumberland Falls State Park, Whitley County.
47. April 7, 1966. Heavily shaded, moist ravine, Disputanta, Rockcastle County.
48. December 5, 1965. Hillside, 1.1 miles south, 3 miles east of Irvine, Estill County.
49. September 6, 1966. Red River valley at Belknap, Wolfe County.
50. July 8, 1967. Bluffs of Red River at U.S. Highway 89 bridge, Estill County.
51. May 16, 1966. Sewage filtration plant, Cumberland Falls State Park, Whitley County.
52. May 14, 1966. Mill Creek valley, 1.5 miles above Mill Lake, Wolfe County.
53. May 29, 1968. Just west of Somerset, old State Highway 80, Pulaski County.
54. May 9, 1966. Lowlands near railroad, 3 miles west of Pineville, old U.S. Highway 25 E, Knox County.
55. April 3, 1966. Murray State University Campus, Murray, Calloway County.
56. December 23, 1966. River bottomland, 8 miles east of Richmond, State Highway 52, Madison County.
57. May 16, 1968. Banks of (or in) Salt River, Shepherdville, Bullitt County.
58. April 9, 1966. Zachariah, Lee County.
59. March 6, 1966. Red River valley and hillsides, Log Lick, Clark County.

ANNOTATED LIST

Corbicula manilensis Philippi
Collections: 3(1) 23(2).
The Asiatic clam, first recorded from the United States in the Pacific Northwest (Ingram, 1959) and from Kentucky near Paducah (Sinclair and Isom, 1961), has steadily spread its range through the Tennessee, Cumberland (Bickel, 1966), Green (Bates, 1962), Kentucky and Red rivers (Branson and Batch 1969). The authors also have several records from Dix River below Lake Herrington Dam in the vicinity of High Bridge. The specimens reported here ranged from 18.5 to 48.0 mm (record size?) in total length, and 17.0 to 41.0 mm in greatest depth. Thomerson's and Myer's (1970) specimen-sample from Granite City, Illinois ranged from 4.0 to 31.0 mm in total length, whereas the 75 specimens reported by us (1969) from the Kentucky River ranged from 14.8 to 33.0 mm.

Pisidium variabile Prime
Collections: 11(3).
The eleven specimens, secured from a mud-bottomed pond, measured 4.0 to 4.5 in total length and 3.9 to 4.0 in height. Bickel (1967) did not list this species for the Kentucky pelecypod fauna.

Sphaerium striatinum (Lamarck)
Collections: 1(42) 8(4).
Probably the most common sphaeriid in Kentucky flowing waters.

Sphaerium sulcatum (Lamarck)
Collections: 2(4).

Sphaerium transversum (Say)
Collections: 1(3).
Common in farm ponds.

Truncilla truncata Rafinesque
Collections: 1(5).
Lampsilis ventricosa (Barnes)
Collections: 1(42).

Dysnomia brevidens (Lea)
Collections: 1(42).

Goniobasis laqueata (Lea)
Collections: 10(6).

Pleurocera canaliculatum (Say)
Collections: 4(7).
The known distribution of this and other Kentucky aquatic snails was outlined by Branson (1970).

Pomatiopsis lapidaria (Say)
Collections: 1(8); 3(9); 10(10) 1(45).
The specimens averaged 6.1 (5.3-7.0) in length, and possessed 5¾ to 6 w 3 whorls.

Oligyra (Helicina) orbiculata (Say)
Collections: 5(11).
Height 5.8 to 6.3; diameter 7.5; whorls 4¾ to 5.

Carychium exiguum (Say)
Collections: 137(4) 8(5).
Height 1.6 to 2.0; diameter 0.5 to 0.7; whorls 5 to 5½. Shell-sculpturing is rather sharply defined.

Carychium nannodes Clapp
Collections: 40(5). 1(12).
Height 1.5 to 1.6; diameter 0.5 to 0.7; whorls 4½ to 5½.

Cionella lubrica morseana Doherty
Collections: 1(5) 1(13).
Hubricht (1968) considers this a full species.

Vallonia pulchella (Müller)
Collections: 2(4) 2(14) 1(15).
Diameter 2.0 to 2.5; whorls 2 1/3 to 3½.

Gastrocopta procera (Gould)
Collections: 14(4). 4(5). 2(14)
This species, in fact pupillids in general, appears to be more abundant west of the eroded plateau area. Height 2.5 to 2.7; diameter, 0.9 to 1.2; whorls 5½ to 6.

Gastrocopta armifera (Say)
Collections: 22(4), 39(5), 37(16). 4(17), 8(18), 1(19).
Height 4.2 (3.7-5.0); diameter 2.2 (2.0-2.5); whorls 6 1/3 to 7½.

Gastrocopta contracta (Say)
Collections: 81(4) 14(5) 1(9) 2(10), 1(12). 2(14). 1(45).
Height 2.3 to 2.7; diameter 1.3 to 1.7; whorls 4 1/3 to 5½.

Gastrocopta pentodon (Say)
Collections: 14(4). 12(5). 4(14).
Height 1.9 (1.6-2.0); diameter 0.9 (0.8-1.0); whorls 4½ to 5½.

Gastrocopta tappaniana (C. B. Adams)
Collections: 25(4). 62(5).
Height 2.1 (1.8-2.2); diameter 1.1 (1.0-1.3); whorls 4½ to 5½.

Gastrocopta corticaria (Say)
Collections: 1(4).
A typical specimen.

Vertigo gouldi (Binney)
Collections: 3(4) 1(5).
Height 1.8 to 2.2; diameter 1.0 to 1.1; whorls 4¾ to 5; 5 teeth.
The shells are distinctly, closely and obliquely striate.

Vertigo milium (Gould)
Collections: 5(4) 5(5) 1(14).
Height 1.4 to 1.5; diameter 0.7 to 1.0; whorls 4½ to 5.

Vertigo tridentata Wolf
Collections: 4(4) 17(5).
Height 1.9 to 2.2; diameter 1.0 to 1.2; whorls 4 7/8 to 5½.

Vertigo ventricosa (Morse)
Collections: 1(14).
Height 2.3; diameter 1.3; whorls 5 2/3.

Columella edentula (Draparnaud)
Collections: 1(5).
Height 2.2; diameter 1.2; whorls 5 2/3

Strobilops aenea Pilsbry
Collections: 1(5), 2(12).

Strobilops affinis Pilsbry
Collections: 2(16).
Diameter 2.4 to 2.5; 6 whorls

Succinea species
Collections: 1(4), 2(5).
The specimens were too immature to allow specific diagnosis.

Succinea ovalis Say
Collections: 2(5). 1(20).
Length 11.0 to 23.2; spire length 3.8 to 9.8; aperture length 8.0 to 15.5; whorls 3 to 3½.

Catinella vermeta (Say)
Collections: 2(5), 1(21), 1(45).

Philomycus batchi Branson
Collections: 4(22).
There is an indistinct, thin, longitudinal black line about one-third the way up from the ventral edge on either side of the mantle in two specimens, and all specimens have the mantle profusely pep-

pered with small black punctae. These slugs strongly resemble ones secured from Black Mountain (Branson, 1968). Contracted length 28.6 to 40.8; width of sole, 3.5 to 6.3.

Philomycus carolinianus (Bosc)
Collections: 3(9) 1(23). 2(17) 1(24), 3(25) 1(26) 2(27).
There is considerable variation in the ground color of this slug, dusky-blue to pale yellowish brown. In all specimens, however, the double row of black spots along the midline of the mantle is present. Contracted length 29.7 (16.5 to 38.3); width of sole, 5.5 (2.5 to 8.0).

Philomycus virginicus Hubricht
Collections: 3(22). 1(28).
The ground color is light chamois, the foot margin being pale yellow suffused by pale gray. The back is profusely peppered and mottled with light brown, and two broad, dark mahogany bands parallel the dorsum (nearly contiguously), diverging slightly anteriorly. The mantle bears a dorso-lateral band of the same color on each side. Contracted length 36.9 (27.8 to 47.5); width of sole 6.9 (4.6 to 8.0).

Pallifera dorsalis (Binney)
Collections: 2(17), 4(22).
All specimens were pale- to bluish-gray above and the sides of the foot were rust colored anteriorly (gray in alcohol). The back is immaculate. Contracted length 16.0 (13.6 to 18.0); 2.0 (1.6 to 2.3).

Pallifera fosteri (Baker)
Collections: 2(12), 1(28).
The mantle is light tan with a wavy, dark brown mid-dorsal streak and an interrupted band or series of blotches along each flank of the mantle. The spaces between the bands by grayish or brownish reticulations and blotches. Contracted length, 13.1 (10.0 to 12.5); width of sole 2.0 (1.9 to 2.0).

Pallifera ragsdalei Webb
Collections: 1(14), 1(29). 1(26) 1(28).
The sides of the mantle are dark grayish-brown, bearing an undulating, dorsolateral, mahogany-brown band on either side. The dorsum is lighter in color, grayish-tan with a double row of elongate mahogany dashes which send a few diagonal stripes to make contact with the lateral bands. The sole is dead white, and the edge of the foot rusty red in life, gray in alcohol. Contracted length 35.4 (27.3 to 43.5); width of foot, 5.5 (5.0 to 5.9).

Pallifera wetherbyi W. G. Binney
Collections: 1(22). 4(24). 1(25 - type locality).
The diagonal cross-bands tend to coalesce laterally to produce an irregular longitudinal band on either side in large specimens, and in the largest specimen from station 24 there is a broad, middorsal band as well, being produced by the contacting chevrons. Contracted length. 36.6 (31.5 to 44.5); width sole, 6.2 (5.5 to 7.4). This species spends daylight hours in sandstone cracks.

Pallifera varia Hubricht
Collections: 3(22).
The mantle bears a very dense, dappled pattern, and the edge of the foot is pinkish gray in life. Contracted length, 29.0 (23.5 to 34.2); width sole, 6.3 (5.5 to 7.5).

Anguispira alternata (Say)
Collections: 1(4). 5(5). 1(8) 1(9) 12 (10) 1(12). 14(15), 27(17), 3(18). 2(26), 1(28). 2(30), 3(31), 3(32) 2(33) 2(34), 2(35). 12(36) 8(45),
In shells of 11.0 to 13.0 mm diameter the periphery is usually strongly depressed to keeled, and in ones 19.0 mm or larger the periphery is nearly always angular The rib-striation is rather coarse, becoming more so at the periphery, and the basal sculpturing varies from low to as heavy as above. In specimens above 18.0 mm there are 7 to 8 ribs per 3.0 mm of body whorl, but in specimens smaller than 10 mm the striations are considerably more crowded, approximately 11 to 14 per 2.0 mm. The increase in height, as well as increase in umbilical diameter, with increase in shell diameter is essentially a straight line relationship (Fig. 1).

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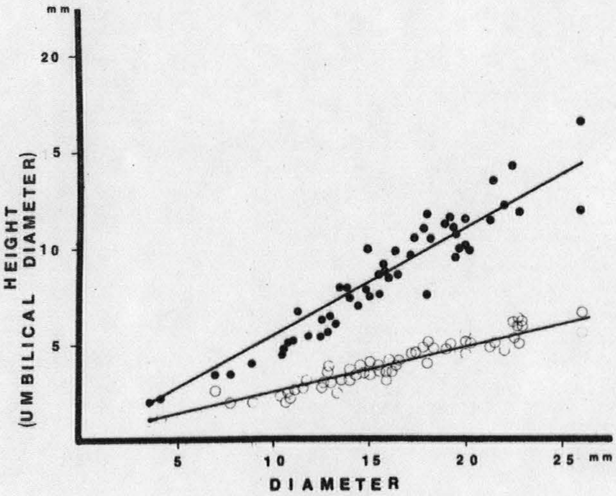
FIGURES 1-3, NEXT PAGE

FIG. 1. Regression of shell height on diameter (solid circles) and umbilical diameter on shell diameter (open circles) in *Anguispira alternata*.

FIG. 2. Histogram showing continuous variation in shell diameter between the nominal species *Retinella cryptomphala* and *Retinella solida*. $t_{0.05}$ of $H_0 : \mu_1 = \mu_2 X$ accepted.

FIG. 3. *Stenotrema edvardsi*. a = basal view; b = apertural view.

Practical Limits	f	Class Mark
3.2 - 3.6	3	3.4
3.7 - 4.1	1	3.9
4.2 - 4.6	4	4.4
4.7 - 5.1	7	4.9
5.2 - 5.6	9	5.4
5.7 - 6.1	3	5.9
6.2 - 6.6	4	6.4



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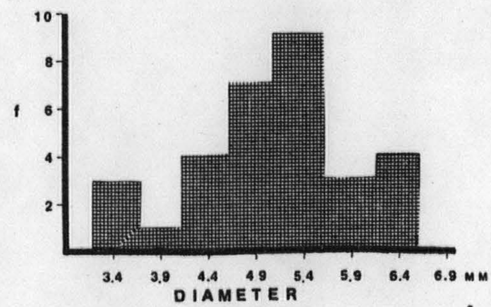

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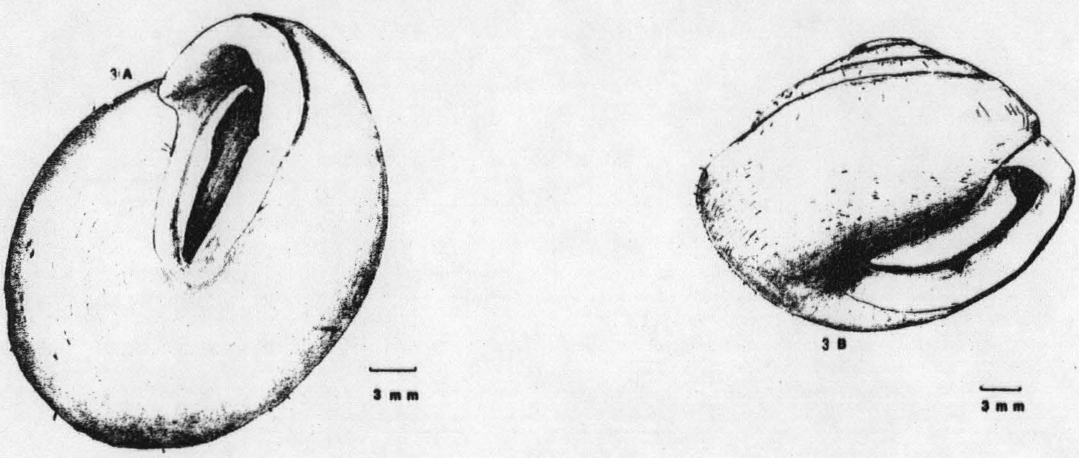

BRANSON AND BATCH

Anguispira kochi (Pfeiffer)
Collections: 7(9), 4(12), 8(37).

Discus cronkhitei (Newcomb)
Collections: 69(4) 11(5). 4(9). 3(10). 19(15) 7(26).

The specimens from stations 4, 9, and 10 seem to be intermediate between typical *D. cronkhitei* and *D. c. catskillensis* (Pilsbry). In fact, the specimens with coarsely raised, round sculpture, angular periphery, rounded aperture, and moderately elevated spire are nearly identical to specimens from Pennsylvania. Diameter 4.7 (3.9 to 5.9); height 2.9 (2.5 to 3.5); whorls 3 1/3 to 4½.

Discus patulus (Deshayes)
Collections: 17(9), 30(12), 1(24). 4(28), 3(38), 4(39), 1(40), 2(41).

Helicodiscus notius Hubricht
Collections: 2(4). 1(42).

Helicodiscus parallelus (Say)
Collections 3(5). 1(14). 2(15). 1(19) 1(35).

Helicodiscus nummus (Vanatta)
Collections: 1(4), 1(5).

Helicodiscus singleyanus (Pilsbry)
Collections: 1(4). 1(5).

Punctum minutissimum (Lea)
Collections: 10(4) 8(5).

Diameter 1.2 (1.0 to 1.2); whorls 3 1/5 to 3½.

Limax maximus Linnaeus
Collections: 1(38).

Deroceras laeve (Müller)
Collections: 10(43).

Retinella burringtoni (Pilsbry)
Collections: 1(15).

The specimen has very obvious spiral sculpture and an ovate aperture. It measured 4.5 in diameter, 2.3 in height, and had a 1.5 umbilicus and 3 whorls.

Retinella wheatleyi (Bland)
Collections: 6(5), 2(9). 1(12). 3(17), 2(39). 1(44) 1(45).

Retinella carolinensis (Cockerell)
Collections: 5(4). 12(10) 1(38), 6(45).
The shells, 3.7 (1.6 to 4.8) in diameter with 2½ to 4½ whorls, possess close-set, beautiful spiral sculpture and an umbilicus which is approximately one-half open.

Retinella cryptomphala (Clapp)
Collections: 4(5) 6(9) 3(10). 4(15), 3(16) 8(17) 3(18) 1(21) 2(45) 2(48), 2(49) 32(59).

The major radial grooves are rather widely spaced on the body whorl, there being only 2½ of them on the last half of that whorl in a shell of 5.5 mm diameter. The large (4.9 to 6.5 mm) shells from stations 5, 21, and 59 are very similar to the nominate form *R. solida* Baker; the major sculpturing is deep set, relatively broad, and the spirals are dense, wavy. As far as the whole collection is concerned, the shells averaged 5.1 (3.2 to 6.5) in diameter. However, when the diameter data are categorized and transformed into a histogram (Fig. 2) continuous variation is demonstrated, probably of the normal type. Likewise, $t_{0.05}$ ($H_o: \mu_1 = \mu_2$) indicates a lack of significance between the means of the larger (4.9 to 6.5) and smaller shells, i.e., the two nominate forms cannot be distinguished by size alone.

Retinella indentata (Say)
Collections: 51(5). 1(9). 4(12). 3(13) 1(14), 5(15). 9(17) 9(18) 1(39) 68(45).

Retinella praecox Baker
Collections: 1(5), 3(12). 2(30).

These pinkish-tan shells averaged 5.5 (3.8 to 7.8) in diameter, with 4 to 5 5/6 whorls.

Retinella sculptilis (Bland)
Collections: 1(28). 1(39). 1(44).

These three shells, averaging 6.8 (5.9 to 7.5) diameter, were rather pinkish in life, but faded to a definite brassy color in vials, more or less whitish on the base. The largest (7.5) shell has 62 major grooves on the last whorl, whereas the 7.0 specimens possess 84. The animal was very dark, nearly black. These characters contrast sharply with those of *R. carolinensis*, in which the animal is light-colored, and where there are about 46 major grooves on the last whorl.

This form may be a new race. If this proves to be the case, it is probably most closely related to *R. sculptilis subdola* H. B. Baker (Pilsbry, 1946) from the Tennessee Smokies.

Mesomphix latior (Pilsbry)
Collections: 2(39)

Diameter 13.0; height 7.3; width of spire 6.0; width of last whorl 6.0; 4 whorls.

Mesomphix perlaevis (Pilsbry)
Collections: 3(5), 18(15) 8(17), 4(23), 2(39), 1(42), 3(44), 1(45), 5(50), 1(51).
Spirally arranged papillae are only weakly developed; the surface is thus glossy. Diameter 15.8 (10.0 to 19.8); height 9.7 (5.7 to 12.3); diameter umbilicus 1.1 (0.4 to 1.4); height aperture 8.2 (5.3 to 11.4); width aperture 8.3 (5.5 to 10.5); 3 5/6 to 5 whorls.

Mesomphix vulgatus Baker
Collections: 15(5), 6(17), 1(18), 1(22), 2(26), 5(30) 3(46).
These beautifully spirally sculptured ('beaded') shells are relatively common in third and fourth order valleys. Diameter 20.6 (16.5 to 23.6); height 12.7 (11.5 to 14.0); whorls 4 1/3 to 5. Two shells, 16.5 and 18.0 in diameter had basal perforations measuring 2.0, respectively.

Mesomphix inornatus (Say)
Collections: 1(5), 5(9), 1(23), 6(35).
Diameter 14.8 (11.5 to 20.0); height 7.3 (6.0 to 10.0); width last whorl 6.4 (4.8 to 7.6); width spire 9.1 (7.0 to 11.3); height aperture 7.5 (5.0 to 10.5); width aperture 7.0 (6.3 to 8.3); 4½ to 5½ whorls.

Mesomphix cupreus (Rafinesque)
Collections: 1(5), 6(12) 10(23), 6(35).
Diameter 24.9 (19.0 to 29.0); height 13.9 (10.0 to 16.5); height aperture 12.3 (9.7 to 14.0); width aperture 12.1 (10.0 to 14.3); diameter umbilicus 3.6 (2.3 to 4.5); 4 to 4¾ whorls. A lowland species.

Mesomphix derochetus Hubricht
Collections: 26(23), 3(26) 11(30), 2 (50).
Often confused with *M. vulgatus*, this species has a dull lustre because of numerous close-set papillose spirals. The apex is whitish, and the general ground color varies from light tan to yellow. The preferred habitat seems to be river valleys. Diameter 20.8 (16.2 to 23.2); height 12.7 (10.0 to 15.0); height aperture 10.2 (8.5 to 11.7); width aperture 11.5 (8.8 to 14.0); 4½ to 5 whorls.

Mesomphix friabilis (Binney)
Collections: 1(4).

Paravitrea capsella (Gould)
Collections: 1(17).
This specimen measures 5.5 in diameter, 3.5 in height, 1.0 in umbilical diameter, and has nearly 7 whorls.

Paravitrea placentula (Shuttleworth)
Collections: 4(15), 2(16). 5(18), 1(52).
Diameter 5.0 (4.0 to 5.7); height 2.9 (2.1 to 3.5); 6½ to 7¼ whorls.

Paravitrea petrophila (Bland)
Collections: 4(5). 9(9).

Hawaiia minuscula (Binney)
Collections: 51(4), 42(5) 1(14) 1(15), 154(45).
Diameter 2.4 (1.9 to 3.0); 3¾ to 4+ whorls.

Euconulus chersinus (Say)
Collections: 1(5), 2(15) 1(16). 1(19).

Guppya sterkii (Dall)
Collections: 3(5), 1(12).
The spire seems somewhat more depressed than usual for this species. Diameter 1.0 to 1.2; 3 to 3½ whorls.

Gastrodonta interna (Say)
Collections: 1(9) 2(12). 1(45).

Ventridens nodus Pilsbry
Collections: 2(12), 4(46).
The base is distinctly concave around a minute umbilicus, and the shell is broadly dome-shaped. The lamella on the thickened columellar axis is directed outward. A second lamella located near the outer edge of the body-whorl floor, is strongly curved, directed slightly inward and upward. The growth sculpture is very low, rounded, and no spiral sculpture is evident. This form was referred to *V. gularis* by Pilsbry (1946, p. 447; holotype, ANSP 165566). We have also collected the species from the eastern end of Pine Mountain, Pike County, Kentucky. Diameter 7.9 (6.5 to 10.5); height 5.2 (3.5 to 7.4); 6 1/3 to 8 whorls.

Ventridens lawae (Binney)
Collections: 6(38).
Very similar to shells secured from Clay County, North Carolina. Diameter 7.0 (5.5 to 9.0; height 3.2 (2.6 to 4.0); 5½ to 9 whorls.

Ventridens acerra (Lewis)
Collections: 1(4) 5(5) 26(9). 6(15), 1(24) 1(53).
Diameter 11.3 (9.5 to 12.5); height 7.9 (7.0 to 9.0); 5½ to 8 1/3 whorls.

Ventridens demissus (Binney)
Collections: 4(5) 1(12), 4(17), 4(23), 12(34) 1(35), 3(38) 6(45), 1(49).
Diameter 9.1 (6.5 to 10.5); height 6.0 (4.0 to 7.5); 5½ to 7 whorls.

Ventridens intertextus (Binney)
Collections: 13(5), 4(9), 9(10). 11(18), 1(28), 17(30).

In most specimens, the radial striae are sharp and the papillose spirals are distinct above and below (almost as strongly developed in specimens from station 28 as those in *V. intertextus eutropis* (Pilsbry). The periphery is angular in all specimens and the umbilicus is tiny, less than 1.0 in diameter. Diameter 11.2 (7.5 to 13.0); height 7.8 (4.6 to 10.5), 5½ to 7 whorls.

Ventridens ligera (Say)
Collections: 11(17), 7(21), 22(26), 11 (30).
Diameter 11.6 (8.9 to 13.8); height 8.6 (6.0 to 10.9); 6 to 7 whorls.

Ventridens pilsbryi Hubricht
Collections: 1(25), 1(39).
Diameter 6.5 to 7.0; height 4.0 to 4.5; 7½ to 7 2/3 whorls.

Zonitoides arboreus (Say)
Collections: 3(4), 1(5), 10(28), 6(45), 2(54).
Diameter 4.2 (2.5 to 5.2); 3¼ to 4 7/8 whorls.

Zonitoides nitidus (Müller)
Collections: 2(45).

Zonitoides lateumbilicatus (Pilsbry)
Collections: 1(16).
Diameter 4.4; diameter umbilicus 1.8; 3 whorls.

Striatura milium (Morse)
Collections: 9(4), 11(5).
Diameter 1.3 (1.1 to 1.5); 2¾ to 3½ whorls.

Striatura exigua (Stimpson)
Collections: 1(30).
33 raised riblets on the last whorl. Diameter 1.5 diameter umbilicus 0.6; 2 4/5 whorls.

Striatura ferrea Morse
Collections: 1(4).
Wide open, perspective umbilicus; riblets poorly defined, and the spiral sculpture is faint. Diameter 1.2; 2½ whorls.

Haplotrema concavum (Say)
Collections: 15(5), 1(8), 6(9), 1(10), 5(12), 3(13), 21(15), 21(17), 5(26), 26 (30), 1(32), 1(39), 4(45), 2(50).
Diameter 15.2 (5.5 to 21.3); height 7.2 (2.5 to 10.0); diameter umbilicus 5.0 (2.0 to 6.6); 3 to 5½ whorls.

Polygyra plicata (Say)
Collections: 36(9), 67(11), 1(30).
Diameter 7.0 (6.5 to 7.5); height 3.1 (3.0 to 3.5); 5 to 5½ whorls.

Stenotrema hirsutum (Say)
Collections: 2(5), 2(9), 1(12), 2(17), 11(38), 1(39).
Diameter 7.4 (6.5 to 8.6); height 4.9 (4.3 to 6.0); whorls 4 2/3 to 5.

Stenotrema stenotrema (Pfeiffer)
Collections: 1(4), 6(5), 31(9), 4(10), 25(15), 6(17), 2(18), 1(23), 1(30), 2(38), 1(39), 4(45).
Diameter 10.3 (8.8 to 12.2); height 6.6 6.0 to 7.7); whorls 5 to 5 4/5.

Stenotrema angellum Hubricht
Collections: 1(5), 33(12), 6(30), 1(32), 2(45), 2(50), 3(54).
Comparing ($H_o: \mu = \mu_o$) the measurable data (height, diameter, and height/diameter) secured from specimens of this species with those secured from the *S. stenotrema* cited above indicates that the means are not significantly different at $P_{.05}$. Hence, the validity of *S. angellum* rests on the angular nature of the body whorl, a character of little value because of extreme variability in the species compared, and the spiral arrangement of the periostracal hairs; in *Stenotrema stenotrema* the bases of the hairs are supposedly radially arranged. In some specimens (station 50) the hairs are very definitely spirally arranged above and below, whereas in others they are spirally arranged above but radially arranged below. One of the specimens from station 12 (10.3 mm in diameter) has radially arranged hairs on the first few whorls but spirally arranged ones on the body whorl. These facts indicate considerable variation in this trait and, to our way of thinking, casts some doubt on the validity of *S. angellum* as a distinct species. Diameter 10.2 (9.5 to 11.2); height 6.5 (5.8 to 7.5); whorls 5 to 5½.

Stenotrema barbatum (Clapp)
Collections: 1(12), 1(15), 3(17), 1(25), 1(30), 1(45).
This interesting form is somewhat of an enigma. The surface is covered with short, stiff hairs, the bases of which are spirally to obliquely arranged. The lip-notch is broadly u-shaped, and the aperture is wider than the reflected portion of the peristome. Since this shell type is relatively scarce by comparison with *S. hirsutum* and *S. stenotrema*, and is sympatrically distributed with both the latter species, the thought occurs that *S. barbatum* might possibly be a hybrid, *S. stenotrema* X *S. hirsutum*. Diameter 9.4 (8.9 to 10.8); height 6.4 (5.8 to 7.0); whorls 4 5/6 to 5½.

Stenotrema edvardsi (Bland)
Collections: 2(23) 3(24) 1(39).
The large specimens from station 24 (Fig. 3 a, b) have been compared with Bland's types at the Museum of Comparative Zoology, Harvard, since they do not 'key' well in Pilsbry's (1940) monograph. Diameter (sta. 5) 10.8 (10.0 to 11.3); height 5.8 (5.0 to 6.3); whorls 4¾ to 5 1/3.

Stenotrema fraternum (Say)
Collections: 1(4) 3(5). 1(10), 5(17), 2(21).
Diameter 9.9 (9.0 to 11.0); height 6.3 (6.0 to 7.0); whorls 5 1/5 to 6.

Stenotrema leai (Binney)
Collections: 1(26), 26(28).
Diameter 8.7 (8.0 to 9.3); height 5.5 (5.0 to 6.0); whorls 5½ to 6½.

Mesodon clausus (Say)
Collections: 2(5), 4(17), 1(24), 1(26), 23(54), 3(55).
Diameter 14.2 (12.5 to 15.5); height 10.6 (9.4 to 15.5); whorls 4¾ to 5¼)

Mesodon downieanus (Bland)
Collections: 7(10), 14(38). 3(54).
The umbilical condition varies from tightly closed to open by the merest niche. Diameter 10.7 (8.5 to 14.0); height 7.5 (5.3 to 10.5); whorls 4½ to 5 1/3.

Mesodon pennsylvanicus (Green)
Collections: 2(15). 1(26).
Diameter 15.5 to 17.0; height 11.2 to 12.8; whorls 5½ to 6¼.

Mesodon thyroidus (Say)
Collections: 1(2), 1(3) 1(4), 29(5), 13(8), 16(9) 3(10) 2(14), 9(15), 15(17), 3(18), 5(19), 4(21), 1(25). 7(26) 2(28), 23(30). 6(38), 1(39), 1(45), 4(50), 12 (54), 2(56), 4(57).
The umbilicus varies from one-half to two-thirds open, and in all shells, where present (9:1), the parietal tooth is small, The specimens from station 14 have depressed shells. Diameter 23.1 (18.5 to 27.5); height 14.9 (11.8 to 18.5); whorls 4½ to 5½.

Mesodon zaletus (Binney)
Collections: 9(5) 46(9), 1(12) 6(15), 1(16), 6(17), 1(23), 4(28), 3(30), 3(31), 12(45). 2(47).
Diameter 28.0 (24.5 to 34.0); height 19.0 (16.5 to 24.3); whorls 4 7/8 to 5¾.

Mesodon elevatus (Say)
Collections 1(17).

Mesodon appressus (Say)
Collections: 3(4). 14(5), 2(8), 42(9), 21(15), 1(21), 5(24), 3(25), 5(26). 23(30), 1(31) 2(35). 11(38), 1(39), 33(44). 3(51), 33(54), 1(58).
At station 5, 5 of 13 specimens (38%) were abnormal: the spire is greatly depressed which causes the outer lip to become flared. In two specimens the second and third whorls are sunken below the level of the first and fourth, and in one fully mature specimen the umbilicus is ¾ open. Diameter 17.2 (14.7 to 19.3); height 8.4 (7.5 to 9.3); whorls 4½ to 5½.

Mesodon perigraptus X *M. appressus*
Collections: 3(15).
These rib-striate, chamois-colored shells possess both incised spirals and papillae between the striae, and measure 17.0 to 17.6 mm in diameter, 7.5 to 8.5 mm in height, and have 4 5/6 to 5 whorls. This diagnosis is admittedly a judgement, but, we believe, a valid one. *Mesodon perigraptus* is known from this region (Branson and Batch, 1970), but it is scarce, which probably accounts for its hybridization with *M. appressus*. The scarcity of one species in the presence of an abundance of another often stimulates the phenomenon of hybridization.

Mesodon sayanus (Pilsbry)
Collections: 1(25), 4(35), 2(44). 1(47).
Diameter 26.2 (23.8 to 29.5); height 15.7 (14.5 to 17.0); diameter umbilicus 5.4 (4.2 to 6.5); whorls 5 2/3 to 6 1/3.

Mesodon inflectus (Say)
Collections: 4(4), 27(5), 15(9), 15(10), 2(12), 7)(17) 3(19) 1(25) 1(34) 1(36), 8(45), 9(54) 1(56).
Diameter 11.1 (9.7 to 12.7); height 6.2 (5.0 to 7.3); whorls 4½ to 5 1/3.

Mesodon rugeli (Shuttleworth)
Collections: 33(5), 7(12), 31(15) 30 (18) 4(21) 8(26) 15(30), 2(32). 5(42) 2(50). 1(51) 3(59).
Mesodon rugeli primarily frequents upland situations, whereas *M. inflectus* is more apt to be collected in the valleys. Diameter 11.1 (9.5 to 12.1); height 6.1 (5.2 to 6.8); whorls 4½ to 5¼.

Triodopsis fraudulenta (Pilsbry)
Collections: 2(9), 1(17), 2(26), 1(30), 3(45).
Diameter 15.7 (14.5 to 17.0); height 8.7 (8.3 to 9.3); diameter umbilicus 3.7 (3.5 to 4.5); whorls 5½ to 6.

Triodopsis claibornensis Lutz
Collections: 26(24).
In all specimens, a callus ridge extends from the lower palatal toward the umbilical region. The distal tip of the parietal tooth is directed above the palatal (one specimen has two palatals). The distribution of this species is additional evidence for demonstrating a biologic relationship between the highlands of Tennessee and the Cumberland Pine Mountain portion of Kentucky. Diameter 11.4 mm (10.0 to 12.9): height 6.6 mm (6.0 to 7.1): whorls nearly 5 to 5½.

Triodopsis tridentata (Say)
Collections: 5(3), 1(5), 4(21) 3(25), 2(28), 3(35), 5(50).
Diameter 16.7 (14.2 to 20.0); height 8.2 (7.1 to 10.0); diameter umbilicus 3.0 (2.3 to 3.5); whorls 5¼ to 5 2/3.

Triodopsis complanata (Pilsbry)
Collections: 7(5). 21(12), 2(17), 5(42), 4(45).
By some considered as a subspecies of *T. tridentata* (Pilsbry, 1940), this form does not seem to intergrade with the last-named species, although they are sympatrically distributed over part of the ranges. The glistening shell bears small patches of granules behind the lip and around the umbilicus, and spirally arranged rows of them occur on the whorls above and below, being heaviest near the sutures. The lip teeth are reduced to mere nubs, the spire is depressed, and the umbilicus is large. Diameter 16.3 (11.4 to 19.5): height 8.6 (7.5 to 9.8); diameter umbilicus 3.6 (3.1 to 4.0); whorls 5 to 5 2/3.

Triodopsis tennesseensis (Walker)
Collections: 9(38).
The parietal tooth points at or slightly below the poorly developed outer palatal. Many papillae follow the growth striae. Diameter 16.4 (14.7 to 17.3); height 7.6 (7.0 to 8.3); diameter umbilicus 3.1 (3.0 to 3.5); whorls 5 to 5 2/3.

Triodopsis denotata (Férussac)
Collections: 1(5), 2(9), 1(15) 1(17), 3(26), 1(36).
Diameter 21.7 (20.6 to 22.5); height 11.4 (11.0 to 12.0); whorls 4 7/8 to 5½.

Triodopsis albolabris (Say)
Collections: 1(5), 13(35) 3(38) 1(39), 3(54).
Diameter 34.7 (32.0 to 37.3): height 22.1 (20.5 to 23.0); whorls 5½ to 6.

Allogona profunda (Say)
Collections: 2(9), 1(12) 2(17) 1(20).
Diameter 27.9 to 29.5; height 14.5 to 16.5; diameter umbilicus 5.0 to 5.8; whorls 5 1/5 to 5 2/3.

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PRESENT STATUS OF *ELLIPTIO COMPLANATUS* IN DOUGLAS LAKE, MICHIGAN

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Matteson (1948) in studying the species' life history in the mid 1940's, transported mussels from Ocqueoc River and Ocqueoc Lake to Douglas Lake and placed them in shallow water near shore to serve as a storage population and stock for experimentation. He states that some clams stored over the winter moved into deeper water with the return of warmer weather and became scattered and difficult to retrieve.

Evidently the small population of *E. complanatus* accidentally released is maintaining itself along the sandy, wave swept shoal areas of the eastern and southeastern shores of Douglas Lake.

Perca flavescens, the yellow perch, has been found to serve as a glochidial host (Lefevre and Curtis, 1912). Matteson (1948) found that only yellow perch, obtained in Douglas Lake, became infected with glochidia and served as a natural host.

It was somewhat surprising on the basis of distribution (Athearn and Clarke, 1962) to find two specimens of *E. complanatus* in Douglas Lake (Cheboygan County) in August, 1968 and two in August, 1969. Furthermore, Dr. W. Fennel found one specimen in early August, 1969. The nearest occurrence of *E. complanatus* is from Ocqueoc River and Lake, approximately 25 miles to the east.

In Michigan this species occurs throughout the Upper Peninsula. However, to date the only authentic Lower Peninsula records are from Alpena and Presque Isle counties, which comprise the extreme western limits of the Northern Atlantic pelecypod faunal region (Goodrich and van der Schalie, 1939); van der Schalie and van der Schalie, 1950).

Eggleton (1952) lists four species of unionids as occurring in Douglas Lake, *Anodonta grandis*, *Ligumia nasuta*, and *Lampsilis siliquoidea*. The fourth, *Anodontoides ferussacianus subcylindraceus* has not been collected for many years and is quite rare, if not extinct, at this time.

E. complanatus occurs in a variety of lentic and lotic habitats, except in very small brooks, and on a variety of marl, clay, sand, and gravel substrates, except on relatively soft mud bottoms.

Matteson (1948) noted that when this species occurs with the same three species as found in Douglas Lake, *E. complanatus* occurs in a zone of deeper water beyond the others. These observations may explain why only a few specimens have been found to date in Douglas Lake.

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ANNOTATED BIBLIOGRAPHY ON THE EXOTIC BIVALVE *CORBICULA* IN NORTH AMERICA, 1900-1971

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The Asian clam, *Corbicula manilensis*, is currently the most costly liability of all exotic molluscs in North America. Its range has expanded since about 1938 from the Columbia River, south to Baja California and east to Florida. Its present range still excludes the Great Lakes Basin, the middle and North Atlantic, the Upper Midsouri and the upper Mississippi River. This pest is benthic as an adult (upwards of 25,000 per square foot) and planktonic as a microscopic, ciliated 'veliger' larva (up to 1,000/ml). This early part of its life cycle provides convenient entry into irrigation systems, condensers, and virtually any pipe system carrying untreated water where they attach and develop into the adult stage. One may add to these damaging aspects the effect on sand and gravel dredging on large inland streams (live clams are a liability when poured in a concrete aggregate) plus the clogging of traveling intake screens, when annual spring mass mortalities of adults occur upstream each spring. In particular sand and gravel dredging operations have been seriously affected on the Tennessee and Cumberland Rivers. The Stockton Nsval Base (California) fire mains were considerably damaged by clogging masses of shells. Passage through the Delta-Mendota canal (California) was impaired by the sheer bulk of beds of *Corbicula*. These problems have been encountered with minor variations as the clam moved into aquatic habitats across the nation.

In its native Asian range *Corbicula* is used as food supporting a commercial fishery. Some California populations have also been exploited for local oriental markets, although the main commercial use has been for fish bait. With the occasional exception of sponge and bryozoan growths and infestations of caddis fly larvae, plant managers have paid little attention to the biological pipe clogging community. There are several factors which have led to severe and unsuspected interference problems with this bivalve. First the animal is relatively new to our fauna, and once into a river basin it rapidly exploits new habitats. Population build-up is explosive. The life cycle is unique for North American bivalves, thus the pelagic larva is capable of reaching numerous man-made conduits and waterways, etc. Furthermore the line may become seriously impaired over a year's time as the adults grow in size. Once established the shells are most difficult to remove. The adult clams like most bivalves are able to withstand shock doses of a variety of chemicals. Furthermore, the small shells are attached by byssus threads and during the annual summer spawning season, new stocks readily take up residency in unprotected pipes. For more complete information and bibliographic references, the reader is referred to the papers listed in section one of the bibliography.

BIBLIOGRAPHY 1900-1971

Entries are listed under these main subjects:

1. Introduction
2. Systematics
3. Ecology
4. Life history and Morphology
5. Salinity and Related Estuarine Species
6. North American Distribution
7. Effects on Hydroinstallations and Control
8. Fisheries
9. Water Quality and Effect of Pollution
10. Role in Echinostomiasis
11. Physiology
12. Massive Mortalities

INTRODUCTION

The following entries are primarily concise summaries of the problem. A similar parallel exists in Europe with a related bivalve, *Dreissena*. Control methods for the latter will be significant in *Corbicula* control. At the rate exotics are reaching our waterways, *Dreissena* also could eventually become established here. The magnitude of the problem and recommendations for preventing the entry of exotics are covered by Lachner, Robins, and Courtenay.

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2. SYSTEMATICS

Within the three basic Asian groups of *Corbicula* (see Table 1) there are numerous geographic names. It has been impossible to fix the country of origin for the North American exotic form, *Corbicula manilensis* Philippi 1841. Ichiro Miyazaki was the first to divide the genus *Corbicula* into three groups based on reproductive characters and ecology. This has proven to be a most workable classification which has generally been confirmed and followed by the majority of the systematists working with *Corbicula* in its home range (see Kuroda, Oyama and Suzuki). Their papers have been generally ignored in the United States literature. It is possible however to place this North American exotic species in *Corbicula* group I of Miyazaki. It is monoecious, incubates the veligers, is basically fresh water, and has nonswimming pelagic veliger larvae.

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TABLE 1. NATURAL GROUPS IN CORBICULA (SENSU STRICTO) *

GROUP	SPECIES - FORMS	HABITAT	SAMPLE LOCALITY	SEXUALITY	REPRODUCTION	LARVAE
ONE	MANILENSIS *C. leana* *producta* *awajiensis* *insularis* [1, 2] *javanica* *manilensis* *vicina* 60 mm[7]	FRESH- WATER	NORTH AMERICA [6] CENTRAL JAPAN KOREA CENTRAL JAPAN FORMOSA INDONESIA PHILIPPINES CANTON	MONOECI- OUS	INCUBATORY	NON- SWIM- MING
TWO	*C. sandai* 40 mm	FRESH- WATER	CENTRAL JAPAN	DIOECI- OUS	NONINCU- BATORY	NON- SWIM- MING
THREE	FLUMINEA *C. japonica* [3, 5] *elatior* *fluminea* *maxima* *(Cyrenodonax)* *formosana*[4] 40 mm	BRACK- ISH	CENTRAL JAPAN KOREA FORMOSA FORMOSA FORMOSA	DIOECI- OUS	NONINCU- BATORY	FREE- SWIM-

(1) Becomes brackish at flood tide.
(2) Sexuality uncertain
(3) Some specimens have radial color stripes on the surface of the shell.
(4) All specimens have radial color stripes on the surface of the shell. Probably the early stage of *Cyrenobatissa subsulcata (=Woodiana)*.
(5) According to personal communication of Dr. Miyazaki this species has been reported to invade fresh-water habitats in N. Japan.
(6) Exotic.
(7) Maximum size length is given in millimeters.

* Modified from Miyazaki.

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3. ECOLOGY

Two exotic freshwater bivalves have become well known during the first half of this century. The first, *Dreissena polymorpha*, has spread extensively throughout Europe from its origin in the Ponto-Caspian area. The other, *Corbicula manilensis*, was deliberately carried by man across the Pacific from Asia to North America. Both have become well known because of their damage to hydroinstallations. Like all exotics, the two reach high population numbers per square meter. Their respective habitats differ somewhat for while *Dreissena* becomes semi-permanently attached by a stout byssus (Figure 1) *Corbicula* utilizes byssal lines (Figure 4) usually discarded as it grows. *Dreissena* then is epifaunal, forming great clusters on various substrates as well as in conduits. *Corbicula* is generally infaunal, burrowing to depths of a meter and through pseudofecal rejection can form vast beds of shells and sediments in irrigation canals. It also opts for byssal thread attachment inside of conduits and on other structures in natural and artificial waterways: *e. g.*, condensers, water lines, a variety of conduits, logs, and intake structures.

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Two freshwater bivalves, *Dreissena* (an invader of Europe) and *Corbicula* (an invader of North America), share a number of characters. Both have been costly interference organisms in hydroinstallations. Both have free living veliger larvae, which explains their successful invasion of conduits carrying untreated water. They occupy a unique place for freshwater bivalves. Water quality requirements appear to be close. Control methods for one are applicable for the other.

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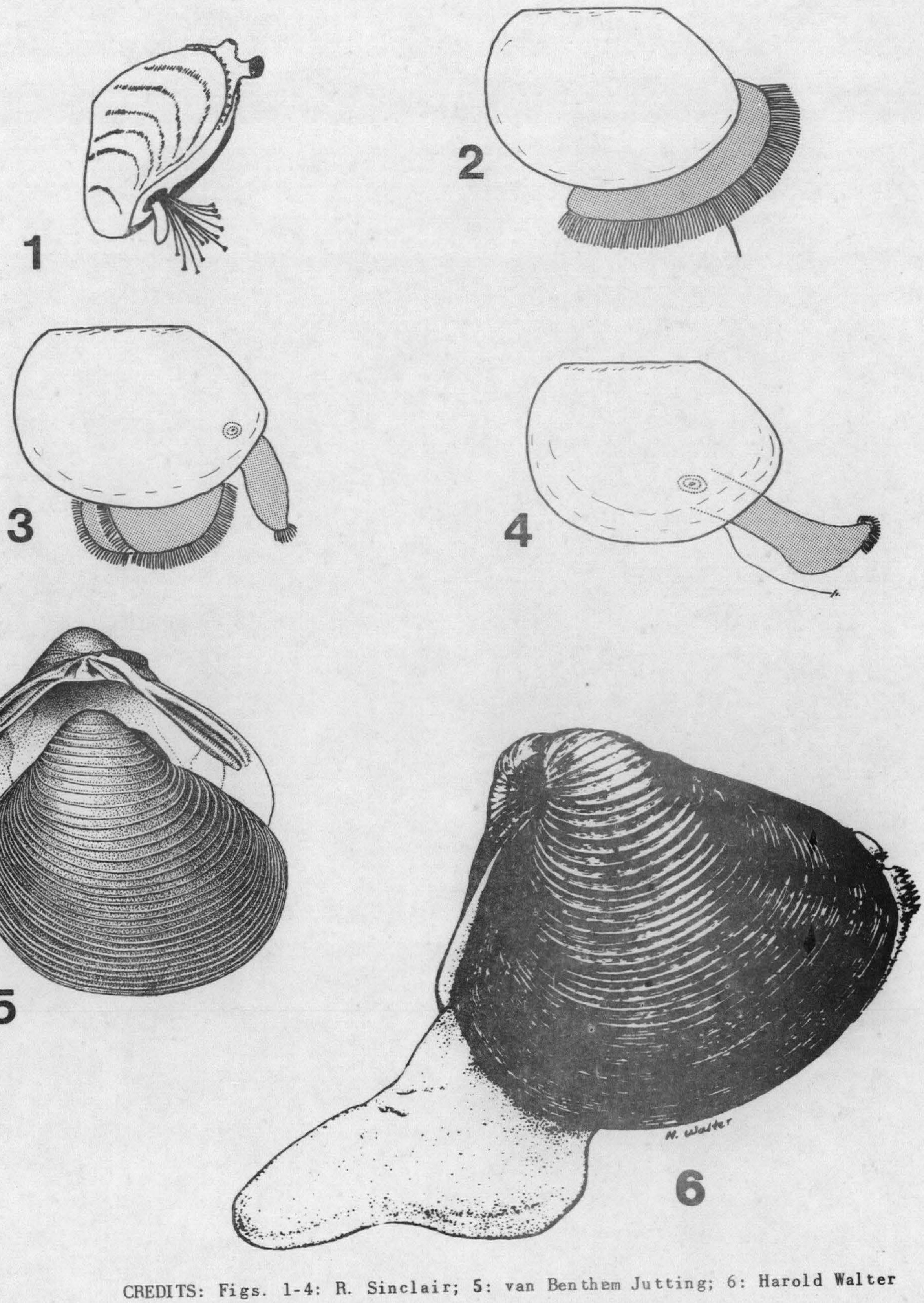
4. LIFE HISTORY AND MORPHOLOGY

LIFE HISTORY

Corbicula species are placed in three main groups by habitat and life history. The brackish-water species (Group III) are dioecious, do not incubate the young, and have free-swimming planktotrophic larvae. The fresh-water species (Group I) are monoecious, incubatory, and have nonswimming planktonic veliger larvae. Both groups in Japan and the United States spawn chiefly in the summer months. The Ohio River Basin form belongs to Group I and discharges planktonic veliger larvae from July to November. The fertilized ova are deposited in the parent's inner gills which are modified as marsupia. Here the zygote undergoes development through the trochophore stage to the veliger stage (so named



CREDITS: Figs. 1-4: R. Sinclair; 5: van Benthem Jutting; 6: Harold Walter because of the prominent velum). The early veliger (approximately 220 µ) is discharged from the adult through the exhalent siphon into the surrounding water where it begins benthic existence probably within 48 hours from discharge. Development of a highly muscular foot (tipped with strong cilia and containing the statocyst) marks the beginning of the benthic pediveliger stage as it leaves the plankton. The foot is used for attachment and locomotion, enabling the larvae to explore for a suitable niche. The young clam may also use the byssal gland to secrete mucilaginous threads forming loose byssus lines. The benthic larvae develop rapidly and may become sexually mature for the next spawning season.

MORPHOLOGY

The most distinctive feature of the clam is the heavy concentric ridges of the outer shell. There are three cardinal teeth in each valve. The lateral teeth are serrated in both valves. They are double in the right valve and single in the left. The anterior teeth in each valve are bent on the anterior margin. Shell characteristics vary from one locality to another, and the color of the periostracum ranges from black to yellow. The inner porcellaneous layer may be deep purple or salmon to white, and shell thickness is varied. Some are thin enough to be crushed between the fingers, others are very thick. Shape varies from trigonal to oval with many distinctive intermediate variations. A Phoenix, Arizona, series has representative specimens in nearly every one of the above variations. One could easily select from the United States specimens of *C. manilensis* to match most of the described fresh-water species of *Corbicula* both in shell morphology and shell color.

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3. SINCLAIR and ISOM (See 2.17).

5. SALINITY

There have been few studies on this exotic and its relation to salinity. It is found at the head of the San Francisco Bay and numbers diminish as salinity increases. Its position in other North American estuaries will be followed with interest.

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6. NORTH AMERICAN DISTRIBUTION

By 1971 this pest had invaded most of the river basins of Mid America with the exception of the Upper Missouri, Upper Mississippi, the Great Lakes, and rivers of the Atlantic slope. Field records show

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PLATE 1. (OPPOSITE PAGE) FRESHWATER NUISANCE BIVALVES

Figure 1. The Zebra Clam, *Dreissena polymorpha* Pallas showing siphons, foot, and heavy byssal strands (actual size).

Figure 2. The Asian Clam, *Corbicula manilensis* Philippi, the microscopic planktonic free larva (D stage veliger) which enters raw water intakes etc. Size 200 µ appr.

Figure 3. The Asian Clam, *Corbicula manilensis*, the microscopic benthic pediveliger stage which may become planktonic again until a suitable substrate is found. Size 200 µ appr.

Figure 4. The Asian Clam, *Corbicula manilensis*, the post pediveliger attached by single or double long byssal lines (2-4 inches) on firm substrates. 220 µ appr.

Figure 5. Asian Clam, left valve showing prominent cardinal teeth (3) and lateral serrated teeth.

Figure 6. Asian Clam, dorsolateral view showing high umbones anf heavy ligament. Tennessee River, Ala. 50 mm

that it is continuing to expand into the South Atlantic basins.

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4. CLENCH, William J. and STANSBERY, D. H. 1969. *Corbicula manilensis* Philippi in the Nolichucky River. -- Nautilus 82: 146.
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15. ---- 1966. Further records of *Corbicula fluminea* (Müller) in the Southern United States. Nautilus 79: 142-143.
16. HORNING, W. B. and KEUP, Lowell. 1964. Decline of Asiatic clam in Ohio River. -- Nautilus 78: 29.
17. HUBRICHT, Leslie. 1963. *Corbicula fluminea* in the Mobile River. -- Nautilus 77: 31.
18. ---- *Corbicula fluminea* at Vicksburg, Mississippi. -- Nautilus 77: 143.
19. ---- 1966. *Corbicula manilensis* (Philippi) in the Alabama River System. -- Nautilus 80: 32-33.
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7. EFFECTS ON HYDROINSTALLATIONS

In terms of water quality, plankton is often ignored, and benthos is seriously neglected. Some costly plant problems could be avoided if the water manager had a plankton analysis program. For example, in the Ohio Basin *Corbicula* has a summer spawning season (two peaks) and samples of plankton taken during the peaks, as well as pre- and post-spawning would have to be taken more frequently. Identification offers no problem since only *Corbicula* has the planktonic D-stage veliger. Breeding populations may be detected at any season through a program of benthic sampling. The most serious effects on hydroinstallations have been irrigation canal clogging in the

West and stopping of raw water lines and condensers in all parts of its new range.

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8. FISHERIES

Extensive utilization of *Corbicula* in its former range is well documented. In the Western United States it has been exploited commercially as a source of fish bait. Ohio Basin populations have been extensively utilized by channel catfish and shell crackers.

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9. WATER QUALITY AND EFFECT OF POLLUTION

In the Ohio Basin this species has been found only in relatively clean water zones. Because it concentrates a variety of toxicants and can be obtained in large numbers in well graded size and age groups, it is an ideal invertebrate for bioassay both *in situ* and in the laboratory.

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index of water pollution based upon the species number of microscopic animals. -- Jap. Jour. Ecol. 10(5): 198-201, 5 tables, 2 maps.

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10. ROLE IN ECHINOSTOMIASIS

In its native range the clam is the intermediate host for Echinostome trematodes. Since it is eaten raw or partially cooked, there is often a high local incidence of Echinostomiasis in Asia. *Corbicula* is not often utilized as food in North America, and there is no evidence of such a trematode cycle being established.

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2. SANDGROUND, J.H. and BONNE, C. 1940. *Echinostoma lindoensis* n. sp. A new parasite of man in the Celebes with an account of its life history and epidemiology. -- Amer. Jour. Trop. Med. 20: 511-535. (The encysted metacercariae carried by *Corbicula lindoensis (= javanica)* which were eaten raw or partly cooked, were responsible for a high rate of echinostomiasis in three Central Celebes villages.

3. van BENTHEM JUTTING (See 2.19).

11. PHYSIOLOGY

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2. ---- 1966. On the relationships between seasonal variations in the chemical components of *Corbicula sandai* and bottom matters in Lake Biwa-ko. -- Venus 16: 63-67.

3. PROKOPOVICH, N.P. (See 1.6 and 7.4).

12. MASSIVE MORTALITIES

Annual spring mortalities have at least on one occasion seriously clogged traveling screens at a large water treatment plant on the Tennessee River. The screens which were mechanically cleaned, had to be scrubbed by hand for the plant to remain in operation. The soft parts of the clam which were being carried downstream above the plant intake, appeared in the stream like a vast popcorn spill.

1. BICKEL, David. (See 3.4).(Speculates that increased sediment loads during spring floods were the cause of annual mortalities on the Ohio River.

2. HEINSOHN, G.E. (See 3.1).

3. HORNING, W.B. (See 6.16).

4. SINCLAIR and ISOM (See 2.17)

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ADDENDA

Page 12, before 2.1, add:

A. BAKER, H.B. (1966) *Corbicula manilensis*. -- Nautilus 79: 144.

Page 12, after 2.7, add:

7a. MORTON, Brian (1970) The evolution of the heteromyarian condition in the Dreissenacea (Bivalvia). -- Palaeontology 13: 563-572. (An excellent diagnosis of the related Dreissenacea. Text Figure 8A of *Corbicula* showing an internal ligament is in error, all species of *Corbicula* including our exotic have a stout external ligament).

Page 14, under 3, ECOLOGY, add to the end of the first paragraph:

These two genera have been costly interference organisms in hydro installations. Both have free living veliger larvae, which explains their successful invasion of conduits carrying untreated water. They occupy a unique place for fresh-water bivalves. Water quality requirements appear to be close.

Page 18, after 11.3, add:

4. MORTON, Brian (1971) Studies on the biology of *Dreissena polymorpha* Pall. V. Some aspects of filter-feeding and the effect of micro-organisms upon the rate of filtration. -- Proc. Malac. Soc. London, 39: 289-301. (Rate of filtration of *Dreissena*, size 2.9 cm., was established as 5-180 ml/hr and is compared in a table with marine and estuarine bivalves. The relatively high rate of *Dreissena* explains the silting up of reservoirs observed by European investigators. See Wiktor 3.9).

NEW LOCALITIES FOR *MICRARIONTA ROWELLI MCCOIANA* WILLETT

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The only site which has been reported for *Micrarionta rowelli mccoiana* is McCoy Well, in the McCoy Mountains of Riverside County, California. Willett (1935) in designating this site as the type locality for *mccoiana*, offered no indication that the snail was to be found elsewhere, and Pilsbry (1939) provided no additional records. Collectors since that time may have found specimens of *mccoiana* at the type locality and in other locations, but no published mention has been made of the fact. The purpose of this paper is to identify sites at which *mccoiana* can be found in the McCoy Mountains, and to report that this snail has been collected in the adjacent Big Maria Mountains.

As part of a study supported largely by the Council for Faculty Research, Eastern Illinois University, I conducted a series of explorations into the McCoy, Big Maria and other nearby mountains during the academic year, 1967-1968. The type locality for *mccoiana* was one of the first sites investigated but no specimens were found and no evidence was turned up to indicate that they might still be found in the vicinity of the well. Subsequently, about a quarter of a mile to the east of the well and about 300 feet above it, on a steep, northwest-facing slope, numerous shells were found at a depth of about two feet under broken rock. This site, which is in section 22, township 6 south, range 20 east (USGS map NI 11-9, Salton Sea quadrangle), is at the base of large, vertically fractured blocks. No living snails were found here, but some relatively recent peristome 'seals' were seen on subsurface rocks, suggesting that live specimens probably could have been collected had more time been spent at the site.

Southwest of McCoy Well about seven miles, in section 17, township 5 south, range 20 east, another locality for *mccoiana* was discovered. The site is about 200 feet above the entrance to the 64-' Mine, currently owned by Reserve Oil and Minerals Corporation, and permission should be obtained before entering the area. Many shells were found in the course of several trips to this site, but only two live specimens were collected and these were found at a depth of about fifteen inches in a heavy rockslide at the base of a large, overhanging face. The snails were sealed to the undersides of rocks which projected into an 'air space' opened up by careful removal of the surface rock.

Several trips were made into the McCoy Mountains at various times during the year in an effort to determine something of the extent of the distribution of *mccoiana*. My most valued field helper and companion was a retired Army officer, Colonel John Mosley, who made the initial find of live specimens above the 64-A site and accompanied me on much of the exploration in the adjacent mountain ranges. Together, we looked in vain for other localities in the McCoy range before moving on to the Big Maria Mountains, which lie about ten miles to the northeast. This range can be entered most easily from the Blythe-Midland road on the west, via several mining trails. We chose to follow a trail which leads to the Eagle Nest Mine, located in section 27, township 3 south, range 21 west, and it was near the end of this trail that *mccoiana* was discovered. About a half-mile by foot from the end of the negotiable portion, the trail crosses a prominent quartz dike and leads to an area where considerable surface rock has been dragged from the surrounding slopes and removed commercially. The site is just about 200 yards north and east, on a north-facing slope. On our first visit to this location after considerable excavation we found a number of shells and some peristome rings at depths of 6 to 18 inches below the surface, at the bases of projecting rock ledged. We also collected four living snails which were found sealed to the undersides of rocks, in aïr pockets such as had been found in the McCoy locality. A second visit to the same site later in the year revealed evidence of much erosion because of heavy rainfall and runoff, and our only finds were peristome rings and one lone shell. Other likely sites were explored, but after much hiking, climbing and digging we had found only a few shells and had seen none which appeared to be fresh.

Micrarionta rowelli mccoiana is probably to be found over all of the McCoy range, although it has been reported only from two localities therein. Its occurrence in the Big Maria range leads to the conclusion that it probably will be found in the Little Maria Mountains, between the McCoy and Big Maria ranges, and possibly also in the Palen Mountains to the west of the McCoy range. Additional likely localities for *mccoiana* may be found in the Mule Mountains just south of the McCoys. My explorations into the Little Marias, the Palens and the Mules have not been successful, but information given to me by a mining geologist familiar with these ranges leads me to believe that *mccoiana* or some other race of *Micrarionta rowelli* will be found in them.

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PILSBRY H. A. 1939. Land Mollusca of North America (North of Mexico). -- Vol. 1, part 1, p. 236.

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ON THE OCCURRENCE OF *POMATIOPSIS CINCINNATIENSIS* IN WISCONSIN

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Baker (1928: 169-170) indicated that the prosobranch snail, *Pomatiopsis cincinnatiensis* (Lea), had not been recorded from Wisconsin but indicated 'there is not the slightest doubt that it will sooner or later be found on Wisconsin soil' because of 'its abundance in northeastern Illinois.' A search of the literature indicated no subsequent record of the species in Wisconsin, however.

Checks of museum collections revealed two Wisconsin records in the Academy of Natural Sciences, Philadelphia. The only locality data available for these specimens are 'Milwaukee' and 'Madison.' There was no date on either collection, but presumably they were collected prior to 1900 (George Davis, personal communication).

A survey was made to determine the current status of the species in Wisconsin during the fall of 1967 and the spring of 1968. Three full days were spent checking out the streams in southeastern Wisconsin; an area inscribed by lines from Beloit to Madison and Madison to 10 miles north of Milwaukee was searched most intently.

All streams were checked at as many sites as possible where roads crossed or ran adjacent to the streams. Those streams having banks resembling the characteristic habitats of *P. cincinnatiensis* (van der Schalie and Getz, 1962) were examined for the presence of the snails. The following streams and their unnamed tributaries were examined during the course of the survey: Sugar River, Rock River, Turtle Creek, Crawfish River, Bark River, Fox River, Root River, Milwaukee River, Pewaukee River, and Menomonee River.

Of these, Sugar River and Fox River had sections in which the banks in general resembled those in which *P. cincinnatiensis* is most commonly found. None was found, however, which resembled precisely what is considered the typical *P. cincinnatiensis* habitat.

P. cincinnatiensis was not found at any of the sites examined. Although there is always a possibility that an isolated colony of the species may be present somewhere in southern Wisconsin, it seems doubtful that such is the case and the species probably does not occur in Wisconsin.

It is difficult to ascertain the basis for Baker's (1928) statement concerning the 'abundance' of *P. cincinnatiensis* in northeastern Illinois. Baker (1928) published only one record for Illinois ('Kankakee River, Illinois'). A check of his collection housed in the Museum of Natural History, University of Illinois, Urbana, revealed only 2 other Illinois localities: 'Illinois River' (no other data) and 'Sugar Creek, near Milford, Iroquois Co.' There were also specimens from Turkey Run State Park, Indiana. If he collected the species at other localities in Illinois, he apparently kept no specimens; it seems highly unlikely he would fail to keep at least a few individuals from all localities at which he found the species.

Additional records (unpublished) from Illinois in the Academy of Natural Sciences included specimens from 'Kankakee', 'Joliet', and 'Fulton County'; no exact locality or date was included on these specimens. One locality record from Illinois ('Canton,' collected by S. W. Stanage, probably prior to 1910) was also located in the collections of the Field Museum of Natural History, Chicago. These are the only known locality records of *P. cincinnatiensis* from northeastern Illinois.

The rivers and streams of southeastern Wisconsin and northeastern Illinois have been greatly disturbed in recent times. In addition to disturbance by pollution, many of the stream banks have beel altered by grazing and agricultural practices (including removal of trees and shrubs along the streams with the resultant increased erosion on the banks) as well as by straightening of the stream channels and destruction of the original banks. These disturbances have changed the physical characteristics of most banks so that they no longer resemble *P. cincinnatiensis* habitat.

Owing to the drastic changes in streams in northeastern Illinois and southeastern Wisconsin and the apparent paucity of prior searching for *P. cincinnatiensis*, it is not possible therefore to estimate the original distribution and abundance of the species in this region.

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MOLLUSCAN REMAINS FROM FOUR ARCHEOLOGICAL SITES IN NORTHEASTERN OHIO

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INTRODUCTION. Partial excavation of four northern Ohio archeological sites assignable to the Whittlesey Focus of Greenman (1937) has yielded molluscan shell samples from both the Cuyahoga and Grand River drainages. The excavations were sponsored by the Cleveland Natural Science Museum, and reports on other aspects of the work have been published elsewhere (Murphy, 1971a, b).

The major occupation at one of the sites, South Park, which was partially excavated by Greenman, is currently placed in a relatively late Late Prehistoric Whittlesey Phase dating about 1500 A.D., though some evidence of occupation as early as 1100-1200 A. D. was also recovered. The Reeve and Fairport Harbor sites, in Lake County, are very closely related to one another, and probably date about 1300 A. D., the Fairport Harbor site possibly being somewhat earlier. These sites are believed to represent an earlier phase, perhaps antecedent to the Whittlesey Phase. The Lyman or Indian Point site is not closely related to the other three excavated sites. It is believed to date around 1500 A.D., contemporaneous with the South Park site, but more closely related to components in western Pennsylvania than to Cuyahoga Valley sites of the Whittlesey Phase. Although there may be some question about the precise dates assigned to these sites, none of them can date before 1000 A.D. It is apparent that any molluscan material recovered from such sites must be of comparatively recent date.

The significance of such molluscan samples is twofold. There is very little reliable distributional data available for the Cuyahoga and Grand River basins. A recent study by La Rocque (1966-70) well illustrates this point. Of the 103 distributional maps presented for the fresh water bivalves, only eight record occurrences in Cuyahoga County; Lake County has only a single species represented. Data for the terrestrial gastropods are similar: of the 114 species for which county distributional data are presented, Cuyahoga County records only nine species and Lake County, seven. By way of contrast, Ashtabula County has forty-nine species listed. Taft (1961) records seven species for Cuyahoga County, one for Lake County, and thirty-nine for Ashtabula County. This paucity of material for Lake and Cuyahoga counties is undoubtedly due in large part to a lack of collecting.

This lack of collecting raises the second reason for the significance of aboriginal molluscan samples. Massive pollution of the Cuyahoga and Grand Rivers has eliminated or greatly reduced the molluscan fauna of considerable stretches of these rivers. Thus Davis (1951) was able to find only three specimens of naiads in a rather extensive sampling of the Cuyahoga River; all three specimens were found in relatively unpolluted tributaries of the Cuyahoga River. In view of the lack of previous collecting and the reduced nature of the present fauna, samples derived from archeological components become an important means of delimiting the original molluscan faunas of these rivers.

ACKNOWLEDGEMENTS. The excavation of these four archeological sites was conducted under the auspices of the Cleveland Natural Science Museum, where the material has been deposited. Permission to excavate was kindly granted by the various land owners, the Lake County Psrk Board, the

Diamond-Alkali Co., the Haydite Co., and Mr. Gilbert Menke.

RELIABILITY OF THE SAMPLES. The Reeve and Fairport Harbor samples were obtained from excavations of nearly equal extent, about 10,000 square feet, and the samples are nearly equal in size. Although an equivalent area was excavated at the Lyman site, the extremely thin midden at that site precluded the presence of more than a handful of naiad shells. Acid soil conditions further reduced the number of identifiable naiad remains found at this site. The unique presence of large refuse pits at the South Park site makes comparison difficult, but is undoubtedly the major reason for the relatively large sample size at that site, as well as for the remarkably good preservation of the shells.

It should be noted that no concentrated effort was made to collect molluscan material at these four archeological sites. All specimens excavated were retained for study, but loam and leaf mold were not sifted through fine screens. All specimens were gathered more or less incidentally to recovery of aboriginal Indian artifact and refuse materials. Consequently, there existed a tendency to overlook the smaller molluscs. It is remarkable that none of the Pupillidae are represented, though the presence in the collections of a specimen of *Cionella lubrica* indicates that not all of the minute terrestrial gastropods were overlooked.

Still another important factor is the possibility of selection by the original collectors. It is quite likely, particularly in the case of the naiads, that the smaller species, those inhabiting deeper water, and those too fragile to be used for the manufacture of tools and ornaments, were either overlooked or ignored by the Indians. Nonetheless, despite the effect of such selectivity, which undoubtedly occurred, the more minute molluscs may occur as 'accidental' inclusions. The presence of *Helisoma* and *Gyraulus* at the Blain site (Murphy, 1970) is inferred to be the result of specimens clinging to water plants or mud inadvertently carried to the village site. With few exceptions, however, the only aquatic molluscs present at a site were deliberately brought there by the Indian inhabitants, either for food or as raw material for implements and ornaments.

NEW OCCURRENCES. Of the land snails represented in these four collections, *Stenotrema hirsutum* and *S. fraternum* have not previously been reported from Lake County and *S. stenotrema* has not been reported from Lake and Cuyahoga counties. Other new occurrences for terrestrial snails include for Lake County, *Mesodon thyroidus*, *M. pennsylvanicus*, *Triodopsis tridentata juxtidens*, *T. albolabris* *Allogona profunda*, *Mesomphix cupreus*, *Anguispira kochi*, and *Cionella lubrica;* for Cuyahoga and Lake counties, *Mesodon clausus*, *Triodopsis tridentata*, *Haplotrema concavum*, and *Anguispira alternata*.

Among the naiads, *Quadrula pustulosa prasina* and *Lampsilis ovata* are newly recorded for Lake County; *Villosa iris*, *Obovaria subrotunda lens*, and *Elliptio crassidens*, for Cuyahoga County; *Amblema costata*, *Pleurobema cordatum coccineum*, *Elliptio dilatatus*, *Lasmigona costata*, *Lampsilis ovata ventricosa*, *L. radiata siliquoidea* *Ptychobranchus fasciolare*, *Actinonaias carinata*, and *Ligumia recta latissima* for Lake and Cuyahoga counties.

LYMAN OR INDIAN POINT SAMPLE. This site lies on a high promontory at the confluence of Paine Creek and the Grand River, four miles east of Painesville in Lake County. The excavated portion of the site stands in an open wooded area at the western end of Indian Point. The trees are predominantly maple, the soil glacial clay and till. The soil is only a few inches thick, resting on shales and siltstones of the Chagrin Formation.

The large number of *Triodopsis tridentata* at this locality can be directly correlated with the shaded, moist nature of the site. Most of the specimens were recovered from the leaf mold, and many retained their original color. Live specimens were also noted.

The five species of bivalves recovered at this site were probably collected from the Grand River, which is still clean enough to support a molluscan fauna. Dead shells of *Ptychobranchus fasciolare* have been noted along the edge of the river, immediately below Indian Point. The Grand River here is a rather quiet, slow flowing stream, though a gravel bar formed at the mouth of Paine Creek does create a small riffle. The *Ptychobranchus* material was found on this gravel bar.

The *Lampsilis* and *Quadrula* specimens very probably were obtained by the Indians from the sluggish stretch of the Grand River lying just above the gravel bar, along the northern edge of Indian Point.

FAIRPORT HARBOR SAMPLE. This site lies on a former bank of the Grand River, within a half mile of Lake Erie. The abandoned channel has been filled with sludge from an adjacent Diamond Alkali plant. At the time of excavation the site was covered with grass and a few small clumps of sumac. Except during the spring, when standing water occupies part of the site, the soil is rather dry. Pollution from the nearby chemical plant may also inhibit species diversity, for noxious fumes from the plant were occasionally so strong as to halt excavation work at the site.

Along the edge of the bluff, a short distance from the excavations, the bare topsoil beneath a clump of thorn apple was literally covered with hundreds of dead shells of *Anguispira alternata;* this is by far the most abundant species in the collection. It is of some interest that of the 1195 specimens found in the village site excavations, only one was sinistrally coiled.

The aquatic *Pleurocera* gastropods were utilized by the Indians for beads, a small hole being made in the outer wall of the body whorl. The heavier of the bivalves, such as *Amblema* and *Actinonaias* were drilled for use as 'hoes' or ladles.

The adjacent sections of the Grand River are now too polluted to support much of a molluscan population. The stream was probably rather slow moving and deep, with a mud or sand bottom; since the stream course was altered many years ago, this must be inferred from the nature of adjacent sections of the river. The bivalves recovered from the village midden are consistent with such an interpretation. The Lampsilinae were more abundant than is indicated in Table 1, for numerous fragments undoubtedly represented specimens of this group which could not be identified at the species level.

REEVE SAMPLE. The Reeve site is nearly contemporaneous with the occupation at Fairport Harbor, though perhaps about one hundred years later, about 1300 A.D. The site location is also very similar to that of the Fairport Harbor village site, on a wooded bluff overlooking the sluggish waters of the Chagrin River, very close to the mouth of the stream, within a half mile of Lake Erie. The site, today, is covered with grass, shrubs, and a few scattered trees. Beneath a thin midden of loam and leaf mold lies a 'hardpan' of clay and glacial sands and gravels.

The terrestrial gastropods recovered from the Reeve site provide some interesting contrasts with the sample from the Fairport Harbor site. *Anguispira alternata,* though common, does not dominate the Reeve sample. *Mesodon pennsylvanicus* is the most common species, whereas it was not found at all in the Fairport Harbor collections. *Stenotrema* is also much more common at the Reeve site. The presence of these and other species, such as *Allogona profunda, Mesodon clausus,* and *Anguispira kochi,* is probably a result of the moister, shadier environs at the Reeve site.

The Reeve bivalves are generally better preserved than those found at Fairport Harbor, an indication that the Reeve site has suffered subsequent disturbance to a lesser degree. (Fairport Harbor has at various times had a village dump, Victory gardens, and a baseball field on the Fairport Harbor site). There seems to be no significant differences in the species composition of the two collections, nor in the relative abundance of individual species. One *Lampsilis radiata siliquoidea* shell from the Reeve site is unusual in retaining traces of the radial color banding. As at Fairport Harbor, shells were used for spoons and 'hoes' or ladles. A left valve of *Lampsilis ovata ventricosa,* a right valve of *Ligumia recta latissima,* and left and right valves of *Ligumia recta latissima* show grinding along the ventral margin. Only one fragmentary perforated shell 'hoe' was found.

Six pleurocerid shells had holes drilled through the body whorl for use as beads or pendants. These, as well as the worked bivalve material, are not included in Table 1.

Morgan and Ellis (1943) note two bivalve species at the Reeve site, *Elliptio dilatatus* and *Ligumia recta latissima.* Unfortunately, neither these authors nor Greenman (1935) present a list of species based upon the unworked shell material found during Greenman's 1929 excavations at the Reeve site.

SOUTH PARK SAMPLE. The South Park site lies on the remnants of an abandoned beach ridge, elevation approximately 700 feet above sea level, presumably a remnant of the Lake Arkona beach. This remnant lies along the east edge of a small bluff of Chagrin shale and siltstone on the west side of the Cuyahoga River, one mile southeast of Independence, Cuyahoga County. The area of Indian occupation extends over the entire area of the top of the bluff, but the 1968 excavations were limited to the eastern edge of the site, along the beach ridge. This portion of the site was occupied by a relatively late Late Prehistoric component assigned to the Whittlesey Phase, *circa* 1400-1500 A.D. The bluff top has been cultivated for many years and was last used as a vineyard. The soil is very sandy, particularly along the ridge at the eastern edge of the site. The steep hill-

TABLE 1

SPECIES	SOUTH PARK Midden	SOUTH PARK PITS	REEVES	FAIRPORT	LYMAN
Stenotrema stenotrema (Pfeiffer)	4	–	26	–	–
S. hirsutum (Say)	–	–	–	5	–
S. fraternum (Say)	–	–	3	–	2
Mesodon thyroidus (Say)	–	–	14	1	1
M. clausus (Say)	13	1	31	–	–
M. pennsylvanicus (Green)	–	1	366	–	–
Triodopsis tridentata (Say)	7	–	–	2	45
T. tridentata juxtidens (Pilsbry)	–	–	9	–	–
T. albolabris (Say)	–	–	5	–	3
Allogona profunda (Say)	–	–	1	–	–
Haplotrema concavum (Say)	7	1	245	17	1
Mesomphix cupreus (Rafinesque)	–	–	–	14	–
M. sp.	6	–	–	–	–
Anguispira alternata (Say)	11	1	315	1195	–
A. kochi (Pfeiffer)	–	–	2	–	–
Cionella lubrica (Müller)	–	–	–	1	–
Campeloma rufum (Haldeman)	–	3	10	3	–
Pleurocera acutum Rafinesque	–	3	24	23	–
Amblema costata Rafinesque	7	17	7	19	3
Quadrula pustulosa prasina (Conrad)	–	–	–	1	1
Quadrula quadrula Rafinesque	–	–	–	X	–
Pleurobema cordatum coccineum (Conrad)	–	2	1	–	–
Elliptio crassidens (Lamarck)	–	–	3	–	–
E. dilatatus (Rafinesque)	10	27	6	3	2
Lasmigona costata (Rafinesque)	–	1	1	–	–
Alasmidonta marginata (Say)	–	3	–	–	–
Lampsilis ovata (Say)	–	–	–	1	1
L. ovata ventricosa (Barnes)	3	11	7	–	–
L. radiata siliquoidea (Barnes)	1	1	6	1	–
Ptychobranchus fasciolare Rafinesque	6	12	2	1	3
Obovaria subrotunda lens (Lea)	2	3	–	–	–
Actinonaias carinata (Barnes)	–	19	4	3	–
Proptera alata megaptera Rafinesque	–	X	–	–	–
Ligumia nasuta (Say)	–	–	–	X	–
L. recta latissima Rafinesque	–	7	X	–	–
Villosa iris (Lea)	–	2	–	–	–

side along the eastern edge of the site is heavily wooded and kept moist by ground water seepage throughout the summer.

In Table 1, specimens obtained from the disturbed 'plow zone' and topsoil have been distinguished from those specimens excavated from refuse or storage pits. These latter are presumed to be contemporaneous with the Indian occupation of the site, though many of the former may also have been. Nearly all of the shells and midden refuse found in the upper four to six inches of the excavated area probably have been plowed out of the upper zones of refuse pits. There is no significant difference in the composition of those collections made from the surface deposits and those from the refuse pits.

The bivalves collected by the Indian inhabitants of the South Park site compare favorably with the only previously published faunal list (Dean, 1890) for the Cuyahoga River, once allowances are made for changes in nomenclature. Dean reports seven species which are not found at South Park, including *Anodontoides subcylindricus, Strophitus edentulus, Lampsilis fasciola, Ligumia nasuta Lasmigona compressa, Fusconaia flava,* and, questionably *F. subrotunda*. Several species found only in the Ohio Canal or above the falls of the Cuyahoga need not be considered here. The excavations at South Park have yielded representatives of four species not included in Dean's list: *Amblema costata, Actinonaias carinata, Villosa iris,* and *Elliptio crassidens.* Dean does mention in the text that *'Unio ligamentinus' (Actinonaias carinata)* is found in the lower Cuyahoga, but he omits it from his faunal list. His *'Unio novaeeboraci'* was probably based upon a specimen of *Villosa iris.* The only perplexing feature of Dean's list is the absence of *Amblema costata,* particularly since it was the second most abundant species in the South Park collections.

Dean considered the possibility that certain species--*Actinonaias carinata, Ligumia recta,* and *Pleurobema clava*--common to the lower Cuyahoga and the Tuscarawas though absent from the upper reaches of the Cuyahoga, may have been introduced into the Cuyahoga by the waters of the Ohio Canal. He suggested that data on the shell fish of other streams flowing into Lake Erie would settle this question; the occurrence of *Ligumia recta* at the Reeve site and *Actinonaias carinata* at both Reeve and Fairport Harbor indicates that these species were not introduced into the Lake Erie drainage by way of the Ohio Canal.

Greenman (1937) does not provide a faunal list in his site report, but Morgan and Ellis (1943) note three bivalve species which were utilized at South Park. Only one of these *Proptera alata megaptera,* was not found during the 1968 excavations.

CONCLUSIONS. Although some archeologists are coming to doubt the value of laborious and sometimes expensive analysis of molluscan remains from archeological sites, the student of terrestrial and fresh water Mollusca can ill afford to ignore such collections. Tanner (1971) has shown that significant extensions in the range of bivalve species can be discovered by careful analysis of the faunas derived from archeological investigations. Although the new ranges for naiad and pulmonate material presented herein do not contain any new records for the state of Ohio, such may occur in collections from other archeological sites. Many changes in the composition of local naiad faunas do not seem to have occurred between the present and the time of occupation of Late Prehistoric, Middle Woodland, and even Archaic sites in Ohio and West Virginia (Murphy 1970). Nonetheless, archeological samples will continue to provide an accurate record of the original molluscan faunas which inhabited areas now too polluted to support diverse faunas.

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SHORTER NOTES

BIBLIOGRAPHIC NOTE

Chamberlin and Jones, in 1929, published their *Descriptive Catalogue of the Mollusca of Utah*, widely cited because of its importance as a major source of information on the subject. It was cited as *Bulletin of University of Utah, Vol. XIX, No. 4, pp. 1-203, 1929* by Henderson (1936, Univ. Colo. Studies, v. 23, no. 2, p. 141 and in synonymies throughout the text). Apparently, the Zoological Record and the writer (La Rocque, 1953, *Catalogue of the Recent Mollusca of Canada*) did not notice the fine print which identifies this as 'Biological Series, Volume 1, No. 1' whereas the masthead carries the indication above. No harm is done providing one has the paper itself, but asking for it from a library, especially on interlibrary loan, as vol. XIX no. 4 can bring up complications for a librarian, since the Union Catalogue of Periodicals lists no vol. 19 for 1929 and only 'Biological Series, vol. I, no. 1.' Some of my students caused quite a flurry of searching recently because of the faulty citation in earlier bibliographies. A cursory examination of the literature indicates that most authors have used the 'Bull., ... v. 19, no. 4' citation, probably because the mention of the Biological Series is entirely subordinate in position and in size of type.

A. L.

STERKIANA'S REPRINTING POLICY

A recent inquiry from a subscriber has led the writer to set down the policy which grew up more or less haphazardly concerning the reprinting of articles in STERKIANA. The three considerations mainly involved are the following: (1) utility to malacologists and students of fossil Mollusca; (2) availability, that is, permission of the author or publisher if the article is covered by copyright; and (3) cost of reprinting.

The first consideration is taken as broadly as possible; what is useful to the present generation of students may be considered obsolete by the next, just as some of the highly prized writings of the present had to be retrieved from their oblivion and the dust of years. Some of the papers considered for reprinting may have no more than historical value but may be curious enough to qualify.

Availability for reprinting may become a touchy subject. In some cases, for example with defunct natural history societies, it is difficult to find out just who has the power to grant permission to reprint. In other cases, the material may be copyrighted and the holder of the copyright cannot be found. In still other cases, the material may or may not be copyrighted but the author or his heirs may object to reprinting. It must be said in fairness that such cases of withheld permission have been extremely rare.

Lastly, cost of reprinting varies according to the process used to prepare copy. In the case of the two Binney reprints (STERKIANA 18, 19, 21, 22, 23, 24, and 25) the text was reset and the text figures photographed and made into plates which are not as convenient as the original's arrangement but obviated the necessity of preparing photographic masters for each page. For the Tryon reprint (STERKIANA 24, 26, 27, 28, 29, 31, 32, and 33) the text was reproduced in facsimile by xerox process but the results leave much to be desired. The illustrations are not all as clear as one would wish and placing two pages of the original on one page of STERKIANA resulted in too much crowding; one learns by experience.

Finally, suggestions for reprinting are welcome and will be considered from the three standpoints mentioned above. As soon as the Wwlker (1918) *Synopsis and Catalogue* is done, the reprinting program will continue with due regard to readers' suggestions.

A. L.

VIVIPARUS WALTONII Tryon.

Vivipara waltonii Tryon, Am. J. of Con., II, 1866, p. 108, pl. 10, fig. 2.
Type locality: St. John's River, Fla.

VIVIPARUS WAREANUS (Shuttleworth).

This species is distinct from *georgianus* Lea.

Genus CAMPELOMA Rafinesque, 1819.

Melanthro W. G. Binney *non* Bowditch.

Pilsbry has recently (105, p. 111) proposed to substitute *Ambloxis* Raf. for *Campeloma* Raf. For the same reasons that I have urged in support of the retention of *Anculosa* Say, it seems to me that the preference should be given to *Campeloma*.

CAMPELOMA DECISUM (Say).

The undescribed forms of this species from Michigan listed as vars. *flava* Currier MSS. and *melanostoma* Currier MSS. (Walker, 142, p. 138) are of doubtful validity.

Binney is in error in referring the following species to *decisum* as synonyms: *integrum* Say, *geniculum* Con., *milesii* Lea, *obesum* Lewis, *rufum* Hald., and *subsolidum* Anth.

Melantho fecunda mentioned, but purposely left undescribed, by Lewis in 1868 (66, p. 135) and listed as a distinct species in 1869 (67, p. 34) does not seem to be separable from *decisum*, judging from the author's original specimens now in my collection. Call's remark (17, p. 135) that this is the female of *obesum* Lewis is wholly wrong.

CAMPELOMA FLORIDENSE Call.

"*Campeloma floridense* Call MSS." (as synonym of *C. limum*), Call, Bull. Washb. Coll. Lab. of Nat. Hist., I, 1886, p. 159, pl. 6, fig. 7; Pilsbry, Naut., XXX, 1917, p. 42.

Type locality not specified. Apparently restricted to the St. John's River and tributary creeks in Florida.

It has very generally been considered to be the *C. limum* (Anth.).

CAMPELOMA GENICULUM (Con.).

The exact status of this species still remains to be settled. Call at one time considered it a valid species (15a, p. 157), but later (17, p. 134) treated it as a variety of *decisum*. Lewis remarks (71, p. 41) that all the Alabama species exhibit this peculiarity. Under this aspect of the case, the species, to which Conrad's form should be referred, can only be determined by an examination of his original type.

CAMPELOMA INTEGRUM (Say).

Is a valid species and quite distinct from *decisum*.

CAMPELOMA INTEGRUM OBESUM ("Lewis" Tryon).

? Paludina obesa "Lewis" W. G. Binney, L. and F. W. Shells, III, 1865, p. 47, fig. 95.
Melantho obesa Lewis, Am. J. of Con., IV, 1868, p. 134.
Melantho obesus Lewis, Pr. A. N. S. P., 1875, p. 336, pl. XXIII, figs. 4-5.
Vivipara obesa "Lewis" Tryon, Mon., 1870, p. 25, pl. 13, fig. 6.
Type locality: Ohio Canal, Columbus, O., and Michigan.

Tryon seems to have been the first to have formally described this well marked form, although Lewis had already referred to it by that name in his papers on *Melantho* in 1868 and 1869. Binney figured what he supposed to be it, but Lewis seems to think (l. c.) that he did not do so. Binney states that "*Paludina obesa*" is preoccupied, but I have not been able to check the reference. If that is true and Binney's figure represents the true *obesa* of Lewis, his remarks and figure are sufficient to fix that name on the form and consequently it would have to receive a new name.

Typically very distinct, this form seems to bear the same relation to *integrum* that *gibbum* does to *rufum*.

Call's statement (17, p. 135) that Lewis' type of this form is the male and the type of his undescribed *fecunda* the female of the same species is an error.

CAMPELOMA LEWISII Walker.

Campeloma lewisii Walker, Naut., XVIII, 1915, p. 126, pl. V, fig. 3.
Type locality: Yallabusha River, Grenada, Miss.

This is the *Melantho coarctata* of W. G. Binney. For full synonymy see Walker, 154, p. 126.

CAMPELOMA LIMUM (Anthony).

According to Pilsbry (103, p. 43) *Melantho decampii* W. G. Binn. is a synonym of this species, which has been very generally misunderstood. The Florida form usually known by this name is *C. floridense* Call.

CAMPELOMA MILESII (Lea).

Is apparently a valid species. If not, it should be referred to *decisum* rather than to *subsolidum*. See Walker, 146, p. 121.

CAMPELOMA PONDEROSUM COARCTATUM (Lea).

This is the *Paludina coarctata* and *P. incrassata* of Lea and the *Vivipara nolani* of Tryon.

For full synonymy see Walker, 154, p. 125.

CAMPELOMA RUFUM (Haldeman).

Is a valid species.

CAMPELOMA RUFUM GIBBUM (Currier).

Melantho gibba Currier, Am. J. of Con., III, 1867, p. 112, pl. 6, fig. 3.
Type locality: Grattan, Mich.

CAMPELOMA RUFUM GENICULIFORME Pilsbry.

Campeloma rufum geniculiforme Pilsbry, Naut., XXX, 1916, p. 42.
Type locality: Dooley Co., Ga.

CAMPELOMA RUFUM MERIDIONALE Pilsbry.

Campeloma rufum meridionale Pilsbry, Naut., XXX, 1916, p. 42.
Type locality: Crozier's Branch, Cabarrus Co., N. C. Also Little Sugar Creek, N. C. and Georgia.

CAMPELOMA SPILLMANII (Lea).

Paludina spillmanii Lea, Pr. A. N. S. P., 1867, p. 81; Jour. A. N. S. P., VI, 1868, p. 343, pl. 44, fig. 29; Obs., XII, 1868, p. 103, pl. 44, fig. 29.
Lioplax spillmanii Tryon, Mon., 1870, p. 35, pl. 14, fig. 7; pl. 15, fig. 8.
Type locality: Jackson Co., Ala.

Tryon (l. c.) gives the type locality as Jackson Co., Miss. Numerous specimens from several streams near Mooresville, Limestone Co., Ala., collected by Rev. H. E. Wheeler agree with the descriptions and figures given by Lea and Tryon and are *Campelomæ*. The embryonic young are strongly and acutely bicarinated, differing in this respect from all the other species of the genus. The operculum is wholly concentric. These shells agree very exactly with the cotypes of *C. decampii* W. G. Binn. in the DeCamp collection. If this identification and approximation are correct, *spillmanii* Lea will follow *decampii* into the synonymy of *C. limum* (Anth.).

CAMPELOMA SUBSOLIDUM (Anthony).

Is a valid species. Whether the *Paludina exilis* of Anthony is a sexual form as believed by Lewis and others or an individual or local mutation is unsettled. The fact that it has not been found in southwestern Michigan, where the species is a common one would seem to cast a doubt on its being a sexual variation.

Genus LIOPLAX Troschel, 1856.

LIOPLAX ELLIOTTII (Lea).

Is a valid species.

LIOPLAX PILSBRYI Walker.

Lioplax pilsbryi Walker, Naut., XVIII, 1905, p. 133, pl. IX, figs. 1-3.
Type locality: Chipola River, Fla. Also Econfine River and Mud Creek, Fla.

Genus TULOTOMA Haldeman, 1840.

TULOTOMA ANGULATA (Lea).

The opinion of Lewis (71, p. 24) and Wetherby (164, p. 207) that this is specifically distinct from *magnifica* Con. is no doubt correct.

TULOTOMA COOSAENSIS (Lea).

This species described as a *Paludina* and referred to *Vivipara* by Binney and to *Lioplax* by Tryon (132, p. 36) is a *Tulotoma* as stated by Wetherby (164, p. 212).

Family VALVATIDÆ.

Genus VALVATA O. F. Müller, 1774.

VALVATA BICARINATA Lea.

Is a valid species. See Walker, 146, p. 124 and 147, p. 29.

VALVATA BICARINATA CONNECTANS Walker.

Valvata bicarinata connectans Walker, Naut., XX, 1906, p. 30.

Type locality: Lake Michigan, New Buffalo, Mich.

VALVATA BICARINATA NORMALIS Walker.

Valvata bicarinata normalis Walker, Naut., XV, 1902, p. 125, fig. 5.

Type locality: Not specified.

Habitat: Muscatine, Ia. and Utica, Ills.

VALVATA BICARINATA PERDEPRESSA Walker.

Valvata bicarinata perdepressa Walker, Naut., XX, 1906, p. 30, pl. I, figs. 15-16.

Type locality: Lake Michigan, Michigan City, Ind.

VALVATA CALLI Hannibal, Naut., XXIII, 1910, p. 107.

Type locality: Marl-deposit, Upper Lahontan Quaternary, Summer Lake, Or.

VALVATA HUMERALIS CALIFORNICA Pils.

Valvata humeralis californica Pilsbry, Naut., XXII, 1908, p. 82.

Type locality: Bear Lake, San Bernardino Co., Cal.

VALVATA LEWISI Currier.

Valvata striata Lewis, Pr. A. N. S. P., 1856, p. 260; *non striata* Philippi, 1836-1844; Binney, L. and F. W. Shells, Pt. III, 1865, p. 13, fig. 18.

Valvata lewisi Currier, Kent Sci. Inst. Misc. Pub., 1868, p. 9.

Type locality: Little Lakes, N. Y.

VALVATA LEWISI HELICOIDEA Dall.

Valvata lewisi helicoidea Dall, Rep. Harriman Exp., XIII, 1905, p. 123, pl. II, figs. 1-2.

Type locality not specified.

Range: "With the type form, to some extent everywhere, but especially toward the Northwest".

VALVATA MERGELLA West.

Valvata mergella Westerlund, Vega Exped. Vetens. Iakt., IV, 1885, p. 209, pl. V, figs. 22 a-d.

Type locality: Port Clarence, near Bering Strait, Alaska.

VALVATA OBTUSA Drap.

This European species has been listed from the mouth of the Genessee River, N. Y., by Baker (3, p. 71).

VALVATA PISCINALIS Müller.

This European species has recently been found by Latchford (65, p. 10) at Honisher Bay, Toronto, Ont.

VALVATA SINCERA DANIELSI Walker.

Valvata sincera danielsi Walker, Naut., XX, 1906, p. 28, pl. I, figs. 10-11.

Type locality: Cannon Lake, Rice Co., Minn.

VALVATA SINCERA NYLANDERI Dall.

Valvata (*sincera* var.?) *nylanderi* Dall, Rep. Harriman Exp., XIII, 1905, p. 122.

Type locality: Aroostook Co., Me.

VALVATA TERRÆ-NOVÆ Ferussac.

Type locality: ?

Specimens under this name are in the Museum of Paris according to Binney (12, p. 430), but it does not appear to have ever been described.

VALVATA TRICARINATA Say.

This species is the type (by designation) of the subgenus *Tropidina* H. and A. Adams, 1858, but as it is based upon the carinated whorls of the typical form and the species varies from ecarinate to tricarinate, it does not seem worthy of recognition.

VALVATA TRICARINATA BASALIS Vanatta.

Valvata tricarinata basalis Vanatta, Naut., XXVIII, 1915, p. 105, fig.
Type locality: Hudson River, N. Y.

VALVATA TRICARINATA INFRACARINATA Vanatta.

Valvata tricarinata infracarinata Vanatta, Naut., XXVIII, 1915, p. 104, fig.
Type locality: White Pond, N. J.

VALVATA TRICARINATA PERCONFUSA Walker.

Valvata tricarinata confusa Walker, Naut., XV, 1902, p. 124, fig. 2, *non V. confusa West.* (1897).
Valvata tricarinata perconfusa Walker, Naut., XXXI, 1917, p. 36.
Type locality not specified.

VALVATA UTAHENSIS Call.

Valvata sincera utahensis Call, Bull. U. S. Geol. Surv., No. 11, 1884, p. 44, pl. VI, figs. 1-3.
Valvata utahensis Call, Pr. Davenport A. N. S., V, 1886, p. 4, pl. I, figs. 1-3.
Type locality: Utah Lake, Utah.

Family AMNICOLIDÆ.

Subfamily BYTHININÆ Stimpson, 1865.

Genus BYTHINIA Leach, 1818.

BYTHINIA PERFECTA Frauenfeld.

Bythinia perfecta Frauenfeld, Verh. der k. k. zool-bot. Ges. Wien, 1862, p. 1154; Ibid, 1865, p. 527, pl. IX.
Type locality: Columbia, North America.

Frauenfeld states that as the types are without the opercula, he could not tell whether the species was a *Bythinia* or an *Amnicola*. If the locality is correct, it is surely not a *Bythinia*. It may be a *Fluminicola*.

BYTHINIA TENTACULATA (L.).

This well known European species has been introduced by commerce and has spread from the Hudson west to Lake Michigan.

Subfamily AMNICOLINÆ Gill, 1871.

Genus AMNICOLA Gould and Haldeman, 1840.

AMNICOLA AUGUSTINA Pilsbry.

Amnicola augustina Pilsbry, Naut., XVII, 1904, p. 113; Walker, Naut., XIX, 1906, p. 117, pl. V, figs. 13-14.

Type locality: St. Augustine, Fla. Also at Tuscumbia, Ala., and fossil in a peat deposit at Lake Panasoffkee, Fla.

AMNICOLA BAKERIANA Pilsbry, Naut., XXXI, 1917, p. 44.

Type locality: Oneida Lake, N. Y.

AMNICOLA BAKERIANA NIMIA Pilsbry.

Amnicola bakeriana nimia Pilsbry, Naut. XXXI, 1917, p. 45.

Type locality: Oneida Lake, N. Y.

AMNICOLA CLARKEI Pilsbry.

Amnicola clarkei Pilsbry, Naut., XXXI, 1917, p. 45.

Type locality: Oneida Lake, N. Y.

AMNICOLA COMALENSIS Pilsbry and Ferriss.

Amnicola comalensis Pilsbry and Ferriss, Pr. A. N. S. P., 1906, p. 171, fig. 37; Pilsbry, Naut., XIII, 1910, p. 98.

Type locality: Comal Creek, New Braunfels, Texas. Also Guadalupe River at the same place.

AMNICOLA DESERTA Pilsbry.

Amnicola deserta Pilsbry, Naut., XXIX, 1916, p. 111.

Type locality: Washington Co., Utah.

AMNICOLA FERRUGINEA Calkins.

Amnicola ferruginea Calkins, Valley Nat., II, 1880, p. 6, text fig.

Type locality: Calumet River, Ill.

Baker (4, p. 331) refers this to *A. limosa* Say.

AMNICOLA FLORIDANA Frauenfeld.

Amnicola floridana Frauenfeld, Verh. der k. k. zool.-bot. Ges. Wein., 1863, p. 1028; Ibid, 1865, p. 529, pl. X.

Type locality: East Florida.

AMNICOLA FLORIDANA CONVEXA Pilsbry.

Amnicola floridana convexa Pilsbry, Trans. Wag. Free Inst. Sci., III, Pt. II, 1892, p. 338.
Type locality: Pliocene marl of the Caloosahatchie and Shell Creek, Fla.; also living in the fresh-water of Florida at the present time.

AMNICOLA HARPERI Dall.

Amnicola harperi Dall, Naut., XXIV, 1913, p. 2.
Type locality: Marl deposit, Lake Panasoffkee, Fla.

AMNICOLA JOHNSONI Pilsbry.

Amnicola johnsoni Pilsbry, Naut., XIII, 1899, p. 21.
Type locality: St. Augustine, Fla. Also fossil at Lake Panasoffkee, Fla.

AMNICOLA LIMOSA (Say).

Includes *A. ferruginea* Calkins according to Baker.

The figure given for this species by Dall (32, p. 117, fig. 84) is incorrect, being a copy of Binney's figure (No. 165) of *A. pallida* Hald.

AMNICOLA LIMOSA PORATA (Say).

Includes *A. orbiculata* Lea as a synonym according to Pilsbry (92, p. 44).

AMNICOLA LUSTRICA Pilsbry.

Amnicola lustrica Pilsbry, Naut., IV, 1890, p. 53.
Type locality not specified.
Range: "New York to Illinois and Minnesota".

AMNICOLA MICROCOCCUS Pilsbry.

Amnicola micrococcus Pilsbry, N. Am. Fauna, No. 7, Pt. II, 1893, p. 277, fig. 1; U. S. Nat. Mus., XXIV, 1901, p. 286, fig. 4.
Type locality: Oasis Valley, Nev. Also Death Valley, Inyo Co., Cal.

AMNICOLA MILIARIA Parreys.

Frauenfeld (40, p. 1027) states that in the Cuming Collection there is a set of this European species labelled "Spring Garden Lake, East Florida". He considers the shells to belong to this species without doubt, so that as he suggests there has probably been a mixing of labels.

AMNICOLA MISSOURIENSIS Pilsbry.

Amnicola missouriensis Pilsbry, Naut., XII, 1898, p. 43.
Type locality: Carter Co., Mo.

Amnicola neomexicana Pilsbry.

Amnicola neomexicana Pilsbry, Naut. XXIX, 1916, p. 111.
Type locality: Socorro, New Mexico.

Amnicola nuttalliana "Lea" Frauenfeld.

Amnicola nuttalliana Frauenfeld, Verh. der k. k. zool.-bot. Ges. Wien., 1863, p. 1029.

The form thus listed by Frauenfeld from Silver Spring, Fort King, Fla., is probably *Gillia wetherbyi* Dall, as suggested by Dall (28, p. 258).

Amnicola olivacea Pilsbry.

Amnicola olivacea Pilsbry, Naut., VIII, 1895, p. 115.
Type locality: Huntsville, Ala.

Amnicola oneida Pilsbry.

Amnicola oneida Pilsbry, Naut., XXXI, 1917, p. 46.
Type locality: Oneida Lake, N. Y.

Amnicola pallida Haldeman.

The figure given by Dall for this species (32, p. 117, fig. 85) is a copy of Binney's figure (No. 168) of *A. cincinnatiensis.*

Amnicola parva Lea.

Is a valid species. See Pilsbry, 92, p. 44.

Amnicola pilsbryi Walker.

Amnicola parva Marsh, Con. Ex., II, 1888, p. 91.
Amnicola pilsbryi Walker, Naut., XIX, 1906, p. 116, pl. V, figs. 11 and 16.
Type locality: Rockford, Ills.

Amnicola sanctijohannis Pilsbry.

Amnicola sanctijohannis Pilsbry, Naut., XIII, 1899, p. 20.
Type locality: St. John's River, Astor, Fla. Also Silver Spring Run, Marion Co., and Wekiva River, Fla.

Amnicola schrokingeri Frauenfeld.

Amnicola schrokingeri Frauenfeld, Verh. der k. k. zool.-bot. Ges. Wien, 1863, p. 1030; Ibid, 1865, p. 528, pl. X.
Type locality: Massachusetts.

If the specimens from several localities in Maine are correctly identified, this species seems to be distinct from *limosa,* to which it is referred by Tryon (132, p. 52).

Closely related to, but very much smaller than *A. winkleyi* according to Pilsbry (102, p. 1).

AMNICOLA WALKERI Pilsbry.

Amnicola walkeri Pilsbry, Naut., XII, 1898, p. 43; Walker, Naut., XIX, 1906, p. 117, pl. V, fig. 12.
Type locality: High Island Harbor, Beaver Ids., Lake Michigan.
Range: Upper St. Lawrence drainage from Ottawa, Ont., to Lake Michigan.

AMNICOLA WINKLEYI Pilsbry.

Amnicola winkleyi Pilsbry, Naut., XXVI, 1912, p. 1, pl. I, figs. 9-10.
Type locality: Saco, Me.

Section CINCINNATIA Pilsbry, 1891.

AMNICOLA CINCINNATIENSIS (Anth.).

Amnicola scarboroughi Tryon MSS. is a synonym according to Tryon (132, p. 54).

Baker's remark (4, p. 336), that Binney's fig. 162 is an error is incorrect. That figure does not represent this species, but is the radula of *A. sayana* Anth. (*Pomatiopsis cincinnatiensis* Lea). The same author (loc. cit., pp. 335 and 343) has reversed the synonymy of the two species, which explains his remark that Haldeman's figures of the two species are interchanged.

The figure given for this species by Dall (32, p. 118, fig. 87) is also incorrect, being Binney's fig. 166 of *A. limosa*.

AMNICOLA EMARGINATA (Kuster).

Paludina obtusa Lea, Pr. Am. Phil. Soc., II, p. 34, (1841), *non P. obtusa* Phil. (1837).
Pauldina emarginata Kuster, Con. Cab., Paludina, 1852, p. 50, pl. 10, figs. 3-4.
Cincinnatia binneyana Hann., Pr. Mal. Soc. Lond., X, 1912, p. 190.

There seems to be no valid ground for the new name proposed by Hannibal.

AMNICOLA PERACUTA Pilsbry and Walker.

Amnicola peracuta Pilsbry and Walker, Pr. A. N. S. P., 1889, p. 88, pl. III, fig. 20.
Type locality: Spivey's Lake, Navarro Co., Texas.

Genus PALUDESTRINA d'Orbigny, 1841.

Bythinella Moq.-Tand, 1851.
Stimpsonia Clessin, Mal. Blätt., XXV, 1878, p. 151.

Except as noted, all the species referred to *Bythinella* by Binney belong to this genus.

PALUDESTRINA ACUTISSIMA "Whit." (Frauenfeld).

? *Amnicola acutissima* "Whit.", Frauenfeld, Verh. der k. k. Zool.-bot. Ges. Wien, 1863, p. 207.

Hydrobia acutissima "Whit.", Frauenfeld, Ibid, 1863, p. 1021.

Type locality: ?

Frauenfeld queries as to who "Whit." is. The fact that *Pal. emarginata* and other North American species are in the Cuming Collection named by "Whit." makes it a possibility that this is also an American species. It is possible that "Whit." stands for T. J. Whittemore, who was a well known collector in Massachusetts in 1840.

PALUDESTRINA ÆQUICOSTATA (Pilsbry).

Bythinella æquicostata Pilsbry, Pr. A. N. S. P., 1889, p. 86, pl. III, fig. 16.

Type locality: Sumpter Co. and Haulover Canal, Fla.

PALUDESTRINA ALDRICHI (Call and Beecher).

Bythinella aldrichi Call and Beecher, Bull. Wash. Coll., I, 1886, p. 190, pl. VII, figs. 11-14.

Type locality: Tributary of Black River, Reynolds Co., Mo.

PALUDESTRINA BREVISSIMA (Pilsbry).

Bythinella brevissima Pilsbry, Naut., IV, 1890, p. 64.

Type locality: Haulover Canal, Indian River, Fla.

"HYDROBIA" CALIFORNICA Tryon.

Hydrobia californica Tryon, Am. J. of Con., I, 1865, p. 221, pl. 22, fig. 11. Is an *Assimenia* according to Pilsbry (96, p. 123).

PALUDESTRINA CORRIGATA (Frauenfeld).

Hydrobia corrigata Frauenfeld, Verh. der k. k. Zool.-bot. Ges. Wien, 1863, p. 1021; Ibid, 1865, p. 525, pl. VIII.

Type locality: Boston, Mass.

PALUDESTRINA DIABOLI Pilsbry and Ferriss.

Paludestrina diaboli Pilsbry and Ferriss, Pr. A. N. S. P., 1906, p. 170, fig. 36.

Type locality: Devil's River, Val Verde, Texas. Also Rio San Filipe in the same county.

PALUDESTRINA HEMPHILLI (Pilsbry).

Bythinella hemphilli Pilsbry, Naut., IV, 1890, p. 63.

Type locality: Kentucky Ferry, Snake River, Idaho.

PALUDESTRINA IMITATOR Pilsbry.

Paludestrina imitator Pilsbry, Naut., XII, 1899, p. 124.
Type locality: Santa Cruz, Cal.

PALUDESTRINA LONGINQUA (Gould).

Amnicola longinqua Gould, Pr. B. S. N. H., V, 1855, p. 130.
Pomatiopsis intermedia Tryon, Am. J. of C., I, 1865, p. 220, pl. 22, fig. 8.
Bythinella intermedia Tryon, Mon., 1870, p. 49.
See Pilsbry, 96, p. 122.

PALUDESTRINA MINUTA (Totten).

Turbo minutus Totten, Am. Jour. Sci., O. S., XXVI, 1834, p. 369, fig. 6.
Cingula minuta Gould, Rep. Invert. Mass., 1841, p. 265, fig. 171.
Type locality: Mass. and Rhode Island.
This species is referred to *Paludestrina* by Pilsbry (99, p. 90).

PALUDESTRINA MONAS Pilsbry.

Paludestrina monas Pilsbry, Naut., XIII, 1899, p. 21.
Type locality: Wekiva River, Fla.

PALUDESTRINA MONROENSIS (Dall).

Bythinella monroensis Dall, Pr. U. S. Nat. Mus., VIII, 1885, p. 256, pl. 17, fig. 99.
Type locality: Brook from Benson's mineral spring into Lake Monroe, Enterprize, Fla.

PALUDESTRINA NICKLINIANA (Lea).

This species is the type of Clessin's genus *Stimpsonia*.

PALUDESTRINA NICKLINIANA ATTENUATA (Haldeman).

Amnicola attenuata Hald., Mon., pt. 4, 1842, p. 3 of wrapper; Mon., 1844, p. 22, pl. I, fig. 13.
Bythinella attenuata Binney, L. and F. W. Shells, pt. III, 1865, p. 68, fig. 132.

PALUDESTRINA PROTEA (Gld.).

Amnicola protea Gould, Pr. Bost. S. N. H., V, March, 1855, p. 129.
Melania exigua Conrad, Pr. A. N. S. P., April, 1855, p. 269.
Tryonia protea Binney, L. and F. W. Shells, III, 1865, p. 72, fig. 140.
Bythinella protea Stearns, N. Am. Fauna, No. 7, Pt. II, 1893, p. 278.
Paludestrina protea Stearns, Pr. U. S. Nat. Mus., XXIV, 1901, p. 277, pl. XIX-XXI.

Hydrobia seemani Frauenfeld, Verh. der k. k. zool.-bot. Gesell. Wien, 1863, p. 1025; Ibid, 1865, p. 525, pl. VIII.

Bythinella seemani Pilsbry, N. Am. Fauna, No. 7, Pt. II, 1893, p. 278.

For an elaborate and fully illustrated account of the variation of this protean species, see Stearns' paper cited above.

PALUDESTRINA SALSA Pilsbry.

Paludestrina salsa Pilsbry, Naut., XIX, 1905, p. 90, pl. III, fig. 10.
Type locality: Cohasset, Mass., in brackish water.

PALUDESTRINA STEARNSIANA Pilsbry.

Paludestrina stearnsiana Pilsbry, Naut., XII, 1899, p. 124.
Type locality: Oakland, Cal. Also Marin, Tuolumne, Contra Costa and Santa Cruz Counties, Cal. Also Ash Canyon and Tanner Canyon, Huachuca Mts., Ariz., Pilsbry and Ferriss (106a, p. 516).

Genus TRYONIA Stimpson, 1865.

Pilsbry (96, p. 122), states that *Tryonia* is probably only a subgenus of *Paludestrina.*

TRYONIA CLATHRATA Stimpson.

This species, described from fossil specimens, has been found living in the Pahranagat Valley, Nev. (Stearns, 123, p. 281).

Genus PYRGULOPSIS Call and Pilsbry, 1886.

Pyrgulopsis Call and Pilsbry. Pr. Davenport A. N. S., V, 1886, p. 9.
Type: *Pyrgula nevadensis* Stearns.

PYRGULOPSIS LETSONI (Walker).

Amnicola letsoni Walker, Naut., XIV, p. 113 (1901); Letson, Bull. Buffalo Soc. Nat. Sci., VII, 1901, p. 241, fig. 165.
Type locality: Post-Glacial deposit, Goat Island, Niagara River, N. Y. Also fossil at Bowmanville, Ills. and living at La Plaisance Bay, Lake Erie, Monroe Co., Mich.

Goodrich (*in lit.*) has suggested that this species should be referred to *Pyrgulopsis* and I fully agree with him.

PYRGULOPSIS NEVADENSIS (Stearns).

Pyrgula nevadensis Stearns, Pr. A. N. S. P., 1883, p. 173, text fig.; Call and Beecher, Am. Nat., XVIII, 1884, pp. 851-855; Call and Pilsbry, Pr. Davenport Acad. Nat. Sci., V, 1886, p. 10, pl. II, figs. 1-10.
Type locality: Walker and Pyramid Lakes, Nev.

PYRGULOPSIS SCALARIFORMIS (Wolf).

Pyrgula scalariformis Wolf, Am. J. of Con., V, 1869, p. 198, pl. 17, fig. 3.
Pyrgulopsis scalariformis Shimek, Bull. Lab. Nat. Hist. St. Univ. Ia., II, 1892, p. 168, pl. xiii, figs. 3a-d.
Pyrgula scalariformis mississippiensis Pilsbry, Am. Nat., 1886, p. 5. No description.
Pyrgulopsis mississippiensis Call and Pilsbry, Pr. Davenport A. N. S., V, 1886, p. 13, pl. II, figs. 14-16; Walker, Naut., XIX, 1906, p. 116, pl. 5, fig. 15.
Type locality: Illinois River, Tazwell Co., Ills. Holocene.

According to Shimek (l. c.) *mississippiensis* is a synonym of *scalariformis.*

PYRGULOPSIS OZARKENSIS Hinkley,

Pyrgulopsis ozarkensis Hinkley, Pr. U. S. Nat. Mus., 49, 1915, p. 588, pl. 78, fig. 2.
Type locality: North Fork of White River, above Norfolk, Ark.

PYRGULOPSIS SHELDONI (Pilsbry).

Amnicola sheldoni Pilsbry, Naut., IV, 1890, p. 52.
Type locality: Lake Michigan, Racine, Wis.

This species seems to be a *Pyrgulopsis* rather than an *Amnicola.*

PYRGULOPSIS WABASHENSIS Hinkley.

Pyrgulopsis wabashensis Hinkley, Naut., XXI, 1908, p. 117.
Type locality: Wabash River, The Chains, Posey Co., Ind.

Genus POTAMOPYRGUS Stimpson, 1865.

POTAMOPYRGUS CORONATUS (Pfeiffer).

Paludina coronata Pfeiffer, Wiegm. Archiv., I, 1840, p. 253.
Type locality: Cuba.

Listed from Miami River, Fla., by Rhoads (113, p. 47).

POTAMOPYRGUS SPINOSUS (Call and Pilsbry).

Pyrgulopsis spinosa Call and Pilsbry, Pr. Davenport A. N. S., V., 1886, p. 14, pl. II, fig. 17-19.
Hydrobia texana Pilsbry, Ibid, V, 1886, p. 33, pl. III, fig. 1-6.
Type locality: *spinosus,* Comal Creek, Texas; *texana,* Guadelupe River and Comal Creek, Tex.

According to Pilsbry (91, p. 327) this species is a *Potamopyrgus* and is doubtfully distinct from *coronatus. Texana* is the ecarinate form.

Genus LITTORIDINA Souleyet, 1852.

LITTORIDINA MONROENSIS (Frauenfeld).

Hydrobia monroensis Frauenfeld, Verh. der k. k. Zool.-bot. Gesell. Wien, 1863, p. 1023; Pilsbry, Pr. A. N. S. P., 1889, p. 88, pl. III, figs. 17-19.
Bythinella monroensis Tryon, Mon. 1870, p. 48.
Type locality: Lake Monroe, Fla.

The generic position of this species, which was doubtfully referred to *Littoridina* by Pilsbry (94, p. 22) has since been confirmed by him. It is not the *Bythinella monroensis* of Dall (28, p. 256).

Subfamily LYTHOGLYPHINÆ Fischer, 1885.

Genus COCHLIOPA Stimpson, 1865.

COCHLIOPA ROWELLI Tryon.

The occurrence of this species in California is considered doubtful by Pilsbry (100, p. 91) and by Pilsbry and Ferriss (106, p. 172). Rowell however insists that the types were collected by him "near Baulinas Bay (not Clear Lake), Marin Co., Cal." (114, p. 10).

It is known to inhabit Nicaragua.

COCHLIOPA RIOGRANDENSIS Pilsbry and Ferriss.

Cochliopa riograndensis Pilsbry and Ferriss, Pr. A. N. S. P., 1906, p. 171, pl. IX, figs. 10-13.
Type locality: Rio San Filipe, near the Rio Grande, Val Verde Co., Texas. Also Devil's River in the same county.

Genus FLUMINICOLA Stimpson, 1865.

Hannibal (53, p. 186) has proposed a new subgenus *Heathella*, "readily distinguished by its globose form," having *F. seminalis* Hds. as the type and including *F. fusca, merriami, erythropoma, columbiana* and *minutissima*.

FLUMINICOLA COLUMBIANA Hemphill.

Fluminicola columbiana "Hemphill," Pilsbry, Naut., XII, 1899, p. 125; Pr., U. S. Nat. Mus., XXIV, 1901, p. 285, fig. 3.
Type locality: Columbia River, Washington, near Wallula and near mouth of Snake River; Snake River, near Weiser, Idaho.

FLUMINICOLA ERYTHROPOMA Pilsbry.

Fluminicola fusca minor Stearns, N. Amer. Fauna, No. 7, Pt. II, 1893, p. 282. No description.
Fluminicola erythropoma Pilsbry, Naut., XII, 1899, p. 125.
Type locality: Ash Meadows, Nye Co., Nev.

FLUMINICOLA MERRIAMI Pilsbry and Beecher.

Fluminicola merriami Pilsbry and Beecher, Naut., V, 1892, p. 143; Stearns, N. Am. Fauna, No. 7, pt. II, 1893, p. 282, fig. 2.
Type locality: Pahranagat Valley, Nev.

FLUMINICOLA MINUTISSIMA Pilsbry.

Fluminicola minutissima Pilsbry, Naut., XXI, 1907, p. 76, pl. IX, fig. 1.
Type locality: Price Valley, Weiser Canyon, Washington Co., Idaho.

FLUMINICOLA MODOCI Hannibal.

Fluminicola modoci Hannibal, Pr. Mal. Soc. Lond., X, 1912, p. 187, pl. VII, fig. 30.
Type locality: Fletcher's Spring, south end of Goose Lake, Cal.

FLUMINICOLA NEVADENSIS Walker.

Fluminicola nevadensis Walker, Occ. Pap. Mus. Zool., Univ. Mich., No. 29, 1916, p. 6, text-fig.
Type locality: Cortez foot-hills, Humboldt Valley, Elko Co., Nev.

FLUMINICOLA SEMINALIS (Hinds).

Paludina seminalis Hinds, Voy. Sulphur, 1844, p. 59, pl. 16, fig. 22.
Lithoglyphus cumingii Frauenfeld, Verh. der k. k. Zool.-bot. Ges. Wien., 1863, p. 195; Ibid, 1865, p. 530, pl. XI.
Amnicola tubiniformis Tryon, A. J. of Con., I, 1865, p. 219, pl. 22, fig. 5.
Type locality: *seminalis,* Sacramento River, Cal.
cumingii, California.
turbiniformis, Crane Lake Valley and Surprise Valley, Cal.

This synonymy is according to Pilsbry (96, p. 123).

FLUMINICOLA SEMINALIS DALLI (Call).

Amnicola dalli Call, Bull. U. S. Geol. Surv., No. XI, 1884, p. 45, pl. VII, figs. 4-6.
Fluminicola seminalis dalli Pilsbry, Naut., XIII, 1899, p. 123.
Type locality: Mountain streams near Pyramid Lake, Nev.

Genus SOMATOGYRUS Gill, 1863.

For a description of the peculiar apical sculpture of this genus, see Walker, 156.

SOMATOGYRUS ALDRICHI Walker.

Somatogyrus aldrichi Walker, Naut., XIX, 1901, p. 114, pl. V, fig. 9.
Type locality: Coosa River, Chilton Co., Ala.

SOMATOGYRUS AMNICOLOIDES Walker.

Somatogyrus amnicoloides Walker, Naut., XXIX, 1915, p. 52, fig. 3.
Type locality: Ouachita River, Arkadelphia, Ark.

SOMATOGYRUS AUREUS Tryon.

Somatogyrus aureus Tryon, A. J. of Con., I, 1865, p. 220, pl. 22, fig. 9.
Type locality: Tennessee River.

SOMATOGYRUS BIANGULATUS Walker.

Somatogyrus biangulatus Walker, Naut., XIX, 1906, p. 99, pl. V, fig. 6.
Type locality: Tennessee River, Florence, Ala.

SOMATOGYRUS CONSTRICTUS Walker.

Somatogyrus constrictus Walker, Naut., XVII, 1904, p. 135, pl. V, fig. 3.
Type locality: Coosa River, Wetumpka, Ala.

SOMATOGYRUS COOSAENSIS Walker.

Somatogyrus coosaensis Walker, Naut., XVII, 1904. p. 137, pl. V, figs. 6-8.
Type locality: Coosa River, Wetumpka, Ala.

SOMATOGYRUS CRASSILABRIS Walker.

Somatogyrus crassilabris Walker, Naut., XXIX, 1915, p. 53, fig. 4; Hinkley, Pr. U. S. Nat. Mus., XLIX, 1915, p. 589, pl. 78, fig. 1.
Type locality: North Fork of White River, Norfolk, Ark.

SOMATOGYRUS CRASSUS Walker.

Somatogyrus crassus Walker, Naut., XVII, 1904, p. 138, pl. V, figs. 11-12.
Type locality: Coosa River, Wetumpka, Ala.

SOMATOGYRUS CURRIERIANUS (Lea).

Amnicola currieriana Lea, Pr. A. N. S. P., 1863, p. 118; Jour. A. N. S. P., VI, 1866, p. 186, pl. XXII, fig. 118; Lea, Obs., XI, 1866, p. 142, pl. XXII, fig. 118.
Somatogyrus currierianus Walker, Naut., XVII, 1904, p. 137, pl. II, figs. 8-9.
Type locality: Huntsville, Ala.

SOMATOGYRUS DECIPIENS Walker.

Somatogyrus decipiens Walker, Naut., XXII, 1909, p. 80, pl. I, figs. 10-11.
Type locality: Coosa River, The Bar, Chilton Co., Ala.

SOMATOGYRUS EXCAVATUS Walker.

Somatogyrus excavatus Walker, Naut., XIX, 1906, p. 100, pl. V, fig. 7.
Type locality: Shoal Creek, Florence, Ala.

SOMATOGYRUS GEORGIANUS Walker.

Somatogyrus georgianus Walker, Naut., XVII, 1904, p. 139, pl. V, fig. 13.
Type locality: Chattooga River, Chattooga Co., Ga.

SOMATOGYRUS HENDERSONI Walker.

Somatogyrus hendersoni Walker, Naut., XXII, 1909, p. 87, pl. VI, fig. 2.
Type locality: Coosa River, Duncan's Riffle, Chilton Co., Ala.

SOMATOGYRUS HINKLEYI Walker.

Somatogyrus hinkleyi Walker, Naut., XVII, 1904, p. 135, pl. V, figs. 1-2; Naut., XXII, 1909, p. 87, pl. VI, fig. 8-9.
Type locality: Coosa River, Wetumpka, Ala.

SOMATOGYRUS HUMEROSUS Walker.

Somatogyrus humerosus Walker, Naut., XIX, 1906, p. 98, pl. V, fig. 2.
Type locality: Tennessee River, Florence, Ala.

SOMATOGYRUS INTEGER (Say).

Includes *Paludina fontinalis* Phil. erroneously referred to *subglobosus* by Binney. Both *integer* and *fontinalis* are referred to *Lithoglyphus* by Frauenfeld (39, pp. 194 and 179).

SOMATOGYRUS NANUS Walker.

Somatogyrus nanus Walker, Naut., XVII, 1904, p. 136, pl. V, fig. 4.
Type locality: Coosa River, Wetumpka, Ala.

SOMATOGYRUS OBTUSUS Walker.

Somatogyrus obtusus Walker, Naut., XVII, 1904, p. 138, pl. V, fig. 10.
Type locality: Coosa River, Farmer, Ala.

SOMATOGYRUS PARVULUS Tryon.

Somatogyrus parvulus Tryon, A. J. of Con., I, 1865, p. 221, pl. 22, fig. 10.
Type locality: Powell's River, Tenn.

Binney's figure of "*Gillia* sp?" (L. and F. W. Shells, III, p. 115, fig. 230) is this species according to Tryon (131, p. 198).

SOMATOGYRUS PENNSYLVANICUS Walker.

Somatogyrus pennsylvanicus Walker, Naut., XVII, 1904, p. 140, pl. V, figs. 15-16; Naut., XIX, 1906, p. 116, pl. 5, figs. 17-18.

Type locality: Columbia, Pa. Also Potomac River, Harper's Ferry, Va.

SOMATOGYRUS PILSBRYANUS Walker.

Somatogyrus pilsbryanus Walker, Naut., XVII, 1904, p. 142, pl. V, figs. 20-21.

Type locality: Tallapoosa River, Tallassee, Ala.

SOMATOGYRUS PUMILUS (Conrad).

Anculotus pumilus Conrad, New F. W. Shells, 1834, p. 62; Binney, L. and F. W. Shells, III, 1865, p. 80.

Anculosa pumila Conrad, A. J. of Con., II, 1866, p. 278, pl. XV, fig. 5.

Somatogyrus pumilus Walker, Naut., XIX, 1906, p. 115, pl. V, fig. 10.

Type locality: Black Warrior River, Ala. Also Cahatchee Creek, Shelby Co., Ala.

In his original description, Conrad quotes his species from Bayou Teche, La., but for some reason did not in his subsequent one in 1866.

SOMATOGYRUS PYGMÆUS Walker.

Somatogyrus pygmæus Walker, Naut., XXII, 1909, p. 88, pl. VI, fig. 3.

Type locality: Coosa River, The Bar, Chilton Co., Ala.

SOMATOGYRUS QUADRATUS Walker.

Somatogyrus quadratus Walker, Naut., XIX, 1906, p. 98, pl. V, figs. 3-4.

Type locality: Tennessee River, Florence, Ala.

SOMATOGYRUS SARGENTI Pilsbry.

Somatogyrus sargenti Pilsbry, Naut., VIII, 1895, p. 102; Walker, Naut., XVII, 1904, p. 139, pl. V, fig. 14.

Type locality: Mud Creek, a tributary of the Tennessee River, Ala.

SOMATOGYRUS STRENGI Pilsbry and Walker.

Somatogyrus strengi Pilsbry and Walker, Naut., XIX, 1906, p. 99, pl. V, fig. 5.

Type locality: Tennessee River, Florence, Ala. Also Wabash River, Posey Co., Ind.

SOMATOGYRUS SUBGLOBOSUS (Say).

Subglobosus (1825) has priority over *isogonus* (1829). *Paludina fontinalis* Phil. doubtfully referred to this species by Binney is a synonym of *integer* Say.

SOMATOGYRUS SUBSTRIATUS Walker.

Somatogyrus substriatus Walker, Naut., XIX, 1906, p. 97, pl. V, fig. 5.
Type locality: Tennessee River, Florence, Ala.

SOMATOGYRUS TENNESSEENSIS Walker.

Somatogyrus tennesseensis Walker, Naut., XIX, 1906, p. 114, pl. V, fig. 8.
Type locality: Shoal Creek, Florence, Ala.

SOMATOGYRUS TROTHIS Doherty.

Somatogyrus trothis Doherty, Quar. J. of Con., I, 1878, p. 341, pl. IV, fig. 1.
Type locality: Ohio River, Campbell Co., Ky.

SOMATOGYRUS UMBILICATUS Walker.

Somatogyrus umbilicatus Walker, Naut., XVII, 1904, p. 137, pl. V, fig. 5.
Type locality: Coosa River, Wetumpka, Ala.

SOMATOGYRUS VIRGINICUS Walker.

Somatogyrus virginicus Walker, Naut., XVII, 1904, p. 141, pl. V, figs. 18-19.
Type locality: Barnard's Ford, Rapidan River, Va.

SOMATOGYRUS WALKERIANUS Aldrich.

Somatogyrus walkerianus Aldrich, Naut., XVIII, 1905, p. 140, text-fig.
Type locality: Conecut (Conecuh?) River, Escambia Co., Ala.

SOMATOGYRUS WHEELERI Walker.

Somatogyrus wheeleri Walker, Naut., XXIX, 1915, p. 51, figs. 1-2.
Type locality: Ouachita River, Arkadelphia, Ark.

Genus GILLIA Stimpson, 1865.

GILLIA WETHERBYI (Dall).

Hydrobia ? wetherbyi Dall, Pr. U. S. Nat. Mus., 1885, p. 258, pl. XVII. fig. 10.
? Amnicola nuttalliana Frauenfeld, Verh. der k. k. Zool.-bot. Ges. Wien., 1863, p. 1029.
Type locality: Lake Eustis, Fla.

Genus CLAPPIA Walker, 1909.

Clappia Walker, Naut., XXII, 1909, p. 89.
Type: *Clappia clappi* Walker.

CLAPPIA CLAPPI Walker.

Clappia clappi Walker, Naut., XXII, 1909, p. 89, pl. VI, figs. 1, 4 and 7.
Type locality: Coosa River, Duncan's Riffle, Chilton Co., Ala.

Subfamily LYOGYRINÆ Pilsbry, 1916.

Genus LYOGYRUS Gill, 1863.

LYOGYRUS BROWNII (Carpenter).

Amnicola brownii Carpenter, Central Falls (R. I.) Weekly Visitor, April, 1872.
Valvata (Lyogyrus) brownii Carpenter, Naut., III, 1889, p. 69.
Type locality: Cunliff's Pond, Elmville, R. I.

The citation of this species from Minnesota by Sargent (115, p. 126) is no doubt erroneous.

LYOGYRUS DALLI Pilsbry and Beecher.

Lyogyrus dalli Pilsbry and Beecher, Naut., VI, 1892, p. 62.
Type locality: Wekiva River, Fla.

LYOGYRUS GRANUM (Say).

Paludina grana Say, J. A. N. S. P., II, 1822, p. 378.
Amnicola granum W. G. Binney, L. and F. W. Shells, III, 1865, p. 86, fig. 170.

This species is known only from the Atlantic drainage in southeastern Pennsylvania and New Jersey. Western records for it and *L. brownii* are in all probability based upon some of the smaller species of *Amnicola*.

LYOGYRUS LEHNERTI Ancey.

Liogyrus lehnerti Ancey, Con. Ex., II, 1887, p. 79.
Type locality: Potomac River, Washington, D. C.

According to Pilsbry (87, p. 113) and part of the original lot in my collection, this is a reversed *Amnicola limosa* Say.

Genus HORATIA Bourguignat, 1887.

Horatia Bourguignat, Etude sur les noms gen. des petites Paludinidees &c., 1887, p. 47.

Westerlund (163, 4th Supp., p. 23) remarks that these small shells have the form of the smallest Pseudamnicolas, the structure of Lithoglyphus, the color of many Bythinellas and are allied to the Valvatas in their operculum. Typical *Horatia* is not represented in the North American fauna.

Subgenus HAUFFENIA Pollonera, 1898.

Hauffenia Pollonera, Boll. Mus. Zool. ed. Anat. Comp. Univ. Torino, XIII, 1898, p. 3.

HORATIA (HAUFFENIA) MICRA (Pilsbry and Ferriss).

Valvata micra Pilsbry and Ferriss, Pr. A. N. S. P., 1906, p. 172, pl. IX, figs. 7-9.
Horatia (Hauffenia) micra Pilsbry, Naut., XXX, 1916, p. 83.
Type locality: Guadalupe River, New Braunfels, Texas.

HORATIA MICRA NUGAX (Pilsbry and Ferriss).

Valvata micra nugax Pilsbry and Ferriss, Pr. A. N. S. P., 1906, p. 173, pl. IX, fig. 6.
Horatia (Hauffenia) micra nugax Pilsbry, Naut., XXX, 1916, p. 83.
Type locality: Guadalupe River, New Braunfels, Texas.

Subfamily POMATIOPSINÆ Stimpson, 1865.

Genus POMATIOPSIS Tryon, 1862.

POMATIOPSIS BINNEYI Tryon.

Pomatiopsis binneyi Tryon, Pr. A. N. S. P., 1863, p. 148, pl. I, fig. 10.
Bythinella binneyi W. G. Binney, L. and F. W. Shells, III, 1865, p. 69, figs. 136-137.

This species is a true *Pomatiopsis* according to Pilsbry (96, p. 123).

POMATIOPSIS CALIFORNICA Pilsbry.

Pomatiopsis californica Pilsbry, Naut., XII, 1899, p. 126.
Type locality: San Francisco, Cal.

POMATIOPSIS CINCINNATIENSIS (Lea).

Cyclostoma cincinnatiensis Lea, Pr. Am. Phil. Soc., I, 1840, p. 289.
Amnicola sayana "Anthony" Haldeman, Mon., 1844, p. 19, pl. I, fig. 11.

This species having proved to be a *Pomatiopsis,* Lea's name takes precedence over that of Anthony which was proposed on the supposition that the species was an *Amnicola.*

Baker (4, p. 343) has erroneously attributed the species to Anthony and his description, figures and synonymy are those of *Amnicola cincinnatiensis* Anth.

POMATIOPSIS HINKLEYI Pilsbry, Naut., X, 1896, p. 37.

Type locality: Black Falls, Florence, Ala.

POMATIOPSIS LAPIDARIA (Say).

Paludina lustrica Say, quoted as *Amnicola lustrica* by Haldeman and authors generally and as *Pomatiopsis lustrica* by Binney according to Pilsbry (89, p. 53) is the young of this species.

POMATIOPSIS ROBUSTA Walker.

Pomatiopsis robusta Walker, Naut., XXI, 1908, p. 97, text-fig.
Type locality: Jackson Lake, Wyo.

PLEUROCERIDÆ.

It has been suggested that the family name should be properly *Pleuroceratidæ.* But Stejneger (Herpetology of Japan, Bull. 58, U. S. Nat. Mus., p. 24) in a similar case has decided that the change is not necessary.

The errata given by Tryon on p. 427 of his "Strepomatidæ" are not included in his index and have, therefore, been noted under the several species as they are likely to be overlooked.

Pilsbry (Pilsbry and Rhoads, 111, p. 496) has proposed the following rearrangement of this family:

Genus IO Lea.

Type *Fusus fluvialis* Say.

Genus LITHASIA Haldeman.

Type *Anculosa* (*Lithasia*) *geniculata* Hald.

Section ANGITREMA Haldeman.

Type *Melania armigera* Say.

Genus PLEUROCERA Rafinesque.

Type ?

Section STREPHOBASIS Lea.

Types *S. spillmani, cornea* and *clarkii* Lea (all = *plena* Anth.)

Genus ELIMIA H. and A. Adams.

Type *Melania acutocarinata* Lea.

Genus GYROTOMA Shuttleworth.

Genus ANCULOSA Say.

Dr. Pilsbry has more recently decided that *Goniobasis* should be restored to its former position as a generic term, on the ground that *Elimia* was a composite group.

It will be noticed that no mention is made of *Eurycœlon* in this arrangement. While, as Tryon remarks (134, p. 341), the genus as aggregated by him is made up of incongruous elements and upon a revision of the family will no doubt be dismembered, the typical group, of which *anthonyi* and *crassa* are leading terms form a very distinct group, which seems entitled to recognition.

Genus LITHASIA Haldeman, 1840.

LITHASIA CURTA Lea.

Lithasia curta Lea, Pr. A. N. S. P., 1868, p. 153; Lea, Jour. A. N. S. P., VI, 1868, p. 340, pl. 54, fig. 24; Obs., XII, 1868, p. 100, pl. 54, fig. 24.

Type locality: Northern Alabama and Tuscumbia.

LITHASIA CYLINDRICA Lea.

Lithasia cylindrica Lea, Pr. A. N. S. P., 1866, p. 133; Jour. A. N. S. P., VI, 1868, p. 341, pl. 54, fig. 26; Obs., XII, 1868, p. 101, pl. 54, fig. 26.

Type locality: Coosa River, Ala.

LITHASIA OBOVATA (Say).

Pilsbry (101, p. 47) has figured the operculum of this species.

For an account of the early stages of growth in this species, see Walker, No. 143.

LITHASIA OBOVATA BICONICA Pilsbry.

Lithasia obovata biconica Pilsbry, 27th Ann. Rep. Dep't. Geol. & Nat. Resc. Ind., 1908, p. 604, fig. 23a.

Type locality: Wabash River, Gibson Co., Ind.

LITHASIA PLICATA Wetherby.

Lithasia plicata Wetherby, Jour. Soc. N. H. Cin., 1876, p. 9, pl. I, fig. 1.

Type locality: Green River, Jackson Co., Ky.

LITHASIA PURPUREA Lea.

Lithasia purpurea Lea, Pr. A. N. S. P., 1868, p. 153; Jour. A. N. S. P., VI, 1868, p. 340, pl. 54, fig. 23; Obs., XII, 1868, p. 100, pl. 54, fig. 23.

Type locality: Cahawba River, Centreville, Bibb Co., Ala.

LITHASIA WHEATLEYI Lea.

Lithasia wheatleyi Lea, Pr. A. N. S. P., 1866, p. 133; Jour. A. N. S. P., VI, 1868, p. 341, pl. 54, fig. 25; Obs., XII, 1868, p. 101, pl. 54, fig. 25.

Type locality: Cahawba River, Ala.

Section ANGITREMA Haldeman, 1841.

LITHASIA ANGULATA (Wetherby).

Angitrema angulata Wetherby, Jour. Cin. Soc. N. H., 1876, p. 11, pl. I, fig. 5.

Type locality: Stone's River, Rutherford Co., Tenn.

LITHASIA PARVA (Wetherby).

Angitrema parva Wetherby, Jour. Cin. Soc. N .H., 1876, p. 9, pl. I, fig. 2.

Type locality: Stone's River, Rutherford Co., Tenn.

PLEUROCERA Rafinesque, 1818.

Pilsbry (105, p. 114) from a consideration of the literature concludes that the type of *Pleurocera* Raf. is *verrucosa* Raf. and that it consequently takes the place of *Angitrema* Hald. and that for this group *Ceriphasia* Sw. should be used. This has been controverted by Walker, No. 161, who argues that the type of *Pleurocera* had never been properly designated and designates *P. acuta* Raf. as the type, thus retaining the name for the group with which it has commonly been known. In a similar case, Dall (20, p. 1141) had already taken the same position as advocated by Walker.

PLEUROCERA ACUTA Rafinesque.

Pleurocera acuta Rafinesque, Enumeration and Account, 1831, p. 3; Walker, Occ. Pap. Mus. Zool., U. of M., No. 38, p. 8.

Is identical with and has precedence over *P. subulare* Lea and is the type of *Pleurocera* Raf. It includes according to Goodrich (49, p. 122) *tractum* Anth., *neglectum* Anth., *intensum* Rve., *pallidum* Lea and *labiatum* Lea.

PLEUROCERA AFFINE (Lea).

Trypanostoma affine Lea, Obs., XI, 1866, p. 101, pl. 23, fig. 57.

PLEUROCERA ALTIPETUM (Anthony).

Trypanostoma corneum Lea, Obs., XI, 1866, p. 104, pl. 23, fig. 63.

PLEUROCERA ALVEARE (Conrad).

Includes *P. plicatum* Tryon.

PLEUROCERA ARATUM (Lea).

Trypanostoma cinctum Lea, Obs., XI, 1866, p. 103, pl. 23, fig. 60.

PLEUROCERA BICINCTUM Tryon.

Pleurocera bicinctum Tryon, Am. J. of Con., II, 1866, p. 4, pl. II, fig. 2.
Type locality: Bridgeport, Ala.

PLEUROCERA CARINATUM (Lea).

Trypanostoma carinatum Lea, Obs., XI, 1866, p. 104, pl. 23, fig. 62.

This species as suggested by Tryon is probably the young of some other species. If, however, it should prove to be a valid one, it will have to be renamed as *Pleurocera* (*Strephobasis*) *carinatum* Lea has priority.

PLEUROCERA CASTANEUM (Lea).

Trypanostoma castaneum Lea, Pr. A. N. S. P., 1868, p. 152; Jour. A. N. S. P., VI, 1868, p. 338, pl. 54, fig. 20; Obs., XII, 1868, p. 98, pl. 54, fig. 20.
Type locality: Coosa River, Ala.

PLEUROCERA CURRIERIANUM (Lea).

Trypanostoma curricrianum Lea, Obs., XI, 1866, p. 103, pl. 23, fig. 61.

PLEUROCERA CYLINDRACEUM (Lea).

Trypanostoma cylindraceum Lea, Obs., XI, 1866, p. 98, pl. 23, fig. 51.
Includes *P. roanense* Lea, according to Pilsbry (111, p. 498).

PLEUROCERA EXIMIUM (Anthony).

Has priority over *gradatum* (Anth.).

PLEUROCERA GLANDULUM (Anthony).

Is undoubtedly the young of one of the earlier described species of *Strephobasis* included in the synonymy of *plena*.

PLEUROCERA GRADATUM (Anthony).

Trypanostoma curtatum Lea, Jour. A. N. S. P., VI, 1866, p. 143, pl. 23, fig. 53; Obs., XI, 1866, p. 99, pl. 23, fig. 53.

PLEUROCERA LESLEYI (Lea).

Trypanostoma lesleyi Lea, Obs., XI, 1866, p. 102, pl. 23, fig. 59.

PLEUROCERA LEWISII (Lea).

As suspected by Tryon this form is only a striate variety of *elevatum*.

PLEUROCERA LYONII (Lea).

Trypanostoma lyonii Lea, Jour. A. N. S. P., VI, 1866, p. 144, pl. 23, fig. 55; Obs., XI, 1866, p. 100, pl. 23, fig. 55.

PLEUROCERA NAPOIDEUM (Lea).

Trypanostoma napoideum Lea, Obs., XI, 1866, p. 99, pl. 23, fig. 54.

PLEUROCERA NUCIFORME (Lea).

Trypanostoma nuciforme Lea, Pr. A. N. S. P., 1868, p. 152; Jour. A. N. S. P., VI, 1868, p. 337, pl. 54, fig. 19; Obs., XII, 1868, p. 97, pl. 54, fig. 19.
Type locality: Connesauga Creek, Whitfield Co., Ga.

PLEUROCERA PUMILUM (Lea).

Is probably the young of some other species. If valid however, it will have to be renamed as *Pleurocera* (*Stephobasis*) *pumilum* Lea has priority, unless that too should prove to be a synonym.